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INDEX.

EDITORIAL—GAS, LIGHTING, &c.

Accident Insurance, Cost of, 1697
Alliance and Dublin Consumers' Gas Company—
  Steam Roller Litigation and the Supply of Water Gas, 790
Analysis of the Accounts of the London Gas Companies, 988
Arbitrations, Commonsense Way of Conducting, 74
Avebury, Lord, and Municipal Trading, 789
Bank Rate, The, 192, 1425
Bills, Gas, Interesting Points in, 74 (*see also* Parliament)
Birmingham University, Prospects of the, 193
Board of Trade—
  Industrial Disputes and Changes in Rates of Wages and Hours of Labour, 75, 257
  Returns, 134, 590
  Trade Unions in 1898, Report on, 19
Boston Retort Oven Gas Plant, 257
Bradford Gas Politics, 916, 1183
Budget, The, 663
Building Act Case, The Wandsworth, 916
Building Lines and Wide Streets, 193
Capital Expenditure, Economy in, 1045
Casual Labourers and the Workmen's Compensation Act, 731
Coal—
  Commission of Inquiry on, Case for a, 1490
  Exported, Question of Taxing, 989, 1044, 1272, 1490
  Market, State of the, 15, 133, 191, 256, 318, 391, 458, 594, 855, 987, 1044, 1106, 1183, 1273, 1424, 1606
  Miners and the Compensation Act, 135
  Miners' Hours, 594, 596
  Output in 1899, 791
  Pickard, Mr. Benjamin, on the High Price of, 392
  Prices and their Effect on the Gas Industry, 1044, 1106, 1183
  Problem, Mr. H. C. Peake on the, 1608
  Profits in 1899, Iron and, 917
  Pronouncements on the Coal Difficulty, 1606
  Resources, Our, 523
  Spontaneous Combustion of, 594
Coke Gas Plant, The Everett, 257
Commercial Gas Company, 916
Commissions, Illicit, 988, 1274
Companies Acts Amendment Bill, 458
Compensation Act, Workmen's—
  A Curious Side of the, 75
  Agricultural Labourers and the, 791
  Casual Labourers and the, 731
  Coal Miners and the, 135
  Liability of "Undertakers" and Contractors, 917
  Ruegg, Q.C., Mr., on the, 459
Compensation and Wages Questions at Manchester, 74
Competition in Gas Supply in New York, 16
Co-operative Union, Congress of, 1540
Copper Trust, A Huge, 524
Crystal Palace District Gas Company—
  Affairs of the, 458
  Responsibility for Damage to Lamp Posts, 392
Darlington, A Lesson from, 665
Dawson, Mr. Nelson, on the Design of Lamp Stands and Columns, 1539
Distribution of Gas, High Pressure, 594
Dockers' Strike, The Latest, 1697
Douglas Gas Works, Fatal Explosion at the, 17
Dublin, Road Rolling and Water Gas in, 790
Eastern Counties Gas Managers' Association, 1044
Educational Questions, 193
Electricians and Hospitalities of Trading Firms, 1697
Electricity and Gas Supply—The Excuse of Unavoidable Cause, 1106
Electricity in Bulk Schemes, 319, 730
Electricity Plants, Gas Driven, 1105
Electric Lighting Acts, Breakdown of the, 192
Electric Wiring, Free, and Assisted Gas Fitting, 1539
Electrolysis of Pipes, 1491
Engineer, An Anglo-American, 17
Engineer, An, on the London Gas Supply, 134
Everett Coke Gas Plant, The, 257
Examinations in Gas Manufacture, 1273
Excuse of Unavoidable Cause, 1106
Explosions in Gas Works, 17
Factory and Workshop Regulation Bill, 1607
Frontages, A Plea for Light Reflecting Street, 393
Gas—
  Driven Electricity Plants, 1105
  Electricity and, Supply—The Excuse of Unavoidable Cause, 1106
  Fitting, Assisted, 1539
  Manufacture, Examinations in, 1273
  Price of, and the Coal Supply (*see* Coal)
  Profits and Rates, 1352
  Stocks, The Fall in, 1274
  Transmission at High Pressure, 730
Gas Institute, The Incorporated—
  Institution of Gas Engineers and, 255, 729, 1043, 1181, 1605
  Position and Meeting of, 1605
  Programme of, 1425
Gasholder Litigation, The Hull, 524, 730
Gaslight and Coke Company—
  Bill, 593, 664, 1272, 1351
  Coal Stock, Position of the, 256, 458
  Half Yearly Report and Accounts, 256
  Meetings of Shareholders, 317
  Rise of Price, 1695, 1696
Glastonbury, The Precedents of, 856
High Pressure, Gas Transmission at, 730
Housing Problem, The, 75, 394, 525, 858, 1275
Hull Gasholder Litigation, 524, 730
Humphrys, Mr. N. H., on the Cost of Coal, 1605
Illicit Commissions, 988, 1274
Imperial Continental Gas Association, 1184
Incandescent Gas Burners, Prices of, and their Effects, 1490
Incandescent Gaslight Litigation, 459
Incandescent Gas Lighting for Streets, 1044
Institution of Gas Engineers—
  Gas Institute and the, 255, 729, 1043, 1181, 1605
  Meeting of the, 987, 1181
Insurance, Cost of Accident, 1697
Iron and Coal Profits in 1899, 917
Iron Market, 1273
Labour—
  Coal Difficulty, The, and Miners, 191
  Coalies, Strike of, 458
  Compensation Act (*see* Compensation)
  Disputes and Changes in Rates of Wages and Hours of Labour in 1898 and 1899, 75, 257
  Dockers' Strike, The Latest, 1697
  Hours of, in Mines, 594, 596
  Old Age Pension Problem, 1491
  Strikes, Legal Discouragement of, 665
  Supply of, The, 74, 191
  Trade Union—
    A Spirit of Sweet Reasonableness in a, 1353
    Conferences 595, 1107
  Trade Unionism, Some Unlovely Aspects of, 135
  Trade Unions in 1898, State of the, 193
Lamp Posts—
  Design and Choice of, 990, 1046, 1539
  Responsibility for Damage to, 392
Legislation, Points of Prospective Gas, 74
Liberty and Property Defence League, 193
Light, Another, that Failed, 393
Light Reflecting Street Frontages, A Plea for, 393
Lillie Bridge Oil Gas Works, Explosion at the, 17
Liverpool Gas Company, 524
London—
  Building Lines and Wide Streets, 193
  Corporation of, and the South Metropolitan Bill, 1489
  Correspondent, The Sapiency of the, 1696
  Gas Supply (*see* Metropolis)
  Streets, Lighting of, 17, 990
  Ugly, 990, 1046
  West-end, Electric Lighting Troubles in the, 192
London County Council—
  A Hint to the, 1107
  Criticisms of the, 258, 319, 525, 664, 856, 857
  Expenditure of the, 1353
  Gas Testing and Prepayment Meter Bill, 915, 1182, 1271, 1272, 1351
  Issue of Stock at a Fixed Price, 1697
Manchester Corporation Gas Supply, 74, 1352
Manchester Institution of Gas Engineers, 524
Massachusetts, Gas Supply Regulation in, 394
Metropolis Gas Supply—
  Analysis of the Companies' Accounts, 988
  Bills, Companies' (*see* Gaslight and South Metropolitan)
  Engineer, An, on Questions relating to the, 134
  Gas Testing and Prepayment Meter Bill, 915, 1182, 1271, 1272, 1351
  Sliding Scale Settlement, The, 73
Midland Association of Gas Managers, 595
Morecambe Gas Bill, 1695
Moxham, Mr. A. J., Career of, 17
Municipal—
  Civil Service, Concerning the, 392
  Corporations, Association of, 1540
  Loans and Fixed Prices, 1697
  Trading, 789, 857, 989, 1425, 1540
Municipalism, A Shady Side to, 1353
New York, Competition in Gas Supply in, 16
North of England Gas Managers' Association, 1106
Oil Market, Hardening of the, 792
Old Age Pension Problem, 1491
Paris Gas Company, 1046
Parliament—
  Budget, The, 663
  Commissions, Bill for the Suppression of Illicit, 988
  Committees on Gas Bills, 730, 790, 915, 916, 1182, 1183, 1271, 1272, 1351, 1423, 1424, 1696
  Companies Acts Amendment Bill, 458
  Compensation for Agricultural Labourers, 791
  Electricity Power Bills, 730
  Factory and Workshop Regulation Bill, 1607
  Gaslight and Coke Company Bill, 664, 1272, 1351
  Hours of Labour in Mines, 594, 596
  Housing of the Poor (*see* Housing)
  Irish Members and the London Water Bills, 791
  London Gas Questions in, 593
  Municipal Trading, Committee on (*see* Municipal Trading)
  Portable Photometer and Prepayment Meter Bill, 915, 1182, 1271, 1272, 1351
  Private Members' Bills, 595
  Queen's Speech, The, 318
  South Metropolitan Gas Bill, 664, 1351, 1423
  Wandsworth and Putney Gas Bill, 1424
Peake, Mr. H. C., on the Coal Problem, 1608
Petroleum Legislation Deferred, 459
Petroleum, "Patent" Process for Making Gas from, 393
Pickard, Mr. B., on the High Price of Coal, 392
Picturesque, For the Preservation of the, 1426
Pipes, Electrolysis of, 1491
Political Economy, Another Outrage on, 1426
Portable Photometer and Prepayment Meter Bill, 915, 1182, 1271, 1272, 1351
Progressivism, Progress of, 1045
Pump, The Danger of the, 730
Queen's Speech, The, 318
Residuals, Gas, Use of, in the Manufacture of Munitions of War, Drugs, and Dyes, 16,
Revenue, The Year's, 990
"Rings," Gas Works Traders', 135
Ritchie, Mr. C. T., on the Housing Problem, 394
Road Roller Litigation at Dublin, 790
Rockefellers, The Ambition of the, 524
Ruegg, Q.C., Mr., on the Workmen's Compensation Act, 459
Salaries of Corporation Officials, 392
Scottish Gas Managers, 917
Scottish Trade Unionists, 1107
Sheffield United Gaslight Company, 731
Sheldrake, Mr. J. H., on the Performance of Street Lamps, 1106
Shelton, Mr. F. H., on Illuminating Gas Transmission at High Pressure, 730
Shrewsbury Gas Main Arbitration, 790
Sliding Scale, The Question of the Settlement of Gas Supply on a, 73
South Metropolitan Gas Company—
  Bill, 593, 664, 1351, 1423, 1489
  Half Yearly Report and Accounts, 318
  Meeting of Shareholders, 457
Southern District Gas Managers' Association, 594, 1491
Stocks, Gas, Bank Rate and the Price of, 1425
Street Lamps, The Performance of, 1106
Streets, The Gloominess of British, 17
Strikes and Lockouts of 1898 and 1899, 75, 257
Strikes, Legal Discouragement of, 665
Sutton, Southcoates, and Drypool Gasholder Litigation, 524
"Times, The," and Municipal Trading, 789
Trade, Some Statistics of, in 1899, 134
Trade Union Questions (*see* Labour)
Traders' "Rings," Gas Works, 135
Transvaal War and Gas Residuals, 16
Underground Water, The Law of, 730
Wandsworth and Putney Gas Bill, 1424
Wandsworth Building Act Case, 916

624503

Water Gas, Carburetted—
Livesey, Mr. George, on, 458
Supply of, in Dublin, 790
Waverley Association Meeting, 989
Weather, The, and Coal Stocks, 458
Welsbach and Sunlight Litigation, 459
Welsbach Company's—
Annual Meeting, 1607
New Prices and their Effects, 1490
West Ham, Parliamentary Aspirations of, 17
Westinghouse Combination Power Plant, 1105
Will, Q.C., Mr. Shiress, on the Law of Underground Water, 730
Worcester, Collapse of the Free Wiring Business in, 1539
Workmen's Compensation Act (*see* Compensation)

WATER AND SANITARY AFFAIRS.

Birmingham Corporation Water Supply, 1427
Bombay Water Supply, 136
British Association of Water Works Engineers—
Annual Meeting, 1698
Control of the Nation's Water Supply, 526
Control of the Nation's Water Supply, 526
Crimp, Mr. Santo, on the Water Supply of Bombay, 136
Divining Rod Commission, A, 259
East London Water Company—
Bill, 1354
Fire Plugs and Hydrants, Use of Water from, 195
Meeting of Shareholders, 918
Electrolysis of Water Mains, 460
Extravagant Use of Water, Timely Attempt to Check, 1047
Fire Plugs and Hydrants, Water Companies and the Use of, 195
Grand Junction Water Company, 1608
Jones, Mr. C. E., on the Control of the Nation's Water Supply, 526
"Lancet" on the Control of the London Water Companies, 1046
Lea Conservancy Board, Proposed Reconstitution of the, 76
Legislation, Interesting Features of Proposed, 18, 76
Local Government Board—
Deputation to the, from the London County Council, 732
Typhoid Fever Epidemics, 596, 732
London County Council—
Bills—
Opposition to the, 18, 136, 459, 526
Parliament and the, 792, 858, 1427
Royal Commission's Proposals and the, 596
Deputation to the Local Government Board, 731
Fire Plugs and Hydrants, Use of Water from, 195
Legislation, Prospective, 1492
Report of the Commission on the Metropolitan Water Supply, 596, 665
Welsh and Staines Schemes, Criticism of the, 732, 792
Maidstone Water Mains, Disinfecting the, 918
Mains, Water, Electrolysis of, 460
Manchester Corporation Water Affairs, 1508
Meter, Water Supply by, 395
Metropolitan Water Supply—
Bills in Parliament, 19, 526, 792, 858, 1354 (*see also* London County Council)
Control of the Companies, Suggested Bill for the, 1046
Fire Plugs and Hydrants, Use of Water from, 195
Intercommunication Scheme, 1427
Lea Conservancy Board, Proposed Reconstitution of the, 76
Local Government Board and the London County Council, 731
London County Council and the (*see* London County Council)
Official Auditor and the Companies, 19
Rating of Reservoirs, 1108
Reports on the Quality of the, 195, 793
Royal Commission on, 18, 136, 194, 258, 320, 394 (*see also* London County Council)
Shaw-Lefevre, Mr., on the, 1541
Staines and Welsh Schemes, Criticism of the, 732, 792
Storage Reservoirs, Proposed New, in the Thames Valley, 18
Thames as a Source of Supply, 859
Paris, Water Affairs in, 259, 793
Parliament, Bills in, 19, 526, 792, 858, 1354 (*see also* London County Council)
Priestley's, Mr. C. H., Presidential Address to the British Association of Water Engineers, 1698
Reservoirs, Rating of, 1108
Royal Commission on the Metropolitan Water Supply, 18, 136, 194, 258, 320, 394, 596, 665
Schönheyder, Mr. William, on Water Supply by Meter, 395
Shaw-Lefevre, Mr., on London Water Questions, 739, 792, 1541
South Essex Water Bills, 1354
Southampton Water Scheme, Rejection of the, 76
Southwark and Vauxhall Water Company, 1608
Staines and Welsh Water Schemes, Criticism of the, 732, 792
Thames as a Source of Supply, 859
Thames Conservancy Annual Report, 1492
Thames Valley, Proposed New Storage Reservoirs in the, 18
Typhoid Fever Epidemics, Local Government Board and, 596, 732
Waste of Water, Checking, 136
Welsh and Staines Water Schemes, Criticism of the, 732, 792
West Middlesex Water Company, 1355
Woodhead, Dr. G. Sims and Ware, Mr. W. J., on Disinfecting the Maidstone Water Mains, 918

ESSAYS, COMMENTARIES, AND REVIEWS.

Accidents, Prevention of Factory, 139
Accounts of the Metropolitan Gas Companies for 1899, 995
Acetylene—
Gas Undertakings and the Supply of, 1720
Recent Literature on, 79
Allan, Mr. C. E., on the Rights of Local Authorities as regards Private Bills, 862
Allen, Mr. A. H., on the Chemistry of Tars and Mineral Oils, 1433
Allen, Mr. R. W., on the Presence of Naphthalene in Coal Gas, 668
America, Municipalization of Public Supplies in, 734
American Coal in Europe, 670
American Engineering Competition, 1428
Andés, M., on Iron Corrosion, Anti-Fouling and Anti-Corrosive Paints, 1296
Arbitration in Trade Disputes, 1211
Architects on the Building of Small Houses, 919
Arc Lamps, The Scientific Principles of Public Lighting by, 598
Auditors—
Directors *versus*, 1051
Duties and Responsibilities of, 81
Liability of, 670
Bacon, The Rev. J. M., on Fogs and their Teaching, 1050
Bacteria, Dr. George Newman on, 797
Barnes, Mr. T. J., on the Law of London Gas Companies, 1636
Bateman, Mr. C. E., on the Building of Small Houses, 919
Bills, Gas, Water, and Other, for 1900, 20, 79, 143, 199, 323, 399
Bills, Private, Rights of Local Authorities as regards, 862
Board of Trade—
Rates of Wages and Hours of Labour in 1899, 262
Returns of Exports and Imports, 669
State of Employment, 599, 735
Trade, A Good Beginning for the Year's, 397
Trade Disputes in 1899, 262
Bueb's, Dr., Cyanide Recovery Process, 80
Calder, Mr. John, on the Prevention of Factory Accidents, 139
Capital, Redemption of Gas and Water Companies', 463
Carter, Mr. F. W., on the Science and Art of Street Lighting, 598
Chemistry of Tars and Mineral Oils, 1433
Chemistry, Works on, 599, 1297
Citizenship, Good, 198
Clowes, Dr. Frank, and Coleman, Professor J. B., on Elementary Practical Chemistry and Qualitative Analysis, 1297
Coal—
American, Competition of, with British, 670, 1359
Kern, M. Gaston, on the Origin and Potentiality of, 1638
Market Abroad, 794
Press and the Scarcity and High Price of, 397, 1295
Prices and Railway Rates, 919
Problem, A "Times" Correspondent on the, 1049
Question, Parliament and the, 921
Resources and Consumption: A Reconsideration of Some Estimates, 462, 528
Scarcity of, in the Seventies, 993
Smyth, Sir Warington, on, and Coal Mining, 1116
Cochrane, Mr. C. H., on the Wonders of Modern Mechanism, 400
Coke Trade of Great Britain in 1899, 142
Companies, Joint Stock, in 1899, 261
Compensation Act—
Digest of Cases under the, 139
Lawyers and the, 861
Consumer's Handbook of the Law relating to Gas, Water, and Electric Lighting, 796
Continent, Gas Testing on the, 197, 261
Crefeld Gas Undertaking, The Progress of the, 22
Crosthwaite's System of Setting Retorts, 669
Cutler, Mr. S., jun., on Carburetted Water Gas, 921
Cyanide Recovery Process, Dr. Bueb's, 80
"Daily News" Special Commissioner on Rural Sanitation, 400
Deaths from Currents of Electricity, 198
Depreciation, Machinery, 529
Directors *versus* Auditors, 1051
Duckworth's, Mr. Lawrence, Consumer's Handbook of the Law relating to Gas, Water, and Electric Lighting, 796
Dundonald's, Lord, Experiments in the Distillation of Pit Coal, 735
Edwards, Mr. A. E. A., on Workshop Lighting, 1546
Electrical Supply, The Future of, 860
Electricity, Deaths from Currents of, 198
Electricity Generation in Bulk Schemes, 531, 860
Electric Lighting Memoranda—
Accidents, Electric Lighting, and Public Confidence, 20 (*see also* Metropolitan)
Accounts, Analysis of Electricity Works, 1636
Automobiles, Electric, 1294
Bills, Electricity Generation in Bulk, 396, 597, 1291, 1355, 1428, 1492, 1719
Board of Trade, President of, and the Troubles of Electric Light Users, 196
Bramwell, Sir F., on the Electric Lighting Acts, 1114
Brighton Corporation, The Electrical Business of the, 1355
Capital Outlay, Sparing, and Jeopardizing the Service, 77
Central London Electric Railway, 1636
Charging for Electricity, Wright System of, 991
Charing Cross and Strand Electricity Corporation, Fire at a Station of the, 667
City of London Electric Lighting Company and Competition, 733
Coal, The Shortage of, and Electricity Supply, 137, 1114
Competition and the Defaults of Electric Light Companies, 196
Connections, Lamp, and the Capacity of Station Plant, 77
Copper and India-rubber, Prices of, 137
Criticism, A, of the "Memoranda," 77
Dublin, The Electric Lighting Affairs of, 20, 1428
Dust Destruction and Electricity Supply, 138
"Electrician" and the Relative Trustworthiness of Gas and Electricity Meters, 1210, 1294, 1356
Electricity Generation in Bulk, 396, 597, 1294, 1355, 1428, 1492, 1719
Failures of Metropolitan Electricity Companies (*see* Metropolitan)
Fire at a London Electric Lighting Station, 667
Force Majeure, Cases of, 1114
Free Wiring at Lincoln and Worcester, 461, 1545
Fuel Value of Town's Refuse, 138
Gas and Electricity Supply, Combination of, 527
General Manager of Town Lighting Wanted, 260
High Voltage Supplies, Costliness of, 20, 1545
India-rubber and Copper, Prices of, 137
"Journal," The, A Source of Merriment, 321
Lamp Posts, A Study in, 1493
Leicester, The Electricity Supply Undertaking of, 527
Lincoln, Free Wiring at, 461
Little, Dr. J. Fletcher, on the Electricity Supply of Marylebone, 321
Local Authorities, Shareholders of Public Companies and Membership of, 1211
London County Council—
Electric Tramway Proposals, 793
Loans to Vestries for Electric Lighting, 733
London Electricity Works Accounts, Analysis of, 1636
London, Electric Lighting Troubles in, 77, 196, 321, 1114
Manchester Electricity Department, No Profits from the, in 1900, 1047
Manchester-Liverpool Express Electric Railway Bill, 1428
Meter Systems, Unreliability of, 991
Meters, The Relative Trustworthiness of Gas and Electricity, 1210, 1294, 1356
Metropolitan Electric Supply Company, Grievances of the Customers of the, 77, 196, 321, 1114
Metropolitan Railways, Electric Traction on the, 260, 460, 1355, 1636
Midlands, Touting in the, 1356
Municipalism in London, The Conflict of, 733
Municipalities and Electric Power Schemes (*see* Bills)
Paris Exhibition, Electricity at the, 1291
Popularity of Electric Lighting Imperilled, 20, 77, 196, 321
Preece, Sir W., on the Relation between Electricity and Engineering, 1114
Professors Disagree, 1493
Railway and Tramway Traction (*see* Traction)
Refuse Destruction and Electricity Supply (*see* Dust)
St. Pancras Playing with Insolvency, 1047
Segundo, Mr. Ed. C. de, on the Fuel Value of Town's Refuse, 138
Shareholders of Public Companies and Membership of Local Authorities, 1211
Subways in the City of London, 860
Sudbury (Suffolk) Electric Lighting and Refuse Destructor Scheme, 860
Swinburne, Mr. J., on Electric Tramways, 793
Traction, Electric, 260, 460, 793, 860, 1355, 1428, 1636
Voltage, Consumers' Bills and the Change to a Higher, 20, 1545
Whitechapel Electricity Supply, 138
Wiring, Free, 461, 1545
Worcester, Experience of, in Free Wiring, 1545
Wright System of Charging for Electricity, 991
Engineering Competition, American, 1428
Engineering Training, Some Views of, 530
Factory Accidents, Prevention of, 139
Fogs and their Teaching, 1050
Fowler, Sir H. H., on Municipal Trading, 1719
Gas Lighting, Chapter in the Early History of, 735
Gas Testing (*see* Photometrical)
Gas Undertakings Returns, 323
German Views on Gas Photometry, 261

Germany, Gas Supply in, 22
Glasgow, The Municipal Life of, 23
Goodell, Mr. J., on Water Works for Small Cities and Towns, 139
Haldane, Dr. J. S., on Carburetted Water Gas, 1048
Hall's, Mr. Jesse, Long Association with the Gas Industry, 599
Hand, Rev. J. E., Essays Edited by the, on Social, Personal, and Economic Problems and Obligations, 198
Harman, Mr. E. A., on the Uses of Steam in Modern Civilization, 531
Hart, Mr. John, on Lord Dundonald's Experiments in the Distillation of Pit Coal, 735
Havant District Council and Water Supply in Outlying Districts, 24
Hedley, Dr., on Deaths from Currents of Electricity, 198
Hopkins, Mr. A. B., on the Boroughs of the Metropolis, 1296
House Building, Intelligent, 464, 919
Housing Question and Municipalism, 1358
Illinois, Private and Municipal Ownership of Public Supplies in, 734
Iron and Steel in 1899, 21
Iron Corrosion, Anti-Fouling and Anti-Corrosive Paints, 1296
Johnson, Dr., and Gas Lighting, 1358
Joint Stock Enterprise in 1899, 261
Kern, M. Gaston, on the Origin and Potentiality of Coal, 1638
Laboratory, The Tyranny of the, 1294
Labour Questions—
  Arbitration in Trade Disputes, 1211
  Compensation, Workmen's (*see* Compensation)
  Employment, The State of, 599, 735
  Old Age Pensions, Cost of, 734
  Remuneration of Labour, 322
  Strikes and Lockouts in 1899, 262
  Wages and Hours of Labour in 1899, 262
  Working Classes, Material Progress of the, 1496
Lawyers and the Compensation Act, 861
Legislation, Proposed Gas and Water, 20, 79, 143, 199, 323, 399
Levinstein, Mr., on the Patent System, 992
Lighting of Workshops, 1546
Liquid Air and the Liquefaction of Gases, 1547
Liverpool Water Supply, 1638
Local Authorities, Minor, and Water and Drainage Questions, 24
Local Authorities, Rights of, as regards Private Bills, 862
Local Government Annual and Official Directory, 400
Lodge, Professor Oliver J., on Signalling Across Space without Wires, 199
London, A History of Gas Prices in, 138
London Gas Companies, The Law of; and Fancies about Some of Them, 1636
Machinery Depreciation, 529
Martin, Mr. J. W., on the Trend in American Cities, 795
Matthews, William, A Biography of, 465
Mechanism, Wonders of Modern, 400
Metropolis, The Boroughs of the, 1296
Metropolis Water Supply, The Royal Commission on the, 397
Metropolitan Gas Companies—
  Accounts of the, for 1899, 995
  Powers of Charge of, 138
Metropolitan Gas Referees' Instructions, 992
Municipal—
  Corruption and Trading in the United States, 795
  Muddling, 141
  Trading, Sir H. H. Fowler on, 1719
  Year Book for 1900, 600
Municipalization of Public Supplies in America, 734
Municipalism—
  A Royal Commission on, 397
  Housing Question and, 1358
Naphthalene Question, A New Aspect of the, 668
Newman, Dr. G., on Bacteria, 797
Norris, Mr. H. M., on the Remuneration of Labour, 322
Old Age Pensions, Cost of, 734
Paints, Anti-Fouling and Anti-Corrosive, 1296
Paisley, Introduction of Gaslight into, 82
Paris—
  Exhibition and the Proposed Congress of Gas Engineers, 140, 796
  Exhibition, 1356, 1430, 1493
  Gas Examination in, 197
Parliament—
  Coal Question and, 921
  Promoters in, 24
Patent Law and Patent Office Reforms, 992, 1115, 1432
Pensions, Cost of Old Age, 734
Petavel, Mr. J. E., on Standards of Light, 461
Photometrical Practice on the Continent, 197, 261
Photometry, M. Vautier's Review of, 77
Physics, Elementary Practical, 1297
Portsmouth Corporation and Local Enterprises, 141
Predictions—General and Gaseous, 1358
Preece, Sir W. H., on Engineering Training, 530
Press and the Scarcity and High Price of Coal, 397, 1295
Prestwich, Sir Joseph, The Life and Letters of, 796
Private Bills, The Rights of Local Authorities as regards, 862
Promoters in Parliament, 24
Railway Rates, Coal Prices and, 919
Redemption of Gas and Water Companies' Capital, 463
Referees' Instructions, The Metropolitan Gas, 992
Remuneration of Labour, The, 322
Retort Settings of 1850 and 1900, 669
Returns, The Gas Undertakings, 323
Reviews of Books, 23, 79, 138, 139, 198, 400, 465, 599, 796, 862, 1116, 1296, 1433, 1547, 1636, 1638
Richmond, Sir David, on the Municipal Life of Glasgow, 23
Rogers', Mr. S. E., Local Government Annual and Official Directory, 400
Rostron, Mr. Laurence W. S., on the Powers of Charge of Metropolitan Gas Companies, 138
Royal Commission on Municipalism, 397
Royal Society—Petavel, Mr. J. E., on Standards of Light, 461
Rural Sanitation, A Scheme of, 400
Scottish Gas Manager, A Veteran, 599
Signalling across Space without Wires, 199
Sloane, Mr. T. O'Conor, on Liquid Air, and the Liquefaction of Gases, 1547
Smith, Professor R. H., on a New Principle in Machinery Depreciation, 529
Smyth, Sir Warington, on Coal and Coal Mining, 1116
Social, Personal, and Economic Problems and Obligations, 198
South Metropolitan Gas Bill, Some Features of the Opposition to the, 1495
Stamp Duties, Stock Conversions and, 1359
Standards of Light, Some Fantastic, 461
Steam, Uses of, in Modern Civilization, 531
Stevenson, Mr. G. E., The Memorial to, 259, 527
Stock Conversions and Stamp Duties, 1359
Stock Market, Gas and Water Companies in the, 19, 77, 137, 196, 260, 321, 396, 460, 527, 597, 667, 733, 793, 859, 919, 991, 1047, 1114, 1210, 1294, 1355, 1428, 1492, 1545, 1636, 1719
Street Lighting, Concerning the Science and Art of, 598
Strikes and Lockouts in 1899, 262
Stroud, Professor, on Elementary Practical Physics, 1297
Swinton, Mr. A. A. Campbell, on Electricity Generation in Bulk, 531
Tanks, Ventilation of Tar and Liquor Storage, 398
Tars and Mineral Oils, Chemistry of, 1433
Testing, Gas (*see* Photometrical)
Tilden, Mr. W. A., on the Progress of Scientific Chemistry, 599
"Times" Correspondent, A, on the Coal Problem, 1049
Trade Disputes, Arbitration in, 1211
United States, Municipal Corruption and Municipal Trading in the, 795
Vautier's, M., Review of Photometry, 77
Ventilation of Tar and Liquor Storage Tanks, 398
Wages and Hours of Labour in 1899, 262
Walker, Professor J., on Physical Chemistry, 1297
Water and Drainage Questions, Minor Local Authorities and, 24
Water Gas, Carburetted—
  Cutler, Mr. S., jun., on, 921
  Haldane, Dr. J. S., on, 1048
Water Works for Small Cities and Towns, 139
Weir's Digest of Cases under the Compensation Act, 139
Wood, Mr. G. H., on the Material Progress of the Working Classes, 1496
Worker, An Early, in the Gas and Water Industries, 465
Working Classes, Material Progress of the, 1496
Workmen's Compensation (*see* Compensation)
Workshop Lighting, Some Views on, 1546
Year's Trade, A Good Beginning for the, 397

NOTES.

Acetylene Industry, Developments in the, 1722
Actinism, Latest Puzzles in, 1052
Air, Compressed, for Power Transmission, 601
Air Inlets and Outlets for Ventilation, 1297
Alabama, Prospects of Cheap Coal from, 1722
Ammonia, Oxidation of, by Iron, 532
Arches, Metallic Joints for Masonry, 1550
Arndt's Econometer, 201
Asphalte, The Action of Water on, 1434
Blast Furnace Work, Large Gas Engines for, 1640
Blue Flame Oil Stove, A, 1118
Boilers, Water Circulation in, 325
Building Material, Fireproof, 84, 601, 1722
Burners, Lighting, by the Induction Spark, 736
Carbide of Calcium and Fire Risk, 1549
Cement Testing, 325, 601
Chemistry, Progress of Electro, 923
Chimney, Throwing a High, 532
Cinder Concrete Floors, 201
Coal—
  Prospects of Cheap, from Alabama, 1722
  Sampling and Analysis of, 923
  Spontaneous Combustion of, 144
  Treating, for Coking, 996
Coke—
  Breeze Concrete Slabs, 1722
  Breeze for Fire Resisting, 601, 1722
  Fuel for Road Motor Vehicles, 325
  Melting of, in Liquid Lime, 1052
  Ovens in France and Germany, 1118
  Quenching, Mechanical, 84
Coking, Treating Coal for, 996
Colliery Workings, Refilling, 1053
Competitors with Gas, New, 1497
Compressed Air for Power Transmission, 601
Concrete—
  Bridge, Collapse of a, in Paris, 1297
  Cinder, Floors, 201
  Coke Breeze, Slabs, 1722
  Construction, Expanded Metal and, 401
  Cross Breaking Tests of, 923
  Frozen, Strength of, 996
Contractor's Business, Some Points of a, 1640
Conveyors, Use of, in Excavating, 996
Crookes's, Sir W., British Association Address, 84
Cyanogen Gas, A, Identical with Argon, 1640
Damp Houses, 1118
Decay of Stones in London Air, 1549
Diesel Oil Engine, The, 144
Domestic Uses of Gas, 26
Draughts in Houses, 600
Dust, Use of Oil for Laying, 1297
Earth Retaining Walls, Thickness of, 325
Econometer, Evidence for the, 201
Electric—
  Incandescent Lamps, 1497
  Lighting, The Cost of Private, 1118
  Lights, Lightning and Street, 467, 1052
  Traction, A New System of, 1118
Electro Chemistry, Progress of, 923
Engine—
  Oil, The Diesel, 144
  Steam, Performance, Standard of, 863
  Westinghouse Gas, Efficiency of the, 84
Engineering Contractor's Business, Some Points of an, 1640
Engines—
  Large Gas, for Blast Furnace Work, 1640
  Pumping, Working by Producer Gas, 863
  Steam, A Source of Waste in, 736
Excavating, Use of Conveyors in, 996
Expanded Metal and Concrete Construction, 401
Ferruginous Incrustations in Water Pipes, 1053
Fireproof Building Material, Tests of, 84, 601, 1722
Fireproofing of Wood, 923
Fire Risk, Carbide of Calcium and, 1549
Floors, Cinder Concrete, 201
Floors, Fire Resisting, 601
Foundations, Strength of, 201
Fuel—
  Oil, Portability of, 84
  Waste, Rise in Price of, 144
Furnaces—
  Management of, 468
  Refractory Linings of, 1052
  Sampling the Waste Gases of, for Carbonic Acid, 201
Gas, Domestic Uses of, 26
Gases, A Mixing Chamber for, 26
Giffen, Sir R., on Sir W. Crookes's Alarmist British Association Address, 84
Heating, Vacuum Steam, 1497
Houses, Damp, 1118
Houses, Draughts in, 600
Igniting Gas Burners by the Induction Spark, 736
Incandescent Bodies, Temperature of, 144
Induction Spark, Igniting Gas Burners by the, 736
Iron—
  Oxidation of Ammonia by, 532
  Oxide Paint, Making Good, 26
  Rusting of, 1549
Krypton, 1298
Labour Remuneration in England, Premium Plan of, 532
Light, A Suggested Theory of, 26
Lighthouse Engineering at the Paris Exhibition, 1549
Lightning and Street Electric Lights, 467, 1052
Lime, Liquid, Melting of Coke in, 1052
London Air, Decay of Stones in, 1549
Lubricants, Improvement of, 863
Lubrication of Machinery, 84
Macadam, Cost of Tar, 26
Machinery, Lubrication of, 84
Magnesite, The Trade in, 1052
Metallic Joints for Masonry Arches, 1550
Meters, Success with, 1497
Mixing Chamber for Gases, 26
Motor Waggons, Gas Mains, and Soft Roads, 923
New York—
  Street Railway Power House, 145
  Tenement House Building in, 923
Nordenskiöld on the Rare Earths, 1118
Oil—
  Engine, The Diesel, 144
  Fuel, Portability of, 84
  Stove, A Blue Flame, 1118
  Use of, for Laying Dust, 1297
Oxidation of Ammonia by Iron, 532
Oxygen Process, Pictet's New, 1497
Packings, Steam, 402
Paint—
  Durability of, 736, 996
  Making Good Iron Oxide, 26
  Medium, A New, 1497
  Perishing of, The, 532
  Zinc White, 863
Paris—
  Collapse of a Concrete Bridge in, 1297
  Exhibition, Lighthouse Engineering at the, 1549
Paving, Tough Coal Tar, 1434
Peat for Carbonizing, 863
Petroleum Blue Flame or Wickless Heating Burner, 1497
Pictet's New Oxygen Process, 1497
Pipe Discharge Formulæ, A Criterion for, 1434
Pipes, Water, Ferruginous Incrustations in, 1053
Pneumatic Pyrometer, The, 401

Pohlé Water Raiser, Tests of the, 1722
Portability of Oil Fuel, 84
Portland Cement, Testing, 601
Power Plant, A Combination, 1722
Premium Plan of Labour Remuneration in England, 532
Producer Gas, Working Pumping Engines by, 863
Pyrometer, The Pneumatic, 401
Railway Power House, New York Street, 145
Rare Earths, Nordenskiöld on the, 1118
Retaining Walls, 325, 1549
Road Motor Vehicles, Coke Fuel for, 325
Rope, Wire, Manufacture of, 467
Rusting of Iron, 1549
Spontaneous Combustion of Coal, 144
Steam—
  Engines, Source of Waste in, 736
  Heat Distribution, 1052
  Heating, Vacuum, 1497
  Improving the Quality of, 467
  Packings, 402
  Rollers and Gas Pipes, 923
Steel, The Tempering of, 468
Stones, Decay of, in London Air, 1549
Tar, Macadam, Cost of, 26
Tar, Paving, Tough, 1434
Temperature of Incandescent Bodies, 144
Tempering of Steel, 468
Tenement House Building in New York, 923
Traction, A New System of Electric, 1118
Ventilating and Warming Engineering, 1497
Ventilation, Air Inlets and Outlets for, 1297
Walls, Retaining, 325, 1549
Warming and Ventilating Engineering, 1497
Waste Fuel, Rise in Price of, 144
Water Circulation in Boilers, 325
Water Power Privileges, Valuation of, 325
Water Raiser, Tests of the Pohlé, 1722
Westinghouse Gas Engine, Efficiency of the, 84
Wind Pressure, 144
Wire Ropes, Manufacture of, 467
Wood, Fireproofing of, 923
Zinc White Paint, 863

COMMUNICATED ARTICLES.

Coal, Cost of. By Norton H. Humphrys, Assoc M. Inst.C.E , F.C.S., 1550
Coal, The Question of an Export Duty on. By a Correspondent, 1298
Engines, Steam and Gas, Efficiency of. By Ed. C. de Segundo, 863
Foundations for Metal Tanks. By R. J. Milbourne, Assoc.M.Inst.C.E., 26
Gas Companies and Peripatetic Gas Testing. By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S., 671
"Gas Fountains." By Just Alix, 264
German Form of Condenser. By Theodor Hiller, 1498
Smoke Preventer for Pipe Jumpers. By J. O. V. Irminger, 263
Temperature of Gas and Electric Light. By Charles F. Botley, Assoc.M.Inst.C.E., 263
Water Gas in France, The Future of. By Just Alix, 997

TECHNICAL RECORD.

Acetylene, Action of, on Copper, 335
Addresses, Presidential—
  Bell, Mr. J. Ferguson (Midland Association), 602
  Carmichael, Mr. J. W. (Scottish Gas Managers), 924
  Helps, Mr. J. W. (Institution of Gas Engineers), 1109
  Irving, Mr. D. (Southern District Association), 610
  M'Lusky, Mr. W. B. (Waverley Association), 999
  O'Connor, Mr. Henry (Society of Engineers), 326
  Oechelhaeuser, Herr W. von (German Association), 1640
  Priestley, Mr. C. H. (British Association of Water Works Engineers), 1725
  Stevenson, Mr. E. H. (Gas Institute), 1542
Allen, Mr. R. W., on the Presence of Naphthalene in Coal Gas, 673, 1003
Ammonia: Its Saving and Concentration, 800
Ammonia, Testing Gas Liquor for, 334
Ammoniæ, Liquor, Production of, from Gas Liquor, 678
Anderson, Dr. W. Carrick, and Roberts, Mr. J., on Recovery of Nitrogen in Coal Distillation, 330
Anthracite Coal, Combustible Matter in Coke and, 869
Asphalt in Tank Construction, 1290
Austria Hungary, Association of Gas and Water Engineers of, 1554
Automatic Stoking and Inclined Retorts, Mr. W. R. Chester on, 1699
Baker, Mr. A., on an Experiment with a Concrete and Expanded Metal Structure, 1292
Barthold, Mr. W. H., on Temperatures in Condensation, 1724
Bell's, Mr. J. Ferguson, Presidential Address to the Midland Association, 602
Benzene and Ethylene, Determination of, in Coal Gas, 1439
Blake, Professor L. J., on the Electrolysis of Cast Iron Water Mains, 86
Bookbindings, Deterioration of, 1001
Boston, U.S.A., Coke Oven Gas Plant at, 205
British Association of Water Works Engineers—
  Cardiff Corporation Water Works, 1726
  Election of Office Bearers, 472
  General Business, 1725, 1726, 1727
  Jones, Mr. C. E., on the Nation's Water Supply and its Effective Control, 541
  President's (Mr. C. H. Priestley's) Inaugural Address, 1725
  Visits to Works, 1727
Bueb's, Dr., Method of Preventing Freezing in Gas Services, 868
Bunte and Eitner's, Drs., Experiments on the Kugel Gas Light, 265
Burner for Incandescent Gas Lighting, 146
Burrator Reservoir, Plymouth, Outlet Valves at, 28
Bye Product Coke Ovens as a Source of Gas Supply, 1213
Calorific Power of Illuminating Gas, 1204
Cannel and Shales, Carbonizing, for Gas Making Purposes, 1286
Carbonization of Coal for the Production of Illuminating Gas, 865
Carbon Monoxide, Volumetric Determination of Small Quantities of, 1004
Carmichael's, Mr. J. W., Address at the Informal Meeting of Scottish Gas Managers, 924
Carpenter, Mr. C. C., on Inclined Retorts at Bankside, 1275
Charlottenburg Gas Works, 468
Chemical Society—Mr. R. W. Allen on the Vapour Pressure of Naphthalene, 1003
Chemistry, A Century of, 1502
Chester, Mr. W. R., on Automatic Stoking and Inclined Retorts, 1699
Chollar, Mr. B. E., on Oxide Purification, 1213
Christiania Incandescent Burner Systems, Sugg's Increased Pressure and, 680
Coal, Price of, and Its Effect on the Gas Industry, 1057
Coals, Analysis of, for Gas Manufacture, 470
Coal Weighing and Recording Machines, 1005
Cockerell, Mr. Douglas, on Leather for Bookbinding, 1001
Coke and Anthracite Coal, Combustible Matter in, 869
Coke Conveying Plant, The De Brouwer, at the Crystal Palace Gas Works, 202, 1302
Coke Oven Gas Plant, Everett, 205
Colman, Dr. H. G., and Smith, Mr. J. F., on the Estimation of Naphthalene in Gas, 330, 798
Colman, Dr. H. G., on the Calorific Power of Illuminating Gas, 1204
Combustible Matter in Coke and Anthracite Coal, 869
Compressed Air, Painting by, 871
Condensation Temperatures, 1724
Cooker, A Large Gas, 541
Crosthwaite's System of Setting Retorts (1850), 679
De Brouwer Coke Conveying Plant and a Carburetted Water Gas Plant at the Crystal Palace Gas Works, 202, 1302
Dellwik, Mr. Carl, on the Manufacture and Application of Water Gas, 1303
Dewar, Professor, on a Century of Chemistry, 1502
Differential and Uniform Prices for Gas, 800
Distribution, Gas, High Pressure, 676, 866, 1723
Distribution of Gas of Different Qualities, 869
Drake's Patent Retort Settings, 679
Dresden Water Works, 146
Dublin, Supply of Water Gas in, 1124
Dunbar, Professor, on the Oxidation Process for Sewage Treatment, 1502
Eastern Counties Gas Managers' Association—
  General Business, 1053, 1060
  Paper and Discussions—
  Shadbolt, Mr. R. G., on Gas Coal: Its Present Price and Effect on the Gas Industry, 1057
  Sheldrake, Mr. J. H., on Incandescent Street Lighting, 1053
Electrolysis of Pipes, 86, 1501
Engines, Gas, in Practice, 929
Enrichment of Coal Gas, The, 1200
Everett Coke Oven Gas Plant, 205
Examinations in Gas Manufacture, 1214
Exchanges, Gas Appliance, 1060
Expert Evidence, Mr. J. Wilkinson on, 1708
Explosion in an Experimental Holder—Action of Acetylene on Copper, 335
Freezing, Preventing, in Gas Services, 868
French, Mr. D. W., on Repairing a Submerged Water Main, 1643
Fuel Gas, Mr. J. R. Lynn on, 1123
Fuel, Value of Producer Gas as a, 403
Fuertes, Mr. J. H., on the Dresden Water Works, 146
Fuller, Mr. F. L., on Covered Reservoir Construction, 472
Gas Appliance Exchanges, 1060
Gas Distribution at High Pressure, 676, 866, 1723
Gas Institute, The Incorporated—
  Amalgamation Proposal, The, 1191, 1617, 1624
  Annual Report and Accounts, 1435
  Dougall, Mr. A., Presentation to, 1617, 1627
  General Business, 1616, 1624, 1625
  Paris, The Visit to, 1632
  President's (Mr. E. H. Stevenson's) Inaugural Address, 1542
  Programme, 798, 1435
Gas Institute (*continued*) —
  Review and Summary of Proceedings, 1609, 1611
  Papers and Lecture—
  Chester, Mr. W. R., on Automatic Stoking and Inclined Retorts, 1699
  Walmisley, Mr. A. T., on Retort House Roofs, 1703
  Webber, Mr. W. H. Y., on the New Gas, 1627
  Wilkinson, Mr. J., on Some Disputed Points among Gas and Water Experts, 1708
  Young, Mr. W., on Naphthalene from Retort to Point of Deposition, 1712
Gas Liquor—
  Production of Liquor Ammoniæ from, 678
  Testing Ammonia, 334
Gas, Pumping, Five Miles at 20 lbs. Pressure, 676, 866, 1723
Gasholders, Guide Framing of, 1499
German Association of Gas and Water Engineers—
  Inaugural Address of Herr W. von Oechelhaeuser, 1640
Gigli, Signor T., on the Action of Acetylene on Copper, 335
Glover, Mr. S., on the Carbonizing of Cannel and Shales for Gas Making, 1286
Governors, Mr. E. H. Millard on, 1119
Guide Framing of Gasholders, 1499
Haber, Professor F., on the Determination of Benzene and Ethylene in Coal Gas, 1439
Hacker, Herr, on the Guide Framing of Gasholders, 1499
Halliwell, Mr. S. E., on Examinations in Gas Manufacture, 1214
Heating of Gas Retorts, The, 606
Helps, Mr. G., on the Heating of Gas Retorts, 609
Helps', Mr. J. W., Presidential Address to the Institution of Gas Engineers, 1109
Herring, Mr. W. R., on Inclined Retorts, 865
Herting, Herr O., on the Testing of Gas Liquor for Ammonia, 334
Hickenlooper, General A., on Street Lighting, 1123
High Pressure Gas Light—
  "Kugel," 265
  Sugg's, 680
Holland, Association of Gas Engineers of, 1554
Hydraulic Mains, Coal Bunkers, &c., Water Clad, 540
Hydro Incandescent Gas System, 28
Illuminating Power of Gas, Scottish Gas Managers on the, 924
Incandescent Gas Lighting—
  Burner, Ordinary Gas Pressure, 145
  Hydro Incandescent Gas System, 28
  In South London, 1002
  Jasper Mantle, 540
  Sheldrake, Mr. J. H., on, for Street Illumination, 1053
  Sugg's Increased Pressure and Christiania Systems, 680
  Torch Lighting for Street Lamps, 1127
  White Deposit on Ceiling Protectors and Chimneys, 402
Incandescent Gas Mantle and Its Use, Professor Vivian B. Lewes and the, 1299, 1360, 1435
Inclined Retorts (*see* Retorts)
Ingham, Mr. W., on the Incrustation of Iron Pipes at the Torquay Water Works, 147
Ingrey, Mr. Charles, on Automatic Coal Weighing and Recording Machines, 1005
Institution of Gas Engineers—
  Amalgamation Proposal, The, 1191, 1617, 1624,
  Autumn Meeting and the Paris Conference, 1193
  Election of Office Bearers, 326
  General Business, 326, 1190
  President's (Mr. J. W. Helps') Inaugural Address, 1109
  Programme, 998
  Review and Summary of Proceedings, 1184, 1186
  Papers and Lecture—
  Baker, Mr. A., on an Experiment with a Concrete and Expanded Metal Structure, 1292
  Carpenter, Mr. C. C., on the Inclined Retorts at Bankside, 1275
  Colman, Dr. Harold G., on the Calorific Power of Illuminating Gas, 1204
  Glover, Mr. S., on Carbonizing Cannels and Shales for Gas Making, 1286
  Irwin, Mr. Wilfred, on the Presence of Naphthalene in Coal Gas, 1282
  Lewes, Professor Vivian B., on Water Gas and Its Recent Continental Developments, 1194
  Livesey, Mr. George, on the Enrichment of Coal Gas, 1200
  Stevenson, Mr. F. W., on Tank Construction, 1290
Institution of Mechanical Engineers—
  Ingham, Mr. W., on the Incrustation of Iron Pipes, 147
  Schönheyder, Mr. W., on Water Meters: With Special Reference to Small Flows and Waste in Dribbles, 335
Intensified Gas Light Company's New Burner, 146
Iron and Steel Institute—Mr. Carl Dellwik on the Manufacture and Application of Water Gas, 1303
Irving, Mr. D.—
  Electrolysis in Gas and Water Mains, 1501
  Presidential Address to the Southern Association, 610
Irwin, Mr. Wilfred, on the Presence of Naphthalene in Coal Gas, 1282
Jasper Mantle, The, 540
Jones, Mr. C. E., on the Nation's Water Supply, and Its Effective Control, 541

Jordeson Gasholder Case, The Law in regard to Underground Water, and its Bearing on the, 737
Killing, Dr. C., on the White Deposit on Ceiling Protectors and Chimneys of Incandescent Gas Burners, 402
"Kugel" High Pressure Gas Light, Illuminating Power and Colour of the, 265
Labour Saving Machinery in Gas Works, 145
Lamp Column, A Model, 1002
Leather Bookbindings, Deterioration of, 1001
Leigh (Lancs.) Gas Works, Inclined Retorts at the, 85
Lewes, Professor Vivian B.—
Incandescent Gas Mantle and its Use, 1299, 1360, 1436
Water Gas and Its Recent Continental Developments, 1194
Liquid Ammoniæ, Production of, from Gas Liquor, 678
Liquid Fuel, Mr. B. J. Allen on, 929
Livesey, Mr. G., on the Enrichment of Gas, 1200
Lynn, Mr. J. R., on Fuel Gas, 1123
Lyon, Mr. J. D., on Gas Engines in Practice, 929
M'Ilhenny, Mr. J. D., on Prepayment Meters, 1124
M'Lusky's, Mr. W. B., Address to the Waverley Association, 999
Maidstone Water Mains, Disinfection of the, 930
Mains (*see* Pipes)
Manchester and District Junior Gas Association, 870, 1214, 1435
Manchester District Institution of Gas Engineers—
General Business, 533
President's (Mr. T. N. Ritson's) Inaugural Address, 534
Visit to the Lake District, 1435
Meade-King, Mr. W. O. E., on Parish Water Supply and Sewerage, 269
Meade, R. K., and Attix, J. C., Messrs., on Combustible Matter in Coke and Anthracite Coal, 869
Merrifield-Westcott-Pearson Carburetted Water Gas Plant at the Crystal Palace Gas Works, 204
Metal, Expanded, and Concrete Structure, An Experiment with a, 1292
Meters, Water, Mr. W. Schönheyder on, 335
Meter Testing, Mr. Paul Doty on, 800
Michigan (U.S.A.) Gas Association, 800
Midland Association of Gas Managers—
General Business, 601, 608, 609, 1552
Helps', Mr. G., Paper on the Heating of Gas Retorts (Discussion), 606
President's (Mr. J. Ferguson Bell's) Inaugural Address, 602
Smethwick, The Inclined Retorts at, 608
Stafford Gas and Electricity Works, 1553
Visit to Stafford, 1552
Millard, Mr. E. H., on Governors, 1119
Murdoch's House at Redruth, 1126
Naphthalene—
Allen, Mr. R. W., on the Presence of, in Coal Gas, 673, 1003 (*see* also "Essays" and "Correspondence)
Estimation of, in Coal Gas, 330, 798
Irwin, Mr. W., on the Presence of, in Gas, 1282
Young, Mr. W., on, 1712
New England Association of Gas Engineers—
Shelton, Mr. F. H., on Pumping Gas Five Miles at 20 lbs. Pressure, 676, 866
Summary of Proceedings, 866, 928
Nitrogen, Recovery of, in Coal Distillation, 330
North of England Gas Managers' Association—
Addresses to Mr. J. H. Cox and Mr. C. Sellers, 1122
General Business, 1119, 1122
Millard, Mr. E. H., on Governors, 1119
O'Connor's, Mr. Henry, Presidential Address to the Society of Engineers, 326
Oechelhaeuser's, Herr W. von, Presidential Address to the German Association of Gas and Water Engineers, 1640
Ohio Gaslight Association, 1060, 1123, 1213
Outlet Valves at Burrator Reservoir, Plymouth, 28
Oven and Retort House Construction and Results, 867
Oxidation Process for Sewage Treatment, 1502
Oxide Purification, Mr. B. E. Chollar on, 1213
Painting by Compressed Air, 871
Paris, A Large Gas Roaster in, 541
Paris, Visit of the Gas Institute to, 1632
Parish Water Supply and Sewerage, 269
Pfeiffer's, Dr. Otto, Improvements in the Production of Liquor Ammoniæ from Gas Liquor, 678
Pipes—
Disinfection of Water, 930
Electrolysis of, 86, 1501
Incrustation of Iron, at the Torquay Water Works, 147
Laying under Water, 928, 1061
Repairing Submerged, 1643
Vitrified Clay, for Gas and Water Mains, 1215
Water Hammer in, 1440
Plymouth (Burrator) Reservoir, Outlet Valves at the, 28
Prepayment Meters in America, 867
Prepayment Meters, Mr. J. D. M'Ilhenny on, 1124
Producer Gas, Value of, as a Fuel, 403
Protectors and Chimneys of Incandescent Gas Burners, The White Deposit on Ceiling, 402
Pumping Gas Five Miles at 20 lbs. Pressure, 676, 866, 1723
Redruth, Murdoch's House at, 1126
Regenerative Benches, Mr. H. C. Slater on, 1723
Repairing a Submerged Water Main, 1643
Reservoir, Covered, Construction in the United States, 472
Retorts—
Helps, Mr. G., on the Heating of, 606
Inclined—
Bankside Gas Works, 1275
Chester, Mr. W. R., on, 1699
Herring, Mr. W. R., on, 865
Leigh (Lancs.) Gas Works, 85
Smethwick Gas Works, 608
Settings of, in 1850 and 1900, 679
Reynolds, Professor J. Emerson, on the Supply of Water Gas in Dublin, 1124
Rhodin, Mr. J. G. A., on the Analysis of Coals for Gas Manufacture, 470
Rigg, Mr. A., on Ventilation without Draughts, 268
Roaster, A Large Gas, in Paris, 541
Robus's Water Clad Hydraulic Mains, Coal Bunkers, &c., 540
Roofs, Mr. A. T. Walmisley on Retort House, 1703
Schönheyder, Mr. W., on Water Meters, 335
Scottish Gas Managers, Informal Meeting of, 924
Scott-Snell Gas Compressor, 28
Service Pipes, Preventing Freezing in, 868
Sewage Treatment, Oxidation Process for, 1502
Shadbolt, Mr. R. G., on Gas Coal: Its Present Price and Effect on the Gas Industry, 1057
Sheldrake, Mr. J. H., on Incandescent Street Lighting, 1053
Shelton, Mr. F. H., on High Pressure Gas Distribution, 676, 866, 1723
Slater, Mr. H. C., on Regenerative Benches, 1723
Smethwick Gas Works, Inclined Retorts at the, 608
Society of Arts—
Cockerell, Mr. Douglas, on Leather for Bookbindings, 1001
Lewes, Professor Vivian B., on the Incandescent Gas Mantle and its Use, 1299, 1360, 1436
Meade-King, Mr. W. O. E., on Parish Water Supply and Sewerage, 269
Rigg, Mr. Arthur, on Ventilation without Draughts, 268
Society of Chemical Industry—
Allen, Mr. R. W., on the Presence of Naphthalene in Coal Gas, 673
Anderson, Dr. W. C., and Roberts, Mr. J., on the Recovery of Nitrogen in Coal Distillation, 330
Colman, Dr. H. G., and Smith, Mr. J. F., on the Estimation of Naphthalene in Coal Gas, 330, 798
Rhodin, Mr. J. G. A., on the Analysis of Coals for Gas Manufacture, 470
Society of Engineers—
O'Connor's, Mr. Henry, Presidential Address, 326
Woodhead, Dr. G. Sims, and Ware, Mr. W. J., on the Disinfection of the Maidstone Water Mains, 930
South London, Incandescent Gas Lighting in, 1002
Southern District Association of Gas Engineers and Managers—
General Business, 609
Irving, Mr. D., on Electrolysis in Gas and Water Mains, 1501
President's (Mr. D. Irving's) Inaugural Address, 610
Visit to Bristol, 1499
Stafford Gas and Electricity Works, 1552
Stevenson's, Mr. E. H., Presidential Address to the Gas Institute, 1542
Stevenson, Mr. F. W., on Tank Construction, 1290
Street Lighting, General Hickenlooper on, 1123
Sugg's Increased Pressure and Christiania Incandescent Burner Systems, 680
Surveyors' Institution—Mr. J. Shiress Will, Q.C., on the Law regarding Underground Water, 737
Tank Construction, Asphalt in, 1290
Temperatures in Condensation, 1724
Torches for Incandescent Street Lamps, 1127
Torquay Water Works, Incrustation of Iron Pipes at the, 147
Underground Water, The Law in Regard to, 737
United States, Covered Reservoir Construction in the, 472
Ventilation without Draughts, 268
Vitrified Clay Pipes for Gas and Water Mains, 1215
Volumetric Determination of Small Quantities of Carbon Monoxide, 1004
Walmisley, Mr. A. T., on Retort House Roofs, 1703
Water Clad Hydraulic Mains, Coal Bunkers, &c., 540
Water Gas—
Lewes, Professor Vivian B., on, and Its Recent Continental Developments, 1194
Manufacture and Application of, 1303
Plant—
Merrifield-Westcott-Pearson, at the Crystal Palace Gas Works, 204
Waters, Mr. J. A., on the Working of, 867
Supply of, in Dublin, 1124
Water Hammer in Pipes, 1440
Water, Laying Pipes under, 928, 1061
Water Supply and Its Effective Control, 541
Water Supply and Sewerage, Parish, 269
Waverley Association of Gas Managers, 999
Westcott, Mr. J. T., on Labour Saving Machinery in Gas Works, 145
Western Gas Association, 1723
Wilkinson, Mr. J., on Some Disputed Points among Gas and Water Experts, 1708
Will, Q.C., Mr. J. Shiress, on the Law in Regard to Underground Water, 737
Woodhead, Dr. G. Sims, and Ware, Mr. W. J., on the Disinfection of the Maidstone Water Mains, 930
Yorke, Mr. E. H., on the Distribution of Gas of Different Qualities, 869
Young, Mr. Peter, on Bye Product Coke Ovens as a Source of Gas Supply, 1213
Young, Mr. W., on Naphthalene from Retort to Point of Deposition, 1712

REGISTER OF PATENTS.

[*The names printed in italics are those of persons by whom patents have been communicated.*]

Abel, C. D.—
Admission Valves for Gas Engines, 801
Coin Freed Meters, 270
Feeding Boiler and other Furnaces, and Removing Ash and Clinkers, 87
American Stoker Company—Making Gas for Heating Purposes, 681
Anspach, J.—Lighting Gas from a Distance, 1442
Apt, J.—Illuminating Media for Incandescent Gas Lighting, 1645
Automatic Universal Gas Lighter, Limited—Automatically Igniting Gas, 272
Beechey, C. G., and Wright, A. T.—Coin Freed Gas Meters, 206, 1728
Beese, R.—Incandescent Gas Lamp, 340, 1064
Berger, F.—Acetylene Generator, 742
Berger, H.—Generating Acetylene, 31
Bernstein, S.—Gas Burners for Incandescent Lamps, 1063
Bernt, J., and Cervenka, E.—An Inverted Gas Mantle Burner, 1556
Blaasch, H.—Strengthening Incandescent Gas Mantles, 151
Blass, E.—Production of Heating Gases, Poor in Nitrogen, from Combustible Materials containing Hydrocarbons, 872
Bollé, C.—Igniting Gas Burners from a Distance, 742
Boult, A. J.—
Acetylene Generators, 208
Carburation of Gas, 801
Mantles for Incandescent Gas Lighting, 1005
Manufacture of Water Gas, 613
Bower, G., Regenerative Gas Burners, 1063
Bray, J. W.—Gas Burners, 1556
Brearley, J. H.—Regenerative Furnaces for Gas Retorts, 616
Brooks, A. G.—Prepayment Attachments for Gas Meters, 208
Buchet, E. V.—Internal Combustion Motors, 1728
Burchard, L. S.—Coin Controlled Vending Attachments for Gas Meters, 742
Carey, J. W.—Acetylene Generators, 474
Chandler, S. & J.—Washers or Scrubbers, 271
Chesley, S. A.—Fluid Meters, 682
Clauss, F.—Continuous Generation of Water Gas, 1062
Clay, W. R.—Incandescent Gas Burners, 270
Colman, H. G.—Treating Coal and Other Illuminating Gas, 405
Compagnie Française de l'Acetylène—Acetylene Gas Burners for Use with Incandescing Mantles, 209
Croizat, V.—Lighting and Extinguishing Series of Street and Other Gas Lamps, 1064
Daix, V.—Treating Earthy Oxides in the Manufacture of Incandescent Mantles, 1644
Darby, H., W. & I., and Punchard, J. H. & W. C.—Circular Flame Gas Burners, 1644
Dauber, A.—Producing Acetylene, 31
De Léry, J. B., and Richardson, C. G.—Making Incandescent Mantles, 1556
Delin, G.—Obtaining Intense Heat from Gas, 1364
Denayrouze, L.—Incandescence Lamps, 1007
Dolan, E. J.—Acetylene Burners, 406
Dougill, A.—Gas Engines, 1442
Drake, J. A.—Generator and Regenerative Furnaces, 615, 681
Dresser, S. R.—Pipe Joints and Couplings, 1130
Duncan, J. H. H.—
Incandescence Bodies, 272
Incandescent Burners and Mantle Supports, 208
Duncan, J. H. H., the New Incandescent (Sunlight Patent) Gas Lighting Company, Limited, and Barnett, H. T.—Incandescence Bodies, 1062
Duncan, W.—Water Meters, 1729
Elliott, C., Damp, G., and M'Dade, J.—Cleaning the Interior of Ascension Pipes, 1364
Evans, A. F.—Silencers for Gas Engine Exhaust, 406
Ernst, O., and Philips, A.—Purifying Acetylene, 871
Firth, G. H., Bentham, F. H. and Stott, J. H.—Anti Vibratory Incandescent Burners, 1441
Fitzlaff, C.—Igniting Gas Burners from a Distance, 742
Fleischer, E.—Manufacture of Water Gas, 613
Foulger, G. F. L., and Glover, J. G.—Lamplighter's Torch, 1063, 1128
Foulis, W.—Apparatus for Charging Retorts and for Stirring and Withdrawing the Charge from Retorts, 931
Franzen, C.—Controlling the Supply of Gas to Burners and Effecting Ignition from a Distance, 31
Friedeberger, L., and the "Vulkan" Gesellschaft für Selbstzündende Glühkörper mit Beschränkter Haftung—Igniters for Gas, 1128

Fäller, E.—Apparatus for Mixing Air and Gas, 1005
Gasmotoren Fabrik Deutz—Admission Valves for Gas Engines, 801
Glasgow, A. G.—Gasholders for Equalizing Intermittent Gas Production and other Purposes, 933
Glover, R. T. & J. G.—Coin Freed Meters, 339
Golby, F. G.—A Double Chimney Incandescent Gas Burner, 1556
Goodwin, R.—Purifying Acetylene Gas, 1555
Grantoff, A. H., and Fritz, F.—Burners for Incandescence Gas Lighting, 1728
Green, H.—Prepayment Meters, 613
Greenall, J.—Gas and Like Fluid Meters, 1557
Greyson de Schodt, P.—Incandescent Gas Lighting and Heating, 152
Guillaume, N. A.—Washing and Purifying Gas, 617, 682
Haddan, R.—Controlling Gas Cocks and Lighting Gas Burners, 340
Hamilton, J. H.—Internal Combustion Engines, 87
Hein, R., and Hahn, T.—Gas Pressure Regulators, 1129
Heinroth, P., and Tresenreuter, G.—Incandescent Gas Burners, 1129
Helmecke, H.—Incandescent Gas Mantles, 871, 1555
Hemingway, H. W.—Desulphurization of Sulphuretted Hydrogen, 1005
Hentze, O., and Müller, H.—Producing Tough Incandescent Mantles, 742
Higgins, W., and Sandilands, H.—Production of Acetylene, 340
Hodder, A. E., and Lester, J. B. G.—Manufacture of Gas for Lighting and Heating, 1127
Holman, S.—Retort Lid Fasteners, 87
Irwin, W., and Leather, J. P.—Extracting Naphthalene from Coal Gas, 87
Irwin, W.—Carburetting Gas, 88
Isitt, F.—Mantles for Incandescent Gas Lighting, 1006
James, R. W.—Making Gas for Heating Purposes, 681
Jenkins, W. J.—Conveyor for Coke, &c., 1005
Johnson, J. Y.—Acetylene Gas Burners for Use with Incandescing Mantles, 209
Keith, J.—Gas and Air Compressors and Pumps, 1363
Kellner, C.—Manufacturing Acetylene, 30
Kent, H. A.—Self Lighting Gas Burners, 616
Kent, W. G.—Liquid Meters, 743
Killing, C.—Automatic Gas Lighters, 208
Kirkham, Hulett, and Chandler, Limited—Condensers, 931
Kitchen, J. G. A.—Internal Combustion Engines, 87
Knaeps, C.—Economizers for Gas Burners, 802
Knapp, W., and Steilberg, R.—
  Producing Illuminating Gas from Resin, 30
  Production of Compressed Gas, 1064
Körting, E.—
  Combustion Chambers of Internal Combustion Motors, 1645
  Purifying Gases, 1646
La Compagnie Anonyme Continentale pour la Fabrication des Compteurs à Gaz et Autres Appareils—Feeding Boiler and other Furnaces, and Removing Ash and Clinkers, 87
La Société Anonyme "Lux Nova"—Controlling Gas Cocks and Lighting Gas Burners, 340
Lake, H. H.—Gas Engines, 273
Lanchester, F. W.—Starting Arrangements for Gas Motors, 1555
Lasserve, M. de—Acetylene Generators, 208
Leigh, H. H.—Acetylene Generators, 474
Lindemann, O.—
  Combustion Chambers of Internal Combustion Motors, 1645
  Purifying Gases, 1646
Livesey, G.—Street Gas Lamps, 1128
Llorens, J.—Generating Acetylene Gas, 88
M'Dougall, A.—Purification of Coal Gas, 151
Mactear, J.—Obtaining Cyanogen Compounds, 406
Marks, C. C.—Automatically Opening a Valve at a Predetermined Time, 1729
Marks, G. C.—Gas Engines, 1008
Marshall, F. D.—Condensers, 931
Matthews, F.—Acetylene Gas Machines, 32
Mazza, E. N.—Separating and Extracting Gases from a Gaseous Mixture, Purifying, Exhausting, and Compressing Gas, and Increasing its Illuminating Power, 1216
Mills, B. J. B.—Gas Heating Burners, 405
Mühlenthal, S., Löwenthal, M., and Hahn, T.—Regulator for Gas and Liquids, 88
Müller, A.—A Double Chimney Incandescent Gas Burner, 1556
Murinick, A.—Incandescent Gas Burner, 152
Murphy, J., and Arnold, H. J.—Automatic Acting Cut Off Stopcocks for Gas Pipes, 340
Murphy, J. P.—Gas Engines, 1008
New, A. G.—Gas Engine Exhaust Silencers, 1441
New Haven Novelty Machine Company—Prepayment Attachments for Gas Meters, 208
Nielson, R. A.—Incandescing Media, 933
Nunn, F. C., and White, T. H.—Gas Motor Engines, 87
Otto, M.—Fly Wheels of Explosion Engines, 272
Pearce, G. W., and Whitbread, S. J.—Coin Freed Gas Meters, 613
Peeters, G.—Carburation of Gas, 801
Perlich, A.—Self Igniting Gas Burner, 272
Pinchbeck, J.—Prepayment Gas Meters, 614
Pipersberg, H.—Checking Apparatus for Coin Freed Gas Meters, 1129
Reisert, H.—Water Meters, 339
Richmond, E. W. T.—Gas Stove with Water Heater, 614
Robus, H. J.—Hydraulic and Foul Mains, &c., 933
Rouma, A.—Generating Acetylene, 474
Schneewers, J.—Acetylene Generator, 31
Schniewind, F. W. C.—Regenerative Coke Ovens on the Everett System, 1217
Schultze, K.—Automatic Gas Igniters, 341
Schuster, E.—Testing Gas Piping for Soundness, 1556
Serin, A.—Controlling the Flow of, and Igniting Gas, 338
Seymour, J., and Clark, W. J.—Detachable Valve for Gas Meters, 406
Shaw, E. J.—Gas Lamps and Lanterns, 152
Sieverts, W. H. A.—Incandescent Mantles, 151
Simmance, J. F.—Lighting and Extinguishing Lamps, 338
Smith, H.—Explosion Engines, 407
Snell, C. S.—Compressing Gas, Air, &c., for Incandescent Lighting Plant, 1062
Société Anonyme Continentale pour la Fabrication des Compteurs à Gaz et Autres Appareils—Coin Freed Meters, 270
Société Anonyme des Fontaines à Gaz—Gas Heating Burners, 405
Standard Automatic Gas Engine Company—Gas Engines, 273
Stenhouse, A., and Atkinson, E.—Automatically Opening a Valve at a Predetermined Time, 1729
Stenhouse, A., and Whitehead, E. A.—Automatically Operating a Valve at any Predetermined Time, 206
Stevenson, G. E., Executrix of the Late—Gas Scrubbers, 1363
Stewart-Wallace, J. S., Cowell, W. B., Paisley, J. R., and Kemp-Welch, J. S.—Manufacturing Gas for Motive, Heating, and Lighting Purposes, 1728
Sugg, W. T.—
  Compressing Gases for Lighting Purposes, 1644
  Incandescent Mantle Supports, 270
  Low Pressure Incandescent Lighting Apparatus, 1441
  Regulating Gas Pressure in Incandescent Gas Lighting, 932
  Sealing, Automatically, Gas Supply Pipes to Burners, 1007
Talbot, H.—Lanterns for Incandescent Gas Lighting, 681, 1441
Theisen, E.—Purifying Gases and Obtaining Bye Products, 207
Thompson, W. P.—Acetylene Generators, 801
Thwaite, B. H.—Safety Valve for Gasholders, 1555
Tobler, A.—Pressure Regulator or Stop Valve, 616
Trendel, F.—Automatic Gas Lighters, 872
Turner, T. G.—Generating Acetylene, 742
Voelker, W. L., and the Voelker Incandescent Mantle, Limited—Burners for Gas Lighting by Incandescence, 32
Webber, W.—Coin Controlled Vending Attachments for Gas Meters, 742
Weber-Marti, C. A.—Actuating Gas Burners from a Distance, 272
Wegmann Hauser, A.—Acetylene Generators, 801
Whitham, C., and Large, E.—Prepayment Gas Meters, 473
Wigham, J. R.—Burning Acetylene Gas, 152
Willcox, B.—Gas Engines, 801
Williams, J.—Gas Engines, 340
Wilson, J.—Incandescent Gas Burners, 30
Wilton, T.—
  Alkaline Cyanides, Manufacture and Purification of, 273
  Anthracene, Manufacture of, 271
Wolf, A., and Co.—Gas Engines, 801
Woodhouse, S. J.—Cement for Caulking Retorts, Pipes, &c., 1645
Woodward, J.—Unloading, Heaping, Storing, and Loading Coal, Coke, &c., 30
Wright, J. F. & G. E., and Sutherland, A. G.—Coin Freed Gas Meters, 1061
Zschocke, G.—Scrubbers, 743

Acetylene—
  Burners—Dolan, E. J., 405
  Burners for Use with Incandescing Mantles—Johnson, J. Y. (*Compagnie Française de l'Acetylène*), 209
  Burning—Wigham, J. R., 152
  Generators and other Means of Producing—
    Berger, F., 742
    Berger, H., 31
    Boult, A. J. (*Lasserve, M. de*), 208
    Dauber, A., 31
    Higgins, W., and Sandilands, H., 340
    Kellner, C., 30
    Leigh, H. H. (*Carey, J. W.*), 474
    Llorens, J., 88
    Matthews, F., 32
    Rouma, A., 474
    Schneeweis, J., 31
    Thompson, W. P. (*Wegmann-Hauser, A.*), 801
    Turner, T. G., 742
  Purifying—
    Ernst, O., and Philips, A., 871
    Goodwin, R., 1555
Alkaline Cyanides, Manufacture and Purification of—Wilton, T., 273
Anthracene, Manufacture of—Wilton, T., 271
Ascension Pipes, Cleaning the Interior of—Elliott, C., Damp, G., and M'Dade, J., 1364
Burners—
  Actuating, from a Distance—Weber-Marti, C. A., 272
  Economizers for—Knaeps, C., 802
  Heating—Mills, B. J. B. (*Société Anonyme des Fontaines à Gaz*), 405
  Igniting Devices for (*see* Igniting)
  New—Bray, J. W., 1556 (*see also* Acetylene *and* Incandescent Gas Lighting)
  Regenerative—Bower, G., 1063
Carburation of Gas—Boult, A. J. (*Peeters, G.*), 801
Carburetting or Enriching Gas—Irwin, W., 88
Cement for Caulking Retorts, Pipes, &c.—Woodhouse, S. J., 1645
Charging and Drawing Retorts—Foulis, W., 931
Coal, Coke, &c., Unloading, Heaping, Storing, and Loading—Woodward, J., 30
Coin Freed Meters (*see* Prepayment)
Coke Ovens, Regenerative, on the Everett System—Schniewind, F. W. C., 1217
Compressed Gas, Production of—Knapp, W., and Steilberg, R., 1064
Compressing Gas, Air, &c., for Incandescent Gas Lighting—
  Keith, J., 1363
  Snell, C. S., 1062
  Sugg, W. T., 1644
Condensers—Kirkham, Hulett, and Chandler, Limited (*Marshall, F. D.*), 931
Controlling the Flow of and Igniting Gas (*see* Igniting)
Conveyor for Coke, &c.—Jenkins, W. J., 1005
Cyanides, Manufacture and Purification of Alkaline—Wilton, T., 273
Cyanogen Compounds, Obtaining—Mactear, J., 406
Desulphurization of Sulphuretted Hydrogen—Hemingway, H. W., 1005
Electrically Controlling the Supply of Gas to, and Igniting Burners (*see* Igniting)
Engines, Gas—
  Abel, C. D. (*Gasmotoren Fabrik Deutz*), 801
  Buchet, E. V., 1728
  Dougill, A., 1442
  Evans, A. F., 406
  Hamilton, J. H., 87
  Kitchen, J. G. A., 87
  Lake, H. H. (*Standard Automatic Gas Engine Company*), 273
  Lanchester, F. W., 1555
  Lindemann, O. (*Körting, E.*), 1645
  Marks, G. C. (*Murphy, J. P.*), 1008
  New, A. G., 1441
  Nunn, F. C., and White, T. H., 87
  Otto, M., 272
  Smith, H., 407
  Willcox, B. (*Wolf, A., and Co.*), 801
  Williams, J., 340
Fly Wheels of Explosion Engines—Otto, M., 272
Furnaces, Feeding Boiler and other, and Removing Ash and Clinkers—Abel, C. D. (*La Compagnie Anonyme Continentale pour la Fabrication des Compteurs à Gaz et autres Appareils*), 87
Gas for Illuminating, Heating, and Motive Purposes—
  Hodder, A. E., and Lester, J. B. G., 1127
  James, R. W. (*American Stoker Company*), 681
  Knapp, W., and Steilberg, R., 30
  Stewart-Wallace, J. S., Cowell, W. B., Paisley, J. R., and Kemp-Welch, J. S., 1728
Gasholders for Equalizing Intermittent Gas Production and other Purposes—Glasgow, A. G., 933
Heating Gases, Poor in Nitrogen, Production of, from Combustible Materials containing Hydrocarbons—Blass, E., 872
Heat, Obtaining Intense, from Gas—Delin, G., 1364
Hydraulic and Foul Mains, &c.—Robus, H. J., 933
Igniting and Extinguishing Devices for Gas Burners and Incandescent Mantles—
  Anspach, J., 1442
  Automatic Universal Gas Lighter, Limited, 272
  Bollé, C. (*Fitzlaff, C.*), 742
  Croizat, V., 1064
  Franzen, C., 31
  Friedeberger, L., and the "Vulkan" Gesellschaft für Selbstzündende Glühkörper mit Beschrankter Haftung, 1128
  Haddan, R. (*La Société Anonyme "Lux Nova"*), 340
  Kent, H. A., 616
  Killing, C., 208
  Perlich, A., 272
  Schultze, K., 341
  Serin, A., 338
  Simmance, J. F., 338
  Stenhouse, A., and Whitehead, E. A., 206
  Trendel, F., 872
  Weber-Marti, C. A., 272
Illuminating Power of Gas, Increasing the, and Removing Naphthalene—Colman, H. G., 405
Incandescent Gas Lighting—
  Anti-Vibratory Burner—
    Clay, W. R., 270
    Firth, G. H., Bentham, F. H., and Stott, J. H., 1441
  Burners, Inverted—
    Beese, R., 1061
    Bernt, J., and Cervenka, E., 1556
  Burners—
    Bernstein, S., 1063
    Clay, W. R., 270
    Darby, H. W. & I., and Punchard, J. H. & W. C., 1644
    Duncan, J. H., 208
    Grantoff, A. H., and Fritz F., 1728

Incandescent Gas Lighting (*continued*)—
Burners—
Heinroth, P., and Tresenreuter, G., 1129
Johnson, J. Y. (*Compagnie Française de l'Acetylène*). 209
Murinick, A., 152
Voelker, W. L., and the Voelker Incandescent Mantle, Limited, 32
Wilson, J., 30
Compressing Gas, Air, &c., fer—
Keith, J., 1363
Snell, C. S., 1062
Sugg, W. T., 1644
Double Chimney Burner—Golby, F. G. (*Müller, A.*), 1556
Earthy Oxides, Treating, in the Manufacture of Incandescent Mantles—Daix, V., 1644
Igniting Devices (*see* Igniting)
Lamps (*see also* Lanterns)—
Beese, R., 340
Denayrouze, L., 1007
Low Pressure Apparatus for—Sugg, W. T., 1441
Mantles and Other Bodies—
Apt, J., 1645
Blaasch, H., 151
Boult, A. J. (*Isitt, F.*), 1006
De Léry, J. B., and Richardson, C. G., 1556
Duncan, J. H. H., 272
Duncan, J. H. H., the New Incandescent (Sunlight Patent) Gas Lighting Company, Limited, and Barnett, H. T., 1062
Helmecke, H., 871, 1555
Hentze, O., and Müller, H., 742
Nielsen, R. A., 933
Sieverts, W. H. A., 151
Mantle Supports—Sugg, W. T., 270
Obtaining Flames of High Thermic Degree by the Injection of Superheated Steam—Greyson de Schodt, P., 152
Regulating Gas Pressure in Incandescent Gas Lighting—Sugg, W. T., 932
Sealing Gas Supply Pipes to Burners—Sugg, W. T., 1007
Torches for Incandescent Street Lamps (*see* Torch)
Lamps, Lighting and Extinguishing Series of Street and Other Gas—Croizat, V., 1064
Lanterns—
Livesey, G., 1128
Shaw, E. J., 152
Talbot, H., 681, 1441
Meters (*see also* Prepayment)—
Gas and Like Fluid—Greenall, J., 1557
Water—
Chesley, S. A., 682
Duncan, W., 1729
Kent, W. G., 743
Reisert, H., 339
Mixing Air and Gas—Füller, E., 1005
Naphthalene, Extracting, from Coal Gas—Irwin, W., and Leather, J. P., 87
Naphthalene, Treating Gas for the Removal of, and Increasing the Illuminating Power—Colman, H. G., 405
Pipe Joints and Couplings—Dresser, G. R., 1130
Prepayment Meters and Attachments—
Abel, C. D. (*Société Anonyme Continentale pour la Fabrication des Compteurs à Gaz et autres Appareils*), 270
Beechey, C. G., and Wright, A. T., 206, 1728
Brooks, A. G. (*New Haven Novelty Machine Company*), 208
Burchard, L. S. (*Webber, W.*), 742
Glover, R. T. & J. G., 339
Green, H., 613
Pearce, G. W., and Whitbread, S. J., 615
Pinchbeck, J., 614
Pipersberg, H., 1129
Witham, C., and Large, E., 473
Wright, J. F. & G. E., and Sutherland, A. G., 1051
Purification of Coal Gas—M'Dougall, A., 151
Purifying Gas—
Guillaume, N. A., 682
Lindemann, O. (*Körting, E.*), 1646
Purifying Gases and Obtaining Bye-Products—Theisen, E., 207
Regenerative and Generator Furnaces—
Brearley, J. H., 616
Drake, J. A., 615, 681
Regenerative Coke Ovens on the Everett System—Schniewind, F. W. C., 1217
Regenerative Gas Burners—Bower, G., 1063
Regulating Gas Pressure in Incandescent Gas Lighting—Sugg, W. T., 932
Regulator for Gases and Liquids—Mühlenthal, S., Löwenthal, M., and Hahn, T., 88
Regulator or Stop Valve—Tobler, A., 616
Regulators, Gas Pressure—Hein, R., and Hahn, T., 1129
Resin, Producing Illuminating Gas from—Knapp, W., and Steilberg, R., 30
Retort Lid Fasteners—Holman, S., 87
Retorts, Charging and Drawing—Foulis, W., 931
Scrubbers—
Stevenson, G. E., Executrix of the Late, 1363
Zschocke, G., 743
Sealing Supply Pipes to Burners—Sugg, W. T., 1007
Separating and Extracting Gases from a Gaseous Mixture, Purifying, Exhausting, and Compressing Gas, and Increasing its Illuminating Power—Mazza, E. N., 1216
Stopcocks, Automatically Acting Cut-Off, for Gas Pipes—Murphy, J., and Arnold, H. L., 340
Stove, Gas, with Water Heater—Richmond, E. W. T., 614
Testing Gas Piping for Soundness—Schuster, E., 1556
Torch Lighting for Incandescent Gas Lamps—
Foulger, G. F. L., and Glover, J. G., 1063, 1128
Simmance, J. F., 338
Valve, Automatically Operating a, at any Predetermined Time—
Marks, C. C. (*Stenhouse, A., and Atkinson, E.*), 1729
Stenhouse, A., and Whitehead, E. A., 206
Valve, Detachable, for Gas Meters—Seymour, J., and Clark, W. J., 406
Valves, Safety, for Gasholders—Thwaite, B. H., 1556
Washers or Scrubbers—
Chandler, S. & J., 271
Guillaume, N. A., 617
Water Gas—Boult, A. J. (*Fleischer, E.*), 613
Water Gas, Continuous Generation of—Clauss, F., 1062

Patent Notices, 32, 88, 153 209, 273, 341, 407, 474, 617, 683, 743, 802, 873, 933, 1008, 1064, 1130, 1364, 1442, 1557, 1646, 1729

CORRESPONDENCE.

Allen, Mr. R. W.—The Presence of Naphthalene in Coal Gas, 803, 934
Anderson, George—Naphthalene in Coal Gas, 874
Anderson, G. W.—Wet Lime Purifiers for Carburetted Water Gas, 275
An Early Visitor—The Paris Exhibition, 1305
An English Gas Engineer—Proposed Visit of the Gas Institute to Paris, 802
An English Member of the Société Technique du Gaz—Proposed Visit of the Gas Institute to Paris, 802
Botley, Chas. E.—Naphthalene in Coal Gas, 803
Botley, Chas. F.—Naphthalene in Coal Gas, 873
Bower, George—Gas Fountains, 408
Brackenbury, C. E.—Mr. Carpenter on Inclined Retorts, 1365, 1729
Bueb, T.—Recovery of Cyanogen from Coal Gas, 273
Carpenter, C. C.—The Inclined Retort Installation at Bankside, 1305, 1443, 1646
Carpenter, R. Forbes—The Presence of Naphthalene in Coal Gas, 683
Carr, Isaac—Price of Gas for Power Purposes at Widnes, 545
Carr, Wm.—Projected Amalgamation of the Gas Institute and the Institution of Gas Engineers, 341
Charing Cross and Strand Electricity Supply Corporation, Limited (Seale, E. W.)—The Maiden Lane Electrical Station Fire, 744
C. N.—The Gas Workers' Union, 89, 408
Clarke, Arthur—Patent Law Reforms, 1217
Colman, Harold G.—Presence of Naphthalene in Coal Gas, 803, 934
Cooper, F. E.—Damage to Mains from Electrolysis, 545
Cornish, J. H.—Registration of Gas Liquor Works, 408
Correspondents—
Coal Exports and Political Economy, 1365
Inquiry Circular Nuisance, 1366
Local Authorities and the Price of Gas, 1218
Low Price of Benzol and Creosote, 683
Notifying Increases in Price, 874
Cripps, F. S.—Gas Companies' Balance Sheets, 804
Dunn, Walter T.—Gas Institute Visit to Paris, 1217
Edwards, A. E. A.—Mr. Edwards's Paper on Artificial Light, 1729
F.—Illicit Commissions, 1065
Gladding, G. B.—Directors *v.* Auditors, 1217
Greville, H. Leicester—
Cyanogen, Recovery of, from Coal Gas, 273
Naphthalene in Coal Gas, 873, 1065
G. T.—Local Authorities and the Price of Gas, 1365
Harman, Edward A.—
Tar and Liquor Storage Tanks, 209
Welsbach Company's New Prices and their Effects, 1558
Helps, J. W., and Dougall, A.—The Projected Amalgamation of the Gas Institute and the Institution of Gas Engineers, 273
Highlands, Mr. S. M.—A Remedy for Stopped Ascension Pipes, 545
Hill, H. Ashton—Proposed New Technical Gas Institution, 1130
Holgate, T.—Water Gas Plant at Halifax, 274
Irwin, Wilfred—Naphthalene in Coal Gas, 873
Jones, H. E.—
Commercial Company's Make of Gas, 1065
Proposed Visit of the Gas Institute to Paris, 802
Kühne, Hermann—Calorimetry of Coal Gas, 1443
Lane, George—Raising the Price of Gas, 804
Layton, Thomas—Sunday Labour in Gas Works, 1365
Leather, J. P.—Presence of Naphthalene in Coal Gas, 744
Lees, Mr. Herbert—The Gas Institute Amalgamation Discussion, 1729
Livesey, George—Improved Lighting in the South Metropolitan District, 1065
Lux—Price of Gas and Value of Residuals, 934
Marshall, F. D.—Proposed Visit of the Gas Institute to Paris, 802
Meyer, Ernest E.—Gas Purification in Germany, 89
Millard, E. H.—
Price of Coke in the North, 874
Proposed Visit of the Gas Institute to Paris, 803
Newbigging, T.—
Morecambe District Council Gas Bill, 874
Progress in Gas Matters, 1306
No Coal—Gas Stoves and Coal Prices, 408
R. C. S.—Treatment of Spent Acid from the Washing of Crude Benzol, 408
Richmond, E. W. T.—Profit Sharing and Automatic Meter Supplies at Stafford, 744
Salomons, C. T.—Proposed Visit of the Gas Institute to Paris, 874
Scotus—Proposed Visit of the Gas Institute to Paris, 802
Segundo, Ed. C. de—Future of Electrical Supply, 934
Shoubridge, S. Y.—Proposed Visit of the Gas Institute to Paris, 732
Simmance, J. F.—The Calorimetry of Coal Gas, 1365, 1503
Steavenson, A. L.—Law in Regard to Underground Water, 874
Stelfox, James—The Gas Institute Amalgamation Discussion, 1729
Stevenson, E. H.—The Question of Compulsory Purchase, 1130
United Coke and Gas Company (*per* Dr. F. Schniewind)—The Boston Retort Oven Gas Plant, 274
Verax—The Scarcity of Coal, 209
Winstanley, Frank A.—Mr. Carpenter's Paper on Inclined Retorts, 1558

Ascension Pipes, A Remedy for Stopped—Highlands, S. M., 545
Balance Sheets of Gas Companies—Cripps, F. S., 804
Benzol and Creosote, Low Price of—Correspondent, 683
Boston Retort Oven Gas Plant—United Coke and Gas Company (*per* Dr. F. Schniewind), 274
Calorimetry of Coal Gas—
Kühne, Hermann, 1443
Simmance, J. F., 1365, 1503
Coal Exports and Political Economy—Your Correspondent, 1365
Coal Prices, Gas Stoves and—No Coal, 408
Coal, Scarcity of—Verax, 209
Coke, Price of, in the North—Millard, E. H., 874
Commercial Company's Make of Gas—Jones, H. E., 1065
Commissions, Illicit—F., 1065
Compulsory Purchase, The Question of—Stevenson, E. H., 1130
Cyanogen, Recovery of, from Coal Gas—
Bueb, T., 273
Greville, H. Leicester, 273
Directors *v.* Auditors—Gladding, G. B., 1217
Edwards, Mr., on Artificial Light—Edwards, A. E. A., 1729
Electrical Supply, The Future of—Segundo, Ed. C. de, 934
Electrolysis, Damage to Mains from—Cooper, F. E., 545
Gas Fountains—Bower, George, 408
Gas Institute and the Institution of Gas Engineers, Projected Amalgamation of the—
Carr, William, 341
Helps, J. W., and Dougall, A., 273
Hill, H. Ashton, 1130
Lees, Herbert, 1729
Stelfox, James, 1729
Gas Institute Visit to Paris (*see* Paris)
Gas Workers' Union, The—C. N., 89, 408
Halifax Water Gas Plant—Holgate, T., 274
Inclined Retorts at Bankside—
Brackenbury, C. E., 1365, 1729
Carpenter, C. C., 1305, 1443, 1646
Winstanley, Frank A., 1558
Inquiry Circular Nuisance—A Correspondent, 1366
Institution of Gas Engineers and the Gas Institute (*see* Gas Institute)
Local Authorities and the Price of Gas—
A Correspondent, 1218
G. T., 1365
Maiden Lane Electrical Station Fire—Charing Cross and Strand Electricity Supply Corporation, Limited (Seale, E. W.), 744
Morecambe Gas Bill—Newbigging, T., 874
Naphthalene in Coal Gas—
Allen, R. W., 803, 934
Anderson, George, 874
Botley, C. E., 803
Botley, C. F., 874
Carpenter, R. Forbes, 683
Colman, Harold G., 803, 934
Greville, H. Leicester, 873, 1065
Irwin, Wilfred, 873
Leather, J. P., 744
Paris Exhibition—An Early Visitor, 1305
Paris, Proposed Visit of the Gas Institute to—
An English Gas Engineer, 802
An English Member of the Société Technique du Gaz, 802
Dunn, Walter T., 1217
Jones, H. E., 802
Marshall, F. D., 802
Millard, E. H., 803
Salomons, C. T., 874
Scotus, 803
Shoubridge, S. Y., 732
Patent Law Reforms—Clarke, Arthur, 1217

Price of Gas and Value of Residuals—Lux, 934
Price of Gas, Increasing the—
Correspondent, 874
Lane, George, 804
Progress in Gas Matters—Newbigging, Thomas, 1306
Purification of Gas in Germany—Meyer, Ernest E., 89
Purifiers, Wet Lime, for Carburetted Water Gas—Anderson, G. W., 275
Registration of Gas Liquor Works—Cornish, J. H., 408
South Metropolitan District, Improved Lighting in the—Livesey, George, 1065
Spent Acid, Treatment of, from the Washing of Crude Benzol—R. C. S., 408
Stafford, Profit Sharing and Automatic Meter Supplies at—Richmond, E. W. T., 744
Stoves, Gas, and Coal Prices—No Coal, 408
Sunday Labour in Gas Works—Layton, T., 1365
Tar and Liquor Storage Tanks—Harman, E. A., 209
Underground Water, Law in Regard to—Steavenson, A. L., 874
Welsbach Company's New Prices, and their Effects—Harman, E. A., 1558
Widnes, Price of Gas for Power Purposes at—Carr, Isaac, 545

PARLIAMENTARY INTELLIGENCE.

Gleanings from the Committee Rooms, 745, 804, 875, 935, 1218, 1306, 1367, 1443, 1730
House of Lords Committees—
Dorking Water Bill, 1131
Higham Ferrers Water Bill, 814
Margate Corporation and Westgate and Birchington Water Bills, 1386
Morecambe District Council Gas Bill, 1730
House of Commons—
Carbolic Acid, &c., The Exportation of, 545
East London and Lambeth Water Bills, 746
Gaslight and Coke Company's Bill, 33, 618, 684
Gaslight and Coke Company's Increase in Price, 1730
Government and Private Members' Bills, 341
London Water Bills, 33, 806, 875
South Metropolitan Gas Bill, 684
Water Gas, Supply of Carburetted, 806, 1444
House of Commons Committees—
Airdrie, Coatbridge, and District Water Trust Bill, 1132
Bradford Corporation Bill, 1008, 1234
East London Water Bill, 1504
Electrolysis and Removal of Gas and Water Pipes, Tramway Schemes and the, 811, 812, 1386
Gaslight and Coke Company Bill, 33, 1313, 1369
Glastonbury Gas Bills, 807, 877
Hartlepool Gas and Water Bill, 809
Lambeth Water Bill, 1507
Lea Conservancy Board Bill, 1134
London County Council Gas Testing and Prepayment Meter Bill, 33, 937, 1219, 1307, 1369, 1370, 1445
Morecambe Urban District Council Gas Bill, 751, 808
North Warwickshire Water Bill, 814
Ossett Gas Bills, 749
South Metropolitan Gas Company's Bill, 1369, 1372, 1446
Southport Corporation Bill, 747
Southport Water Bill, 813
Subways under London Streets, 1133
Wandsworth and Putney Gas Bill, 1449, 1503
Municipal Trading, The Joint Committee on, 1503, 1732

Progress of Bills, 153, 210, 275, 409, 475, 545, 618, 684, 746, 806, 875, 877, 936, 1008, 1131, 1219, 1369, 1444, 1503, 1730

LEGAL INTELLIGENCE.

Birmingham Winter Assizes—The Baker Syndicate, Limited, and Foster *v.* John Wright and Co., Limited, and Others, 816
Central Criminal Court—Regina *v.* Norris—Falsification of Accounts, 1318
Chancery Court of Lancashire—Taylor *v.* Oldham Corporation, 1733
Court of Appeal (Ireland)—Alliance and Dublin Consumers' Gas Company *v.* County Council of Dublin, 1733
High Court of Justice—
Chancery Division—
Welsbach Incandescent Gaslight Company, Limited, *v.* New Sunlight Incandescent Company, Limited, 153, 409, 475, 547, 618, 1135
Queen's Bench Division—
Crystal Palace District Gas Company *v.* Idris and Co., 412
Dewsbury and Heckmondwike Water Board *v.* Assessment Committee of the Penistone Union, 411
Jones and Attwood *v.* Laindon Gas and Water Company and Others, 684
London County Council *v.* East London Water Works Company, 211
London County Council *v.* Wandsworth and Putney Gas Company, 950
Sheen *v.* Haynes—The Promotion of the Automatic Gas Meter Company, 815, 879
Sheldrake *v.* Duncan, 210
High Court of Justice (Ireland)—Chancery Division—
Alliance and Dublin Consumers' Gas Company *v.* County Council of Dublin, 753, 815
Alliance and Dublin Consumers' Gas Company *v.* Thompson and Harris, 547
House of Lords—Sutton, Southcoates, and Drypool Gas Company *v.* Jordeson, 545, 1318
Llanelly Police Court—Unlawfully Connecting a Gas Meter, 1366
South Western Police Court—London County Council *v.* Wandsworth and Putney Gas Company, 1235
Supreme Court of Judicature—Court of Appeal—
Welsbach Incandescent Gas Light Company, Limited, *v.*—
New Sunlight Incandescent Company, Limited, 210, 341, 1366
Riemer and Sluice, 342

Acetylene and Coal Gas, Cost of, 754
Acts, Operation of Special and General, 1558
Assessment of Premises for Water Rate, 1558
Birmingham Corporation, A Workman's Claim against the, 1733
Brighton, Lighting of Private Streets at, 1558
Bristol Gas Works, Compensation for an Accident at the, 1508
Broadstairs Gas Company, Embezzlement by the Late Manager and a Clerk of the, 548
Brymbo Water Company, Actions against the, 212, 548
Cardiff, Tampering with a Gas Meter at, 953
Compensation Cases, 548, 953, 1508
Dublin Gas Works, The Delivery of Petroleum to the, 952
East London Water Company—Payment of Water Rates for Small House Property, 685
Electricity—
Cost of Gas and, 548
Stealing, 154
Electric Lighting, Deficiency of, 34, 212, 1135, 1235
Embezzlement, Charges of, 154, 548, 619, 685, 754, 953, 1318, 1366
Employers' Liability Act, Claim under the, 89
Exmouth, A Public Lighting Charge at, 953
Explosions of Gas, Claims in respect of Damages Caused by, 89, 476, 953
Gaslight and Coke Company, The—
A Disputed Gas Bill, 1646
Dismissal of an Action for Damages against, 212
Harrington Gas Company, Powers of the, 879
Honley Explosion, Claim in respect of Damages Caused by the, 89
Illuminating Power, Fine for Deficient, 412
Incandescent Mantle Remover, 412
Incandescent Mantles—
Monazite Sand for the Manufacture of, 1733
Traffic in Infringing, 153, 547, 619, 685, 816, 953
Intimidating Stokers, 1366, 1454,
Lillie Bridge Oil Gas Works, Fatal Explosion at the, 953
Mains, Water, Unlawful Interference with, 754
Manchester, Emanations from Gas Residual Works at, 34
Mantleless Incandescent Gas Corporation, Limited, Winding Up of the, 212
Meter, Gas—
Fraudulent Interference with a, 476
Registration, Disputed, 754, 1558
Tampering with a, 953
Metropolitan Electric Lighting Companies' Troubles, 34, 212, 1135, 1235
Monazite Sand for the Manufacture of Incandescent Mantles, 1733
Morley Corporation and their Catchwater, 547
Newport (Mon.) Gas Company—
Claims for Wages, 1646
Damages for Personal Injuries Sustained in a Gas Explosion, 476
Intimidating Stokers, 1366, 1454
New River Company and the Assessment of Premises for Water Rate, 1558
Paving Stones, Relaying, after Making Gas Connections, 154
Plymouth Gas Company, Stealing Coal from the, 685
Prepayment Meters, Thefts from, 342, 1558, 1733
Preston, Fraudulent Interference with a Gas Meter at, 476
Private Streets, Lighting of, 1558
Reservoirs, The Rating of, 89
Residuals Works, Emanations from, in Manchester, 34
Sheffield Gas Collector—Embezzlement by a, 1318
South Shields Gas Company, A Paltry Action against the, 548
Stealing—
Electricity, 154
Gas, 153, 953
Stoker, Salutary Lesson for a, 754
Stokers, Intimidating, 1366, 1454
Trenches, Unprotected, 1318
Voelker Incandescent Mantle Litigation, 618
Water, Charge for, for Street Cleansing Purposes, 1235
Water Rates, Questions as to, 619, 685, 1558, 1733
Wath-upon-Dearne Gas and Lighting Company, Limited, 547
Willenhall Gas Company Fined for Deficient Illuminating Power, 412
Wright's (Frank) Prepayment Gas Meter Corporation, Charge of Falsifying the Books of the, 548, 619, 685, 754, 953, 1318

GENERAL INDEX.

Aberavon Gas Supply, 1639, 1746
Aberdare Water Supply, 893
Aberdeen Gas Supply, 218, 284, 424, 696
Aberdeen Water Supply, 961
Abingdon Gas Company, 622
Accidents, 32, 37, 156, 217, 277, 557, 765, 766, 806, 1079, 1145, 1213, 1245, 1444, 1508, 1509, 1516, 1657
Accidents, The Prevention of, Mr. J. Calder on, 139
"Accountant," The, on the Duties of Auditors, 81
Accounts of the London Gas Companies for 1899, 988, 995, 1065
Accrington Electricity Supply, 1391
Acetylene (*see also* Calcium Carbide)—
Action of, on Copper, 335, 395
An Explosive, 428, 969
Behaviour of, towards Hypochlorites, 1718
Burners (*see* Burners)
Composition of, 1722
Congress at Buda Pesth, 334
Cost of Lighting by, 429
Gas Companies and the Supply of, 1720
Acetylene (*continued*)—
Generating and Utilizing Systems, 30, 31, 32, 88, 208, 340, 474, 742, 801, 1550
German Books on, 79
Lighting in France and Belgium, 884
Origin of the Word, 460
Purifying, 871, 1555
Town Lighting by, 159, 428, 429, 1446
Versus—
Coal Gas, 754
Electric Lighting at Sydney, 683
Acetylene Illuminating Company, 1720
Acetylene Light Syndicate, 165, 1511
Acts, Special and General, The Operation of (*see* Building Bye Laws)
Adams, Mr. A. D., on the Future of Electrical Supply, 860, 934
Addresses, Presidential—
Bell, Mr. J. Ferguson (Midland Association), 595, 602
Carmichael, Mr. J. W. (Informal Scottish Meeting), 924
Addresses, Presidential (*continued*)—
Helps, Mr. J. W. (Institution of Gas Engineers), 1109
Irving, Mr. D. (Southern District Association), 594, 610
M'Lusky, Mr. W. B. (Waverley Association), 999
O'Connor, Mr. H. (Society of Engineers), 326, 395
Oechelhaeuser, Herr W. von (Association of German Gas and Water Engineers), 1640
Priestley, Mr. C. H. (British Association of Water Works Engineers), 1725
Ritson, Mr. T. N. (Manchester District Institution), 524, 534
Stevenson, Mr. E. H. (Incorporated Gas Institute), 1542
Vautier, M. (Société Technique du Gaz), 77
Adelaide Electricity Supply, 349
Air, Compressed, for Power Purposes, 601
Air, Liquid, and the Liquefaction of Gases, 1547
Airdrie, Coatbridge, and District Water Trust Bill, 199, 762, 1132

Airedale Gas Company, 414, 483
Alabama, Prospects of Cheap Coal from, 1722
Aldeburgh Town Council and the Water Works, 949
Aldershot Gas and Water Company, 347, 553
Aldershot Town Council and the Gas and Water Works, 1246
Alfreton and the Electric Light, 157
Alix, M. Just, on—
  Gas Fountains, 264
  Water Gas in France, 997
Allan, Mr. C. E., on the Rights of Local Authorities as Regards Private Bills, 862
Allen, Mr. A. H., on Commercial Organic Analysis, 1433
Allen, Mr. R. W., on the Presence of Naphthalene in Coal Gas, 668, 673, 683, 744, 803, 873, 934, 1003, 1065
Alliance and Dublin Gas Consumers' Company—
  Comparative Cost of Gas and Electric Lighting, 486
  Delivery of Petroleum, 952
  Fatal Accident at the Works, 1516
  Half Yearly Report and Accounts, 880
  Meeting of Shareholders, 955
  Steam Rollers and Gas Mains, 752, 790, 815, 1733
  Supply of Carburetted Water Gas, 756, 790, 806, 818, 889, 1124, 1652
  v. Thompson and Harris, 547
America—
  Coal Gas Statistics in, 93
  Coal Production in, in 1899, 1362, 1639
  Compulsory Reduction of the Price of Gas in, 394, 417, 491, 883
  Covered Reservoir Construction in, 472
  Electrolysis of Cast Iron Water Mains in, 86, 666
  Municipalization of Public Supplies in, 734, 795
  Natural Gas in, 564
  Production of Ammoniacal Liquor and Sulphate of Ammonia in, 93, 494
  Standardizing of Weights and Measures in, 1359
  Steel Production in, 996
  Supply of Electric Power in, 533
American—
  Coal in Europe, 670, 1184
  Engineering Competition, 1428
  Society of Civil Engineers, 1727
  Water Works Association, 1643
Ammonia—
  Oxidation of, by Iron, 532
  Recovery of, from Ammoniacal Liquor without Distillation, 1118
  Testing Liquor for, 334
Ammoniæ, Liquid, Production of, from Gas Liquor, 678
Ammoniacal Liquor, Treatment of, 1118
Analysis, Commercial Organic, 1433
Analysis, Dr. Frank Clowes on, 1297
Anderson, Mr. G., on Naphthalene, 874
Anderson and Roberts, Messrs., on the Recovery of Nitrogen in Coal Distillation, 330
Anglo-Continental Gold Mines Company, Oppenheimer *v.*, 1733
Anglo-Romano Gas Company, 883
Anthracene, Manufacture of, 271
Anthracite Coal and Coke, Determining the Combustible Matter in, 869
Antwerp Water Works Company, 964
Arbitration in Trade Disputes, 1211
Arbitrations—
  Brigg Gas, 93, 1652
  Coventry Gas, 277
  Dronfield Water, 159
  Horsforth Water, 1012, 1516
  Loughborough Gas, 817
  Regulating the Cost of, 74
  Shrewsbury, 486, 549, 685, 790, 817, 892
  Skipton Gas, 46, 93
  Whitwick and Coalville Gas, 1067, 1508, 1655
Arbroath Gas Corporation, 1074
Arches, Metallic Joints for Masonry, 1550
Ardrossan, Gas Explosion at, 559
Argon, A Cyanogen Gas Identical with, 1640
Armagh Gas Company, 622, 874
Arrol, Sir W., and Co., Visit of the Chinese Ambassador to the Works of, 489
Artificial Lighting, Mr. E. A. Edwards on, 1275, 1729
Ascension Pipes—
  Cleaning of, 263, 1364
  Remedy for Stopped, 545
Ascot Gas Company, 552
Ashford and the Mid-Kent Water Bill, 562
Ashford Gas Supply, 494
Ashton Gas Supply, 1444
Ashton Water Supply, 1386
Asphalte, The Action of Water on, 1434
Assessment Questions—
  Dewsbury and Heckmondwike Water Board, 411
  New River Company, 1558
  Purchase of Water Works, 101
  Reservoirs, Basis of Rating for, 89, 222, 765, 1108, 1140, 1465
  Stoke Gas Works, 344
Association of Municipal Corporations, 1540, 1560
Auditors—
  Appointment of Public, in Scotland, 489
  Directors *versus*, 1051, 1217
  Duties and Responsibilities of, 81, 670, 1051
  Liability of, 670
Australian Gaslight Company, 691
Austria Hungary, Association of Gas and Water Engineers of, 1554
Austrian Welsbach Incandescent Light Company, 1664
Automatic Gas Meter Company, 815, 879
Avebury, Lord, on Municipal Trading, 789
Avening Water Supply, 427
Ayton Gas Supply, 263
Bacon, Rev. J. M., on Fogs, 1050
Bacteria, Mr. G. Newman on, 797
Bacterial Treatment of Sewage, 1108
Bagshot Gas Works, 99, 493, 688
Baker, Mr. A., An Experiment with a Concrete and Expanded Metal Structure, 1292
Baker Syndicate, Limited, and Foster *v.* John Wright and Company, 816
Balance Sheets of Gas Companies, Mr. F. S. Cripps on, 804
Balloons, Dangers Attending the Filling of, 1246
Banff Gas Company, 1019
Bank Rate, The, 192, 1425
Barbados Manjak Mines, 1134
Barnes, Mr. T. J., on the Law of London Gas Companies, 1498, 1636
Barnet District Gas and Water Company, 493, 553
Barnoldswick Gas and Water Supply, 1463
Barnsley Gas Supply, 553
Barnsley Water Supply, 199
Barnstaple Gas Company, 553, 862
Barnstaple Water Company, 1051
Barrow Electricity Supply, 1320
Barrow Gas and Water Supply, 1503
Barry Gas and Water Supply, 1662
Basingstoke Water Supply, 1143
Bateman, Mr. C. E., on House Building, 919
Bath Electricity Supply, 279, 486, 557
Bath Gas Company, 483
Bath, Suffocation by Gas at, 1570
Bathurst (N.S.W.) Gas Supply, 1326
Batley Gas Supply, 1557
Battle Gas Company, 1639
Becquerel Rays, The, 1052
Bedford Electricity Supply, 627
Bedford Gas Company, 20, 622, 804
Belfast Electricity Supply, 278, 621, 1565
Belfast Gas Supply—
  Charge for Meters to Consumers not taking a Supply, 1572
  Coal Contracts, 1571
  Increased Consumption, 37
  Loan to the Electric Lighting Department, 621
  Price of Coke, 621
Belfast, Suffocation by Gas in, 163, 561
Belfast Water Supply, 100, 1079
Belgian Gas Company, 1077
Belgium, Acetylene Lighting in, 884
Bell's, Mr. J. Ferguson, Presidential Address to the Midland Association, 595, 602
Benzene, The Determination of, in Coal Gas, 1439
Benzol—
  Low Price of Creosote and, 683
  Treatment of the Spent Acid from the Washing of, 408
Bermondsey and the Electric Light, 1073
Berne Gas Supply, 619
Beverley, Gas Explosion at, 287
Beverley Water Supply, 1079
Bewdley Water Supply, 162
Bexhill Electricity Supply, 216
Bideford, Incandescent Gas Lighting at, 1516
Bideford Water Supply, 1516
Bills (*see* Parliament)
Bilston Gas Company, 101
Bingley, Gas Poisoning Fatality at, 1454
Bingley Gas Supply, 25, 222, 401, 797, 1064, 1442
Binyon, Mr. A. H., on Electric Traction, 1644
Birkdale District Council and Electric Lighting, 418
Birkdale District Council and the Gas Supply, 102, 323, 745, 747
Birkenhead Electricity Supply, 278
Birkenhead Gas and Water Undertakings, 695
Birmingham—
  Appointment of City Treasurer, 25, 83
  Gas Fitting Class at the Technical School, 101
  University, 193
Birmingham Association of Mechanical Engineers, 700, 1275, 1464, 1546, 1729
Birmingham Corporation Gas Department—
  Annual Report, 1389, 1454
  Capital Expenditure in 1899, 1662
  De Brouwer Conveyor for the, 493
  Fatal Accident at Saltley, 32
  Official Change, 1721
  Quality of the Supply, 1325
  Railway Rates for Coal, 1389
  Record Consumption, 47
  Visit of the Birmingham Association of Mechanical Engineers to the Saltley Works, 700
  Wages Question, 486
  Water Gas Plant, 1389
Birmingham Corporation Water Department—
  Accident at the Works, 765
  Annual Report, 1427, 1458
  Borrowing Powers, 287
  Capital Expenditure in 1899, 1662
  Use of Water for Gardens, 1078
  Visit to the Works, 1464
  Wages Question, 486
  Welsh Scheme, The, 39, 212, 1246, 1427, 1458
  Workmen's Compensation, 548, 1733
Birmingham Electricity Supply, 94
Birmingham Incandescent Lighting Company, 1134
Birthday Honours, 1434
Bishop's Stortford Gas Company, 1664
Blackburn Gas Supply, 359
Blackpool Electricity Supply, 418
Blackpool Gas Supply, 277, 1135, 1498, 1558
Blagden, Mr. J. W., on the Behaviour of Acetylene Towards Hypochlorites, 1718
Blast Furnace Gas for Blowing Engines, 1359, 1640
Blyth and Cowpen Gas Company, 1742
Board of Trade—
  Committee on Patent Office Procedure, 145, 1427, 1724
  Death of Sir F. Marindin, 1213
  Directory of Industrial Associations, 1246
  Electric Lighting Act, 1882, Amendment Bill, 1139
  Exports and Imports, 669
  Gas and Water Provisional Orders, 1734
  Inquiries—
    Tonbridge Water, 884, 1459
    Wath-upon-Dearne Gas, 819, 891
  Labour Market, 599, 735
  Municipalization of Electric Light Works, 285
  Power of Granting Licences, 285
  Report on Gas, Electric Lighting, and Water Bills and Orders of the Present Session, 881
  Returns Relating to Gas Undertakings, 323, 990
  Strikes and Lockouts in 1898 and 1899, 19, 75, 257, 262
  Trade, Condition of, 134, 397
  Trade Unions in 1898, 193
  Wages and Hours of Labour in 1899, 257, 262
Bognor Gas Company, 689, 1327
Bognor Water Company, 766, 893, 1570
Boiler Makers' and Iron Shipbuilders' Society, 1353
Boilers, Petroleum for Removing the Incrustation from, 598
Boilers, Water Circulation in, 325
Bolling and Lowe, Messrs., on the Iron and Steel Trades in 1899, 21
Bolton Electricity Supply, 37, 348
Bolton Gas Supply, 1369, 1561, 1736
Bolton, Incandescent Gas Lighting at, 766
Bolton Water Supply, 100, 359, 1328
Bombay Gas Company, 83, 1144, 1319
Bombay Water Supply, 136
Bookbindings, The Effect of Gas on, 1001
Books, Notices of, 23, 79, 139, 196, 198, 400, 465, 540, 564, 599, 666, 796, 862, 965, 1293, 1296, 1427, 1465, 1498, 1547, 1636, 1638
Bordeaux Gas Company, 428
Borings for Water, Some Deep, 672
Boston Gas Company, 1639
Boston (U.S.A.), Coke Oven Gas in, 38, 205, 257, 274, 1047
Boston Water Company, 347
Bothwell and Uddingston Gas Company, 1513
Botley, Mr. C. E., on the Presence of Naphthalene in Coal Gas, 803
Botley, Mr. C. F., on—
  Naphthalene in Coal Gas, 874
  Temperature of Gas and Electric Light, 263
Bournemouth Gas and Water Company, 223, 1639
Bower, Mr. G., on Gas Fountains, 408
Boyle (Co. Roscommon), Acetylene Lighting at, 428
Boys, Mr. C. V., on Fluids in Motion and at Rest, 25, 145
Brackenbury, Mr. C. E., on—
  Inclined Retorts, 1365, 1729
  Labour Saving Machinery in Gas Works, 996
Bradbury and Hirsch's Review of the Sulphate of Ammonia Market in 1899, 154
Bradford Corporation Gas Supply—
  Bill for the Purchase of Outlying Companies, 74 79, 163, 222, 766, 916, 936, 1008, 1064, 1130, 1137, 1183, 1219, 1234
  Discounts and Grouping of Accounts, 699, 1464, 1517, 1571, 1654
  Fire near the Works, 45
  Incandescent Lighting, 886
  Increased Consumption, 47, 758
  Increase in Price, 1397, 1654
  Official Changes, 862
  Profits of the, 1076
  Resignation of Alderman T. Speight, 467
Bradford Corporation Water Supply, 557, 1021, 1146, 1328, 1465, 1654
Bradford Electricity Supply, 557, 759, 1242
Bramwell, Sir F., on the Electric Lighting Acts, 1114
Brand, Mr. J., on Some Points of a Contractor's Business, 1640
Braunton Water Supply, 1661
Brechin Gas Supply, 1460
Brentford Gas Company, 201, 345, 413, 427, 698
Brentwood Gas Company, 1639
Bridgnorth Gas Supply and Electric Lighting, 1328
Bridgwater and the Electric Light, 349, 1320
Brierley Hill Gas Company, 144, 467
Brigg Gas Supply, 93, 736, 766, 1652, 1746
Brighouse Gas Supply, 263
Brighton and Hove Gas Company, 622, 745, 804, 811, 891
Brighton Corporation and the Lighting of Private Streets, 1558
Brighton Corporation Bill, 745, 811, 804
Brighton Electricity Supply, 759, 1355
Brisbane Gas Company, 883
Bristol and Warren (R.I.) Water Company, 101
Bristol Gas Company, 414, 483, 1508, 1663
Bristol, Gas Testing and Public Lighting at, 416
Bristol, Method for the Prevention of Electrolysis in Gas and Water Pipes at, 1491, 1501
Bristol Water Company, 143, 428, 827, 890, 964, 1145
British Association of Water Works Engineers (*see also* "Technical Record"), 472, 526, 541, 1698, 1725
British Gas Traction Company, 47
British Gaslight Company, 20, 341, 428, 633, 683, 817, 1297, 1368

Brixham Gas and Water Supply, 428, 1246
Broadberry, Mr. A. E., Accident to, 1213
Broadstairs Gas Company, 494, 548, 736
Bromley Gas Consumers' Company, 414, 552
Brompton, Chatham, &c., Water Company, 415
Bromsgrove Gas Company, 483
Brothers, Mr. Horatio, Will of, 402
Brush Provincial Electric Lighting Company and East End Vestries, 958
Brussels Gas Supply, 823, 1138
Brymbo Water Works Company, 212, 548
Buda Pesth, Acetylene Congress at, 334
Budget, The, 663
Budleigh Salterton Gas and Water Supply, 289, 562
Bueb, Dr., on—
  Prevention of Freezing in Gas Services, 868
  Recovery of Cyanogen from Coal Gas, 80, 273
Buenos Ayres (New) Gas Company, 1051, 1076, 1236
"Builder" The, on—
  Decay of Stones in London Air, 1549
  London Gas Supply, 633, 1071, 1327
  Testing of Gas, 1017
Building Bye Laws and the Operation of Special and General Acts, 193, 859, 916, 950, 1108, 1235, 1558
Building Construction, Fireproof, 84, 201, 601
Building of Houses, Suggested Improvements in the, 464, 919
Bunsen, Sir Henry Roscoe on, 1550
Bunte, Dr. H., on the "Kugel" Light, 265
Burners—
  Actuating from a Distance, 272
  Automatically Sealing Gas Supply Pipes to, 1007
  Improvements in—
    Acetylene, 152, 209, 406
    Gas, 272, 802, 1556, 1644
    Incandescent (*see* Incandescent)
    Regenerative, 1063
  Lighting and Extinguishing Devices for, 31, 208, 272, 338, 340, 341, 616, 736, 742, 872, 1064, 1128, 1442
  Petroleum Blue Flame or Wickless, 1118, 1497
Burnham, Essex, Discontinuance of Acetylene Lighting at, 429
Burslem Gas Supply, 1319
Burton-on-Trent, Explosion of Coal and Sewer Gas at, 46
Burton-on-Trent Gas and Electricity Supply, 1655
Bury Gas Supply, 1246, 1655
Bury Water Bill, 199, 492
Bury St. Edmunds Gas Company, 414
Buxton Electricity Supply, 1510
Buxton Gas Supply, 401, 532
Cagliari Gas and Water Company, 632, 692
Calcium Carbide (*see also* Acetylene)—
  Dangers of the Manufacture of, 97
  Fire Risks of, 1549
  Manufacture of, Abroad, 1517
  Swiss Output of, 143
  Works for the Production of, in 1899, 83
Calcutta Electricity Supply, 1242
Calcutta Water Supply, 46
Calder, Mr. J., on the Prevention of Factory Accidents, 139
Calorific Power of Illuminating Gas, 1204, 1306, 1365, 1443, 1503
Calorimeter, The Inventor of the, 1365, 1443, 1503
Calverley and Horsforth Gas Company, 483
Camborne Water Company, 484
Cambridge and the South Essex Water Bill, 289, 494
Cambridge Gas Company, 347
Cambridge Town Council and the Water Works, 46, 100, 200, 288
Cambridge Water Company, 347
Cambridge (Mass.), Water Meters for Checking Consumption at, 800
Campbeltown Water Supply, 356
Cannel and Shales, Mr. S. Glover on the Carbonizing of, 1286
Canterbury Electricity Supply, 1321
Canterbury Gas and Water Company, 600, 622, 996, 1071, 1549
Cape Town Gas Supply, 491, 600, 1359, 1564
Cape Town Water Supply, 671, 963, 1212, 1328
Capital and Labour, Mr. J. A. Hobson, on, 199
Capital Expenditure, Need for Economy in, 1045
Capital, Redemption of Gas and Water, 463
Carbon Monoxide, Volumetric Determination of Small Quantities of, 1004
Carbonic Acid, The Determination of, 668
Carbonic Oxide Poisoning, 798
Carbonizing Cannel and Shales for Gas Making Purposes, 1286
Carburetting or Enriching Gas, 88
Cardiff Electricity Supply, 418, 1242, 1391
Cardiff Gas Supply, 37, 493, 953
Cardiff Water Supply, 162, 288, 1146, 1726
Carlisle Electricity Supply, 486
Carlisle Gas Supply, 153
Carlisle Water Supply, 1327
Carmarthen Water Supply, 158, 485
Carmichael's, Mr. J. W., Address to the Informal Meeting of Scottish Gas Managers, 924
Carnforth Water Company, 347
Carpenter, Mr. C. C., on Inclined Retorts at Bankside, 1275, 1305, 1365, 1443, 1558, 1646, 1729
Carpenter, Mr. R. Forbes, on the Presence of Naphthalene in Coal Gas, 683
Carter, Mr. F. W., on the Scientific Principles of Public Lighting by Arc Lamps, 598
Carter, Mr. J., on Rates and Gas and Water Charges in Provincial Towns, 277, 358
Castle Rising Water Supply, 669
Ceará Gas Company, 467, 797, 862
Ceiling Protectors, Deposits on, Caused by Incandescent Gas Lighting, 402
Cement—
  Concrete—
    Coke Breeze, 601, 1118, 1722
    Construction, Expanding Metal and, 401, 1292, 1297, 1550
    Cross Breaking Tests of, 923
    Strength of Frozen, 996
  For Caulking Retorts, Pipes, &c., 1645
  Sampling of, for Testing, 325
  Testing for Soundness, 601
Central London Electric Railway, 1636
Cerium Oxalate, The Composition and Determination of, 1698
Chaplin's, Mr., Committee on Old Age Pensions, 734
Charges, Gas and Water, in Provincial Towns, 277, 358
Charging and Drawing Machinery for Retorts, 931
Charing Cross and Strand Electricity Supply Corporation, 667, 744
Charlottenburg Gas Works, 468, 1498
Chatham, &c., Water Company, 287
Chelmsford Electricity Supply, 349
Chelmsford Gas Company, 623
Chelsea Water Company, 19, 399, 423, 1738
Cheltenham Gas Company, 554, 689
Chemistry, A Century of, at the Royal Institution, 1108, 1354, 1502
Chemistry, A Short History of the Progress of Scientific, in Our Own Times, 599
Chester Electricity Supply, 557
Chester Gas Company, 347, 414
Chester, Mr. W. R., on Stoking Machinery and Inclined Retorts, 1612, 1699
Chester Water Company, 415, 671
Chesterfield and the Electric Light, 158, 486, 1391
Chicago, Street Lighting in, 1135
Chicago Water Supply, 359
Chiltern Hills Water Company, 1051
Chimney, Throwing a High, 532
Chipping Norton Water Supply, 485
Chorley Gas Supply, 890
Cinder Concrete Flooring, 201
Cinderford Gas Supply, 101
City—
  Court of Common Council and the South Metropolitan Gas Bill, 1489, 1508, 1651
  Public Lighting of the, 953, 1241
  Subways for Gas, Water, and Electricity Mains in the, 860, 875, 1133
  Validity of an Electric Lighting Contract, 1211
  Work of the Public Health Department in 1899, 1241
City and Guilds of London Institute—
  Examinations in Gas Manufacture, 1238, 1273, 1734
  Work of the, 1427
City of London Electric Lighting Company, 157, 733, 860, 875, 1210, 1636
City of London (Various Powers) Bill, 399
Clacton Gas and Water Supply, 162
Clarke, Mr. A., on Patent Law Reforms, 1217
Clay Cross Gas Supply, 1051
Clayton, Allerton, and Thornton Gas Company, 414
Cleckheaton and the Bradford Corporation Gas Bill, 766
Cleethorpes Gas Company, 20, 83, 805
Clevedon Gas Company, 862, 891
Cleveland Water Company, 224, 347, 484, 736
Clifton Water Works, 1663
Clowes, Dr. F., on Chemistry and Analysis, 1297
Coal—
  Analysis of, 470, 923
  And Coal Mining, Sir W. Smyth on, 1116
  American, 670, 1359, 1362, 1639, 1722
  Anthracite, Determining the Combustible Matter in, 869
  Conciliation Board, 223
  Contracts of the London Gas Companies, 798, 888, 990
  Conveyors (*see* Conveying Machinery)
  Exported, Taxing of, 989, 1044, 1272, 1298, 1365
  Exports for 1898 and 1899, 991
  For Coking, The Treatment of, 996
  Mines—
    Bill to Restrict Hours of Labour in, 594, 596
    Persons Employed in, in 1899, 791, 820, 862
  Miners and Workmen's Compensation, 135
  Miners' Federation, The, 135, 392
  Origin and Potentiality of, 1638
  Output in 1899, 791, 820
  Prepayment Meters and the Price of, 408
  Profits in 1899, 917
  Price of—
    As Affecting Gas, 855, 934, 987, 1045, 1057, 1106, 1183, 1211, 1606
    Humphrys, Mr. Norton H., on, 1550, 1607
    Press and the, 1295
    Railway Rates and the, 919, 1135, 1273, 1322
  Resources of England, 462, 523, 528
  Russia, The Supply of, in, 200, 794, 820, 1053
  Scarcity of—
    At Electric Light Works, 137
    At Gas Works, 45, 46, 102, 133, 223, 209, 288, 391, 458, 492
    German Opinion on the, 688
    In the Seventies, 993
    Press and the, 397
  Spontaneous Combustion of, 144, 594, 610
  Supply—
    Peake, Mr. H. C., on the Probable Duration of the, 1608
    Proposed Royal Commission on, 881, 921, 1237, 1490
Coal (*continued*)—
  "Times, The," on the Question of, 1049, 1071, 1107
  Trade—
    Abroad, 794, 820
    Condition of the, 15, 19, 42, 97, 133, 144, 191, 209, 256, 391, 392, 397, 458, 408, 794, 820, 855, 1049, 1071, 1424, 1463
    Reports, 43, 44, 98, 161, 220, 286, 357, 426, 490, 560, 631, 697, 763, 826, 887, 962, 1020, 1075, 1143, 1244, 1324, 1396, 1462, 1514, 1569, 1660, 1745
  Waste Fuel, Rise in Price of, 144
  Weighing and Recording Machines, 1005
  West Australian, 471
  West Riding Owners and Gas Coal Contracts, 1136, 1454, 1515
  World's Output of, 18, 1463
Coatbridge and the Gas Workers' Union, 425
Coatbridge Gas Company, 347, 414, 767, 1742
Cochrane, Mr. C. H., on Modern Mechanism, 400
Cockerell, Mr. D., on the Effect of Gas on Bookbindings, 1001
Cockermouth Gas Supply, 1570
Coke—
  Breeze for Fire Resisting, 601, 1118, 1722
  Conveyors (*see* Conveying Machinery)
  Determining the Combustible Matter in, 869
  For the Treatment of Sewage, 1108
  Fuel for Road Motor Vehicles, 325
  Making, Treating Coal for, 996
  Melting of, in Liquid Lime, 1052
  Price of, in the North, 874
  Quenching, Mechanical, 84
  Trade in 1899, 142
Coke Oven Gas in Boston (U.S.A.), 38, 205, 257, 274, 1047
Coke Ovens—
  In England, 142
  In France and Germany, 1118
  Regenerative, 1217
Colchester Gas Company, 483
Colliery Workings, Refilling, 1053
Colman, Dr. H. G., on—
  Calorific Power of Illuminating Gas, 1204, 1306, 1365
  Naphthalene in Gas, 330, 798, 803, 873, 934
  System of Treating Coal and Other Illuminating Gases, 405
Colnbrook Gas Company, 102
Colne Gas Supply, 144, 1516
Colne Valley Water Company, 347, 484
Colney Hatch Gas Company, 554
Colombo, Lighting, Water Supply, and Sanitation of, 100
Colonial Gas Undertakings, 691, 883
Colson, Mr. A., on the Development of Electricity as an Illuminant, 216
Colwyn Bay and the Electric Light, 759
Colwyn Bay Gas Works, 164
Combustion Tester, Mr. G. Craig's, 468
Commercial Gas Company, 880, 916, 954, 1065, 1661
Commercial Organic Analysis, 1433
Commissions, Secret (*see* Secret)
Compagnie l'Union des Gaz, 1297
Compagnie pour l'Eclairage des Villes et Fabrication des Compteurs, 562
Companies—
  Holding of Shares in, by Members of Local Authorities, 1211
  New Joint Stock, 42, 276, 632, 804, 1134, 1142, 1246, 1366, 1394, 1515, 1572, 1664
  Promoters of, in Parliament, 24
  Registered in 1899, 261
  Wound Up, 47, 633, 759
Companies Acts Amendment Bill, 458
Compensation, Workmen's—
  Act—
    An Agreed Award under the, Dealt with in the County Court, 548
    Casual Labourers and, 731
    Coal Miners and the, 135
    Cost of Insurance under the, 1697
    Digest of Cases, 139
    Extension of the, 791
    Lawyers and the, 861
    Liability of "Undertakers" and Contractors under the, 917
    Litigation under the, 219, 731, 917, 953, 1508
    Ruegg, Mr., on the, 459
    Working of the, 75, 139
  Action for, under the Common Law, 1733
  Settlement of a Claim by the Manchester Corporation, 632
Compressed Air Power Transmission, 601
Compressed Fuel Syndicate, The, 1394
Compressors for Gas and Air, 1062, 1064, 1363, 1644
Concrete (*see* Cement)
Condensers—
  German Form of, 1498
  Improvements in, 931
Consett Water Company, 347, 485
Contract, Increase in the Amount Paid on a, 1746
Contractor's Business, Some Points of a, 1640
Conveying and Elevating Machinery for—
  Excavating, 996
  Gas Works, 30, 145, 202, 1005, 1302
Cookstown Gas and Light Company, 1394
Co-operative Union, Congress of the, 1540
Copper Trade, Condition of the, 137
Copper Market, The Rockefellers and the, 524
Cork Gas Consumers' Company, 623
County Councils and Water Questions, 162, 822
Coventry Corporation and the North Warwickshire Water Bill, 698, 759

Coventry Electricity Supply, 561
Coventry Gas Supply, 277, 561, 1737
Coventry Water Supply, 1464
Cowes Gas Supply, 45, 358
Cowlyd Water Board, 164, 1079
Crackanthorpe, Mr. M., Fire Caused by Electricity, at the Residence of, 38, 94
Cradley Heath Gas Company, 623
Craig's, Mr. G., Combustion Tester, 468
Cranleigh Gas Company, 47
Crawley Gas Works, 1145, 1325, 1655
Crefeld Gas Works, 22, 89, 144
Creosote and Benzol, The Low Price of, 683
Crewe Electricity Supply, 759
Cripps, Mr. F. S., on Gas Companies' Balance Sheets, 804
Cromer Gas Supply, 881
Crook, Gas Explosion at, 1570
Crookes's, Sir William, British Association Address, 84
Crowborough Water Company, 143, 219
Croydon Gas Company, 163, 414, 481, 1639
Crystal Palace District Gas Company—
  Coke Conveyor and Water Gas Plant, 202, 270, 1302
  Election of Mr. T. Guyatt as Auditor, 467
  Half Yearly Report and Accounts, 413
  Lass, Mr. A., Resignation of, as Auditor, 401
  Meeting of Shareholders, 458, 479
  Presentation to Mr. C. M. Ohren, 1456
  Street Lamp, Liability for Damage to a, 392, 412
Cumberland, A Big Water Scheme for, 1245, 1514
Cupar Gas Company, 1323, 1460, 1513
Cut Off, Automatic, for Gas Pipes, 340
Cutler, Mr. S., jun., on Water Gas, 921
Cyanides, Manufacture and Purification of Alkaline, 273
Cyanogen, The Recovery of, from Coal Gas—
  Bueb, Dr., on, 80, 273
  Stenhouse, Mr. T., on, 666
Cyanogen Compounds, Obtaining, 406
Cyanogen Gas, A, Identical with Argon, 1640
"Daily News" on—
  Early Closing Bill, 1426
  Factory and Workshop Regulation Bill, 1607
  London County Council, 319
  Paris Exhibition, 1294
  Rural Sanitation, 400
  Workmen's Compensation Act, 135
Dalkeith and the Electric Light, 1659
Darlington and the Electric Light, 348
Darlington Gas and Water Supply, 621, 665, 888, 956, 1571, 1664, 1721
Darmstadt, Incandescent Gas Lighting in, 222
Dartmouth and the Electric Light, 157
Dartmouth Gas Company, 689, 1213
Darwen Water Supply, 161
Dawson, Mr. B., Death of, 733
Dawson, Mr. N., on the Design of Lamp Standards, 1539
Deaths—
  Bain, Mr. J., 25; Barratt, Mr. W., 467; Bell, Mr. C., 201; Betteridge, Mr. E., 736; Blumer, Herr B., 922; Bodkin, Mr. W. P., 922; Borradaile, Mr. T. S., 1548; Boulger, Mr. H., 263; Bowditch, Mrs. M., 798; Bowman, Mr. J., 1359; Breingan, Ex-Provost, 798; Breittmayer, M. E., 1297; Brown, Mr. W., 671; Bruff, Mr. P. S., 600; Buckley, Mr. J. W., 671; Clark, Mr. E., 798; Clarke, Mr. W., 1051; Clarke, Mr. W. H. C., 467; Cowen, Mr. J., 467; Davidson, Mr. W. B., 467; Dawson, Mr. B., 733; Doig, Mr. W., 696; Earl, Mr. G., 1434; Earle, Sir T., 1051; Falkner, Mr. W., 25; Geinitz, Herr H. B., 922; Gow, Ex-Bailie, 600; Hallam, Mr. J., 144; Hawley, Mr. T., 263; Haywood, Mr. T. B., 1297; Hickmott, Mr. H. H., 263; Hislop, Mrs. G. R., 1721; Hodgkin, Major E., 201; Hooker, Mr. C., 1434; Hunter, Mr. T., 144; Johnson, Mr. J. S., 1721; Jones, Mr. P., 25; Jones, Mr. S., 1548; Jordan, M. S., 736; Laming, Mrs. G., 83; Langton, Mr. J., 736; Legg, Mr. H., 144; Long, Sir G. H., 263; Maltby, Alderman J., 671; Marindin, Sir F., 1213; M'Landsborough, Mr. J., 600; Osborne, Mr. A., 532; Pallister, Mr. C., 201; Phillips, Mr. E. J. 532; Pritchard, Mr. E., 1359; Quaglio, Herr J., 201; Rammelsberg, Herr C. F., 201; Robb, Mr. J., 1721, 1744; Roberts, Mr. T., 201; Sandilands, Bailie, 1051; Sawer, Mr. J. F., 1548; Simpson, Mr. P., 1117; Squarey, Mr. A. T., 1213; Stanford, Mr. J., 1434; Stiven, Mr. D., 600; Sumner, Mr. G., 1721; Symons, Mr. G. J., 736, 1355, 1551; Tall, Mr. J. R., 1213; Trewhitt, Mr. T., 83; Wadham, Mr. T., 1051; Waller, Mr. A. F., 1639; Wharton, Mr. J. T., 736; White, Alderman J., 671; Willis, Mr. E., 1297; Wilson, Mr. T. H., 1359; Wyatt, Mr. H., 1051
De Brouwer Coke Conveying and Elevating Plant at the Crystal Palace Gas Works, 202, 1302
Dellwik's Water Gas Process for Enriching Purposes, 260, 1303
Denny Gas Supply, 1074, 1744
Depreciation of Machinery, 529
Derby Gas Company, 414, 996, 1052, 1212, 1434
Derwent Valley Water Board, 164, 195, 893, 996, 1297
Desulphurization of Sulphuretted Hydrogen, 1005
Devonport—
  Explosion of Gas at, 1021
  Public Lighting, 1561
  Suffocation by Gas at, 889
Devonport Electricity Supply, 693
Devonport Gas Company, 25, 401
Devonport Water Works, 563
Dewar, Professor, on the Effect of Low Temperatures on Coal Gas, 996
Dewsbury and Heckmondwike Water Board *v.* Assessment Committee of Penistone Union, 411
Diesel Oil Engine, The, 144
Directors *versus* Auditors, 1051, 1217
Distributing Gas—
  At High Pressures, 676, 730, 866, 1723
  Of Different Qualities, 869
Divining for Water, 225, 259, 765, 962, 1076
Dockers' Strike, 1697
Dodd, Mr. J. T., on the Poor Law, 198
Doncaster Corporation Electricity Supply, 958
Dorchester Gas Company, 414
Dorking and the Electric Light, 1565
Dorking Gas Company, 957
Dorking Urban Council and the Water Supply, 289, 561, 936, 1131, 1246
Dorking Water Company, 99, 143, 625, 936, 1131, 1246
Dougall, Mr. A., Presentation to, 1617
Douglas and the Electric Light, 215
Douglas, Gas Explosion at, 209
Douglas Gas Supply, 17, 36, 91, 209, 623
Dover Corporation Water Supply, 102, 165
Dover Electric Lighting Company, 884
Dover Gas Company, 623, 767
Draughts in Houses, 268, 600
Dresden Water Supply, 146
Driffield Gas Supply, 46, 736
Droitwich Gas Supply, 144, 263
Dronfield Water Supply, 159
Dublin—
  Damage to Gas Mains by Steam Rollers in, 752, 790, 815, 1733
  Gas Explosion in, 698
  Supply of Water Gas in, 756, 790, 806, 818, 1124, 1561
Dublin Electricity Supply, 20, 38, 820, 1428
Dublin Gas Supply (*see* Alliance)
Duckworth, Mr. Lawrence, on the Law Relating to Gas, Water, and Electric Lighting, 796
Dudley Electricity Supply, 1510
Dukinfield Gas Supply, 964, 1319
Dumfries Gas Supply, 219 696, 1074, 1744
Dunbar Gas Supply, 160, 219
Dunbar, Professor, on Sewage Treatment, 1502
Duncan, Sheldrake *v.*, 210
Dundalk Gas Supply, 467
Dundee, Electric Traction in, 285, 1074
Dundee Gas Supply, 285, 559, 696, 767, 1141, 1243, 1567, 1743
Dundee, Gas *v.* Electricity at, 1074
Dundee Water Supply, 1659
Dundonald, Lord, and the Discovery of Coal Gas, 735
Dunfermline Gas Supply, 488, 761, 1018, 1322, 1395, 1568, 1658
Dunoon Gas Company, 1323
Dunstable Gas and Water Company, 1077
Durham Gas Supply, 224, 415
East Ardsley Gas Company, 144
East Grinstead Gas and Water Company, 623
East London Water Works Company—
  Bills, 422, 399, 1354, 1504
  Charge for Water for Road Watering, 1235
  London County Council and the Use of Fire Hydrants, 195, 211
  Meeting of Shareholders, 422, 918, 958
  Payment of Water Rates for Small House Property, 685
East Preston and the Littlehampton Gas Company, 154
East Shropshire Water Works Scheme, 143, 563, 752, 1663
East Stirlingshire Water Supply, 200
East Worcestershire Water Company, 415, 556
Eastbourne Electricity Supply, 157, 759
Eastbourne Gas Company, 623
Eastern Counties Gas Managers' Association (*see also* "Technical Record"), 1044, 1053, 1106
Eckington and Mosbro' Gas Company, 551
Econometer, Evidence for the, 201
Economy Gas Cooking Stoves Company, 1572
Edenbridge Gas Company, 1434
Edinburgh and Leith Gas Commission—
  Accounts, 1735, 1743
  Annual Dinner, 824
  Assessment of the New Works, 628
  Coal Contracts, 355, 629, 1243
  Incandescent Street Lighting, 1243
  Increased Consumption, 355, 629, 824, 1243, 1512
  Inspection of the New Works, 1387
  Subways for Mains, 285
  Voting of Members Interested in Contracts, 629
  Wages of the Men, 629
Edinburgh District Lunacy Board Bill, 200
Edinburgh Electricity Supply, 630, 824, 1461
Edinburgh, "Gas Fountain" Exhibition in, 157
"Edinburgh Review" on Arbitration in Trade Disputes, 1211
Edinburgh Water Supply, 285, 696, 1659
Edwards, Mr. A. E. A., on Workshop Lighting, 1546, 1729
Eitner, Dr. P., on the "Kugel" Light, 265
Elche Water Works Company, 804
Electric—
  Cables, The Cost of, 137
  Lamp, Curious Explosion of an, 157, 216
  Lamp, Nernst, 494
  Lamps, Miniature, 1497
  Power Plant, A Combination, 1722
  Street Lamps, Lightning and, 467, 1054
  Traction (*see* Traction)
Electric Lighting—
  Acetylene *versus* (*see* Acetylene)
  Act (1882) Amendment Bill, 1139
  Acts, Failure of the, 192, 321, 1114
  Analysis of Electricity Works Accounts, 1636
  Board of Trade and the Municipalization of, 285
  Boxes and Culverts, Explosions in, 94, 349
  Capital Expenditure, Comparisons of, 630
  Competition, 1139
  Failures, 37, 94, 157, 158, 192, 196, 212, 214, 216, 278, 321, 486, 491, 626, 1572
  Free Wiring Systems, 461, 548, 1539, 1546
  Gas *versus* (*see* Gas)
  High Voltage Supplies, Cost of, 1545
  Law relating to, 796
  Memoranda, 20, 77, 137, 196, 260, 321, 396, 460, 527, 597, 667, 733, 793, 860, 991, 1047, 1114, 1210, 1294, 1355, 1492, 1545, 1636, 1719 (*see* "Essays, Commentaries, and Reviews.")
  Notes, 37, 94, 157, 215, 278, 348, 418, 486, 557, 626, 692, 759, 820, 884, 958, 1016, 1073, 1139, 1242, 1320, 1391, 1456, 1510, 1565, 1656
  Popularity of, Imperilled, 20, 77
  Private, The Cost of, 1118
  Tampering with Lamps, 215
  Town's Refuse, Fuel Value of, for, 138
  Wiring for, 38, 94, 330, 461, 548, 1539, 1546
Electrical Supply, The Future of, 860, 934
"Electrician"—
  And the "Journal," 77, 321
  Electrical Trades Directory, 564
  Gas and Electricity Meters, 1210, 1294, 1356
  Popularity of Electric Lighting Imperilled, 20, 77
Electricians and "Hospitalities" of Trading Firms, 1697
Electricity—
  And Engineering, Sir W. H. Preece on, 1114, 1116
  Carter, Mr. F. W., on Street Lighting by, 598
  Company Fined for Insufficient Supply of, 1106, 1114, 1135, 1235
  Deaths from Currents of, 198
  Development of, as an Illuminant, 216
  Fires Caused by, 38, 94, 418, 1139
  Gas Engines for Generating, 158
  Generation of, in Bulk, 216, 279, 319, 396, 418, 486, 531, 533, 597, 860, 1294, 1355, 1428, 1492, 1719, 1722
  Systems of Charging for, 991
  Taxing as an Import, in America, 533
  Temperature of Gas and, 263
  Thefts of, 45, 154, 965
  Unaccounted for, 1636
  Wright System of Charging for, 991
Electro Chemistry, The Progress of, 923
"Electroid" Gas Condemned as Dangerous, 153
Electrolysis of Gas and Water Pipes, 86, 221, 416, 460, 545, 666, 793, 812, 1368, 1386, 1491, 1501
Elgin Gas and Water Supply, 467
Elland Electricity Supply, 216
Elland Gas Company, 263, 415, 623, 797
Elland, Explosion Caused by Lightning at, 1663
Embezzlement, Charges of, 154, 494, 548, 619, 685, 754, 953, 1274, 1318, 1366
Energy, The Waste of, by Artificial Lights, 920
Engineer—
  Preece, Sir W. H., on the Training of the, 530
  Qualifications of the True, 17
"Engineer" on—
  Private Electric Lighting Installations, 1118
  Steam, 467
Engineering and Electricity, 1114, 1116
Engineering Competition, American, 1428
"Engineering Magazine" on Water Hammer in Pipes, 1440
"Engineering News" on Laying Pipes under Water, 1061
"Engineering Record" on—
  Flow of Water in Pipes, 1434
  Vitrified Clay Pipes, 1216
Engines—
  Gas—
    Blast Furnace Work and, 1640
    Comparative Cost of Electric and, 1719
    Efficiency of Steam and, 863
    Electric Plant Driving by, 158, 1211
    Improvements in, 87, 272, 273, 340, 407, 464, 801, 1008, 1441, 1442, 1555, 1645, 1728
    Lyon, Mr. J. D., on, 929
    Melvin and Son's, Messrs. T., 464
    Producer Gas for, 863, 1051
    Silencers for the Exhaust of, 406
    Westinghouse, 84, 1105
  Oil, The Diesel, 144
  Steam—
    A Source of Waste in, 736
    Efficiency of Gas and, 863
    The Standard Performance of, 863
Engines, Pumping—
  Duty of, 466
  Producer Gas for, 863
Ennis Gas Supply, 467
Enrichment of Gas, 260, 1200
Epping Gas Company, 415
Epsom Electricity Supply, 958
Epsom Water Supply, 814
Ethylene, The Determination of, in Coal Gas, 1439
Ettingshall, Fatal Electricity Accident at, 1657
Everett Coke Oven Gas Plant, 38, 205, 257, 274, 1047, 1217
Evesham Gas Supply, 1328
Examinations in Gas Manufacture—
  City and Guilds of London Institute, 1238, 1273, 1734
  Halliwell, Mr. S. E., on, 1214
  Polytechnic, 1238

Excavating, The Use of Conveyors in, 996
Exeter Electricity Supply, 215, 418, 557, 693, 884, 1320
Exeter Water Supply, 1570
Exmouth Gas Supply, 890, 953
Exmouth Water Supply, 100, 143, 200, 494, 563, 625, 700
Experts, Disputed Points among, Mr. J. Wilkinson on, 1614, 1708
Explosions—
  Acetylene, 335
  Chemical Works, 47, 768
  Coal and Sewer Gas, 46
  Gas, 17, 36, 46, 89, 91, 164, 209, 213, 278, 287, 428, 476, 493, 559, 633, 698, 1021, 1073, 1515, 1570, 1663
  Gas Stove, 46
  In Electric Culverts, &c., 94, 157, 216, 349, 626
  Oil Gas Works, 17, 40, 953
Factory and Workshop Regulation Bill, 1607
Falkirk Gas Supply, 79, 159, 488
Falkirk Water Supply, 200, 630, 695, 762
Falmouth, Acetylene *v.* Coal Gas at, 754
Falmouth Water Supply, 165, 557, 596, 884, 1017, 1657
Faringdon Water Supply, 699
Farnham Water Company, 491
Farnworth and Kearsley Gas Company, 401, 554
Farnworth and the Electric Light, 1017
Farrer, The Late Lord, Estate of, 201
Faversham Gas Supply, 532, 600
Faversham Water Supply, 273, 625, 1071
Faxon, Mr. J. L., on Gas Piping in Buildings, 1510
Felixstowe Gas Company, 325
Felixstowe Water Company, 625
Fenton Gas Supply, 888, 1571
Ferruginous Incrustations in Water Pipes, 1053
Fife Water Supply, 697
Fire Bricks, Advance in the Price of, 162
Fireproof Building Construction, 84, 201, 601, 1722
Fires, 38, 45, 46, 94, 344, 667, 744, 825, 886, 892, 1139
Fishguard Water and Gas Bill, 143
Fittings, Gas, Dangers Arising from, 1510
Flameless Gaslight Company, 632
Floods, Gas and Water Supply Interfered with by, 494, 556, 562
Fluids, A Mixing Chamber for, 26
Fluids in Motion and at Rest, 25, 115
Fogs, Rev. J. M. Bacon on, 1050
Folkestone Electricity Supply Company, 958
Forfar Borough Accounts, The Auditors for the, 489, 559
Forfar Gas Supply, 42, 489, 825, 1073
Formby Gas Supply, 671, 936
Foulger-Glover Torch Syndicate, 276
Foundations, The Strength of, 201
Fowler, Sir H., on Municipal Trading, 1425, 1719
France—
  Acetylene Lighting in, 884
  Artificial Illuminants in, 923
  Coke Ovens in, 1118
  Distillation of Tar in, 994
  Future of Water Gas in, 997
  Sulphate of Ammonia and Nitrate of Soda in, 800, 1108
Frank Wright's Prepayment Meter Corporation—
  Falsifying the Books of, 548, 619, 685, 754, 953, 1274, 1318
  Reconstruction Scheme, 1517
Freezing—
  Preventing Gas Pipes from, 681, 868
  Process for Use while Excavating, 874
French, Mr. D. W., on Repairing a Submerged Water Main, 1643
Frimley and Farnborough Water Company, 485
Fuel—
  Portability of Oil, 84
  Rise in the Price of Waste, 144
  Value of Producer Gas as, 403
Fuller, Mr. F. L., on Covered Reservoirs in the United States, 472
Furnace Gases, Importance of Testing, for Carbonic Acid, 201
Furnace Linings, Refractory, 1052
Furnace Management, 468
Furnaces, Apparatus for Feeding, and Removing Ash and Clinker from, 87
Fyfe Asylum Gas Supply, 1323
Fylde Water Supply, 1076
Gainsborough Gas Supply, 1327
Gainsborough Water Supply, 165, 408
Galashiels Gas Supply, 488
Gas—
  Calorific Power of Illuminating, 1204
  Carburation of, 801
  Carelessness in the Use of, 142
  Discovery of, 1126
  Distributing Different Qualities of, 859
  Domestic Uses of, 26
  Early History of, 735, 1126
  Effect of Low Temperatures on, 996
  Electricity *versus*—
    At Newcastle, 818
    Comparison of the Cost of, 418, 486, 548, 557, 824, 1719, 1738
    Economy and Efficiency, 471
  Failures, 46, 162, 491, 936, 1571
  From Town Refuse, 681
  Illuminating, from Coke Ovens, 38, 205, 257, 274, 1047, 1217
  Law Relating to, 796
  Liquor, Production of Ammonia from, 678
  Liquor, Testing for Ammonia, 334
  Manufacture, Examinations in (*see* Examinations)
Gas (*continued*)—
  Manufacture, Mr. W. R. Herring on, 865, 886
  Manufacturing Systems, 30, 157, 681, 1127, 1728
  New Competitors with, 1118, 1497
  New, Mr. W. H. Y. Webber on the, 1613, 1627
  Obtaining Intense Heat from, 1364
  Price of Coal and, 855, 934, 987, 1183
  Roaster, A Large, in Paris, 541
  Supply, The Necessity of Giving Notice of Discontinuance of, 1646
  Temperature of Electric Light and, 263
  Undertakings Returns, 323, 990
  Water, and Electric Lighting, The Law Relating to, 796
Gas Companies' Protection Association, 545
Gas Engineering Society, 755
"Gas Fountains," 157, 264, 408, 1142
Gas Institute (*see also* "Technical Record")—
  Annual Meeting, 798, 1425, 1435, 1542, 1605, 1609, 1699
  Proposed Amalgamation of the Institution of Gas Engineers and the, 255, 273, 341, 729, 1043, 1130, 1181, 1191, 1605, 1609, 1611, 1617, 1624, 1729
  Visit to Paris, 732, 802, 874, 1217, 1632
Gas, Water, and General Investment Trust, 563, 691
Gas Workers' Union (*see also* Glasgow Gas Supply), 89, 408, 563, 1079, 1460, 1572
Gas Works—
  And the London Building Act, 1108
  Closing of a, 1729
  Competitive Plans for New, 533
  Labour Saving Appliances in, 30, 145, 202, 996, 1005, 1302, 1612
  Sales of, by Auction, 493, 688, 1145, 1245, 1325, 1655
  Sunday Labour in, 1293, 1365
Gaseous Firing, 201, 468
Gases—
  A Mixing Chamber for, 26
  Explosions of, 798
  Separating and Extracting, from a Gaseous Mixture, Purifying, Exhausting, and Compressing Gas, and Increasing its Illuminating Power, 1216
  Treating Coal and Other Illuminating, 405
Gasholder—
  For Equalizing Intermittent Gas Production and Other Purposes, 933
  Guide Framing, Herr Hacker on, 1499
  Litigation as to the Construction of a, 524, 545, 730, 737, 1318
  Safety Valve for, 1556
  Tank Construction, Mr. F. W. Stevenson on, 1290
Gaslight and Coke Company—
  Accident at the Beckton Works, 1245
  Bill for the Issue of Debenture Stock, 20, 33, 593, 618, 664, 684, 1272, 1307, 1313, 1351, 1367, 1369
  Disputed Gas Bill, 1646
  Extension of West's Stoking Machinery, 764
  Increase in the Price of Gas, 1663, 1695, 1734
  Meetings of Shareholders, 317, 342
  Prepayment Meter Collections in 1893, 402
  Report and Accounts, 201, 256, 275
  White *v.*, 212
"George Newton, Limited," 804
Georgetown (British Guiana) Gas Company, 1215
Gerhard, Mr. W. P., on Carelessness in the Use of Gas, 142
German—
  Benzine Association, 996
  Continental Gas Company, 882
  Opinion on the Scarcity and High Price of Coal, 688
  Protest Against the Prohibition of the Exportation of Carbolic Acid from England, 263
German Association of Gas and Water Engineers, 1640
Germany—
  A Form of Condenser in Use in, 1498
  Coal Tar Industry in, 16, 526
  Coke Ovens in, 1118
  Conditions of Gas Supply in, 22, 89, 144, 261
  Gas Purification in, 22, 89
  Law to Punish Thefts of Electricity in, 45, 965
  Metric System in, 613
  Old Age Pensions in, 225
  Testing Portland Cement in, 601
Giffen, Sir R. and Sir W. Crookes's Predictions as to the Coming Scarcity of Wheat, 84
Gijon Gas Supply, 407
Glasgow—
  Gas Explosion in, 164
  Municipal Insurance Fund in, 96
  Municipal Work in, 23
  Suffocation by Gas in, 98
Glasgow Corporation Electricity Supply, 24
Glasgow Corporation Gas Department—
  Coal Contracts, 488, 559, 1323, 1394, 1659, 1743
  Contractors' Claim Against the, 356, 425
  Dispute with the Men, 36, 41, 95, 159, 213, 218, 284, 348, 355, 424, 558, 1073, 1305
  Fair Wages Clause in Contracts, 991
  Increased Revenue, 1743
  Inspection of the Works, 1659
  Liability of, for Lighting Common Stairs, 760
  Lyon, Mr. J., Presentation to, 671, 761
  New Works, 1073, 1394, 1567, 1659
  Phinn, Mr., Presentation to, 401
  Progress of the, 23
  Proposed Friendly Society, 156, 488
  Quality of the Supply, 356
  Social Gathering of Employés, 427
  Supply of Prepayment Meters, 425
Glasgow Corporation Water Supply, 23, 490, 532, 1051, 1244, 1461, 1659
Glastonbury and Street Gas Supply, 20, 74, 79, 745, 805, 807, 856, 875, 877
Glastonbury Water Supply, 1664
Gloucester Chamber of Commerce and the Welsh Water Scheme, 349
Gloucester Electricity Supply, 157, 1456
Gloucester Gas Company, 1325
Glover, Mr. S., on Carbonizing Cannel and Shales for Gas Making Purposes, 1286
Glyncorrwg Corporation Gas Bill, 79
Golden Grain Bread Company, 1051, 1217
Gomme, Mr. G. L., on Old Age Pensions, 199
Good Citizenship, 198
Goodell, Mr. J., on the Water Supply of Small Towns, 139
Goole Gas Supply, 532
Govan, Narrow Escape from Gas Poisoning at, 358
Governors, Mr. E. H. Millard on, 1119
Grand Junction Water Company, 422, 1515, 1608, 1650, 1733
Grantham Gas Company, 21, 415, 467, 1368
Grantham Water Company, 415
Gravesend Gas Supply, 797
"Greased Air" Gas Process, Another, 393
Great Berkhampstead Water Works Bill, 143
Great Central Railway and Ugly Bridge Construction, 1426
Great Malvern and the Electric Light, 418
Great Malvern Gas Supply, 102
Greenock Gas Supply, 219, 467, 558, 671, 825, 797
Greenwich, Electricity Fatality at, 557
Greville, Mr. H. Leicester, on Naphthalene in Coal Gas, 873, 1065
Grimsby Electricity Supply, 557
Guildford Electricity Supply, 759
Guildford Gas Company, 83, 217, 494, 556, 889
Guildford, Interruption of the Lighting and Water Supply by Flood at, 494, 556
Guildford Water Supply, 359, 556
Gunnislake Gas Supply, 934
Haber, Professor F., on the Determination of Benzene and Ethylene in Coal Gas, 1439
Hacker, Herr, on the Guide Framing of Gasholders, 1499
Hackney Vestry and the Charge for Water for Cleaning Roads, 1235
Hadley Gas Supply, 736
Haldane, Dr. J. S., on Carburetted Water Gas, 1048
Halesowen Gas Company, 483
Halifax, Appointment of Mr. J. Lord as Borough Engineer of, 401
Halifax Chamber of Commerce and the Yorkshire Electric Power Bill, 1565
Halifax Electricity Supply, 487, 1557, 1657
Halifax Gas Supply, 45, 157, 274, 428, 889, 1557
Halifax Water Supply, 200, 760, 930, 1557
Hall, Mr. Jesse, Life Work of, 599
Halliwell, Mr. S. E., on Examinations in Gas Manufacture, 1214
Hamilton Gas Supply, 629 961, 1567
Hamilton Water Supply, 200
Hammersmith Electricity Supply, 154
Hampton District Council *v.* The Southwark and Vauxhall Water Company, 89, 222, 765
Hanley Electric Light Installation, 884, 1391, 1510
Hanley, Gas Explosion at, 493
Hanley Gas Supply, 20, 341, 428
Harman, Mr. E. A., on—
  Uses of Steam in Modern Civilization, 531
  Ventilating Tar and Liquor Storage Tanks, 209
  Welsbach Company's New Prices, 1558
Harrington Gas Company, 879
Harrogate Gas Company, 623
Harrogate Water Supply, 1326
Harrow and Stanmore Gas Company, 632, 691
Hartlepool Corporation and the Gas and Water Supply, 1571
Hartlepool Gas and Water Company, 21, 83, 144, 277, 671, 805, 809, 1571
Harwich Water Supply, 1393
Hastings and St. Leonards Gas Company, 689, 701
Hastings, Gas *v.* Electric Light at, 1738
Hastings Water Supply, 100, 323, 412
Havant District Council and the Portsmouth Water Company, 24
Haverhill Gas Supply, 25
Haverhill (Mass.), Price of Gas Compulsorily Reduced at, 394, 417, 491, 883
Hawarden Water Company, 671
Haynes, Sheen *v.*—Promotion of the Automatic Gas Meter Company, 815, 879
Heaphy, Mr. M., on the Protection of Electric Lighting Wires, 94
Heckmondwike Electricity Supply, 1391
Heckmondwike, Gas Poisoning at, 163
Heckmondwike Gas Supply, 688, 890, 934
Helensburgh Gas and Water Supply, 42, 425, 798, 1568
Helps, Mr. G., on the Heating of Gas Retorts, 606
Helps, Mr. J. W., Inaugural Address to the Institution of Gas Engineers, 1109
Helston Gas Company and the Corporation, 1145, 1309
Hemel Hempsted Water Bill, 200, 632
Hemsworth Gas Supply, 201
Henley-on-Thames Gas Supply, 412
Hereford Electricity Supply, 418
Herne Bay Gas Supply, 144, 203
Herring, Mr. W. R., on Inclined Retorts, 865, 886
Hertford Gas Company, 624
Herting, Herr O., on Testing Gas Liquor for Ammonia, 334
Heswall Public Lighting, 223, 695

Heysham and the Morecambe Gas Bill, 562, 1145
Heysham Water Supply, 494
Heywood and Middleton Water Supply, 1071, 1463
Heywood and the Electric Light, 418, 1510, 1565
Heywood Gas Supply, 162, 1327, 1390
Hickenlooper, General, on Street Lighting, 1123
High Wycombe Gas Company, 46, 802, 1328
Higham Ferrers Water Bill, 143, 407, 814
Highlands, Mr. S. M., on a Remedy for Stopped Ascension Pipes, 545
Hill Brow Water Company, 222
Hinckley Gas Supply, 221, 1563
Hipperholme, Unlawful Interference with Water Mains at, 754
Hobson, Mr. J. A., on Capital and Labour, 199
Hoddesdon Gas Company, 483, 487
Holland, Association of Gas Engineers of, 1554
Holmfirth Water Supply, 1078
Holyhead and North Wales Gas and Water Corporation, 671
Holywood Water Supply, 359
Home Office Statistics as to the Output of Coal, 791, 820, 862
Honley Gas Explosion, 89
Honley Gas Supply, 688, 689, 1328, 1563
Hopkins, Mr. A. B., on the London Government Act, 1899, 1256
Horbury District Council and the Ossett Gas Bills, 492, 1071
Hornsey Gas Company, 692, 922
Horsforth Water Supply, 1012, 1516
Horsham Gas Company, 102
House Building—
  A Plea for Intelligent, 464, 919
  In New York, 923
Houses, Damp, 1118
Housing of the Working Classes, 75, 394, 525, 858, 1045, 1275, 1358
Huddersfield Electricity Supply, 215, 557, 820
Huddersfield Gas Supply, 225, 1389
Hull Electricity Supply, 348, 561, 1321, 1510
Hull Gas and Water Supply, 288, 561, 683, 891, 892, 1130, 1245, 1390
Humphrys, Mr. N. H., on—
  Cost of Coal, 1550, 1607
  Gas Companies and Peripatetic Gas Testing, 671
Hungerford Gas Supply, 1571
Hunstanton Gas Supply, 223
Huntly Gas Company, 1359
Hydraulic Main, Mr. H. J. Robus's Water Clad, 540, 933
Hydro Incandescent Gaslight Company, 28, 1021
Hypochlorites, Behaviour of Acetylene towards, 1718
Idris and Co., Crystal Palace Gas Company *v.*, 392, 412
Ignition of Gas (*see* Burners)
Ilford Gas Company, 491, 1325, 1721
Ilfracombe Gas Company, 689
Ilfracombe Water Supply, 100, 323, 358, 1076, 1368
Ilkeston Electricity Supply, 1391
Ilkeston Gas Supply, 818
Ilkeston Water Supply, 558, 732
Illinois, Gas Works in, 428
Illinois Labour Commissioners' Report, 734
Imperial Continental Gas Association, 1184, 1235
Incandescent Bodies, The Temperature of, 144
Incandescent Gas Lighting—
  Anti Vibratory Fittings, 1441
  Burners—
    Chimneyless, The De Mare Patent for, 632
    New, 30, 32, 146, 152, 208, 270, 340, 1007, 1053 1064, 1129, 1542, 1556, 1728 (*see also* "Register of Patents," p. viii.)
    "Solar," 1542
  Compressors for, 1062, 1064, 1363, 1644
  Deposit on Ceiling Protectors and on the Chimneys of Burners, 402
  Electricity *versus*, 471
  Hydro Incandescent System, 28, 1021
  Intensified (*see* Intensified)
  Jasper Mantle, The, 540
  Lamps for, 681, 1002, 1441
  Lewes, Professor Vivian B., on, 1299, 1360, 1436
  Litigation (*see* "Legal Intelligence," p. x.)
  Low Pressure System of, 680, 1441
  Mantle Supports, 208, 270
  Mantles and Other Bodies—
    For Acetylene, 209
    Inverted, 1556
    Monazite Sand for the Manufacture of, 1733
    New, 151, 209, 272, 742, 871, 933, 1006, 1062 1555, 1556, 1645 (*see also* "Register of Patents," p. ix.)
    Strengthening, 151, 742
    Traffic in Infringing, 153, 517, 685, 816
    Treating Earthy Oxides for the Manufacture of, 1644
  Regulating Gas Pressure in, 932
  Sheldrake, Mr. J. H., on, 1044, 1053, 1106
  Street Lighting, 222, 312, 358, 425, 427, 493, 562, 687, 756, 766, 886, 887, 953, 956, 1002, 1064, 1324, 1327, 1516, 1561
  Temperature of Bodies in, 144
  Torches for, 1063, 1127
Incandescent Mantle Remover Company, 412
Income Tax, Deduction of, from Dividends, 1145
Increases in Price, Notifying, 874, 1327
Increases in the Price of Gas, 101, 102, 224, 428, 491, 492, 561, 632, 685, 764, 765, 802, 862, 888, 891, 934, 1016, 1327, 1397, 1454, 1515, 1562, 1652, 1654, 1655, 1663, 1695, 1734, 1736, 1742
Increasing the Price of Gas, Suggestions for, 804
Influenza and the Labour Supply, 74
Ingham, Mr. W., on the Incrustation of Iron Pipes at the Torquay Water Works, 147
Ingleton Water Power Company, 1394
Ingrey, Mr. C., on Coal Weighing Machines, 1005
Inquiry Circular Nuisance, The, 1366
Institute of Secretaries, 1117
Institution of Civil Engineers (*see also* "Technical Record"), 144, 194, 922, 1117
Institution of Gas Engineers, The Incorporated (*see also* "Technical Record")—
  Annual Meeting, 201, 326, 987, 998, 1109, 1181, 1184, 1275
  Proposed Amalgamation of the Gas Institute and the, 255, 273, 341, 729, 1043, 1130, 1181, 1191, 1605, 1609, 1611, 1617, 1624, 1729
Institution of Heating and Ventilating Engineers, 1497
Institution of Mechanical Engineers (*see also* "Technical Record"), 147, 259, 335, 395
Institution of Mining Engineers, 1608
Insurance, Accident, The Cost of, 1697
Intensified Gas Lighting, 146, 265, 756, 1319
Inventors, Facilities for British, 145
Inverness Gas Supply, 160
Ipplepen Water Supply, 1, 76
Ipswich and the Electric Light, 1747
Ipswich Gas Company, 483, 554
Ipswich Water Supply, 1326
Irminger, Mr. J. O. V., on a Smoke Preventer for Pipe Jumpers, 263
Iron—
  Oxidation of Ammonia by, 938
  Oxide Paint, 26
  Rusting of, 1549
  Trade in 1899, 21, 917
"Iron and Coal Trades Review" on—
  Coke Trade, The, 142, 1463
  Value of Producer Gas as a Fuel, 403
  Vitrified Clay Pipes, 1215
Iron and Steel Institute, 1303, 1359
Iron and Steel Market, Price of Coal and the, 1273
Iron Corrosion, Anti Fouling, and Anti Corrosive Paints, 1296
Irving, Mr. D.—
  Electrolysis in Gas and Water Pipes, 1491, 1501
  Presidential Address to the Southern District Gas Managers' Association, 594, 610
Irwin, Mr. W., on Naphthalene in Coal Gas, 873, 1282
Islington, Destruction of the Grand Theatre at, through a Gas Explosion, 633
Islington Electricity Supply, 733
Italian Gas Company, 1020
Italy, Utilization of Water Power in, 1644
Japan, The Chemical Industry of, 613
Jasper Incandescent Mantle, The, 540
Jedburgh and the Electric Light, 1744
Johnson, Dr., A New Story about, 1358
Johnson-Lundell System of Electric Traction, 1118
Johnstone Gas Supply, 285, 489
Jones and Attwood *v.* Laindon Gas and Water Company, 684
Jones, Mr. C. E., on the Control of Water Supply Areas, 526, 541
Jordeson, The Sutton, Southcoates, and Drypool Gas Company *v.*, 524, 545, 730, 737, 1318
"Journal" and the "Electrician," 77, 321
"Journal des Usines à Gaz," Death of One of the Founders of the, 736
Keighley Electricity Supply, 215, 1456, 1510
Kelso Water Supply, 761, 1568
Kempston Gas Company, 806
Kennedy's, Professor, Wiring Rules, 330
Kent Water Works Company, 467
Kern, M. Gaston, on the Origin and Potentiality of Coal, 1638
Kettering Gas Company, 483
Kettering Water Company, 746
Kidderminster Water Supply, 102
Killing, Dr. C., on the White Deposit on Ceiling Protectors and on the Chimneys of Incandescent Gas Burners, 402
Kimberley Water Company, 1459
Kimbolton (Hunts.) Gas Company, 1729
King's Lynn Electricity Supply, 693
King's Lynn Gas Company, 689
Kingsbridge Gas Company, 561
Kingsbridge Water Supply, 563, 963
Kingston Electricity Supply, 1391
Kingston Gas Company, 21, 25, 144, 483
Kingston-upon-Hull Gas Supply, 32
Kirchhoff's Law on Light Absorption, 990
Kirkmilloch Gas Supply, 922
Kovno Water Works Company, 804
Kirriemuir Gas Supply, 263
Krypton, 1293
"Kugel" High Pressure Gaslight, The, 265
Laboratory Note Book for Chemical Students, 666
Laboratory, The Tyranny of the, 1294
Labour Saving Machinery in Gas Works, 30, 145, 202, 996, 1005, 1302
Labour Questions (*see also* Compensation, Trade Unions, Coal, *and* Profit Sharing)—
  Arbitration in Trade Disputes, 1211
  Board of Conciliation and Arbitration in the North of England, 359
  Board of Trade Returns on the Labour Market, 599, 735
  Capital and, 199
  Casual Labourers and the Workmen's Compensation Bill, 731
  Dockers' Strike, 1697
  Free Labour, Contributions to, by Gas Committees, 157
  Gas Workers' Paradise, A, 214
Labour Questions (*continued*)—
  Gas Workers' Questions—
    Aberdeen, 424
    Birmingham, 486
    Glasgow, 36, 41, 96, 156, 159, 213, 218, 284, 348, 355, 424, 488, 558, 1073, 1395
    Halifax, 428
    Hinckley, 221
    Llanelly, 96, 159, 348
    Manchester, 37, 74, 90
    Morley, 688
    Newcastle, 412, 764
    Newport (Mon.), 1219, 1366, 1454, 1559, 1646
    Salford, 101
    Sheffield, 1144
  Gas Workers' Union (*see also* Glasgow Gas Supply), 89, 408, 563, 1079, 1460, 1572
  Influenza, Effect of, on the Labour Market, 74
  Leaving Work without Notice, 754
  Miners (*see* Miners)
  Picketing, The Law Against, 665
  Profit Sharing (*see* Profit Sharing)
  Remuneration of Labour, 322, 532
  Strikes and Lockouts of 1898 and 1899, 19, 75, 257, 262
  Strikes, Legal Discouragement of, 665
  Strikers, Relief of, from the Rates, 47, 665
  Sunday Labour in Gas Works, 1293, 1365
  Wages and Hours of Labour in 1889, 257, 262
Lachie, Mr., on Various Systems of Charging for Electricity, 991
Laindon Gas and Water Company, Jones and Attwood *v.*, 684
Lambeth Water Company, 400, 1246, 1386, 1507
Lambton (N.S.W.), Trouble Over a Lighting Rate at, 1077
Lamp Posts—
  Design of, 1539
  For Incandescent Burners in South London, 1002, 1065
  In London, 1002, 1046, 1065, 1493
  Responsibility for Damage to, 392, 412
  Sheldrake, Mr. H. J., on, 1044, 1053, 1106
Lamps, Gas—
  Breaking Public, 1571
  Improvements in, 152, 681, 1128
Lanark Gas Company, 1117
Lancashire and Yorkshire Railway Company's Gas Works, 344, 1721
Lancashire Coal Trade During 1899, 43
Lancashire Electric Power Bill, 210, 486, 958, 1719
Lancaster Gas and Water Supply, 600, 633, 798, 1571
"Lancet" on the Metropolis Water Supply, 1046
Lanchester Gas and Oil Engine Company, 42
Land Forming a Watershed, Eighty Years' Purchase for, 161
Larne Electricity Supply, 94
Launceston Gas Company, 415
Law of London Gas Companies, and Fancies about some of them, 1636
Law Relating to Gas, Water, and Electric Lighting, 796
Lea Conservancy Bill, 76, 1134
Leamington Electricity Supply, 759
Leamington Gas Supply, 766, 802, 1390, 1652, 1732
Leather, Mr. J. P., on Naphthalene, 744
Leatherhead Water Company, 625
Leeds Association of Engineers, 225
Leeds Corporation Electricity Supply, 216, 222, 418, 1321, 1656
Leeds Corporation Gas Department—
  Coal Contract Conditions, 1136
  Coal, Difficulty of Obtaining, 956
  Extensions, Proposed, 101
  Price of Gas, Increase in, 1455, 1652
  Quality of the Supply, 492, 956
  Salaries, Increase in, 417, 701
  Street Lighting, 222, 1319
  Wages, Increase in, 1455, 1462
  Water Gas Plant, Proposed, 492, 550
Leeds Corporation Water Supply, 102, 699, 965, 1442
Leek Gas Supply, 223
Lees, Mr. H., on the Amalgamation of the Gas Institute, 1729
Leicester Electricity Supply, 347, 487, 527, 758, 1212, 1510
Leicester Gas Supply, 214, 347, 758, 1212
Leicester Water Supply, 766
Leigh Gas, Electricity, and Water Supply, 85, 221, 1015, 1297, 1515
Leighton Buzzard Gas Company, 554
Leith Electricity Supply, 94
Leominster Gas and Coke Company, 624
Levinstein, Mr., on Patent Law Reform, 992
Lewes and the Electric Light, 1391
Lewes Gas Company, 689
Lewes, Professor V. B., on—
  Incandescent Gas Mantle and its Use, 1299, 1360, 1436
  Water Gas and its Recent Continental Developments, 1194
Liberty and Property Defence League, 193
Liberty, Mr. W. J., on the Rise and Development of the London Gas Supply, 755
Lichfield Gas Company, 690
Light—
  Absorption of, by Glowing Gas, 990
  Artificial Revenue from the Sale of, 76
  Suggested Theory of, 26
Lighthouse Engineering at the Paris Exhibition, 1549
Lighting and Watching Act, The, 223
Lightning and Street Electric Lights, 467, 1052

Lightning, Gas Explosion Caused by, 1663
Lights, The Waste of Energy by Artificial, 920
Lime, The Melting of Coke in Liquid, 1052
Limehouse, Electric Lighting in, 1139
Limerick and the Electric Light, 215
Lincoln Electricity Supply, 461, 692, 1391
Lincoln Gas Supply, 953, 1239
Lincoln Water Supply, 627, 671, 1239
Liquid Air and the Liquefaction of Gases, 1547
Liquor Works, The Registration of, 408
Liscard, Failure of the Electric Light at, 157
Little, Dr. J. F., on Electricity Supply, 321
Littleborough Gas Company, 554
Littlehampton Gas Company, 154
Liverpool, Gas Stove Explosion in, 46
Liverpool Electricity Supply, 348, 486, 693
Liverpool Gas Fittings Company, 1144, 1326
Liverpool Self Propelled Traffic Association, 325
Liverpool United Gas Company—
  Death of Sir T. Earle, 1051
  Fatal Accident at Garston, 766
  Half Yearly Meeting, 524, 550
  Increased Consumption, 162
Liverpool Water Supply—
  Accident to a Large Main, 1146
  Extensions of Works, 882
  Large Consumption, 162
  Report of the Engineer on the Supply, 1638
  Supply to Wallasey, 224, 427, 1562
Liversedge and the Purchase of the Heckmondwike Gas Works, 688, 890, 934
Livesey, Mr. G., on—
  Enrichment of Coal Gas, 1200
  Price and Power of London Gas, 482
  Sliding Scale, 73
Llandrindod Wells Water Supply, 143
Llandudno Gas and Water Supply, 225, 890, 1387
Llanelly Gas Supply, 96, 102, 159, 348, 1366
Llangollen Water Supply, 1661
Llanrwst Gas Supply, 671
Loans for Promoting Bills, Period for Repayment of, 1368
Loans for Purchase of Slot Meters, The Repayment of, 871
Local Administration in London under the London Government Act, 1899, 1296
Local Authorities—
  Dispensing with the Consent of, 1564
  Incandescent Gas Lighting, 1324
  Price of Gas, 1218, 1365
  Puffing of Electrical Installations, 1356
  Rights of, as Regards Private Bills, 862
Local Government Annual and Official Directory, 400
Local Government Board—
  Audit of the London Water Companies' Accounts, 19
  Electric Lighting Inquiries, 37, 157, 158, 215, 278, 279, 348, 418, 486, 557, 693, 759, 820, 884 1017, 1139, 1242, 1320, 1321, 1391, 1456, 1656
  Gas and Water Inquiries—
    Bewdley, 162; Blackpool, 277; Bolton, 100; Colne (Lancs.), 1516; Cowlyd, 164; Falmouth, 557, 596; Hastings, 100; Holywood, 359; Ilkeston, 818; Leigh (Lancs.), 221; London, 1427, 1457; Mansfield, 47; Manchester, 1137; Plympton St. Mary, 1664; Rothwell, 621; Stockport, 358; Taunton, 1664
  Inspection of Water Supplies, 596
  Intercommunication Water Scheme for London, 1427, 1457
  London County Council, Deputation to the, 731, 760
  Period for the Repayment of Loans for the Purchase of Slot Meters, 871
  Tax on Gas Liquor Works, 408
"Local Government Journal" on the Lighting and Watching Act, 223
Local Taxation Returns, 334
Lochgilphead Gas Supply, 263
Lochore and Capledrae Cannel Coal Company, 1322
Lodge, Professor A. J., on Wireless Telegraphy, 199
London—
  Appointment of Sir Forrest Fulton as Recorder of, 797
  Cause of the Ugliness of, 990, 1046
  Electric Lighting (*see* Bermondsey, City of London Electric Lighting Company, Islington, Limehouse, London Electric Supply Corporation, Marylebone, Metropolitan Electric Supply Company, New Cross, St. Pancras, Whitechapel)
  Gas Companies, The Law of, 1498, 1636
  Incandescent Street Lighting in, 312, 956
  Local Administration in, under the London Government Act, 1899, 1296
  Streets, The Lighting of, 17
"London Correspondent," The Sapiency of the, 1696
London County Council—
  Bacterial Treatment of Sewage, 1108
  Bill to Regulate the Metropolis Gas Supply—
    "Builder" on the, 1327
    Comments, 745, 915, 935, 1182, 1218, 1271, 1272, 1306, 1351, 1367, 1443
    Proceedings in Committee, 937, 1219, 1307, 1369, 1376, 1445
    Provisions of the, 33, 89
  Cost of Fussiness, 1552
  "Daily News" on the, 319
  Electric Traction for Tramways, 794, 812
  New Loan, 1697
  Policy of the, 664, 857, 1045, 1352
London County Council (*continued*)—
  Quality of the South Metropolitan Gas Supply, 1515
  River Steamboats, 1045, 1107
  Self Importance of the, 258
  Testing of Gas, 345, 428
  Wandsworth and Putney Gas Company and the, 859, 916, 950, 1235
  Water Supply Questions (*see also* Royal Commission)—
    Deputation to the Local Government Board, 731, 760
    Fire Hydrants, The Use of, 195, 211
    Parliamentary Procedure in Regard to, 596, 731, 760, 1492, 1511
    Purchase Bill, 399, 791, 792, 806, 856, 858, 875, 1427, 1457
    Report of the Royal Commission, 596, 664, 665, 694
    "Sterilization Clause," The, 1492, 1511
    Welsh Scheme, The (*see also* Royal Commission)—
      Bill, 18, 136, 399, 427, 791, 792, 806, 856, 858, 877, 1427, 1457
      Opposition to the, 349, 493
  Woolwich Election, 525
London Electric Supply Corporation, 1106, 1114 1135, 1235
London Government Act, 1899, A Handbook to Local Administration in London under the, 1296
London Hydraulic Power Company, 806
London Sea Water Supply Bill, 400
Londonderry Gas Company, 690
"Londoner" on the Ugliness of London, 990
Long Eaton Gas Company, 764
Long Sutton Gas Company, 46
Longton Electricity Supply, 1242
Longton Gas Supply, 83, 144, 348, 621
Longwood Gas Company, 415, 484
Loomis-Pettibone Company, The, 1465
Loughborough Gas Supply, 817, 892, 1324, 1656
Loughborough Water Supply, 700, 1324
Love, Mr. C. H., on Gas Undertakings and the London Building Act, 1108
Lowestoft Water and Gas Company, 358
Lubbock, Sir J., Elevation of, to the Peerage, 25
Lubricants, The Improvement of, 863
Lubrication of Machinery, 84
Luton Gas Company, 1070
Luton Water Company, 625, 1742
Lymington Gas Supply, 74, 79, 341
Lymm (Cheshire) Gas Supply, 144
Lyon, Mr. J. D., on Gas Engines, 929
Lysons *v.* Andrew Knowles and Sons, 731
Lytham Gas Supply, 965, 1463
M'Lusky's, Mr. W. B., Address to the Waverley Association of Gas Managers, 999
Macadam, Tar, for Roads, 26, 1434
Macclesfield Gas Supply, 263, 1067
Machinery Depreciation, A New Principle in, 529
Machinery, The Lubrication of, 84
Madrid Gas Company, 562
Magnesite, The Trade in, 1052
Maiden Lane Electrical Station Fire, 667, 744
Maidenhead Gas Company, 21
Maidenhead Water Supply, 288, 918, 930
Maidstone and the Electric Light, 820, 1456
Maidstone Gas Supply, 288, 736, 1326
Maidstone Water Company, 626 918, 930
Mainlaying and the Compensation Act, 219
Mains and Pipes—
  Damage to, by—
    Drainage Operations, 101, 486, 549, 685, 797, 817, 892
    Electrolysis, 86, 221, 416, 460, 545, 666, 793, 812, 1368, 1386, 1491, 1501
    Steam Rollers, 752, 790, 815, 1078, 1733
    Traction Engines, 547, 698, 923
  Danger of Laying Electric Cables Close to Gas, 745, 804, 811
  Determining the Flow of Water in, 1434
  Disinfection of Water, 918, 930
  Glass Lined Water, 1722
  Incrustation of Water, 147, 1053
  Laying under Water, 1061
  Obtaining Power from Water, 1076
  Preventing the Freezing of Gas, 681, 868
  Protected Lead, 265
  Repairing Submerged Water, 1643
  Scraping Water, 1727
  Stating Mileage of, in Board of Trade Returns, 990
  Thawing Frozen Water in, 990
  Unlawful Interference with Water, 754
  Vitrified Clay, 466, 1215, 1722
  Water Hammer in, 1440
Malden, Professor W. J., on Sulphate of Ammonia as a Manure, 324
Maldon (Essex) Gas Company, 690
Malta and Mediterranean Gas Company, 1462, 1648
Malton Gas Company, 415
Malvern and the Electric Light, 349
Manchester—
  Electrolysis of Water Mains in, 221
  Freedom of the City for Sir John Harwood, 1496
  Nuisance from Residual Works at, 34
  Opposition to the Lancashire Electric Power Bill, 279
Manchester Acetylene Gas Company, 1515
Manchester and District Junior Gas Association, 280, 870, 1214, 1435
Manchester Electricity Supply, 94, 158, 349, 418, 486, 956, 1047, 1070, 1238, 1388, 1656
Manchester Corporation Gas Department—
  Coal Contracts, The, 1454
  Disturbance of the Streets, 819
  Engineership, The, 37, 83, 91, 416, 393
  Estimates, 1070, 1238
  Extensions, 90, 956, 1137
  Gibson, Alderman, Conversion of, 1352, 1387
  Grant to Mr. Stevenson's Widow, 37, 74, 90
  Increase in Price, 1325, 1352, 1387
  Increases of Salaries to Officials, 818
  Local Government Board Inquiry, 1137
  Meter Tests, 1653
  Prepayment Meter Collections, 358
  Quality of the Gas, 45, 90
  Record Consumption, 47
  Sanitary Condition of the Works, 90
  Settlement of Claims, 101, 632
  Sulphate of Ammonia Plant for the, 316, 688
  Wages of the Men, 37, 74, 90
Manchester Corporation Water Department—
  Consumption of Water, 102, 289, 1146
  Disturbance of the Streets, 819
  Electrolysis of Mains, 416, 460, 486
  Estimates, 1238
  Extensions, 491, 633, 688, 1463, 1608, 1653, 1746
  Increases of Salaries to Officials, 818
  Leakage in the Thirlmere Main, 224
  Position of the Supply, 1566
  Quantity of Water in Store, 224
Manchester District Institution of Gas Engineers (*see also* "Technical Record"), 524, 533, 1435
Manchester-Liverpool Express Electric Railway Bill, 1428
Manningtree and Mistley Gas Company, 467
Mansfield Gas Supply, 1076
Mansfield Water Supply, 47
Mantleless Incandescent Gas Corporation, 212, 759
Margate Water Supply, 323, 699, 1386
Market Harborough Gas Supply, 1662
Marlow Water Company, 485
Marriage, 144
Maryborough Gas Supply, 263, 883
Marylebone Electricity Supply, 34, 37, 94, 192, 196, 212, 214, 278, 321, 1139
Marylebone, Proposed Incandescent Gas Lighting in, 342
Masonic, 401, 862, 1356
Masonry Construction, Mr. I. O. Baker on, 325
Massachusetts Gas Commissioners, The Powers of the, 394, 417, 491, 883
Matlock Gas Company, 164, 554, 624
Matthews, Mr. William, A Biography of, 465
Maybole Gas Supply, 1721
Meade-King, Mr. W. O. E., on Parish Water Supply and Sewerage, 269
Mechanism, Modern, The Wonders of, 400
Melbourne Gas Company, 698
Meldrum Bros., Limited, 1365
Melrose Gas Company, 996
Meltham Gas Supply, 417
Menstone Water Supply, 200
Mersey Docks and Harbour Board, 1213
Merthyr Tydfil Gas Supply, 922
Merthyr Tydfil Guardians and Poor Law Relief to Strikers, 47, 665
Metal, Expanded, and Concrete Construction, 401, 1292, 1297, 1550
Meters—
  Electricity—
    Comparison between Gas and, 1210, 1294, 1356
    Unreliability of, 991
  Gas—
    Comparative Accuracy of Electricity and, 1210, 1294, 1356
    Disputed Registration of, 754, 1558
    Detachable Valve for, 406
    Improvements in, 1557
    Increase in the Price of, 922
    Prepayment (*see* Prepayment)
    Tampering with, 476, 953
    Unlawfully Connecting a, 1396
  Water—
    For Checking Consumption, 800
    Improvements in, 339, 682, 743, 1729
    Schönheyder, Mr. W., on, 335, 395
    Success of, in America, 1497
Meters Limited, 1465
Metric System—
  Chambers of Commerce and, 794
  Cost of Introducing the, 1126
  In Germany, 613
  Squire, Dr. W. S., on, 401
Metropolis Gas Supply—
  Accounts of the London Gas Companies for 1899, 988, 995, 1065
  "Builder" on the, 633, 1071
  Chief Gas Examiner's Reports, 213, 1070
  Coal Contracts of the London Companies, 798, 888, 990
  East End Consumers and the Price of Gas, 1661
  Law of London Gas Companies; and Fancies about Some of Them, 1498, 1636
  "London Correspondents" of Provincial Papers and the, 1696
  London County Council Bill to Regulate the (*see* London County Council)
  Powers of Charge Committee and the Redemption of Obsolete Capital, 463
  Price and Illuminating Power of the, 482, 862, 1663, 1696, 1734
  Public Authorities and the South Metropolitan Company's Bill, 474, 593, 619, 1489, 1508, 1651
  Referees, Qualification of the, 1294
  Referees' Summer Instructions, 992
  Rise and Development of the, 755

Metropolis Gas Supply (*continued*)—
Sliding Scale, The—
Editorial References, 73, 134
Livesey, Mr. G., on, 73, 482
Rostron, Mr. L. W. S., on, 73, 138
Water Gas, The Supply of, 1444
Metropolis Water Supply—
Annual Report of the Thames Conservancy, 1492
"Lancet" on the, 1046
Local Government Board Inquiry Regarding the Intercommunication Scheme, 1427, 1457
London County Council and the (*see* London County Council)
Metropolitan Water Companies Bill, 33, 399, 791, 792, 806, 858, 875
Official Examiner's Reports, 195, 793
Rainfall and the Quality of the, 892
Royal Commission, Report of the (*see* "Royal Commission")
Shaw-Lefevre, Mr., on the, 1541
Staines Reservoirs Scheme, The, 666, 732, 792
Suggested Supply from Scotland, 288
Metropolitan District Railway Company, 17, 40, 260, 460, 953
Metropolitan Electric Supply Company, 34, 37, 77, 94, 192, 196, 212, 214, 278, 321, 627, 1135, 1139, 1636
Metropolitan Gas Company of Melbourne, 201
Metropolitan Railways and Electric Traction, 260, 460
Meyer, Mr. E. E., on Gas Purification in Germany, 89
Michigan (U.S.A.) Gas Association, 800
Mid-Kent Water Company, 103, 143, 875
Mid-Sussex Water Supply, 1327
Middlesbrough Electricity Supply, 418
Middlesbrough Gas Supply, 277, 1016
Middlesbrough, Suffocation by Gas at, 493
Middlesex County Council—
Appointment of Inspector to the, Under the Sale of Gas Acts, 1117
And the Rating of Reservoirs, 1661
Middleton Gas and Electricity Supply, 1391, 1516, 1563
Midland Association of Gas Managers (*see also* "Technical Record"), 595, 601, 744, 1552
Midland Railway Gas Works, 1213, 1548
Midland Railway Stock Conversion and the Stamp Duties, 1359
Milbourne, Mr. R. J., on Foundations for Metal Tanks, 26
Millard, Mr. E. H., on Governors, 1119
Milton-next-Sittingbourne Gas Supply, 492, 632
Miners, Bill to Restrict the Hours of, 594, 596
Miners' Federation, The, 135, 392
Mirfield Gas Company, 554
Mixing Air and Gas, 1005
Molesey, Public Lighting of, 764
Monazite Sand for the Manufacture of Incandescent Mantles, 1733
Monifieth Gas Supply, 761
Monte Video Gas Company, 1397, 1509
Monte Video Water Works Company, 826, 936
Morecambe Electricity Supply, 486, 1656
Morecambe Gas Supply, 79, 156, 745, 751, 808, 871, 1145, 1696, 1730
Morecambe Water Supply, 886
Morley Gas Supply, 80, 685, 688
Morley Water Supply, 323, 407, 547
Motherwell Water Supply, 323, 762
Mountain Ash Water Bill, 323
Moxham, Mr. A. J., The Career of, 17
Municipal Civil Service, The, 392
Municipal Corporations Association, 1540, 1560
Municipal Loans and Fixed Prices, 1697
Municipal Trading—
Avebury, Lord, on, 789
Fire Insurance Funds, 96
Fowler, Sir H., on, 1425, 1719
Harrison, Mr. J., on, 735
In America, 734, 795
Local Taxation Returns, 331
Metropolitan Water Commission on, 397
Parliamentary Committee on, 857, 989, 1354, 1425, 1503, 1540, 1732
Rollit, Sir A., on, 1540, 1560
"Times, The," on, 789
Municipal Year Book for 1900, 600
Municipalism, A Shady Side of, 1353
Murdoch's House at Redruth, 1126
Mutual Gas, Water, and Electricity Supply Company, 699
Naphthalene—
Estimation of, in Gas, 330, 790
Extracting from Gas, 87
Presence of, in Gas, 663, 673, 683, 744, 803, 873, 934, 1003, 1065, 1282
Young, Mr. W., on, 1615, 1712
National Gas Engine Company (1900), 632
Neath Gas Supply, 83, 1738
Nernst Electric Lamp, The, 494
Netherlands Incandescent Gaslight Company, 1077
New Cross, Failures of the Electric Light at, 216
New England Association of Gas Engineers, 676, 730, 866, 928
New Mills Gas Supply, 1117, 1212
New River Company, 1558, 1663
New South Wales, Artesian Wells in, 1078
New Sunlight Incandescent Company—
Chimneyless Burner Patent, 632
Patent Litigation, 153, 210, 341, 409, 459, 475, 547, 618, 632, 1135, 1366
Slander Action against the Chairman of the, 210
New Swindon Gas Company, 217
New York—
Competitive Gas Supply in, 16, 73, 1456
Dangers of Electricity in, 891
Gas and Electric Light Combination in, 76
Laying Pipes under Water in, 1061
Street Railway Power House in, 145
Tenement House Building in, 923
Water Supply, 39, 1740
Newark (N.J.) Gas Works, Explosion at the, 278
Newbigging, Mr. Thomas, on Progress in Gas Matters, 1306
Newbury Gas Supply, 1464
Newcastle and Gateshead Gas Company, 165, 412, 484, 554, 698, 764, 818, 891, 1454
Newcastle and Gateshead Water Company, 476, 485, 891
Newcastle and the Electric Light, 278, 418, 818, 884, 958
Newhaven and Seaford Water Supply, 700, 823, 1246, 1398, 1657
Newhaven, Incandescent Street Lighting at, 887
Newman, Mr. George, on Bacteria, 797
Newmarket Electric Light Company, 759
Newmarket Gas Company, 554, 557
Newport Electricity Supply, 1656
Newport (I. of W.) Gas Supply, 698
Newport (Mon.) Gas Company, 21, 476, 484, 532, 1219, 1366, 1454, 1559, 1646, 1656
Newquay Water Supply, 700
Newtown and Llanllwchaiarn Gas Supply, 80, 276, 685
Newtown (Mon.) Water Supply, 103
Nitrate of Soda, 102, 800
Nitrogen, The Recovery of, in Coal Distillation, 330
Nordenskiold, Baron, on the Rare Earths, 1118
Normanton Gas Company, 624
North Berwick Gas Supply, 160
North Middlesex Gas Company, 622
North of England Gas Managers' Association (*see also* "Technical Record") 1106, 1119
North Shields Water Company, 893
North Walsham Water Supply, 1079, 1145
North Warwickshire Water Company, 143, 162, 698, 759, 806, 814, 1328
Northallerton Gas Company, 201
Northampton Gas Company, 1663
Northampton Water Supply, 922
Northumberland County Council and the Water Supply, 822
Norwich, Incandescent Street Lighting in, 1064
Notkin Syndicate, The, 1142
Nottingham Gas Supply, 699, 888, 934
Nottingham Water Supply, 263, 288
Oban and the Electric Light, 285
Obituary (*see* Deaths)
O'Connor, Mr. H.—
Address to the Society of Engineers, 326, 395
Some Engineering Points in a Modern Gas Works, 761
Oechelhaeuser's, Herr W. von, Address to the German Association, 1640
Official Changes—
Airth, Mr. J., 467; Askew, Mr. S. G., 144; Barker, Mr. H., 532; Barney, Mr. W. E., 1117; Barwise, Dr., 996; Bell, Mr. J. F., 1434; Bennett, Mr. C. V., 263; Bower, Mr. T., 144; Brooke, Mr. J. W., 467; Buckley, Mr. J. H., 996; Bullivant, Mr. H., 1212; Chalmers, Mr. J., 671, 797; Clare, Mr. T. H., 25, 83; Couper, Mr. R. M., 1639; Donaldson, Mr. J., 922; Donaldson, Mr. W., 144; Dowsu, Mr. W. J., 862; Duncan, Mr. J., 263; Dunn, Mr. Matt, 401, 532; Easson, Mr. D., 1639; Easton, Mr. A., 532, 600; Eden, Mr. J., 1246; Elliott, Mr. G., 263; Falkner, Mr. F. J., 25; Fletcher, Mr. J. L., 144; Fowler, Mr. H., 1548; Gandon, Mr. H., 83; Gemmell, Mr. J., 996; Gibb, Mr. J., 922; Gibson, Mr. J. W., 25; Green, Mr. F., 797, 862; Guyatt, Mr. G. R., 467; Hall, Mr. J. C., 467; Hargreaves, Mr. E., 83; Hearson, Mr. W., 1548; Heath, Mr. H. B., 83; Heaton, Mr. J., 263; Higginson, Mr. F., 736; Hilton, Mr. J., 532; Holland, Mr. F. W. W., 671, 1212; Hollins, Mr. G., 1496, 1549; Howarth, Mr. E., 144; Howarth, Mr. F., 1721; Hoyte, Mr. P. S., 1548; Hughes, Mr. V., 1496, 1548; Hunt, Mr. P. C. H., 1721; Jones, Mr. W. C., 144; Jowett, Mr. T., 671; Kenshole, Mr. J. E., 922; Kent, Mr. C. F., 467; Kindler, Mr. H. K., 736; Kingdon, Mr. A. J., 862; Lister, Mr. W., 671, 1639; Lloyd, Mr. A., 922; Lord, Mr. James, 401; Love, Mr. G. R., 83; Lucking, Mr. J. S., 1051; M'Farlane, Mr., 1721; M'Lusky, Mr. W. B., 1496; M'Nair, Mr. H., 1212; Mann, Mr. W., 201; Mason, Mr. E., 1721; Maxwell, Mr. W. H., 1297; Murray, Mr. T. R., 1212; Myers, Mr. C. P., 144; Newbigging, Mr. E. L., 263; Newbigging, Mr. J. G., 83, 91; Page, Mr. H. C., 996; Philipson, Mr. R., 325; Pickford, Mr. H., 401; Platt, Mr. E., 862; Reilly, Mr. E. P., 600; Renfrew, Mr. J., 263; Roberts, Mr. G. H., 1721; Sandeman, Mr. E., 1297; Scott, Mr. W., 144; Silcox, Mr. R., 83; Smedley, jun., Mr. G. B., 1212; Smith, Mr. B. W., 1213; Speakman, Mr. J., 83; Stewart, Mr. G. H., 401; Stewart, Mr. J., 1117; Stone, Mr. A. W., 467; Sutcliffe, Mr. E. J., 862; Swaine, Mr. E. H., 401; Tarratt, Mr. E. P., 1721; Tomlinson, Mr. F., 922; Townsend, Mr. W. W., 736; Trethewy, Mr. F., 401; Turriff, Mr., 467; Wadman-Smith, Mr. C. J. P., 736; Walker, Mr. A. W., 736; Watson, Mr. W. V., 325; Williams, Mr. G., 922; Williams, Mr. H. S., 600; Wilson, Mr. W. R., 144; Woodall, Mr. H. W., 1639
Ohio Gaslight Association, 1060, 1123, 1213
Oil—
Burners, Blue Flame or Wickless, 1118, 1497
Fuel, The Portability of, 84
Industry of Scotland in 1899, 95
Lighting, Substitution of Gas for, 1732
Pipe Lines, Gas Companies and the Use of, 952
Use of, for Laying Dust, 1297
Okehampton Water Supply, 1246
Old Age Pensions, 199, 225, 734, 1491
Oldbury Gas Supply, 103, 632, 889, 957
Oldham Electricity Supply, 158, 1073
Oldham Gas Supply, 163, 427, 862, 922, 1326, 1562, 1736
Oldham Water Supply, 823, 1664, 1733
Oppenheimer *v.* Anglo-Continental Gold Mines Company, 1733
Ossett Gas Supply, 21, 80, 222, 492, 745, 749, 1071
Oswestry Electricity Supply, 37, 418, 1391
Otley Water Supply, 323
Otto Hilgenstock Coke Oven and Coal Washing Company, 1246
Ottoman Gas Company, 416, 485
Over and Wharton Gas Company, 1463
Oxygen Process, Pictet's New, 1497
Paignton Dowson Gas Company, 1515
Paignton Town Council and the Price of Gas, 1742
Paignton Water Supply, 323
Paint, Zinc White, 863
Painting by Compressed Air, 871
Paints—
A New Medium for the Preparation of, 1497
Anti Fouling and Anti Corrosive, 1296
Durability of, 532, 736, 996
Preservative, 26
Paisley Electricity Supply, 760, 886
Paisley Gas Supply, 82, 159, 760, 1394, 1460, 1659
Paisley Water Supply, 762
"Pall Mall Gazette" on Paris Water Supply, 793
Pará (New) Gas Company, 1721
Paris—
Commission on Water Divination in, 259
Exhibition—
Collapse of a Concrete Bridge at, 1297
Description of the, 1356, 1430, 1493
Electricity at the, 1294, 1498
Estimated Consumption of Gas for the, 1184
Gas Exhibition and Proposed Congress at, 140, 259, 732, 796, 802, 862, 874, 1211, 1217, 1494
Large Gas Roaster in, 541
Lighthouse Engineering at the, 1549
Plan of the, 1431
Views of an Early Visitor, 1305
Water for the, 288
Gas Company, 533, 1046, 1065, 1550
Gas Testing in, 197
Visit of the Gas Institute to, 1632
Water Supply, 259, 793, 1502
Parish and Rural Councils and Gas Undertakings, 1076
Parish Water Supply and Sewerage, 269
Parliament—
Bills—
Gas, Water, and Electricity for 1900, 20, 33, 74, 79, 143, 199, 323, 399, 459, 881
General, Notices of, 341
Opposition to, on Standing Orders, 136, 153, 210, 275
Private Members', 595
Progress of, 409, 475, 545, 526, 618, 684, 746, 790, 806, 875, 936, 1008, 1131, 1219, 1369, 1444, 1503, 1730
Budget, The, 663
Company Promoters in, 24
East London Water Bill, 746
Gaslight and Coke Company—
Bill, 618, 684
Rise in Price of Gas, 1730
Gleanings from the Committee Rooms, 745, 804, 875, 935, 1218, 1306, 1367, 1443, 1730
Housing of the Working Classes Bill, 1275
Lambeth Water Bill, 746
Lea Conservancy Bill, 76
London County Council Water Bills, 791, 792, 806, 856, 858, 875
Metropolitan Water Companies Bill, 791, 792, 806, 858, 875
Queen's Speech, The, 318
Select *v* Hybrid Committees, 730
South Metropolitan Gas Bill, 684
Water Gas in Dublin, 790, 805
Water Gas in London, 1369
Water Gas, The Supply of, 1444
Welsh Water Scheme for London, 136, 791, 792, 806, 858, 877
Workmen's Compensation Act, 791
Parliamentary Committees—
Airdrie, Coatbridge, and District Water Trust Bill, 1132
Bradford Corporation Bill, 916, 936, 1008, 1130, 1183, 1219, 1234
Brighton Corporation Bill, 745, 804, 811
Cleethorpes Gas Bill, 805
Corporation of London Subways Bill, 1133
Dorking Water Bill, 936, 1131
East London Water Bill, 1354, 1504
Gaslight and Coke, Commercial Gas, and South Metropolitan Gas Companies Bill (*see* London County Council)
Gaslight and Coke Company Bill, 1272, 1307, 1313, 1351, 1367, 1369
Glastonbury Gas Bills, 745, 805, 807, 856, 875, 877
Hartlepool Gas and Water Bill, 805, 809
Higham Ferrers Water Bill, 814

Parliamentary Committees (*continued*)—
Ilfracombe Improvement Bill, 1368
Lambeth Water Bill, 1507
Lea Conservancy Board Bill, 1134
London County Council Bill to Regulate the Metropolis Gas Supply (*see* London County Council)
London County Tramways (No. 2) Bill, 794, 812
London Hydraulic Power Company Bill, 806
Manchester-Liverpool Express Electric Railway Bill, 1428
Margate Water Bill, 1386
Morecambe Urban District Council Gas Bill, 746, 751, 808, 874, 1696, 1730
Municipal Trading, 857, 989, 1503, 1540, 1732
North Warwickshire Water Bill, 806, 814
Ossett Gas Bills, 745, 749
Salford Corporation Bill, 1444
South Eastern Metropolitan Electric Tramways Bill, 1368, 1386
South Essex Water Bill, 1354
South Metropolitan Gas Bill, 1351, 1367, 1369, 1372, 1423, 1443, 1446, 1495
Southport Corporation Bill, 745, 747
Southport Water Bill, 813
Walker and Wallsend Gas Bill, 1444
Walsall Corporation Bill, 1307
Wandsworth and Putney Gas Bill, 1424, 1449, 1443, 1503
Westgate and Birchington Water Bill, 1386
Patent Gas Enrichment Syndicate, 47
Patent Law Reform, Suggestions for, 992, 1115, 1217, 1432
Patent Office Procedure, Board of Trade Committee on, 145, 1427, 1724
Patents in 1899, 1354
Payments by Gas Committees, The Sanctioning of, 45
Peake, Mr. H. C., on the Probable Duration of the Coal Supply, 1608
Peat for Carbonizing, 863
Peebles Gas Supply, 1073, 1460
Pence, Increased Coinage of, 25
Penistone Union Assessment Committee, Dewsbury and Heckmondwike Water Board *v.*, 411
Penmaenmawr Water Supply, 1566
Pernambuco Gas Supply, 1548
Personal Paragraphs, 25, 83, 144, 201, 263, 325, 401, 467, 532, 599, 600, 671, 736, 797, 862, 922, 996, 1051, 1117, 1212, 1297, 1359, 1495, 1548, 1639, 1721
Perth, Fatal Gas Poisoning at, 221
Perth Gas and Electricity Supplies, 489, 696, 761, 797, 882, 885, 1019, 1141, 1323, 1395, 1460, 1496, 1512, 1658, 1721
Petavel Mr. J. E., on Standards of Light, 461
Peterhead Gas Supply, 1395
Petroleum—
An Impossible Scheme for Making Gas from, 393
For Removing Boiler Incrustation, 598
Legislation, No Present Prospect of, 459
Russian, Output of, 461
Pfeiffer, Dr. Otto, on the Production of Liquor Ammoniæ from Gas Liquor, 678
Photometry, A French View of, 77
Photometry in Different Countries, 197, 261
Physical Chemistry, Introduction to, 1297
Physics, Elementary Practical, 1297
Pictet's, M. R., New Oxygen Process, 1497
Picturesque, The Preservation of the, 1426
Pipe Couplings, Improvements in, 1130
Pipe Joints, Stopping Leaky, 1130
Pipes (*see also* Mains), Arranging Gas, in Buildings, 1510
Piping, Gas, Testing for Soundness, 1556
Planet Acetylene Generating Plant, 1550
Plymouth and Stonehouse Gas Company, 83, 685, 891, 1456, 1548
Plymouth, Gas Poisoning Case at, 47, 957
Plymouth Public Lighting, 94, 158, 278, 279, 358, 493, 687, 756, 1327, 1391
Plymouth Water Supply, 28, 224, 963, 1359, 1464, 1721
Plympton St. Mary Water Supply, 1664
Plymstock Water Supply, 1021
Poetsch Freezing Process, 874
Pohlé Water Raiser, Tests of the, 1722
Political Economy, Questions of, 1426
Polytechnic Examinations in Gas Manufacture, 1212, 1238
Pontefract Gas Company, 484, 624
Poole Gas Company, 415
Poor Law, The, 198
Port Elizabeth Gas Supply, 492
Portable Gaslight Company, Limited, 632
Portable Photometer (*see also* London County Council Bill)—Humphrys, Mr. Norton H., on the, 671
Portishead Gas Supply, 467
Portishead Water Company, 1078
Portland Gas Works, Purchase of, by the Local Authority, 620
Portsay, Acetylene Lighting at, 159
Portsea Island Gas Company, 555, 756
Portsmouth Corporation and the Tramways Company, 141
Portsmouth Water Company, 24, 632, 1464
Powers of Charge of the Metropolitan Gas Companies, 73, 75, 138
Predictions—Gaseous and General, 1358
Preece, Sir W. H., on—
Electricity and Engineering, 1114, 1116
Functions of the Engineer, 530
"Premium" Plan of Paying for Labour, 322, 532
Prepayment Gas Meters—
Abstracting Money from, 342, 1558, 1733
And the Price of Coal, 408
Improvements in, 206, 208, 270, 339, 473, 613, 614, 615, 742, 1061, 1128, 1728
Increased Bronze Coinage and, 25
Repayment of Loans for the Purchase of, 871
Use of Coal Checks in, 1513
Presentations—
Cox, Mr. J. H., 1122; Dougall, Mr. A., 1617; Fo.d, Mr. A., 1117; Grafton, Mr. W., 1212, Harris, Mr. A. T., 263; Higginson, Mr. F., 797; Kindler, Mr. H. K., 736; Lyon, Mr. J., 671, 761; Mappin, Sir F. T., 797; May, Mr. T., 1549; Moore, Mr. S., 263; Ohren, Mr. C. M., 1496; Phinn, Mr. J., 401; Restler, Mr. J. W., 922; Sandeman, Mr. E., 1721; Sellers, Mr. C., 1122; Smith, Mr. B. W., 1639; Stephenson, Sir H., 797; Wilson, Mr. A., 1721; Wilson, Mr. T., 1212
Pressure, High, for Gas Distribution, Shelton, Mr. F. H., on, 676, 730, 866, 1723
Pressure Regulators or Stop Valve, 616, 1129
Preston Gas Company, 476, 1385
Prestwich, Sir Joseph, The Life and Letters of, 796
Priestley's, Mr. C. H., Presidential Address to the British Association of Water Engineers, 1725
Private Bill Legislation, Local Authorities and, 852
Producer Gas as Fuel, The Value of, 403
Producer Gas for Working Engines, 863, 1051
Products, Gas—
Current Sales of, 43, 98, 160, 220, 286, 357, 426, 490, 560, 631, 697, 762, 825, 887, 962, 1019, 1074, 1143, 1244, 1323, 1396, 1461, 1513, 1569, 1660, 1745
Low Prices of, 683
Price of Gas and Value of, 934
Transvaal War and, 16, 194, 263, 402, 545, 1550
Profit Sharing—
At Stafford, 1662
In Operation, 1397
"Premium" Plan and, 322, 532
Richmond, Mr. E. W. T., on, 744
Provand's, Mr. A. D., Suggested Royal Commission on Coal Supply, 881, 921
Provisional Orders, Gas and Water, for 1900, 1734
Pudsey Gas Company, 276
Pudsey Water Supply, 957
Pulsometer Engineering Company, 201
Pumping Gas Five Miles at 20 lbs. Pressure, 676, 730, 866, 1723
Pumping Water, The Pohlé System of, 1722
Purchase of Gas, Water, and Electric Light Works by Local Authorities, Proceedings in Regard to the (*see* Aldeburgh Water; Aldershot Gas and Water; Birmingham Electric; Brigg Gas; Cambridge Water; Cardiff Gas; Clacton Gas and Water; Clifton Water; Dorking Water; Eastbourne Electric; Exmouth Water; Falmouth Water; Faversham Water; Fylde Water; Gainsborough Gas; Galashiels Gas; Glastonbury Gas; Hartlepool Gas and Water; Heckmondwike Gas; Hemel Hempstead Water; Honley Gas; Horsforth Water; Leamington Gas; Loughborough Gas; Lymington Gas; Morecambe Gas; Newport (I.W.) Gas; Portland Gas; Rothwell Gas; St. Albans Water; Skipton Gas; Southport Water; Spalding Water; Truro Water; Whitwick and Coalville Gas; Winsford Gas; Wolverhampton Gas)
Purification—
Bueb, Dr., on, 80, 273
New Systems of, 151, 207, 682, 1646
Wet Lime System of, for Water Gas, 275
Pyrometer, The Pneumatic, 401
Queen's Speech, The, 318
Radio-Active Elements, 1052
Rainfall in 1899, 195
Ramsgate and the Electric Light, 486
Ramsgate Gas and Water Supply, 1733
Ramsgate Improvement Bill, 323
Rare Earths—
Nordenskiold, Baron, on the, 1118
Treatment of, for the Manufacture of Incandescent Mantles, 1644
Rates and Gas and Water Charges in Provincial Towns, 277, 358
Rating Questions (*see* Assessment)
Rawtenstall and the Bury Joint Water Board, 492
Reading Gas Company, 555
Redditch Electricity Supply, 157 1242
Redhill Gas Company, 21, 555
Reductions, 164, 487, 492, 619, 688, 1385, 1662
Referees, Metropolitan Gas—
Qualifications of the, 1294
Summer Instructions of the, 992
Refuse Destructors and Power Plants, Mr. C. N. Russell on, 194
Refuse, Manufacture of Gas from Town, 681
Regenerative Furnaces, Improvements in, 615, 616
Regenerator Settings for Small Gas Works, 1662
Regina *v.* Norris, 1318
Regulator for Gases and Liquids, 88
Reigate and the Electric Light, 1320
Reigate Corporation and the Redhill Gas Company Bill, 562
Renton Gas Company, 42
Reports of Gas Associations for 1899, 196
Reservoirs, Covered, in the United States, 472
Reservoirs, Rating of, 89, 222, 765, 1108, 1140, 1465, 1661
Residuals (*see* Products)
Resignations—
Ashton, Mr. R., 862; Brett, Sir W., 1051; Brooks, Mr. J., 1213; Cocker, Mr. J. L., 922; Croxford, Mr. W., 201; Daniel, Mr. A. V., 467; Darney, Mr. R., 532; Dawes, Mr. S., 862; Dickson, Mr. A., 467; Donaldson, Mr. W., 83, 144; Faull, Mr. E., 1548; Fisher, Mr. R., 996, 1052; Fuller, Mr. W. J., 1639; Gibson, Mr. B., 671; Gorse, Mr. W., 922; Guyatt, Mr. T., 467; Hanan, Mr. H., 1721; Jeffrey, Mr. D., 922; Jones, Mr. E., 1117; Malam, Mr. G. D., 25; May, Mr. T., 600, 1549; Pickup, Mr. J., 401; Rusett, Mr. H. de, 862; Smith, Mr. T., 1721; Smith, Mr. W., 996; Speight, Alderman T., 467; Spier, Mr. W., 862; Stewart, Mr. S., 467, 558; Taylor, Mr. C., 996, 1052; Taylor, Mr. J. F., 325; Wharton, Mr. A., 1548; Wilson, Mr. A., 797, 882, 885; Wilson, Mr. T., 1212.
Resin, Producing Illuminating Gas from, 30
Retort—
Lids, Fastenings for, 87
Settings of 1850 and 1900, 679
Retorts—
Heating, Discussion on, 606
Inclined—
Carpenter, Mr. C. C., on, 1275, 1305, 1365, 1443, 1558, 1646, 1729
Chester, Mr. W. R., on, 1612, 1699
Discussion on, 608
Herring, Mr. W. R., on, 865, 886
Regenerative Furnaces for, 615, 616, 631
Returns Relating to Gas Undertakings, 323, 990
Revenue, The Year's, 930
Reynolds, Professor J. E., on the Supply of Water Gas in Dublin, 1124
Rhodin, Mr. J. G. A., on the Analysis of Coals for Gas Manufacture, 470
Rhyl Electricity Supply, 1139, 1456, 1565, 1656
Richmond and Co.'s Profit Sharing Scheme, 1397
Richmond, Mr. E. W. T., on Profit Sharing and Automatic Meter Supplies, 744
Richmond, Sir D., on the Municipal Life of Glasgow, 23
Rickmansworth and Uxbridge Valley Water Bill, 143
Riddings District Gas Company, 555
Rigg, Mr. A., on Ventilation without Draughts, 268
"Rings" in Trade, Recrudescence of, 135
Ripon Gas Supply, 163, 165, 288, 1503
Ripponden District Water Supply, 768
Ritchie, Mr. C. T. on the Housing Problem, 394
Ritson's, Mr. T. N., Presidential Address to the Manchester District Institution, 524, 534
River Plate Gas Company, 101, 1011, 1135
Rixdorf Gas Works, 533
Roads—
Breaking up by Gas Companies without Sufficient Notice, 548
Charge for Water for, 1235
Effect of Mechanical Traction on (*see* Mains)
Oil for Laying Dust in, 1297
Responsibility of Gas Companies for the Repair of, 154
Tar Macadam for, 26, 1434
Unprotected Trenches in, Liability for, 1318
Roberts and Anderson, Messrs., on the Recovery of Nitrogen in Coal Distillation, 330
Robus's, Mr. H. J., Water Clad Hydraulic Main, 540, 931
Rochdale Gas Supply, 1237, 1655
Rochdale Water Supply, 1135, 1366, 1655
Rochester, Chatham, &c., Gas Company, 415, 1297
Rockefellers, The Ambition of the, 524
Rockhampton Gas Company, 862, 883, 922
Rollit, Sir A., on Municipal Trading, 1540, 1560
Romsey Gas Company, 25
Roofs for Retort Houses, Mr. A. T. Walmisley on, 1614, 1703
Rosario Consolidated Water Company, 1375
Roscoe, Sir Henry, on Bunsen, 1550
Rostron, Mr. L. W. S., on the Powers of Charge of the Metropolitan Gas Companies, 73, 75, 138
Rotherham, Death of the Town Clerk of, 263
Rotherham Electric Lighting Works, 884
Rotherham Gas Supply, 323, 957, 1240
Rotherham Water Supply, 323
Rothwell Gas Supply, 621
Rowley Regis and Blackheath Gas Company, 624
Royal Aquarium Gas Exhibition, 34, 92
Royal Commission on the Metropolis Water Supply, Report of the—
Abstract of the, 216, 279, 350, 419
County Councillors' Opinions, 283
Editorial Comments, 18, 194, 258, 320, 394, 397
London County Council and, 596, 664, 665, 694
Press Opinions, 282
Royal Institution, 25, 145, 1108, 1212, 1354, 1502, 1550
Royal Scottish Society of Arts, 865, 886
Royal Society, 461, 609, 1721
Ruegg, Mr., on the Workmen's Compensation Act, 459
Rugby Gas Company, 555, 1117
Rugeley Gas Company, 21, 287, 493
Rural and Parish Councils and Gas Undertakings, 1076
Rural Sanitation, A Scheme of, 400
Rushden and Higham Ferrers Gas Company, 889
Russell, Mr. C. N., on Refuse Destructors and Power Plants, 194
Russia and the Coal Question, 200, 794, 820, 1053, 1184
Rust, An Unsuspected Cause of, 200
Ryde and the Electric Light, 759
St. Agnes Water Supply, 289

St. Albans Water Supply, 143, 427
St. Andrews Gas Supply, 599
St. Anne's Gas Supply, 99, 963
St. Austell Gas Company, 484
St. Helens Chemical Works Explosion, 768
St. Helens Corporation and the Control of Water Supplies, 822
St. Helens Corporation and the Lancaster Electric Power Bill, 216, 958
St. Helens Electricity Supply, 279
St. Helens Gas Supply, 1070, 1653
St. Ives (Cornwall) Gas Supply, 1548
St. Ives (Cornwall) Water Supply, 217
St. Ives, Gas Explosion at, 1515
St. Ives (Hunts) Gas Supply, 1496, 1549
St. Louis Corporation and the Electric Light Company, 626
St. Mary Church Gas Supply, 1077, 1397, 1661
St. Pancras Electricity Supply, 1016, 1048, 1073, 1636
St. Petersburg Electricity Supply, 958
St. Petersburg Water Supply, 161, 561
St. Thomas (W.I.) Gas Supply, 600
Salford Electricity Supply, 692, 958, 1321, 1391
Salford Gas Supply, 45, 101, 323, 683, 1444
Salford Water Supply, 323
Salisbury Gas Company, 690
Salisbury, Gas Explosion at, 46
Saltcoats Gas Supply, 1568
San Paulo Gas Company, 890, 955
Sandeman, Mr. E., on the Outlet Valves at the Burrator Reservoir, Plymouth, 28
Sanitation, Rural, A Scheme of, 400
Sawston Gas Works, 1145, 1325
Scarborough Gas Company, 415, 555
Schniewind, Dr. F., on the Everett Coke Oven Gas Plant, 205, 257, 274
Schonheyder, Mr. W., on Water Meters, 335, 395
Scotland—
  Gas Affairs in, during 1899, 41
  Mineral Oil and Paraffin Industry of, in 1899, 95
  Notes from, 41, 95, 159, 218, 284, 355, 424, 488, 558, 628, 696, 760, 824, 885, 960, 1018, 1073, 1141, 1243, 1322, 1394, 1460, 1512, 1567, 1658, 1748
Scottish Gas Managers, Informal Meeting of, 917, 924, 960
Scottish Trades Union Congress, 1107
Scrubbers, Improvements in, 743, 1363
Sculcoates Water Supply, 1021
Scunthorpe Gas Supply, 287
Seaford Gas Supply, 562
Sealing Gas Supply Pipes to Burners, 1027
Secret Commissions—
  Bill for the Suppression of, 983, 1065
  Legality of, 1274
Segundo, Mr. E. C. de, on—
  Efficiency of Steam and Gas Engines, 853
  Fuel Value of Town's Refuse, 138
  Future of Electricity Supply, 934
Selby Gas Supply, 1737
Selkirk Gas Company, 1639
Sellers, Mr. Charles, Jubilee of, 755
Selsey (Sussex) Gas Company, 1136
Semet Solvay Bye Product Coke Ovens in England, 142
Separating and Extracting Gases from a Gaseous Mixture, Purifying, Exhausting, and Compressing Gas, and Increasing Its Illuminating Power, 1216
Sevenoaks and the Electric Light, 215, 418
Sevenoaks Water Company, 164, 700, 765
Sewage, Bacterial Treatment of, 1108
Sewage Treatment, The Oxidation Process for, 1502
Sewerage Operations, Damage to Gas Mains through, 101, 486, 549, 685, 790, 817, 892
Shadbolt, Mr. R. G., on Gas Coal: Its Present Price and Effect on the Gas Industry, 1057, 1106
Shanghai Gas Company, 1564
Shanghai Water Works Company, 743
Shanklin Gas Company, 415, 550
Share List of Gas and Water Companies, 19, 41, 96, 160, 218, 283, 352, 423, 487, 558, 625, 695, 761, 821, 886, 959, 1013, 1074, 1138, 1240, 1320, 1392, 1457, 1511, 1565, 1657, 1739
Shareholders and the Membership of Local Authorities, 1211
Shares and Stocks—
  Fall in the Price of, 1274, 1425
  Sales of, 154, 217, 287, 358, 412, 491, 632, 746, 891, 933, 1071, 1145, 1245, 1325, 1398, 1456, 1570, 1663, 1742
  Transactions in the Money Market, 19, 77, 137, 196, 260, 321, 396, 460, 527, 597, 667, 733, 793, 859, 919, 991, 1047, 1114, 1210, 1294, 1355, 1428, 1492, 1545, 1636, 1719
Shaw-Lefevre, Mr., on the London Water Question, 1541
Sheen *v.* Haynes, 815, 879
Sheffield Electricity Supply, 157, 487, 626
Sheffield United Gaslight Company—
  Embezzlement by a Collector, 1318
  Extension of West's Stoking Machinery, 764
  Gas Workers' Union and the, 1144
  Half Yearly Report and Accounts, 481
  Meeting of Shareholders, 731, 757
  Official and Directorial Changes, 83, 144
  Presentation of the Freedom of the City to Sir F. T. Mappin and Sir H. Stephenson, 797
  Scarcity of Coal, 102
Sheldrake, Mr. J. H., on Incandescent Street Lighting, 1044, 1053, 1106
Sheldrake *v.* Duncan, 210
Shelton, Mr. F. H., on Pumping Gas Five Miles at 20 lbs. Pressure, 676, 730, 856, 1723
Sheppy Gas Company, 764
Shepton Mallet Gas Company, 1051
Shifual Water Supply, 275
Shipley and the Electric Light, 348
Shotley Bridge and Consett Gas Company, 690, 1570
Shotts Iron Works, Fire at, 825, 886
Shrewsbury, Damage to Gas Mains through Sewerage Operations at, 101, 486, 549, 685, 790, 817, 892
Shrewsbury Electricity Supply, 1391
Shrewsbury Gas Company, 101, 486, 549, 685, 790, 817, 892
Shrewsbury Water Supply, 493, 1078, 1397, 1663
Signalling Across Space Without Wires, 199
Sileby Gas Supply, 1662
Silsden Gas Supply, 1662
Singapore Gas Company, 1020, 1117, 1136
Sittingbourne District Gas Company, 671, 922
Skegness Gas Company, 46
Skipton and the Electric Light, 348
Skipton Gas Supply, 46, 93, 222, 671
Sleaford Gas Company, 415
Sliding Scale, The London Gas Companies and the (*see* Metropolis Gas Supply)
Sloane, Mr. T. O'Connor, on Liquid Air and the Liquefaction of Gases, 1547
Slough Gas Company, 1246
Smethwick Gas Supply, 164, 494, 608, 758, 1496, 1548, 1639
Smith, Mr. B. W., on Inclined Retorts at Smethwick, 608
Smith, Mr. J. F., on the Estimation of Naphthalene in Coal Gas, 330, 798, 873
Smith, Professor R. H., on A New Principle in Machinery Depreciation, 529
Smoke Preventer for Pipe Jumpers, A, 263
Smyth, Sir W., on Coal and Coal Mining, 1116
Société Technique du Gaz en France, 77
Society of Arts, 269, 268, 1001, 1299, 1359, 1360, 1436, 1539
Society of Chemical Industry (*see also* "Technical Record"), 330, 401, 470, 668, 673, 683, 744, 798, 934, 992, 1003, 1698
Society of Engineers, 326, 395, 918, 930, 1427, 1644
Soil, Physical Properties of, 1005
"Solar" Incandescent Gas Burner, 1542
Solihull Gas Supply, 671
Somzée-Greyson System of Gas Lighting, 1319
South African Lighting Association, 1397
South Australian Electric Light and Motive Power Company, 349
South Devon, Divining for Water in, 765
South Eastern Metropolitan Electric Tramways Bill, 1368, 1385
South Essex Water Supply, 143, 200, 224, 289, 494, 1354
South Hants Water Company, 626
South Metropolitan Gas Company—
  Additional Stoking Machinery for East Greenwich, 348
  Bill of the—
    Editorial Comments, 593, 664, 1351, 1423, 1489
    Features of the, 1495
    Local Authorities and the, 474, 619, 1508, 1651
    Meeting of Shareholders to Approve the, 478
    Proceedings in Committee, 684, 1367, 1369, 1372, 1443, 1446
    Provisions, 21
  Fatal Accidents at the East Greenwich Works, 806, 1509
  Incandescent Street Lighting, 956
  Increase in the Price of Gas, 862
  Livesey, Mr. G., on the Price and Illuminating Power of London Gas, 482
  Meetings of Shareholders, 457, 477
  Model Street Lamp Column, A, 1002, 1065
  Quality of the Gas, 1515
  Report and Accounts, 318, 345
  Stealing Gas from the, 153
South Shields Gas Company, 428, 548, 555, 622
South Staffordshire Water Company, 47, 415, 556, 862, 1130
South Wales Electrical Power Distributing Company Bill, 418
South West Suburban Water Company, 890
Southampton Electricity Supply, 158, 626, 693, 1321
Southampton Gas Company, 1237
Southampton Water Supply, 76, 103, 164
Southbank and Normanby Gas Company, 401
Southend Gas Company, 1078
Southend Water Company, 217, 891, 1325
Southern District Gas Managers' Association (*see also* "Technical Record"), 594, 609, 1491, 1501, 1499
Southport Corporation Gas Supply, 102, 163, 323, 745, 747, 963, 1016, 1658, 1735
Southport Electricity Supply, 963
Southport Water Supply, 143, 162, 345, 415, 699, 813
Southwark and Vauxhall Water Company—
  Bill, 422
  Hampton Urban District Council *v.*, 89, 222, 765
  Meetings of Shareholders, 422, 1608, 1649
  Presentation to the Engineer, 922
Southwark, Incandescent Gas Lighting in, 956
Spain, Utilization of Water Power in, 1644
Spalding Water Supply, 200, 275, 1146
Spons' Architects and Builders' Price Book, 965
Squire, Dr. W. S., on the Metric System, 401
Stafford Gas and Electricity Supply, 1455, 1553, 1662
Staffordshire Potteries Water Company, 1516
Staines Reservoirs, Safety of the, 666, 732, 792
Stalybridge Gas Supply, 532, 953, 1239
Stamp Duties, Stock Conversions and, 1359
Standards of Light, Some Fantastic, 461
Stealing—
  Coal, 685
  Electricity, 45, 154, 965
  Gas, 153, 159, 953
  Money from Prepayment Meters, 342, 1558, 1733
Steam—
  Heat Distribution, 1052
  Heating Vacuum, 1497
  Improving the Quality of, 467
  Packings, 402
  Rollers, Damage to Gas and Water Mains by, 752, 790, 815, 1078, 1733
  Uses of, in Modern Civilization, 531
Steel—
  Production in America, 996
  Tempering of, 468
  Trade in 1899, 21
Stelfox, Mr. J., on the Amalgamation Discussion at the Gas Institute Meeting, 1729
Stenhouse, Mr. T., on Cyanogen, 666
Stevenson's, Mr. E. H., Presidential Address to the Incorporated Gas Institute, 1542
Stevenson, Mr. F. W., on Some Examples of Tank Construction, 1290
Stevenson, The Late Mr. G. E., Proposed Memorial to, 259, 527
Stevenston (Ayrshire) Gas Company, 1568
Stirling Gas Supply, 489, 1019, 1073
Stock Conversions and Stamp Duties, 1359
Stockport Electricity Supply, 216, 870, 1320
Stockport Gas Supply, 358, 870, 1562
Stockport Water Supply, 401, 427, 619
Stockton Electricity Supply, 418
Stockton Gas Supply, 736, 819, 891, 1240
Stoke Gas Supply, 156, 217, 277, 344, 802
Stoke-sub-Handon, Public Lighting of, 1732
Stoking Machinery, Mr. W. R. Chester on, 1612, 1699
Stone, Artificial, 265
Stone, The Decay of, in London Air, 1549
Stonehaven Gas Company, 1460
Stourbridge and the Electric Light, 94
Stourbridge Gas Supply, 1508, 1662
Stoves—
  Gas—
    "British Medical Press" on, 892
    Burners for, 405
    Improvements in, 614
  Oil, A Blue Flame, 1118, 1497
Stratford-on-Avon Gas Supply, 1326
Strathaven Gas Company, 1212
Street Frontages, Light Reflecting, A Plea for, 393
Street Lighting, General Hickenlooper on, 1123
Street Lighting, The Science and Art of, 558
Streets, English, The Gloominess of, 17
Streets, The Lighting of Private, 1558
Strikers, Relief of, Out of the Rates, 47, 665
Strikes and Lockouts in 1898 and 1899, 19, 75, 257, 262
Stroud, Mr. H., on Elementary Practical Physics, 1297
Subways for Street Mains, 860, 875, 1133
Sudbury and the Electric Light, 158, 349, 693, 860, 1391
Sudbury Water Supply, 103
Suffocation by Gas, 47, 98, 163, 164, 214, 221, 278, 493, 561, 957, 1454, 1570
Sugg's Increased Pressure and Christiania Incandescent Burner Systems, 680, 1441
Sulphate of Ammonia—
  Condition of the Trade in, During 1899, 102, 154
  For Manurial Purposes, 324
  In France, 800, 1108
  Production of, in America, 93, 494
  Warington, Professor R., on, 533, 1005
Sulphate of Ammonia Committee, 533
Sulphuretted Hydrogen, Desulphurization of, 1005
Sunbury Gas Company, 144
Sunday Labour in Gas Works, 1293, 1365
Sunderland and South Shields Water Company, 485, 556
Sunderland Electricity Supply, 1391
Surveyors' Institution, 730, 737
Sutton Coldfield and the Electric Light, 692
Sutton District Water Works Bill, 143
Sutton, Southcoates, and Drypool Gas Company *v.* Jordeson, 524, 545, 730, 737, 1313
Sutton (Surrey) Gas Company, 690
Swansea Electricity Supply, 1565
Swansea Gas Company, 1077, 1515
Swinburne, Mr. J., on Electric Traction, 793
Swinton, Mr. A. A. C., on the Generation of Electricity in Bulk, 531
Switzerland, Output of Carbide from, 143
Sydney, Acetylene Lighting at, 562, 683
Sydney Gas Supply, 883
Sydney Water Supply, 356
Tank Construction, Mr. F. W. Stevenson on, 1290
Tanks, Metal, Foundations for, 26
Tar—
  And Liquor Storage Tanks, The Question of Ventilating, 209, 398
  Chemistry of, Mr. A. H. Allen on the, 1433
  Colour Industry in Germany, 16, 526
  Distillation of, in France, 994
  Macadam for Roads, 26, 1434
Tarapaca Water Works Company, 1017
Taunton Water Supply, 323, 1664
Tax on Gas Liquor Works, 408
Taylor *v.* Oldham Corporation, 1733
Technical Education, Expenditure by Local Authorities on, 395
Tees Valley Water Board, 889, 1394

Teignmouth Gas Supply, 936, 1021, 1079, 1563
Temperature, Effect of Low, on Coal Gas, 996
Tendering, Wide, 137, 348
Tendring Hundred Water Company, 600
Testing of Gas—
"Builder" on the, 1017
Calorimetric, 883, 1204
Humphrys, Mr. N. H., on, 671
Methods for, in Different Countries, 197, 261
Thames Conservancy Board, 325
Thames Steamboat Service, 1045, 1107
Thawing Frozen Water in Pipes, 990
Thompson, Professor S. P., on the Protection of Electric Lighting Wires, 38
Thornaby Gas Supply, 1328
Thun Gas Works, Death of the Manager of the, 922
Thwaite Plant for Utilizing Waste Gases, 1566
Tilden, Dr. W. A., on the Progress of Scientific Chemistry, 599
"Times, The," on—
American Engineering Competition, 1428
Coal Problem, 1049, 1071, 1107
Housing Question and Municipalism, 1358
Municipal Trading, 789
Tipton Gas Supply, 1146, 1515
Tipton Water Supply, 47
Tiverton and the Electric Light, 486
Tiverton Gas Supply, 1397, 1663
Tobacco Smoke, Carbonic Oxide in, 798
Todmorden Gas Supply, 701
Todmorden Water Supply, 827, 1517
Tonbridge Water Company, 884, 1459, 1570
Torches for Lighting Incandescent Gas Burners, 1063, 1127, 1128
Torquay Electricity Supply, 693, 958
Torquay Gas Company, 827
Torquay Water Works, 147, 765, 1398
Totnes Gas Company, 685, 764, 1325
Tottenham and Edmonton Gas Company, 154, 482, 551, 1212, 1213
Tow Law Gas Supply, 1662
Town's Refuse, The Fuel Value of, 138
Traction—
Electric, 260, 460, 793, 860, 1118, 1211, 1428, 1636, 1644
Gas Engines for Electric, 1211
Mechanical, Weight of, on Roads, 923
Steam, 325
Trade, Condition of, 134, 397, 669, 1045
Trade Union—
Commonsense Report of a, 1353
Conferences and Deputations, 595, 1107
Trade Unionism—
And the Law against Picketing, 665
In 1898, 193
"Premium" Plan of Paying for Labour, 322, 532
Unlovely Aspects of, 135
Traders—
Electricians and, 1697
Recrudescence of "Rings" of, 135
Transvaal War and the Gas Industry, 16, 194, 263, 402, 545, 1550
Trenches, Unprotected, Liability of Water Companies for, 1318
Troon Gas Supply, 42, 144, 1142
Truro Corporation and the Water Works, 767
Truro Gas Supply, 888
Truro Water Company, 415
Tunbridge Wells Gas Company, 624
Tunbridge Wells Water Supply, 1297
Tunstall, Suffocation by Gas at, 164, 214
Tuxford Gas Supply, 162
Tynemouth Gas Company, 467, 624, 690
Tynemouth Water Supply, 893
Uckfield Gas Company, 1434
"Unavoidable Cause" in the Supply of Electricity, 1106, 1114, 1135, 1235
United States Geological Survey Coal Gas Statistics, 93
Uttoxeter Gas Company, 754
Uxbridge and Hillingdon Gas Company, 600, 624, 688
Valves, Automatic Operating, 206, 1729
Valves for Gasholders, 1556
Van Vriesland Ærogene Gas System, 92, 289
Vautier's, M., Inaugural Address to the Société Technique du Gaz en France, 77
Ventilation, Mr. M. O'Gorman on, 1297
Ventilation without Draughts, 268, 600
Ventnor Gas and Water Company, 165, 467, 754
Vitrified Clay Pipes for Gas and Water Mains, 466, 1215
Voelker Mantle, Limited, 18, 618
Wages and Hours of Labour in 1899, 257, 262
Wakefield Electricity Supply, 692
Wakefield Gas Company, 484, 555, 621, 736
Walker and the Electric Light, 279
Walker and Wallsend Gas Company, 347, 484, 1444
Walker, Mr. J., on Physical Chemistry, 1297
Wallasey Gas Supply, 1509
Wallasey Water Supply, 103, 224, 427, 699, 1328, 1562
Walls, Retaining, The Thickness of, 325, 1549
Walmisley, Mr. A. T., on Roofs for Retort Houses, 1614, 1703
Walsall Electricity Supply, 486, 820
Walsall Gas Supply, 323, 492, 685, 699, 757, 922, 1015, 1213, 1307
Waltham Abbey and Cheshunt Gas Company, 484
Walton-on-Thames and Weybridge Gas Company, 802
Walton-on-the-Naze Gas Supply, 1721
Wandsworth and Putney Gaslight Company, 21, 358, 859, 916, 950, 1235, 1424, 1443, 1449, 1503
Wantage Gas Supply, 163, 765
Warington, Professor R., on Sulphate of Ammonia, 533, 1005
Warrington and the Electric Light, 348
Warwick District Council and the North Warwickshire Water Company, 162
Warwickshire County Council on the Abstraction of Water from one Parish for the Benefit of Another, 342
Washing and Scrubbing Gas, 271, 617
Water—
Abstracting from one District for the Benefit of Another, 342
Benefits of Filtering, 162
Charge for, for Street Cleansing Purposes, 1235
Divining for, 225, 259, 765, 962, 1076
For Power Purposes in Italy and Spain, 1644
Power Privileges, The Value of, 325
Rapid Methods for the Purification of, 265
Some Deep Borings for, 672
Supply Questions—
County Councils and, 162, 822
Ineptitude of Local Bodies in Regard to, 24
Meade-King, Mr. W. O. E., on, 269
Protection and Control of the Sources of Supply, 162, 342, 526, 541, 596
Rates, Liability for, 1733
Rates, Payment of, for Small House Property, 619, 685
Waste, The Checking of, 136, 335, 395, 679, 800, 1046
Underground, Law Relating to, 730, 737, 874
Works for Small Towns, 139
Water Clad Hydraulic Mains, Coal Bunkers, &c., 540, 933
Water Gas—
Association of Municipal Corporations and, 1540, 1560
Cutler, Mr. S., jun., on, 921
Dellwik's Process for Enriching Purposes, 260, 1303
Future of, in France, 997
Haldane, Dr. J. S., on, 1048
Lewes, Professor V. B., on, 1194
New Apparatus for, 613, 1062
Reynolds, Professor J. E., on, 1124
Supply of, in Dublin, 1561, 1652
Wet Lime Purifiers for, 275
Wath-upon-Dearne Gas Supply, 547, 819, 891, 1323, 1564
Waverley Association of Gas Managers, 989, 999, 1018
Weardale and Shildon Water Company, 289, 347
Webber, Mr. W. H. Y., on "The New Gas," 1613, 1627
Wednesbury, Suffocation by Gas at, 278
Weir, Mr. J., on the Workmen's Compensation Act, 139
Wellingborough Gas Company, 624
Wellington (N.Z.) Gas Company, 883
Wellington (Salop) Gas Company, 690
Wellington (Salop) Water Supply, 698
Wells and Co.'s "Lightning" Painter, 871
Welsbach Incandescent Gaslight Company—
Annual Report, 1559
Assault on Inspectors, 619
Committal for Selling Infringing Mantles, 685, 816
Embezzlement by a Traveller, 153
Meeting of Shareholders, 1607, 1647
Patent Litigation, 18, 153, 210, 341, 342, 409, 412, 459, 475, 547, 618, 632, 953, 1135, 1366
Patents Expiring in 1900, 76
Reduction of Prices, 1490, 1558
Welsh Water Scheme (*see* London County Council)
Welshpool Gas Supply, 632
Wenlock Water Supply, 827
West Ashford Water Supply, 103
West Bromwich Corporation Bill, 323
West Bromwich Electricity Supply, 1139
West Bromwich Gas Supply, 412, 693, 1240, 1562
West Gloucestershire Water Company, 964
West Ham Gas Company, 1245
West Ham, Parliamentary Aspirations of, 17
West Hartlepool and the Electric Light, 693, 953
West Middlesex Water Works Company, 422, 1355, 1392
West Riding Coalowners and Gas Coal Contracts, 1136, 1454, 1515
West Suffolk County Council and the South Essex Water Bills, 766
West Surrey Water Company, 626, 1570
Westcott, Mr. J. T., on Labour Saving Machinery in Gas Works, 145
Westerham Gas Company, 736, 1434
Western Australia, Coal in, 471
Western (U.S.A.) Gas Association, 1723
Westgate and Birchington Water Bill, 143, 1386
Westhoughton Gas Company, 401, 532
Westinghouse Gas Engine, The, 84, 1105
Weston-super-Mare Gas Company, 688, 690
Westward Ho! Gas Company, 862
Wetherby District Water Bill, 143
Weybridge Water Supply, Quality of the, 1570
Weymouth and the Electric Light, 1139
Weymouth Consumers' Gas Company, 556
Whimster, Mr. T., on Deriving Power from the Rise and Fall of the Tide, 1142
Whitby and the Electric Light, 759, 1656
Whitby Water Company, 415
Whitechapel Electricity Supply, 37, 138, 1137
Whitehaven Electricity Supply, 37
Whitwick and Coalville Gas Supply, 1067, 1508, 1655
Widnes Gas Supply, 492, 545, 1067, 1558, 1664
Wiener Neustadt Gas Works, An Explosion at the, 213
Wigan Electricity Supply, 37, 94
Wigan Gas Supply, 1219, 1654
Wilkinson, Mr. J., on Some Disputed Points among Gas and Water Experts, 1614, 1708
Will, Mr. J. Shiress, on the Law of Underground Water, 730, 737
Willenhall Gas Company, 412
Wilmslow and Alderley Edge Gas Company, 1392
Winchester Water and Gas Company, 625
Wind Pressure, 144
Windsor Gas Company, 263, 401, 736, 826
Windsor Water Supply, 99
Winsford District Council and the Gas Works, 1463
Winsor, Mr. F. A., Tomb of, 1634
Winstanley, Mr. F. A., on Inclined Retorts, 1558
Wire Ropes, The Manufacture of, 467
Wireless Telegraphy, 199
Woking Electricity Supply, 157
Woking Water and Gas Company, 690, 1318
Wolverhampton and the East Shropshire Water Bill, 563, 752
Wolverhampton Electricity Supply, 1656
Wolverhampton Gas Supply, 21, 561, 625, 752, 767, 936
Wolverhampton Water Supply, 768, 1516
Wonders of Modern Mechanism, The, 490
Wood, Mr. G. H., on the Material Progress of the Working Classes, 1496
Wood, The Fireproofing of, 923
Woodbridge Water Bill, 143
Woodhead, Dr. G. S., and Ware, Mr. W. J., on the Disinfection of Water Mains, 918, 930
Woolwich, London County Council Election at, 525
Worcester Electricity Supply, 215, 1242, 1539, 1546
Worcester Gas Supply, 46
Worcester Water Supply, 765
Working Classes, Housing of the, 75, 394, 525, 858, 1045, 1275, 1358
Working Classes, Material Progress of the, 1496
Workington Water Supply, 1246
Workmen's Compensation (*see* Compensation)
Workshop Lighting, Some Views of, 1546, 1729
Wrexham Gas Company, 767
Wright, J., and Co., Baker Syndicate and Foster *v.*, 816
Wright's, Messrs. Alex., and Co., Torch for Incandescent Street Lamps, 1127
Yarmouth Electricity Supply, 486
Yeadon and Guiseley Gas Company, 484
Yeadon and the Electric Light, 418, 557, 1391, 1456
Yeadon Water Company, 347, 563
Yeadon Water Supply and Lead Poisoning, 563
York Electricity Supply, 626, 958
York Gas Company, 347, 415, 755
York Water Company, 325, 347
Yorke, Mr. E. H., on Distributing Gas of Different Qualities, 869
Yorkshire, Increased Output of Coal from, 1663
Yorktown and Blackwater Gas Company, 144
Youghal Gas Supply, 1721
Young, Mr. W., on the Naphthalene Question, 1615, 1712
Zurich, New Gas Works for, 407

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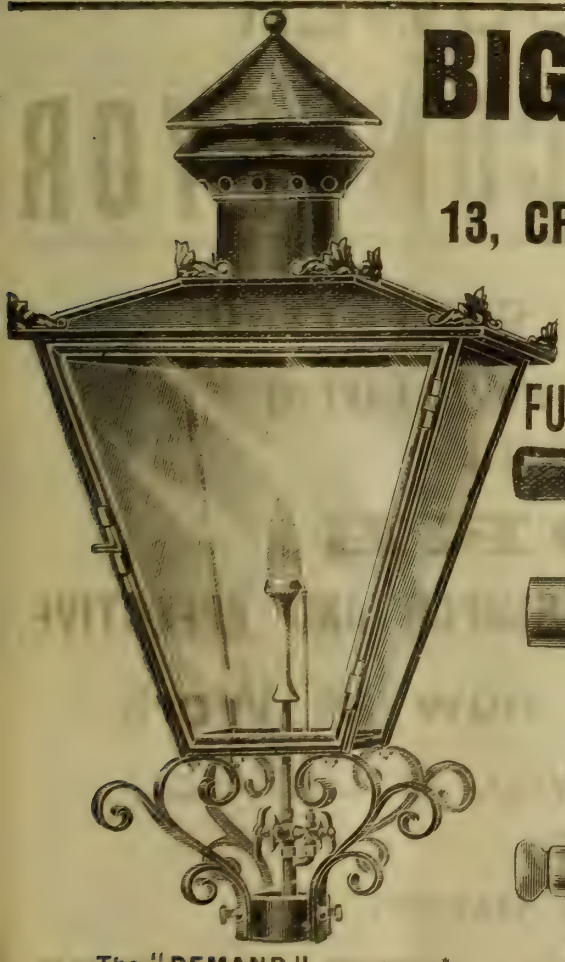
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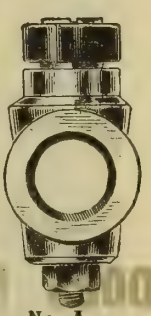
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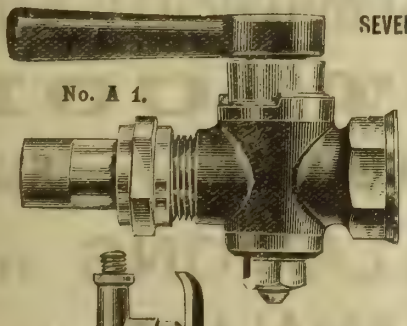


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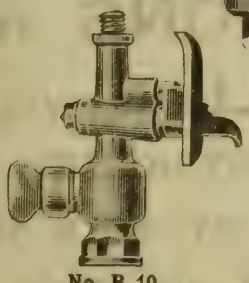

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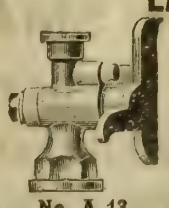
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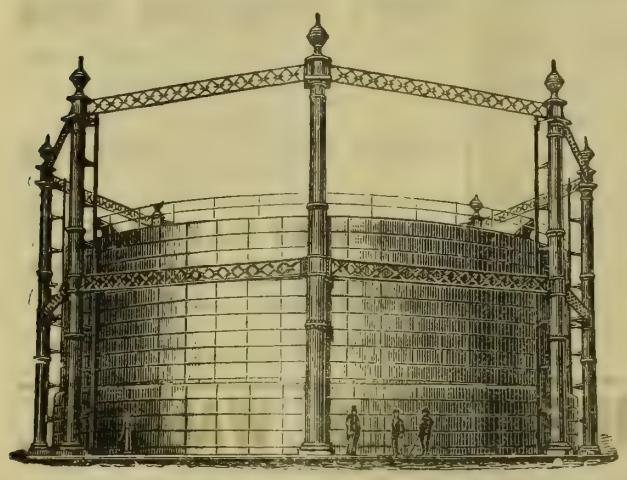
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PATENT COKE-CONVEYOR

FOR ELEVATING AND CONVEYING.

SUPERSEDES ALL OTHERS FOR DEALING AUTOMATICALLY WITH

HOT COKE.

DOES NOT BREAK THE COKE. SIMPLE AND EFFECTIVE.

25 INSTALLATIONS now at Work.

SUITABLE FOR SMALL AS WELL AS LARGE

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MANUFACTURERS OF ALL KINDS OF GAS PLANT.

RETORT-BENCH FITTINGS; SIEMENS'S REGENERATIVE AND ORDINARY FURNACES;
CONDENSERS, EXHAUSTERS, AND ENGINES; SCRUBBERS, WASHERS;
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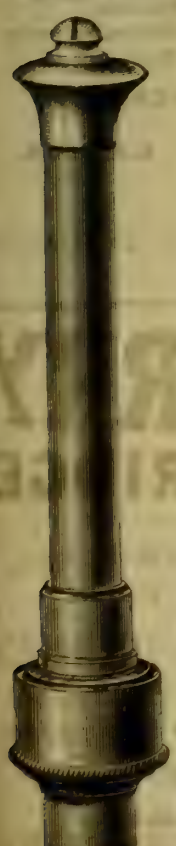
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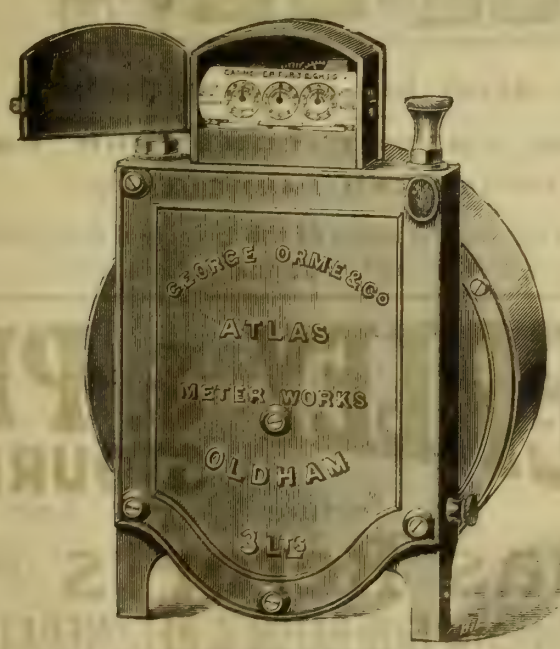
Telegraphic Address:
"ORME, OLDHAM."

ATLAS METER WORKS, OLDHAM.

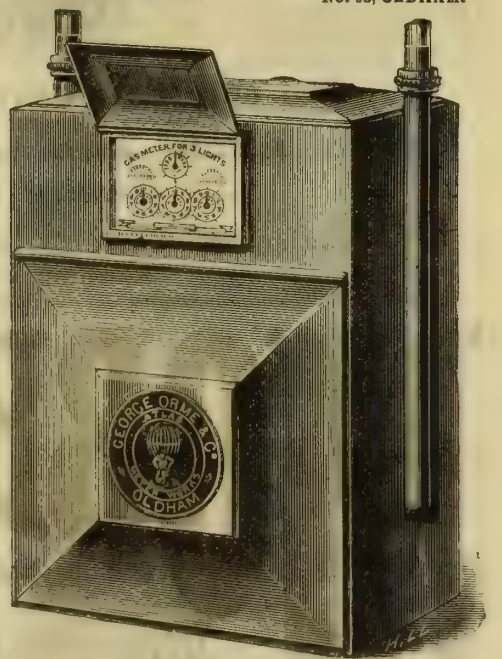
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WET GAS-METER IN CAST-IRON CASE.



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ORME'S GAS REGULATOR FOR STREET LAMPS.

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Main Gas Cocks, Pressure-Gauges, & all descriptions of Gas, Water, & Steam Fittings in stock.

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RETORTS and FITTINGS, MOUTHPIECES with Self-Sealing Lids.

Improved COAL and COKE HANDLING PLANT, CONVEYORS, and ELEVATORS,

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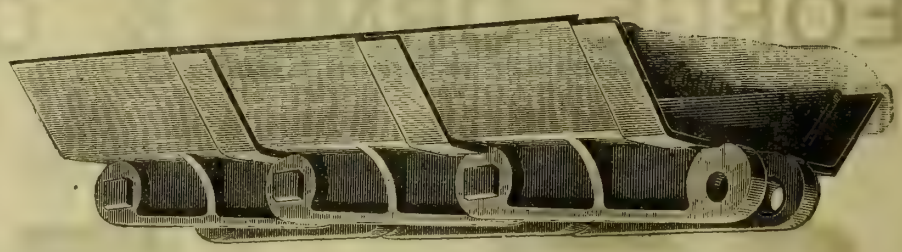
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The fullest Inquiry invited. Can be seen at work in some of the principal Gas-Works in the United Kingdom, where they are giving the utmost satisfaction.

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Manufacture & supply best quality of

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The only System actually giving over

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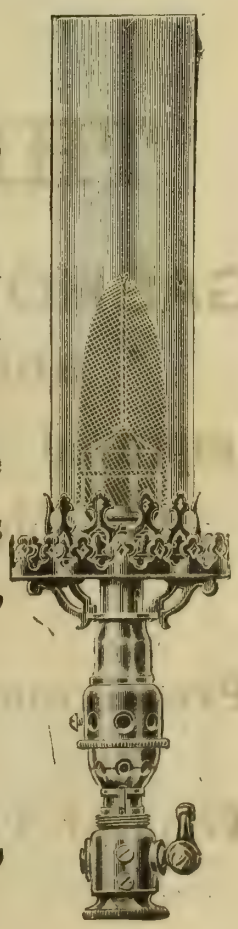
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"The perfection of artificial lighting on the large scale."—"*Journal of Gas Lighting*," April 18, 1899.

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The most Effective and Economical Burner on the Market for both Indoor and Outdoor Lighting. Mantles specially manufactured for the Company, for both Systems, by the Welsbach Incandescent Gas-Light Company.

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Gas Engineers, Ironfounders, and Contractors.

CHIEF OFFICES AND WORKS: **ST. THOMAS, EXETER.** Telegrams: "Willey, Exeter." Telephone: 132 and 263.

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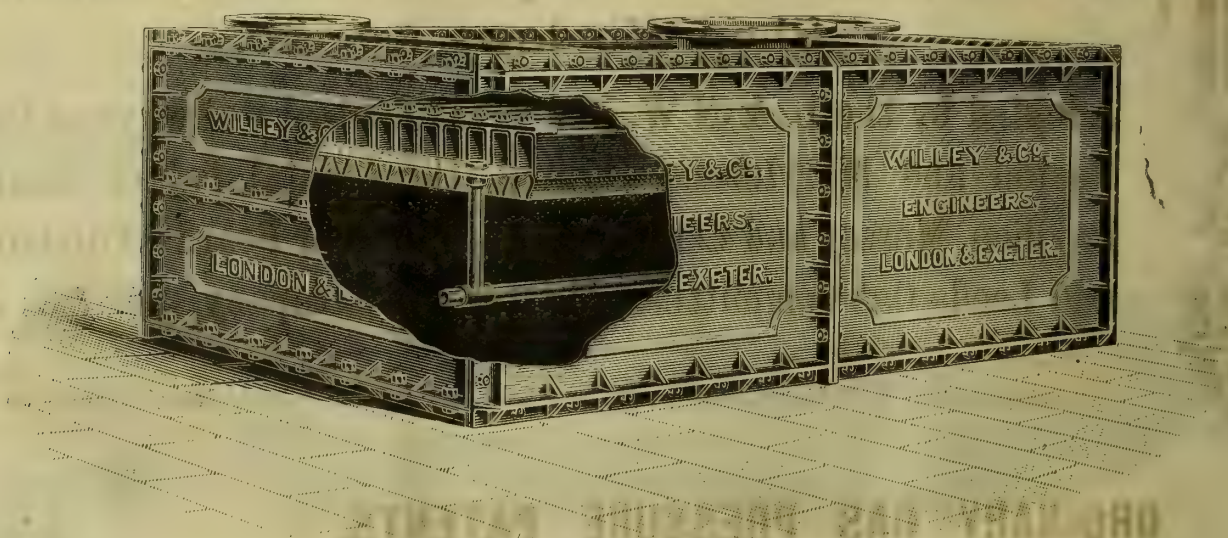
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Manufacturers of

GASHOLDERS, PURIFIERS, WASHERS, and every description of Gas Plant.

Improved Gas Governors, Station Meters, Consumers' Meters, Gas Apparatus, and Gas-Fittings.

SPECIALITY.

Prepayment Meters for any coinage, unexcelled for Accuracy and Reliability.

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INCANDESCENT STREET LIGHTING.

NEW

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25 Candles per Cubic Foot of Gas.

SUPPLIED IN SIX SIZES, CONSUMING FROM ¾ TO 7 CUBIC FEET OF GAS PER HOUR.

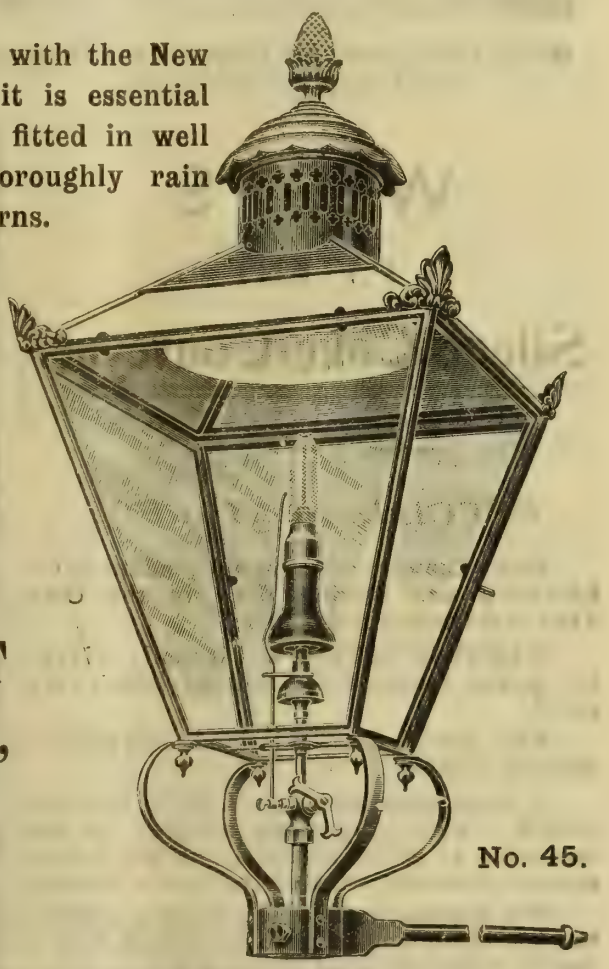
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No. 49.

To ensure success with the New Welsbach Burners, it is essential that they should be fitted in well constructed and thoroughly rain and wind proof lanterns.



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THE GAS LANTERNS MANUFACTURED BY THE WELSBACH INCANDESCENT GAS-LIGHT COMPANY, Ltd., are of the best Workmanship and Design.

THE WELSBACH ANTI-VIBRATION ATTACHMENT enables the new Welsbach Burner to be used with the greatest economy in renewal Mantles for Street Lighting, or otherwise, notwithstanding the severest vibration.

PRICE LIST ON APPLICATION.

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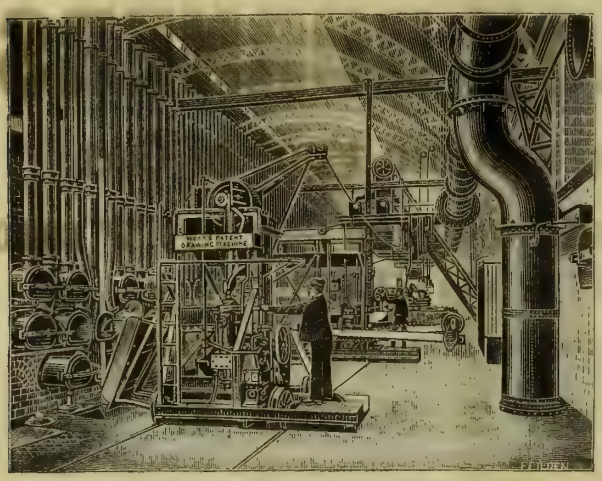
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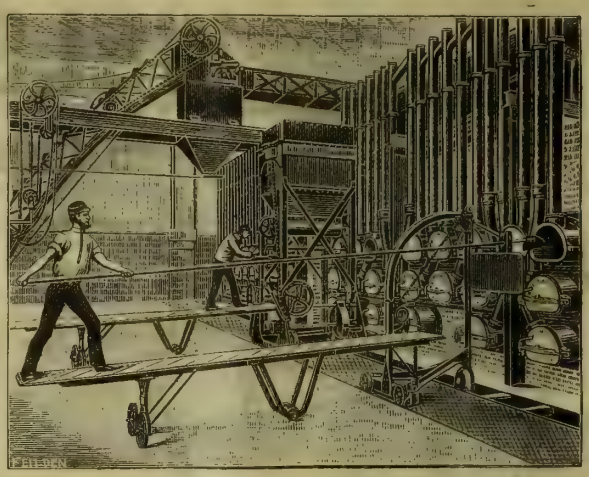
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MANCHESTER.

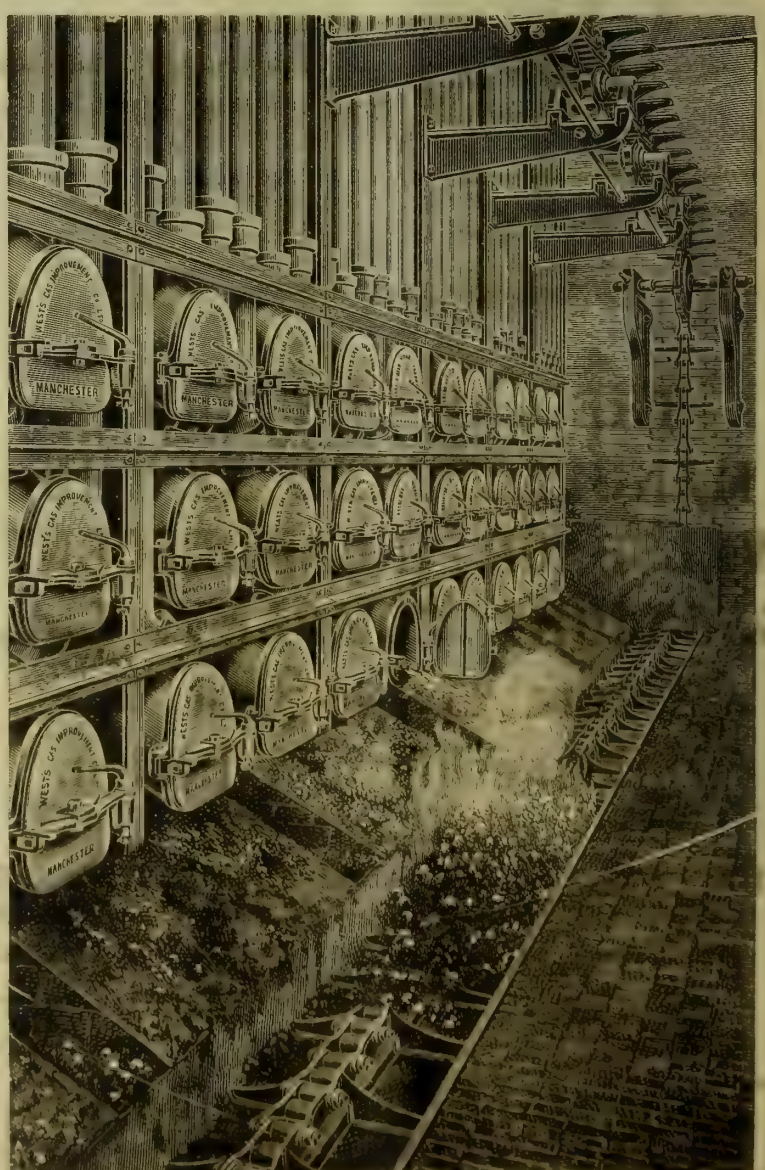


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WEST'S PATENT Silent Coke-Conveyor.



SPECIAL FEATURES:

This Conveyor is specially adapted for Elevating and Storing Coke in the Coke Yard or Overhead Hoppers.

SILENT IN ACTION, and is easily driven; the power required for driving being very small.

Has easily renewable and inexpensive wearing parts.

Is fitted with HUNT'S PATENT ROLLER CHAIN, which is specially adapted for the conveying of gritty materials, as the Rollers prevent excessive wear of the Chain Wheels.

The working parts of the Chain and Slide-Bar are easily and efficiently lubricated by a special lubricator fixed at one point.

No Rivets or Bolts in the Chain to work loose; the whole of the Chain being kept together by the Joint Pins.

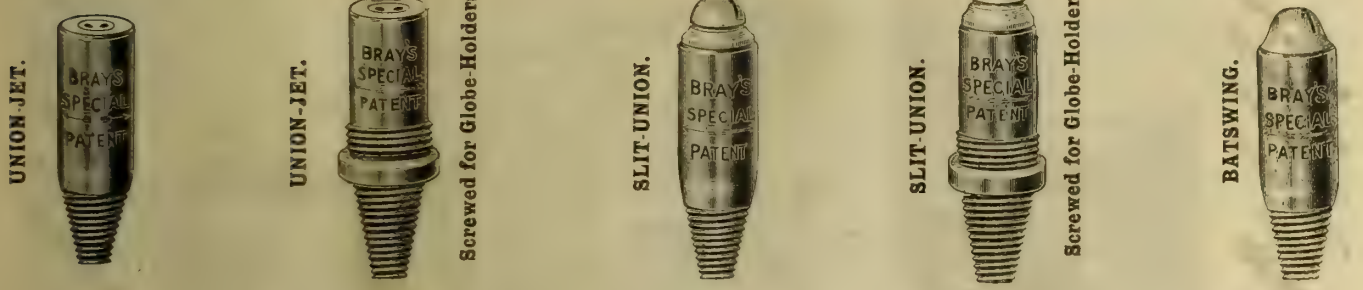
DOES NOT MAKE ANY BREEZE, as the Coke does not roll over in its passage along the Conveyor, and no violent rubbing of the pieces against one another occurs.

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BRAY'S

"SPECIAL" GAS-BURNERS.



SUITABLE FOR ALL PRESSURES AND CONDITIONS.

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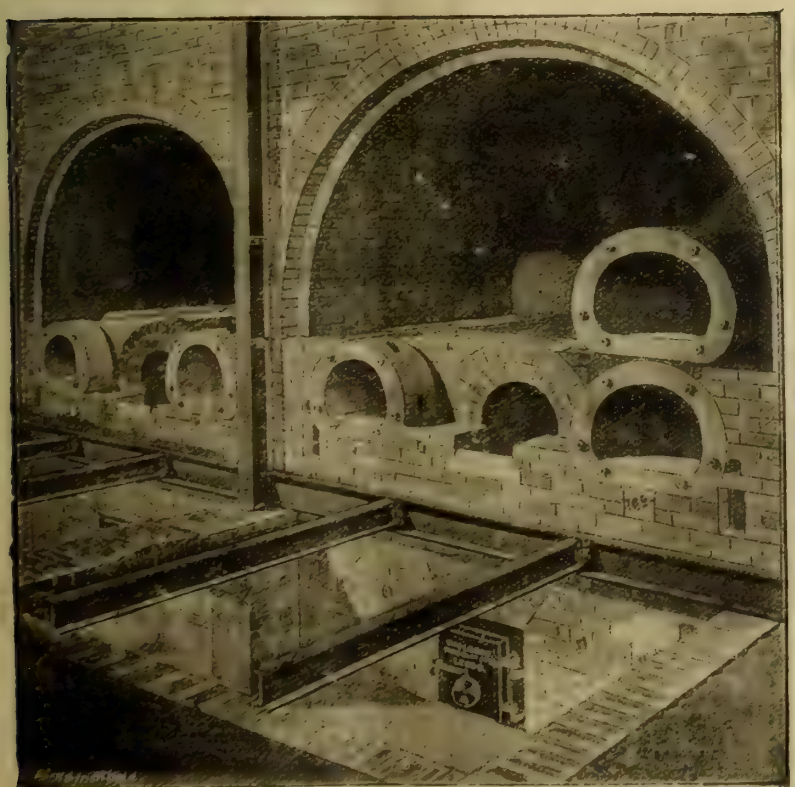
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THE LEEDS FIRE-CLAY CO., LD.

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MANY INSTALLATIONS.
EXCELLENT RESULTS OBTAINED.

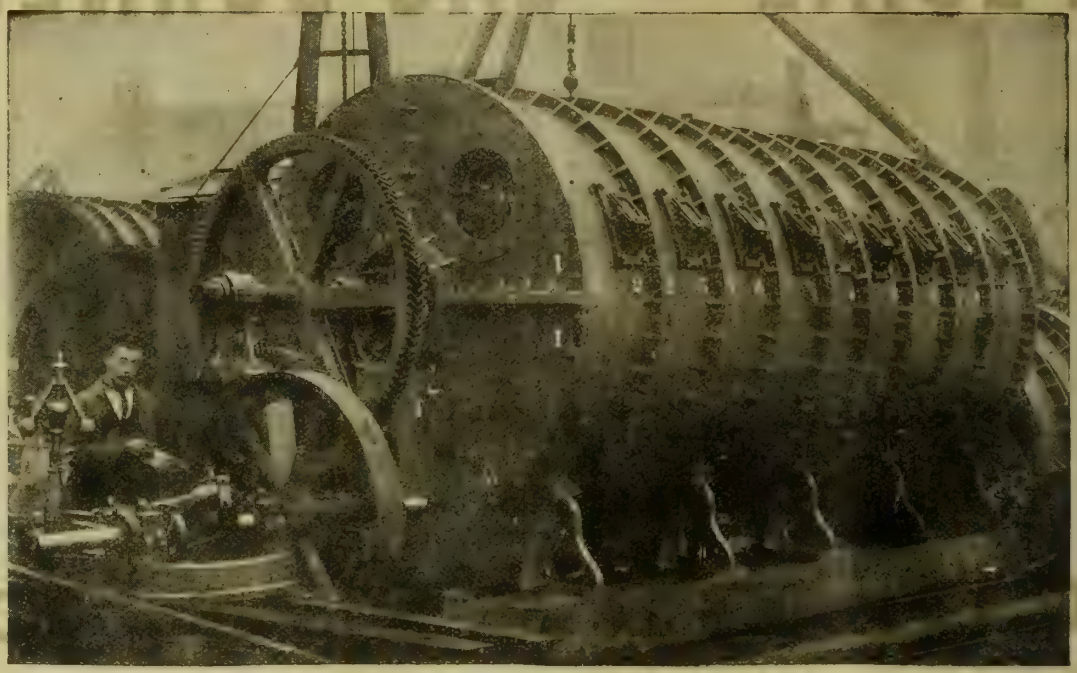
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RETORT IRONWORK.
COAL AND COKE-BREAKING AND CONVEYING MACHINERY.
BUILDINGS, ROOFS, &c.

W. C. HOLMES & CO.'S PATENT "NEW" SCRUBBER-WASHER

HORIZONTAL TYPE.

Machines of this and Vertical Type erected last year and now on order, equal to 62,920,000 cubic feet.

Results guaranteed.



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CAST-IRON PIPES

ALL SIZES.

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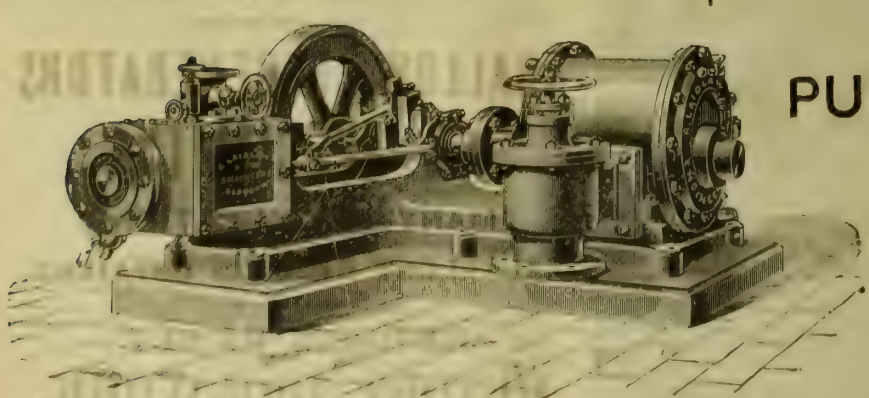
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SPECIAL BRICKS and BLOCKS of every description for GENERATOR and REGENERATOR FURNACES.

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Large Stocks of Bricks of all sizes, Burrs, Boiler Seating Blocks and Covers, Plain and Rebated Tiles, &c., &c.

RETORTS and other FIRE-CLAY GOODS CAREFULLY PACKED for EXPORT.

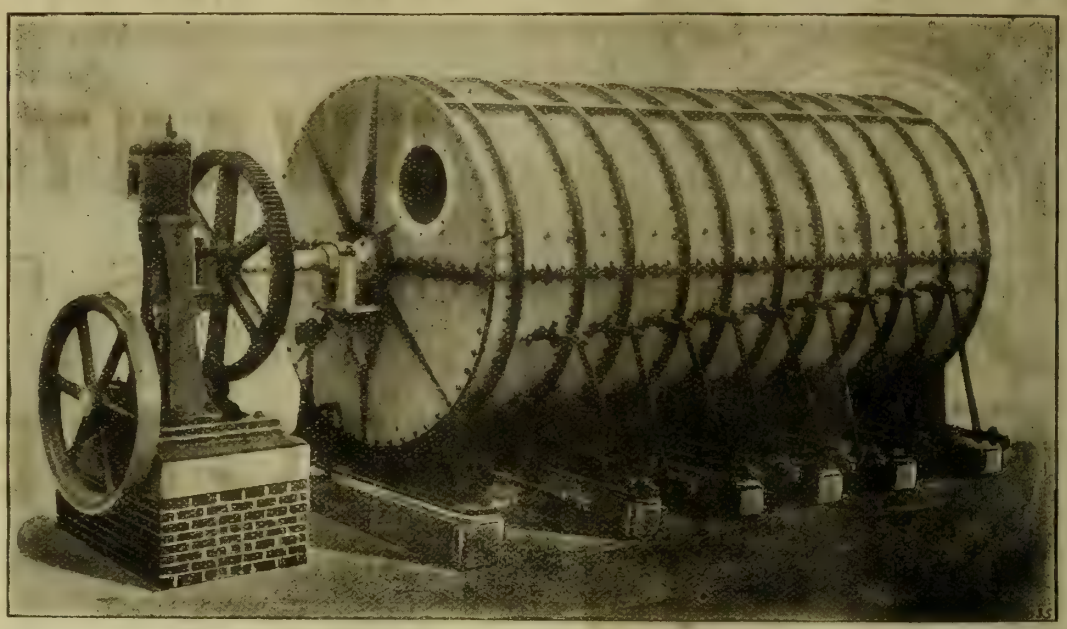
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PATENT "STANDARD" WASHER-SCRUBBERS

Complete Extraction of Ammonia and large proportion of CO_2 and H_2S.

Maximum Strength Liquor produced, Minimum Water Supply and Driving Power required.



Old Pattern Machines fitted with latest Improvements at Small Cost.

PATENT "STANDARD" WASHER-SCRUBBER (one of two) recently erected at the Devon Street Works of the Birmingham Corporation.

Nearly 600 in use.

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PURIFIERS, SCRUBBERS, CONDENSERS, WASHERS, TANKS, VALVES, PIPES, LAMP PILLARS, RETORT-FITTINGS, ETC.

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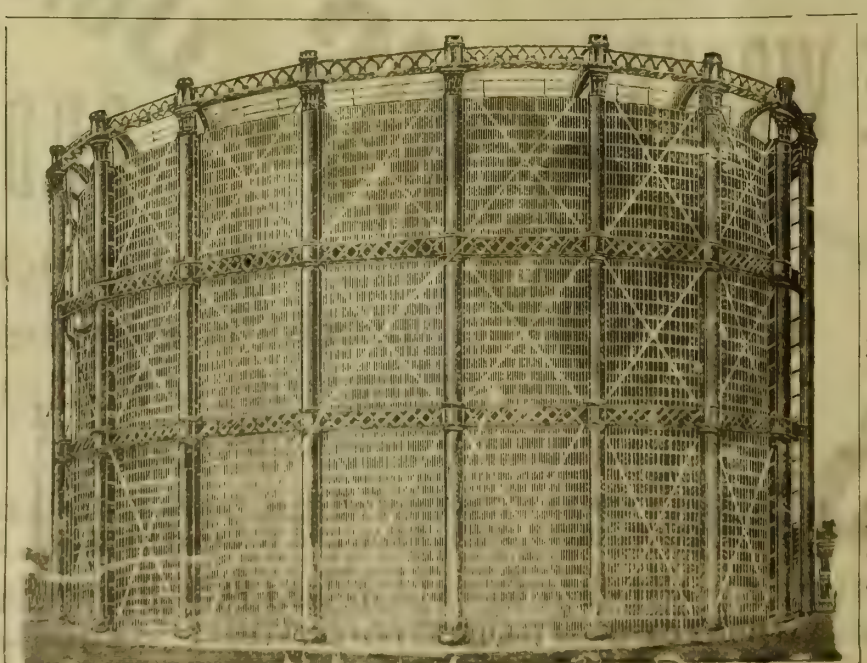
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FOR THE FOLLOWING UNDERTAKINGS:—

American construction is instanced only when from the LONDON Designs of Messrs. Humphreys & Glasgow.

	Cub. Ft. Daily.
Copenhagen	700,000
Copenhagen (Second Contract)	2,500,000
Belfast	1,700,000
Belfast (Second Contract)	4,500,000
Brussels	700,000
Brussels (Second Contract)	700,000
Liverpool	3,500,000
Liverpool (Second Contract)	4,500,000
Tottenham	750,000
Tottenham (Second Contract)	750,000
Santiago de Cuba	400,000
Swansea	750,000
Manchester	3,000,000
Brighton	1,750,000
Preston	1,500,000
New York	1,200,000
Southport	750,000
Bath	1,000,000
Newburgh, N.Y.	350,000
Newburgh, N.Y. (Second Contract)	250,000
Hoylake	125,000
Coventry	600,000
Coventry (Second Contract)	600,000
Bordentown, N.J.	125,000
Winchester	200,000
Shanghai	225,000
Stockport	500,000
Norwich	1,000,000
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Lea Bridge	350,000
Lea Bridge (Second Contract)	350,000
Stockton-on-Tees	500,000
St. Joseph, Mo.	750,000
Edinburgh	2,000,000
Guildford	350,000
Brentford	1,200,000
Bridlington	125,000
Syracuse, N.Y.	850,000
Middlesbrough	1,250,000
Croydon	1,250,000

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Commercial Gas Co.	850,000
Commercial (Second Contract)	850,000
Commercial (Third Contract)	1,250,000
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Taunton	225,000
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Dorking	125,000
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Bremen	550,000
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Aarhus	800,000
Falmouth	150,000
Southampton	800,000
Hartlepool	750,000
Utrecht	1,000,000
Deventer	150,000
Portsmouth	1,000,000
Bournemouth	1,000,000
Aylesbury	150,000
Hamburg	1,750,000
Dublin	2,000,000
Redhill	275,000
Posen	450,000
Dunedin (N.Z.)	150,000
Stockport (Second Contract)	500,000
Brighton (Second Contract)	1,750,000
Croydon (Second Contract)	625,000
Maidenhead (Second Contract)	225,000
The Gaslight and Coke Co., Beckton	2,250,000
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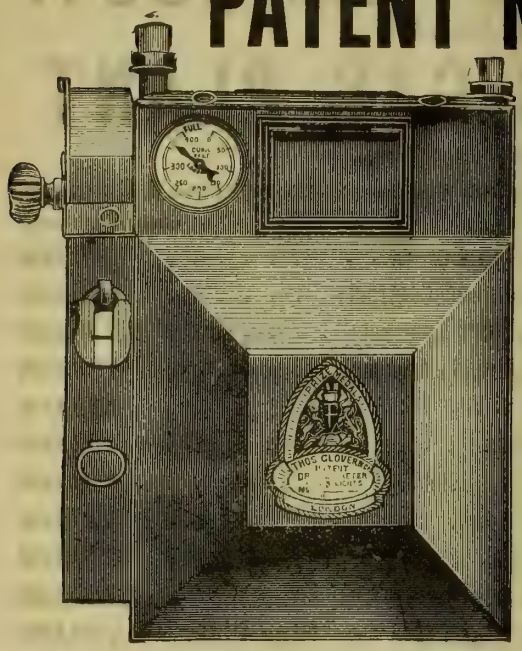
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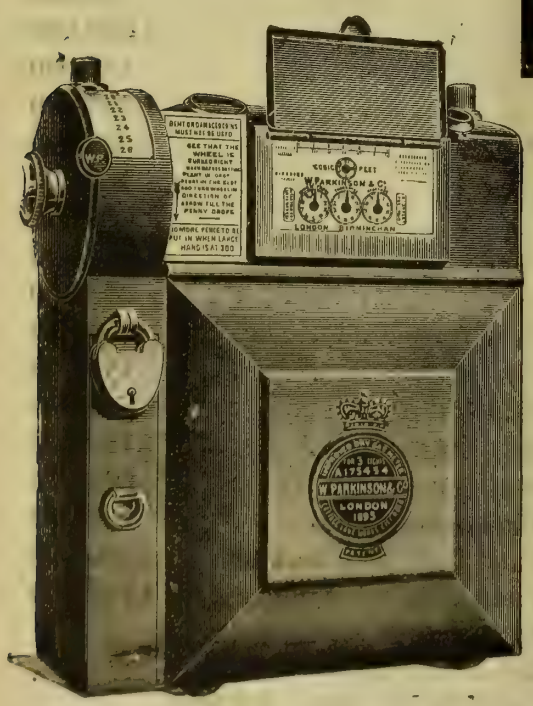
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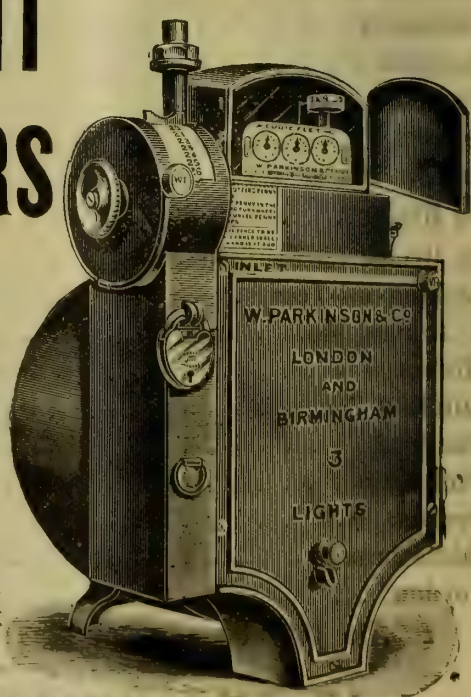
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CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE.
The State of the Coal Market . . . 15
Concerning the Gas Residuals Trade . . . 16
Competitive Gas Supply in New York . . . 16
The Gloominess of British Streets . . . 17
Two Fatal Gas-Works Explosions . . . 17
The Parliamentary Aspirations of West Ham . . . 17
An Anglo-American Engineer . . . 17
WATER AND SANITARY AFFAIRS—
Water Questions for the Ensuing Twelve Months . . . 18
The London County Council Bills and other Projects . . . 18
The Official Auditor under the Metropolis Water Act, 1871, and the London Water Companies . . . 19
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market . . . 19
Electric Lighting Memoranda . . . 20
Gas Bills for 1900 . . . 20
Iron and Steel in 1899 . . . 21
Gas Supply in Germany—The Crefeld Works . . . 22
The Municipal Life of Glasgow . . . 23
Promoters in Parliament . . . 24
Minor Local Authorities and Water and Drainage Questions . . . 24
NOTES:—
A Suggested Theory of Light; Domestic Uses of Gas; The Cost of Tar Macadam; The Making of Good Iron Oxide Paint; A Mixing Chamber for Gases . . . 25
COMMUNICATED ARTICLE:—
Foundations for Metal Tanks. By R. J. Milbourne, A.M.I.C.E. . . . 25
TECHNICAL RECORD:—
An Improvement in the Hydro-Incandescent Gas System . . . 28
The Outlet-Valves at the Burrator Reservoir, Plymouth . . . 28
REGISTER OF PATENTS:—
Unloading, Storing, and Loading Coal, Coke, &c.—Woodward, J. . . . 30
Incandescent Gas-Burners—Wilson, J. . . . 30
Producing Gas from Resin—Knapp, W., and Steilberg, R. . . . 30
Manufacturing Acetylene—Kellner, C. . . . 30
Controlling the Supply of Gas to Burners and Effecting Ignition from a Distance—Franzen, C. . . . 31
Acetylene Generator—Schneeweis, J. . . . 31
Generating Acetylene—Berger, H. . . . 31
Producing Acetylene—Dauber, A. . . . 31
Acetylene Gas Machines—Matthews, F. . . . 32
Burners for Gas Lighting by Incandescence—Voelker, W. L., and the Voelker Incandescent Mantle, Limited . . . 32
Patent Notices . . . 32
PARLIAMENTARY INTELLIGENCE:—
Projected Gas Legislation for the Metropolis—The Bills of the Gaslight and Coke Company and the London County Council . . . 33
The Provision of Additional Reservoirs in the Thames Valley . . . 33
LEGAL INTELLIGENCE:—
Emanations from Gas Residuals Works in Manchester . . . 34
The Deficiency of Electric Lighting in Marylebone . . . 34
MISCELLANEOUS:—
The Royal Aquarium Gas Exhibition . . . 34
Fatal Explosion at the Douglas Gas-Works—Three Lives Lost . . . 36
The Dispute with the Glasgow Corporation Gas Workers . . . 36
Manchester Corporation Gas Supply—The Vacant Engineership . . . 37
Belfast Corporation Gas Supply—Record Outputs . . . 37
The Proposed Municipalization of the Cardiff Gas-Works . . . 37
Electric Lighting Notes . . . 37
The Welsh Water Scheme of the Birmingham Corporation . . . 39
Proposed Auxiliary Water Supply for New York . . . 39
Notes from Scotland . . . 41
Gas and Water Companies' Stock and Share List . . . 41
Current Sales of Gas Products . . . 43
The Lancashire Coal Trade in 1899 . . . 43
Coal Trade Reports . . . 44
PARAGRAPHS:—
OBITUARY: Mr. W. Faulkner; Mr. John Bain; Mr. Philip Jones. 25
PERSONAL: Mr. J. W. Gibson; Mr. F. J. Falkner; Mr. G. Dunbar Malam; Mr. John Williams; Mr. Thomas H. Clarke; Sir John Lubbock, Bart., M.P. . . . 25
The World's Coal—The Welsbach Company's Patents . . . 18
Trade Disputes in 1898—The Coal Trade Outlook in Great Britain . . . 19
The Bronze Coinage—"Fluids in Motion and at Rest" . . . 25
The Gas Supply of the Kingston-upon-Hull District—Fatal Accident at the Saltley (Birmingham) Gas-Works . . . 32
The Supply of Coke-Oven Gas in Boston (U.S.A.) . . . 38
Fatal Explosion at the Lillie Bridge Oil-Gas Works . . . 40
Complaints as to the Quality of Manchester Gas—The Sanctioning of Payments by Gas Committees—The Bradford Gas-Works in Danger—Theft of Electrical Energy—Salford Corporation Gas Supply—The Shortage of Gas at Halifax . . . 45
Shortage of Gas at Driffield—The Proposed Municipalization of the Cambridge Water-Works—Fire at the Worcester Gas-Works—Lincolnshire Towns in Darkness—Gas Explosion in Salisbury—A Curious Gas-Stove Explosion in Liverpool—Water Supply in Calcutta—Explosion at Burton-on-Trent—The Award in the Skipton Arbitration—Opening of New Offices for the High Wycombe Gas Company . . . 46
Additional Storage at the Cranleigh Gas-Works—The Water Famine in the Black Country Last Summer—Companies Wound Up During the Past Year—Record Gas Consumptions—Mansfield Water Supply—Gas Poisoning Case at Plymouth . . . 47

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EDITORIAL NOTES.

The State of the Coal Market.

THE New Year opens with a season of anxiety for many gas managers; the shortage of coal becoming a more serious matter as the days pass. The Christmas Holidays have meant a stoppage of work in the collieries of practically a week; while the holiday passenger traffic has not tended to relieve the congestion of those of the Northern and Midland railway lines upon whose shoulders the coal-owners are freely laying some of the blame of non-delivery. The very rough weather experienced at the end of last week—the barometer on Friday, we note, was lower than at any time since the gale of December, 1886—was also, by the derangement of shipping, calculated to aggravate the troubles of those Companies who depend mainly on seaborne coal for their supplies. Moreover, the past three weeks have been exceptionally favourable to the consumption of gas, and deliveries must have been abnormally heavy in many cases. The result of this concatenation of events has been a considerable depletion of coal stocks, which, owing partly to the failure of contractors to deliver, and partly to the hesitation of some managers to buy fully earlier in the year, in case a reaction in the even then stiff price of coal should arrive, were before none too heavy.

The question of the moment for the Companies who are running perilously short of coal is not what price they shall give for further supplies, but where they are to get such supplies at any price. It is little, if any, exaggeration to say that gas coal is not to be bought "for love or money;" while household coal, to which it is not improbable that many Companies will resort in the not distant future, is becoming more scarce and dearer daily, and prophecies of a real all-round famine in coal are everywhere to be heard. To find a similar condition of the coal market, it is necessary to go back to the period of 1872-4. Coal was then so scarce and dear—that which was 18s. 6d. per ton in 1870 averaged 32s. 6d. for the first six months of 1873; while for two days in February of that year, it was quoted on the Coal Exchange at 45s.—that Parliament appointed a Select Committee early in 1873 to inquire into the causes thereof. The Committee found that one of the principal sources of the scarcity was then, as now, great activity in the iron trade; though it is to be observed that while this activity was then mainly due to an abnormal demand for iron for America, the present increased output is chiefly needed to supply home requirements. A further cause of the shortness of the coal supply in 1873 was found by Mr. Ayrton's Committee to be the unsettled state of the miners, following on the passing of the Mines Regulation Act, and a consequent reduction in the coal raised per miner. It is stated by the owners in some districts at the present time that, owing to the high wages they are receiving, the men are disinclined to work so long as in poorer times. But this state of affairs is, we believe, by no means general. The men in not a few collieries are making hay while the sun shines. That this must be so is evident from the fact that the quantity of coal raised in the year just ended is now estimated at 225 million tons, as against a previous best of just over 202 millions. That the output in the near future will be materially affected by the withdrawal of something like 30,000 miners for service in South Africa is certain, for expert miners are not made in a day, even if raw material out of which to make them were not scarce. But, in spite of this shortage of labour, we see that, in view of the great demand for coal, it is proposed to sink fresh shafts near the coast in Durham, while all the thin-seamed pits, not worth working with coal at low prices, are being mined again.

There can therefore be very little doubt that, even if—as appears probable—the iron trade should continue as active as at present, before many months are over the high prices obtainable for coal will stimulate production until the market can practically supply the demand. This, however, is little consolation to the harassed gas manager, who is facing Generals January and February with very little idea of how he is to win through. If, as we hope, he manages to scrape enough coal together to keep up the supply at proper pressure, he will have some compensation for the cost and anxiety of the pinch, in the value his residuals are fetching. The demand for patent fuel is sending pitch up with a run; and the need of explosives by the Government is considerably hardening the carbolic

market—one of the principal ingredients of lyddite being carbazotic, or picric, acid—while other explosive mixtures are manufactured from gas residuals. Altogether, then, the situation in the next few weeks will be an anxious one for many, and an interesting one for all, of those engaged in the gas industry. It is certainly an uncommon occurrence for managers to be praying to be delivered from a visitation of frost and fog.

Concerning the Gas Residuals Trade.

It is curious to note at how many points the trouble of the Transvaal touches the gas industry—and the gas industry of the United Kingdom at that. Still, although people conversant with the wide developments of gas engineering and the commercial relations of the industry knew that its products went out into all lands, and subserved an infinity of uses, it was distinctly surprising when the Foreign Office last week warned all British manufacturers of, and dealers in, "some of the residual products of gas-works" against selling to new or unknown purchasers, as this might amount to the offence of "trading with the enemy." The reference is obviously to carbolic and cresylic acid, which by nitration becomes picric acid, which in turn constitutes the high explosive for charging shells variously known as lyddite or melinite, according to the characteristics of the last process of preparation for military use. It certainly seems rather late in the day to stop the exportation of British gas-works residuals, for fear of their being returned on our hands in another guise. Besides, as a "Times" correspondent aptly points out, if the enemies of our country want melinite, they can buy it ready made in France. The suggestion is that the English Government should have had the foresight to lay in a sufficient stock of these useful gas residuals some time ago, in which case they might have laughed at the attempts of foreign agents to denude the country of them now. But it is not in accordance with the traditions of the Government of the United Kingdom to be beforehand with anything. If a political party which is "out" elects to take a vote against the party which is "in" on the question of the sufficiency of warlike stores in the country, that is business. At other times, anybody who should warn a Government Department of the gradual disappearance of the raw material of a high explosive and its accumulation in a foreign country, would only get snubbed for his pains. Another gas-works residual which newspaper correspondents newly arrived in South Africa wrote of with suppressed emotion was cyanide. Some of them knew that "cyanide" was something akin to prussic acid; and they jumped to the conclusion that the importation into South Africa of this deadly drug, beloved of the sensational novelist, was intended for the poisoning of the wells. A little higher standard of knowledge of the ways of the scientific and commercial world seems desirable for Foreign Office officials and newspaper writers. So far as dealings in gas-works residuals are concerned, the Foreign Office warning is sadly out of date. Besides, is not coal carbonized everywhere? If all that has been rumoured is true—of train-loads of ammunition passed into the Transvaal at the eleventh hour, and guns sent on the same way under the noses of Colonial officials—it is sheer Departmental pedantry to make out now that there is any harm in the international traffic in gas residuals.

Apart from the political bearing of the possible use of gas-works residuals in the manufacture of munitions of war, it is worthy of remark that public opinion is becoming shaken with regard to the soundness of that German adroitness in the working up of coal-tar drugs and dyes which has been so often thrown in the face of the slow-moving British manufacturer of fine chemicals. We have all heard so many times of those grand German factories where hundreds of chemists are maintained, in dignified independence of commercial results, to witch the world with the fairy tales of synthetical organic chemistry. Well, it seems that the thing is getting overdone. So many wonderful new preparations have been put upon the market from these establishments, that the simple pharmacists and dyers for whom they are made are growing sceptical of the actual existence of differences of constitution and operation among these specialities. The official title of one has a few syllables more than that of its precursor; but what are they among so many? It is not that organic chemistry is exhausted, or that new substances may not come to the front at any moment with characteristics as well marked as that of saccharin, or anything else that might be named as an example. But the suspicion has arisen that the exigencies of his business have put the scientific drug or dye maker in the unenviable position of the spiritualistic "medium"—if the real spirits did not materialize at the right moment, he had to be ready with substitutes, in order not to disappoint his patrons. And, of course, there are people who will say that some of the coal-tar products had better have been left in their native obscurity—such as the "naphthalene yellow," which is suspected of being the means employed to impart a "richness of appearance" to milk and milk products. There is, fortunately, no link between science and ethics, else one might be exercised to pronounce between the comparative morality of utilizing gas-works residuals to make lyddite, or for sophisticating skim milk. One might well be quite as deadly as the other.

Competitive Gas Supply in New York.

Some interesting intelligence has come to hand, in the American technical journals, respecting the course of the "gas-rate war" of New York. Early last month, rumours began to circulate that the suicidal competition between the New York Gas Companies which has prevailed since May last was about to end in the customary fashion by an agreement of the rivals to return to the *status quo ante bellum*. It will be as well to explain what this was. The New York Legislature had cut the Gordian Knot of the metropolitan gas problem, by passing a law that up to the end of last year the price of gas in the city should not exceed $1·10 per 1000 cubic feet; with the New Year it was to be not more than $1·05; and $1 after Jan. 1, 1901. This appears a drastic ordinance, recalling the bread-and-beer assizes of the Middle Ages of English history. The selling price of gas at the time of the passing of the law was $1·50; and the representatives of the Consolidated Gas Company, which is constituted of all the old New York gas undertakings upwards of ten years old or thereabouts, swore by all their gods that the legal rate meant no dividend for their stockholders. The nominal amount of capitalization of the Consolidated Company was $36,000,000; how much of which was "water" nobody could say. It did not seem to matter greatly to the proprietors whether their rate of dividend was 8 or 6 per cent.; and the State Legislature thought it would not hurt them to be restricted to such profit as they could get out of selling gas at the reduced legal price. Thus the Nemesis of arbitrary legislative prescription waited on a long period of secret dealing, during which the associated and ultimately united Companies charged what they would for gas—nobody outside knowing what it could be supplied at on a reasonable commercial and financial basis. The accounts of the Companies are not published, so that the actual amount of their profits was not known. The Legislature brushed aside all financial and technical considerations, and said that New York should have "dollar gas" in the near future.

By the time the new law came into operation, however, other and, as it proved, much more powerful influences had arisen to force down the price of gas in New York. The Consolidated Gas Company had indeed swept up into its big pool all the old Metropolitan Gas Companies; but the weakness of this "Trust" plan of action is that there is no end to the operation. No sooner have A, B, and C combined, and bought up D, than E springs into existence by as good a right as any of the older brood; and it is followed by F and G, and so on *ad infinitum*. "Buy us," says every new comer, "or we will undersell you." Thus the Consolidated Gas Company of New York was exposed to attack by the Standard Company, the New Amsterdam Company, the Mutual Company, and possibly others. We do not know how many concerns were in the business. After some preliminary skirmishing, however, the big Consolidated Company decided, as from last May year, to "freeze out" the younger and weaker Companies outside the ring, and announced their intention to supply gas "until further notice" at the all-round price of 65 cents per 1000 cubic feet. The reason why the Directors took this step, when they might have legally charged $1·10 per 1000 cubic feet, was their cognizance of the fact that the outside Companies were insidiously draining away many of their customers by offering to supply at anything down to 50 or 45 cents. Forthwith, the Mutual Company, which is in harmony with, but not united to, the Consolidated Company, followed suit, and made their rate also 65 cents.

The New Amsterdam Company, who seem to have started the rate-cutting trick, immediately "went one better," with a published price of 50 cents, or anything less that would ensure trade in the competitive area. The Standard Company (another "pirate" concern, in the opinion of the Consolidated people) prudently did not say what their price would be, but only announced their intention of "taking "care of their consumers"—and, doubtless, of as many quondam consumers of the other undertakings as they could get hold of.

So the competition, which it would mightily please certain gentlemen connected with the Corporation of the City of London to see reproduced in this part of the world, raged fiercely during the summer. It was the right season of the year for the combatants to make a great fuss without losing much wool over it; and, of course, the oldest and strongest undertakings felt it least. When the season of large gas consumption had fairly set in, the first of the pirates had to cry off. By the end of November, the New Amsterdam Company were fain to declare that, owing to the vast increase of their business, the capacity of their works was quite overtaken; and they must put up their price to the legal rate of $1·10. The truth of the matter was obvious. Meanwhile, however, the Companies charging 65 cents continued to hold on their way, serenely oblivious of the despairing retreat of their challenger. The administrators of the Standard Company, by the latest advices, did not know what to do. The old Consolidated and the Mutual seem to be quite content to carry on "until further notice," as they originally said, at the 65-cent rate. How long they would continue doing so after their complete triumph over, and the retirement from business of, their rivals—assuming this to be the end of the competition—may be regarded as doubtful. Suppose the State Legislature seizes the opportunity, and nails the rate for New York at 65 cents "until further notice." Why not? If the Companies can do it for their own pleasure, they can do it for the benefit of the public. We have told at length the story of the latest competitive gas supply, because of its intrinsic importance, and also for the sake of its teaching.

The Gloominess of British Streets.

In one of the leading Reviews, a travelled Englishman has recently given publicity to some of his impressions of London on returning to its streets after many years' habitation of Continental cities. In very many respects, these observations apply with equal force to the aspect presented by other English cities and towns which have been largely rebuilt of late years. This witness finds London better lighted than it used to be—artificially, that is. But with regard to natural lighting, he is not so well pleased. He notices with regret the modern tendency to increase the height of town buildings, which, as he truly remarks, is a step in the wrong direction for our northern latitudes. Lofty façades are a mistake where the sun never rises very high in the heavens. Another blunder is the tint and character of the surfaces of our supposed "improved" building frontages. We pour scorn and contempt upon the stucco fronts of old Regent Street, which had to be painted at least once in three years; but the effect was ever so much brighter than that of our modern fashionable terra cotta, pressed brick, or stone, which all weathers in the course of a few years into a dingy, dirty monochrome. He is right. These natural-surfaced building materials are not the most satisfactory for English town buildings. They are almost entirely absorbent of light. Now that we are getting to employ artificial street lights on something like the Continental scale, it is very disappointing to find that they look no better than the lights in a photometer-room, or a coal-cellar, by reason of the blackness of the façades. If white and pale-tinted glazed bricks and tiles are not available for all purposes, let us have the painted plaster again! Architects must be switched off dark red terra-cotta, portland stone, and plain bricks, if anything like cheerfulness is to be preserved for our narrow northern streets.

Two Fatal Gas-Works Explosions.

Two fatal explosions in gas-works happened during the closing days of the Old Year; but the particulars have only transpired in time to be given in our present issue. One was at the town gas-works of Douglas, Isle of Man; the other at the private (oil) gas-works of the Metropolitan District Railway Company, at Lillie Bridge. Both these occurrences were of a simple character, and are chiefly remarkable as illustrations of the force of the old saying, "Familiarity breeds contempt," in regard to the proceedings of workmen engaged in manufacturing operations requiring a modicum of prudence for their safe conduct. In the Douglas case, which unhappily resulted in the death of three men, the circumstances which led to the explosion were explained by Mr. T. Newbigging, the Consulting Engineer to the Gas Company; and our report in another column contains ample information for technical readers as to how it came to pass. The victims of the accident appear to have been working in proximity to a tar and liquor tank by the unprotected light of a candle held by the yard foreman close to the open manhole. The result is not surprising, though we should hesitate to accept the finding of the High Bailiff's Jury as setting out the correct rule of practice in this regard. In the Lillie Bridge case, the man who was killed had a safety lamp for use in looking at his oil and tar tank gauges. Of course, he left it in the cupboard, and struck a match one foggy day when he wanted to see the gauge, which was near both the gas-oil and the oil-tar tanks. Others had done the same thing before; but this time the heaviness and stillness of the atmosphere, or something, made a difference. It is worthy of remark, in view of the flash-point agitation that has been one of the London County Council's hobbies, that the County Council Inspector tested the oil, and found it "had a flash-point of "150°." This grain of fact is bad for the hobby. It, however, supports our contention that all these hydrocarbon fluids are apt to be very treacherous things to handle, and that the most staid of them needs reasonably careful treatment.

The Parliamentary Aspirations of West Ham.

Some of the newspapers have noted with consternation the parliamentary programme of the West Ham Corporation, as notified in the "London Gazette" for Nov. 24, which it fills from p. 7675 to p. 7683. The Bill thus heralded would not, in the ordinary way, come under our notice, inasmuch as circumstances have forbidden to the West Ham Corporation those privileges of gas and water supply which are understood to form the backbone of the Progressivism of many Municipal Corporations. West Ham, however, is well calculated to become the cynosure of Local Authorities of districts in other parts of the kingdom, by reason of its being actually under the domination of some of the lights of Labour and Socialistic politics. Some time ago, these eminent persons cleared their course by sending the old Town Surveyor packing at very short notice. Now they are bent on abolishing their Aldermen, and vesting the powers and property of the Overseers, Burial Board, and Vestry Clerk in the Corporation. The Corporation are to make all the rates, and see about the deduction thereof from the rent. The Corporation are also to have the power of levying all manner of rates and charges, of conferring exemption from the payment of any rates and charges, of erecting artisans' dwellings, and of doing many other things. West Ham not having started as a "Garden City" with wide thoroughfares and imposing vistas, but having, in point of fact, outgrown its mean central nucleus, the latter is to be improved out of knowledge. And then the tramways! There is to be nothing niggardly in the laying out of these necessaries of civilization. It is pleasing to observe that the lack of much that usually goes to make a self-contained municipality, according to modern ideas, is not allowed to cramp the aspirations of the West Ham Progressives. How the borrowing powers of the Authority will bear the strain of all this enterprise, and what the rates are likely to rise to if it is carried out, are matters as to which the Parliamentary Committees to whom the Bill must be referred will probably direct inquiry.

An Anglo-American Engineer.

Some months ago we had occasion to remark upon the peculiarly English and American conception of the nature of the true engineer, as being that of a man who can do certain things as they should be done; and the example we then had in view was the late Mr. Edward Case, of Romney Marsh. Another personal illustration in support of our observations on this head is supplied by the account given in the "Engineering Record" as to the career of

Mr. Arthur J. Moxham, who was lately chosen as Manager of the Dominion Iron and Steel Company, of Montreal, whose works at Sydney, Cape Breton, have a close connection with the coke-gas manufacturing plant at Everett, Boston, already described in the "JOURNAL." Although Mr. Moxham is an Englishman by birth and citizenship, his life's work has lain in America, and its character has been typically American. His record begins in 1870, when he became receiving clerk of a rolling mill in Louisville, which was in financial difficulties. He and some associates leased the works, and ran them successfully for several years. While still a lad—his age was 24—Mr. Moxham organized the Birmingham Rolling Mill Company, who built works at the new town of Birmingham, Alabama, and started business eight months after the plans were settled. A few years later, Mr. T. L. Johnson, a street railway magnate, wanted somebody to undertake the manufacture of what was then an unheard-of thing, but is now universally known as the "girder rail." Other steel-men had refused to undertake to roll such a rail; but Mr. Moxham did it. He and Mr. Johnson went into partnership; and the union soon resulted in the Johnson Company, and the large establishment at Johnstown, Pennsylvania. After a time, the Company thought they were paying too dearly for their steel, and decided to make their own. This was done at Lorain, Ohio, where steel was produced on April 1, 1895, with plant which had been started only in the previous month of July. During Mr. Moxham's reign at Johnstown, the awful catastrophe of the breaking of the dam occurred. In one night, 12,000 people were left without food or shelter, and the sun arose on 3000 corpses. When the survivors first came together, they chose Mr. Moxham for their Dictator. As was told in Congress: "It was he who, in that dreadful "moment, stepped to the front, and, in the name of the "whole community, brought order out of chaos—who "destroyed whiskey and seized food, who fed the living "and buried the dead, and again set in motion the ma-"chinery of organized government and civilized life." Mr. Moxham had retired from business, and started on a tour round the world in his steam yacht. He chanced to meet Mr. Henry M. Whitney, who was responsible for the Cape Breton and Everett scheme, and was persuaded to put off his plans for a long period of leisure and—shall we say?—try and pull this venture round somehow. If this is not a record of a "certificated engineer," it is at least the story of an able man who is as much of an engineer as most members of the profession would like to be.

The World's Coal.—The output of coal throughout the world in 1898 is computed at 662,820,000 tons. In this total, Great Britain figured for 202,054,516 tons; the United States, for 196,405,953 tons; Germany, for 130,928,490 tons; France, for 32,439,786 tons; Belgium, for 22,075,093 tons; Austria and Hungary, for 35,039,417 tons; Russia, for 12,862,033 tons; and all other countries, for 30,960,712 tons.

The Welsbach Company's Patents.—Our readers may remember that in the list given in the "JOURNAL" for the 5th ult. of the firms who had decided to take part in the Gas and Allied Trades Exhibition now being held at the Royal Aquarium, a notice of which appears in another part of this issue, was the Voelker Mantle, Limited, who proposed to place their mantle upon the market early in the New Year. The Welsbach Company assert that this mantle is an infringement of their patent rights; and on this ground they obtained on the 21st ult. an order restraining the Voelker Company, their servants and agents, from such infringement. Copies of this order were duly served upon the employees of the Company and the Manager of the Aquarium; and this will account for the absence of the promised Voelker exhibit. While referring to the Welsbach patents, we may point out that the recent judgment of the Court of Appeal in the Daylight Company's case merely affects the question of costs (the patent referred to having expired when the judgment was delivered), and in no way interferes with the sale of the Welsbach Company's present mantle, which is made under their 1893 patent. This patent, it may be remembered, was strongly supported by Lord Justice Romer, whose views were concurred in by the Master of the Rolls, in the judgment above alluded to. His Lordship characterized the use of a small quantity of cerium in the manufacture of the mantles as "a remarkable and astonishing discovery of later years;" and inasmuch as the patent covering this invention, under which the only mantles that have ever been of any commercial value have been made, has another seven years to run, the statements persistently circulated that the Welsbach monopoly is at an end may be estimated at their real worth. The view of the patent taken by the Court of Appeal is of the utmost importance to the shareholders in the Welsbach Company.

WATER AND SANITARY AFFAIRS.

In entering upon another year, it may not be out of place to glance for a moment at some of the questions relating to water supply which are likely to occupy attention in the coming twelve months. First in importance, undoubtedly, stands the Metropolitan Water Supply. More than nine months have elapsed since the Royal Commission appointed to deal with the matter held their last public sitting, and no sign has yet been given of the issue of the final report. Just before the inquiry closed, Lord Llandaff, the Chairman of the Commission, seemed to take a rather despondent view of the results of their labours; and he went so far as to hint at the possibility of nothing being done as the outcome of their prolonged investigation. We do not share this view, and venture to express the opinion that the recommendations of the report now daily expected will go far in the direction of placing the water supply of the Metropolis upon a much firmer basis than that on which it now stands. Already the Commission have done some good work by the issue of their interim report, the effect of which has been to ensure an uninterrupted supply of water in those districts of London where it is most needed. This, at any rate, is something accomplished. The questions upon which we are now awaiting the opinion of the Commission are much more difficult than the one that has been disposed of. Is it desirable, in the interests of the ratepayers and consumers, that the supply of water in the Metropolis should be taken out of the hands of the Water Companies, and transferred to one or more public bodies? Should the reply to this question be in the affirmative, we cannot for a moment suppose that it will be on the ground of failure on the part of the Companies to discharge all their statutory obligations, but rather in deference to the growing desire for the municipalization of water-works. But assuming that the reply should be in the negative, the Commission will say what additional powers of control should be exercised by local or other authorities in respect of the water undertakings. The Companies are at present under the supervision of a Department of State; and they willingly submit to it. Evidence of this is afforded by the proposals contained in the Bill, noticed in another column, which they are promoting in furtherance of their scheme of storage reservoirs in the Thames Valley. Such a scheme, carried out on the initiative of the Local Government Board, should furnish all the water required by London for the next forty years; and it would have the special merit of not putting any burden on the ratepayers.

The London County Council have made the second move in their parliamentary plan of campaign, by depositing two Bills to sanction their Welsh water scheme and the purchase of the Water Companies' undertakings; and their progress will necessarily engage a large share of attention, both in the Metropolis and in the Provinces. These two measures will, of course, be opposed by the Companies, but not by them alone. There are already signs of local objections to the scheme; for at the recent annual meeting of the Federated Chambers of Trade for South Wales, objection was raised to the attempt of the London County Council to rob South Wales of that which belongs to her by geographical position and requirements. As a scheme is on foot for providing a water supply for Glamorganshire and Monmouthshire from the watershed upon which the Council have their eyes, its promoters will no doubt seek to make themselves heard against the larger one emanating from the Metropolis. Here comes in the question of the control of watershed areas about which something will in all probability be said in Parliament next session; and allied to it is that of the right to underground water, some alteration of the law in regard to which appears to be called for. The water legislation for the session presents some interesting features which may be left to be dealt with as they arise. Special interest will attach to the Bills for the re-constitution of the Lea Conservancy Board and the formation of Joint Water Boards for Bury and South Essex. In the case of Bury, the parties concerned are pretty well agreed; whereas in that of South Essex it is reported that there are already dissentients among the Local Authorities concerned. The purchase projects will be interesting as showing the progress of Municipalism; while the extension schemes may possibly bring out some new and useful points in connection with boundary and engineering questions. In view of the reverse of last year,

the fate of the East London Water Company's Bill will be watched with a certain amount of curiosity; while that of the Lambeth Company, by which, among other things, an attempt will be made to abolish the sinking fund created under their Acts of 1888 and 1896, may be expected to arouse opposition in the usual quarter.

Reference has already been made to the supervision of the London Water Companies by the Local Government Board. The strictness with which they are looked after by the Official Auditor under the Metropolis Water Act of 1871 (Mr. Allen Stoneham), has been shown in recent annual reports of the Board, as well as by what has transpired at the Companies' meetings. One of the latest difficulties has arisen with the Chelsea Company, whose accounts for the past and the preceding half year had to be presented to the proprietors without the signature of Mr. Stoneham. The trouble arose over a sum of £34,215, under the following circumstances: The Company paid off two sums of £80,000 and £90,000 which they had raised by bond prior to, or under the provisions of, their Act of 1852, and re-borrowed £135,785 by perpetual 4½ per cent. debenture stock; raising the balance of £34,215 by the creation and issue of ordinary shares, which have since been converted into stock. In the March accounts, the last-named sum was thus entered. But, on making his usual investigation, the Official Auditor would not certify them, on the ground that the mode in which this amount had been raised was not authorized by the Acts relating to the Company. This little "rift "within the lute," as the Chairman called it at the recent half-yearly meeting of the Company, postponed the payment of future dividends, in accordance with section 40 of the Act of 1871. The Directors felt that they had acted rightly in what they had done, having consulted Mr. Cripps and Mr. Cozens-Hardy on the matter; but, in order to remove the difficulty, they promoted a Bill to sanction the conversion of the shares in question into stock and the payment of the dividends, notwithstanding the absence of Mr. Stoneham's signature to the accounts. Happily, however, there is a possibility of the dispute being satisfactorily arranged; and, consequently, the Bill will be dropped. All's well that ends well. At the same time, expense has been incurred in drafting the Bill and giving the necessary notices, all of which might have been saved if the Directors had been informed a little more promptly as to the intentions of the Official Auditor.

Trade Disputes in 1898.—The report of the Chief Labour Correspondent of the Board of Trade (Mr. H. Llewellyn Smith) on the strikes and lock-outs in 1898 was issued last Thursday. It shows that the number of disputes was 711, or considerably less than in any of the previous four years. The number of workpeople affected numbered 253,907; while the aggregate duration of working days lost was 15,289,478. This large aggregate, it is explained, is due to the fact that one important dispute of the year—that in the Welsh coal trade—not only involved a great number of persons, but lasted for an exceptionally long period. As to the results of the various disputes, the balance of advantage was largely on the side of the employers—due again to the Welsh coal trade dispute, which resulted unfavourably for the workpeople concerned. We purpose noticing this report at greater length.

The Coal Trade Outlook in Great Britain.—Dealing with the subject in a recent issue, the "Iron and Coal Trades Review" remarked that if the figures given by the Royal Commission of 1869 as to the quantity of coal then lying at depths not exceeding 4000 feet in the coalfields of the United Kingdom—viz., 90,208 tons—were approximately correct, though they have since been proved to have been under-estimated, it should not be a difficult matter to compute, from our rate of increase in production since the figures were compiled, the approximate date when our coal should be expected to become scarce and dear. Mr. Price-Williams, in a paper read before the Royal Statistical Society, arrived at the conclusion that, granting an average increase of 2½ per cent. per annum, the total output between 1897 and 1988 would be 72,077 million tons, which would practically, with the quantities worked between 1869 and 1897, mean the approximate exhaustion of our ascertained coal supplies towards the close of the next century. This estimate was founded on the assumption that we shall go on increasing the annual output as we have hitherto done until, in the ten years ending 1987, it reaches 1723 million tons, which would mean eight tithes the approximate output of coal for this year. Our contemporary thinks it extremely unlikely that any such annual output will ever be reached, and considers that if the average annual production remains what it is, and has been for the last few years, the result shown by the adoption of these figures will, of course, be very different, and our available supplies should be quite equal to keep us going for several centuries to come.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 41.)

THE condition of the Stock Exchange last week—the closing week of the year—was a surprise to most people. Bad as its predecessor had been, almost worse was anticipated to follow. Money is always tight at the end of the year; and the stringency was already so acute that it would scarcely bear drawing any closer. To the universal relief, therefore, came a slackening of the pinch. The Stock Exchange settlement, which had been an object of dread, was got through better than might have been hoped, although some smaller operators had to succumb. Its demands for money were fairly well met; and generally there was a more cheerful feeling abroad. Prices in every department advanced, some of them showing considerable gains. Discount rates have eased off materially; and if the relaxation be not overdone, they may well remain so awhile. In the Gas Market, business was decidedly limited; and there was very little movement in prices. What there was, too, was very irregular; the various issues affected appearing to be influenced by the special circumstances of their case. In Gaslights, the ordinary was moderately dealt in at good, steady figures, which varied but little through the week; but the quotation was pushed by small stages. The secured issues presented no feature. South Metropolitan was rather quiet, and quite firm. Commercials were untouched. Scarcely anything was marked in the Suburban and Provincial group; and quotations stood still. The Continental Companies were almost equally listless; but Imperial receded a point. There was nothing observable among the remoter undertakings, beyond a slight retrogression in Buenos Ayres and River Plate. Business in the Water Companies was much restricted; and prices continued to show a marked disposition to shrink.

The daily operations of the four days available for business need not be detailed.

A comparative table of the prices of Gas and Water Stocks as they are now, and as they were twelve months ago is appended. The fact that, for the most part, quotations are lower now than they were then can only have been expected when the present large rise in the value of money is considered. Some reductions proceed from local troubles and impaired dividends; and some improvements are traceable to increased prosperity and appreciation of the undertaking. Gaslight and Coke and Tottenham and Edmonton issues have been reconstructed in the course of the year, and do not permit tabular comparison with the figures of a year ago.

NAME.	Prices on Dec. 31, 1898.	Prices on Dec. 30, 1899.	Gain or Loss.
GAS COMPANIES.			
Alliance and Dublin Company, 10 per cent.	21—22	21—22	—
Do. 7 per cent.	16—17	14½—15½	−1½
Australian (Sydney) 5 per cent. Debentures	105—107	102—104	−3
Bombay, Limited	6¼—6¾	5¾—6¼	−½
Do. New, £4 paid	4¼—4¾	4—4½	−¼
Brentford, Consolidated	275—280	273—278	−2
Do. New	210—215	210—215	—
Do. 5 per cent. Preference	140—145	140—145	—
Do. 4 per cent. Debenture Stock	128—133	124—128	−4½
Brighton and Hove, Original	263—268	250—260	−10½
Do. A Ordinary Stock	192—196	183—188	−8½
Bristol, 5 per cent. max.	130—135	130—135	—
British	45—47	43½—44½	−2
Bromley, Ordinary 10 per cent.	26—28	25—27	−1
Do. 7 per cent.	20—22	19—21	−1
Buenos Ayres (New), Limited	9¼—10	8½—9	−1
Do. 4 per cent. Debenture	98—100	98—100	—
Cagliari, Limited	29—30	28—29	−1
Cape Town and District, Limited	14—15	13½—14½	−½
Do. 6 per cent. 1st Mort.	57—59	56—58	−1
Commercial, Old Stock	310—315	305—310	−5
Do. New do.	240—245	240—245	—
Do. 4½ per cent. Debenture Stock	145—150	140—145	−5
Continental Union, Limited	200—205	177—181	−23½
Do. 7 per cent. Preference	187—192	178—183	−9
Croydon Commercial, A 10 per cent.	315—320	335—340	+20
Do. B 7 per cent.	252—257	265—270	+13
Crystal Palace Ordinary 5 per cent. Stock	125—130	130—135	+5
Do. 5 per cent. Preference	140—145	140—145	—
European, Limited	23—24	21—22	−2
Do. £7 10s. paid	17—18	15½—16½	−1½
Gaslight and Coke, 4 per cent. Ordinary	—	104—106	—
Do. 3½ per cent. maximum	—	97—99	—
Do. 4 per cent. Con. Pref.	—	119—122	—
Do. 3 per cent. Con. Deb.	—	96—98	—
Hong Kong and China, Limited	13½—14½	13½—14½	—
Imperial Continental	227—232	212—217	−15
Do. 3½ per cent. Debs. Stk.	102—105	101—104	−1
Malta and Mediterranean, Limited	4¾—5¼	5—5½	+¼
Metropolitan of Melbourne 5 p. c. Deb.	110—112	110—114	+1
Do. Do. 4½ p. c. Deb.	105—107	107—109	+2
Monte Video, Limited	13—14	11—12	−2
Newcastle and Gateshead Consolidated	232—236	220—225	−11½
Do. 3½ p.c. Deb. Stk.	112—115	104—107	−8
Oriental, Limited	7—7⅞	7—7⅞	—
Do. New, £4 10s. paid	6¼—6⅝	6¼—6⅝	—
Do. do. 1879, £1 paid	1⅜—1⅝	1⅜—1⅝	—
Ottoman, Limited	5—5⅛	5¼—5⅜	+¼
People's Gas of Chicago, 2nd Mtg. Bds.	102—105	102—106	+½
River Plate, Ordinary	9—9⅛	10½—11	+1½
Do. 4 per cent. Deb. Stock	98—100	98—100	—
San Paulo, Limited	15—16	12—13	−3
Sheffield, A	242—245	247—249	+4½
Do. B	242—245	247—249	+4½
Do. C	242—245	247—249	+4½

Name.	Prices on Dec. 31, 1898.	Prices on Dec. 30, 1899.	Gain or Loss.
GAS COMPANIES.			
South Metropolitan, 4 per cent., Ordinary	136—139	133—136	−3
Do. 3 per cent., Deb. Stk.	102—105	101—103	−1½
Tottenham and Edmonton, A	—	141—143	—
Do. B	—	102—104	—
Do Deb.	—	113—117	—
Tuscan, Limited	9½—10½	9—10	−½
Do. 5 per cent. Debs. Red.	100—103	98—100	−2½
WATER COMPANIES.			
Chelsea, Ordinary	310—315	305—310	−5
Do. 5 per cent. Preference	168—173	157—162	−11
Do. 4½ per cent. Preference Stock 1875	147—150	140—145	−6
Do. 4½ per cent. Debenture Stock	157—162	148—153	−9
East London, Ordinary	210—215	200—205	−10
Do. 4½ per cent. Debenture Stock	157—160	145—150	−11
Do. 3 per cent. Debenture Stock.	101—103	98—100	−3
Grand Junction 10 per cent. maximum	110—115	107—109	−3½
Do. 4 per cent. Debenture Stock	138—143	131—136	−7
Kent	365—370	348—353	−17
Do. New, 7 per cent. maximum	212—217	200—210	−9½
Lambeth 10 per cent. maximum	295—300	290—295	−5
Do. 7½ per cent. maximum.	225—230	215—220	−10
Do. 4 per cent. Debenture Stock	138—143	135—138	−4
New River, New Shares	432—437	428—433	−4
Do. 4 per cent. Debenture Stock	138—143	133—138	−5
Southwark and Vauxhall, Ordinary.	184—189	203—208	+19
Do. Do. 7½ per cent. do.	170—175	190—195	+20
Do. Do. 5 per cent. Pref.	168—171	160—165	−7
Do. Do. 4 p.c. A Deb. Stk.	138—143	131—136	−7
West Middlesex	290—295	290—295	—
Do. 4½ per cent. Deb. Stock	160—165	147—152	−12
Do. 3 per cent. Deb. Stock	102—105	100—102	−2½

ELECTRIC LIGHTING MEMORANDA.

The Popularity of Electric Lighting Imperilled—The Cost of High Voltage Lighting—Information Wanted—Mr. R. Hammond on the Needs of Dublin.

Recent events in electric lighting "circles" in different parts of the country are considerably exercising the technical mind, and not a little troubling that section of the public which patronizes central station electricity supplies. The shortcomings of so many undertakings when the dark days of winter set in were a great annoyance and disappointment to many influential supporters of the fashionable illuminant; and the defaulting electricians learnt with chagrin that their excuses, which ranged all the way from the engineers' strike to the Transvaal war, were not accepted. People who were left in darkness when they wanted light proved unappeasable by mere words. On the top of these sporadic shortages, came a sudden extinction of the light over another district which had rejoiced in a constant and uninterrupted supply for nearly ten years. This occurrence, as an electrical contemporary confesses, was due to "one of those rare accidents likely to shake the public faith in the reliability of electric supply." Then came the moving incident of the outbreak of fire at Mr. Montague Crackanthorpe's, described in our last week's Electric Lighting Notes (p. 1558); and this was swiftly followed by the deplorable transformer fatality at Bolton. In view of these troubles it is no wonder the "Electrician" regards the popularity of electric lighting as seriously imperilled.

It is impressed on the whole electrical profession by our contemporary that no off-hand treatment of the emergency on the "accidents will happen" line is likely to reassure the public, and restore the shaken confidence of the community in the ability of electricity supply undertakers to fulfil their obligations. The matter is no mere grumbling, as of one customer who feels that he is not so well served as his neighbour next door, or in the district of another company. What the general public are coming to perceive is that all services of the kind are no better or safer than they were a decade and more ago. It is the same old original sins that persist in the grown-up organism which was so severely dry-nursed by the Electric Lighting Act in 1882. The public want a reliable, adequate light at reasonable cost; and they do not want mysterious conflagrations and death-dealing shocks. It is doubtful if many electricians yet realize how much heed the users of electric light pay to these elementary points, and how utterly beside the main point are all the technical frills and feathers which fill the professional papers and periodicals and pass for "progress." What is a saving of fuel appearing in the second place of decimals in the analysis of working costs per unit—what is anything else, to a man who cannot get a light when and where he wants it?

It is unfortunate that just at this juncture many electricity supply undertakings are trying to change their distribution voltage from 100 to 200. People in some of the London electric lighting areas are complaining that their local companies are trying to "coerce" them into consenting to the change by threatening to cut off the supply in the event of refusal, or by raising the price of current to the statutory maximum, and so forth. Of course, electric lighting undertakers have no power to act in any such manner; and it therefore seems foolish to threaten to do so. It appears, however, that the consumer is more often asked to consent to the alteration by the inducement of a discount off the customary charge for current—8 per cent. is named as an offer. Against this advantage, it is alleged that the higher voltage means an increased consumption of current per lamp, and more lamp renewals. The difference is put as high as 25 per cent. to the consumers' light bills on the whole. It would be a satisfaction if some competent and reliable witness would tell the world the truth about this matter. Honestly, we do not know the exact rights of it.

Electricians are very much "on the rampage" in some of the most prominent cities and towns of the kingdom outside the Metropolis. Already, the electric lighting troubles of Dublin are notorious. The Corporation have had several advisers of various degrees of competence and impartiality; and now they have gone back to Mr. Robert Hammond, who has fallen in with the old suggestion, condemned years ago by Dr. Kennedy, to shift the generating station to Pigeon House Fort. Those who are locally interested in the business will doubtless find it edifying to compare Kennedy of 1897 with Hammond of 1899. It is sufficient for us to remark here that the Sub-Committee of the Electric Lighting Committee of the Corporation have just recommended the adoption of Mr. Hammond's scheme, the most notable feature of which appears to be that while the generating plant is to be capable of supplying 63,300 lamps of 8-candle power, there are to be 95,000 lamps returning revenue. It is not for us to say where all these lamps are to be fixed. Mr. Hammond has been over the place, and we have not. He is a sanguine gentleman; as appears from his recommendation to lay out new electricity distributing plant all over Dublin, "in many cases in most unpromising positions . . . . in view of the certainty of the time arriving when gas as an illuminant will disappear from Dublin." There is nothing like taking time by the forelock; but in no pictorial realization of the Man with the Scythe have we seen him portrayed with a tuft of such length as would be that after which Mr. Hammond is fondly feeling. Who was the philosopher who used to recommend "patience and short views" as a good rule of sane and contented living? He seems to be badly wanted in Dublin.

GAS BILLS FOR 1900.

The Bills for the coming session of Parliament relating to gas supply which have been deposited in the Private Bill Office are as follows, beginning with those promoted by Gas Companies:

The Bedford Gas Bill is to enable the Company to raise £40,000 additional share capital, which may be issued as 7 per cent. ordinary or 4 per cent. preference capital. The borrowing powers are to extend to one-third of the new issue.

The British Gaslight and Coke Company, Limited (Staffordshire Potteries), Bill is to authorize the Company to expend for the purposes of the undertaking capital to the amount of £75,000, in addition to the sum of £197,610 already authorized by previous Acts down to 1895. Of the new capital, not more than £50,000 is to be in capital stock of the Company bearing 5 per cent. interest, and the balance is to be borrowed money bearing not more than 4 per cent. interest. All loans to be raised under the Act are to be procured on the best terms obtainable at the time of borrowing. Additional gas lands are to be acquired in Hanley, for the construction of extension works.

The Cleethorpes Gas Bill proposes to convert and consolidate the old capital of the Company into the equivalent sum of 5 per cent. stock, and to increase the amount by £60,000, with power to borrow one-third. The sliding-scale imposed on the Company by an Order of 1879 is to be adjusted. The initial price is 4s. per 1000 cubic feet; and the sliding-scale is to operate in respect of entire years. Additional gas lands are required. The Company propose to take powers for manufacturing and dealing in everything "in any way connected with gas-works or with the supply of gas, as they may from time to time think fit." A certain occupation road is to be stopped up. The insurance fund is to be made applicable to the compensation of workmen. Power is sought for the laying of pipes in undedicated roads, and to use pipes for ancillary purposes. The rate of interest payable on consumers' deposits is to be reduced to 4 per cent. The use of anti-fluctuators may be required for gas-engine services; and the customary clauses are inserted in relation to prepayment in certain cases, the period of error in defective meters, and the exemption of hired-out fittings from distress.

The Gaslight and Coke Company's Bill is to authorize the creation and issue of debenture stock not exceeding the nominal amount of £2,500,000. This new issue would be known as the Second Three per Cent. Debenture Stock, and rank next after the existing Three per Cent. Consolidated Debenture Stock. The amount is one million sterling less than the Company asked for in their last year's Bill. The holding of the Company in certain scheduled lands and hereditaments is to be confirmed; and the Company propose to acquire by agreement other 150 acres of land, not for manufacturing gas or any residual product.

The Glastonbury and Street Gas Bill is to incorporate and confer powers on a Company originally formed in 1862, who obtained an Order in 1892. The present share capital consists of £4575 in original 10 per cent. shares, and £5425 in 7 per cent. shares, with £2200 borrowed money. The Company's limits of supply are to be enlarged to include the parish of Walton, in the rural district of Wells; and the name of the Company is to be changed to the Glastonbury, Street, and District Gas Company. The existing ordinary share capital is to be consolidated and converted into an equivalent amount of 5 per cent. stock, to which £20,000 of new capital is to be added. The loan capital is to be in the proportion of one-fourth. The sliding-scale clause of the Order of 1892 is to be applied to the converted stock. Power is sought for the declaration of an interim half-yearly dividend without the calling of a meeting of shareholders. The Company desire to acquire not exceeding

6 acres of additional land by agreement, not for manufacturing purposes.

The Grantham Gas Bill is to enable the Company to extend their supply to the parishes of Great Gonerby and Barrowby, in the parts of Kesteven, Lincolnshire, and to extend their works. The existing share capital of the Company is to be consolidated into the equivalent amount of 5 per cent. stock, with the addition of £45,000 of new stock. The borrowing powers are to be one-third of the amount of the consolidated stock. Gas of 15-candle power is to be supplied. The rate of interest on consumers' deposits is to be reduced to 4 per cent. Power of inspection of new consumers' fittings is sought, subject to appeal to two Justices from the Company's order to amend.

The Hartlepool Gas and Water Bill is also a stock conversion and consolidation measure. The existing share capital, amounting to £390,000, is to be, "by force of this Act only, and without any other requisite, consolidated and converted into £573,000" Hartlepool Gas and Water Company's five per cent. maximum ordinary stock. The Company desire an addition of £200,000 to their gas capital, at 5 per cent. maximum dividend, with power to borrow one-fourth.

The Kingston-upon-Thames Gas Bill is for general extension purposes. The existing share capital of the Company is to be consolidated and converted into £192,500 of standard 5 per cent. stock, with the addition of £107,500 of new stock. The borrowing powers are to be increased to one-third of all nominal stock issues. Additional gas lands are required. It is proposed to adopt the sliding-scale, with the standard price of 3s. 6d. per 1000 cubic feet. Gas for the public lamps is to be charged at the lowest prevailing price. Pipes for ancillary purposes are to be laid with consent of the Local Authority. Fifteen-candle gas is to be supplied, under detailed prescriptions as to testing. Power is sought to supply gas in bulk, and also to apply for an Electric Lighting Order, but not for the borough.

The Maidenhead Gas Bill is to consolidate and convert the existing share capital into a stock bearing a maximum 5 per cent. dividend, with the addition of £60,000 of new capital, and one-fourth borrowing powers. It is proposed to take the sliding-scale, with the standard price of 4s. per 1000 cubic feet within 1½ miles of the Maidenhead Town Hall, and 4s. 3d. beyond. Gas of 15-candle power is to be supplied, tested on the works.

The Newport (Mon.) Gas Bill is to extend the limits of supply and consolidate the existing capital upon a 5 per cent. basis. Additional capital to the amount of £150,000 is required, with one-fourth loan. A clause provides for the settlement by arbitration of disputes as to the crossing of railways or canals by gas-mains.

The Ossett Gas Bill is to extend the limits of supply and other statutory powers of the Company. The existing share capital is to be consolidated and converted into £69,200 of 5 per cent. stock, with the addition of £50,000 of new capital, and one-fourth loan. The sliding-scale is asked for, with a standard price of 3s. 6d. per 1000 cubic feet for 15-candle gas. A copy of the Bristol clause of last year respecting the control over consumers' fittings is proposed. Power is sought for the provision of workmen's dwellings.

The Redhill Gas Bill is to enable the Company to enlarge their works, and to raise £75,000 additional 5 per cent. capital, with power to borrow one-third. The sliding-scale is proposed, with the standard price of 3s. 6d. per 1000 cubic feet within the borough of Reigate, and 4s. beyond, for 15-candle gas. The existing share capital may be consolidated and converted into a 5 per cent. stock, with the sanction of three-fourths of the proprietors in special general meeting. Demands under £50 are to be made recoverable in the County Court.

The Rugeley Gas Bill is to incorporate a limited Company formed in 1847, and never placed under statutory protection. There is a share capital of £10,000, fully paid up; and £4000 has been expended out of revenue on works extension and improvement. The capital of the new Company is put at £30,000, whereof £20,000 is to represent the original share capital, £4000 is the improvement capital, and £6000 the new capital to be raised—all bearing 5 per cent. standard dividends. A clause is proposed enabling the Directors to take out of, and charge to, revenue account a "renewal fund" payment of 1½ per cent. on the paid-up capital; the maximum amount of such fund being 5 per cent. on the said paid-up capital. This fund is to be applicable to the "renewal and repair" of the gas-works, mains, and pipes. The sliding-scale is asked for, with the standard price of 4s. 6d. per 1000 cubic feet for 15-candle gas. Clause 63 proposes that: "All fittings connected with any service gas-pipe to communicate with the mains and pipes of the Company which shall be provided by any person, shall be placed and removed under the superintendence of the Company, and at the expense of such person." Discounts up to 20 per cent. may be allowed to consumers. The Company desire to be empowered to apply for an Electric Lighting Order

The South Metropolitan Gas Bill has already been summarized in the "JOURNAL" (*see* Vol. LXXIV., pp. 1483, 1496). It is to empower the Company to vary the standard price of their gas from 3s. 3d. to 3s. 1d. per 1000 cubic feet, according as the illuminating power is dropped from 16 to 14 candles. The statutory price is at present 3s. 6d. per 1000 cubic feet for 16-candle gas. New provisions are to be made for the testing of the gas; and the surcharge to users of slot meters to cover the cost of the fittings is not to exceed 9d. per 1000 cubic feet. Provisions are suggested for the regulation of this class of business and its representation in the official accounts of the undertaking. Power is sought for the making of a railway to connect the East Greenwich station of the Company with the Angerstein branch of the South-Eastern Railway Company. A part of the Bill relates to the authorization of the purchase by the Company, by agreement, of the Surrey-side portion of the undertaking of the Gaslight and Coke Company. Another part deals with the form of accounts of the Company, and proposes to show the difference due to stock conversion.

The Wandsworth and Putney Gas Bill is to enable the Company to enlarge their works; taking fresh lands for the purpose and stopping up certain thoroughfares. The existing capital is to be consolidated and converted into "A" consolidated 5 per cent. stock, "B" consolidated 3½ per cent. stock, and 3 per cent. debenture stock. The Company require £300,000 of new 3½ per cent. stock, with one-third in debenture stock. The Company's standard price, settled in 1880, is not to be altered; but the sliding-scale is to be adjusted to the new denominations of capital. Pipes may be used for ancillary purposes. A clause extends the exemption of the Company from the London Building Acts, to structures hereafter to be erected.

The Wolverhampton Gas Bill is to permit the Company to enlarge their works, erect workmen's dwellings, and raise £140,000 of additional 6 per cent. capital, with one-fourth loan. The usual clause requiring consumers to give 24 hours' written notice of their intention to quit premises supplied with gas is slightly varied, to make the consumer liable to pay all dues until 24 hours after he shall have given notice that he has quitted the premises. This liability ceases at the next usual registration, or on reletting. The Bristol clause as to the position of meters, &c., is inserted. Demands under £50 are to be recoverable through the County Court. Penalties are not to be incurred for unavoidable or insignificant defaults in the supply. The power of sale to the Corporation of Wolverhampton included in the Company's Act of 1852 is to be re-enacted.

IRON AND STEEL IN 1899.

REFERENCE was made in the "JOURNAL" last week to some statistics published by the Board of Trade bearing upon the rise in wages and prices in the iron and steel trades. We have now received the "Trade Review" published at the close of each year by Messrs. Bolling and Lowe, which has a higher value than the official statistics by reason of being, in addition to a compilation of figures, a survey of the past year's working and the present situation written by first-hand observers in the metal industries, well acquainted with the commercial world in general.

Messrs. Bolling and Lowe naturally refer with much satisfaction to the present state of the market, and to the greatly increased volume and value of their trade in the past twelve months. Their comparison of prices, comprising those of Middlesbrough pig warrants, Scotch warrants, and hematite warrants, bar iron, steel rails, angles, plates, &c., on the 14th of December with the corresponding prices in the two preceding years, shows an average increase of 35 per cent. over 1898, and 52 per cent. over 1897 figures. Satisfaction at the present state of affairs does not, however, prevent the writers from recognizing that, while they have great hopes that the activity in their trade will last for a considerable time, the existing period of prosperity cannot be permanent or even of very prolonged duration. It can, in fact, only last while Germany and the United States continue to be so largely occupied with supplying home requirements. When these requirements fall off, or when stimulated production overtakes the market, and the time comes for these countries—especially the States—to seek outlets for their surplus production, a rapid fall in prices, both here and on the Continent, will inevitably ensue. That such reaction need not, as we said last week, be immediately anticipated is, however, evident from the fact that, while the output of rails in the States for the past year is estimated at 2½ million tons (chiefly for use in the construction of new, and the relaying of old, lines in that country), it is reported that home orders to the extent of 2 million tons of rails for the ensuing year have already been booked.

The extension of the railways in the United States has indeed been most remarkable; the mileage having exactly doubled in eighteen years. The absolute figures are 186,810 miles of railway in 1898, compared with 93,262 miles in 1880; an increase valued by Messrs. Bolling and Lowe at 1029 millions sterling. The consequent growth of the iron trade in the United States, and her rapid overhauling and passing of our own country in this respect, will be best realized from the following comparison. (The 1870 and 1895 figures are taken from the Board of Trade returns, the 1899 from Messrs. Bolling and Lowe's review.) The production of pig iron in those years was—

	1870 Tons.	1895 Tons.	1899 (estimated) Tons.
United Kingdom	5,963,515	7,703,459	9,000,000
United States	1,665,178	9,446,308	14,000,000

It is, then, obvious what a very serious matter it will be for the iron industries of this country when our friend across the herring pond finds his home requirements much more than satisfied by his production. To those who are, from mere curiosity or more

directly, interested in the relative positions of English and American trade, may be recommended a study of a symposium in the "North American Review" for October, on "The Anglo-Saxon Rivals," and particularly of Mr. Maurice Low's article on "The Decline of British Commerce."

In referring to commercial conditions in the States, Messrs. Bolling and Lowe incidentally make an observation which, when read, appears obvious, but is, in fact, frequently overlooked by those responsible for vast undertakings. The remark is *à propos* to the statement that the gigantic Trusts in America have yet to prove their value to the shareholders and the country, and is to the effect that "to direct concerns working with vast capitals hitherto unheard of in the industrial world, and in some cases under totally new conditions, must require master minds." Who that is intimately acquainted with the inner history of the large amalgamations in the gas world, will, arguing *de minima ad maxima*, fail to appreciate the truth of this observation? The human factor is the determining one; and the greater the undertaking, the greater the power of that factor to make or mar.

On the situation generally Messrs. Bolling and Lowe express the opinion that a high Bank Rate and scarcity of gold will rule for some time to come. Industrial concerns and traders must, under pressure of higher values of materials, be prepared in many cases to find much more working capital than formerly sufficed, and at an increased cost as compared with last year. This, as we have formerly pointed out, is a very good reason for avoiding any but absolutely necessary capital expenditure. We do not believe, as a general principle, in "starving" works; but there are times, of which the present is one, when it is at least advisable to keep them hungry. As to the effect of the Transvaal war on trade, it is pointed out and the fact illustrated that after war both victor and vanquished usually show greater activity in all directions than they did in the preceding time of peace; and the conclusion is drawn that, once the Transvaal troubles are settled, great development will take place all over South Africa. The iron and steel trades, it is clear, can enter upon the New Year without serious misgiving for the near future.

GAS SUPPLY IN GERMANY—THE CREFELD WORKS.

The Continental excursion of the Incorporated Institution of Gas Engineers last autumn brought home forcibly to the minds of many who took part in it the conviction that there was much of value to be learnt from a study of the plant and operations of a modern German gas-works. It is true that the "Journal" had kept its readers posted in the contemporary history of gas supply in Germany, and had pointed emphatically to the great strides which had been made there of recent years in gas manufacture, simultaneously with the immense expansion of general industrial effort throughout that country. But to many conviction arrives only with ocular evidence of the truth of even well authenticated statements; and the autumn excursion of the Institution proved an invaluable eye-opener to some who were fain to believe that British gas-works embodied all that was of value in gas manufacture.

It is not many years since Germany had much to learn from, and nothing to teach, us in connection with the gas industry; but she has latterly advanced to a foremost position in this, as in many other important industries. How rapid has been her advance in the iron industry, for instance, is shown by figures published in the "Zeitschrift für angewandte Chemie." In 1877, she produced only 1900 tons of pig iron, against 6600 tons on the part of Great Britain. In ten years her production had more than doubled; for in 1887 it was 3960 tons, compared with Great Britain's 7560 tons. By 1897, the German output was 6770 tons, and the British 8795 tons. Thus in twenty years Germany succeeded in increasing her production of pig iron to three-and-a-half times its former amount; while the British output increased only by one-third. This is an indication of the progress which Germany is making in an industry which was not long since all but a British monopoly. It is true that simultaneously the United States, with unrivalled natural advantages, had made somewhat faster progress in the iron industry—having advanced from an output of 2065 tons in 1877 to the record output of 9650 tons in 1897—but comparing the resources of the two countries, we are forced to the conclusion that the German progress is the more meritorious. In the gas industry, we do not find so clearly marked an advance in Germany; but the conditions obviously are dissimilar, as the area of supply is of necessity restricted in the case of each gas-works. There is no import and export of illuminating gas; each country and each town must be its own producer. Making due allowance for this limitation of the development of gas-works, we must admit that, relatively to other countries, Germany has made as much progress in the gas industry during the last quarter of a century as she has done in the iron industry. We do not propose now furnishing exhaustive evidence of the correctness of this proposition, which we believe few readers will attempt to gainsay, but will merely draw attention to the progress the last few years have witnessed in one German gas-works, of which a most exhaustive annual report has just come to hand.

The works referred to is that of Crefeld, a town of about 108,000 inhabitants in the Rhine Provinces of Prussia. It is the seat of the silk and velvet manufacture of G[illegible] in other respects is an important industrial centre. Since 1871, its population has nearly doubled. The gas supply is now in the hands of the Municipality, who acquired it in July, 1896. There were then two works, of which one was capable of producing 106 millions, and the other 141 millions per annum. Since then the second of these two works has been greatly enlarged; and further extensions are in progress. The total make of gas during the year ending March 31 last was 301,975,000 cubic feet, of which 231,735,000 cubic feet was made at the second works, which are in the St. Töniserstrasse. The increase over the total make of the preceding year was 12·22 per cent. The unaccounted-for gas, however, reached the large proportion of 11·88 per cent. of the make; and therefore the gas sold was only 266,100,000 cubic feet. Of this, 57·25 per cent. only was for illuminating purposes—viz., 8·36 per cent. for public lighting, 5·69 per cent. for lighting public buildings, 41·42 per cent. sold to private consumers, and 1·78 per cent. for lighting on the works. Of the remaining 42·75 per cent., 9·74 per cent. was used in gas-engines, and the remainder for heating, cooking, and industrial purposes. The amount taken for gas-engine use showed the large increase of 22·38 per cent. over the amount sold for the same purpose in the preceding year, owing to an increase of 28 in the number of motors, representing an increase of 241 in horse power.

It is difficult to compare the quantities of gas consumed for different purposes with the amounts used for similar purposes in English towns, because it is not the custom in this country to provide separate services. There is no question, however, that the proportion of gas sold for purposes other than lighting in Crefeld is very much higher than generally obtains here. The difference is due chiefly to the fact that differential prices for gas are the rule in Crefeld, as in most German towns. Gas for illuminating purposes is charged for at prices ranging from 2s. 10d. to 5s. 6d. per 1000 cubic feet, according to the quantity taken by the consumer in the course of the year. Gas for other purposes, however, is sold to all alike at the universal price of 2s. 10d. per 1000 cubic feet. As a matter of fact, only the larger customers obtain gas for illuminating purposes at a less price than 5s. 6d., for that is the rate charged except the amount consumed exceeds 211,860 cubic feet per annum. The average price obtained for gas used for illuminating during the last year was, however, only a little over 5s. per 1000 cubic feet. Only two consumers obtained their supply at the lowest rate of 2s. 10d. per 1000 cubic feet. Had all the consumers been charged the average price of 5s., these two consumers would, we gather, have had to pay some £1400 per annum more for their gas; and it is not unlikely that they would, under such circumstances, have found an electric lighting plant a profitable investment. The Crefeld report, moreover, indicates that the low price being charged for gas used for other purposes than lighting creates a large demand. Had gas been sold at the uniform price of 4s., which is about the average of the prices actually obtained, it is certain that considerably less would have been sold for purposes other than lighting. Whether the low uniform price would have brought up the illuminating consumption sufficiently to compensate for the decreased sales for other purposes, is a moot point, which each of our readers will decide according to the bent of his sympathies. It may, however, be pointed out, in extenuation of the German policy of charging a high price for gas for lighting purposes, that in that country the only alternative popular illuminant—viz., petroleum—is also dear, owing to heavy import duties. Consequently, the German gas manager does not feel so intensely as his English *confrère* the necessity for selling illuminating gas at the lowest possible price, in order to meet the competition of duty-free petroleum. But there appears to have been no reason why gas should not have been sold at Crefeld at a uniform price of a little over 3s. per 1000 cubic feet, had the Municipality been content to forego a profit of some £11,500 on the year's working. The practice, however, of selling gas at abnormally high prices in order that profits may be made for the municipal coffers, is one with which we are familiar in the case of many English municipal gas-works. We regret to find the system prevails also at Crefeld and other Continental towns.

The coal carbonized during the year ending March 31 last amounted to 29,630 tons, and cost on the average nearly 13s. 3d. per ton. The cost was lower than in previous years. The make of gas per ton of coal was 10,260 cubic feet; and the yield of coke was 70·82 per cent. of the weight of coal carbonized. The coke consumed in the retort furnaces amounted to nearly 27 per cent. of the coke obtained, corresponding to 19 per cent. of the coal carbonized. The average price secured for the coke which was sold was nearly 12s. 6d. per ton. The crude gas liquor contained on the average 1·55 per cent. of ammonia—*i.e.*, the liquor was of about 7 "ounces" strength. It was worked up into concentrated liquor, containing on the average 19·75 per cent. of ammonia. The returns from the manufacture and sale of this concentrated liquor amounted to 1½d. per 1000 cubic feet of gas sold. The washing and scrubbing plant worked very satisfactorily; and the average amount of ammonia found in the finished gas was only 0·4 grain per 100 cubic feet. Sulphuretted hydrogen was occasionally present in traces in the purified gas; but the sulphur compounds as a whole did not, on the average, exceed 9·2 grains of sulphur per 100 cubic feet. This unusually high degree of purity was, so far as one can judge from the report, secured by the use only

of oxide (or perhaps one of the preparations consisting chiefly of ferric oxide which are extensively used on the Continent) as a purifying material. Clearly, therefore, the coals carbonized must have had an uncommonly low content of volatile sulphur. The oxide was used, however, with scrupulous care, in order to facilitate the recovery from it of the cyanogen compounds present in the gas. As is well known, it is essential to the production of ferrocyanide in oxide from these compounds that the gas entering the purifiers should be virtually free from ammonia; and it is further necessary, in order to prevent the ferrocyanide being broken up, that the heat of the mass during revivification should not become excessive. By due attention to these essential points, the Crefeld works produced spent oxide yielding over 6 per cent. of prussian blue, and containing very little of the objectionable alternative cyanogen products—viz., sulphocyanides. The value of the prussian blue recovered from the spent oxide more than sufficed to recoup the works for the cost of new oxide.

In these and other matters, the works laboratory rendered invaluable assistance; while it also carried out large numbers of testings of a very interesting character, but of less direct utility to the works management. Among these, may be quoted periodical analyses of the gas delivered to consumers, from which it appears that the following represents its mean composition in percentages by volume: Carbonic acid 1·85, heavy hydrocarbons 3·53, oxygen 0·26, carbonic oxide 7·22, methane 33·74, hydrogen 47·96, and nitrogen 5·44. The average illuminating power of the gas was such that, if the testings had been made on the English methods, it would have been returned as about 14 candles. The management recognized the continually increasing importance of high calorific value; and the gas was examined almost daily with a Junkers calorimeter. Its mean calorific value was rather more than 150 calories per cubic foot, which is very good for 14-candle coal gas. The average specific gravity of the gas was 0·396. The amount of water formed by combustion of a given volume of the gas was also ascertained, and found to be equivalent to 418 grains per cubic foot.

The comprehensiveness and close attention to detail which characterize the laboratory operations appear to have extended to all parts of the works, though naturally they cannot be indicated by such evidence as the analytical data quoted above affords in the case of the laboratory. We have, however, now said enough to show that the Germans are mastering the *technique* of gas manufacture with the same thoroughness which they have brought to bear on many other industries which were once almost restricted to British enterprise. Many points to which the German gas manager gives attention are regarded by his English *confrère* as insignificant, and unworthy of care amid the manifold operations which cannot be neglected, if consumers are to obtain a more reliable supply of gas than the fickle current which electricity supply works grant their customers. But the German gas manager has an equal responsibility in this respect, though we admit he is rarely so restricted in regard to the quality of his gas supply as are many English managers. Yet is he able to turn also to the many apparently trivial details of manipulation and procedure which bridge the gap intervening between our present practice and perfection in gas manufacture and distribution. Many of us may learn much from an intelligent study of a progressive German gas undertaking, such as that of Crefeld, and no one will find the study totally fruitless.

THE MUNICIPAL LIFE OF GLASGOW.

Under the title of "Notes on Municipal Work from November 1896, to November, 1899," Sir David Richmond has recently presented to the Corporation of Glasgow a *résumé* of the work done by the Municipality in the three years during which he filled the office of Lord Provost of the city, with special reference to the inauguration of any new schemes for the benefit of the citizens, or the extension and development of existing lines of policy. We have received a copy of the report,* and abstract some of the facts most likely to interest our readers.

Sir David entered the Council in 1879; and the intervening twenty years have seen great changes in the very progressive and much municipalized city of Glasgow. In 1879, the area of the city was 6111 acres, the population 505,000, and the valuation of lands and heritages £3,432,112; whereas at the present time the city comprises 12,688 acres, with a population of 747,222, and a valuation of £4,780,000. The work of the Corporation has, however, increased at an even greater ratio. New departments—such as tramways, electricity, baths and washhouses, municipal buildings, and sewage disposal—have added their burden to the shoulders of the Corporation; while the older departments have grown amazingly. The details of this work are fully set out in Sir David's report. Among the subjects specially referred to, are the promotion in Parliament of important Bills to obtain powers to carry out works in connection with the city improvements, tramways, gas, sewage, and other departments, involving the expenditure of two to three millions sterling; the projected substitution of electric traction for horse power on the tram lines; the rebuilding of the congested areas in the poorer quarters; the practical completion of the duplicate aqueduct from Loch Katrine; the obtaining of powers for the erection—at an estimated cost of a million sterling—of the new Provan gas-works; the erection of the Port Dundas and Pollokshaws Road power stations for the Electricity Department, and the acquisition of the undertaking of the Kelvinside Electricity Company; the extension of the electric lighting of the city; and many other subjects illustrating the onerous and diversified tasks undertaken by the Glasgow Municipality. This vast bulk of enterprise entails, of course, the use of a large amount of capital, obtained by means of Corporation loans (amounting, on May 31 last, to £7,669,340), in connection with which Sir David points out that, owing to the low average rate of interest and the marvellous growth in the assessable rental of the city, the burden of increased and increasing debt has not been appreciably felt. But he thinks it necessary—a notable fact—to warn the members of the Corporation that, "unless capital expenditure is kept within bounds, and made to correspond with the expansion of the city, the growing charges for interest and sinking fund will necessitate in the near future increases in rates and taxes." Coming from such a source, it is to be hoped that this warning will not be unheeded. The Lord Provost points out, with justifiable satisfaction, that Glasgow has been able to borrow very cheaply—"more cheaply, probably, than any other Municipality. The rate of interest reached its lowest level about three years ago, when the Corporation obtained par for 2½ per cent. stock." Since then various causes, chief among which has been the great expansion of trade, have tended to raise the value of money, and thereby to lower the market price of gilt-edged securities. The most striking departure in the financial operations of the Corporation during the period under review was, in Sir David's opinion, the issue of Glasgow Corporation promissory notes, which proved a very successful method of raising money. The London County Council have similar powers to those possessed by Glasgow; but the latter city claims to have pioneered the innovation.

The review of the work of the Gas Department shows very clearly the rapid increase in the sale of gas in the city, in spite of the activity of the rival Electricity Department. The annual output of the gas-works rose in the last three years from 4812 million to 5772 million cubic feet—an increase equal to about 6½ per cent. per annum. To provide for the increasing demand for gas, capital to the amount of £278,566 was spent, chiefly on a retort-house and fittings at Dawsholm, a gasholder, retort-house, purifiers, and other plant at Tradeston, and a gasholder at the Temple works. It was also necessary to lay a further 60 miles of mains, and to spend nearly £50,000 on new meters. The Dawsholm and Tradeston chemical works, owned by the Corporation, but worked by contractors, have been altered and enlarged in order to deal with the increased make of tar and ammoniacal liquor. The large increase in the sale of gas is ascribed by Sir David Richmond in great measure to the reduction in the price, in 1896, from 2s. 4d. to 2s. 2d. per 1000 cubic feet—a price (the lowest on record for Glasgow) contrasted by him with that of 4s. 7d., which was being charged when the Corporation took over the gas supply in 1869. The works now supply an area 15 miles in extreme length by some 10 miles in extreme breadth. Reference is made to the Provan gas-works now in process of construction—rendered necessary by the fact that the Dalmarnock works did not permit of extension. It is intended to close the latter on the opening of the Provan works, which are designed for the manufacture of about 40 million cubic feet a day, or more than double the capacity of all the existing works put together. The record daily delivery was that of 31,124,400 cubic feet on Jan. 29, 1899. It is obvious therefore, that the new works will provide a considerable, margin for increased consumption. The Dalmarnock works are being heavily written down, in view of their eventually being closed.

The Water Department has, besides the ordinary work of supply, been occupied during the past three years with the final stages of the new aqueduct from Loch Katrine to Glasgow, which, with the subsidiary works, has been in course of construction for some years; the necessary powers having been provided by the Act of 1885. Of the total length—23½ miles—of aqueduct to be constructed, 22¼ miles are actually completed, and in use; and the remaining 1¼ miles will very shortly be finished. Other work at Loch Katrine, which it was expected, at the time of Sir David's report, would be completed by the end of last year, will enable the water in the loch to be raised to a height of 5 feet above the present top-water level, thereby increasing the storage capacity of the loch from 5623 million to 9849 million gallons. This raising of the level of the famous loch has involved considerable labour in the replacing of the shore-roads and the felling of the timber on the banks, which will be thereby submerged. This work has been done by the employees of the Water Department; but the actual dam as well as the outlet works have been executed under contract. The additional supply rendered available by the new aqueduct, as far as already completed, has resulted in a considerable improvement in the pressure and constancy of the supply in the higher districts of the city and suburbs. The consumption per head of population has risen in the three years from 50 to 54 gallons per day. The hydraulic supply works are using an increasing quantity of water; their consumption at present exceeding 90,000 gallons per day. Careful soundings of Loch

* Published by Robert Anderson, Glasgow.

Katrine have determined the depth to be 751 feet—a depth which tends to keep the water cool in summer and warm in winter, while it is said to contain fewer micro-organisms than the water in some of the shallower lochs in the district. Attention is called to the material reductions made in April last in the charges for water; the rate being lowered from 6d. to 5d. in the pound, and the charge for water by meter being reduced from 33s. 4d. to 30s. per 100,000 gallons. The reductions are estimated to cost the revenue account £18,000 per annum. The revenue had, however, risen in the three past years from £189,713 to £216,744; so that the lower rates are evidently justified. The department has expended just on a quarter of a million sterling in the three years; and the capital cost of the undertaking now stands at just over 3¾ millions.

The Electricity Department has also been very busy during the term of Sir David Richmond's office; the capital account thereof having risen from £131,962 to £339,782. This heavy expenditure, necessitated by the constantly increasing demand, has been upon the provision of two large storage batteries—the largest in the United Kingdom—giving a combined supply equal to 700-horse power for two hours, and two new generating stations. £37,000 was also spent on the acquisition of the Kelvinside Electricity Company's undertaking. The Kelvinside is a rapidly growing district; but the works, though at present only small, are capable of considerable extension. The quantity of electricity sold in the third of the three years reported upon was practically double that in the first; being 2824 thousand units in 1898-9, as compared with 1498 thousand units in 1896-7. The Corporation now charge private consumers on the demand-indicator or "Brighton" system. The average prices charged in the years ended May 31, 1897, 1898, and 1899 were 5·09d., 4·36d., and 3·89d. per unit respectively.

In connection with the subject of public health in Glasgow, the report specially mentions that two smoke inspectors were appointed a few months ago to deal with the smoke nuisance. On this question, Sir David says:

> The delicacy and difficulty of the work is quite recognized—that, on the one hand, there may be no avoidable interference with our manufacturing industries, while, on the other, the best possible atmospheric conditions are secured for the general community. Care will, however, require to be taken that the Corporation do not assume responsibility by their inspectors making suggestions as to the adoption of any special machinery or alterations on works—the responsibility for taking whatever steps are necessary for the prevention of smoke nuisance must rest with the manufacturers. It is hoped that, by a quiet, firm, and constant pressure, the improvement which we all (manufacturers and non-manufacturers alike) so much desire may be gradually effected.

The outcome of this attempt to obtain the longed-for smoke nuisance abatement will be watched with interest, and not least by the other Richmond in the field.

From the section on sewage purification works, we learn that a determined effort is to be made to restore the Clyde, "which for so many years has been little better than an open sewer," to something like purity. The cost will be between one million and a million-and-a-half sterling.

We have now touched briefly upon all the points of special interest to our readers; but the whole report is worthy of study. Its perusal gives one the impression that in Glasgow the citizens just elect the Corporation—the Corporation do all the rest.

PROMOTERS IN PARLIAMENT.

The paramount interest of news from the seat of war has for some time, and necessarily, overshadowed various subjects which under normal circumstances would have been prominently noticed in the newspapers. Law reports have been ruthlessly curtailed to suit the exigencies of space, and important legal decisions which on other occasions would have furnished texts for leader-writers have been allowed to pass almost unnoticed. Even in times of peace and quietness, the results of trials on circuit receive briefer treatment than those disposed of at our Temple of Justice in the Strand, though the *venue* is not always a fair test of the importance of the litigation. Be that as it may, the case of *Jackson v. Clough*, recently tried by Judge and Jury at Leeds, deserves, for various reasons, attentive consideration at the hands of all who are concerned with the promotion and flotation of joint-stock companies. In the form of the action there was nothing unfamiliar. Mr. F. S. Jackson sued Mr. W. O. Clough, M.P., for damages in respect of alleged false and fraudulent misrepresentations, and also of certain alleged untrue statements contained in the prospectus of the India-Rubber Company, Mexico, Limited. Stated without undue technicality, the plaintiff's grievance was (1) that he was induced to underwrite £2000 in debenture stock of the above Company by the representation that the defendant, who was connected also with a concern called the Mexican Finance Corporation, Limited, had made no promoter's profit on the transfer of certain india-rubber estates; (2) that the India-Rubber Company, Mexico, Limited, did not acquire, notwithstanding affirmative representations, two large estates upon which there were 350,000 trees available for tapping.

According to the plaintiff's Counsel, Mr. Clough was the projector of the whole enterprise, having acquired the Mexican property which was to be resold first to the Finance Corporation and then to the India-Rubber Company. On the other hand, Mr. Clough disclaimed all intention to mislead Mr. Jackson or anyone else; and he pointed to the report of an expert (Mr. Abram) as justifying all that had been put forward in the prospectus of the Company. It appeared that in 1889 somebody acquired the concession, and a condition of the purchase was that the concessionaires bound themselves to plant in the first year 300,000 trees, and in each subsequent year 550,000 trees, until a total of 15,000,000 trees was reached. They were to be planted on the Pacific Coast—rather a vague locality. At any rate, events proved at the trial that the trees never had been planted on the estates which were put forward as an excellent investment for the British public. In short, the amazing failure of those concerned to distinguish between the past tense and the future tense—between what was promised and what was performed—seems to have been at the root of the entire *fiasco*. But what of the expert's report? This might have availed to cover Mr. Clough's position, but for the Judge's view that the defendant already had before him data which made it incredible that Mr. Clough could have believed what the expert had to say on the subject of these evanescent rubber trees. One broad and striking fact was patent. In 1891 there were no trees on the estate; but now, according to the expert, there were 30,000, and a sufficient number of them ready for tapping to the tune of £70,000 to £80,000 a year!

But Mr. Clough was not the only member of Parliament upon whom the presiding Judge—Mr. Justice Grantham—had strictures to pass in connection with this extraordinary example of company promotion. It seems that Mr. Allen, M.P., was sent out to Mexico to inspect and report on the position of affairs. But his Lordship's difficulty was to discover what Mr. Allen did when he got there, and in what way he earned the £1900 which was paid to him for his services. Taking one consideration with another, Mr. Justice Grantham hinted plainly to the Jury that the House of Commons nowadays is used for other purposes than politics, and that the lobbies of the House are the "happy hunting-ground" of the company promoter.

Undoubtedly, this India-Rubber case does give rise to very suggestive reflections, both as to the ethics of company promotion and the use or abuse of the initials "M.P.," and all that those once-respected initials imply. But the point of more practical importance is that which is involved in the value of an expert's opinion. Let it be clearly understood that directors cannot in all circumstances shelter themselves behind these so-called "expert" opinions of others. Section 3 of the Directors' Liability Act, 1890, while making directors liable for statements in a prospectus "not purporting to be made on the authority of an expert," expressly qualifies the exemption by requiring it to be proved not only that the protected statement was made on such authority, but that the director had reasonable ground to believe, and did up to the time of allotment believe, that the statement was true. Moreover, the belief must not be merely a blind belief; and the director will still remain liable, in spite of the most glowing report that an imaginative or unscrupulous expert ever compiled, if it be proved that there was "no reasonable ground to believe that the person making the statement, report, or valuation was competent to make it." The term "expert," it should be added, includes, for the purpose of the Act, "any person whose profession gives authority to a statement made by him." In the Leeds case, the learned Judge and the Jury (who returned a verdict against Mr. Clough) considered that that gentleman was not entitled to "take cover" behind Mr. Abram. In short, the lesson of the trial is that directors should be as critical of the experts they employ as shareholders should be of their directors.

MINOR LOCAL AUTHORITIES AND WATER AND DRAINAGE QUESTIONS.

The ineptitude of local bodies of the minor sort in dealing with questions of water supply and drainage has on many occasions furnished the theme for critical comment in the "Journal;" and the action, or inaction, of the Havant Urban District Council in regard to these vital problems is quite in accordance with familiar traditions. It seems that two places called Darranth and Redhill are outlying portions of the Town of Havant, which includes within its boundaries the pumping-stations and main sources of supply of the Portsmouth Water Company. Havant itself, therefore, possesses in the matter of water supply advantages which might fairly be envied by most towns of equally small population. The two outlying districts above mentioned, however, are not at present included in the Company's area; but the Company have long been ready and willing to supply the district with water, provided the District Council will guarantee the minimum revenue contemplated by the Legislature. In the minds of the members and officers of the Council, considerable doubt appears to have existed with respect to the intentions of Parliament; and it may be gathered, from some remarks made at a recent meeting, that the subject has repeatedly engaged the attention of the members of the Council sitting in Committee. We may point out that the position is governed by section 35 of the Water-Works Clauses Act, 1847, which, after enacting that a supply of pure and wholesome water for domestic use shall be provided and kept in the pipes for those who are entitled to demand a supply, goes on to declare that "the

undertakers shall cause pipes to be laid down and water brought to every part of the town or district within the limits of the Special Act whereunto they shall be required by so many owners or occupiers of houses in that part of the town or district as that the aggregate amount of water-rate payable by them annually at the rate specified in the Special Act shall be not less than one-tenth part of the expense of providing and laying down such pipes." There is a proviso that no such requisition shall be binding on the undertakers unless the owners or occupiers shall severally execute an agreement binding themselves to take such supply of water for three successive years at least.

Of course, in the whole of the Water-Works Clauses Act there is no more familiar section than the one just cited. But the Havant Council seem to have thought that the enactment did not enable the Council as a Local Authority to give the statutory undertaking. This desire to keep scrupulously within their powers may, in some respects, be commendable; always assuming that the wish was not "father to the thought." If, however, the Portsmouth Water Company were prepared to accept the responsibility of the Council, it is difficult to understand why so much diffidence has marked the conduct of those whose plain duty it is to see that their constituents are provided with one of the prime requirements of life. At any rate, there need be no further hesitation on the part of Havant. The Local Government Board, when appealed to for guidance, advised the District Council that there is nothing to prevent them from giving the Company the required guarantee, and, in effect, that it ought to be given. This official view of the scope of section 35—a view which doubtless is based on an authoritative legal opinion—may be commended to the careful attention of other District Councils throughout the country. Meanwhile, all excuse for further procrastination on the part of the local body immediately concerned is absolutely at an end.

In connection with the question of drainage also, official correspondence with the Havant District Council affords at the same time another lesson which in various quarters should be laid to heart. Not very long since, the same Water Company had to set the Public Health Act in motion for the purpose of compelling those who bear rule in Havant to dispose satisfactorily of the sewage of their district—a question necessarily of vital moment to the Company and the population of Portsmouth. The outcome of the inquiry entirely justified the action of the Company. But the local idea of dealing with this important problem may be gathered from another letter addressed by the Local Government Board to the District Council. The following is the most significant portion of the communication: "The Board gather that it is proposed to discharge the effluent from septic tanks and filter-beds direct into the mill-stream; and they direct me to state that they are not prepared to accept as satisfactory any scheme of sewage disposal which does not provide for the treatment of the sewage effluent upon an adequate area of suitable land prior to its discharge into the stream." The brilliant notion of the Havant Authority seems to have been to borrow money first and work out the drainage scheme afterwards; but the Local Government Board plainly intimate that this method of putting the cart before the horse is not in the fitness of things. The first step, of course, should be to settle a provisional agreement for acquiring land suitable in area and situation for treating the sewage effluent. If the mill-stream were to be poisoned in the manner contemplated, the remedy for Havant's present sanitary shortcomings would probably prove infinitely worse than the disease.

The Bronze Coinage.—In the "JOURNAL" for the 19th ult., reference was made to the difficulty arising from the scarcity of coppers owing to the largely extended use of "penny-in-the-slot" gas-meters and other machines of like character for the automatic delivery of commodities. This "shortage" was felt notwithstanding a very great increase in the number of bronze coins struck at the Mint last year as compared with 1898; the numbers being 42,413,700, against 26,902,096. The value of the bronze coinage issued last year for the United Kingdom was £130,055; whereas in 1898 it was only £75,070.

Mr. C. Vernon Boys, F.R.S., on "Fluids in Motion and at Rest."—We are not surprised to read that a great audience, composed nominally of juveniles, but mainly of middle-aged and elderly people, were charmed last Thursday with the first of the six "children's" lectures on the above subject which Mr. C. Vernon Boys, F.R.S., one of the Metropolitan Gas Referees, is delivering at the Royal Institution. Many of us remember how the late Professor Huxley used to delight us with his discourses on natural history, at the Museum of Practical Geology and elsewhere; and we know with what interest Mr. Boys can invest so common an object as a soap-bubble. It may therefore be concluded that his lectures will be profitable to a far larger audience than that for which they were originally intended. The first lecture of the course is noticed here mainly to call attention to the fact that, when describing the action of the syphon, Mr. Boys took the opportunity of enlightening his adult hearers on the subject of the testing of London gas, in connection with which he described Mr. Vernon Harcourt's pentane lamp, and stated that this instrument, by providing a light which was always steady and constant, deserved to be called a Godsend to the gas examiners.

OBITUARY.

We regret to record the death, on the 14th ult., in his 64th year, of Mr. WILLIAM FALKNER, who was for thirty years Manager of the Romsey Gas Company. He had been ill for some weeks; and his son, Mr. F. Falkner, had been attending to his duties. Owing to his long residence at Romsey, deceased was very well known, and was widely respected.

Mr. JOHN BAIN, a well-known coal traveller in Glasgow, who did a large business with gas managers, met with an exceedingly sad death in that city on the evening of Thursday, the 7th ult. He resided in Kirkintilloch, and the 10.45 p.m. train for his home had just started from Queen Street Station when he was observed running up the platform as if to get into it. It is not very clear what happened, but it is surmised that he had attempted to get into an open brake-waggon, but had missed his hold. He fell between the waggon and the platform, and the wheels of two waggons in the rear ran over his right arm and leg, shattering both of them. The poor sufferer was taken to the Royal Infirmary, where he died in the course of the night. Mr. Bain was of a lively temperament—in fact, he overflowed with cheerfulness. He regularly attended meetings of gas managers, and was always the centre of a mirthful group. He was so much respected that his funeral was made a public one.

The Kingston Gas Company have just sustained a great loss by the death, early on Christmas Day, of their Chairman, Mr. PHILIP JONES. Deceased had for a long time been troubled with an asthmatic affection; but, although in his 82nd year, he was attending to business on the day prior to his death, notwithstanding the fog which prevailed. Mr. Jones's connection with the Company dates back 36 years; he having in 1863 been appointed an Auditor. The duties of this office he discharged till Aug. 26, 1880, when he was elected to a seat on the Board. On Nov. 3, 1892, he was appointed Chairman, in succession to Mr. J. Page, deceased, and he continued to discharge the duties of this office up to the time of his death. The Directors met last Thursday—the Vice-Chairman (Alderman Bedford Marsh, J.P., presiding—and, out of respect for the memory of the deceased, and the cordial relations which had ever existed between them and their late colleague, they decided to adjourn for a week. The Secretary (Mr. J. A. Fricker) was directed to send to the deceased's relatives a letter expressing the deep sympathy and condolence of the Board with them in the bereavement they have sustained, and a sincere acknowledgment of the lengthened and valuable services which Mr. Jones had rendered to the Company. Deceased had resided in Kingston nearly all his life, and had been a member of the Town Council, an Alderman, an Overseer, a Charity Trustee, and a Justice of the Peace. The funeral took place last Saturday.

PERSONAL.

Mr. J. W. GIBSON is to succeed his brother, Mr. Brooke Gibson, as Manager of the Haverhill Gas-Works.

Mr. F. J. FALKNER has been appointed Manager and Secretary of the Romsey Gas Company, in succession to his father, whose recent death is noticed above.

The Gas Committee of the Bingley District Council have accepted with much regret the resignation of Mr. G. DUNBAR MALAM, their Engineer and Manager, referred to last week; and his engagement will terminate on the 31st of March. It will be seen, from an announcement which appears elsewhere, that the Committee are inviting applications for the position.

The funeral of the late Mr. JOHN WILLIAMS, Secretary of the Devonport Gas Company, whose death was recorded in the last issue of the "JOURNAL," took place on Sunday, the 24th ult., at the cemetery at Milehouse, Devonport. Eight employees of the Company were the bearers; and the different departments were all represented. Among the wreaths was one from the office staff, and another from the workmen.

The Finance Committee of the Birmingham Corporation have decided to recommend Mr. THOMAS H. CLARE for the position of City Treasurer, in succession to the late Mr. W. R. Hughes. Mr. Clare has been closely associated with the City Treasurer's Department for many years. He was originally with the Birmingham Gaslight and Coke Company; but when the undertakings were acquired by the Corporation in 1875, he entered the service of the Gas Department. He remained there until 1887, when he was appointed Deputy-Treasurer.

Among the New Year honours conferred by Her Majesty, we are pleased to notice the dignity of a peerage for Sir JOHN LUBBOCK, Bart., M.P. In addition to being head of the banking firm of Messrs. Robarts, Lubbock, and Co., Sir John is a Director of various Companies, and President of the Association of Bankers. His elevation calls for notice here from the fact that he is a careful scientific observer, and has been President of several learned societies. He also did good work as Vice-Chairman of the London County Council from 1888 to 1890, and as Chairman from 1890 to 1892. Addressing the Council, at their meeting on the 2nd of June in the last-named year, on the proposed acquisition of the London Water Companies' undertakings, he confessed to being one of those who believe that undertakings of this character are, as a rule, more economically managed by private enterprise than by public bodies. This opinion he has held ever since; and it may be said that generally he is averse to Municipalism.

NOTES.

A Suggested Theory of Light.

A correspondent of the "Engineer" offers, very tentatively, a solution of the problem of the transmission of light, which he describes as a modification of Newton's corpuscular theory. It is pretty generally admitted that there are grave difficulties in the way of complete faith in the undulatory hypothesis, and especially that the supposititious ether of the physicist is strained almost beyond any reasonable burden in the endeavour to make it carry all the phenomena now associated with light. Consequently, there are those who are inclined to think that the corpuscular theory may not be quite dead. The great objection to it, in its simplest expression, is that it is inconceivable that any particle of ponderable matter flying at the velocity of light, or 198,000 miles per second, could come into contact with the eye without destroying it. The suggestion put forward is that it is feasible to imagine light transmission as going forward by impulse through a chain of perfectly elastic little spheres, all in contact, like a row of pyramid balls on a billiard table. Unhappily for this idea, the mechanism described is familiar to physicists, who employ it to illustrate other concepts of natural forces and agents; but it would not explain the phenomena of light and analogous radiations without exercising the scientific imagination even more exhaustingly than the ether itself.

Domestic Uses of Gas.

A writer in the "Ironmonger" discourses very entertainingly on the tendency of inventors to devote their cleverness to the production of things which nobody wants, while neglecting crying needs of the age. He remarks that now is the golden time for inventors to look into other matters than safety sash-fasteners, of which there is already a glut, or such inutilities as "egg-top chippers," or "incandescent mantles which are a palpable piracy of existing patents;" and to turn their attention to devices for the saving of domestic labour. The existing dearth of household help is no passing phase of the labour market, but is the pressure which will bring about a thorough revolution of the working methods of middle-class households. In this emergency, there is the opportunity for the introduction of labour-saving methods and appliances with the object of reducing the drudgery of housework to its narrowest possible limits. It is remarked that "many domestic operations hitherto performed by hand can be lightened if proper forethought in the furnishing and decoration of rooms is exercised; and what with the use of machines for cleaning knives and forks, sweeping carpets, lighting fires, chopping meat, and (most precious of all) gas-stoves for cooking and heating, an enormous amount of work ordinarily involving much muscular exertion and the creation of endless dust and dirt may be avoided." If candid, unpretentious little local conferences of housewives could be held for the discussion of domestic labour-saving devices, progress in this direction would perhaps be more rapid than it is.

The Cost of Tar Macadam.

The "Builder" concludes its recommendation of tar macadam for common roads by giving some particulars of the cost of specimen works. Naturally, the cost of such macadam as is usually laid down for roadways varies with the amount of preparation of the ground that may be necessary. Where the road is an old one, and the foundation exists ready made, the only preparation required is stripping off the bad top and making good any weak places that may be discovered in the old foundation. When the road is quite a new one, the cost of making the foundation may be very considerable—as much, possibly, as 30 per cent. of the total. In a job of the kind at Canterbury, about 40 cubic yards of tar and pitch macadam were prepared from 45 yards of pit gravel, 79 gallons of tar, 284 lbs. of pitch, with 84 bushels of coke, and 30 bushels of breeze. The wages for preparing and mixing came to £7 18s. 7d.; and the cost of the other items would, of course, vary. In this case, the pitch and tar together cost about £1. The total cost of the mixture works out to 9s. 2d. per yard; and was laid to a thickness (compressed) of 4 inches. It therefore cost 18d. per yard super. The cost of stripping, ballasting with broken brick, laying the tar macadam in three coats, rolling, and finishing was 3s. per yard super. So that the total cost of the road was 4s. 6d. per yard super; calculated to last seven years, with annual repairs at 2d. a yard. At Croydon, where the original foundation was not disturbed, but the tar macadam laid directly upon it to a rolled depth of 8 inches—some of the old road metal being used up for the lowest layer of tar macadam—the total cost was not more than 3s. 6d. per square yard.

The Making of Good Iron Oxide Paint.

M. Ligot, of Auderghem, Belgium, contends, in a letter to the "Engineer," that an experience of nearly 50 years has demonstrated the superiority of a particular kind of iron paint as a preservative of iron, over every other preparation intended for the same use. The writer urges the observance of certain indispensable precautions for the successful preparation of this kind of paint. In the first place, it is necessary to use a good drying medium, without turpentine, which latter makes iron pigments run. Good, boiled linseed oil is recommended, made into a quicker drier by the addition of manganese or litharge. This question of the drier should always be taken into account in tests of iron paints against lead paints, because it often happens that the former do not receive proper treatment in this respect. Red lead paint dries hard quickly enough; but not iron oxide. The latter is more apt to form a shining skin of little adhesion to the iron, from which it consequently easily strips. This is entirely due to insufficient drying, and is no fault of the base itself. The purity of the base is another important consideration. It should always be a good natural oxide, containing 65 to 70 per cent. of ferric oxide, and never the oxide upwards of 96 per cent. pure, which is not natural, but is a chemical product. The only impurities of a sound natural iron oxide are clayey matters. M. Ligot is positive that if this kind of oxide is used as the paint base, mixed with good drying oil without turpentine, and so laid on as to dry properly, it will prove to be an iron preservative every whit as good as, and much cheaper than, red lead paint.

A Mixing-Chamber for Gases.

A curious point is made by T. Meyer in the "Chemiker Zeitung," quoted in the "Journal of the Society of Chemical Industry," of the design of apparatus for mixing gases or fluids of different specific gravities. It is remarked that if different fluids, of the same specific gravity, enter a circular basin, as in the accompanying figure (Fig. 1), with equal velocity through tangential openings of the same size, and gravitate towards a central outlet, they mix very fairly on the way. If, however, the fluids are of different specific gravities, a uniform mixing

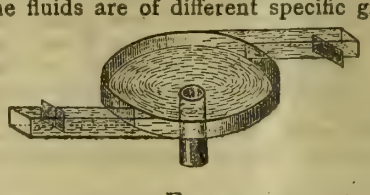


Fig. 1.

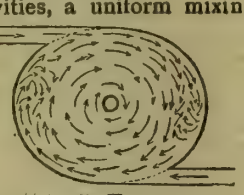


Fig. 2.

does not take place under the same conditions. This can be secured, however, by a slight modification of the shape of the mixing-basin—*i.e.*, making it oval instead of circular in section (Fig. 2). By this means, eddies are formed in the currents at the two narrow sides of the basin, as shown in the figure, and mixing ensues, even with fluids of different specific gravities, provided that the difference is not too great. The essential features of a mixing-chamber on this principle, intended for gases, are here shown. The depth of the chamber must be exactly equal to the diameter of the inlet tubes, so that the motion throughout the apparatus is uniform. The throttles, or slides, shown in the first figure, may be used to check one of the gas currents, so as to vary the proportions of the resultant mixture, taking care that the baffling of the current is not on the tangential side of the pipes. Carburetted and poor gas, or air and gas, might apparently be mixed in this compact apparatus.

COMMUNICATED ARTICLE.

FOUNDATIONS FOR METAL TANKS.

By R. J. Milbourne, Assoc.M.Inst.C.E.

Whenever the ground available for the erection of a new tank and gasholder is of such a nature that the adoption of the ordinary brick or concrete tank would be a matter accompanied by grave risks and expense, the dangers and difficulties may be avoided by the adoption of a metal tank. Mild steel is the material now almost universally adopted; being possessed of qualities superior to wrought or cast iron, and less in cost than the latter. But whether the material selected be steel or cast or wrought iron, the conditions necessary in the provision of foundations would be exactly the same in either case.

Substratum.—After the form of tank has been decided upon, the next, and probably the most important, point to receive attention will be the foundation upon which the strength and stability of the tank, holder, and framing depend. The chief object to be attained in the construction of the foundation, is the formation of such a solid base that a minimum amount of subsidence shall take place under the maximum load—that is to say, after the erection of the complete structure, and the tank has been filled with water. All heavy structures of this class will settle to a certain extent, for the reason that all soils are more or less compressible under the weight brought upon them.

It is not, however, sufficient to aim only at the minimum of settlement, but it is of the utmost importance to insure that whatever settlement does take place shall be of a uniform nature throughout the whole bearing surface of the foundations. Otherwise the guides of the tank and holder are liable to be thrown out of the vertical position; thus causing the accurate working of the gasholder to be impaired or interfered with in a more or less serious degree. A soft marshy ground, of even consistency, is very frequently met with, and is much more favourable for our purpose than a somewhat harder ground of varying strength or thickness, as settlement in this latter case is liable to be more unequal than in the former. The nature of the bearing strata having been carefully ascertained by trial or bore-holes, the safe bearing strength of the ground per square foot of area can then be determined.

It is hardly advisable or possible to attempt to give any general rules for the safe bearing strength of the various kinds of ground

that may be met with. Each site must be judged for itself. But, speaking roughly, it may be said that alluvial soil or quicksand ought not to be loaded with more than about 1000 lbs. per square foot; a soft clay 2 or 3 feet below the surface, from 1000 to 1700 lbs.; compact clay 3000 to 5000 lbs.

Concrete Bed.—The thickness of the concrete bed upon which the tank is to be erected, though usually determined by experience, may vary from 9 inches to 2 feet or 2 ft. 6 in., according to the nature of the substratum. If the ground is soft and loose, the area of bearing surface can be enlarged by increasing the margin of the concrete bed beyond the usual allowance of 9 inches all round the outside of tank, so as to insure that the maximum pressure upon the subsoil shall not exceed the safe pressure per square foot. It should be borne in mind, however,

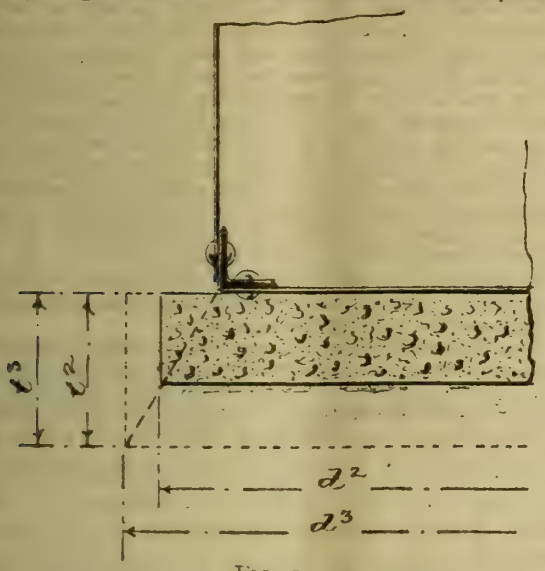


FIG. 1.

that when this increase in the diameter of the concrete bed is rendered necessary by these local circumstances, the thickness of the bed should also be increased in a certain definite proportion, in order to obtain the full advantage of the enlarged surface. As fracture is most likely to occur at an angle of about 60° with the horizontal, as shown by the thick dotted lines in fig. 1, causing the concrete bed to rupture in a number of triangular prisms, shearing or sliding over each other, the effective diameter of the concrete bed at the base may be taken as equal to the diameter indicated by d^2 in fig. 1. From this it will be apparent that, to obtain an enlarged bearing surface equal to d^3, the depth of the concrete bed should be made equal to t^3, as shown in the figure. In some extreme cases, where the increased bearing surface could only be obtained by an abnormal thickness of concrete, it might be more economical to build the tank and holder upon a foundation of piles. But this is beyond the scope of the present article.

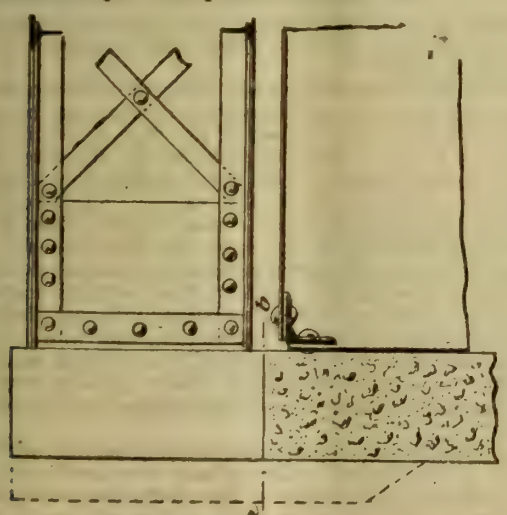


FIG. 2.

Sometimes the standards forming the guide-framing of the gasholder are secured to the sides of the tank; but when they are carried down to, and take a firm bearing on, the concrete bed, it is very important that the pressure on the substratum should be uniform. The projecting portions of the concrete bed intended to carry the standards or columns should, therefore, be proportioned accordingly. Furthermore, it may be necessary that the thickness should be increased at these points, as indicated by dotted lines in fig. 2, in order to avoid any danger of the concrete bed breaking across. The foundation for the standards is shown in fig. 2; and it may be considered as in the condition of a cantilever carrying a distributed load tending to produce fracture at A B., as indicated above. The recess which is formed in the concrete bed for the reception of the inlet and outlet pipes to the gasholder, should either be bridged over with light steel rolled joists, arched openings, or dwarf walls of brickwork or concrete, built up to afford a support for the bottom plates of the tank, immediately over this recess, after the pipes have been fixed in position and the joints properly made. This method is decidedly better than filling up the recess, or bedding both the pipes into the concrete bed in a solid mass. The small bed of concrete which is intended to form the foundation for the short vertical inlet and outlet pipes may be detached from the main tank foundation.

The horizontal pipes which pass under the bottom of tank are more reliable if made of steel instead of cast iron, owing to the flexibility of the former, which may prove advantageous in case of excessive settlement.

The character of the concrete should be made to suit the local conditions. A mixture suitable to most instances would be that composed of one part of Portland cement by measure, one-and-a-half parts of sharp clean sand, and four-and-a-half parts of broken stone, bricks, or any other suitable material. Almost any hard substance may be considered suitable when broken up, such as old clay retorts, broken earthenware, or burnt clay of an imperishable kind. Fragments of a porous nature are, however, preferable to those which possess a smooth or glossy surface, as the Portland cement will more readily adhere to them, and so form a compact and close mass free from voids. The pieces of broken brick or other material which it is intended should form the aggregate of the concrete, should be of such a size that each piece will pass through a one-and-a-half to two inch gauge or screen; the fragments being angular in shape. These materials should be carefully gauged in wooden, bottomless boxes placed on a temporary timber platform (not upon the bare ground, as it is necessary to keep the concrete clean from all earthy matter); the measuring boxes being filled up one above the other, with the matrix or cementing material on top. These boxes or frames, upon being removed, will cause the constituents of the concrete to assume a conical shape mound upon the timber platform suitable for mixing. The whole mass is then to be thoroughly incorporated by being turned over twice dry. A sufficient quantity of water, applied through a fine spray or rose, should then be added, to render the concrete plastic, and to ensure the cohesion of the various ingredients. After the concrete has again been turned over twice wet, it should be rapidly filled into barrows, wheeled to the site, and tipped into the required position in layers about 9 or 12 inches thick and carefully rammed. The ramming must not be too prolonged, or it will affect the strength of the concrete. The method of conveying the concrete down steeply-inclined wooden shoots into the exact position where it is to be deposited is very unsatisfactory, as the heavier portions of the aggregate have a tendency to collect together and separate out from the matrix; thus robbing the concrete of its homogeneity. If the concrete is more than 12 inches thick, it is advisable to use a somewhat slow-setting cement, so that the second layer of concrete can be prepared and placed in position before the first layer has had time to set. In cases, however, where it is impossible to apply the second layer until after the first layer has already set solid, the surface should be swept clean with a stiff brush, then made rough and watered. Concrete laid in cold weather stands better than that laid during hot; mild damp weather is, however, preferable to either extremes.

Excavation.—It is generally advisable to keep the tank as much out of the ground as possible, in order to afford opportunities for regular examination and painting; and also to avoid the necessity for timbering the sides of the excavation, the struts from which would materially interfere with the laying of the concrete bed. Nevertheless, the bottom of the concrete bed should always be laid at least 3 ft. 6 in. below the ground-line, to preserve the foundation from the effect of varying degrees of temperature or the percolation of rain water, which, in some soils, causes the foundations to become rent and injured by the contraction and expansion of the ground. A soft clay is very subject to expansion and contraction, owing to variations in temperature; and it is positively dangerous to erect the tank upon such a soil unless it be protected from atmospheric influence, while many soils, otherwise reliable, will assume a soft, muddy condition when exposed to the effects of the atmosphere or to rain water. When, however, the concrete bed is placed at the depth suggested, the difficulties produced by atmospheric influence are unlikely to occur in this country, owing to the protection thus obtained. The excavation should be made about 3 feet larger in diameter than the diameter of the tank, at the top level of the concrete bed, to allow sufficient room for the workmen erecting the tank to get all round the same for riveting up the sides.

Sand Bed.—To ensure the whole of the tank bottom bearing evenly and firmly upon the concrete foundations, the entire upper surface of the concrete should be made perfectly level, and then covered with a layer of clean sand about three-quarters of an inch thick. When the tank is lowered on to the foundations, the rivet heads of the bottom plates bed themselves firmly in this layer of sand, which works up between them and gives an even support to the whole area of the bottom plates.

Foundation Bolts.—It is not necessary to provide any holding-down bolts for taking hold of the standards of the gasholder guide-framing when the standards are carried down to the level of the bottom of the tank.

Fender Walls.—In most cases where the tank is erected in "made" ground, such as ashes, cinders, or town refuse, it is advisable to protect the sides from the corrosive action of this filling in. This protection can be obtained by building (say) a 9-inch brick fender wall all round the tank, or by ramming a layer of puddle, at least 9 inches thick, well up against the side plates the full depth they enter the ground.

Filling in.—It is of importance that the foundations should be kept clear of water during the laying of the concrete bed, and also while the lower portion of the tank is being erected; and as soon as the tank bottom and a sufficient depth of the side plates have been rivetted and finished complete, the tank should be carefully lowered on to its foundations, and the surrounding excavation filled in and rammed and made up to the proper level.

TECHNICAL RECORD.

AN IMPROVEMENT IN THE HYDRO-INCANDESCENT GAS SYSTEM.

In high-power incandescent gas lighting, as in other things, experience and wider application produce improvements which tend to higher results with greater economy. Some months since, we were promised by the Hydro-Incandescent Gas-Light Company, Limited, an important advance upon their then method of raising the pressure of gas for their system of lighting; and it seems they have (judging from the following information, supplied by the Company) been true to their word. The Company's old form of pressure-raiser has been replaced by the Scott-Snell compressor, or intensifying machine, which is such a compact arrangement that it does not occupy more space than a 5-light gas-meter, so that its location is not limited on account of bulkiness. In the new instrument, too, the combination of simplicity with range of utility is marked. The same machine will work over a range of water pressure between 15 lbs. and 70 lbs. with equal efficiency; and it will deliver gas at any pre-arranged pressure—that is, from the moderate increased pressure of (say) 9 inches up to 60 inches of water. The adjustment is only a matter of a few seconds; and by a simple additional appliance (a description of which is at present withheld on account of foreign patents), the machine can be made to set itself, and also become self-regulating when once coupled with the water supply—that is to say, any variation in the water pressure would be automatically met by the machine, and not by what is called "the crude unscientific process" of choking the flow of water. The machine is set or adjusted by hand for ordinary services by the simple process of sliding a block on the back of a lever and clamping it. This changes the leverage, and maintains the effectiveness of the machine at any water pressure.

Since the regulation of the machine is effected by mere change of leverage, and the movement in the gas division remains constant, it is the stroke of the water division that changes—lessening or increasing in amplitude in accordance with the rise and fall of the water pressure. This is an important point in water economy, and in great contradistinction to systems which have to fall back upon choking the water supply if its pressure is above that for which the machine is proportioned. In addition to this, accessories such as gas bells and reservoirs to control the water-inlet are avoided. Both the gas and water consumption are in strict accordance with the lights in use; the speed of the machine being naturally subject to the demand. The function of the machine is, in fact, to maintain a constant pressure of gas. It is usual to add a small drum at any convenient part of the installation, to give capacity enough to eliminate any palpitation in the circuit due to pulsation of the machine. This drum may conveniently form a pedestal for the machine. On large circuits the pipe capacity alone is, however, sufficient without the drum. The exhaust water is perfectly pure after passing through the machine, and may be used for any industrial or domestic purposes.

As regards constructive details, the machine consists of a gas-compressing division, in which is a pulsating diaphragm and a water-pressure division, in which is a smaller diaphragm; the whole system being formed by a simple arrangement of three castings, which have but a minimum of machining to fit them in position. The movement of the water piston-rod is transferred to the gas piston-rod through a compound lever with a sliding-block, whereby the leverage can be readily adjusted. The gas-valves are outside the machine, and may be examined without disconnection of any pipe joints. In regard to the over-all dimensions, it may be noted that a machine for 18 lights of 500-candle power each, occupies a ground space of about 18 in. by 24 in., and requires only about a foot in height. For large installations, a number of machines may be placed as it were in parallel, with cocks for cutting out any individual machine for examination. The opening of the machine for inspection purposes is effected with ease; and any parts can be replaced with readiness. The consumption of water required for raising the pressure of the gas is fixed at 8 gallons an hour for each light, consuming 12 cubic feet. With a water pressure of 30 inches, a 54-inch gas pressure is obtained, and the resultant illuminating efficiency is given as 46 candles per cubic foot of gas consumed.

THE OUTLET-VALVES AT THE BURRATOR RESERVOIR, PLYMOUTH.

As briefly notified in the "JOURNAL" for Aug. 1, a paper upon the above subject was read by Mr. E. SANDEMAN, Water Engineer to the Plymouth Corporation, at the recent meeting of the Institution of Mechanical Engineers in that town. Before dealing with matter specially to be considered, the author gave a sketch of the history of the Plymouth Water-Works, which date back to 1585, when the Corporation obtained an Act of Parliament which conferred power for constructing a weir across the River Meavy, and for cutting a channel or water-course, locally known as a "leat," from the weir to the town—a distance of 10½ miles in a straight line, but 17 miles along the course taken. The weir and leat were constructed in 1591 by Sir Francis Drake, and were the means of supplying the town for 300 years. The Act authorizing the construction of the Burrator reservoir and of the pipe-line to supersede the leat was passed in 1893. It is situated on the western slope of Dartmoor, and contains 651 million gallons; the top water-level being 708 feet above the sea. The reservoir is formed by two embankments—one of masonry 77 feet high (fig. 1), and the other of earth with a puddle core 23 feet in height. The outlet-pipes are three in number; and their sizes are 36, 30, and 25 inches respectively—the latter being the diameter of the town's supply-main. The author then proceeded to describe, as follows, the manner of controlling these pipes:—

It is well known that great power and strength are necessary in valves which have to be used against a considerable head of water; and especially is this the case when the closing of the valves is in process. At the Burrator water-works, the largest pipe is estimated to be capable of delivering 200 million gallons per day; and in this instance the force to be reckoned with is equivalent to a weight of 36,000 tons travelling at the rate of 36 miles per hour, or ten tons travelling 52½ feet per second. It will be apparent that unless this force is brought to a standstill slowly, a considerable shock must inevitably result. The outlet-pipes from the reservoir are provided with valves on the inside as well as on the outside of the masonry dam. On the down-stream side are placed the valves which are for ordinary use. With the exception of two, these valves are arranged so as to be in one valve-chamber. The 36-inch and 25-inch pipes, which were laid in the 10-feet outlet tunnel through the dam, divide into four pipes, which are respectively 36, 30, and two 25 inches in diameter (fig. 2). The 36-inch and the 25-inch pipes continue directly into the weir pool. These pipes are used in emptying the reservoir. When used in conjunction with the 30-inch pipe at a higher level, the reservoir is emptied in 2½ days.

For ordinary use there are two valves on each pipe—each of a different kind. That nearest to the reservoir is the ordinary double-faced sluice-door with a bye-pass; while the second one is a double-spindled valve, having two doors, the smaller of which, being about one-seventh the area of the larger, is intended to be opened first, thereby relieving to some extent the pressure against the larger one. It would probably have been an improvement on these valves had their sectional area been reduced to from one-third to one-half that of the pipe, as, on the principle of the Venturi tube, the loss of the delivery power of the pipe would not be great.

Special valves were designed to close the bell-mouthed ends of the outlet-pipes, in case the valves for ordinary use required repairs. There are four valves of the type shown in figs. 3 to 6; and of these it will be sufficient to describe one—the principle being the same, and the only difference being in the number of separate lifts in the valves. The largest of the valves, which have been called "cone" valves, from their conical shape, is designed to act upon the open end of a 36-inch pipe, which has a bell-mouth measuring 48 inches across. It is divided into three circular segments faced with gun-metal (fig. 3). A 3-inch gun-metal spindle runs vertically through the centre of the valve, which is lifted and lowered together with the separate parts of the valve by gearing placed in a chamber at the top of the dam. Gun-metal rods (and chains passing over pulleys where there is a change of direction) connect the spindle to the gearing.

In opening the valve, the upper circular section, which is the smallest, is first raised by the spindle to a height of 4 inches, when it engages the heads of four bolts connecting it to the second section of the valve; and, as it continues to rise, this second part also is lifted, rising to a height of 6 inches above the third. By similar means the third section is raised from its seating to a height of 12 inches, so that the valve being fully open leaves three circular spaces through which water can enter the bell-mouth outlet-pipe. All lateral motion of the different parts of the valve is prevented by guides and stays. The total area of the spaces is nearly three times that of the sectional area of the pipe, with the object of considerably reducing the velocity of the water passing through. The action of the four valves at work has been very satisfactory. In the future design of similar valves, an air-pipe rising above water-level from the top of each valve might be provided; and for this purpose the vertical spindle might be made hollow.

The water taken from the reservoir for the town's use is measured by a Venturi meter fixed a few yards below the valve-house. The pipe on which it is fixed is 25 inches in diameter,

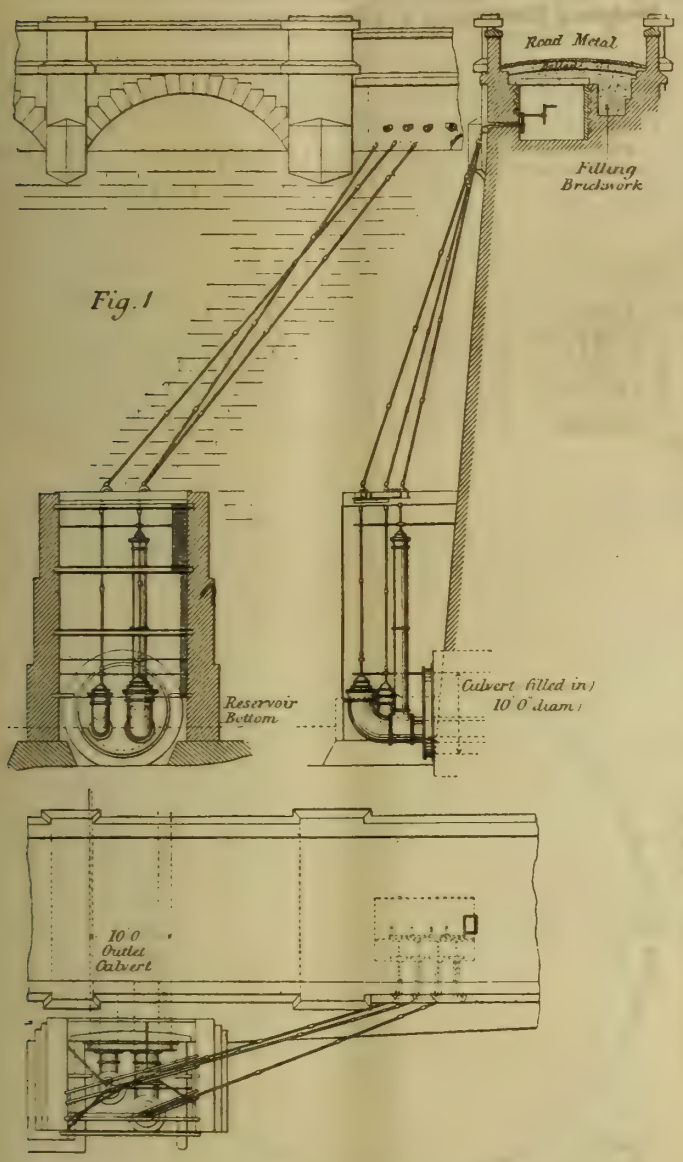


Fig. 1

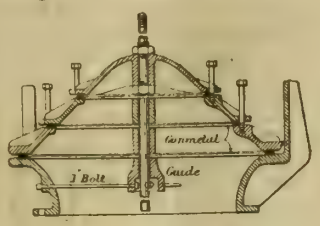


Fig. 3. Sectional Elevation

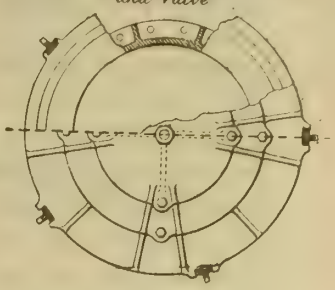


Fig. 4. Part Plans of Bellmouth and Valve

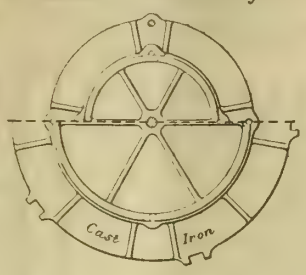


Fig. 5. Half Plans of Second and Third Rings

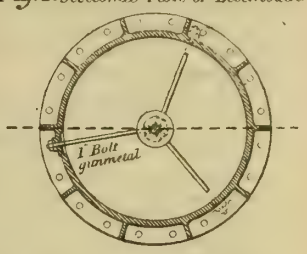


Fig. 6. Sectional Plan of Bellmouth

which at the throat of the Venturi tube is diminished to $11\frac{3}{16}$ inches. The meter will measure quantities varying between 1 and 12 million gallons, which are recorded on a diagram; and the quantity is also given in gallons by a counter.

The discussion upon the paper was opened by Mr. J. Mansergh, who explained that his connection with the new water supply of Plymouth was in the capacity of Consulting Engineer. It was the author of the paper who had done the work. Mr. Pearson asked whether the conical valves would not "seize" in the guides which were provided to prevent lateral motion of different parts, as described. If they were to do so, there would be difficulty in lifting them, and they would then not be able to get any water through. What would be done in that case? Mr. H. Davey said he had not met with an outlet-valve like that described by the author. It was ingenious, and by it the construction of the water-tower was avoided. It had the objection, however, that it could not be drawn out for repairs; but this might be said of any valve not used in conjunction with a tower. They should consider what would happen in closing the valve under a press of water. The force might take up the slack of the rods, and would set up what he described as a "tithering" action. This, however, would not be a serious defect. At the same time, he should like to know if it had been experienced. Sir Frederick Bramwell asked why an apparatus similar to that used in water-softening plant should not be adopted. It consisted of a pipe kept near the surface by means of a float. Mr. Sandeman, in reply, thanked Mr. Mansergh for his very kind remarks. As to what Mr. Pearson had said, he did not anticipate any "seizing" of the valve. The valve referred to so often had acted well, except on one occasion, and then the trouble was due to air. He had stated in his paper, however, that the rod should be made hollow, and so let the air escape. There had been no "tithering" action as mentioned by Mr. Davey. If the floating pipe arrangement were used, as was suggested by Sir Frederick Bramwell, he did not see how the reservoir could be emptied; and in regard to the syphon arrangement, he thought the speaker did not realize that the reservoir was 70 feet deep.

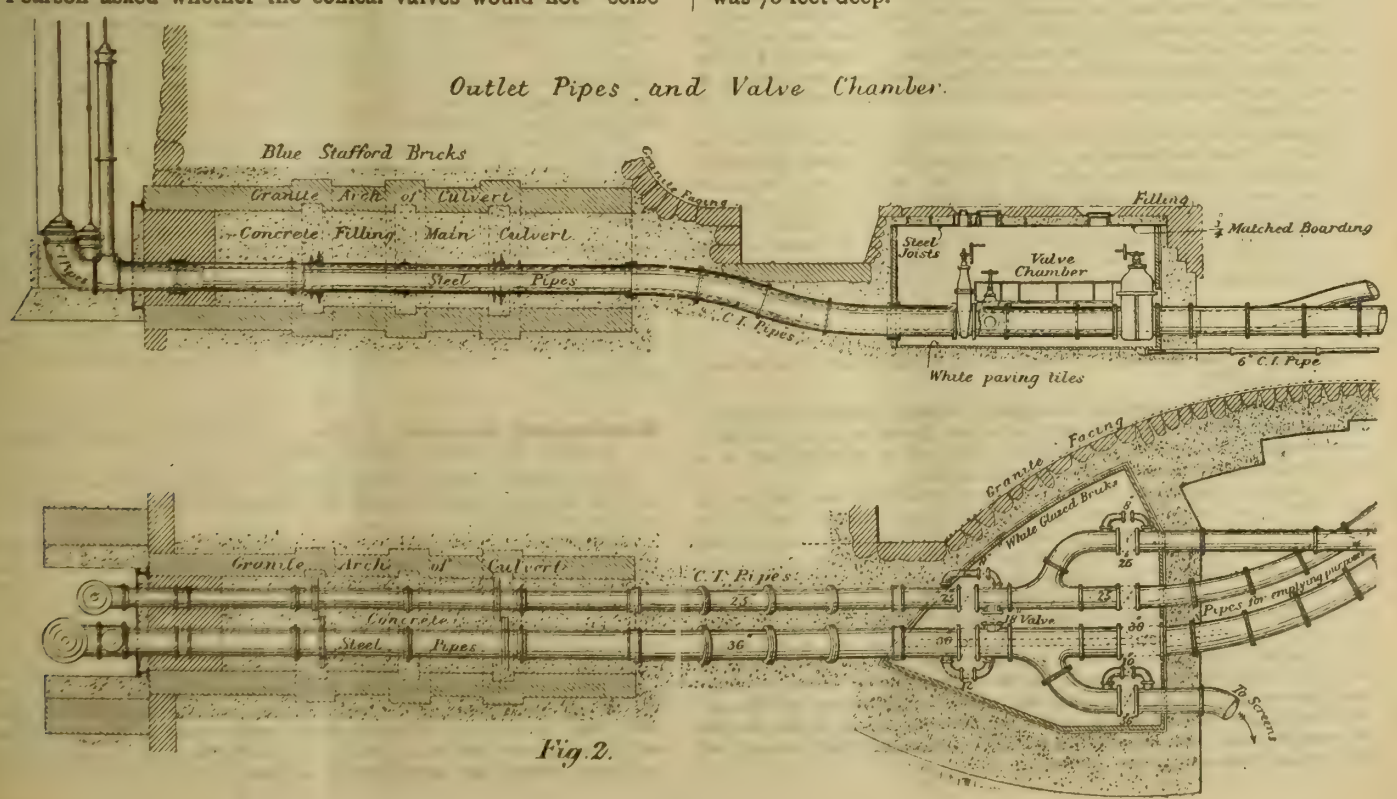


Fig. 2.

REGISTER OF PATENTS.

Unloading, Heaping, Storing, and Loading Coal, Coke, &c.—Woodward, J., of Manchester. No. 25,298; Nov. 30, 1898.

This invention relates to a combination of mechanism and arrangements by which coke or coal may be unloaded from vehicles or vessels, and heaped, stocked, or stored "in large quantity in the the least area of surface, and by the same means may be loaded from the heap into vehicles or vessels, or loaded into boxes, receptacles, or shoots so as to be readily discharged into carts or other vehicles which are to convey it away."

The invention—which is designed more especially for use in gas-works for storing or stocking coke, but may also be used for coal, ores, and other materials—consists in a single line (by preference) of railway, arranged in a circle of any desired diameter; the rails being beams, the vertical web of which is straight, and its upper straight edge forms the bearing or rail surface. Each beam thus forms one side of a polygonal figure forming the circular single-line railway. The adjoining ends of each two beams are secured to the upper ends of pillars arranged to extend to any desired height above the surface upon which the coke or coal is to be heaped or stocked.

In the engraving, C is a pillar in the centre of the railway, upon and around which the apex of a triangular platform D rotates. This triangular platform has, near its broad end, a central vertical pillar secured to it, upon which the crane E can swivel entirely round. This crane, which is the ordinary traversing steam-engine crane, has at the other end a jib, which carries the pulley over which the hoisting-chain passes from the winding-barrel. Like an ordinary steam-engine travelling crane, it can rotate round the central pillar, and hoist and lower, slew round its central pillar, and traverse on the railway; and it is stopped and started, as the usual type of crane, in the ordinary manner.

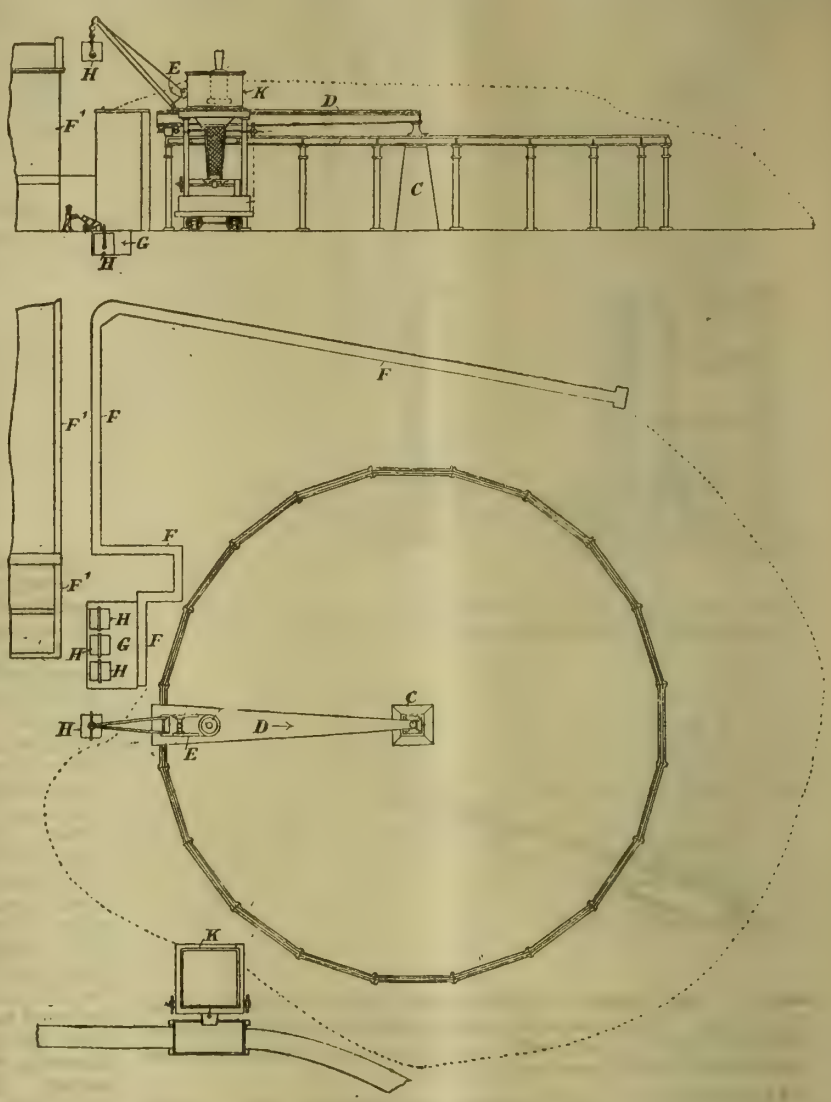
The traversing movement of the platform D on the railway is similar to that for driving the four wheels on two axles of a traversing crane, working on two lines of railway; but in this case it is only required to drive two axles having but one carrying wheel on each axle. It will thus be seen that the crane can hoist and lower, slew round, or travel upon or round the circular railway indicated in the engraving.

The illustration shows part of the walls and buildings of a supposed gas-works, near which the central railway is erected—F being the boundary wall of the ground upon which the circular railway is placed, and F^1 part of some of the buildings of the works near which a pit G is formed (for convenience below the level of the surface of the adjoining ground), into which buckets H are placed to be filled with coke by barrows from the gas-works. The buckets (large enough to hold 1 or 1½ tons) may be arranged to be tilted over to be emptied of their contents, or made with an opening bottom to allow the material to drop out when required.

The hook upon the hoisting-chain is hooked to the loop which passes across the bucket when it is to be lifted; it is hoisted to any desired height; and the crane is slewed round, and the platform traversed, to bring the loaded bucket over the part inside or outside the circular railway within the range of the slewing movement of the crane where the material is to be deposited.

The irregular dotted line shows the height to which the coke may be heaped; and the boundary wall in the plan and the irregular dotted line, the limit to which the coke or material may be heaped or fall to an inclination when discharged from the bucket. But if the coke is to be heaped above the level of the railway, the heaping is commenced at the furthest distance away from the point where the buckets are first lifted, and gradually approaches that point on each side as the material being dealt with is stacked.

Instead of discharging the coke upon the heap, it may be shot into a bunk K—a square receptacle standing on a framework elevated sufficiently high above the ground. The upper part of the bunk forms a box, and its lower part a hopper through which the material is discharged on to the upper end of a sloping shoot, the bottom of which is formed by bars with spaces to act as a screen and allow the small coke or breeze to pass through and into a box below; the large coke being discharged from the spout at the lower end into a waggon or other receptacle.



Incandescent Gas-Burners.—Wilson, J., of Birmingham. No. 26,488; Dec. 15, 1898.

This invention, relating to atmospheric burners suitable for incandescent gas-lamps, consists in one part of an alteration in the arrangement described in Patent No. 24,328 of 1897, and in another part of a new form of nipple burner and mixing chamber.

The burner, which is of the bunsen type, consists of the tube part of an ordinary burner surmounted by a funnel-shaped crown, through the enlarged end of which (suitably fitted with gauze or perforated metal) passes the tube part of a rod-holder, to hold the rod which, in its turn, supports the mantle to be rendered incandescent. The patentee takes the open-topped shank of an ordinary gas-burner; but instead of removing the bottom, he pierces one or more very small holes in the base for the admission of gas. The tapered and threaded end is left whole for a sufficient distance for it to effectually close the nozzle of an ordinary gas bracket when screwed into it—generally for about $\frac{3}{16}$ inch; and immediately above this space the shank is perforated for the admission of air. The open top of the shank is slotted to receive the bar disposed crosswise as described in the 1897 patent, of which an abstract has already appeared in our columns.

Producing Illuminating Gas from Resin.—Knapp, W., and Steilberg R., of Hamburg. No. 16,619; Aug. 16, 1899.

This invention, relating to the production of illuminating gas from resin, has for its object to effect this production by a single operation; thereby essentially differing from all previous methods, in which several reactions in succession are necessary.

The process consists principally in passing liquefied or melted resin (corresponding to the gas production required) through a series of superimposed retorts filled with iron or steel turnings, whereby the resin is volatilized and subsequently gasified. The resulting gas—which is free from moisture and all impurities—is led direct into the gasholder.

The melted resin, prepared from solid lumps, is fed continuously, and in uniform quantity, from a reservoir into the upper row of retorts, where it is volatilized at a red heat. The resulting vapours are led into a second row of retorts (situated immediately under the first), and there gasified; the gas being dried by passing it through a third set of retorts in connection with the second row. It is then conveyed direct through a pipe to the holder.

The gasifying surface is greatly increased by the iron or steel turnings contained in each retort; while at the same time the flow of the melted resin is restricted so as to increase the intensity of the vaporization and subsequent gasification.

The superimposed rows of retorts, which are formed of a number of pipes corresponding in quantity to the gas consumption in view, are placed in a charging oven, where they are raised to a red heat; the vaporization and immediate gasification of the melted resin, which is fed to the apparatus in a continuous stream of uniform dimensions, is rapidly effected by the aid of the turnings contained in the pipes. Any impurities that may have accompanied the gas are retained by the turnings.

Manufacturing Acetylene.—Kellner, C., of Golling, near Salzburg, Austria. No. 21,035; Oct. 20, 1899.

This invention relates to the regular evolution of acetylene from carbide, by decomposing it by means of a solution of chloride of calcium or calcium oxychloride.

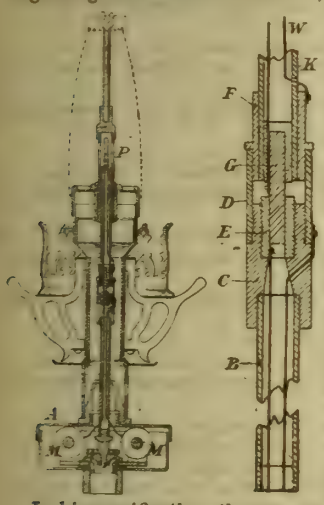
In explanation of his invention, the patentee remarks: "The violent and irregular evolution of acetylene which occurs when calcium carbide is brought into contact with water, and the phenomenon known as 'after-evolution,' form, as will be known, the principal difficulties in the way of a more general introduction of acetylene for illuminating purposes; since exceedingly complicated apparatus must be used to control the evolution of the gas, and, moreover, experience has shown that even these provisions do not always act with certainty. Instead of regulating the generation of the acetylene by mechanical means, attempts have often been made to do so by mixing with the water used to decompose the carbide substances which are not acted upon by the carbide; and, as will be known, methyl and amyl alcohol, acetone, glycerine, ether, and sugar

have already been proposed as such substances. Now, although the generation of the gas can be quite well regulated by mixing these substances with the reacting water, these proposals could not be carried out in practice, because it is too expensive."

The process according to this invention consists in using a substance which can "be provided in enormous quantities at small expense, because it occurs in a large industry as a most troublesome bye-product." This substance is chloride of calcium ($CaCl_2$), produced in the manufacture of ammonia soda by the Solvay process, and in other industries. The carbide is treated with a solution of calcium chloride in water; and the concentration of the solution depends on the quantity of gas that is to be generated in a given time from a given quantity of carbide. A solution having a specific gravity of 1·38 yields, for example, with 600 grammes of carbide, sufficient acetylene to supply a table lamp for a period of 29 hours. In this process, the carbide is always covered by liquid, and no variation in pressure can occur; while the same solution can always be used again, as it is only necessary to add from time to time a quantity of water corresponding to the amount of carbide added. When the calcium chloride solution is used for the first time, some of the lime produced by the decomposition of the carbide is dissolved and forms calcium oxychloride (basic calcium chloride).

Controlling the Supply of Gas to Burners and Effecting Ignition from a Distance.—Franzen, C., of Cologne. No. 635; Jan. 10, 1899.

In most electrical devices for controlling the gas supply to, and effecting the ignition and extinction of, gas-burners from a distance, separate electro-magnets have heretofore been needful; and consequently a double-circuit wire has been requisite for supplying the necessary currents. Furthermore, the devices for leading the current to the point of ignition are usually arranged outside the burner, which is liable to the disadvantage that the devices become injured, and with incandescent gas-burners the devices can easily injure the mantle when fitting on or removing the burner-head. Again, the point of ignition requires to be so near the hot zone of the incandescence body that the igniting bodies (whether platinum points for igniting by electric spark, or a platinum coil for igniting by incandescence) are liable to become deteriorated by the heat. The present invention relates to "an improved construction of such appliances, whereby these disadvantages are obviated."



In his specification, the patentee describes the invention in connection with the well-known electrical device for opening and closing the gas supply in which a rotatable disc having a series of peripheral holes receives a step-by-step rotary motion by means of a ratchet-wheel and pawl actuated by an electro-magnet, so that in one position of the disc a perforation is brought opposite the gas-supply passage, and admits gas to the burner, while in another position the solid part of the disc covers the passage and cuts off the gas supply. Applied to a Welsbach burner, the arrangement is as shown in the accompanying illustration—a vertical section with an igniter applied thereto, and part of the central tube (enlarged).

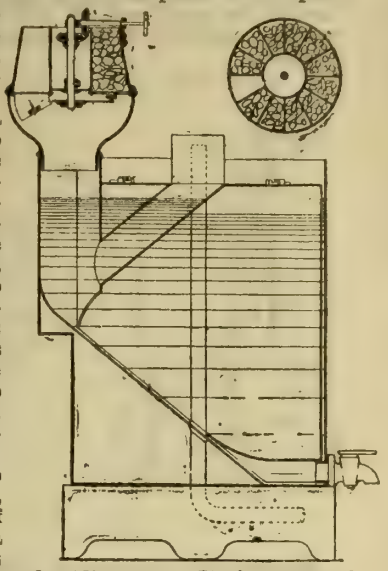
On the vertical stationary axis A of the electro-magnet appliance, on which a perforated disc is made to rotate, is fixed a small tube B that extends up within the tubular mixing-chamber of the burner (which may conveniently be carried on the top of the casing of the electrical appliance); and at a certain point within the chamber, it has fixed to its upper end a cylindrical head-piece C of insulating material, on the upper end of which is fixed a socket D of conducting material. The head C has a central passage, in which is fixed a small tube E of conducting material.

One lead of the electro-magnet M which works the perforated disc is passed up the tube B, and is fixed to the conducting tube E. The second lead is also passed up through the tube B, and through a lateral hole in the head C, and is fixed to the conducting socket D. Into this socket is (removably) fitted a short tube F of metal, which is thus in conducting contact with the socket D, and is suitably fixed on a small glass tube K extending up through, and to a certain distance above, the burner-head. Through this glass tube pass two conducting wires W, to the lower end of one of which is fixed the metal tube F surrounding the glass tube, while the lower end of the other wire is fixed to a metal conducting-pin G cemented into the glass tube. The pin fits into, and makes conducting contact with, the inner metal tube E, to which the one wire from the electro-magnet M is fixed. The upper ends of the two wires pass through the upper closed end of the glass tube, and have there fixed to them the two ends of a platinum loop or coil P extending up a certain distance above the burner-head.

By these connections of the lower and upper wires respectively with the conducting parts of the insulating head and the conducting parts of the glass tube that fit into it, a closed circuit is formed, extending from the winding of the one electro-magnet limb, up through the platinum wire loop or coil, and down again to the winding of the second limb. Thus, when a current is passed through the electro-magnet for actuating the perforated disc, it at the same time passes through the platinum loop or coil P, and, in heating it to incandescence, effects the ignition of the gas and air issuing through the burner.

Acetylene Generator.—Schneeweis, J., of Hanau-on-the-Main, Germany. No. 2392; Feb. 2, 1899.

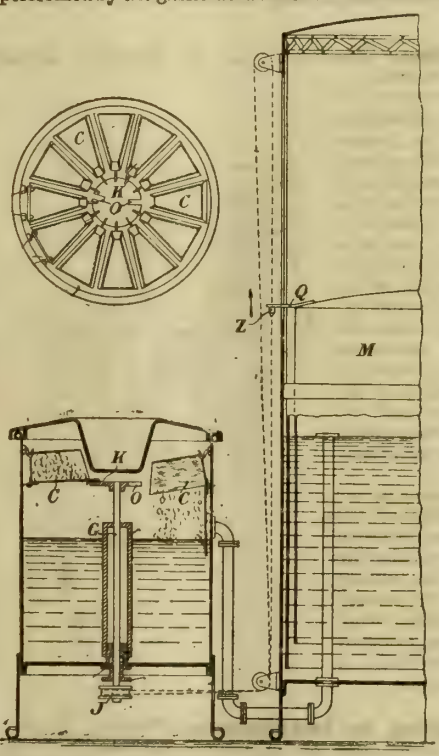
This invention relates to a generator of acetylene and an automatic distributor of the calcium carbide for use in connection therewith, consisting of a series of chambers circularly arranged (as shown) into which the carbide is introduced, and on being released drops into the generator by means of a rotating plate, which permits of the respective bottom plates closing each of the receptacles to be opened in succession—the plate being rotated by gear operated on the depression of a gasholder not shown, as it forms no part of the invention.



The generator is fitted with a rear-inclined bottom surface, to facilitate the falling of the carbide into the bell-shaped receiver within the casing, and having a perforated bottom plate for the reception of the lumps of carbide. The receiver is provided with a dome, from which the gas-pipe passes to the holder; and there is an inclined tube shoot (whose orifice is capable of being closed by means of a lid or stopper) serving the purpose of guiding the carbide into the receiver when filled by hand. For automatically feeding the carbide, there is a distributor consisting of a casing tightly fitted on to the side tube of the generator, made up of a circular series of compartments each closed by a bottom hinging plate provided at its edge with a roller and wedge-shaped guiding-piece. In the centre of the casing is a vertical spindle, at whose extremity a plate is mounted which has a circumferential slot, into which each of the hinging bottom plates falls ine succession on th slot of the plate passing into coincidence therewith.

Generating Acetylene.—Berger, H., of Berlin. No. 4223; Feb. 25, 1899.

The patentee claims that his generator provides for a certain quantity of carbide falling into the water, without it being previously exposed to aqueous vapour, and there is "the least possible amount of work to be performed by the gasholder bell for the automatic feeding of the apparatus."



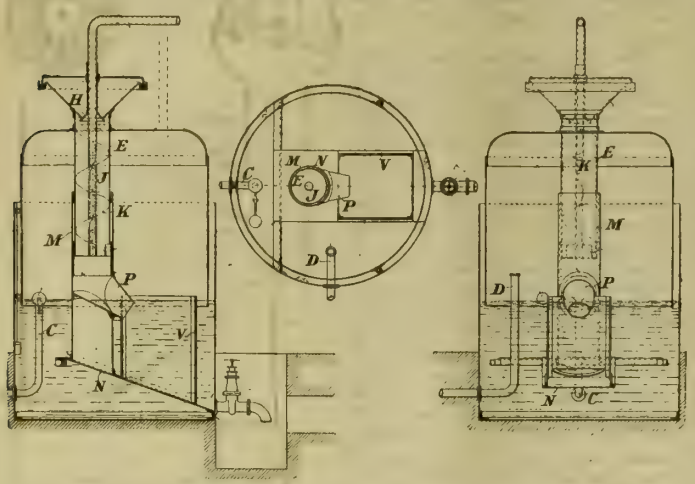
The generator (as shown) is half filled with water, and made gas-tight at the top by means of a cover. The carbide-holders C are composed of sheet-metal boxes, of circular segmental cross section, closed at the sides and top, and widened towards the bottom. The bottoms of the boxes consist of flaps pivoted on hinges, and having in the front pins soldered on; the holders being suspended on hooks fixed to the generator. In the middle of the generator is a vertical shaft G running through the bottom, and fitted with a stuffing-box and gland. It passes through a sleeve screwed to the stuffing-box, and terminates at the top in a disc K. This disc is provided with one or more slots O, so disposed that when the disc is partially turned, the pin of the case lying next the slot will fall through the slot, open the box, and allow carbide to drop into the water below. The cases being suspended from their upper rear ends on the generator and at a slight distance from the wall, when the pin falls through the slot of the disc, the box bumps down with its lower rear edge against the wall of the generator, and effectually shakes all the carbide out into the water.

The lower end of the spindle G, at the bottom, is provided with a fixed pulley J, round which a chain or cord engages; being guided on the gasholder, and carrying a stop Z capable of being adjusted to approximately the lowest position of the bell M. The bell is provided with a striker or fork Q which, when it sinks to approximately its lowest position, comes into contact with the stop on the cord or chain, and pushes it, and with it the cord or chain, down, and turns the pulley and partially rotates the disc so as to bring a slot under the pin of a fresh carbide receptacle and discharge it into the water of the generator.

Producing Acetylene.—Dauber, A., of Bochum, Germany. No. 17,343; Aug. 26, 1899.

In this arrangement of acetylene generator—vertical sections (at right angles to each other) and a cross section are shown on p. 32—the gasholder consists as usual of a fixed tank and a bell or moveable top. A water-pipe C with float regulates the admission of water and keeps it at a uniform level; while a discharge-pipe D allows the escape of the gas. The arrangement for admitting new raw material into the central part of the tank is as follows: A large tube E is fixed to the roof of the gasholder bell, and hangs down into it. At the bottom, it is closed; and at the top, it is provided with a feeding hopper covered by a lid, while below there is a cone H, to be raised and lowered to open or close the communication

from the feeding hopper to the lower part of the tube E. In the centre of the tube is arranged a perforated pipe J; and a spiral K is placed between the pipe J and the sides of the tube E, down which any raw material entering the tube from the hopper is guided to an opening at the bottom.

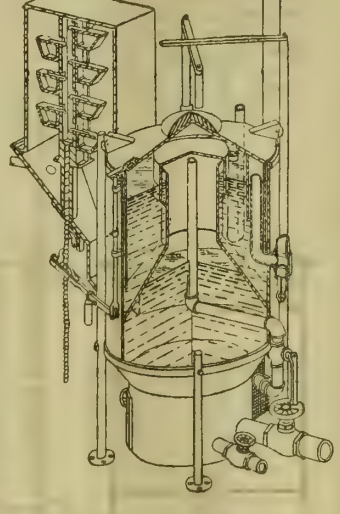


The lower part of the tube E is guided in a fixed tube M standing upon an oblique plate N, at the bottom part of the tank. About half way up (in the middle height of the tank) a spout or a funnel P is arranged in the tube M, forming an outlet sideways; and thus, when the bell with the feeding tube E has sunk so deep into the tank that this side opening arrives at the upper edge of the funnel and lower, the discharge of the material upon the spiral K into the funnel P begins.

The funnel discharges its contents into a small tank V placed upon the oblique plate N, and reaching up to the water-level in the apparatus. This has for its object to prevent the distribution of the carbide over the whole area of the bottom of the tank, so that no formation of gas can take place near the edges, where it could escape between the sides of the tank and the bell.

Acetylene Gas-Machines.—Matthews, F., of Montreal, Canada. No. 17,406; Aug. 28, 1899.

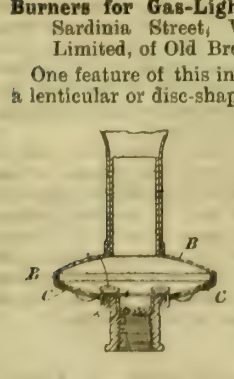
The object of this invention is to devise a compact and simple form of automatic machine for the manufacture of gas from carbide of calcium. It consists essentially (as shown) of a generator provided with a central hollow stem having connected to its four sides upsettable buckets to hold the carbide; the holding catch of the buckets being released by the head of a rod extending up through the stem and deriving an upward movement through the rise and fall of the gas in the holder, so as to upset the carbide in the bucket, or each set of buckets, in its turn into a shoot, which leads to a water receptacle underneath.

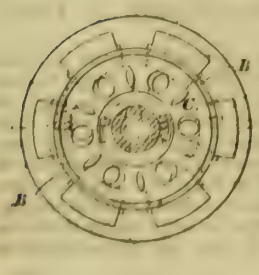


The generated gas thereby passes up a tube in the middle of the holder (which tube is provided with a safety air-pipe), so as to raise the dome in proportion to the amount of carbide deposited in the water; a blow-off pipe, of course, being provided to prevent any accident in the way of explosion from a mixture of air with the gas.

Burners for Gas-Lighting by Incandescence.—Voelker, W. L., of Sardinia Street, W.C., and the Voelker Incandescent Mantle, Limited, of Old Broad Street, E.C. No. 18,750; Sept. 16, 1899.

One feature of this invention consists in making the bunsen tube with a lenticular or disc-shaped chamber or enlargement near the lower end, and having in its lower or upper wall holes for the admission of air to the burner. By this means, the entering air impinges on the upper wall of the enlargement or chamber; and "the velocity of the air current ascending the smaller part of the bunsen tube is thus rendered approximately constant, notwithstanding external draughts or currents, and the flickering or disturbing effects of the latter on the light are consequently obviated or greatly reduced." Another feature of the invention consists in means for regulating the quantity of air and gas admitted to the burner. This is effected in the case of the air by arranging a perforated ring or annular valve to slide over the air-holes in the enlargement or chamber; so that, by turning the ring or valve, the admission of air can be regulated or controlled as desired. In the case of the gas, there is arranged in the inlet-jet a perforated diaphragm and a corresponding perforated disc to move over it—the apertures in the disc being preferably elongated and inclined relatively to a radius of the disc. Thus the area of the gas-inlet passages will be gradually increased or diminished (or closed) as the disc is turned in one or the other direction.





The illustration shows a side elevation (partly in vertical section) and an underside view (partly in transverse section) of an incandescent burner having these improvements applied to it.

In the upper end of the inlet-jet or nipple is mounted the bunsen tube, having at its lower end a lenticular enlargement or chamber B formed by two dished rings united to each other at their outer edges. In the lower wall of the chamber is formed a series of apertures, and on the underside is loosely mounted a ring C held in place by an inwardly-turned flange on the upper dished ring. The ring is provided with a series of apertures of similar size and pitch to those in the lower wall of the chamber B, and is formed with a series of projections whereby it can be readily turned about its axis. In the upper part of the inlet nipple is mounted a diaphragm having a number of apertures, and above is an adjustable disc having a series of apertures which are elongated and inclined relatively to a radius of the disc, so that, as the disc is turned in one or the other direction, the apertures will be gradually opened or closed. The disc and its apertures are (preferably) so arranged that the gas-way cannot be entirely interrupted—thus obviating the necessity of employing a separate bye-pass for a pilot-light.

These improvements are said to "render the burner more efficient than heretofore," and enables a bunsen tube to be used of smaller diameter than those generally employed.

APPLICATIONS FOR LETTERS PATENT.

25,114.—Melius, R. J., "Elevating and conveying coal and the like." Dec. 19.

25,138.—Dorman, D. M., "Acetylene gas-generators." Dec. 19.

25,164.—Schmidt, E., "Igniting devices for lighting gas and like lamps." Dec. 19.

25,171.—Abercrombie, J. H., and Symington, R. B., "Incandescent lighting mantles." Dec. 19.

25,197.—Rausch, J. H., "Lamps." Dec. 9.

25,229.—Meldrum, J. J., T. J., & J. W., "Furnaces." Dec. 20.

25,240.—Oldham, O., and Dack, W. N., "Separating water from gas or vapour." Dec. 20.

25,266.—Renault, L., "Explosion engines, and the utilization of the heat and products of combustion therefrom for the generation of gases or vapours." Dec. 20.

25,271.—Baker, F., "Means of illumination." A communication from C. Martin. Dec. 20.

25,332.—Wilson, J., "Gas-engines." Dec. 21.

25,359.—Duncan, J. H. H., and The New Sunlight Incandescent Company, Ltd., "Incandescence bodies for use with gas and like burners." Dec. 21.

25,374.—Robus, H. J., "Manufacture of coal gas." Dec. 21.

25,379.—Sharp, J., "Fluid meters, motors, and pumps." Dec. 22.

25,395.—Challen, W. B., "Unions for gas-pipes." Dec. 22.

25,443.—Marks, G. C., "Automatically operating a valve at any predetermined time." A communication from A. Stenhouse and E. A. Whitehead. Dec. 22.

25,465.—Alexander, T. W., "Pressure reducing and regulating devices." A communication from J. S. L. Alexander and A. G. Schoonmaker. Dec. 23.

25,492.—Nelson, W. O., Houghton, L. S., and Miller, E., "Acetylene gas-generator." Dec. 23.

25,503.—Quelch, G. H., and Kent, T. O., "Generation of acetylene gas." Dec. 23.

The Gas Supply of the Kingston-upon-Hull District.—The Gas Engineer of the Hull Corporation (Mr. F. J. Bancroft) reported to the Gas Committee on Wednesday that the output of gas from the Broadley Street works was being well maintained; and on the preceding Friday, the consumption had been 540,000 cubic feet, which was the greatest amount ever sent out from the works in one day. The plant will now be dismantled as soon as the connection with the British Gaslight Company's mains can be made. Reference to this matter was made in the course of the proceedings. Mr. Beautement inquired the reason of the delay in establishing the connection. The Chairman (Alderman Massey) replied that the explanation was simple. The N.E.R. Company said the Corporation's Act did not give them power to go under the Queen's Dock lock-pit. The Company had eventually to give way; but the wrangling with them cost the Committee about £500 for the renewal of the contract. It was also intimated that the pipe-laying contract would be finished by next April.

Fatal Accident at the Saltley (Birmingham) Gas-Works.—Thomas Price, aged 47, was killed last Tuesday evening at the Saltley Gas-Works of the Birmingham Corporation while shunting some coal and coke trucks. It appears that he signalled to the engine-driver to "come on." But in stepping clear of the rails, he stumbled and fell; and before the driver could stop, the wheels passed over him, severing the head from the body. Deceased had been engaged in shunting work for nine or ten years. At the Coroner's inquiry on Friday, it was stated by a witness that deceased gave the signal to the driver to move, and then started to get in front of the engine, in order to walk before it to see that the way was clear. This proceeding was described as a necessary one, and as being deceased's duty. There was no evidence to show how Price came to fall in front of the engine; but several witnesses stated that there was a stack of pipes at the side of the line, and two of them were very near the metals. One witness said the ends of the pipes were only 17 inches away; but Mr. Chaney, the Superintendent of the works, asserted that the nearest pipe was 3 ft. 2 in. from the rails. Jackson and the engine-driver said they had complained to the men who put them there, of the proximity of the pipes to the metals. The Coroner, in summing up, referred to the statement made by the driver as to the shunter walking before his engine, and said if this was a custom it was certainly one to which attention ought to be directed. The Jury returned a verdict of "Accidental death," but added a rider "that they thought there was culpable negligence in pipes lying so near." The Coroner drew Mr. Chaney's attention to the rider; and the latter said he could add nothing more to what he had said. No one, he pointed out, saw deceased stumble over the pipes.

PARLIAMENTARY INTELLIGENCE.

PROJECTED GAS LEGISLATION FOR THE METROPOLIS.

The Bills of the Gaslight and Coke Company and the London County Council.

In the "JOURNAL" for the 19th ult., we gave a full abstract of the Bill to be introduced into Parliament next session by the South Metropolitan Gas Company to enable them to alter the existing provisions as to the standard price and illuminating power of their gas, and to purchase by agreement the portion of the undertaking of the Gaslight and Coke Company on the south side of the Thames. The only other Bills relating to the supply of gas in the Metropolis are those promoted by the Gaslight and Coke Company and the London County Council. The general scope of these measures has been already indicated; but we are now able to notice them at greater length.

The Bill of the Gaslight and Coke Company is mainly a duplicate of the one which was unsuccessful last year. The preamble sets forth that by the Act obtained in 1898 the Company's debenture stocks were converted into one stock, called "3 per cent. consolidated debenture stock;" and that it is expedient that the Company should have further power to raise money by the creation and issue of £2,500,000 of debenture stock. The stock is to be offered by auction or tender, at a reserve price; and any premium resulting from the sale, after deduction of the expenses, is not to be considered as profits of the Company. The new issue is to be known as the "second 3 per cent. debenture stock." Unsold stock may be put up again at a subsequent sale, or be offered for tender under the previous conditions, and at a price equal to or above the reserve fixed. The Bill authorizes the Company to hold certain lands specified, and erect thereon works for the manufacture and storage of gas and the treatment of residual products; also to use other lands specified for any of their purposes except those named above. Power is sought to purchase by agreement further lands, not exceeding 150 acres, which may be required for the purposes of the undertaking, but not to be used for the manufacture of gas or residual products. A clause of the Bill specifies that the Company are not to be authorized to purchase or acquire ten or more houses which on the 15th ult. were occupied wholly or partially by persons belonging to the labouring class as tenants or lodgers, or, except with the consent of the Local Government Board, ten or more which were not so occupied at that date, but which have been or shall be occupied subsequently.

The Bill of the London County Council is for "making further provision as to testing the illuminating power of the gas" supplied by the Gaslight and Coke, Commercial, and South Metropolitan Companies in the Administrative County of London, and for "regulating the supply by those Companies of prepayment meters and fittings in connection therewith," and other purposes. The preamble sets forth the Acts which provide for the gas being of a certain illuminating power, and the arrangements made for testing it. It then goes on to say that it has been found that the illuminating power of the gas supplied by the Companies named in their districts generally "cannot be satisfactorily or sufficiently tested by tests made only at certain prescribed testing-places;" and that it is desirable that power should be given to the Gas Examiners to make additional tests elsewhere, in manner to be prescribed by the Gas Referees. Allusion is then made to the introduction of the system of supplying fittings and apparatus and selling gas by means of penny-in-the-slot meters at a charge which includes the price of gas and something additional for the meters and fittings; and it is stated that, as a consequence, the statutory provisions regulating the price of gas are in danger of being defeated. The Council consider that "the supply of such meters and fittings, and the charges therefor, should be regulated by the Board of Trade, and the amount of such charges stated to the persons who pay them, and that the Companies should keep and publish separate accounts of their receipts and expenditure in respect of such meters and fittings."

The Bill is divided into four parts, and there are 16 clauses. Part I. consists of the short title and interpretation clauses. Part II. relates to testing. Under clause 3, any gas examiner may make, at any place within the district supplied by any of the Companies, tests for ascertaining whether the illuminating power of the gas supplied by such Company at that particular place is such as is required by law. The apparatus to be employed in these tests, and the mode of conducting them and recording the results, are to be from time to time prescribed by the Gas Referees, who are to make regulations with respect to these matters, and send to the Council, the City Corporation, and each of the Companies a copy of the regulations. Clause 4 provides for the application of sections 11 to 14 and 17 to 20 of the Gaslight and Coke and other Gas Companies Acts Amendment Act, 1880, to the Act now applied for. Clause 5, relating to the notice to be given to a Company of the intention to test, runs as follows:—

> At least 24 hours before any test is made under this Act, the Council or the Corporation, as the case may be, shall give to the Company interested notice that tests are about to be made under this Act, specifying in such notice one of the testing-places prescribed and certified by the Gas Referees, and an hour at which it is proposed to start from such testing-place in order to make tests under this Act. No person shall disclose to such Company by such notice, or otherwise, the place at which any such tests are to be made. Any officer of such Company who may attend at the time and place specified in such notice shall be entitled to be present at the making of such tests, but shall not interfere therein. Any notice under this section may be sent by post.

Part III. of the Bill (clauses 6 to 15) relates to prepayment meters and fittings. It is specified in clause 6 that, as soon as may be after the passing of the Act, the Board of Trade shall, after holding an inquiry, approve a standard pattern or patterns of prepayment meters, and fittings for use in connection therewith, and shall fix, for the use of these meters and fittings by the consumer, such charges per 1000 cubic feet of gas supplied by means thereof as they may think reasonable, having regard to the fair and proper cost of supplying such appliances. By the next clause, the Board of Trade are to send to each of the Companies, to the Council, and to the Corporation, a statement showing the approved standard patterns, and the charges fixed. Specimens of meters and fittings of such standard patterns, or of such parts thereof as the Board of Trade may appoint, are to be kept at the Board of Trade, and at the offices of each of the Companies, the Council, and the Corporation, and are to be open to public inspection at all reasonable times. Clause 8 sets forth that, within two months from the receipt of the statement above referred to, the Companies are to furnish to each of their consumers supplied with gas by means of a prepayment meter, a statement, in a form to be approved by the Board of Trade, setting out the charges fixed by the Board for standard fittings, the places at which the specimens are to be seen, and the conditions under which persons are entitled to be supplied therewith.

Under the next clause, any person who is entitled, in respect of the ownership or occupation of any premises, to be supplied with gas by any of the Companies may, by notice in writing specifying the premises, require the Company to supply thereon standard fittings; and they shall, within a reasonable time, supply the same accordingly, and shall keep in repair and renew them when necessary. If the applicant requires the Company to supply standard fittings on any premises on which there are, in working order and repair, similar fittings already supplied by the Company, the latter are not to be bound to supply them until the applicant shall have paid to them the reasonable expenses of replacing, either by substitution or alteration, the fittings already on the premises by standard fittings. Any question as to the amount of such payment is to be decided by a Court of Summary Jurisdiction.

The next three clauses (10 to 12) relate to the charges to be made for the fittings. Under clause 10, it is not to be lawful for any of the Companies to charge, or for a consumer to agree to pay, for the supply of gas by means of standard fittings, a greater sum per 1000 cubic feet than the price which the Company may be by law entitled to charge for gas, together with the charges for the use of such fittings fixed by the Board of Trade. After the issue by the Board of a statement showing the standard patterns approved and the charges fixed, no agreement entered into by any Company with any person for the supply to him of gas by means of a prepayment meter otherwise than by standard fittings shall be valid, unless and until the Company shall have handed to such person a copy of the Board's statement, and unless such agreement shall be in writing, and shall expressly specify that such person does not desire to be supplied with gas by means of standard fittings. Receipts are to be given for moneys received from any consumer supplied with gas by means of a prepayment meter; and every such receipt is to contain a statement showing clearly the charge for gas per 1000 cubic feet and the charges fixed by the Board of Trade for standard fittings. The Companies are to keep, in a form to be approved by the Board of Trade, a separate account showing all expenditure and receipts in respect of prepayment meters and fittings, and furnish to the Council and the Corporation copies of such account with their annual statement of accounts. Except as otherwise provided, these separate accounts are to be subject in all respects to the statutory provisions relating to the general accounts of the Companies respectively. Each of the Companies shall, in each half year, carry from the separate account to a renewals account such sum as the Auditor appointed by the Board of Trade to audit the accounts of such Company shall direct; and the money standing to the credit of such renewals account is to be applied solely in providing for renewals of such meters and fittings.

Clauses 13 and 14 provide for the revision of the standards and charges. If at any time after the expiration of five years from the date of an inquiry under the Act, any of the Companies, the Council, or the Corporation request the Board of Trade in writing to revise the patterns or the charges approved and fixed, the Board are to hold a fresh inquiry, and they may, if they think fit, make any alterations in the patterns or charges. It is provided that the Board may at any time, if they think fit, at such request, hold such inquiry and make such alterations as aforesaid. At least 28 days before holding any inquiry, the Board of Trade are to give to each of the Companies, to the Council, and to the Corporation notice of the time and place thereof, and the Companies, the Council, and the Corporation are to be entitled to attend and to be heard thereat.

Clause 15 specifies that the penalty for any breach of the provisions of the Act is not to exceed £5; and for any continuing breach, not to exceed £5 for every day during which such goes on. The penalties are to be recovered, applied, and apportioned as if they were penalties under the Metropolis Gas Act, 1860.

Part IV. consists of one clause (16), which provides for the costs, charges, and expenses incidental to the passing of the Act being defrayed as payments for general county purposes within the meaning of the Local Government Act, 1888.

THE PROVISION OF ADDITIONAL STORAGE RESERVOIRS IN THE THAMES VALLEY.

The Bill promoted by the London Water Companies with the object of conferring upon the Local Government Board power to call upon them to submit schemes for additional storage reservoirs in the Thames Valley, to which reference has already been made in the "JOURNAL," has been deposited, and the following is an abstract of its provisions.

The preamble sets forth that Lord Balfour's Commission, in their report, expressed the opinion that in the year 1931 the population of the area served by the London Water Companies would be upwards of 11 millions, and that the needs of this increased population would be met by the construction of storage reservoirs in the Thames Valley at no great distance above the intakes of the Companies. It then refers to the authority given to the Staines Reservoirs Joint Committee and the Southwark and Vauxhall Water Company to make reservoirs (the former being, in fact, an instalment of the scheme recommended by the Commission), and to the Companies to effect intercommunication between their systems, and carry out such works as might be necessary to enable them to supply each other with water. It goes on to state that "for the purpose of giving more complete effect to the opinion and recommendations of the Commissioners, it is expedient that further powers be conferred upon the Local Government Board with a view to the providing, by means of additional storage reservoirs in the Thames Valley, for

the supply of water in the future within the districts of the Metropolitan Water Companies, and that the obligation be imposed upon the Companies of giving effect to any requisitions of the Local Government Board in that behalf."

Clause 1 of the Bill simply gives the short title—the "Metropolitan Water Companies Act, 1900." Clause 2 confers upon the Local Government Board power to require the Water Companies to submit schemes for making the reservoirs above referred to; and the Companies are to submit them accordingly. Clause 3 provides that when the Companies have complied with the Board's request, an inquiry is to be held on the scheme by one of the Inspectors; and the next clause charges the Companies with the costs. Under clause 5, the Local Government Board may make such order, upon the report of the Inspector, as they may think fit, requiring the Companies to carry out the works specified in the scheme; and the Companies are to comply with the order, and, if necessary, apply to Parliament for further powers to enable them to do so. Clause 6 empowers them to take any lands, &c., specified in the order; and the following one prohibits the acquisition of 10 or more houses occupied by persons of the labouring class, unless some scheme prepared by the Companies for providing new dwellings has obtained the sanction of the Local Government Board. Clause 8 makes section 12 of the Water-Works Clauses Act, 1847, applicable to the new works to be constructed. Clause 9 is as follows:—

For the purpose of filling with water any reservoir which may be constructed by any Company or Companies as aforesaid, such Company or Companies may, with the sanction of the Local Government Board in writing, and with the consent in writing of the Conservators of the River Thames, take further water from the River Thames and its tributaries, at such times and places, but at such times and places only, as the Local Government Board specify in that behalf as being, in their opinion, times and places at which such water may be taken without injury to the River Thames, and without prejudice to the rights of any Companies or persons empowered by statute to take water from the river, or to the rights of any third parties.

Under clauses 10 and 11, the Companies may agree for the joint exercise of the powers conferred by the Act and the apportionment of the water to be obtained under it; and any one or more of them may purchase lands by agreement. Clause 12 sanctions the raising of the necessary money by the issue of debenture stock, which is not to be subject to the sinking fund. The remaining clauses (13 to 16) specify that any Company failing to comply with an order will be liable to a penalty of £100 a day, or any less sum which the Court may adjudge; that the expression "Metropolitan Water Companies" means those mentioned in section 3 of the Metropolis Water Act, 1871, and that "Thames Valley" means and includes the basin of the River Thames between Molesey and Lechlade, and the basins of all rivers and streams falling into the Thames between those places; that the Companies are not to be exempt from the provisions of the General Acts relating to the supply of water to the Metropolis now or hereafter to be in force; and that the costs incidental to the passing of the Act are to be borne by the Companies.

LEGAL INTELLIGENCE.

Emanations from Gas Residuals Works in Manchester.

Last Thursday week, the Manchester Stipendiary (Mr. F. J. Headlam) gave his decision at the City Police Court, in the matter of two summonses taken out by the Corporation against Messrs. Hamor Lockwood and Co., and Messrs. Hardman and Holden, chemical manufacturers at Miles Platting, in respect of a nuisance alleged to have been caused by the emission of noxious fumes from the gas-residuals works of the defendants. The summonses had formed the subject of a protracted investigation at the Police Court. Mr. Headlam said he understood the difficulty there had been in ascertaining definitely where the nuisance arose; the works of the two defendants being in close proximity to each other. He was of opinion, however, that the evidence exonerated Messrs. Hardman and Holden; and the summons against them would be dismissed. He was further of opinion, after considering the evidence, that the smells arose from the works of Messrs. Hamor Lockwood and Co.; the evidence offered on their behalf as to the manner in which they carried on their business not being so satisfactory. They would, therefore, be fined £5 and costs in two cases.

The Deficiency of Electric Lighting in Marylebone.

At the Marylebone Police Court last Friday, the Metropolitan Electric Supply Company, Limited, of Baker Street, appeared in answer to summonses, taken out by the Guardians of Marylebone and the Marylebone Vestry, for making default in supplying electrical energy to the Workhouse and the Vestry premises on the 7th, 9th, 11th, 12th, and 14th ult. Mr. Herbert Manisty supported the summonses; and Mr. Muir represented the defendants. Mr. Fenwick informed the Court that he was present on behalf of 33 persons living in Great Portland Street who wished to take action against the Company. Mr. Muir said the Company admitted the default, but it was owing to an unavoidable accident. That the demands made upon them had exceeded their most sanguine expectations would be seen when he stated that, whereas the number of lamps supplied in 1892 was 78,000, in 1897 it had risen to 187,000. There had been an unprecedented augmentation since 1897 in the number of lamps; the increase being 20 per cent., or 80,000 lamps, in addition to what they had already to provide for. The Company desired to acknowledge the forbearance and courtesy received from their customers during this trying period. The object of the prosecution being to ensure the fulfilment of the Company's contract, he hoped the Magistrate would not inflict any penalty at this period, but would adjourn the summonses till after the dark days had passed. Mr. Plowden said it seemed to be clear that when the Company started they never contemplated their future greatness; and when this fact became apparent, they made frantic and praiseworthy efforts to meet the emergency—efforts, however, which had not been a complete success. The cases were adjourned for three months.

MISCELLANEOUS NEWS.

THE ROYAL AQUARIUM GAS EXHIBITION.

Not for the first time, the Royal Aquarium has lent its aid in demonstrating progress in artificial lighting by means of gas. If we remember rightly, it was in one of the galleries of this place of pleasure that the Denayrouze burner made its *début* in this country; and now the authorities have given up a large portion of their ground space to one of the finest collections of modern gas lighting methods that has been brought together during recent years—thanks in the main to the active organization of Mr. M. J. G. Ritchie and Mr. T. G. S. Hersey. Gas cooking and heating, and even the realm of the gas-plant manufacturer, are not altogether neglected; but gas lighting predominates. On entering, one is met with a perfect effulgence in the body of the building, at either end of which are congregated most of the principal stands. Altogether there are upwards of forty stands, and the major part of them are centres of light—both coal gas and acetylene; and as some of the exhibitors have done their best to out-shine their neighbours, the great light here and there is almost dazzling, if not bewildering. Looking round generally, one is struck by the fact that progress and present-day requirements have almost entirely shut out some of the old friends of the gas industry. Where now, for instance, are the many types of flat-flame burners and recuperative and regenerative lamps that held sway at the time of the great exhibition at the Crystal Palace? The present exhibition supplies the answer. On every side, whichever way he turns, the visitor is met by the incandescent gas-light, and the many novelties and accessories which the makers of gas-fittings have introduced in connection therewith. Competition and the demand for a stronger light have produced these things; and slowly but surely the old forms of lighting are falling before them. The exhibition is to remain open until the 23rd inst.; and no doubt many gas engineers and managers will take this opportunity of inspecting under favourable conditions this aggregation of lighting systems. No good purpose would be served by noticing in detail here all that is to be seen; but we give a general indication of the character of the articles on view, with special mention of some of the striking features.

As near as it is convenient to do so, we shall follow the order of the stands as set forth in the catalogue. Adopting this course, we have first to deal with what is called "Area, East Section." Stand 1 comprises a collection of high-power and street-lamps on the incandescent system, furnished by the Welsbach Company, and situated in the Abbey entrance to the building. Here are seven large burners supplied with gas at 8 inches pressure by means of Keith's apparatus; the increased pressure raising the illuminating power from 100 to 240 candles per burner, with a consumption of only 8 cubic feet of gas per hour. For convenience only, in this particular instance, the Keith apparatus is operated by a small gas-motor; but if water was employed in the usual way, we are assured about 2 gallons per hour would suffice for the purpose, which speaks well for its economical efficiency. A variety of the Welsbach Company's street-lamps are also on view; but the most attractive feature of this section of their exhibit is an illustration of the adaptation of their system to lighthouses. The honour of being prime mover in this direction is due to Mr. H. Matthews, the Engineer-in-Chief to the Trinity Board; and the dioptric apparatus on view has been kindly lent by the Elder Brethren of the Board. Already the light has been applied to two or three lighthouses on the coast; and the section of lenses on view comes from the one at Lowestoft Low. These lenses multiply the light seven or eight times; so that as the lamp contains seven mantles, each giving a light of 240-candle power, a magnificent illuminating power is arrived at, as will be found by working out this little sum: 240 candles × 7 × 8. A short distance away the light has the appearance of a large incandescent pillar. There seems to be no reason why the incandescent system should not be generally adopted for lighthouse purposes where a supply of compressed gas can be provided. Stand 8 is also furnished by the Welsbach Company. The structure makes a beautiful centre-piece in this section of the exhibition. It is about 25 feet high, and has a dome-shaped roof, surmounted by a huge model of a Kern burner, giving a light of 3500-candle power. Probably by this time a large opal reflecting screen has been raised above the burner; and we can imagine that with this arrangement there will be a perfect flood of light from this source. The body of the stand is covered by multifarious fittings of chaste and exquisite design, bearing the various forms of Kern burners and mantles. Tasteful shades and globes of divers shapes and hues all assist in making up a very pretty stand. Among the globes is one which has been specially designed for use with the Kern burner, in order to ensure a downward radiation of the rays—a small improvement with an important effect. The Matchless bye-pass lighters as applied to the Welsbach burners are also exhibited, in order to give visitors an opportunity of testing their utility. A further display is made by the same Company at stand No. 43 in the south gallery; and much that has been said about stand 8 applies also to this. Among the numerous attractions will be observed the improved Frédureau gas projector for street lighting, and the "Simplicitas" gas-fittings for domestic lighting. There are several choice designs of these patent fittings; and they certainly possess noteworthy advantages. There is no brasswork above the chimney to get discoloured by the gas-fumes, the globes are easily removed for cleaning, the artistic effect and graceful outline of electrical fittings is attained in combination with the practical advantages and economy of incandescent gas lighting, and the position of the burner is such as to give the greatest illumination where the light is wanted. Altogether it may be said the Welsbach Company make a very successful display.

At stand 2 Messrs. Worsnop and Co., Limited, of Halifax, have an exhibit of new acetyloid lamps for domestic and other uses. Mr. L. Wiener occupies stands 3 and 30 with stentite acetylene burners and gas and electric light fittings; and on stand 4, Mr. C. Maynard Walker presents samples of his water-heaters, heating-stoves, anti-shock attachment for incandescent mantles, and gas fittings and lamps. The Davis Gas-Stove Company, Limited, are in possession of stand 5, which is not given the prominence that such an old-established firm should have commanded. However, they have made the best use of their space. Two noble-looking exhibits are an automatic hot-plate for employment in large

institutions, and a double oven roaster for hotel use. The famous "Metropolitan" gas kitcheners, of course, bulk largely; and a collection of other domestic and trade gas appliances make up a very presentable display. Stand 6 was allotted to the Voelker Mantle, Limited; and their preparations promised a very gorgeous display. But presumably through the intervention of the arm of the law (in the form of an injunction issued on the petition of the Welsbach Company), the work has been stopped. Workmen, however, were again busy there at the end of last week; but to what use the stand is now to be put we do not at present know. On stand 7, the Acetylene Illuminating Company have a number of photographs illustrating their system of lighting. Acetylene apparatus is shown on stands 9 and 10 respectively by the F. Dye Heating Company and the Husson's Safety Acetylene Syndicate. Attention is next arrested by the exhibits of the combined firms of Thomas Glover and Co., Limited, and R. & A. Main and Co., Limited, at stand 11. Numerous examples of the well-known meters of the first-named firm are shown; and the meter which took several prizes for them at the great exhibitions of several years ago is to be seen encased in glass. A prepayment meter is also open for inspection; and an old friend is once more to the front in the shape of the model of the 3000-light dry meter which was used at the Crystal Palace in Hyde Park in 1851, to measure all the gas used in that building. A test-holder, gauges, and several other of the goods of the firm are also on view. Messrs. R. & A. Main and Co. have supplied a splendid collection of their gas cookers, which contain certain new features enhancing their usefulness and economy. In addition to the gas-fires and other goods, visitors will be interested in the complete installation of a prepayment supply. Stand 28 (in the small concert hall) is also in the occupation of this firm; and among the manufactures on view there is an 8-feet steam hot closet. In conjunction with the firm's exhibits, Miss Blanche Cameron lectures twice daily. Passing the Buffington Acetylene Gas-Light Company's attractive display, we come to stand 13, at which Messrs. Wright and Butler, Limited, of Birmingham, make their first bow to the public as manufacturers of gas heating and cooking stoves. This firm were originally oil-stove makers, but have now put down a foundry and shops for turning out gas-stoves of high-class finish and workmanship. They have a good assortment of fires and stoves of various types, some of which are quite artistic in appearance. The aim of the firm is evidently to produce goods which, while giving satisfaction in use, shall have a pleasing exterior. Messrs. S. Clark and Co.'s "Syphon" stoves, which occupy stand 14, are too well known to require any lengthened reference. Turr's Acetylene Gas Syndicate, Limited, have an interesting exhibit of acetylene generators and appliances on stand 15; and they are followed (stand 16) by Messrs. Falk, Stadelmann, and Co., Limited, who have brought together a choice collection of their newest and most improved designs in gas-fittings, and acetylene burners, lanterns, and fittings. Further acetylene apparatus is found on stand 17; the exhibitors being Messrs. Thorn and Hoddle.

Passing now to what has been named the "Area, West Section," the first stand demanding attention (No. 18) is that of the Hydro-Incandescent Gas-Light Company, whose principal object of interest is the new Scott-Snell gas-compressor, which has been incorporated in their system of high-power lighting, and for which the Company claim several excellent qualities. A more extended notice of this machine is given elsewhere; but it may here be mentioned that the one on view (which is astonishingly small for the work performed) is in operation, and is employed in raising the pressure of the gas for the lights illuminating the southern gallery, the stand itself, and St. Stephen's Hall (west entrance)—in all some sixteen 500-candle power lamps. With a pressure of 30 inches off the water-main, this small instrument imparts a pressure to the gas of about 54 inches; and every facility is given for testing on the spot the truth of the statements made. The machine, which works smoothly and silently, is worthy of the inspection of the professional visitor. Plans showing the adaptability of the system to any purpose from docks to drawing-rooms may be inspected. On the same stand are also seen samples of the patent "Economy" gas-cooking stoves and hot-plates. These, which are of German origin, are fitted with specially constructed bunsen burners, giving a splendid heat, with a moderate gas consumption. The hot-plates are closed in all round like a cooking-range; and in this way the heat is retained to such an extent that several pans may be kept practically boiling, with (say) only one burner alight. Further exhibits of the Hydro-Incandescent Company will be found on stands 36 and 38 in the southern gallery. The Incandescent Accessories and Maintenance Syndicate make a very respectable show at stand 19. The speciality of this firm is the maintenance of incandescent lights; but at the stand the most interesting exhibit is an anti-vibration burner, to which a gold medal was awarded at the Leicester Industrial Exhibition in October last. Hard by, on stand 20, Messrs. Samuel Cutler and Sons make a display of several clear and well-finished photographs of gasholders completed and in course of erection, and also of apparatus for the manufacture of coal gas and carburetted water gas. Stand 21 is engaged in displaying a light refracting and diffusing "envelope" for electric incandescent lamps, which is also applicable to gas lighting. The exhibitors are the Spiral Globe, Limited. The Acetylithe Light Syndicate show special generators and apparatus using "acetylithe"—a form of prepared carbide. This is the system known in France as the Letang-Serpollet.

We now come to a set of exhibits which will be found extremely interesting to the gas-works engineer. They are supplied by West's Gas Improvement Company, Limited, and are disposed on stand 25. One of the first things to claim attention is a splendid and powerful coal-breaker, fitted with a double pair of claws, and slide-door complete. By its side stands a vertical 8-horse power engine to drive it. In erecting these coal-breakers for use, the manufacturers prefer to place the engine in a separate building, connecting up through the partition wall. The initial expense of this division of the plant is perhaps a little more than would otherwise be the case; but it is soon counter-balanced by the saving in wear and tear. These machines certainly look capable of any amount of hard work. There is also on view a 4½-inch double-cylinder compressed-air motor, designed for driving West's compressed-air charging-machines; but it can also be employed for hauling coal trucks and waggons on gas-works. A smaller pattern (3½ inch) such as is used for operating the drawing-machines, is also shown. Careful workmanship is betokened by the nice adjustment and finish of these motors; and expert tests accord to them a very high degree of efficiency. There is also to be seen a model of the firm's new patent coke-conveyor, with Hunt's patent roller chain, for which West's Improvement Company are the sole agents. Another object of interest is a model of a section of a retort-house fitted with West's manual charging and drawing machines and elevator complete. On the screen at the back of the stand are a number of photographs and pictures illustrating the Company's labour-saving appliances for gas-works and their various shops at the Miles Platting works. Several, if not all, of these photographs, and some splendidly executed original drawings, were the work of an old servant of the firm—Mr. R. J. H. Sayers.

We now come to the exhibit of the New Sunlight Incandescent Company, Limited (No. 26), who have supplied, by the ingenious arrangement of their stand, one of the attractions of the exhibition. Around an old fountain they have constructed what, a little distance away, appears to be a veritable temple of light; and it occupies in this area a corresponding position to stand No. 8 of the Welsbach Company in the east section. By means of a number of gas-pipes, a circular body with domed roof is delineated. Closely placed over this framework are the different types of the Company's burners and mantles, all alight; and the whole is surmounted by three clusters of high-power burners—the entire arrangement forming quite a brilliant spectacle. Of course, prominence is given to the Company's "Simplex" burners and white mantles; and they may be seen in use without chimneys, or ensconced in very prettily designed bulbs and globes. It will be observed that the "Simplex" burners are constructed in three sizes, suitable (No. 2) for cottage lighting, (No. 3) for shop and interior lighting, and (No. 4) for street lighting, and that they are supplied with an ornamental attachment, which gives them a very sightly appearance for interior use. We understand that the No. 4 burner is being largely adopted for street lighting, and that it gives a duty of something like 100 candles per 4 cubic feet of gas consumed, without any artificial means. Concerning the mantles, attention is called to the double supporting threads at the top, which is a further protection against collapse—dividing as it does the responsibility for the safe upholding of the mantle. We are also informed that the companies who cater for high-power illumination show a decided preference for Sunlight mantles owing to their durability. On this point of strength and lasting power, the Company are naturally elated over the results of some comparative tests made by Mr. C. R. Bellamy, the Corporation Lighting Superintendent of Liverpool, and which are referred to in a letter by the Chairman of the Company in alluding to an interview he had with Mr. Bellamy. An extract from the letter has been handed to us; and it may be conveniently quoted here. It reads: "Mr. Bellamy showed me a very interesting table of curves yesterday, showing the Welsbach mantles starting at about 27 candles per foot (with their rich gas this is possible), but coming down steadily and rapidly to about 12 candles per foot, and giving out at about 700 to 1000 hours; whereas our mantle, starting at about 14 candles, went up to between 15 and 16, and then kept almost a dead-level right across the paper to 2800 hours, and he had a note from his assistant saying that it had done now 3100 hours without any show of loss in efficiency. The effect on the table of the curves was very striking; but my attention was, of course, arrested by the fact that, with his specially rich gas, he got but little over 15 or 16 candles. It then transpired that these were tested over a governor which reduced the pressure to about 7-10ths. I have no doubt that this was the result of our comparatively low showing." Returning to the Company's exhibit, a goodly collection of effectively designed gas-lamps, pendants, brackets, and fittings of all kinds suitable for incandescent lighting are arranged for close inspection here and on stands 26*a* and 39—the latter being in the south gallery.

Gas-engines occupy the next three stands to be noticed. On the first (No. 27), Messrs. Crossley Bros., Limited, show a fine example of their type "O" high-speed electric-lighting engine, fitted with extra heavy fly-wheel supported by outside bearing. This engine is specially arranged for electric lighting direct from the dynamo, and is capable of giving an effective constant load of 12-horse power at the normal speed. The engine on view is used for driving a dynamo for lighting the stand. Messrs. Bilbie, Hobson, and Co. (the London representatives of Messrs. J. E. H. Andrews and Co., Limited) exhibit one of the modern type "Stockport" engines (8 brake horse power), fitted with two fly-wheels, and all the latest improvements, which may be critically inspected. A useful little engine is shown by Messrs. Lawton and Parker. It is of ¼-horse power and 1-horse on the brake. It is equal to supplying current for ten 18-candle power electric lamps. The claims for it are that it is simple in construction, effective in operation, and withal cheap. Of course, other sized engines are supplied by the firm.

On stand 31, Mr. Strauss Collin exhibit the electric and pneumatic arrangements for lighting and extinguishing gas lamps, jets, and mantles at any desired distance, as described in the "Journal" for Oct. 10 last (p. 876). They may be inspected and tested, fitted to domestic lights and street-lamps; and the ingenious piece of mechanism which is the centre of the whole operation is open to examination and explanation. In regard to the use of this device for public lighting, we are told that the street-lamps of Metz have been fitted with it, with very satisfactory results. In the case of the lamps containing double incandescent burners, the fittings have been so arranged that one burner in each lamp may be extinguished at any given hour; the other remaining alight. The experience at Metz, it is stated, has proved that distance does not affect the effectual operation of the contrivance. Close by, on stand 33, Mr. J. W. Wilson exhibits a cheap form of incandescent burner, which he can supply at the modest price of 1s. The stem is tapered so that it can be used on any ordinary fitting. The gas-inlet is very minute compared with the mixing-chamber above; and the proportion of air to gas used is fixed at 5 to 1—the consumption of gas being about 2¾ cubic feet per hour. Above the gauze top of the burner, a small disc is provided, for the purpose of directing the flame fully on to the mantle. On the next stand, Messrs. Defries and Sons, Limited, exhibit their patent differential gas regulators and economizers, chandeliers, brackets, standards, illumination devices, &c.

In the north-west gallery, a suite of rooms is being sumptuously fitted up for demonstrating the effectiveness in ordinary use of the Denayrouze system and the Ærogene gas-light (Van Vriesland's patent). This latter is said to be a cheap method of lighting country villages and private houses where coal gas is not obtainable. The Van Vriesland

compressor for use as a pressure augmenter for ordinary gas is also to be shown. It is claimed to be the simplest and most efficient system for the purpose named. At the end of last week, the installation was not quite complete; but probably by this time it is ready for inspection. A great deal of expense has been incurred in making this a very attractive exhibit, and worthy of a visit.

In the south gallery, there are a few stands; but, beyond those already noticed, there is only one to which reference need be made, and that is No. 41. It is in the occupation of Messrs. Thorpe and Salter, who are showing the "Ruby" gas-engines for driving coffee mills, dynamos, and small pumps. The gas consumption is said to be only 5 cubic feet per hour, including the burner for tube.

This completes our notice of the exhibition; and sufficient has been stated to show that the exhibitors have done their best with the space placed at their command, and have brought together a good collection of some of the best results of recent invention. These are the things which have done much to give a fresh spurt to progress and development in the industry with which the "JOURNAL" is identified, and which promises, in spite of electrical competition, to grow in strength as the years roll on.

FATAL EXPLOSION AT THE DOUGLAS GAS-WORKS.

Three Lives Lost.

Shortly after five o'clock in the afternoon of Friday, the 22nd ult., three serious explosions, unfortunately attended by fatal results, occurred at the Douglas (Isle of Man) Gas-Works. It should be explained that when the works were reconstructed some years ago, two gasholders, which occupied a position close to the boundary wall, were taken down, and a larger one was erected on a different site. The tanks, however, about 40 feet in diameter and 14 feet deep, were left, and afterwards covered with a brick-work and concrete roof, supported on pillars and girders, and provided with manholes, and used as receptacles for tar and liquor. Close to the liquor-tank stood the washer and tower scrubber; and beyond the tar-tank was the sulphate-house. In front of the two tanks stood the engine and exhauster house and the stores, with the condensers and purifiers at one end; and beyond this building was the retort-house. At the time mentioned above, two workmen, named Coole and Baird, in the employ of Messrs. Knox and Son, Engineers, of Douglas, assisted by James Mudie, one of the Gas Company's servants, were engaged in fitting up a new pump for the liquor-tank; and it is surmised that, contrary to the rules of the Company, they used a naked light. While they were at work a violent explosion occurred in the liquor-tank; blowing off the roof, and fracturing a main lying above it, which conveyed the gas from the scrubber to the purifiers, liberating the gas, which immediately took fire. A few minutes later, the washer blew up, and then the scrubber. Consternation prevailed in the town as well as on the works. On recovering from the first effects of the shock, prompt measures were taken by shutting off the gas from the holders and opening the retort-lids, to reduce the tremendous blaze. In these operations, great bravery was displayed by all the men on the works. When the flames were at length extinguished, it was discovered that three men were missing. Coole was discovered grasping one of the pillars which had supported the roof of the tank. At this moment an act of splendid heroism was performed by James Boyde, one of the workmen, who made a desperate attempt to reach Coole, but failed, and both men fell into the liquor. Boyde managed, however, to secure him to a rope, which was round his waist, and they were then drawn up. On reaching the surface, Coole was found to be dead, and Boyde's bravery would have cost him his life had not doctors been in attendance to properly treat him, for he was for some time thought to be dying. The other two men—Baird and Mudie—were still missing; and it was considered to be impossible that they could be found alive. It was then decided to empty the tank; and a steam-pump was promptly set to work for the purpose. Baird's body was recovered early the following morning; but it was not until last Tuesday morning that Mudie was found beneath a mass of tar and *débris*. The interruption in the supply of gas which resulted from the explosion necessarily caused great inconvenience in the town; the shop-keepers being busy in view of Christmas. But the Secretary and Manager of the Company (Mr. C. H. Kay) set about repairing the damage as quickly as possible; and, by making a temporary connection between the condensers and the purifiers which had not been damaged, he was able to resume gas making by Saturday night, and to send out what, under the circumstances, was a very good supply of gas. In some portions of the town, however, there was none until Sunday evening. In the meantime, Mr. T. Newbigging, the Company's Consulting Engineer, who designed the principal portions of the works, was telegraphed for. On reaching Douglas he at once proceeded to the works, and expressed satisfaction with the measures which had been taken to restore the supply.

An inquiry into the circumstances attending the catastrophe was opened by the High Bailiff of Douglas and a Jury on the 23rd ult.; but only formal evidence of identification was given, and the scene of the accident visited. The proceedings were resumed last Wednesday, when Mr. Newbigging was the principal witness. He said the construction of the liquor-tank, where the explosion took place, was similar to that of the tanks at many other gas-works; but, in his opinion, it would have been better to have ventilated it by means of a shaft instead of manholes. The tanks were the only portion of the plant and works which had not been erected under his advice; if they had been, he would have advised ventilation shafts. The explosion, in his opinion, was caused by a naked light having come in contact with hydrocarbon gases issuing from the tank; but the light must have been about a foot from the manhole. Mr. Kay stated that verbal instructions had been given to the men not to smoke or carry lights near the tanks. The deceased man Mudie was yard foreman, and knew about the danger. Alfred Hughes, an apprentice working with the three deceased men, but who had been sent away on a message when the explosion occurred, deposed that a naked light had been used both then and on the previous day. Mudie held the light while Baird was working. The inquest was then adjourned till the following day, when Thomas Moore, clerk at the weighing office, said he had warned the lad Hughes not to take a naked light to the tar yard. James Christian said there were only two closed lamps on the premises—one being in the engine-house and the other in the sulphate-house. The Coroner, in summing up, commented on the careless use of lights and the improper ventilation of the tank. He expressed the hope that the Gas Company would provide for the widows and orphans of the dead men. The Jury, in their verdict, said that the explosion was due to the careless use of a naked light, which had been used to the knowledge of Mudie, the yard foreman. They recommended that the ammonia-tank should be ventilated by air-shafts, and that notices should be posted up giving a warning against using lights in dangerous parts of the works. Safety lamps should also be provided. For the Company, an undertaking was given that the recommendations would be complied with.

A subscription has been started in Douglas for the benefit of the widows and children of the unfortunate victims of the disaster.

THE DISPUTE WITH GLASGOW CORPORATION GAS WORKERS.

The Corporation and the Proposed Conciliation Board.

The campaign by the Trade Union interest against the right of the Corporation of Glasgow to deal with their own workmen proceeds slowly. The leading event of the week before Christmas was the reception, on the 21st ult., of the deputation appointed at the public meeting held on the previous Thursday to lay before the Town Council the views of the "new men of peace." The proceedings in the Council were, so far as the deputation were concerned, of a regular, almost circumspect, order, as will be seen from the report given below. The objurgations which enliven the remarks of speakers at what are called "organizing meetings" were laid aside, and moderate statements took their place. It is one thing to "organize" a working man, and another to "organize" a well-informed town councillor. This revelation shows that those who are directing this movement mean business, and that they are men of ability, or at least of discretion, who can frame a policy on prudent lines. The Town Council will therefore do well to be on their guard, and not be led away into the too common region of false security, or into the more fatal course of despising their enemy; for enemies these are, to public order, which, in the end, is the public interest or weal. The deputation were heard out of courtesy, against which nothing can be said, because they were citizens; and then, as they were not members of the Town Council, they had to retire from the precincts, and leave their cause to be dealt with and fostered by their friends in that body. The Council were unable to come to an agreement on the subject, and have adjourned it till they take up the two motions dealing with the same question, of which notice has been given. This is about the only course which could have been adopted. Let their deliberations be as calm as possible. A remit to a Committee to make inquiries is a course which should be well considered. It would be interesting to know how Conciliation Boards have worked, or maybe have been worked, in the places where, as the Town Council were informed, they are already in existence. There is nothing like ascertaining the facts, as it helps to a decision upon any subject. If time and pains be taken to inquire, much misapprehension will be removed; and although the end may be the rejection of the conciliation proposals, it will more probably be less of a convulsion.

At the Meeting of the Corporation of Glasgow on Thursday, the 21st ult.—Lord Provost Chisholm presiding—the Deputy-Clerk (Mr. Monro) read a letter from the Chairman of a meeting held in the City Hall in regard to the proposal to form a Board of Conciliation and Arbitration in connection with the Gas Workers' and General Labourers' Union. A request was made in the letter that a deputation appointed at the meeting should be received by the Council. Treasurer Murray thought that, after the decisive vote at the last meeting, they need not take up time in hearing a deputation on a subject which could not possibly be considered for six months. He moved that the deputation be not received. Mr. Graham seconded the motion. Mr. Cronin said it had always been customary to receive any number of citizens with the utmost courtesy, and to hear what they had to say; but Treasurer Murray now proposed to depart from that position, and do nothing of the kind. He was well aware that five-sixths might not agree with what the deputation might say, but it was only courteous to hear them. He begged to move, as an amendment, that the deputation be received. Bailie Ferguson seconded the amendment, which, on a division, was carried by 28 to 24—one declining to vote. The deputation, which numbered about 25, was then received. Mr. Cronin, in introducing them, said that they represented the Trades' Council, the Workmen's Municipal Election Committee, and the Independent Labour Party. Mr. J. Burgess, the Acting District Secretary of the Gas Workers' Union, said that the object of the deputation was to petition the Council to consent to the formation of a Board of Conciliation and Arbitration on the lines suggested in the recent memorial of the Union. This involved a recognition of the right of the workmen to be represented by the officials of the Union with which they were connected. This was a principle that already obtained in a large number of corporations and administrative bodies—practically in all such bodies controlling areas in which Trade Unions of corporation employees existed. If such a Board were established, the method of working would be by frequent conferences between the heads of departments and the officials of the Union, the Board only meeting when an amicable settlement between the representatives of both parties could not be made. Leaving out of consideration altogether the question of workmen's grievances, they believed it could be demonstrated that the formation of a Conciliation Board would be to the advantage of the Council, and especially would tend to promote the peace of mind of heads of departments. The Lord Provost said the statement which had been made would receive consideration. The deputation then withdrew. After discussion, in the course of which several motions were made, it was resolved that consideration of the statement should be delayed until two motions, of which notice was given at the previous meeting, should be submitted.

The latest published statement places the number of prepayment meters in use at Huddersfield at 4188, of cooking-stoves at 1059, and of heating stoves at 90.

MANCHESTER CORPORATION GAS SUPPLY.

The Vacant Engineership—Workmen's Wages—Projected Extensions.

At a Meeting of the Gas Committee of the Manchester Corporation held just before Christmas, reference was made to the appointment of a Chief Gas Engineer, in succession to the late Mr. G. E. Stevenson, applications for which position have already been received. The matter is in the hands of a Sub-Committee. At a previous meeting of the Committee, it was decided to recommend the Council to make a grant of £5000 to Mr. Stevenson's widow; but this matter will have to come before the Council for confirmation before anything is done. Another important subject which was under discussion by the Committee at their last meeting was the remuneration of the workmen in the Gas Department; and partly as a concession to the known feeling of the men, it was unanimously decided to recommend an advance of 5 per cent. on the present rate paid to the employees of the works, in the streets, and elsewhere. This proposed advance does not affect artisans, who, as heretofore, will be paid the rate of wages ruling in the district. One or two other concessions and re-arrangements were also agreed to in the interests of the men, among which was a decision to grant time-and-a-half for one extra shift on Sundays. Hitherto this has been allowed for two shifts; but in future it will, if the recommendation is carried out, be allowed for three shifts. The estimated extra expenditure involved in the proposed wages concessions will be about £6000 a year; and this will, no doubt, allay any dissatisfaction that may have existed on the part of the men. The Committee had also under consideration the question of increasing the make of gas, with the view of being better prepared next winter to meet any extra demand; and it was decided to recommend that a certain portion of the works should be enlarged, with the object of increasing the productive capacity by 3½ million cubic feet per day. The measures recommended by the Committee will in all probability come before the City Council at their meeting to-morrow.

With regard to the appointment of a Chief Gas Engineer in succession to Mr. Stevenson, we understand that for the present this is being held in abeyance, and that practically nothing definite will be done at the meeting of the Council to be held to-morrow; the Sub-Committee, who have received a number of applications, having in the meantime the question under consideration.

BELFAST CORPORATION GAS SUPPLY.

Record Outputs—The Value of Auxiliary Carburetted Water-Gas Plant.

The introduction of electric lighting does not seem to have proved a serious obstacle to the increase of gas consumption in the progressive city of Belfast. From figures given in the local newspapers, it would appear that on no less than four days recently records were made only to be broken. Previous to last year, the largest single day's output had been 7,740,000 cubic feet—on Dec. 24, 1896. The largest single day's consumption in 1898 was on the 23rd of November; and it only reached 7,338,000 cubic feet. The following are the figures relating to the four days above referred to: Dec. 13, 8,250,000 cubic feet; Dec. 19, 8,254,000 cubic feet; Dec. 20, 8,569,000 cubic feet; Dec. 22, 8,785,000 cubic feet. It will thus be seen that on the 22nd ult. the output exceeded the largest day's delivery in 1898 by 19¾ per cent., and the previous record of 1896 by 13½ per cent. This sudden and quite unexpected demand was easily met by the use of extra carburetted water-gas plant; and though the total storage, including the contents of the relief holders, only amounts to barely 6 million cubic feet, there was no occasion to restrict the pressure at any time. On the contrary, extra daylight pressure was given to accommodate the shopkeepers during the busiest week of the year. The large additional output, and the satisfactory manner in which it was furnished, must have been highly gratifying to the Corporation Gas Committee and to Mr. Stelfox, their Engineer, who doubtless had reason to be thankful for the assistance rendered by his water-gas plant.

THE PROPOSED MUNICIPALIZATION OF THE CARDIFF GAS-WORKS.

The Gas Company Refuse to Negotiate.

Last Friday week, the Committee appointed by the Cardiff Corporation to communicate with the Directors of the Cardiff Gas Company with a view to opening negotiations for the purchase of the undertaking held a meeting Sir Thomas Morel presiding.

The Town Clerk reported that he had communicated with the Secretary of the Company, and had forwarded to him the resolution of the Council, which embodied an inquiry whether the Company were prepared to open negotiations for the sale of their undertaking, and upon what terms. The letter was acknowledged on Nov. 8, stating that the Directors would give the communication their consideration. A further reply had been received from the Secretary, dated Nov. 20, in the following terms: "Your letter of the 7th inst. has been submitted to, and considered by, the Directors of the Company; and, in reply, I am directed to state that the Directors have no desire whatever to part with the undertaking, and are not prepared to open negotiations for the sale of the Company's property."

The Chairman (in response to a remark by a member of the Committee, that this letter settled the matter) said the communication read by the Town Clerk was quite contrary to what the Directors had told him verbally. He had been to see them on other matters; and they said that the reasons they had sent the letter in were that the discussion at the Council had been of such a nature, and such pronounced opposition had been shown by some members, and statements made rather depreciatory of their property, that they had thought it would be the best thing to write as they had. They, however, still gave him to understand that if the Corporation were really serious in the matter, and would look at the value of the property in the right way, they would be prepared to still consider the proposal in the manner they told him in the first instance.

Alderman Jones pointed out that the Directors had sent him an answer in black and white, stating that they would have nothing to do with the negotiations at all; and so far as he could see they were not likely to carry out the transaction with them.

The Chairman said there was a mode of finding out the value of the undertaking; and on these terms he believed the Directors were prepared to consider the matter. Ten years ago the Directors had made up their minds not to enter into any negotiations with the Corporation; but they were open still, as business men, to consider the matter in a business way. When questions of this kind were discussed in public, there was bound to be a certain amount of friction. The Corporation had the water-works in their own hands; and this question of public lighting was of equal importance. He really thought, therefore, they should pursue the matter further. He suggested that a Sub-Committee should be formed to report to the Committee. He could easily obtain an interview with the Chairman and some of the Directors of the Gas Company, and arrange for them to meet the Sub-Committee and talk the matter over.

Mr. Jenkins said that the duty for which the Committee had been appointed had now been discharged. They had been appointed to negotiate with the Company; and the Directors had now absolutely refused to have anything to do with the Corporation so far as the sale of the undertaking was concerned. The Committee could not go any further now without fresh instructions from the Council. If the Council thought it would be wise to negotiate further, well and good.

The Chairman said he should be sorry if the negotiations came to an abrupt end. The matter was of such importance that he would treat it as a business transaction; and as a business transaction he would carry it through.

Mr. Jenkins pointed out that the letter from the Directors was an absolute refusal.

The Chairman said they must take the letter with the statement he had made; and his advice was that they should probe the matter further, and see to what extent it was meant.

Alderman Jones said that, under ordinary circumstances, business men met one another to discuss a business matter after absolute refusal to negotiate; but when a public body received an answer of this kind from another public body, it seemed to shut out any hope for negotiation. In the absence of the withdrawal of the letter, the Corporation would have to go cap in hand and ask the Directors to negotiate; he did not see what they could do in the face of the letter. If the Chairman could get the matter re-opened, they could attend to it; but the Directors absolutely shut it now. To assist in keeping the question alive, he moved a resolution to the effect that the matter be left in the hands of the Chairman to ascertain whether the answer of the Directors of the Company was really a final one.

Alderman Beavan seconded.

On the suggestion of the Town Clerk, the resolution was amended to read, "That the question be adjourned; and that in the meantime Sir Thomas Morel be asked to continue his inquiries."

The resolution was put and carried unanimously.

ELECTRIC LIGHTING NOTES.

The Whitechapel District Board of Works have just completed an installation of electric lighting plant at a cost of £70,000; and the current was switched on for the first time on the 21st ult.

The Oswestry Town Council concluded not to proceed with their application for an Electric Lighting Provisional Order until the result of the recent Local Government Board inquiry is known. This inquiry was relative to a loan of £18,000 for the purchase of the Electric Light Company's undertaking and making certain extensions. There was a very strong opposition to the application; and, in view of this, the action of the Council is rather significant.

Some months ago, the Wigan Corporation decided to erect works for the supply of electric light in the borough, and they are in course of construction. It was desired, however, that the past year should not close without a temporary supply being afforded; and accordingly the necessary arrangements were made by the Electrical Engineer (Mr. H. Collings Bishop). The plant has been erected at the gas-works; and on the 20th ult. the current was switched on by the Mayor (Mr. J. T. Gee), in the presence of a numerous company.

Small towns searching for truth as to the expense of lighting streets by electricity have here the actual experience of Whitehaven. When the town adopted electricity, some £800 or £900 was the sum set down as the price of street lighting, to put against the cost of gas. In the last financial year, the cost of public lighting is set down at £1441—that is, the amount of credit taken for current supplied for public lighting. In addition to this, there was paid for public lamps £452 16s. 9d. Altogether the cost of public lighting for the year approached £1900.

In consequence of the repeated failure of the electric light in the Marylebone district, a meeting of residents and tradesmen interested was held a few days ago, at the Portland Hotel, at which it was decided to take common action with a view to obtaining a better supply in future, and compensation for the loss now being sustained. Dr. Fletcher Little, in urging the adoption of this course, pointed out that in St. Pancras and Hampstead the electric lighting arrangements were in the hands of the Vestry; whereas in Marylebone the right had been given to a private Company who had to be legally compelled to fulfil their obligations.

A sad fatality occurred at Bolton on the 22nd ult. in connection with the Corporation electric light undertaking. Three workmen were engaged in removing the transformer at the underground sub-station, when one of them, named William Hazelton, a Londoner, made a mistake by switching the wires wrongly; thereby charging the transformer with 2000 volts of electricity from the principal generating station. The result was that all three men were rendered insensible; and flames and smoke shot into the air, creating great consternation among the townspeople. A Corporation Inspector, named Albert Sides, gallantly descended and rescued the men; but Hazelton died later from asphyxia, while a second workman, named Walker, died on Saturday morning, never having

recovered consciousness. The circumstances attending the fatality were the subject of a Coroner's investigation last Tuesday, when a verdict of "Accidental death" was returned. The Electrical Engineer to the Corporation (Mr. A. Ellis) remarked that, notwithstanding all the precautions that were taken, transformers were a source of danger; and he stated that the Corporation were spending £30,000 in introducing an improved system.

A special meeting of the Dublin Municipal Council was held last Thursday to receive a report from the Electric Lighting Committee, submitting for approval a scheme prepared by Mr. Robert Hammond, the Consulting Electrical Engineer to the Corporation, for the extension of the present electric lighting system, at an estimated capital expenditure of £254,500, made up as follows: Mains, &c., for private supply, £103,000; public arc lighting, £40,500; Pigeon House works, £96,000; meters and house connections, £15,000. It was explained that the proposed plant would have a capacity of 3000 kilowatts, but that it would be prudent to treat one set as "reserve." This would leave 2000 kilowatts available, or (say) with 10 per cent. extra at top load 2200 kilowatts. Of this, 300 kilowatts would be used for the arc lamps; leaving for the private lighting 1900 kilowatts, capable of dealing with 63,300 lamps of 8-candle power, all alight at one time, or (say) 95,000 lamps fixed on consumers' premises. The following estimates were given by Mr. Hammond: Revenue—95,000 lamps, using 16 units each per annum, or 1,520,000 units, at an average price of 4½d., £28,500; meter-rents, £1000; 500 arc lamps, at £18, £9000; total, £38,500 (carbon and trimming being paid by the Lighting Authority). Expenditure—Private lighting 1,520,000 units, public arc lighting 1,125,000 units, together 2,645,000 units, at 1·5d., £16,531; gross profit, £21,696, to provide for interest and sinking fund. In conclusion, Mr. Hammond said that, when the demand justified the laying down of an additional 1000 kilowatts set, the output for private lighting could be increased by 760,000 units. The gross profit arising therefrom would increase to £31,469. Alderman Meade moved the adoption of the report, and stated generally what the Corporation proposed to accomplish. He said that, taking the amount to be received at £38,500, and the cost of production and delivery at £16,531, they had £21,969 to deal with. The proposed cost being £254,500, as they could get their money at £4 12s. 6d. per cent., paying off the loan in 40 years, this came to £11,748. They had also to provide for the expenditure on their present works, which he had put down at £80,000. This at £4 12s. 6d. per cent. came to £3700, which left a surplus of £6521 per annum for the Council to deal with as they wished. As, by putting down an additional set of 1000 kilowatts, at an extra cost of £40,000, the gross profit could be increased by, as Mr. Hammond calculated, £7500, the surplus would then amount to £14,000 a year; and the result would be that in forty years' time all the works, mains, engines, and plant, would be the absolute property of the Corporation of the day, without having to pay anything towards it. He submitted that, in the interests of the city, the work was one which should be undertaken without further delay. He begged to move—"That Mr. Hammond's scheme be adopted; that your Committee be empowered to apply to the Local Government Board for their sanction to a loan of £254,500 (the Law Agent and the Town Clerk to take any legal steps that may be essential to this end); and that your Committee be further empowered to alter the schedule of streets attached to the report if they consider it advisable." Mr. Pile seconded the motion, and it was unanimously adopted, with an alteration of the third recommendation so as to read "if it is considered advisable."

Professor Silvanus P. Thompson has replied in "The Times" to the letter of Mr. Montague Crackanthorpe, given in last week's "Notes," on the subject of the fire caused in his house through damage to the insulating material of the electric light wires. It may be remembered that Mr. Crackanthorpe advised the use of some incombustible mineral material as an insulator for the wires. Professor Thompson says he would advocate the total abolition everywhere, except in laboratories and factories, of the use of wood casing for covering the wires. In this view he knows he is at variance with many of the authorities and with half the electric lighting contractors. He would not allow a single inch of wood casing in his own house. When he wired it about six years ago, he decided, in the teeth of all the existing fire insurance rules, to exclude wood casing, and to employ instead either wires drawn into incombustible pipes or wires the insulation of which was protected by an armouring of lead. Lead-armoured twin conductors, braided together externally with an outer braiding, tarred or painted, constitute the main part of the wiring of his house. Such protected conductors are, he says, air-tight, water-tight, electric-tight, gas-tight, and rat-tight. They can be either embedded in the plaster of the walls, secured against its surface, or run under the floors, with the utmost security. In cases where internal conduits are employed, these likewise may be embedded in plaster or run under the floors with safety. He goes on to say: "Another point of divergence from the fire rules that were in favour six years ago is the absolute avoidance of fuses in ceiling roses and other inaccessible places. On the other hand, I rigidly exclude from permissible things, though permitted by the insurance inspectors, the existence of any joint, soldered or otherwise, however well made, in an inaccessible place under a floor. All branch wires must be continued back to some accessible place, where they can be brought to a joint-box or fuse-box. Much too great reliance has been placed by insurance officers upon the use of fuses, with the result that there are far too many of them, and they are put in all sorts of bad places; for example, in ceiling roses, and at every place where flexibles are joined to the leads. Far too little stress has been placed on the necessity of not allowing any joint where it cannot be inspected. But the greatest defect of all is this foolish allowance of the use of wood casing. Behind it bad workmanship and bad jointing lie hid. As wood casing is difficult to carry between floors, it is often omitted in such parts, and the wiring goes unprotected in these uninspected regions. Also, when wood casing passes along a damp wall, it may, except in those cases where alternating currents are supplied, set up new troubles arising from electrolytic conduction." He concludes by saying that the main endeavours should be to get rid of wood casing at all costs. If its use is prohibited, every wiring contractor will be compelled to adopt methods which allow less scope for bad workmanship, and the chance of fire will assuredly diminish. Mr. A. Lester Taylor, of Liverpool, however, characterizes Professor Thompson's letter as "needlessly alarming." He states that, on looking over carefully compiled statistics of fires of electrical origin in this country during the past twenty years of his own experience as an engineer in connection with electrical installations of all kinds, aided by the specially detailed information available in his position as a fire office adviser, he cannot find a single instance of any serious fire loss having originated through the use of wood casing, or one which would probably not have occurred had some other method of enclosing the wires been adopted. He points out that there are other excellent methods of enclosing or supporting conductors, as detailed in fire office rules—some being decidedly preferable to wood casings in a few situations; but the wholesale condemnation of these casings in a manner so disturbing to the great majority of users of current in this country is, he says, certainly "not justified by actual experience." Another correspondent, writing from his own personal experience, suggests, in place of the abolition of wood casing, the use of non-flammable wood, which, while being a non-conductor, is an inexpensive method of rendering electric wires innocuous.

Mr. Crackanthorpe replied in "The Times" of Monday last week to Professor Thompson's letter. He commenced by expressing regret that he had not had the advantage of the Professor's opinion before he used wood casing in his two residences—one in London and the other in the North of England. In his London house, he is forced by the Electric Lighting Company to receive a current of 200 volts, which, being double the voltage he requires to overcome the resistance of his lamps, subjects his insulation to a penetrating force twice as powerful as need be brought to bear upon it. In his country house, he never has more than 100 volts delivered from the accumulators, and when the lights are on he finds that a current of 96 or 97 volts is the most beneficial for the eyes. But there he regulates his voltage at will, since he generates his own electricity by water power. His recent unpleasant experience was not unique, for he subsequently received a communication from a distinguished artist stating that a similar accident had occurred to him. In Mr. Crackanthorpe's previous letter, he mentioned three precautions against insidious electric fires: (1) Outside wiring; (2) abolition of wood casing; (3) testing periodically for leakage, both by the pole-to-pole and the earth test. In his second letter, he enlarged a little on No. 2, since the proposal would, he said, be regarded as revolutionary by the trade. His remarks on this point were as follows: "Professor Thompson's words are, 'the main endeavour should be to get rid of wood casing at all costs;' and he suggests that we should employ instead 'either wires drawn into incombustible pipes or wires the insulation of which is protected by an armouring of lead.' The latter, he tells us, is the way in which his own house was wired about six years ago, and he holds his apparatus to be 'air-tight, water-tight, electric-tight, gas-tight, and rat-tight.' I should be sorry to ruffle a feather of my friend the Professor, for whose scientific attainments I have the most sincere admiration; but I confess that I am not entirely satisfied with his lead armouring for general use. As was pointed out in a paper read last year by Mr. Frederick Bathurst before the Incorporated Association of Municipal and County Engineers, 'lead coverings are liable to rapid deterioration when in contact with the strong chemical cements and plaster now commonly used in building construction;' and just as rats and mice occasionally attack lead-covered gas and water pipes, so also will they attack lead-covered wires, regardless of the consequences to themselves that may ensue. The Conduit and Insulating Company, Limited, claim to have solved the insulation-protecting problem by running the wires through an iron tube carrying on its inner surface an insulating lining so expanded by pneumatic pressure as closely to fit the tube. I pass no opinion on this contrivance, except to say that it seems to be both fireproof and waterproof, also (so far as the lining goes) non-conducting. The material is, however, heavy and, I should imagine, expensive. Another much cheaper method is to employ wood casing, but not until it has been treated by a special process, so as to be incapable of transmitting fire to other wood. . . . In my previous letter I also referred to asbestos; and there is no doubt that asbestos, such as that obtained from the neighbourhood of Montreal, will, when mixed with good cementing materials, bear an enormous amount of heat without its durability being impaired. . . . There is yet another method to which I also referred—viz., the use of Uralite. The Manager of the British Uralite Company, Limited, wrote to say that this material was about to be further tested, and that he believed it would prove a success. I do not know how this may be, and shall await the result of the further testing with considerable interest." Having enumerated the substitutes for wood casing which had come to his knowledge, Mr. Crackanthorpe concluded his letter as follows: "The question is, Who is to decide between them? In the United States, the fire insurance authorities have established an electrical bureau, whose business it is to examine and test electrical apparatus, to record particulars of electric fires, and to discover their probable origin. Can such a bureau be established here? I suggest that it can, and that the nucleus of it already exists in the Electrical Department of the London County Council. That body sends us its admirable Fire Brigade, and, after the fire is well over, if it is reported to have occurred through electricity, it sends us a highly-trained official to endeavour to ascertain the specific cause. These causes are, I presume, duly tabulated and classified. Prevention is, however, better than cure; and there are many of us who would be glad to have had the benefit of this departmental experience before we wired our houses. It is perhaps too much to expect that the Insurance Companies will unite and revise their rules made some eighteen years ago; and, failing such revision, we must look elsewhere. The London County Council might, as it seems to me, take the matter in hand, might examine the competing substitutes for wood casing with the aid of impartial experts, and might recommend to the ratepayers of the Metropolis such methods of electric lighting as can be adopted at the least cost compatible with perfect safety."

The Supply of Coke-Oven Gas in Boston (U.S.A.).—We learn from the "Boston Advertiser" of the 5th ult. that the Massachusetts Pipe-Line Gas Company made their first delivery of gas from the works of the New England Gas and Coke Company the previous night; the gas being sent through their mains to the Jamaica Plain Gaslight Company. It was expected that in the course of the next few days gas would be delivered to the Brookline Company at the rate of a million cubic feet per day, which would be gradually increased within two weeks to 2½ millions, the present output of the Company. The plant, it may be remembered, was described in the last volume of the "Journal" (pp. 1114, 1176).

THE WELSH WATER SCHEME OF THE BIRMINGHAM CORPORATION.

"The Times" of Monday last week contained the following article, from a correspondent, on the Welsh water reservoirs of the Birmingham Corporation. It is interesting in connection with the particulars as to the progress of the works furnished in the last report of the Water Committee of the Corporation, noticed in the "JOURNAL" for the 5th ult.

The four great dams on the River Elan which will form the reservoirs for the future water supply of Birmingham have reached a point of progress when some idea may be conveyed of their dimensions, strength, and storage capacity. . . . An obscure and thinly-populated valley in Radnorshire, on the higher reaches of the Wye and its minor tributaries, has been transformed into a populous though shifting community, and into a scene of big engineering undertakings. The future water supply of Birmingham will, of course, be a vastly improved one; and as the period of ten years allotted from the date of the Royal Assent to the Bill for the completion of the works expires on June 27, 1902, the city may be said to be getting within measurable distance of the realization of that benefit. But even with this improved supply, Birmingham will fall very far short of the magnificent provision of water with which the ancient city of Rome was blessed. Indeed, even London itself falls considerably behind the old Roman capital. In A.D. 100, no less a quantity than 300 million gallons of water, conveyed in aqueducts ranging from 30 to 60 miles in length, flowed daily into Rome; while London to-day, with its five millions of population, has but 200 million gallons. The daily supply to Birmingham from the present sources, including draught on storage, is about 20 million gallons. The daily supply from the new works, when completed, is estimated at 99 million gallons, of which 27 millions go for compensation; leaving 72 millions for actual supply. The cost of the construction of the various reservoirs and the aqueduct complete, as regards tunnel and cut-and-cover work, and two lines of pipes in syphon to Birmingham, will probably be about £4,500,000.

The Birmingham Corporation railway to the uppermost dam starts from the Elan Valley Junction at a point near Rhayader, on the Mid-Wales Railway; and the first dam reached is that of Caban Coch. The foundations of this dam on the Breconshire side had at the time of a recent semi-official inspection been carried to a depth of 30 feet below the bed of the river, in order to get beneath natural fissures through which a leakage might occur. The masonry superstructure on each side of the river has been carried up to a height of over 40 feet; and while the excavation of the middle portion is proceeding, the water of the river passes through a 16-feet culvert on each side. When completed, this dam will be 600 feet in length across the valley, and from 120 to 122 feet in height. The river bed is 700 feet above Ordnance datum; therefore the top level of the reservoir will be 820 feet above Ordnance datum. The foundation stone of this dam was laid on Oct. 8, 1896, by Mr. Lawley Parker, Chairman of the Elan Valley Water Supply Committee, and on May 28, 1897, Mr. James Smith, Lord Mayor of Birmingham, laid a commemoration stone 25 feet above the foundation stone. This reservoir will extend about four miles up the valley, including a reach along the River Claerwen; and its capacity will be about 8000 million gallons. The area drained is 45,562 acres; but portions of this drainage will be impounded by two of the higher reservoirs—namely, Pen-y-Gareg and Craig Goch. The flood discharge is reckoned at 15 cubic feet per acre per minute, or a total of 683,430 cubic feet per minute, or 300 million gallons in 24 hours. The top-water level of the Caban Coch reservoir will extend very nearly to the base of Pen-y-Gareg dam. The geological formation in this locality is silurian grit and conglomerate—an exceedingly hard stone; and an enormous amount of masonry has been excavated from an adjacent quarry on the Radnorshire side of the river. The Elan has usually flowed with a volume of 4 million gallons daily; but long-continued drought has reduced this discharge to 3 million gallons, as determined by gauge. The compensation water has been fixed at 27 million gallons, or nine times the present natural discharge of the river; and this compensation water will be delivered from the Caban Coch dam to the Wye. An important provision for the benefit of the salmon fisheries and for cleansing the river by artificial "spates" is guaranteed by the Act. One-fifth of the 27 million gallons daily compensation must occasionally be reserved each day for a fortnight, and discharged during 48 hours together with the daily allowance.

We come next to the submerged dam at Careg Ddu, a few yards below the tunnel which marks the commencement of the intake of the 72 million gallons daily supply of water to Birmingham. It is situated near the middle of the four miles of reservoir between the Caban Coch dam and the Pen-y-Gareg dam. Its crest, 780 feet above Ordnance datum, is 46 feet below the top-water line (820 feet) of the Caban Coch reservoir in which it is submerged. Should the reservoir fall, in any long-continued drought, to the extent of 40 feet, the crest of the submerged dam would become visible, and the water above the submerged dam would be there impounded, and retained solely for the supply of Birmingham; while the daily compensation to the Wye would be drawn solely from the portion of the reservoir below the submerged dam. So far as the dam is concerned, it is practically finished; but a great deal of work remains to be done to carry a roadway over the reservoir upon seven segmental arches, each of 48 feet span, resting upon piers built upon the dam. Visitors to the works show much interest in this submerged dam and in the mouth of the tunnel, the arched floor of which is 770 feet above Ordnance datum, or 170 feet higher than the storage reservoirs at Birmingham. The total length of the tunnels, conduits, syphons, and pipes is 73¼ miles; and the water will flow through them at rather less than two miles an hour—in other words, the passage of any given portion of water from the intake to Birmingham will occupy about 40 hours. As a general rule, the fall in the tunnels and in the cut-and-cover conduits will be about 1 in 4000, or about 16 inches per mile; whereas the fall in the syphons and iron pipes will be about 1 in 1760, or 36 inches per mile. The length of the Foel tunnel is 7160 feet, or nearly 1½ miles.

The Pen-y-Gareg dam is built across the valley of the Wye to a height apparently of 60 or 70 feet. When completed, it will have an extent of 525 feet, and a height of 128 feet. The base of this dam is practically on a level with the top water of the Caban Coch reservoir below it. The extent of this reservoir, to the next dam at Craig Goch, will be two miles, and the top-water level of the reservoir will be 945 feet above Ordnance datum. When full, it will have an area of 124 acres and a capacity of 1320 million gallons of water.

The Craig Goch dam is the last and uppermost of the four. It is eight miles from the Elan village. In this case, a culvert has not been made in the base of the dam for the passage of the river during the execution of the dam, but a tunnel has been bored through the solid rock at its eastern extremity. When completed, the extent of this dam across the valley will be 625 feet, and its height 120 feet. The top-water level of the reservoir will be 1040 feet above Ordnance datum, and its length will be two miles. When full, it will have an area of 217 acres and a capacity of 2000 million gallons.

The excellent character of the entire work is everywhere conspicuous along the ten miles of specially constructed railway from the Elan Valley Junction to the head works up the valley. The organization of each dam strikes the observant spectator as perfect. The huge masses of stone which are transported in the trucks and deposited in the beds of concrete prepared for them are matters for astonishment. Each load of stone moved by the travelling crane is weighed; one object of this process being to assist in the calculation of the entire mass of the superstructure opposing the weight of the water pressure. Masonry revetments are formed in the sloping banks of the reservoir. These are very necessary under newly-made roads, and especially on the exposed banks of the Caban Coch reservoir, where the wind is at times strong enough to create along the sides of the funnel-mouthed gorge waves that will exceed in height the roll of the Severn "bore."

The following statistics of the rainfall in the locality of the reservoirs are interesting: The mean annual rainfall at Nantgwillt, recorded by the late proprietor (Mr. R. Lewis Lloyd), for a period of 20 years, commencing in 1871, was 63·78 inches. The gauge was 768 feet above sea level. The mean altitude of the watershed is 600 feet higher. Mr. Mansergh, the Engineer of the works, calculates the rainfall on the gathering ground at 66 inches; and he thinks it possible, with sufficient storage reservoirs, to collect 40 inches of it.

PROPOSED AUXILIARY WATER SUPPLY FOR NEW YORK.

Proffered Help by a Water Company.

American engineering papers have lately contained particulars respecting a proposed scheme of auxiliary water supply for New York which has been made the subject of inquiry by a Commission of the Legislature. It appears that water is very short in some districts, and that the authorities have to put forth great efforts to prevent a famine. The supply is barely equal to the demand, the population is increasing, 130 gallons of water per head are required, and there is great waste. In these circumstances, an offer was made by the Ramapo Water Company to supply the city with 200 million gallons daily from the Esopus watershed. The offer, far from being cordially received, as one might have expected, has given rise to considerable feeling on the part of the citizens, who characterize the offer as a "job." A recent number of the "Engineer" contained an article on the subject, from which we make the following extracts.

The Ramapo Water Company—which was incorporated as long ago as 1887 for the purpose of furnishing a supply of water to New York—offer to deliver 200 million gallons daily, at a head of 300 feet, at the northern boundary of the city, at the point of intersection with the New Croton aqueduct. The contract price for this water is to be $70 per million gallons. This price would not include anything for distribution or storage; and it is not at all out of the way to place the price of supply to consumers at $100 per million gallons. Let us see what this figure works out to be. The daily amount is, as already stated, 200 million gallons. The daily charge would, therefore, amount to no less than $20,000; and, supposing New York agrees to take an equal amount every day throughout the year, the huge total of $7,300,000, or (say) £1,460,000, is obtained. It is this expenditure that the citizens of New York complain of. There would seem to be ample grounds for grumbling. It would appear that only four years ago an authoritative estimate was got out for supplying only 100 million gallons a day to the Ridgewood reservoir in Brooklyn from the same source—the Ramapo. This estimate showed that the cost would be only $16 per million gallons; and the water would have had to be conveyed across Long Island Sound. The supply to New York would, it is said, be obtained some time in 1902. This, again, is a point of dispute; for it is contended that it would be impossible for the necessary works to be completed in the time. Then, again, the contract is only for forty years, after which time, if the Company choose to withdraw, New York might have to look out for another source of supply, building works of its own, or the Company, if they went on working, might get their own terms.

The engineering Press is most emphatic in its opposition to the scheme, and it seems to think that the measure will not obtain the sanction of the authorities. It is pointed out that the proposed contract does not provide for a proper approval of the plans and construction by the city. Then, again, it is stated that the Company promise impossibilities; that the Engineer is a young man without experience in designing or building such enormous works, "and people who know how difficult it is to properly plan and build great dams will require more than his word, or that of the Engineer of the Commissioner of Water Supply, to convince them that reservoirs can be built in three years in the Esopus Valley which will ensure a supply of 200 million gallons a day by 1903." It is urged that no proper surveys have been taken; while no less than $100,000 were expended in borings alone in order to find the best place for the great Croton dam now in course of construction. A work, we are told, of the magnitude of that at present proposed, "entered upon so blindly, absolutely without competition, is simply unprecedented in the history of engineering and municipal public works; and it is made all the more notorious because it is proposed at a time when the most marked feature of municipal administration is the insistence on getting and keeping public water supplies under municipal control." Only nine out of the fifty largest cities of the United States are dependent upon private companies for their water supply. Four of these nine have recently taken steps to change to public ownership. Of the forty-one whose supplies are actually under municipal control, about half were originally started under private ownership.

Besides the fifty largest cities, there had been among other towns no less than 200 changes from private to public ownership up till the end of 1897. In fact, the general idea expressed at the present moment is that, whatever may be thought of the claims for municipal ownership of lighting, street railway, and telephone systems, it is now almost universally admitted in the United States that water-works should be under public ownership. The matter is summed up by a leading journal under three heads. When a city like New York finds itself in need of an additional water supply, it should engage competent and honest expert advice to determine—first, what its needs really are; secondly, what, if anything, can be done to increase or improve the present supply; and, thirdly, the best of the additional sources available.

The other side of the question—viz., the position taken up by the city authorities—is as follows: Mr. William Dalton, the Commissioner of Water Supply, in a report to the President of the Board of Public Improvements, begins by saying that the present and future condition of the water supply of Greater New York imposes upon the authorities the imperative duty of taking prompt and decisive action to remedy existing deficiencies and to secure to the people an adequate supply of pure water. The full normal supply of the borough of Brooklyn is 93 million gallons for an estimated population of 1,200,000 persons. About three-fifths of this supply is obtained from flowing streams and ponds, and about 40 million gallons has to be pumped out of the soil from driven wells. The entire supply has to be pumped to a height of 170 feet. Some of this has again to be pumped another 50 feet, and some again 80 feet more. The available supply has not increased for five years, while the population has done so materially. Were Brooklyn to be supplied at the same rate per head as other portions of Greater New York, there would now be needed a daily supply of 150 million gallons. In the borough of Queens, the conditions are even worse. The entire supply is obtained from wells, and some of these are so near the shore of East River or Long Island Sound, that the pumping of water from them has to be carefully limited, so as to prevent the drawing of an admixture of salt water. Some of the wells, too, have surroundings where there is a constant increase in population, which will in a short time compel an abandonment of wells in consequence of pollution from house drainage. The wells are worked to their maximum capacity, producing a supply of 3,350,000 gallons of water per day. This is quite inadequate for present needs, much less for an increased population.

The Commissioner estimates that the present needs of this portion of the city are some 6 million gallons. New York proper, consisting of the boroughs of Manhattan and the Bronx, has had an average consumption during the last six months of 265 million gallons a day. During June and July, the maximum rose to 286 million gallons daily, which is a 12 per cent. increase over last year's amount. The combined capacity of the old and new Croton aqueducts and the Bronx River conduit, which are now the only means of conveying water to these boroughs, is 400 million gallons a day. At the present rate of consumption, the limit of capacity will be reached in four years or less; and on the basis of a 10 per cent. increase it will be reached in less than five years. The entire supply from the Croton, Bronx, and Byram watersheds comes into the city by gravitation. The maximum elevation to which the water can be delivered is 119 feet; in many places it is considerably less than this. The demand for high-pressure supply continues to grow at a constantly increasing rate. In the borough of the Bronx there is as yet no high-pressure service, and many portions of it lying on higher ground are not supplied. The amounts which will be required at the end of four years are estimated by the Commissioner to be as follows: Brooklyn, 136,161,000 gallons; Manhattan and the Bronx, 387,986,000 gallons; Queens, 11,450,000 gallons—total, 535,597,000 gallons. And in ten years he estimates that this figure will have reached 640½ million gallons.

Foreseeing that some additional supply must be obtained, the Commissioner made a tour of inspection, accompanied by four engineers "of high standing." Two of these were the Chief Engineer of the Department of Water Supply and the Chief Engineer of the Board of Public Improvement. The names of the other two are not given. These gentlemen visited the highlands of the Hudson, and part of that district which is generally described as the Catskill Mountains. The particular section of the Catskills visited embraced the valley of the Esopus Creek, the upper water of the Schoharie Creek, and the head waters of the east branch of the Delaware River. Here there are a large number of natural sites for storage reservoirs which can be made available with comparatively small cost for the construction of dams, sluices, &c. Seven proposed sites for reservoirs were examined. These were the Fort Montgomery site, which is 40 miles from the city, has a watershed of 45 square miles, has an elevation of 400 feet, and will flood about 150 acres; the Popolo site, which has an elevation of 500 feet, and an area of about 250 acres; the Mine Pond, which is 600 feet high, and has a natural area of 10 acres; Lake Popolopen, which is over two miles long and 1000 feet wide, and 650 feet above sea-level; Lake Hill site, which can be flooded to 300 acres at an elevation of 1050 feet; the Coal Brook reservoir, in the Esopus Valley, which can be made to contain 15,000 million gallons at an elevation of 675 feet; and the Olive reservoir site, which can be made to impound 7000 million gallons. The area of all the watersheds of the above is in excess of 1400 square miles. The rainfall is said to be 15 per cent. in excess of that of the Croton watershed. The population averages not more than ten to the square mile. The geological and topographical features point to a large percentage yield of potable water; and it is estimated that ultimately a daily amount of 900 million gallons will be obtained from this district.

Then as regards cost, if the city itself undertakes the supply of water from this district, the Commissioner remarks that it must build so that the addition to the water supply shall be assured for a series of years after the completion of the works. This means that it must build reservoirs and conduits of sufficient capacity to guarantee an additional supply of not less than 600 million gallons per day, and must be ready to issue bonds to the amount of not less than $70,000,000, and possibly of as much as $100,000,000, instead of paying, in accordance with the proposal, $70 per million gallons without any further risk or expense.

Several points in Mr. Dalton's report are taken up and adversely criticized. The Brooklyn and Queens supply is acknowledged to be inadequate, even disregarding the phenomenal growth which the Commissioner ascribes to the latter borough. There have been, says one New York paper, many reports on the subject of the water supply of these two boroughs made to the Commissioner of City Works. In some of these, water from sources west of the Hudson—from the Catskill Mountains, in fact—has been considered, and in every case found more costly than a supply from other gathering grounds. "Hence," it says, "so much of the Ramapo job as depends on the needs of the Long Island portion of New York may be dismissed as beside the point." With regard to the Manhattan and the Bronx districts, while the Commissioner's figures are accepted, the waste in the former is stated to reflect little credit on the officials in charge of the distribution. In 1870, 80 gallons per head sufficed for the needs of the inhabitants. The amount has been gradually growing, particularly since the opening of the new aqueduct in 1890. In 1895 it was 100 gallons per head; now it is about 130 gallons, of which 30 gallons at least are put down as waste. It is even alleged that builders on Manhattan Island are familiar with tales of unexpected springs which retard excavation. These often occur in places where water can only come from the city mains. But even supposing that all waste was stopped, it is recognized that the time has arrived when something should be done; and it is suggested that recourse should be had to the Ten Mile River catchment area lying just north of the Croton basin. From this something over 100 million gallons of water per day can be obtained, and with comparative ease. This, it is urged, will give the authorities time to look round them. The amount of water which will be required depends upon the growth of the population. If it continues at the present rapid rate, it may be necessary to go to the Great Lakes or the Adirondack Mountains. If the population bids fair to remain nearly stationary, then the Catskill Mountains may be able to deliver all that is necessary. These are subjects, however, which it is considered are for the future. The present course is "to throw over the Ramapo job, remedy the leaking pipes, stop the waste in houses, and develop the Ten Mile River basin."

In reply to all this the Water Commissioner says that from Ten Mile River, in the Housatonic watershed, a daily supply of 110 million gallons might be obtained, but it would fail to give the much-needed increase of pressure. To obtain higher pressure, a new aqueduct would have to be built, at a cost of $40,000,000 or more. Moreover, pollution of the water would nearly certainly ensue, owing to the large population near the source. Then, too, as regards Lake George, Lake Ontario, and Lake Champlain. The water from the first would only reach New York at sea-level, and would require a tunnel 10 miles long. The cost of carrying out the work would be not less than $200,000,000. A supply from Lake Champlain would flow by gravity to Troy, where it would have to be pumped 250 feet high, so as to reach sea-level at New York, and then again be pumped to be of any use. Further, a tunnel of 56 miles would be required. From Lake Ontario water would flow by gravity to Albany, where it would have to be pumped 230 feet high in order to flow by gravity to sea-level at New York. A tunnel 50 miles long would be required *en route*. Then, lastly, a gravity supply equal to that which the Catskills would furnish could be obtained from the Adirondacks; but the works would cost not less than $500,000,000, and could not be completed in less than twelve years.

New York is truly in the thick of deep troubles. On the one hand, there are the officials, who, while grasping the gravity of the situation, yet shrink from doing the necessary work themselves, and catch at a straw held out by a private Company. On the other hand, the citizens are up in arms at what they think to be needless expense and dangerous obligations about to be undertaken. From an outside point of view there, of course, comes the question: "Why cannot the city do the work itself?" The Commissioner gives seven reasons, which, at first sight, are plausible enough, against it; but they will scarcely bear close examination. The "Engineer" thinks New York's most advantageous course is clear—viz., to provide her own water supply.

Fatal Explosion at the Lillie Bridge Oil-Gas Works.—Last Wednesday, Mr. C. Luxmore Drew opened an inquiry at Fulham into the circumstances attending the death of John Joseph Clements, aged 49, a gas maker in the employ of the District Railway Company, who was killed by an explosion at the Lillie Bridge works of the Company on the previous Saturday. William Clark, a gas maker's assistant, said that on the day in question Clements was engaged in making gas with petroleum oil, which was pumped into tanks, and then into the retorts. He was supplied with a Davy lamp to use where a naked light was not allowed; and the lamp was found hanging in a cupboard after the accident. Mr. George Estall, the Resident Engineer, explained that at the side of the oil-tank was another pit containing tar refuse, which was covered with boards, through the cracks in which the gas could escape. This refuse always threw off gas, and the prevailing thick fog would prevent it rising. As soon as it was in contact with the atmosphere, it became explosive. The oil used was crude oil supplied by the American Oil Company. He had formed the opinion that Clements, in order to see the gauge in the tank below, struck a match, and the explosion followed. Commander Wells, Chief Officer of the Metropolitan Fire Brigade, said he had visited the premises, but could not form any opinion as to the cause of the explosion. The vapour might have arisen from the petroleum or from the tar waste. The crucial point was that the man neglected to use his Davy lamp. The inquiry was adjourned. When it was resumed on Friday, Thomas Williams, the foreman at the works, stated that there had been two previous explosions, in one of which a man named Webber was fatally injured. The gauge-glass was below the level of the ground. George Simpson, stores porter, said that when Clements left him to examine the gauge he was not carrying the Davy lamp. The explosion occurred half a minute after. Edward Creedy said he had examined the gauge on several occasions, and had carried a naked light into the pit. An explosion occurred, and he was injured. Inspector Wade, of the London County Council, said he had tested the oil, and it had a flash-point of 150°. The Jury returned a verdict of "Accidental death through an explosion caused by a naked light;" but they said there was not sufficient evidence to show how the light was introduced. They added a rider that the gauge should be placed in such a position as to be read from the ground level; that ventilating shafts should be fixed to the bottoms of the pits; that the disused pit should be filled in; and that all fires should be immediately notified to the Fire Brigade officials—there having been some delay in this respect on the present occasion.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

When these "Notes" appear in print, the world will have entered upon the last year of the century. I am glad to observe that the "JOURNAL" is not being made a medium of those who preach the foolish notion that the century ends with 1899. To go further might lead to rejoinders; for the subject is one upon which there is a keen conflict of opinion. So I will content myself with the closing year as it has been, without reference to what position it is to occupy in the roll of the ages. In gas matters within the area of Scotland, it has been rather a hum-drum year. It has not been distinguished for anything striking. You can scarcely fix your mind upon any single event and say, "This is notable." It has, nevertheless, been a year of great activity. Increased outputs, many of them unusually large, have been experienced at all the larger works, without exception. The sequel is found in the bustle of making arrangements to meet the ever-growing demand for gas. Entirely new works are in course of erection at Glasgow, Edinburgh, and Perth; practically new works have been completed at Stirling; new works are in contemplation at Falkirk; and North Berwick; large extensions are in progress at Dundee; and extensions were completed at Paisley, Renfrew, Forfar, and other places. All this extra work has been put upon gas managers, who, in addition, have not been free from anxiety upon other subjects—chiefly coal and labour. The price of coal has advanced considerably during the year—main from 9s. 3d. to 11s. per ton; ell from 7s. 3d. to 13s.; and splint from 10s. 6d. to 13s. Though this great increase in the cost of raw material has added heavily to the burden of management, it is fortunate that, as yet, there has been little occasion for raising the price of gas, which, in most cases, remains at what it was a year ago. The labour question has been brought forward by Trades Union interests. When the men were working quite contentedly, the Union officials swooped down upon them, set up branches in different towns, and then proceeded to formulate demands for higher wages. These have been conceded in Glasgow, Edinburgh, Dundee, and Aberdeen; and in the three latter towns no further trouble has as yet been experienced. In Glasgow, however, an effort is being made to compel the Corporation to recognize the Union. Had these elements not developed, the year would have been one of great material prosperity. With them on their shoulders, it is not exaggerating to say that gas managers face the coming year with careful countenances. Not without hope, by any means, for the path is not in any particular downwards. It is still upwards; and if there should be a curtailment of the business conducted by gas undertakings during 1900, the gas industry will not stand alone, for the great task which the nation has set itself in South Africa will undoubtedly lead to the practising of economies in many walks of life.

There has been nothing of the nature of an organic change in gas production or use during the year. There has been no new installation of carburetted water gas, which is now only used in Edinburgh. Neither has acetylene gas fared well. It has been abandoned at Cowdenbeath; and at Portsoy, the only other place where it was adopted for public use, there have been difficulties of a financial nature, which, I rather think, have not yet been surmounted. Coal gas is thus more than holding its ground. In the burning of it, there has been a great extension of the incandescent system, but nearly altogether for private lighting. The slow rate at which public bodies have adopted it is amazing.

Transfers were completed at Peebles, Troon, and Helensburgh; and the preliminary steps for a transfer have been taken at Dunoon.

Gas Companies have been registered under the Companies Acts at Barrhead, Strathaven, Annan, Saltcoats, and Newport (Fife). At the latter place, the Company have taken power to supply electricity.

In the electric lighting world, Paisley is the only place of note where a new installation has been completed. Negotiations are being carried on, or works are in progress, for its introduction into Stirling, Brechin, and Montrose; but there does not appear to be much heart in the work.

There have been a good many changes among gas managers. Mr. George Keillor, jun., was transferred from Assistant at Hamilton to be Manager at Peterhead; Mr. Peter B. Watson was transferred from Castle Douglas to Stranraer; Mr. P. R. Chalmers, of Coupar Angus, received the appointment at Castle Douglas; Mr. A. Smith was appointed Manager at Airdrie, but after three months resigned on account of ill-health, and Mr. D. Vass, of Portobello, was appointed in his place; Mr. W. Blair was transferred from Haddington to Helensburgh, and was succeeded at Haddington by his brother, Mr. Peter Blair, of Blaenau Festiniog; Mr. S. G. M'Lusky was appointed Manager at Coldstream; Mr. A. M. Canningham, at Kilmalcolm; Mr. J. Walker, of Edinburgh, at Comrie; Mr. John O'Neill, at Cumnock; Mr. James Kay was promoted from Assistant to be Manager at Elgin; Mr. J. W. Napier was transferred from Auchterarder to Carnoustie; Mr. James Dawson, from West Calder to Auchterarder; Mr. C. Winton, from Comrie to West Calder; and Mr. W. M'Lean Ross succeeded his father at Stonehaven.

The obituary list is, happily, short. It includes the names of Mr. W. Taylor, of Elgin, Mr. Patrick O'Neill, of Lochmaben, and Mr. Graham Ross, of Stonehaven. Mr. D. Bruce Peebles, of Leith, who held a distinguished position in the world of gas supply, was also recently removed by death.

Mr. J. Burgess, of the Gas Workers' Union, has published another letter in the "Glasgow Herald," in reply to that signed "A Ratepayer," dealing with the proposed establishment of a Conciliation Board in Glasgow. Mr. Burgess reaches the conclusion that "the hands may be the hands of 'A Ratepayer,' but the voice is the voice of Mr. George Livesey." This is interesting, whatever meaning may be put upon the words—and they are capable of more than one interpretation. But the consolation which Mr. Burgess takes out of them is curious: One advantage to them is "that the worst that can be said of this Union has now been said." The species of pleading indulged in, is shown by the passage in which he says: "The point before us is not what this Union did, or proposed to do, or was alleged to attempt, ten years ago, but what it proposes to do to-day. I always understood that past character was of more value in forming an estimate as to uprightness than is present profession; but Trade Unionists of this stamp seem to act upon principles which differ from those by which other people are guided. Then the writer speaks of the present system of managing the gas undertaking as an "autocracy." The Managers are the masters of the situation. Thence arises a great deal of the friction in our Corporation Gas-Works—friction which it is the object of this proposal to remove—that those who

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 19.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
500,000	15	Oct. 13	10½	Alliance & Dublin 10 p. c.	21—22	..	4 15 5
100,000	10	,,	7½	Do. 7 p. c.	14½—15½	..	4 16 9
900,000	100	July 3	5	Australian 5 p. c. Deb.	102—104	..	4 16 2
200,000	5	Nov. 15	6	Bombay, Ltd.	5¾—6¼	..	4 8 11
40,000	5	,,	6	Do. New, £4 paid	4—4½	..	5 6 8
880,000	Stk.	Aug. 16	12	Brentford Consolidated	273—278	..	4 6 4
270,000	,,	,,	9	Do. New	210—215	..	4 3 9
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
158,878	,,	Dec. 14	4	Do. 4 p. c. Deb.	124—128	..	3 2 6
220,000	Stk.	Sept. 15	11½	Brighton & Hove Orig.	250—260	..	4 8 6
226,320	,,	,,	8½	Do. A. Ord. Stk.	183—188	..	4 10 5
973,500	Stk.	Aug. 16	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Sept. 29	10	British	43¼—44½	..	4 9 10
50,000	10	Aug. 31	12	Bromley, Ord. 10 p. c.	25—27	..	4 8 11
75,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd.	8½—9	−½	6 13 4
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	98—100	..	4 0 0
150,000	20	July 13	8½	Cagliari, Ltd.	28—29	..	5 13 10
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	13½—14½	..	5 10 4
50,000	50	Nov. 2	6	Do. 6 p. c. 1st Mort.	56—58	..	5 3 5
550,000	Stk.	Oct. 13	13½	Commercial Old Stock	305—310	..	4 7 1
200,750	,,	,,	10½	Do. New do.	240—245	..	4 5 9
200,750	,,	Dec. 14	4½	Do. 4½ p. c. Deb.	140—145	..	3 2 1
600,000	Stk.	Dec. 14	9	Continental Union, Ltd.	177—181	..	4 19 5
200,000	,,	,,	7	Do. 7 p. c. Pref.	178—183	..	3 16 6
51,600	Stk.	Aug. 31	14	Croydon A 10 p. c.	335—340	..	4 2 4
168,400	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
555,000	Stk.	Aug. 16	5½	Crystal Palace Ord. 5 p. c.	130—135	..	3 17 9
60,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
498,000	15	July 28	11	European, Ltd.	21—22	..	5 0 0
354,060	10	,,	11	Do. £7 10s. paid	15½—16½	..	5 0 0
1,993,075	Stk.	Aug. 16	4⅞	Gas-light and Coke	4 p. c. Ord.	104—106	+1	4 12 5
2,000,000	,,	,,	3½		3½ p. c. max.	97—99	..	3 10 8
3,799,735	,,	,,	4		4 p. c. Con. Pref.	119—122	..	3 5 7
3,993,975	,,	Dec. 14	3		3 p. c. Con. Deb.	86—98	..	3 1 3
70,000	10	Nov. 15	8	Hongkong & China, Ltd.	13½—14½	..	5 10 4
1,900,000	Stk.	Nov. 15	10	Imperial Continental	212—217	−1	4 12 2
473,470	Stk.	Aug. 16	3½	Do. 3½ p. c. Deb. Red.	101—104	..	3 7 4
75,000	5	Dec. 14	6	Malta & Medn., Ltd.	5—5½	..	5 9 1
560,000	100	Oct. 2	5	Met. of Melbourne	5 p. c. Deb.	110—114	..	4 7 9
250,000	100	,,	4½		4½ p. c. Deb.	107—109	..	4 2 7
641,920	20	Nov. 15	8	Monte Video, Ltd.		11—12	..	5 0 0
617,946	Stk.	Aug. 31	9½	Newc'tle & Gatesh'd Con.		220—225	..	4 2 3
264,855	Stk.	Dec. 29	8½	Do. 8½ p. c. Deb.		104—107*	..	3 5 5
60,000	5	Sept. 29	7	Ottoman, Ltd.		5½—5¾	..	6 1 9

*Ex div.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
150,000	5	Nov. 30	8	Oriental, Ltd.	7—7½	..	5 6 8
135,000	5	,,	8	Do. New, £4 10s. pd.	6¼—6⅝	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.	1½—1¾	..	4 11 5
500,000	100	Dec. 1	6	People's Gas of Chicago 2nd Mtg. Bonds	102—106	..	5 13 2
851,070	10	Oct. 13	7	River Plate Ord.	10½—11	−¼	6 7 3
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	98—100*	..	4 0 0
250,000	10	Sept. 15	10	San Paulo, Ltd.	12—13	..	7 13 10
135,000	Stk.	Sept. 15	10	Sheffield A.	247—249	..	4 0 4
209,053	,,	,,	10	Do. B.	247—249	..	4 0 4
447,427	,,	,,	10	Do. C.	247—249	..	4 0 4
5,600,000	Stk.	Aug. 16	5½	South Metrop., 4 p. c. Ord.	133—136	+1	3 18 5
1,520,000	,,	July 13	3	Do. 3 p. c. Deb.	101—103	..	2 18 3
120,000	Stk.	Aug. 31	6	Tottenham and Edmonton A. 5 p. c. B. 3½ p. c. 4 p. c. Deb.	141—143	..	4 3 11
250,520	,,	,,	4½		102—104	..	4 6 6
55,100	,,	Dec. 14	4		113—117	..	3 8 5
182,380	10	June 15	5	Tuscan, Ltd.	9—10	..	5 0 0
149,900	10	July 3	5	Do. 5 p. c. Deb. Red.	98—100	..	5 0 0
				WATER COMPANIES.			
746,184	Stk.	Dec. 29	11	Chelsea, Ord.	305—310*	..	3 11 0
150,000	,,	,,	5	Do. 5 p. c. Pref.	157—162*	−½	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	140—145*	+½	3 2 1
175,785	,,	Sept. 29	4½	Do. 4½ p. c. Deb.	148—153	..	2 18 10
1,720,560	Stk.	Oct. 13	7	East London, Ord.	200—205	..	3 8 4
654,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb.	145—150*	−3½	3 0 0
890,000	,,	,,	3	Do. 3 p. c. Deb.	98—100*	−½	3 0 0
700,000	50	Dec. 14	7½	Grand Junction 10 p. c. max. 4 p. c. Deb.	107—109	..	3 8 10
810,000	Stk.	Sept. 29	4		131—136	..	2 18 10
708,000	Stk.	Aug. 16	14	Kent	348—353	..	3 19 4
160,000	,,	,,	7	Do. New, 7 p. c. max.	200—210	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.	290—295*	..	3 11 2
406,200	100	,,	8	Do. 7½ p. c. max.	215—220*	−1½	3 12 9
850,000	Stk.	Sept. 29	4	Do. 4 p. c. Deb.	135—138	..	2 18 0
500,000	100	Aug. 16	13½	New River, New Shares	428—433	..	3 2 4
1,000,000	Stk.	July 28	4	Do. 4 p. c. Deb.	133—138	..	2 18 0
902,300	Stk.	Dec. 14	7½	South-wark and 5 p. c. Pref.	Ord.	203—208	..	3 12 1
126,500	100	,,	7½		7½ p. c. max.	190—195	..	3 16 11
489,200	Stk.	,,	5			160—165	..	3 0 7
1,019,585	,,	Oct. 13	4	Vauxhall 4 p. c. A Deb.		131—136	..	2 18 10
1,155,066	Stk.	Dec. 14	10	West Middlesex		290—295	..	3 7 9
200,000	,,	,,	4½	Do. 4½ p. c. Deb.		147—152	−3	2 19 3
200,000	,,	Sept. 15	8	Do. 8 p. c. Deb.		100—102	−1	2 18 10

labour for the Corporation in the various departments may do so with the greater confidence because of the consciousness that if an attempt be made to wrong them they have always a court of appeal open for the redress of their grievances. What impertinence! Where is the evidence of any attempt ever having been made to wrong anyone? And what are the grievances that are spoken of? If there are any wrongs or grievances, the columns of the "Glasgow Herald" are open for their exposure; and there could be no better way of suppressing them. Publicity would be far more effectual than any Conciliation Board. Mr. Burgess cannot be ignorant of this; but, of course, if wrongs were righted without the intervention of the Union, where would the Union come in? Which would make it appear that it is the good of the Union which is sought, and not alone the good of the workpeople.

Extensions at the works of the Renton Gas Company having been completed, they were formally brought into use on Wednesday, when gas was turned on to a new holder by Mr. R. Ritchie, the Chairman of the Company. The new holder increases the storage capacity at the works from 28,000 to 114,000 cubic feet. It is a wire-rope guided holder, built by Messrs. Ashmore, Benson, Pease, and Co., Limited. Besides the holder, a new station governor and a new engine and exhauster have been placed in the works; and 2000 yards of new mains have been laid, 8-inch pipes having been substituted for 4-inch ones. The whole of the work has been carried out under the supervision of Mr. W. White, the Gas Manager.

The Corporation of Helensburgh, having been judicially barred from placing a new gasholder where they desired, have resolved to erect it upon ground which they already possess, beside the gas-works. The new holder is to be of 200,000 cubic feet capacity. Had a neighbouring proprietor consented to sell a piece of ground adjoining, a more complete scheme could have been adopted; but he absolutely declined to part with his property.

After much agitation, some of it of a not very courteous nature, Mr. Forbes Waddell has succeeded in getting the storage accommodation for gas put upon a satisfactory footing in the Forfar Gas-Works. The new holder, which has been erected for the Corporation by Messrs. Henry Balfour and Co., Limited, to plans prepared by Mr. Waddell, was inaugurated on Monday. Provost M'Dougall, at the opening ceremony, said that they had been afraid to go into such expenditure as this, because of the outcry about the electric light; but, though the electric light had been introduced into the factories in Forfar, the demand for gas had gone on increasing. It had risen, within the past few years, from 27 to 32 million cubic feet per annum. They were now convinced that the electric light would not hurt their gas undertaking. The gas was turned on to the new holder by Bailie Hanich, the Convener of the Gas Committee. Thereafter Provost M'Dougall expressed the indebtedness of the Gas Corporation to the community for the patience they had displayed during the past few weeks. The Manager, he said, had had a great task to supply the town with gas, and had only been able to do so by lowering the pressure. The company were entertained by the Gas Corporation; and some speaking followed, in which Mr. T. D. Hall, of Montrose, and Mr. C. P. Myers, of Kirriemuir, took part. The new holder has cost about £4000. It is of 150,000 cubic feet capacity, and has taken the place of an old and worn out 25,000 cubic feet holder. There is another holder in the works of 86,000 cubic feet capacity. The maximum daily make is 200,000 cubic feet; while there is now storage accommodation for 236,000 cubic feet. Mr. Waddell thus finds himself lifted from a position of having storage for 89,000 cubic feet less than his maximum daily output, into one of having a surplus of 36,000 cubic feet. He has had a struggle to get it; but now it has been obtained, he should have an easier mind. It may be said that, till now, Mr. Waddell has never, since he went to Forfar, had the opportunity of working on anything like favourable lines.

Much is being written at present about a threatened coal famine. Without doubt, coal is scarce; and the customary policy when this state of matters arises has been adopted, of blaming the railway companies for the short supply of waggons. This is nonsense. The railway companies in 1898 handled more than 700,000 tons of coal for shipment above what they did in 1899—which is equal to 122,000 waggon journeys—and there was no complaint to speak of upon the score of the waggon supply. The present condition of the market is altogether artificial. For the cause of it, more than one reason may be assigned. Probably the most powerful one is the war. Were it over, there would be a heavy fall in prices. Probably the fall may take place before peace is secured; for there is nothing which plays such havoc with trade as war does. It is almost a certainty that coal will not be quite so cheap in 1900 as it has been in 1899; but present prices cannot be anything like maintained. Coalowners who have large unsold stocks may be overtaken by the fall before they can realize; and I quite expect that some of the more knowing ones are already selling out as fast as they can—being content with the rise which they have obtained. Were it possible to establish this, the avalanche would at once follow.

December has been a month of great darkness. The sun has scarcely shone in it; and the clouds have been heavy. In addition to darkness, there has been fog in Glasgow and the West of Scotland. Gas consumption has consequently been very heavy. Wednesday was a foggy day in Glasgow; and the consumption of gas reached the total of 33 million cubic feet, which is looked upon as the greatest quantity of gas ever sent out in one day. The resources of the undertaking were taxed to their utmost to keep up the supply. Work of this sort is not satisfactory to anybody; and already one man has written to the newspapers complaining that the want of gas interferes with the operations of gas-engines and the use of gas-fires. The new works at Provan should make matters right in this respect.

At Troon, a defect at the gas-works has led to a scarcity of gas; and the Gas Commissioners have issued a circular to consumers, asking them in the meantime to economize in the use of gas as much as possible.

A Company has been formed with a capital of £100,000, in £1 shares, to acquire certain inventions of Mr. F. W. Lanchester relating to gas and oil engines, &c.

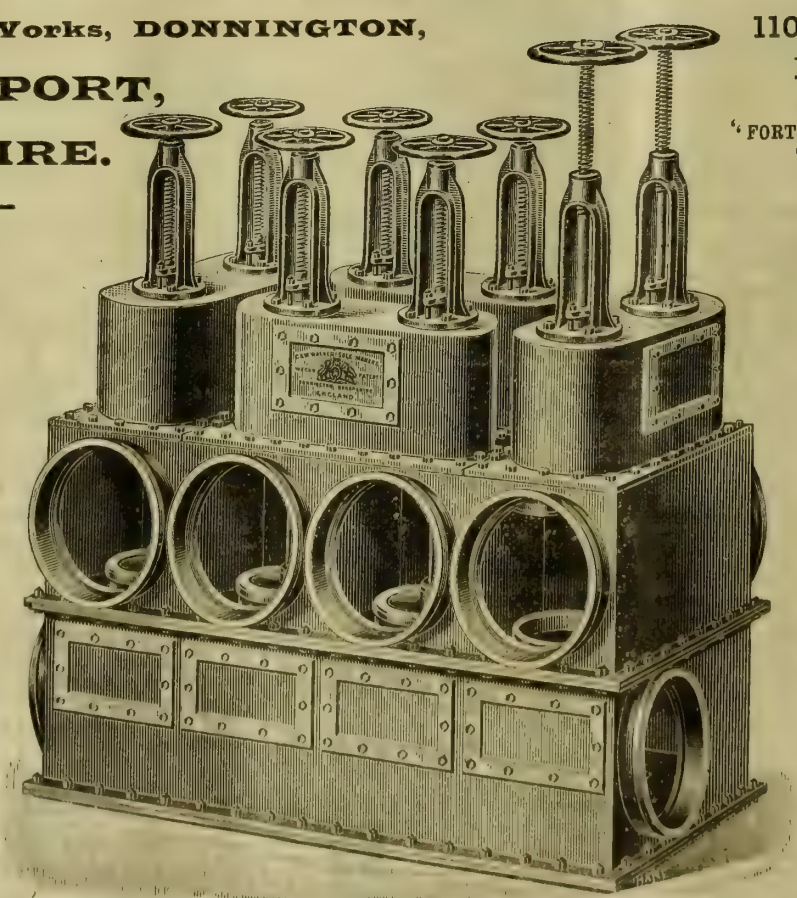
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GASHOLDERS.
SPIRAL-GUIDED
GASHOLDERS.
SCRUBBERS.
SULPHATE
OF
AMMONIA PLANT.
CONDENSERS.
VALVES.
TAR-BURNERS.

Weck's Patent Centre-Valve for Four Purifiers.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 30.

Sulphate of Ammonia.—The business of the week has been quite of a holiday character; and parcels offering have not been easily disposed of. The closing quotations are £10 18s. 9d. to £11 2s. 6d. per ton delivered f.o.b. at the ports. Inland transit on the Continent is still interrupted; and this has not only permitted, but necessitated, the postponement of shipments, so that demand has become sluggish. In the forward position, there has been more inquiry; and buyers' views being much below those of makers, any selling done has been of a speculative character.

Nitrate of Soda is steady on spot at 8s. per cwt. for good, and 8s. 1½d. for refined, quality; and for cargoes, values are barely maintained.

LONDON, *Dec.* 30.

Tar Products.—Very little new business is reported. Ninety per cent. benzol continues flat; but for 50's there is a little better inquiry. The position of benzol is somewhat remarkable, as notwithstanding the enormously increased production, makers state that they hold no stocks; while it is well known that users have not stocked latterly. There is again some inquiry from the Continent, which is encouraging, having regard to the fact that very little benzol has been sent abroad for some time. Toluol is steady, solvent naphtha is strong, crude naphtha is weak, and heavy naphtha is firm. Creosote is reported slightly weaker; but makers are well sold, and in some instances oversold. Heavy oils are somewhat scarce, and command better prices. Pitch is dearer, with inquiries for spring delivery. Crude naphthalene is stronger. Anthracene is weak, with no inquiry.

Prices obtaining during the week are: Tar, 16s. 6d. to 25s. 6d. Pitch, east coast, 34s.; west coast, 31s. 6d. Benzol, 90's, 8d.; 50's, 11d. Toluol, 90 per cent., 1s. 3½d.; pure, 2s. 2d. Solvent naphtha, 1s. 4d.; crude, 30 per cent., naphtha, 4¾d.; heavy naphtha, 1s. 3½d. Creosote, 3¼d. Heavy oils, 3½d. to 4d. Carbolic acid, 50's, 2s. 6d.; 60's, 2s. 9d. Crude naphthalene, 55s. Anthracene, "A," 3¾d.; "B," 2½d.

Sulphate of Ammonia does not improve; and it is doubtful whether the position to-day is quite as strong as it was a week ago. Owing to the holidays, very little business has been done, and quotations are more or less nominal. For prompt delivery, £11, less 3½ per cent., is asked; and for forward delivery makers quote at least 5s. more.

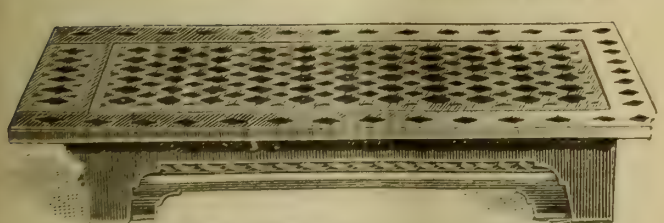
In recognition of old employees' long and faithful services, Mr. John Gwynne, the head of the firm of Messrs. J. & H. Gwynne, Limited, of the Hammersmith Iron-Works, has just assigned to them 1000 fully-paid-up shares in the Company. The participants number nearly forty. According to the deed of gift, the dividends are to be divided, and paid half yearly. The only conditions imposed are that the men shall continue working for the firm unless incapacitated by illness or accident, and that upon the death of a participant his relatives shall have no claim.

THE LANCASHIRE COAL TRADE DURING 1899.

The coal trade of this district has during the past twelve months experienced a period of greater prosperity than has been known for a very considerable number of years. With the exception of the better classes of round coal (the demand for which has perhaps been below the average—partly as a result of the exceptional mildness of the winter seasons and the prolonged and exceedingly hot summer, and partly owing to the largely increased introduction of gas cooking and heating appliances), all descriptions of fuel have been in pressing request for iron-making, steam, and general manufacturing purposes, with supplies for the most part short to meet the requirements of consumers. Even house-fire coals have not been at all plentiful; and any surplus output has been required to replenish the very low stocks held at collieries, with the result that pits worked much less short time in the summer than usual, and prices during the twelve months have been advanced about 1s. 4d. to 1s. 6d. per ton—the comparative quotations at the opening and the close of the year being as follows: Opening rates: 12s. to 12s. 6d. per ton at the pit for best Wigan Arley, 10s. 6d. to 11s. for Pemberton four-feet and seconds Arley, and 9s. to 9s. 6d. for common house coal. Closing rates: 13s. 4d. to 13s. 10d. per ton for best Wigan Arley, 11s. 8d. to 12s. 6d. for Pemberton four-feet and seconds Arley, and 11s. for common house coal. The exceptional activity throughout the iron, engineering, and in fact all the principal coal-using branches of industry, has naturally brought the greatest pressure of demand upon the lower qualities of round coal, and on all descriptions of slack, supplies of which have been inadequate to meet requirements. Common round coals, for steam and forge purposes, have advanced quite 2s. per ton; pit prices, which in January averaged about 8s. 6d. to 9s. per ton, having risen to 10s. 6d. to 11s. On steam coal for shipment there has been a similar upward move, averaging about 3s. per ton; prices rising from 9s. 6d. per ton in January, to 12s. 6d. in December, delivered at the ports on the Mersey. Engine fuel, of which there has been an absolute scarcity of supplies, has advanced something like 75 per cent., and this, coupled with a previous advance of 40 to 50 per cent., makes a total upward move approaching 125 per cent. upon the minimum figures ruling during the period of depression in the coal trade. Slack, which in January was quoted at 4s. 6d. per ton at the pit for common, 5s. for medium, and 6s. for best sorts, has by successive advances risen to 7s. 6d. per ton for common, 8s. 6d. for medium, and 9s. 6d. for best qualities; and even at the maximum figures, collieries, as a rule, have only comparatively limited supplies for their regular customers, with nothing to offer in the open market, where all sorts of prices are ruling to outside buyers, who have to purchase as best they can. This exceptional state of things, especially as regards the pressing demand for the lower qualities of round coal, has necessarily strengthened the position of collieries with respect to the usual contracts for gas coal and locomotive fuel; and they have not been slow to take full advantage of the situation. With the object of counteracting, not only the competition of local collieries, but also that from Yorkshire and other districts, which in previous years



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has tended very considerably towards keeping down the contract prices for gas coals, the Lancashire and Yorkshire coalowners early on in the year opened up negotiations with a view to some co-operation with regard to the prices that should be quoted when the gas coal contracts came upon the market. This resulted in an understanding as to some uniform course of action; and eventually an arrangement was mutually come to that when the usual tenders for gas coal were asked for, these should not in any case be sent in at less than 1s. 6d. per ton above the prices accepted in 1898—many of the coalowners expressing a determination to hold out for an advance of 2s. This firm position taken up by the coalowners, and the general indications of the market, which all pointed to the probability of prices being still higher as the year progressed, brought buyers of gas coal on the market at an earlier period than usual; and contracts were not only settled with unusual promptitude, but in most cases to cover the full requirements of consumers, who in previous years had generally left over small quantities to be bought subsequently, as any favourable opportunity in the market might arise. It was, however, only too evident that during the current year no advantage was to be gained by waiting, and that if extra quantities had to be bought later on, it was more than possible they would only be obtained at still higher prices than those at which the contracts were placed. The arrangement which had been come to by the Lancashire and Yorkshire coalowners was firmly adhered to throughout; and no contracts were concluded except at an advance of 1s. 6d. per ton over the previous year's rates, while in some special cases collieries obtained an advance of as much as 2s. The average basis of prices at which contracts were placed ranged from about 9s. and 9s. 3d. per ton at the pit for the lower descriptions, to about 9s. 6d. and 10s. for the better qualities of gas coal, as compared with 6s. 9d. to 7s. for the lower qualities and 7s. 9d. to 8s. for the best gas coals in 1898. The Lancashire and Yorkshire coalowners also came to a similar arrangement with respect to the locomotive fuel contracts, which they mutually agreed should not be entertained except at an advance of 1s. 6d. per ton over the previous year's rates. The railway companies for a time held aloof from placing their contracts; and in one instance an attempt was made to break through the arrangement by offering to contract at 1s. 3d. over the previous year's rates. But collieries held firmly to the position they had taken up; and the railway companies had ultimately to accept the coalowners' terms. The bulk of the contracts were eventually placed on the basis of 8s. per ton at the pit for locomotive fuel, as against 6s. 6d. in 1898; while in one or two instances, where railway contracts were not settled till later on in the year, an advance of 2s. had to be paid to secure supplies. The coke trade has also been exceptionally active during the year; and with not only the high price, but also the scarcity of slack, which has prevented a large number of ovens being put in, prices have gone up about 10s. per ton during the twelve months; ordinary furnace cokes, which in January could be bought at 14s., having been advanced to 23s. and 24s., and foundry cokes have risen from 20s. up to 29s. 6d. and 30s. at the ovens. A noteworthy feature of the year in the coal trade has been the absence (excepting a short-lived dispute with the engine winders, which was amicably settled) of any of the labour and wages troubles which almost invariably come to the front during any period of special activity in trade. This, so far as the miners are concerned, is no doubt due to the continuance of the Conciliation Board, who have regulated wages without any approach to friction; and under this arrangement the miners have received an advance of 7½ per cent. during the year. Whether the Conciliation Board will finally be renewed on the terms which have been conditionally agreed to, would perhaps seem rather doubtful, as many of the miners are strongly objecting to it. It is, however, to be hoped that some means may be found for securing to the trade a similarly satisfactory relationship between the coalowners and the miners in the future. The coalowners themselves have also taken advantage of the exceptional position of trade. A Coal Sales Association has been formed for regulating prices, and has taken the extraordinary step of declining to contract with merchants at any stipulated prices, but only for deliveries of stipulated quantities; the prices to be fixed when deliveries are made, in accordance with whatever may be the then current market rates. That such terms as these have been strongly opposed by merchants, can be readily understood; and comparatively few contracts have been entered into under the above conditions. The Lancashire coke manufacturers have also formed an Association which during the year has met periodically to regulate prices, and settle the advances that were to be made.

COAL TRADE REPORTS.

From Our Own Correspondents.

Northern Coal Trade.—The coal trade is very busy; and the interruption to the production by holidays has made fuel scarcer than ever, and in some cases has raised the prices. Best Northumbrian steam coals vary from 15s. to 15s. 6d. per ton f.o.b., and steam smalls are from 8s. 6d. to 9s. Demand is full; and some of the collieries cannot guarantee delivery for a fortnight. In regard to gas coal, most of the deliveries that are being made are on old contracts, some of the heaviest of which have three months or more to run yet, and which are on comparatively low prices. These deliveries are so large that they take up most of the coal that is being produced. For the small quantities that are beyond these contracts, about 15s. per ton f.o.b. is asked, and has on one or two occasions been paid. Manufacturing coals are steady, without change in the prices. Gas coke is in good demand; and the large output is well taken up. Prices vary considerably, so that actual quotation is difficult.

Scotch Coal Trade.—Trade in coal is perhaps best described as in a state of expectancy. It is quite manifest that owners are holding up for a rising market. There has already been an increase in prices, in some instances to the extent of about 40 per cent. The expectation is common that there will be a still further rise; and, in the meantime, it has been resolved to give out no quotations, but to sell at what can be secured. Last week the prices obtainable were: Main 11s. to 11s. 6d. per ton f.o.b. Glasgow, ell 13s. to 14s., and splint 13s. to 14s.



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Complaints as to the Quality of Manchester Gas.—At the last monthly meeting of the Moss Side District Council, it was resolved to send a letter to the Manchester Corporation protesting against the present quality of the gas supply. The Chairman remarked on the extraordinarily poor quality of the gas during the previous few days. The light had been no better than that received from a candle. He had wondered whether the Corporation were trying to push the sale of the electric light; but in any case consumers of gas ought to be better treated. Mr. Box said there were a great many complaints from Moss Side ratepayers regarding the gas supply. The quality was so bad that it blackened a new ceiling in twenty-four hours.

The Sanctioning of Payments by Gas Committees.—At a recent meeting of the Cowes District Council, a letter was read from the District Auditor (Mr. O'Neil), stating that when the examination of the gas accounts was completed, he proposed to ask for the Council's sanction to the whole of the expenditure made by the Gas Committee during the year, amounting to £7000. It would, he remarked, be within the recollection of the Council that some of the accounts were not brought before the Council for payment, and some cheques were even signed in private residences, which system could not be passed. After the reading of the communication, Mr. Brown reminded the Council that on several occasions they had blindly sanctioned all the Gas Committee's proceedings up to a certain date. Mr. Fellows, sen., thought the Committee were quite justified in their action. They ascertained what was done in other places, where District Councils had the management of the gas-works; and they acted on the same principle. The Committee had also brought their proceedings before the Council; and they had been confirmed. He moved that a resolution sanctioning all payments made by the Committee be adopted. This was agreed to.

The Bradford Gas-Works in Danger.—A fire, attended with a serious loss of property, broke out on the night of the 23rd ult. in the warehouse occupied by Messrs. W. Rouse and Co., spinners and manufacturers, Bradford. The building is an old one five storeys high; and, being well filled with yarn, waste, bobbins, and paper, it burnt with great rapidity. The whole of the old building was entirely destroyed, and the adjoining warehouse, occupied by Mr. E. B. Whitley, dealer in mohair, was also burnt, with its valuable contents. An alarming feature in connection with the outbreak was its close proximity to the purifier-house of the Corporation Gas-Works, in which were six purifiers. The Deputy-Manager (Mr. T. H. Duxbury) was quickly on the spot; and, seeing the position of affairs, he with great presence of mind shut off the purifiers, and allowed the gas in them to go to waste. When the warehouse collapsed, it fell on to the purifier-house, and brought down the roof; the whole of the *débris* dropping on to the boxes, which only a few minutes before were full of gas. Three of them were broken; but, fortunately, nothing more serious happened. Mr. Wood and Mr. Duxbury were able to assure the firemen that they need have no apprehension of danger from the purifiers; and the men therefore mounted them, and brought their hose into play from this position. Their efforts were successful in preventing the flames from reaching a gasholder.

Theft of Electrical Energy.—It may be remembered that on more than one occasion the German Courts have decided that the theft of electrical energy is not punishable by law, according to the existing code, as electric current or electrical energy cannot be considered to be a material object. A Bill to remedy this state of affairs has been laid before the German Federal Council.

Salford Corporation Gas Supply.—Despite the increasing use of electricity in Salford, says a local paper, the consumption of gas steadily advances; the percentage of increase given in the last annual report being equal to 3·11 over 1898. The coal and cannel carbonized during the year amounted to 135,372 tons; and the quantity of gas made was 1,388,186,000 cubic feet, of an average illuminating power equal to 19·24 candles, the parliamentary standard being 18 candles within the borough and 17 candles, as tested in the out-districts. The cost of coal was rather more than in the previous year. The market for residuals had shown improved results for coke and sulphate of ammonia; but the receipts from the sale of tar had been slightly less. The works and plant have been maintained in a thoroughly efficient condition; and the Gas Committee are at present largely increasing the purifying and scrubbing plant. The length of mains is 235 miles; last year it was 231 miles. The prepayment meters actually in use last March numbered 3269; but on the 12th ult. the number was 5444, while for gas-cookers there has also been a most satisfactory demand.

The Shortage of Gas at Halifax.—A representative of a local newspaper recently waited upon Mr. Thomas Holgate, the Engineer of the Halifax Corporation Gas-Works, with the view of ascertaining the cause of the inadequate gas supply during the week or two before Christmas. It may be remembered that the Gas Committee issued a request to the consumers to exercise the greatest economy; and Mr. Holgate explained that the reason for this notice was that the cold weather, combined with fog, came at a time of greatest demand for gas, and the increase in consumption had gone up to an abnormal degree. The only thing the Committee could therefore do was to diminish the pressure until they could increase the stock sufficiently to be able to resume full pressure, which they were anxious to do towards the end of the week before Christmas, so that the tradespeople should not experience any inconvenience in their Christmas displays. By having reserved what little gas they could, they appeared to be through their difficulties. With Halifax being such a hilly town, continued Mr. Holgate, the want of gas was felt only by the consumers who lived on the lower levels, and unfortunately the inconvenience had to fall upon those residing in the town. If, he added, the new carburetted water-gas plant had been in operation, it would have assisted in getting through the strain. The reason it was not ready was that the contractors were behind with their work, owing to having had great difficulty in getting steel and iron from the manufacturers. The editors of the local papers appear to have received many letters complaining of the deficient supply. The electrical service of the borough has also been giving much annoyance; and there was a complete collapse of the lighting on the Corn Market the Wednesday before Christmas.

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Shortage of Gas at Driffield.—The extended use of gas for cooking and heating purposes at Driffield led to such a demand on the works in the week preceding Christmas, that something like a "famine" occurred on one evening, which, unfortunately, was a particularly dark one. The Gas Committee have very wisely decided to extend their plant.

The Proposed Municipalization of the Cambridge Water-Works.—The Bill which the Cambridge Town Council propose to promote in the next session of Parliament to confer upon them several important powers, among others authority to purchase the water-works, was submitted at a meeting of ratepayers last Thursday. There was a vigorous and influential opposition to several of the proposals; and the motion consenting to the promotion of the measure was defeated by a considerable majority. A poll was demanded.

Fire at the Worcester Gas-Works.—About two o'clock last Friday, an explosion occurred in the oil-shed at the Worcester Gas-Works. The structure, owing to the inflammable nature of the contents, was quickly in flames, which threatened to attack the adjacent buildings. By the prompt arrival of the Fire Brigade, the fire was extinguished in about half-an-hour; but everything inside the shed had been destroyed. It seems that the giving way of a joint in the oil-tank allowed oil to escape; and this became ignited.

Lincolnshire Towns in Darkness.—Owing to the non-arrival of coals, and the consequent inability of the Gas Company to manufacture gas, the town of Long Sutton was in darkness on the evenings of the 20th and 21st ult., and remained so for several succeeding ones. The Company have a contract with a Sheffield firm, but were unable to obtain supplies of coal. On the 22nd, one of the Directors sent a ton from his own house in order to make a small quantity of gas. Difficulty has also arisen at Skegness. Owing to their inability to obtain coal, the Skegness Gas Company have not been able to make their usual supply of gas; and in consequence the streets of the town have been in darkness for several nights. Lord Scarborough's agent offered the Company the use of some stored coal, otherwise Skegness would have been in darkness during the whole of the Christmas holidays.

Gas Explosion in Salisbury.—Soon after noon on Wednesday, the 20th ult., a serious gas explosion occurred at the shop of Mr. C. A. Bentlif, brush manufacturer, &c., in Winchester Street, Salisbury, forcing up a large portion of the flooring, and generally wrecking the shop. It seems that Mr. Bentlif had noticed an escape of gas for some days, and had given notice to the Gas Company, who sent a couple of men to put matters right. Outside the shop, the men found a leakage in the service pipe; and, having rectified this, they were testing the joints of the meter, which stood in a small cupboard in the shop, when a violent explosion occurred beneath the flooring. Subsequent examination revealed the cause of the disaster. The service-pipe inside the shop was as defective as the portion which had been repaired outside; and gas in considerable quantity had been escaping from it—filling the space beneath the boards of the floor. The explosive mixture became ignited, with the result stated. Fortunately, the explosion was unattended by personal injury.

A Curious Gas-Stove Explosion in Liverpool.—On Christmas night, a gas-stove in a house in Beaumont Street, Liverpool, exploded, injuring three women. It is stated that the stove became very hot, and water was thrown upon it to cool it, with the result recorded. The women were seriously burnt, and the windows of the apartment were blown out.

Water Supply in Calcutta.—The length of pipes for conveying filtered water in Calcutta now amounts to just over 315 miles. The average daily consumption is 20,684,393 gallons; the estimated daily consumption per head being 34·01 gallons in the town proper, and 19·86 gallons in the added area. The gross cost per 1000 gallons is 2·66 annas. The daily supply of unfiltered water is 4,778,899 gallons; the consumption per head being 10·95 gallons.

Explosion at Burton-on-Trent.—The inhabitants of the northern portion of Burton-on-Trent were greatly startled last Wednesday morning by an explosion caused by a combination of coal and sewer gas. The coal gas had apparently escaped in large quantities, and accumulated in the old sewers in Waterloo and Princes Streets. For the length of a mile, all the manholes, numbering 20, were blown into the air. Several buildings were shaken, and a quantity of glass shattered.

The Award in the Skipton Arbitration.—At the last monthly meeting of the Skipton Urban District Council, the Clerk (Mr. R. Wilson) announced that he had taken up the award of Mr. J. Mansergh, the Umpire in the recent arbitration proceedings respecting the purchase of the gas-works. As mentioned in the "Journal" for the 19th ult., the price is £71,250. Though the award is a good deal more than the Council's offer, the purchase is regarded as satisfactory, inasmuch as it brings into the ratepayers' hands an undertaking which many think should have been acquired years ago.

Opening of New Offices for the High Wycombe Gas Company.—The desire of the Directors of the High Wycombe Gas Company to be in a position to meet all the requirements of the consumers was manifested a few days ago by the opening of their new central offices and showrooms. The premises have undergone considerable improvement, under the supervision of the Manager and Secretary (Mr. J. F. Wicks); and they are now attractive and well adapted for their purpose. The Chairman of the Company (Mr. G. Wheeler), the Directors, and some friends, accompanied by Mr. Wicks, made an inspection of the various burners, fittings, cookers, and gas-fires on view, after which Mr. Wheeler formally opened the premises. He said the Directors believed the step they had taken would very much enhance the appreciation of, and give an impetus to the use of, gas, which had so many advantages over all rival lights in economy, efficiency, and warmth. The Company were a most up-to-date undertaking, inasmuch as they could supply anything from a 1d. burner up to a £1000 gas-engine, if required; and already the manufacturers in the town were availing themselves of their special terms offered for the purchase of gas-engines, the cost of running being about ¾d. per horse power per hour. Mr. Wicks thanked those present for the congratulatory remarks they had made with regard to the general arrangement of the show-room; and stated that it was the intention of the Board to start practical cookery lectures.

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WINDSOR STREET WORKS, BIRMINGHAM (Second Contract)	2,000,000
HALIFAX	1,000,000
TORONTO	250,000
OTTAWA	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
TORONTO (Second Contract; Remodelled)	2,000,000
BELLEVILLE	250,000
OTTAWA (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000
BUFFALO, N.Y.	2,000,000
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.,	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
LEICESTER	2,000,000
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BUENOS AYRES (RIVER PLATE CO.)	700,000
BURNLEY	1,500,000

And Additional Work, including complete Gas-Works at Nelson and Rossland, British Columbia.

Additional Storage at the Cranleigh Gas-Works.—Messrs. Westwood and Wrights will shortly commence erecting at the Cranleigh Gas-Works a new gasholder which they are constructing to the designs of the Company's Engineer, Mr. F. S. Cripps, Assoc.M.Inst.C.E., who has recently remodelled the works. The tank is a concrete one, having wrought-iron bands embedded in it; and the interior is rendered water-tight with portland cement. It is being built locally to designs by Mr. Cripps.

The Water Famine in the Black Country Last Summer.—A letter was read on Wednesday, at the monthly meeting of the Tipton district Council, from the Town Clerk of Dudley, stating that the Local Government Board had replied to a resolution passed at a meeting of representatives of Local Authorities to request the Local Government Board to hold an inquiry with respect to the water famine last summer and the supply by the South Staffordshire Water Company. The Board replied that they had carefully considered the matter, and having regard to the Company supplying the water under parliamentary powers, they were not able to intervene.

Companies Wound Up During the Past Year.—The "Financial News" published yesterday a list of the companies wound up during the past year. It shows that the Acetylene Gaslight, Power, and Calcium Carbide Company, the Acetylene Trust Company, and the Nernst Lamp Company were wound up voluntarily; that the New Incandescent (Sunlight Patent) Gas Lighting Company, the Kent Collieries Corporation, the Kent Coal Finance and Development Company, the Kent Coal Exploration Company, and the Mid-Kent Coal Syndicate were wound up voluntarily with a view to continued existence in another form; and that the Compressed Gas Company, Patent Gas Enrichment Syndicate, and British Gas Traction Company were wound up by order of the Court.

Record Gas Consumptions.—Reference was made in the "Journal" last week to the time of stress through which the Gas Committee of the Birmingham Corporation had been passing; their output of gas in the week ending the 14th ult. being 185½ million cubic feet—11 millions more than the previous highest weekly delivery. It was thought that the consumption in the succeeding week would not show any very great increase on the above figures; but, as a matter of fact, the output reached 197,589,000 cubic feet—a rise of 12 millions, in round numbers. On Thursday, the 21st ult., the consumption of gas in Bradford was a "record" one; the quantity sent from the works being 10,626,000 cubic feet. The previous highest consumption occurred on a very dark day in 1895, when the figures were 10,272,000 cubic feet. Last Wednesday, according to the "Manchester Courier," was "a day to be remembered for darkness out of doors;" and the consumption of gas in the city amounted to 26 million cubic feet. This is the largest figure ever recorded; the normal daily consumption in Manchester in winter being nearly 22 millions. On the same day, the consumption of gas at Rochdale was the heaviest on record; the output being no less than 3,089,000 cubic feet. The nearest approach to this high figure was on the 15th of last month, when 3,011,000 cubic feet were consumed. This was the first time the quantity sent out in 24 hours had exceeded 3 millions.

Mansfield Water Supply.—Lieut.-Col. A. C. Smith held a Local Government Board inquiry at the Town Hall, Mansfield, last Thursday, into the application of the Mansfield Corporation for power to borrow £1415 for water supply. The Deputy Town Clerk (Mr. J. H. White) stated that the estimated population of the town was upwards of 20,000, and the annual assessable value £56,700. The balance of debts outstanding was £90,773, including loans sanctioned, and not yet raised. Mr. F. W. Hodson, of Loughborough, stated that the Corporation had recently completed entirely new works for water supply. In 1892 a loan of £25,000 was sanctioned by the Local Government Board; and on the 10th of July, 1894, an additional sum of £2200 for the purpose of substituting larger mains for those in existence and providing better machinery was also raised. Subsequently there was a further inquiry to raise money for an auxiliary pumping-station, and the Board sanctioned the borrowing of £5000; making the total sum raised £32,200. The works were now all completed, and had proved quite satisfactory; the net cost being £30,639, which was a saving of £1437 on the accepted tenders. The gross cost was £33,443, or £1243 in excess; and to cover this amount, they asked permission to borrow £1250. The reason of the excess was the gradual increase in the cost of labour and building material after the time the tenders were accepted. There was no opposition to the application.

Gas Poisoning Case at Plymouth.—Another case of gas poisoning has occurred at Plymouth. On the night of Friday, the 22nd inst., a sailor in the Royal Navy named George Abbot and a girl of loose character named Mary Wright went to a house in Summerland Place. Next morning they did not get up; and on the bedroom being entered, they were found to be unconscious, and the room was full of gas. The girl was dead; but a policeman and a doctor applied artificial respiration in the case of the man, and he recovered. At the inquest last Thursday, Abbot stated that he sat up in bed to turn the gas down, and it went out. He procured a box of matches to light it again; but Wright took it from his hand, and he went to sleep. The tenant of the house stated that the gas was lowered at the meter, but not turned off. The policeman who examined the gas-bracket found that the tap was loose; and though it was not defective, it was possible that Abbot pulled it over and turned the gas on again. A verdict of "Accidental death" was returned.

Messrs. Biggs, Wall, and Co. have received an order for four of their "Rapid" charging-machines from the Newport (Mon.) Gas Company.

At the annual dinner of the staff of Messrs. R. & A. Main, Limited, of Glasgow, which took place on the 22nd ult., "The Absent-Minded Beggar" was read, after which the sum of £7 6s. 3d. was subscribed by those present for the Glasgow War Fund.

Under the title of Glenfield and Kennedy, Limited, a Company has been registered in Edinburgh, with a capital of £325,000, in £10 shares, to adopt an agreement with the Liquidators of the Glenfield Company, Limited, and Kennedy's Patent Water-Meter Company, Limited.

The Local Government Board Auditor (Mr. Dolby) last Thursday intimated his intention to surcharge individually the Merthyr Guardians in respect of out-relief granted to ironworkers and colliers employed at the stoneyards during the great strike of 1898. It is reported that the amount of the surcharge will be £6709.

Messrs. W. Wilson and Co., of the Lilybank Boiler-Works, Glasgow, in their report for the past year state that this period was marked in the dry-sand and cast-iron pipe trade by a steady demand for all sizes of pipes. Every town of any importance seemed to have been increasing its water or gas works mains. The foreign demand had also been considerable; large orders having been placed for South America, India, Africa, Japan, and Russia.

A serious explosion occurred at the Middlesbrough chemical works of Messrs. S. A. Sadler and Co., Limited, last Wednesday morning; but, fortunately, though several men were working in the immediate vicinity, none of them were injured. A pitch-cooler which had been under repair was brought into use. Boiling pitch was poured into it, when the explosion at once occurred, splitting the cooler to pieces and scattering lumps of metal in all directions. One workman, when the accident occurred, had the presence of mind to turn off the pitch, and thus undoubtedly prevented a great conflagration. It is supposed that some matches or other foreign matter had been left in the cooler, which would, when the boiling pitch was poured in, cause an explosion.

We have received from the Gas-Meter Company, Limited, a tastefully prepared catalogue of the meters and other gas appliances which they manufacture, and for the excellence of which they have obtained a world-wide reputation. The Company's association with the manufacture of meters has been an exceptionally interesting one; they having from the very first manufactured the instrument bearing the honoured name of Croll. The faith which engineers placed in that meter at the beginning has not by any means abated; on the contrary, in its improved form its establishment in the gas world continues to be strengthened year by year. The catalogue is illustrated by close upon 150 excellent engravings, showing the Company's most improved types of wet and dry meters, test meters and holders, motive power and air meters, station meters, governors, pressure registers and gauges, street columns, lanterns, and meters, water and gas fittings, thermometers, and ordinary and special indices. This list only partly indicates the wide range of gas-works requisites manufactured by the Company. Two of their specialities are the "mutual" automatic meter and the Valon prepayment meter; and the illustrations of these are accompanied by an extended description. A commendable feature of the catalogue is that it presents in concise form the exact nature of the Company's productions, and is not interlarded by a mass of extraneous matter which is wearisome to the business man.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

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Apply, by letter, to No. 3406, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TRAVELLER wanted for London, to REPRESENT WHOLESALE GAS-FITTINGS WAREHOUSE.
Apply, stating full Particulars of previous Experience, Age, Salary, &c., to No. 3405, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SHARPNESS DOCKS GAS COMPANY.
WANTED, a good stoker, used to shovel Charging. Constant berth to a suitable Man. Six Retorts in Winter, Four in Summer. Wages to commence 22s. per week.
Apply to the MANAGER, Gas-Works, SHARPNESS DOCKS.

DRAUGHTSMAN wanted, accustomed to Gas-Works Construction and Plant. Good knowledge of General Building Construction, Structural Ironwork, and able to take out Stresses.
Apply, stating Age, Experience, and Salary required, to ENGINEER, Gas and Water Department, RAMSGATE.

WANTED, at once, a First-class DRAUGHTSMAN experienced in Gas-Works Construction and Estimating Quantities.
Apply, giving full Particulars as to Age, Experience, and Salary required, with *copies* of Testimonials to
J. H. BROWN.
Gas-Works, Ilford, E.

COOKING AND HEATING BY GAS.
WANTED, by a Foreign Gas Company, a thoroughly competent MAN to take entire charge of the above Departments. Three years' contract. Salary to commence with, £250.
Applications, with full details, to No. 3404, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

INCANDESCENT LIGHTING.
WANTED, a Gentleman with Com-mercial Ability and Experience to ASSIST IN MANAGEMENT of new Company. No one without thorough knowledge of the Trade need apply.
Full Particulars, with Salary required, and *copies* of Testimonials, to No. 3407, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

DRAUGHTSMAN wanted, one who thoroughly understands Gas-Works Construction and Plant, with good knowledge of General Building Construction, Constructional Ironwork, and Strains and Stresses.
Apply, stating Age, Experience, and Salary required, sending *copies* of three Testimonials to No. 3408, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

LUTON GAS COMPANY.
GAS-FITTER.
WANTED, immediately, a smart, ener-getic Man of good address who thoroughly understands Main and Service Laying, Meter, Stove, and Incandescent Burner Fixing.
State Age, Experience, Salary required, and send *copies* of three Testimonials, to
W. R. PHILLIPS,
Manager and Engineer.
Gas Company's Office, Luton.

MERTHYR TYDFIL GAS COMPANY.
WANTED, a competent young Man as INSPECTOR of METERS and ASSISTANT CLERK in the Gas-Fittings Department. Wages 25s. per week.
Applications, in own Handwriting, stating Age, where last employed, and enclosing *copies* only of Three recent Testimonials as to Character and Experience, to be addressed to the undersigned not later than Saturday, the 20th inst.
JOHN L. COCKER,
Secretary and General Manager.
Gas Office and Works, Merthyr Tydfil,
Glamorganshire, Jan. 2, 1900.

THE Bingley District Council desire to receive APPLICATIONS for the post of GAS ENGINEER AND MANAGER of the Gas-Works at Bingley. The person appointed will be required to devote the whole of his time to the services of the Council, and to commence his duties on the 1st of April next.
The Output of Gas from the Bingley Works is from 80 to 90 million cubic feet per annum.
Written Applications, with Testimonials, and stating Age and Qualifications of Applicants, and Salary required, and marked "Gas Manager," must be sent to the Chairman of the Gas Committee, Town Hall, Bingley, not later than the 12th of January, 1900.
ALFRED PLATTS,
Clerk to the Council.
Town Hall, Bingley.

URBAN DISTRICT COUNCIL OF BUXTON.
GAS MANAGER.
THE Urban District Council of Buxton require an experienced MANAGER for their Gas-Works.
Candidates must have a thorough knowledge of the Manufacture, Testing, and Distribution of Gas, the Working of Generator and Regenerative Furnaces, and all Residuals. They must be competent, and will be required to design and carry out Extensions on the most approved and modern principles.
Salary £200 per annum, with House, Coal, Gas, and Water free.
Applications, with *Copies* of three recent Testimonials, to be addressed to the Chairman of the Gas Committee, on or before the 15th day of January next, endorsed "Gas Manager."
By order,
JOSIAH TAYLOR,
Clerk to the Council.
Town Hall, Buxton,
Dec. 29, 1899.

WANTED, for a London Gas Company, a JUNIOR RENTAL CLERK. Must be quick at figures, and accustomed to the work. Salary to commence at £80 per annum.
Apply by letter in the first place, addressed GAS RENTAL CLERK, 63, CHANCERY LANE. Would be required to begin work about the first week in February, 1900.

IRON ROOF for Sale, 132 feet long by 53 ft. 4 in. Span, in first-class condition.
Apply to CLAYTON, SON, AND CO., LIMITED, Hunslet, LEEDS.

ENGINES and Exhausters, from 3500 to 30,000 cubic feet per hour, in Stock, ready for delivery. No reasonable offer refused.
J. F. BLAKELEY, Thornhill, DEWSBURY.

LIVESEY Washer, 1 Million per diem, 18-inch Valves. MORRIS & CUTLER'S CONDENSER, 18-inch Valves. All in perfect order, and cheap.
J. F. BLAKELEY, Thornhill, DEWSBURY.

RETORT IRONWORK.
RIVETED Wrought-Iron U Hydraulic MAINS, with 5-inch Pipes, 20 in. by 15 in., and 21 in. by 15 in. ∩ MOUTHPIECES, in sets of six and seven, complete. Equal to new, and cheap.
J. F. BLAKELEY, Thornhill, DEWSBURY.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

TENDERS FOR GAS COAL.
THE Magistracy of Copenhagen are prepared to receive TENDERS for the supply and delivery of 140,000 Tons of Best GAS COAL during the Year 1900, from April to the end of December.
The Magistracy reserve the right to divide the Contract between two or more Contractors.
Further Information, and Conditions for the delivery, can be obtained on application to Kobenhavns Belysningsvœsen, Vestre Boulevard, Kjobenhavn, V.
The Tenders should be under sealed envelope, marked "Tilbud paa Kul," and be sent to Magistratens 4de afdeling Lavendelstrœde No. 1 Kjobenhavn K, on or before the 15th of January, 1900, Twelve o'clock, at which time the Tenders will be opened in the presence of the parties tendering who may be present.
THE MAGISTRACY OF COPENHAGEN.
Dec. 19, 1899.

THE Gas Committee of the Corporation of Heywood are prepared to receive TENDERS for the supply of FIRE-CLAY GOODS.
Specification, Quantities, and Form of Tender may be obtained upon application to Mr. W. Whatmough, Gas Manager.
Contractors tendering for this work must pay their workpeople at least the Standard or Trade Union Rate of Wages, and observe the Trade Conditions which attach to the various kinds of work for which the Tender is sent in.
Tenders, endorsed "Fire-Clay Goods," to be sent to me not later than Tuesday, Jan. 16, 1900.
By order,
J. H. BALDWICK,
Town Clerk.
Municipal Buildings, Heywood,
Dec. 20, 1899.

SCUNTHORPE GAS-WORKS.
CONTRACTS Nos. 1 & 2.
THE Urban District Council of Scun-thorpe (Lincolnshire) are prepared to receive TENDERS for the construction and erection of the BUILDINGS and PLANT at their Gas-Works.
Copies of the Specification and the Drawings can be seen on and after Friday, the 5th day of January, 1900, at the Office of the Clerk to the Council, or at the Office of the Engineers, Messrs. Stevenson and Burstal, 38, Parliament Street, Westminster.
Copies of the Tender and Bill of Quantities can be obtained from the above-mentioned on payment of Two Guineas each, which will be returned upon receipt of a *bonâ-fide* Tender.
Sealed Tenders, endorsed in accordance with the instructions at the head of the Tender, to be delivered to the undersigned, not later than Wednesday, the 17th day of January, 1900.
(Signed) F. C. HETT,
Clerk to the Council.

CRYSTAL PALACE DISTRICT GAS COMPANY.
SALE BY TENDER OF £20,000 FIVE PER CENT. PERPETUAL DEBENTURE STOCK.
MINIMUM PRICE, £150 PER CENT.
NOTICE is Hereby Given, that it is the intention of the Directors of this Company to SELL, BY TENDER, £20,000 of FIVE PER CENT. PERPETUAL DEBENTURE STOCK, in accordance with the provisions of the Crystal Palace District Gas Act, 1893 (56 and 57 Vic.).
Particulars of same, with Form of Tender, can be obtained at this Office on application to the undersigned; and Tenders must be sent in on or before Thursday, the 18th day of January, 1900.
The Stock will be allotted to the highest bidders; but no Tender will be accepted at a lower price than at the rate of £150 money for each £100 Debenture Stock.
By order of the Board,
CHARLES M. OHREN,
Secretary.
Offices and Works: Lower Sydenham, S.E.,
Dec. 16, 1899.

SKIPTON URBAN DISTRICT COUNCIL
(GAS DEPARTMENT.)

TENDERS FOR OXIDE OF IRON.

THE Council invite Tenders for the supply of 100 Tons of Natural OXIDE OF IRON, to be delivered at the Gas-Works, Skipton, free of carriage.

Sealed Tenders, stating times of delivery, are to be sent to me on or before Tuesday, Jan. 9, 1900.

The Council do not bind themselves to accept the lowest or any Tender.

RICHARD WILSON,
Clerk to the Council.

Dec. 21, 1899.

SKIPTON URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

THE Council invite Tenders for the supply of 1000 Tons of best screened GAS COAL, to be delivered in quantities of about 250 Tons each during each of the four weeks commencing the 8th of January next.

Tenders, marked "Tender for Coals," and stating Price including delivery at Skipton Railway Station, and at the Wharf on the Leeds and Liverpool Canal adjoining the Works, are to be sent to me on or before Friday, the 5th of January next.

The Council do not bind themselves to accept the lowest or any Tender.

No Forms of Tender supplied.

RICHARD WILSON,
Clerk to the Council.

Skipton, Dec. 28, 1899.

COUNTY BOROUGH OF BURY.

TO RETORT & FIRE-BRICK MANUFACTURERS.

THE Gas Committee are prepared to receive TENDERS for RETORTS, FIRE-BRICKS, and FIRE-CLAY required at their Gas-Works.

Forms of Tender may be obtained from Mr. H. Simmonds, Engineer and Manager, Gas-Works, Elton, Bury.

Tenders, sealed and endorsed "Tender for Retorts, &c.," to be sent to the undersigned not later than Monday, the 15th of January, 1900.

JOHN HASLAM,
Town Clerk.

Corporation Offices, Bank Street,
Bury, Dec. 29, 1899.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
GUILDFORD GASLIGHT AND COKE COMPANY.

NEW ISSUE OF £5000 ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, the 16th of January, 1900, at Two o'clock.

Particulars of the AUCTIONEER, as above.

By order of the Directors of the
SOUTHEND WATER-WORKS COMPANY.

NEW ISSUE OF 600 £10 ADDITIONAL ORDINARY SHARES.

MR. ALFRED RICHARDS will Sell THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, the 16th of January, 1900, at Two o'clock.

Particulars of the AUCTIONEER, as above.

By order of the Directors of the
WANDSWORTH AND PUTNEY GASLIGHT AND COKE COMPANY.

NEW ISSUE OF £3000 ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Tuesday, the 30th of January, 1900, at Two o'clock, in Lots,

£3000 OF NEW ORDINARY STOCK IN THE ABOVE UNDERTAKING,

Ranking for a Standard Dividend of 7 per Cent., subject to the Sliding-Scale; the last Dividend on similar Stock in the Company having been 12½ per cent.

Particulars of the AUCTIONEER, as above.

JAMES OAKES & CO.

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts and Covers, and rendering Leakage impossible.

WILL BE READY ON FRIDAY NEXT,

Demy Octavo, 172 Pages, Bound in Dark Blue Cloth, Lettered, Price 6s., post free,

THE

"POWERS OF CHARGE"

of the

METROPOLITAN GAS COMPANIES:

A HISTORY OF THE QUESTION OF PRICE IN LONDON FROM THE INTRODUCTION OF GAS LIGHTING TO THE PRESENT TIME.

BY

LAURENCE W. S. ROSTRON,

M.A., B.C.L.,
Of New College, Oxford, and Lincoln's Inn,
BARRISTER-AT-LAW.

WITH A PREFACE BY

GEORGE LIVESEY, M.Inst.C.E.

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

CASES FOR BINDING

VOLUMES OF THE "JOURNAL"

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Price 2s. each.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH N.B.

HOLMSIDE

GAS COALS.

Present Daily Produce over 5000 Tons.

Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton	11,205 Cubic Feet.
Illuminating Power	16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality)	13¾ Cwt. per Ton.
Sulphur	A little over 1 per Cent.
Ash	Under 1 per Cent.
Tar	163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor	103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR

PELTON GAS COALS.

Present Daily Produce available 3000 Tons.

Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.

Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.

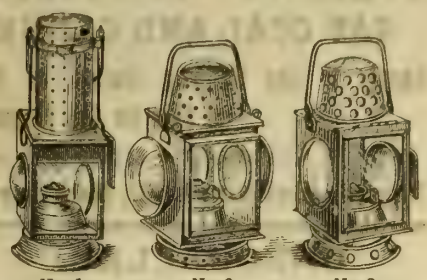
These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,

HOLMSIDE & SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

ARMSTRONG'S PATENT

CANDLE SAFETY LAMPS.



No. 1. No. 2. No. 3.

43, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

WELDON MUD

FOR

GAS PURIFICATION.

For use in the

RECOVERY OF SULPHUR,

ALSO

Removal of last Traces of SULPHURETTED HYDROGEN in catch position.

Full Particulars on application to the Patentees:

GAS DESULPHURIZATION CO.,

— *LIMITED.* —

1, FENCHURCH AVENUE, LONDON, E.C.

THE

"MALL" LANTERN

Absolutely the STRONGEST and CHEAPEST Lantern in the Market.



WINDPROOF & SHADOWLESS.

Adopted for Lighting ST. JAMES'S PARK *and around* BUCKINGHAM PALACE.

WILLIAM EDGAR,

GAS ENGINEER,

Blenheim House, HAMMERSMITH, W.

Telegrams: "GASOSO, LONDON."
Telephone: 14 HAMMERSMITH.

WILSON CARTER & PEARSON,

GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.

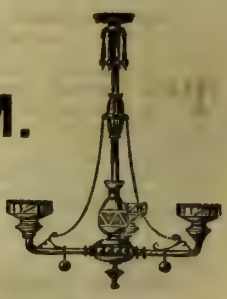
ADDRESS CHIEF OFFICES:

Temple Buildings, 50, New Street, Birmingham.

OSLER,

BIRMINGHAM.

MANUFACTURERS OF GASELIERS IN GLASS AND METAL.



UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY

RAVENSTHORPE, NEAR DEWSBURY.

BOLDON GAS COALS.

ANALYSIS.

Yield of Gas per Ton. .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

For Prices, &c., apply to

W. H. PARKINSON,

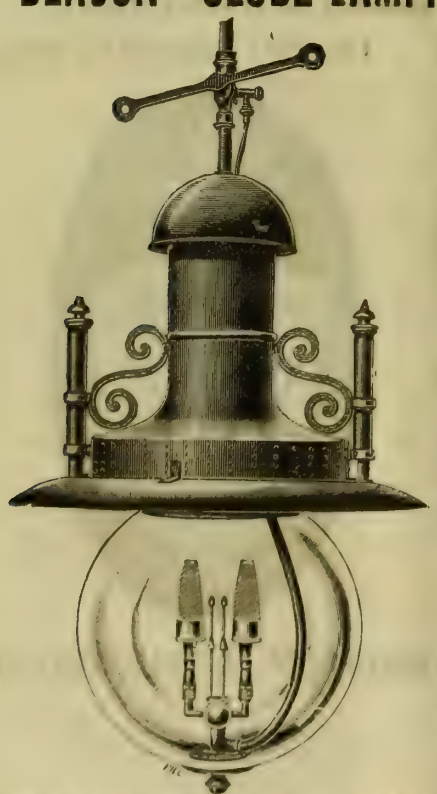
THE HARTON COAL CO., LTD.,

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Telegraphic Address: "PARKINSON, NEWCASTLE."

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"BEACON" GLOBE LAMP.



As fitted at London Bridge near Railway Approach; three Lamps giving the Illuminating Power of 600 Candles. See Surveyor's Report as published in the "*JOURNAL*" for Jan. 10, 1899.

H. GREENE & SONS, Ld.

Late of Cannon Street,

19, FARRINGDON ROAD, E.C.

Telegrams: "LUMINOSITY, LONDON."

PRICE'S COKE & COAL BARROW



effects a great saving of time, labour, and expense.

For Particulars Price, &c., apply to Mr. EDWARD PRICE, 119, Queen's Road, FINSBURY PARK, N.

Prices are Reduced.

GAS-FITTINGS.

BURNERS

Welsbach Pattern

per 7/6 Doz.

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WHOLESALE FITTINGS COMPANY

80, Commercial Road, London, E.

INCANDESCENT

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

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TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE;

OR

E. FOSTER & CO.,

21, JOHN STREET, ADELPHI LONDON, W.C.

THOMAS DUXBURY & CO.,

16, DEANSGATE, MANCHESTER.

GAS ENGINEERS' AGENTS AND CONTRACTORS FOR

Meters, Fire-Clay Goods, Oxide of Iron, and all other Gas Apparatus. Retort Carbon purchased.

Inquiries Solicited.

Telegrams: "DARWINIAN, MANCHESTER."

Telephone 1806.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON.

Yield of Gas per Ton . .	10,500 Cub. Ft.
Illuminating Power . . .	16·9 Candles.
Coke (of good quality) . .	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

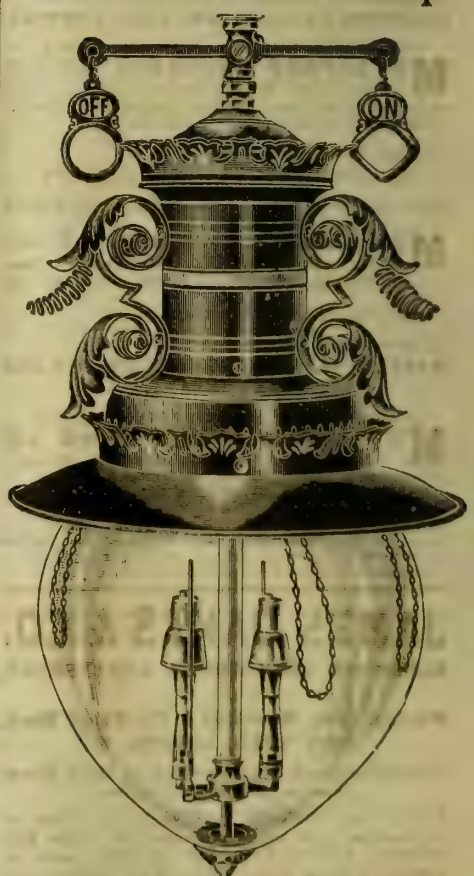
For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

THE

"Matchless" Arc Lamp.



Suitable for the "C" or the "Kern" Burner.

PRICE LIST ON APPLICATION.

J. & W. B. SMITH,

21 & 23, FARRINGDON ROAD, E.C.

PUBLIC CAUTION!

ON THE 21ST OF DECEMBER AN ORDER WAS MADE

in the High Court, in the pending Action of the

WELSBACH INCANDESCENT GAS-LIGHT CO., LTD.,

against the

VOELKER INCANDESCENT MANTLE, LTD.,

RESTRAINING

the Latter, their Servants, and Agents from

Infringing the Patent Rights

of the Welsbach Company until the trial of the Action.

Any **EXHIBITION, SALE,** or **USE** of the **VOELKER MANTLE** will render all concerned liable to Proceedings for Contempt of Court, for Breach of the said Order.

The Trade and the Public are warned against the

INFERIOR IMITATIONS OF THE NEW WELSBACH (KERN) BURNER

lately placed upon the Market. **All Dealers and Users** of the

NEW WELSBACH (KERN) BURNER

are requested to ignore the Newspaper Threats of the New Sunlight Incandescent Company, Ltd., and, in case of an Action being brought, to at once communicate with the Welsbach Company, who, upon receipt of the Writ, are prepared to take the Defence of the Action into their own hands, and to Indemnify the person attacked from all consequences.

MANTLES.

Dealers and Users are also **Warned** not to believe the rumours circulated by Infringers, that the Company's Patent Rights expire shortly. These

RIGHTS EXIST UNTIL 1907;

and the Company will continue to uphold their rights, and to Suppress all Infringements of Mantles as well as of Burners.

The Company are doing their best to accelerate the Action now pending in respect of the

SUNLIGHT COMPANY'S WHITE MANTLE,

which, it is claimed, is an

INFRINGEMENT OF THE WELSBACH PATENTS.

Dealers and the Public are cautioned against Buying, Selling, or Using the said Mantle.

The Welsbach Incandescent Gas-Light Co., Ltd.

76-80, YORK STREET, WESTMINSTER, LONDON, S.W.

NITRATE of Thorium and Cerium.
FABRIK CHEMISCHER PRAEPARATE VON STHAMER NOACK, AND CO., HAMBURG.

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.
Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.
LONDON OFFICE: R. CULL, 34, OLD BROAD STREET, E.C.

LONDONDERRY GAS COALS
FROM THE
LONDONDERRY COLLIERIES,
COUNTY OF DURHAM.
Available Output up to 5000 Tons per day.
Yield of Gas 11,000 cubic feet per Ton of Coal as per Analysis by
Mr. John Pattinson, F.C.S., F.I.S.
FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR,
COUNTY OF DURHAM.

THOMAS TURTON
AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.
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GAS ENGINEERS
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WORKMANSHIP and MATERIALS OF THE HIGHEST QUALITY.
PECKETT'S LOCOMOTIVES
Built to any Specification or Gauge.
PECKETT & SONS, Atlas Locomotive Works, BRISTOL.

JOHN BROWN & CO., LTD., SHEFFIELD,
Proprietors of
ALDWARKE MAIN, CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.
ALDWARKE MAIN GAS COAL
Analysis: 12,600 Feet of 19-Candle Gas per Ton.
Value in Pounds of Sperm, 820·80.
VERY FREE FROM IMPURITIES.
TELEGRAMS: "ATLAS, SHEFFIELD."

INCLINED RETORTS
UP-TO-DATE FURNACES
AND SETTINGS.
J. & H. ROBUS, 20, Bucklersbury, London, E.C.

NEW SUNLIGHT INCANDESCENT COMPANY, LIMITED,

33 & 34, SHOE LANE,

LONDON, E.C.,

Dec. 28, 1899.

SUNLIGHT WHITE MANTLES.

Dear Sir,

Referring to an advertisement of the Welsbach Company which has just appeared claiming that it "is doing its best to accelerate the action against our White Mantle," we beg simply to state that, having asked the permission of the Court to administer certain interrogatories to the Company and its servants - the fairness of which has, of course, to be judged by the Court before we administer them - we have been met by an announcement that the Welsbach Company's officials will refuse to answer these interrogatories, and will take this preliminary point up to the House of Lords. This is what is termed "accelerating the action."

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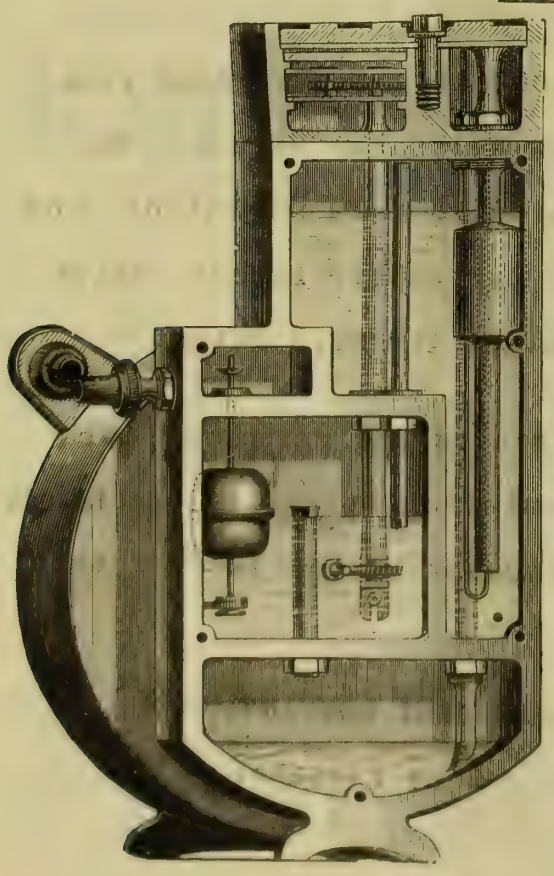
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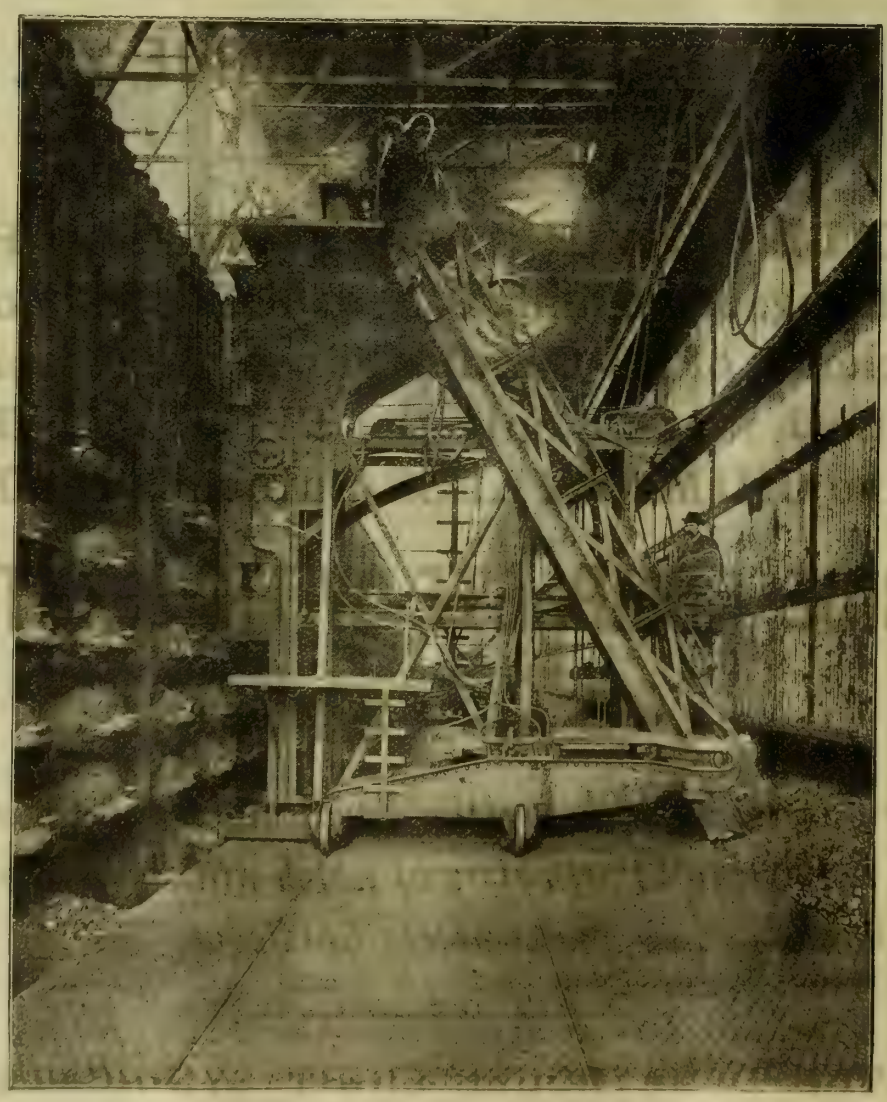
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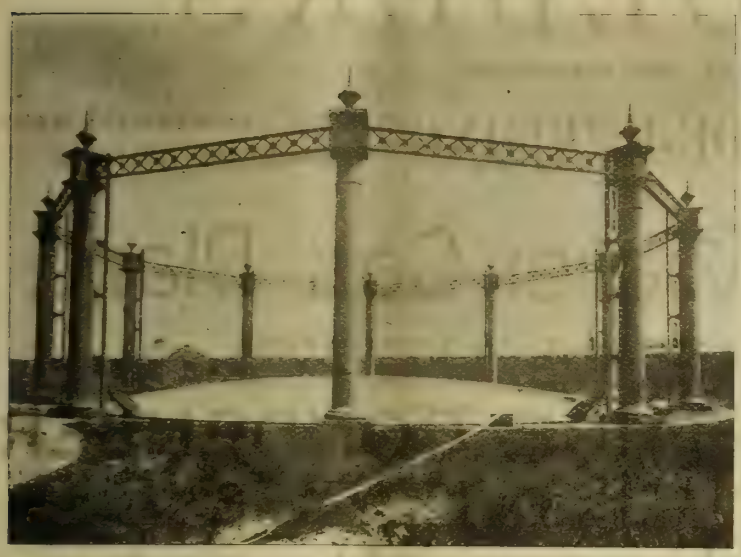
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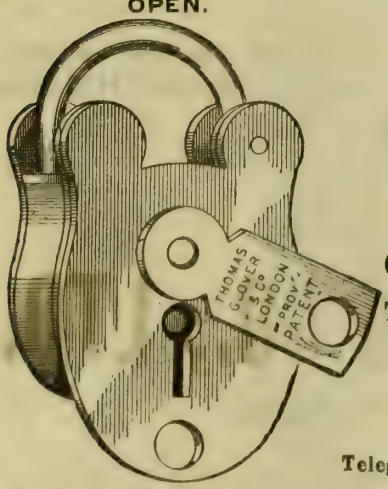
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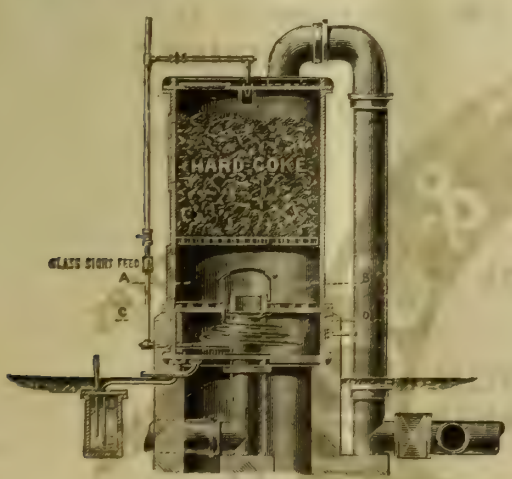
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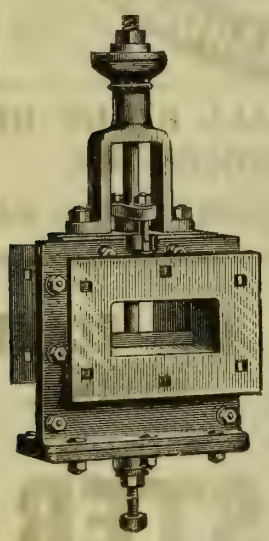
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CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE.
The London Gas Settlement . . . 73
Points of Prospective Gas Legislation . . . 74
A Further Shortening of the Labour Supply . . . 74
Compensation and Wages Questions at Manchester . . . 74
The Strikes and Lock-Outs of 1898 . . . 75
A Curious Side of the Workmen's Compensation Act . . . 75
Government and the Housing Problem . . . 75
WATER AND SANITARY AFFAIRS—
The Proposed Reconstitution of the Lea Conservancy Board . . . 76
Rejection of the Southampton Corporation's Water Scheme . . . 76
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market . . . 77
Electric Lighting Memoranda . . . 77
A French Review of Photometry . . . 77
Recent Literature on Acetylene . . . 79
Gas Bills for 1900 . . . 79
Dr. Bueb's Cyanide Recovery Process . . . 80
The Duties and Responsibilities of Auditors . . . 81
The Introduction of Gaslight into Paisley . . . 82
NOTES:—
The Lubrication of Machinery; The Portability of Oil Fuel; Mechanical Coke Quenching; The Efficiency of the Westinghouse Gas-Engine; Tests of Fireproof Building Construction; Sir W. Crookes's Alarmist Address . . . 84
TECHNICAL RECORD:—
Installation of Inclined Retorts at the Leigh (Lancs.) Gas-Works . . . 85
The Electrolysis of Cast-Iron Water-Mains . . . 86
REGISTER OF PATENTS:—
Retort-Lid Fasteners—Holman, S. . . . 87
Internal Combustion Engines—Kitchen, J. G. A. . . . 87
Internal Combustion Engines—Hamilton, J. H. . . . 87
Extracting Naphthalene from Gas—Irwin, W., and Leather, J. P. . . . 87
Gas-Motor Engines—Nunn, F. C., and White, T. H. . . . 87
Feeding Boiler and Other Furnaces and Removing Ash and Clinkers—Abel, C. D. (La Compagnie Anonyme Continentale pour la Fabrication des Compteurs à Gaz et Autres Appareils) . . . 87
Generating Acetylene—Llorens, J. . . . 88
Regulator for Gases and Liquids—Mühlenthal, S., Löwenthal, M., and Hahn, T. . . . 88
Carburetting or Enriching Gas—Irwin, W. . . . 88
Patent Notices . . . 88
CORRESPONDENCE:—
How Far has the Gas Workers' Union been Recognized? . . . 89
Gas Purification in Germany . . . 89
LEGAL INTELLIGENCE:—
The Rating of Reservoirs . . . 89
Claim in Respect of Injuries Caused by the Honley Explosion . . . 89
MISCELLANEOUS:—
Manchester Corporation Gas Supply . . . 90
The Fatal Explosion at the Douglas Gas-Works . . . 91
The Royal Aquarium Gas Exhibition . . . 92
The Brigg and Skipton Arbitrations . . . 93
American Coal-Gas Statistics . . . 93
Ammoniacal Liquor and Sulphate of Ammonia in the States . . . 93
Electric Lighting Notes . . . 94
Mineral Oil and Paraffin Industry of Scotland during 1899 . . . 95
Notes from Scotland . . . 96
Gas and Water Companies' Stock and Share List . . . 96
Current Sales of Gas Products . . . 98
Coal Trade Reports . . . 98
PARAGRAPHS:—
PERSONAL: Mr. R. Silcox; Mr. H. B. Heath; Mr. G. R. Love, Assoc.M.Inst.C.E.; Mr. Edward Hargreaves; Mr. Thomas H. Clare; Mr. Herbert Gandon; Mr. Walter Donaldson; Mr. Joseph Speakman; Mr. R. A. Browning, Assoc.M.Inst.C.E.; Mr. John Gibson Newbigging, Assoc.M.Inst.C.E. . . . 83
OBITUARY: Mrs. Georgiana Laming; Mr. Thomas Trewhitt . . . 83
The "Powers of Charge" of the Metropolitan Gas Companies . . . 75
The Revenue from the Supply of Artificial Light—Expiring Patents—A Gas and Electric Light Combination in New York . . . 76
The Production of Calcium Carbide . . . 83
South Staffordshire Water Company's Supply . . . 88
The Bagshot Gas-Works in the Market—Additional Storage at the St. Anne's Gas-Works—Windsor Corporation Water Accounts—Dorking Water Company and the Local Authorities . . . 99
Hastings Water Supply—Bolton Corporation Water-Works—Ilfracombe Water Scheme—The Lighting, Water Supply, and Sanitation of Colombo—The Proposed Purchase of the Cambridge Water-Works—The Progress of the Mourne Mountain Water Scheme for Belfast—Exmouth Water-Works . . . 100
Increase in the Price of Gas at Cinderford—Settlement of Compensation Cases at Manchester—Installation of Water-Gas Plant at the River Plate Gas Company's Works—Gas Workers' Wages at Salford—Estimating the Value of Water-Works—Public Lamps and Sewerage Operations—A Practical Gas-Fitting Class at the Birmingham Technical School—Bilston Gas Company—Prospective Extension of the Leeds Gas-Works . . . 101
Increases in the Price of Gas—Curtailment of the Public Lighting at Sheffield—Sulphate of Ammonia and Nitrate of Soda in the Past Year—Birkdale again Complains of the Quality of the Gas Supply—The Great Malvern District Council and the Link Gas-Works—Protecting the Leeds Water Supply—The Water Undertaking of the Dover Corporation—Manchester Water Supply—Kidderminster Water-Works—Price of Gas at Llanelly . . . 102
Mid-Kent Water Company—Oldbury Gas-Works—Southampton Water Supply . . . 103

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EDITORIAL NOTES.

The London Gas Settlement.

IN the last issue of the "JOURNAL," we gave a brief account of the state of the New York gas supply, as brought about by the system of competition in the business in which the town communities of the United States still believe. Instructed opinion in this country, and generally throughout the Eastern Hemisphere, differs from American judgment in this matter, for what are regarded as good and sufficient reasons. We "on this side" hold that competition in trade must be judged as merely a means to an end—the end being the supply of the article of commerce, whatever it is, to the public at the cheapest price, and with the highest attainable efficiency. Not all trades or public services are suitable for competitive operation. Every case must be treated on its own merits. Political economists, constantly in search of the rules or "laws" that govern the trading operations of the world, have made a close connection between the freedom of competition and the mobility of trading capital. They remark that, in the same degree that the capital necessary for carrying on a particular undertaking has to be immobilized, or sunk without the possibility of recovery, so far must it be protected from injurious competition. Besides, the question is really as broad as it is long. If capital has to be sunk in a business which is remunerative enough, but is not protected from competition, then the capital will get protection for itself by the setting apart of an adequate provision out of its earnings for redemption, or as a "war chest," or something similar.

Hence we argue that the existence of competition, potential or actual, in the American gas business, is of necessity so dealt with by Gas Companies as to defeat the object which the public fondly believe it secures. The laws will not promise the Companies protection from disturbance during good behaviour, in return for which the capital so protected would accept a reasonable rate of remuneration; and consequently the Companies take care of themselves. The European concession system is the reverse of this; but it is so inelastic, and at variance with Free Trade views of economics, that it can only maintain its vogue in Protectionist countries. There is no need to discuss this system at the present juncture. There is, on the other hand, every justification for reviewing in all possible lights the British, and especially the Metropolitan, principles of gas supply, because they are going into the parliamentary melting-pot, and nobody knows what, if anything, will come out of it before all is done.

The cardinal feature of modern British Gas Companies' statutory and financial condition is the sliding-scale; and the important thing in the sliding-scale is the standard price. There may be several views of the true character of this settlement. One is that when the Company have once had a standard price assigned to them, they are free to take the fullest advantage of it in the way of distributing the utmost increased dividend that the actual selling price of their gas allows—indeed, that they are legally required to do so. Another view is that, in fixing a standard price, Parliament does not intend it to be the last word of regulation of the Company's finances. According to this view, a standard price may, at some time or other, be revised like any other enactment, if found to be unfair, or not to the public advantage in any way. It cannot be denied that the latter view has gained strength of late. Indeed, support for it has been discovered by the Powers of Charge Committee of last session; and those who desire further instruction in the history of the subject may be commended to the little book of Mr. Laurence W. S. Rostron, just published, with the advantage of a preface by Mr. George Livesey. We mention this useful work here, for the sake of the remarkable admission made by Mr. Livesey in the preface, that henceforward when a sliding-scale Gas Company go to Parliament, under a certain condition "a "reduction of the initial price may be expected."

Hitherto, as Mr. Livesey observes, although a Parliamentary Committee could never be induced to say that the initial or standard price ought never to be reduced, as a matter of fact this had not been done; and the learned and astute gentlemen on the public side of the Committee tables practically treated the standard as a fixture. Yet they were all reckoning without their host; and were one and all shutting their eyes to every other consideration except the financial one—that to alter the standard price

would be a breach of faith with the investors who had bought the Company's stock on this basis. But there were disturbing elements in the case which, although ignored and suppressed, could not be got rid of; and these factors have now asserted themselves with a force that must be respected and reckoned with. One was the uncomfortable knowledge that, whereas in some instances the standard price had by an accident been fixed so high that the owners dared not take the full benefit of it, in no case was it so low that the Company had any reason for complaining. Obviously, if the inducement to purchasers of new stock issues under the sliding-scale was the controlling consideration, the actual amount of the standard price was immaterial. But it was not really so. An excessively high standard price meant that the bulk of old stockholders had the power of voting themselves dividends far beyond anything they either expected or deserved. The institution of the sliding-scale was never intended to give 10 per cent. stockholders the privilege of dividing 15 per cent. and upwards; and every instance of the kind was a peril to the whole system. Where such a condition of things prevailed, the complete purpose of the settlement was defeated. Every Company that dared not divide their profits "up to "the hilt" according to their sliding-scale, confessed an excess, and invited revision; and every Company that divided too much, albeit within the legal limits, challenged attention to the circumstances. There is no fixed standard of "sweet reasonableness" in this matter.

It seems to emerge from all the considerations pertinent to the question of the settlement of gas supply on a sliding-scale, that "the proof of the pudding is in the eating." It is the essential nature of sliding-scales to be of limited operation. The margin within which they act is narrowed by every move in the two opposite directions, until it disappears. When this consummation is arrived at in the case of a Gas Company, the public will exclaim "Ah! "If the dividend had not started quite so high up, the "price would have gone lower." Then what is to be done? Alter the law—or bear the consequences of a mistaken valuation for ever? One need not be a prophet to perceive which course is likely to prove the line of least parliamentary resistance.

Points of Prospective Gas Legislation.

In the programme of Gas Legislation for the coming session, as sketched in the numerous Bills which we have abstracted according to annual custom, several interesting points rise into prominence. We have already discussed the proposals actually formulated for a partial resettlement of the London Gas Supply, and need not now return to these suggestions. It is worthy of notice that the gas problem of Bradford is being attacked by the Corporation on a simpler preamble than that previously formulated. Last year the favoured plan involved the partition of several outlying gas undertakings. But the hopelessness of effecting this operation equitably has been accepted; and consequently some of the undertakings are to be bought outright. In a single case, the Bradford Corporation propose to buy gas in bulk from a border Gas Company, to sell within the city. It is a curious situation altogether. We are not surprised that the scandal of extravagantly elaborate and costly arbitrations for ascertaining the transfer value of small gas undertakings, on which we animadverted in the "Journal" for the 5th ult. (see p. 1367), has been effectually prevented by the terms of the Glastonbury and Lymington Corporations Bills. Every credit is due to the framers of these measures for the common-sense way in which they have risen to the occasion. The Glastonbury Bill, moreover, is not an agreed Bill; the Company having a Bill of their own for giving them a new lease of life. Still, the leading fact is that the Company have a capital of £10,000; and the Corporation are willing to buy the property at a fair valuation, taking due care of officers and servants. But the arbitration is to be conducted by a single arbitrator; and neither party is to be represented by more than one Counsel and two expert witnesses. Quite enough, too! It is more than ridiculous for all Great George Street and a couple of Inns of Court to be engaged for days in pretending to instruct three men, who know all about it, whether this or that item of £20 a year should be capitalized as a permanent asset. In the Lymington case, the arbitration is already an agreed thing. The parties are both well meaning and businesslike about it. All they desire is to strike a fair and reasonable bargain; and so they choose their arbitrators, who are empowered to get an umpire in case of disagreement, and the valuation is to be arrived at without the assistance of Counsel or expert witnesses at all. Prodigious! Consultants and Counsel have "pulled the string" too often and too hard; and people are now learning to do without them. It is a happy augury that both Glastonbury and Lymington are advised by men who are wise enough to take the warning that our pages have so often given.

A Further Shortening of the Labour Supply.

War, famine, and pestilence were the three great factors upon which philosophers formerly relied for preventing what to them appeared a very great calamity—any considerable increase in the population of these islands. That population has steadily advanced until it has reached dimensions, and created problems, undreamt by those philosophers, without however as yet involving the country in ruin. In fact, the boot is at present on the other leg; for, in spite of that great increase in population, the commercial community is just now, by reason of two of the three factors named, suffering from a too limited supply of labour. That shortage is not, however, fortunately likely to be of the permanent character of the reduction in population contemplated by the "economists" of former times. They looked to war and pestilence to kill off, from time to time, some of the surplus population. The country is suffering from both these evils at the present moment; and the labour market is thereby considerably deranged. But, with the exception of what will, in comparison with the bulk of the industrial population, be the very small—though absolutely all too large—number of workers killed or permanently incapacitated in the course of the campaign in South Africa, the large majority of those at present withdrawn from the service of our industries will, in course of time, return to their former duties.

Reference has been previously made to the effect of the war upon the labour market. A further dislocating cause is now making itself widely felt, and is seriously inconveniencing many business concerns, the cause which we have—with somewhat of exaggeration, perhaps—designated as "pestilence." Reference, of course, is here made to the severe epidemic of influenza which is hitting right and left throughout the country. Some industries (if not all) have been severely hit, and not least the gas undertakings. We hear on every hand of companies with a large percentage both of their staff and of their hands on the sick-list—a misfortune always inconvenient, but at the present time peculiarly so. In regard to the staff, this is just the period at which they are particularly busy, closing the books and preparing the accounts for the six months that have just ended; while so far as hands are concerned, since managers have already—owing to the activity of trade and the demands of the war—experienced difficulty in obtaining their winter hands, of whom they have required a full supply to enable them to cope with the increased demand for gas, any considerable, if only temporary, disabling of men must be most vexatious.

That the epidemic is widespread in its effects is seen—if, indeed, any of our readers need proof of it—from the fact that about 7000 members of the Hearts of Oak Benefit Society are reported to be suffering from influenza; while the deaths therefrom in the last week of 1899 were nearly 200 (or nearly eight times the normal) in the Metropolis alone, sending up the total death-rate to over 35 per 1000. As to its causes, its prevention, its cure, and how the infection is conveyed, the medical profession at present appear to possess an extensive ignorance. It is cheering for the journalistic profession to know that the present epidemic appears to have a partiality for brain-workers, and very generally attacks the nerves. However, let us hope that, as the epidemic is sharp, so it may also be short. Just now, what with scarcity of coal, shortness of labour, and dearness of materials, the gas manager's lot is not a happy one.

Compensation and Wages Questions at Manchester.

As will be seen by the report which appears elsewhere, attention was given at the meeting of the Manchester City Council last Wednesday to several matters of great importance relating to the Gas Department. The recommendations of the Committee to grant the sum of £5000, in a 3 per cent. mortgage of the city rate, for the benefit of Mrs. Stevenson and her family, commended itself to the

unanimous opinion of the Council, and will, we believe, be heartily approved by the citizens generally. A feeble attempt was made to show that greater generosity was displayed in this case than in that of an ordinary workman who was compelled to go to a lawyer to enforce his claims. This charge was disposed of by Mr. Alderman Gibson, the Chairman of the Gas Committee, in his vigorous speech. It is a fact, however, that sometimes recourse is had to a lawyer before application is made to anybody else; and hence such claims are said to be settled on the "legal basis." One case was specially referred to by the Chairman, in which a man was said by his own lawyer to be a "fool" for not accepting the offer of the Committee. The decision of the Committee to grant an advance of 5 per cent. on the wages of all workmen in the Gas Department, and time-and-a-half for an additional shift on Sundays, must give great satisfaction to all concerned. Alderman Gibson was careful to explain to the representatives of the men who waited upon him, and also to the Council, that these concessions had been granted not because the Gas Workers' Union had made certain demands in the interests of their own members, but because they were just and right, and extended to all workers, whether they were members of the Union or not; and they would have been granted just as readily if the men themselves had applied. It was said at the Council meeting that a responsible official of the Gas Committee had intimidated members of the Union. This has been shown to be incorrect; and if any intimidation has been attempted, it has been on the part of the Union men towards the Manager. The concessions to the workmen will increase the Corporation wages bill by about £6000 a year.

The Strikes and Lock-Outs of 1898.

Some notice, even in these preoccupied times, has been bestowed upon the report by the Chief Labour Correspondent of the Board of Trade on the "Strikes and "Lock-Outs of 1898." This return is somewhat belated, and does not encourage the belief that the staff of old Trade Union officials who man the "Labour Department" of the Board of Trade are overworked, although the majority of them take a good deal more than the Trade Union rate of wages. It begins to dawn upon the industrial world that we got on very well before all these workpeople's squabbles were made into statistical hashes of doubtful nutritive value, at considerable cost to the country. The statistical method is all very well, so far as it goes and is applicable to the subject-matter; but it is open to doubt whether strikes and lock-outs are fairly amenable to this treatment. Thus, of the total aggregate duration of disputes for the year, which is stated at 15 million days, no less than 11½ million days were accounted for by the then South Wales colliers' strike. Why this suspension of work should be lumped in with a handful of tailors' disputes, is not apparent. It is possible, of course, to multiply the number of dishes on a dining-table by the gas-burners in use in the room, as a means of arriving at the gorgeousness of the feast; but the practice is not usual. If these returns show anything at all, it is that the cultivation of strike management as a profession has fallen upon evil days. Failing the command of the strike funds—which, unfortunately, in the South Wales case were non-existent—the professionals turned their attention to the task of "negotiation." The Department graciously magnifies their performance in this way by entering, in the same line, those disputes which were settled directly between the parties themselves "and their agents." The latter are the gentlemen who "intervened"—much better word than "interfered"—and helped to square the matter up. The report gives a dry account of the Welsh coal trade dispute. This would be registered in the tables as one dispute; but it scores heavily, in numbers of men and duration, among those terminated in favour of employers. The Department must hurry up its reports, if they are not to be passed over as ancient history.

A Curious Side of the Workmen's Compensation Act.

Notwithstanding all the pressure which will doubtless be brought upon them by friends and enemies of the Workmen's Compensation Act, it is greatly to be hoped that the present Government will hold their hands from any extension of the law on the same lines, at least until the last session of this House of Commons. Indeed, we are not sure that better speed would not be made if the rounding off of the law were still further postponed. The reason is that several years must pass before the true bearings of the law declare themselves. We do not speak now of the puzzles that continually arise as to the application of the Act to this or that employment, or any mere questions of interpretation or limitation. The gravity of issues of this kind to the several parties concerned must not obscure their essentially transient character. It is the permanent elements that count; and these are only slowly shaping themselves. For example, one of the greatest of the changes effected by the Act was the substitution of a totally new basis for the calculation of compensation for injuries for anything that had previously been recognized in industrial law. For the first time, the consideration of the extent of a man's responsibilities to his kindred and dependents was made to affect his claim upon his employment. We are scarcely beginning to see what this may mean. Only the other day, it was seriously pleaded that the compensation to a man for the loss of an arm should be reduced by the consideration that since the accident the man had married a widow who kept a public-house, and had consequently suffered no pecuniary damage at all! This is nothing to laugh at; but it goes to show that the recognition of consequential injury by the Act may work out into curious results that need time for their full development.

Government and the Housing Problem.

Ratepayers should be forearmed against the threatened new development of Progressivism, of which warning is being given in different quarters. This is no other than the proposal to buy land outside the towns, and erect municipal settlements as a means of relieving the congestion of the population in the central regions. We noticed a short time ago that the politicians of the National Liberal Federation had no time for consulting over the problem of the housing of the working classes; but it now appears that this is not to prevent them trying to make party capital out of the question by moving an amendment to the Queen's Speech, if the Government does not "satisfactorily" deal with the matter. So the "Codlin "not Short" business is already in the air. The inconsistency of A attacking B for not doing something that A has never troubled himself about, is nothing in political circles. In the meantime, Lord Salisbury has, it seems, admitted "the grave importance of providing cheaper "and better houses, and in far greater numbers, than "has hitherto been done, to meet the still rapidly "growing demand of working men in London for suitabl "dwellings within a reasonable distance of the localities "in which they are obliged to work." And not in London only. Mr. Ritchie, the President of the Board of Trade, has expressed his regret that Local Authorities throughout the country have so far made little use of the powers in this regard conferred upon them by the Act of 1890. He is of opinion that had such bodies utilized to the best advantage the powers then given them, much more than has been effected might have been done to avoid the present congestion of our great cities. Here we have an example of the uselessness of legislating in advance of public opinion. The Municipalities were so bent upon going into trade, that they could not see their duty in other matters towards the people committed to their care. It is high time the Local Authorities set themselves, literally, to the task of putting their houses in order. What is wanted is, in the first place, agreement as to the lines on which real progress in this direction can be made; and next the force of public opinion to make the advance effective.

The "Powers of Charge" of the Metropolitan Gas Companies.—In view of the widespread interest aroused by the report of the Select Committee of the House of Commons on the "Powers of Charge of Metropolitan Gas Companies," taken in conjunction with the alteration by the House of Lords of the standard price of the Lea Bridge Gas Company, a history of the sliding-scale settlement of the London Gas Supply has been written by Mr. Laurence W. S. Rostron, M.A., B.C.L., Barrister-at-Law, to which Mr. George Livesey has written a preface. Seeing that Mr. Livesey is one of the few surviving actors in the great movement that led to the establishment of this rule in gas supply, his co-operation with Mr. Rostron in recording the history of the transaction is of inestimable service to the cause of historical truth. Mr. Rostron has spared no pains in setting out the law and its origin, from the stormy times of London gas competition downward. The book is published at the office of the "Journal."

WATER AND SANITARY AFFAIRS.

The importance of the River Lea as a source of water supply for the Metropolis invests with more than ordinary interest the Bill promoted by the Conservancy Board for that river to obtain parliamentary sanction to their reconstitution. Seeing that the Lea furnished about 22 per cent. of the water consumed in London in 1898, it is in the highest degree necessary that its guardians should keep strict watch over it, so as, on the one hand, to prevent its waters from being drawn upon unduly, and, on the other—a far more serious matter—to preserve them from pollution. We are not aware that the Board have ever laid themselves open to the charge of neglecting their duty in either respect. As at present constituted, the Board has five representatives from landowners, one from barge owners, one from a group of Local Authorities, one each from the City Corporation and the London County Council, and two each from the New River and East London Water Companies. This arrangement has for some years failed to satisfy the County Council, who on two occasions—in 1890 and 1893—made unsuccessful attempts to induce Parliament to alter it. In each case they gained the ear of the House of Commons, but failed to convince the Upper House of the necessity for a change. Undaunted, however, they slipped into a General Powers Bill promoted last year provisions for the dissolution and reconstitution of the Board in accordance with their notions of proper representation —that is to say, their authority was to be greatly enlarged, and that of the Water Companies considerably restricted. Under their scheme, the five County Authorities of Bedfordshire, Essex, Hertfordshire, Middlesex, and West Ham were each to send one member, London was to be represented by seven, the Corporation by one, and the two Water Companies by one—making altogether fourteen (one more than the present Board), and excluding altogether the land and barge owners' representatives. The Council urged that the principle of county representation was the proper one to follow for river conservancy, and that local representation had been adopted before county government was reformed. They thought that, as six Water Companies were represented by a single member on the Thames Conservancy Board, one would be ample to protect the two Companies concerned in the River Lea, wherever their interests differed from those of the consumers, represented by the counties. They justified their exclusion of the land and barge owners on the ground that their interests would be looked after by the county members. When the Bill containing this scheme was about to be read a second time, an undertaking was given on behalf of the Conservancy that they would promote a Bill in the next or succeeding session to reconstitute the Board; and they have fulfilled their promise.

The proposals for the reconstitution of the Board which have been embodied in the Bill deposited for next session are of a rather more liberal character, as far as representation goes, to the two Water Companies than were those of the County Council. The number of members is still to be thirteen; but the Council will only send two; while the Councils of Essex, Hertfordshire, and Middlesex, the Corporations of London and West Ham, and the two Water Companies will be represented by one each. There are to be four elected members—one each by the Local Authorities and riparian owners in what are called the upper, middle, and lower districts, and one by the barge-owners. This seems to us to be a better distribution of the representation than that proposed by the Council. Even supposing they were justified in reducing the number of the Water Companies' members by three, which we do not admit, surely the interests of the land and barge owners were large enough to justify direct representation. While curtailing the Companies' voting powers, their contributions to the funds of the Conservancy are to be increased, without any additional privileges being granted. If the Bill passes, the aggregate annual sum payable to the Board by the Companies under the River Lea Water Act of 1855 will be increased to £8000, of which £3750 will be paid by the New River Company and £4250 by the East London Company; and the yearly amount payable under the Lea Conservancy Act of 1868 will be increased to £2000. The Bill, it need scarcely be said, contains a clause prohibiting the throwing of ballast, &c., overboard. Anyone guilty of offending in this way, or of suffering waste products to pass into the river, or heaps of manure, gas lime, town sweepings, or refuse matter of any kind, to remain for more than two days in such a position as to be likely to drain or be blown into the stream, will be liable to a penalty not exceeding £20, and to a continuing penalty not exceeding £10 a day. Stringent measures of this character are, of course, necessary to keep the river as clear as possible.

The question of the water supply of Southampton seems fated to be a source of trouble and dissension in the Town Council and of expense to the ratepayers. In successive sessions of Parliament the Corporation have made abortive attempts to acquire the undertaking of the South Hants Water Company; last year's expenditure on this object amounting to rather more than £4000. Failing in their attempts to obtain possession of the Company's works, they thought they would endeavour to improve their own by taking steps to secure their sources of supply from possible contamination. Their Water Engineer, Mr. W. Matthews, advised the acquisition for this purpose of certain lands at Otterbourne, where the works are situated; and he had to back him up no less an authority than Mr. W. Whitaker, whose opinion was sought on the matter. This distinguished geologist had, in the course of an address to the Sanitary Institute, suggested that "round each works for the supply of water a certain "tract of the water-bearing bed should be saved from the "assaults of surface contamination;" and therefore it was only consistent for him to support Mr. Matthews. In his report to the Parliamentary Committee of the Corporation, he pointed out that this protection had been applied in the case of gravitation supplies, and to a slight extent where water was taken from springs; but he confessed that he could not remember any instance where a well supply, such as that at Otterbourne, had been protected by the acquisition of a considerable area of land round the well. He thought, however, in view of the possibility of some such protective measures as these being insisted upon by the Local Government Board, that the Corporation would be displaying wisdom by putting themselves in the position of being able to stop any proceeding which might appear to have any risk of detrimentally affecting the water supply within a considerable distance of their works. Looking to the future, he regarded the scheme as a good one. The quantity of land proposed to be acquired was 178½ acres, which was 72½ acres less than was originally proposed; and a Bill was prepared on this basis for next session. But when it was submitted to the Council for approval last Wednesday, it encountered very strong opposition. The opinion of the majority of the speakers was that the suggested expenditure was not called for, inasmuch as the purchase of the land was not stated to be absolutely necessary. As the supply was drawn from the chalk, the danger of contamination was characterized as a "bogey," and the scheme generally as "suicidal;" and it was thought that the ratepayers were already burdened heavily enough with a rate of 8s. 7d. in the pound, without incurring further expenditure on "expen-"sive fads." In view of these strong expressions, it is not surprising to find that the scheme was rejected by a large majority. There will consequently be no parliamentary expenditure on water supply this year by Southampton; but time will show whether or not the Corporation have been "penny wise and pound foolish" in declining to adopt suggestions of their Water Engineer and skilled adviser.

The Revenue from the Supply of Artificial Light.—The annual revenue from the sale of gas is estimated to be about £20,500,000; that from the sale of petroleum, about £4,500,000; while that accruing from electric supply during the past year may be expected, according to the "Electrician," to attain nearly £2,000,000.

Patents Expiring in the Present Year.—Among the patents which will expire in the present year are Nos. 3592, 8157, and 9806 of 1886. The first and third, dated March 13 and July 29, were taken out by Dr. Welsbach for "illuminant appliances for gas-burners" and "incandescent mantles, &c.;" and the second was taken out by Mr. F. Siemens on June 19, for "regenerative gas-retort furnaces."

A Gas and Electric Light Combination in New York.—According to a telegram received last Wedesday from the New York Correspondent of the "Yorkshire Post," the Consolidated Gas Company have absorbed the Electric Lighting and Heating Company. This step will, he says, convert the Consolidated into the most powerful illuminating company in New York, and "put it in a position to make a strenuous attempt to unite all the gas and electric light companies in the city."

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 96.)

In Capel Court the "Happy New Year" opened on Tuesday a little more happily than the old year had closed; but fluctuations rapidly set in, and so quickly did the changes work that the tendency varied from day to day. This seems to have arisen from there being several conflicting factors at work pulling different ways; and so things were see-sawed up and down. The most potent influence was in the Money Market, which underwent a complete transformation; but against this came the Local Loans issue. Then the Joint Stock Bank returns were exhilarating; but depression was caused by heavy sales on German account. And meanwhile war news was almost *nil*. So altogether it was a rather distracted week. Money is so abundant, and discount rates have eased down so remarkably, that hopes of a reduction in the Bank of England rate at no distant date are being entertained. In the Gas Market, business had quite a revival (and it was time enough, too) after a long period of depression; but although transactions were numerous, operations were for the most part confined to the leading issues. Prices kept nearly at a dead level; and hardly a quotation of importance had a change. But such as they were, the changes were all in the upward direction. In Gaslight issues, the ordinary had quite a brisk time, and made several attempts to top the quotation, but could not quite manage it. The secured issues were a good deal left alone, and made no particular sign. South Metropolitan displayed more activity, and were steady. There were a few dealings in Commercial, but prices were not higher. One single bargain was all that was marked in the Suburban and Provincial group. Sheffield is locally quoted at a rise of two points; but none of the rest made a sign. Among the Continental Companies, nothing was noticeable except Imperial, which was a good bit dealt in, but at figures which were much disposed to shrink, though no actual fall took place. Of the remoter undertakings, Buenos Ayres and River Plate effected a recovery. The Water Companies exhibited their usual placidity; but they showed a disposition to mend in sympathy with the easier condition of the Money Market, just as they had fallen in response to its hardening.

The daily operations were: Gas opened firm on Tuesday, and prices were good; but quotations did not move. In Water, Lambeth advanced 2; but Southwark ordinary was 1 lower. Business in Gas was a little quieter on Wednesday. Buenos Ayres and River Plate went up ¼ each. In Water, Chelsea preference gained 5. Thursday was moderately brisk; and quotations were not moved. Friday was the busiest day, especially for Gaslight ordinary and South Metropolitan. Buenos Ayres rose ¼. Saturday was about as active as usual; and quotations closed without further variation.

ELECTRIC LIGHTING MEMORANDA.

A Criticism of the "Memoranda"—Return to the Charge—Sparing the Capital—The Sad Case of the Metropolitan Company.

The attention paid by our Electrical Contemporaries to these "Memoranda" is very gratifying, having regard to their character and purpose. We glory in exhibiting the "seamy side" of electrical business, and endeavour not to miss an opening for directing attention to the drawbacks and shortcomings of electrical enterprises. This being our propensity, which is indulged week by week—now at the expense of the Shoreditch affair, or with reference to the failure of electricians to cure the unreliability of their light, or something equally painful—our readers may rest assured that the electrical journals are not likely to spare us if they can catch us tripping. A proof of this is furnished by the gleeful way in which the "Electrician" of this week pounces upon a remark appearing in this column respecting the lack of connection between the economical working of electricity generating stations and the prevention of risk of interruption of the service. We demanded, what is coal saving, or anything else, to a man who cannot get a light when or where he wants it? And to this our esteemed contemporary rejoins, "As if, forsooth, economy necessarily implied risk of breakdown." The contention is contemptuously dismissed as "an amazing *non sequitur*."

Well, although there is an infinity of contempt in this "forsooth;" and notwithstanding the dread we feel of a *non sequitur*, which is indeed a "fearful wild fowl," we must keep the same opinion still. We did not, and do not, say economy of electrical works design or management necessarily implies risk of breakdown; but we certainly do hold that the obligation upon central station designers and managers to "cut it fine" in both capital outlay on spare or relief plant, and in the running expenses, distinctly jeopardizes the reliability of the service. The "Electrician," with a too obvious desire to lead its public off the scent, professes ability to well understand the alarm of its gas friends "at the close attention electrical engineers are paying to high economy, and at the excellent results this careful attention is producing." There is plenty of room for all the saving that electric lighting engineers can effect in the planning and working of central stations, before they can get level with the despised gas manager in this respect. At any rate, so thinks, and says, "the man from Sheffield," to whom we beg to refer the "Electrician" for very late information on this head.

This is the point—the obligation to eke out capital compels electricians to overrate the earning capacity of the plant they lay down in the first instance, and afterwards to take on more lamp connections than the station plant can safely supply. Is proof of this assertion wanted? It may be found in the valuable and only too big sheet table of electricity supply works in operation in the United Kingdom, sent out this week as a supplement to the "Electrician." It is not our task to frame a rule giving the margin of generating plant that a central station ought to have in reserve; but everybody knows the service provided by the City of London Company, for example, has not been quite satisfactory of late—not to put it more strongly. On looking up the entry relating to this undertaking in our contemporary's table, we observe that, while the total lamp connections number 425,000, the total plant capacity is 425,000 lamps also. With regard to saving of coal being against working with an adequate reserve, is it necessary to argue that driving steam plant at full load is more economical than having plenty of engine power in hand, and some boilers with banked fires? Besides, has it not been stated somewhere that reserve electric generating plant of the very latest and most improved kind is most difficult to work in to help the output on a pinch? How is this for the much-lauded three-phase system?

An important outcome of the heroic but ill-fated attempt of the Metropolitan Electric Supply Company to serve a lamp connection numbering 498,000 by means of plant only up to 144,000 lamps was the prosecution of the Company by the Vestry on the 29th ult., at the Marylebone Police Court, for having made default in the supply of the Vestry buildings and the Workhouse. It has not escaped observation that British philanthropy is liable to go astray in the matter of supplying the destitute with things that they do not need and are not thankful for. This case of lighting the Marylebone Workhouse by electricity seems to be an illustration in point, if it is not an attempt to realize Sir W. Preece's idea of the electric lamp being a poor man's light—at other people's expense. The Company pleaded guilty to the charge made against them, and threw themselves on the mercy of the Court. Their Counsel offered an extremely interesting, and not a little pathetic, explanation of the straits in which the Company found themselves when the dark days of last autumn set in. He did not add, as he might have done, that a conviction would come in very handily for the Vestry in depreciating the value of the Company's undertaking in the parish, which the Vestry are required to purchase before starting their own contemplated business in the same line. It is really a very untoward set of affairs altogether for the Company, who, if they have been rather greedy in booking new customers, are surely paying dearly for their offence.

A FRENCH REVIEW OF PHOTOMETRY.

The prospect that the whole subject of the purpose of, and the arrangements for, the statutory testing of the gas supply of London for illuminating power will be brought before Parliament during the ensuing session, lends fresh interest to the inaugural address of M. Vautier, the President of the Société Technique de l'Industrie du Gaz en France, which is given in full in the volume of the Society's "Transactions" just published. This masterly composition possesses all the charming clarity of expression and exquisite sense of style which one is accustomed to look for in French technical writings. The address deals with the legal, or regulation, photometry of England, Germany, and France; and, as the author remarks, the subject is one that had not been brought before the Société for a long time, during which important changes of practice have been made.

To signalize the nature of some of these modifications, the President plunges straightway into an account of the prescriptions of the London Gas Referees, contained in their latest Instructions. It is unnecessary to repeat these particulars. The description of the new Foucault photometer concludes with the remark that, apart from the mechanical differences between the appliances used, and the correction for temperature and atmospheric pressure, the determination of the illuminating power is made in England as in France, by the volume which must be consumed by the standard burner in order to obtain the same intensity as the standard of light employed; both the gas-burner and the standard of light being fixtures of the photometer. The fact is noticed that this was not always the method; and the older system is described in order to register the course of evolution in this regard. To go no further back than the Referees' Instructions dated September, 1896, it will be found that the illuminating power was the intensity given by the combustion in the standard burner of a fixed quantity of gas equal to 5 cubic feet per hour, corrected for temperature and pressure to 60° Fahr. and 30 inches.

This correction has been criticized by the Dutch Photometrical Committee;* for it is possible for the volume of gas to

* *See* "Journal," Vol. LXIV., p. 1161.

vary between 4·35 and 5·42 cubic feet, and it would be necessary to know the corresponding temperature and pressure at the test, and burn in the standard burner the volume of gas which, brought from these data to 60° Fahr. and 30 inches, would be equal to 5 cubic feet. Without this, the definition of the illuminating power rests upon the disputable hypothesis that the illuminating power of a flame is proportional to the consumption of gas. M. Vautier discusses the point in a note. He observes further that the Instructions of the Referees anterior to 1898 are open to other criticisms. First he criticizes the candle standard, next the Letheby and Evans photometers, and dismisses the whole outfit as imperfect. Fortunately, as he holds, they are all put out of date by the new Instructions, and possess merely an historical interest. He characterizes the new Instructions as realizing important improvements, among which are classed, for convenience of reference and comparison, the following salient features:—

1.—The standard of light is a part of the flame of a gaseous mixture flowing through a fixed aperture under a given pressure.

2.—Its intensity, tenfold that of the superseded standard, is more comparable with the intensity of usual sources of light.

3.—The standard gas-burner and the standard of light are placed at fixed and not very unequal distances from the disc of the photometer.

4.—The illuminating power is defined by the volume of gas under test, which must be consumed in the standard burner to equal on the screen the intensity of the standard of light (volume corrected to 60° Fahr. and 30 in. barometrical pressure).

So much for the English method. The German practice is taken by M. Vautier from the prescriptions of the Photometrical Committee of the German Gas and Water Managers' Association, which are official so far as the authority of the Association goes. That is to say, the scheme in question is only provisional, and does not necessarily correspond with the actual practice of any city of the German Empire. Where there is the opportunity for doing so, this is the method of photometry which the German Association would recommend for use. The standard gas-burner is the Elster argand, burning 150 litres per hour, with a chimney 210 mm. high, made by Schott, of Jena. It should be noted that there is no universal standard gas-burner accepted for German towns lit by concessionary companies. Divers test burners are in use besides the Elster argand already mentioned, as the Hohlkoff-Schnitt flat-flame burner, consuming 150 litres per hour; and also the Sugg "London" argand, No. 1. The illuminating power should be from 14 to 16 Hefners with flat-flame burners, and from 18 to 20 Hefners with argands, according to the terms stipulated. The photometer is that of Lummer and Brodhun; and the standard of light is the Hefner, which is a lamp certified by the Imperial Physico-Chemical Institute of Charlottenburg, burning acetate of amyl.

This is the simplest of light standards. It resembles in appearance a small common spirit-lamp, burning the combustible by means of a cotton wick in a flame 40 mm. high, or thereabouts. Extreme precision is unnecessary. The Berlin house of Kahlbaum undertakes the preparation of the amyl acetate, or pear oil, in a sufficiently pure state for photometrical purposes; and the Technical Institute of the Duchy of Baden, at Carlsruhe, supplies it in sealed litre bottles. It must be kept closely stoppered and in the dark, and must never be used for photometrical purposes after it has turned sour, as tested by blue litmus paper. The Hefner unit is slightly inferior in value to a German candle (union paraffin, burning with a 50 mm. flame, measured from origin to point). The following equivalents are given by M. Vautier:—

1 Hefner unit = 0·83 German union paraffin candle.
" " = 0·87 English standard candle.
1 German candle = 1·20 Hefner units.
1 English " = 1·14 " "

The Lummer and Brodhun photometer preferred in Germany offers remarkable advantages as regards sensitiveness, precision, and ease of application. As this photometer is not well known in France, M. Vautier describes it in detail. It is employed at the Central Electrical Laboratory of Paris, and is in regular use in the laboratories of the Lyons Faculty of Sciences. M. Vautier thinks its screen is more sensitive than any others of the bunsen type. The German Committee prescribe the following practice of gas photometry with this instrument: First, the standard gas-burner is to be regulated, after a quarter-of-an-hour from lighting-up, to consume the exact rated amount of gas. This must be done as carefully as possible, because no compensation for quantity is permissible. The hourly consumption is deduced from observations of the test meter for one minute. When the measurement is correct for two consecutive minutes, the adjustment is considered perfect. The Hefner unit is also lighted ten minutes before it is wanted; and its flame is then regulated to the proper height. Ten readings of the photometer constitute a test; the average being struck. It is not corrected for temperature or pressure; but the temperature of the photometer-room is maintained as nearly as may be at 17·5° Cent., with a tolerated margin of 5°. By whatever method determined, illuminating power of gas in Germany means the luminous intensity given by the hourly consumption prescribed for the standard burner—say, 150 litres per hour. This definition of illuminating power is the same as prevailed in England until the Referees made their change—exception made, of course, for the difference of the standard of light and the corrections.

French photometry is still exactly as Dumas and Regnault left it. M. Vautier takes this for an excellence; remarking that these illustrious *savants* succeeded the first time in devising a method and choosing apparatus answering so well to the industrial requirements that there has been no need to seek others. "They realized from the start, in their essential elements, that perfection which in other lands has only been approached by long and tedious endeavours." Complimentary all round. Yet it strikes one as remarkable that this supreme attainment should have been left a monopoly of the French, notwithstanding the fact that in 1860, when Dumas and Regnault laboured, the pre-eminence of French science was more widely accepted than it has been ever since. M. Vautier found it unnecessary to describe the details of the standard national method of photometry to his audience, contenting himself with registering the accepted order as being based on the use of a standard gas-burner (Bengel), and the carcel standard lamp, each placed at the same fixed distance of 1 metre from the screen of the Foucault pattern photometer. The equality of illumination of the screen is obtained by varying the volume of gas burnt at a pressure of from 1 to 2 mm.; and the illuminating power of the gas tested is stated in terms of the consumption per hour of the Bengel burner, without correction.

M. Vautier makes his memoir more complete by adding to it descriptions of all the known absolute and secondary standards of light. He describes the well-intentioned effort of M. Violle to produce an absolutely fixed standard of light by exposing a square centimetre of the surface of molten platinum at the point of solidification. But while admitting the desirability of such a means of standardizing and comparing among themselves the usual working, or secondary standards of light, he omits to show that this service has ever been done generally by means of the Violle standard. He does not say that he has ever seen it, much less worked with it. He speaks with another note of the working secondary standards, with which he is evidently familiar. Of the Hefner unit, he remarks that its illuminating power is very variable with the height of the flame, which, again, is very mobile. The slightest movement of the air makes it jump and tremble. It must be used in a closed apartment; and the operator must not move, speak, or breathe near it. The wind outside, or the slamming of a door in the same house, will unsettle it. Optical means are required to ascertain when the height of the flame is about the normal, in order to permit an observation to be made; and even then, an error of 1 or 1·5 per cent. in the luminous intensity of the standard is not rare. The humidity of the air, the proportion of carbonic acid present, climatic conditions, and many other influences affect the Hefner unit; so that measurements of the illuminating power of gas by its agency can vary by as much as 8 per cent. between winter and summer. The Charlottenburg Technical Institute, and the German Gas Association, have worked long and hard to make the national standard of light really serviceable. Dr. Bunte, at Carlsruhe, has done all that is possible in this regard; and keeps a stock of lamps and amyl acetate for distribution to other experimenters. Still, M. Vautier thinks the standard an imperfect one by reason of the impossibility of ensuring its reproduction with invariable value. It has been taken up in Germany because it is an improvement on the German standard candle. The makers and markers of electric incandescent lamps, we know, have jumped at it as a perfect Godsend—not, perhaps, altogether without regard for the circumstance of its being the poorest kind of "candle" known. With all the pomp and circumstance of an International Congress, the Continental electricians unanimously adopted the "decimal candle" as the unit of luminous intensity. In default of any actual candle corresponding to this hypothetical illuminant, the electricians proceeded to elect the Hefner unit as its representative, which arrangement, as the unit in question happened to be 13 per cent. or thereabouts less brilliant than the English parliamentary standard candle, suited them very well. Even as a secondary standard of light, the feebleness and redness of the Hefner light are grave objections to its use in industrial photometry.

M. Blondel has found the Hefner lamp so troublesome, on account of its vacillating flame and its dependence on a combustible not marketed in a pure form—which, moreover, has a boiling point so high as to provoke carbonization of the wick—that he has tried to improve it by substituting alcohobenzol for the amyl acetate. This preparation is a solution of 16 volumes of crystallizable benzine in 84 volumes of absolute alcohol, which gives a flame of about the correct Hefner value. The wick does not char; and the open flame is surmounted by a chimney of metal with glass shutters for the passage of the light. Here, again, a difference of 1 mm. in height of flame means a variation of 2 per cent. in the light. As M. Vautier remarks, all these standards of so feeble intensity are objectionable on this account alone, and also for many other reasons both scientific and practical. If it were impossible to get anything better, one would have to put up with them notwithstanding their inherent defects; but this is so plainly not the case that the wonder is why working photometrists should submit to be troubled with them.

M. Vautier has no reserve in his admiration for the carcel lamp, which has reigned over French photometry these forty years. He cites the authority of M. Crova for the statement that, even with two carcel lamps of very different make, the light will never differ more than 2 or 3 per cent. at the outside. This constancy is attributed to the fact of the lamp being on the old "Moderator" principle, with the oil regularly overflowing at the wick. He states that Violle constantly found the proportion of 2·08 between the platinum and carcel standards, which is wonderful agreement for what unkind sceptics would designate two variables. It is admitted, however, that to obtain such constancy of working it is necessary to follow exactly all the prescriptions indicated by Dumas and Regnault; and that it is doubtless because of want of this rigorous conformity to the instructions that foreigners, otherwise incontestably competent in photometry, have classified the carcel lamp as defective. This is hardly fair to the foreigner. What we have always understood to be the cardinal defect of the carcel lamp is not that it cannot be easily made to burn its 42 grammes of colza per hour and give its proper light in competent and honest hands, but that it can be so easily made or allowed to give a very poor light while consuming the rated quantity of oil, that the proof of the latter could not be successfully pleaded in a Court of Law as positive evidence that the lamp was working properly. And of other proof there is none. Whatever the defects of the candle standard, it was not open to this suspicion. If gas was found to show a bad test, the pieces of candle were there to speak for themselves; but nobody could swear to what the carcel lamp would do from one lighting to another.

M. Vautier runs through the well-known English standards, but has nothing to say of his own knowledge as to the merits of the accepted Harcourt ten-candle pentane standard. He makes the wise suggestion that the calorimetric testing of gas should be actively followed up. Surveying photometrical practice in the three countries named, M. Vautier compliments England and Germany on their progress in this respect; but he is not bold enough to more than hint at the possibility of improvement of the French practice. He admits, however, that the classical method of Dumas and Regnault answers in Paris and some other large French towns, because they allow a margin of 4 litres of gas to the carcel for errors of observation. Where, as in numerous instances, the margin is cut down to 1 litre per carcel, he admits that corrections for temperature and pressure might be worth making. Also, if a change were to be made, the Bengel burner might be found to be susceptible of improvement—after forty years! Meanwhile, French conservatism preserves the carcel lamp intact, although industrial as compared with legal photometry has little patience with it.

RECENT LITERATURE ON ACETYLENE.

We have received a small manual entitled "Hilfsbuch für Installationen von Acetylen-Beleuchtungsanlagen," by Herr Fr. Liebetanz (Leipsic, Oskar Leiner; 1900). It constitutes a compact and useful guide for persons called upon to deal with acetylene plant, as well as a compendium of information for fitters engaged on acetylene installations. The author writes for those unfamiliar with strictly technical terminology, and explains the properties of carbide and acetylene in simple language. The information given is, however, quite sound; and we are glad to see the dangers of acetylene are not minimized, though the precautions which in practice abolish all risk are fully set out.

Another handy pocket book, entitled "Taschenbuch für den Acetylen-Techniker," compiled by Dr. Anton Ludwig (Berlin, L. Toporski; 1900) has also reached us. It comprises a calendar for 1900, and a memorandum book, as well as a useful collection of data and tables for manufacturers, fitters, and users of acetylene plant. The special information on acetylene is sound. We think, however, that Dr. Ludwig scarcely does justice to the incandescent gas-light, when, in a comparative table of the cost of lighting by different means, he ascribes to it a duty equivalent to only about 14 candles per cubic foot of gas consumed. The comparison naturally is more unfavourable to coal gas in Germany than it would be in England; for the price of 4s. 6d. per 1000 cubic feet which is taken as the basis, is not unreasonable for that country, though it would be excessive here. Nevertheless coal gas comes out well in Dr. Ludwig's comparative table, which is much fairer than the majority of such tables put forward by advocates of acetylene.

We also note that the compiler classifies acetylene generators primarily into two classes, in place of the less rational classification into three classes which was formerly common. Even Professor Lewes, who at one time always made three primary classes of generators, has in his recent popular articles on "Acetylene Generators" in "Feilden's Magazine," adopted the simpler classification into two classes—viz. (1) those in which water is brought in contact with carbide, the carbide being in excess during the first portion of the operation; and (2) those in which the carbide is thrown into water, the amount of water present being in excess. We believe that it was Mr. W. J. A. Butterfield who first pointed out, in the course of a discussion on a paper by Professor Lewes (see "Journal," Vol. LXXI., p. 1380), that this was the only rational primary classification of generators; and his view is now finding acceptance.

GAS BILLS FOR 1900.

The following Bills promoted by Municipal Corporations and Local Authorities, relate in various ways to gas supply.

The Bradford Corporation Tramways, Gas, and Various Powers Bill is an awkwardly-named measure which contains a part concerned with gas, chiefly applying to dealings by the Corporation with the undertakings of the five neighbouring Gas Companies—namely, the Clayton, Allerton, and Thornton Company, the North Bierley Company, the Eccleshill and Bolton Company, the Airedale Company, and the Drighlington and Gildersome Company. These Companies supply gas to portions of the city of Bradford, at higher prices than the Corporation supply the greater portion of the district. The preamble states the desire of the Corporation to acquire the undertakings of the four first-named Companies, and to purchase gas from the last-named for supplying within the city and the parish and urban district of Hunsworth. Accordingly, the Bill proposes to empower the Corporation to require the Companies to sell their properties at three months' notice, given within a year from the passing of the Act. Among the other conditions of the absorption of these gas districts by the Corporation, is that of making the price of gas uniform within the city. A clause specifies the conditions and object with which the Corporation are to be empowered to supply the present Bradford district of the Drighlington and Gildersome Company with gas purchased from the Company in bulk at a price to be agreed upon or determined by a single arbitrator to be appointed by the Board of Trade. The mains and distributing plant of the Company in the district so supplied are to be purchased by the Corporation. Borrowing powers are desired for whatever amount of money may be necessary to carry out the provisions of this part of the Act, to be repayable in 50 years.

The Falkirk Corporation Gas and Burgh Extension Bill is to give powers for the acquisition of additional gas lands. The sum of £80,000 is to be borrowed for this and other gas purposes. Clause 20 runs as follows: "Any pipes or other fittings for the distribution or supply of gas by the Commissioners from any of their mains to any house or building within the limits for the supply of gas by the Commissioners, shall be made sufficient in workmanship and size and material so as to prevent the escape of gas, and to ensure a satisfactory supply of gas to any such house or building, all to the satisfaction of the Commissioners; and if any person requiring a supply of gas shall fail so to do, the Commissioners shall not be bound to furnish a supply of gas for such house or building."

The Glastonbury Corporation Gas Bill proposes to transfer the undertaking of the Glastonbury Gas and Coke Company, Limited, to the Corporation, at a valuation to be determined by arbitration under the Arbitration Act, 1889. Allowance is to be made for the plant being in excess of the requirements of the Company; and officers and servants are to be compensated. The arbitration is to be conducted by a single arbitrator to be agreed upon or named by the President of the Institution of Civil Engineers. Neither the Company nor the Corporation are to employ more than one Counsel and two expert witnesses. The maximum price of 15-candle gas is to be 4s. 6d. per 1000 cubic feet, tested on the works or at the Corporation offices. The Street Urban District Council are to have the option of purchasing their part of the undertaking. Notice of new gas-fittings intended to be covered up is to be given to the Corporation, who are to have the right of refusing to supply gas to unsuitable fittings, subject to appeal to a Court of Summary Jurisdiction. Besides the sum required to purchase the undertaking, £10,000 is to be borrowed for extending and improving the property. Surplus gas profits are to go to the district fund.

The Glyncorrwg Urban District Council Gas Bill is to give effect to an agreement arrived at by the Council and the Llynvi Valley Gas Company for the transfer to the Council of the portion of the undertaking and plant within their district, and generally to enable the Council to build gas-works and supply their district with gas. The sum of £3250 is the price agreed upon for the transferred portion of the Company's undertaking; and £8000 more is required to build new works and as working capital. The maximum price of 14-candle gas is to be 5s. per 1000 cubic feet. The rate of interest on consumers' deposits is to be 3 per cent. The gas loan is to be paid off in fifty years. Surplus gas profits are to go to the district fund.

The Lymington Corporation Gas and Electric Supply Bill is to empower the Corporation to take the supply of gas and electricity into their own hands. The local gas undertaking is called the Lymington Gas and Coke Company; and the proprietors have agreed to sell it to the Corporation at a price to be determined by an arbitration under the Lands Clauses Act, provided that no counsel or expert witnesses are to be employed by either side, but each party is pledged to give to the arbitrators such information as shall be required. This agreement is only to hold good in case Parliament passes the Bill. The gas limits are the borough of Lymington and the parishes of Boldre and Milford. The maximum price of 15-candle gas is to be 5s. 6d. per 1000 cubic feet. The rate of interest on consumers' deposits is 3 per cent. The sum of £10,500 is to be borrowed for gas-works extensions and improvement. Any surplus gas profits are to go to the district fund.

The Morecambe Urban District Council (Gas) Bill is to make

provision for the transfer of the undertaking of the Morecambe Gas and Light Company to the District Council, in accordance with the terms of an agreement which forms a schedule to the Bill. The promotion of the Bill is one of the points of this agreement. The measure contains the usual clauses authorizing the supply of gas by the Local Authority. The maximum price of 15-candle gas is to be 5s. per 1000 cubic feet. There is a clause as to the inspection of gas-fittings in new buildings. The sum of £50,000 is to be borrowed for gas-works extensions and improvement. The gas capital is to be repayable in fifty years. Surplus gas profits are to go to the district fund.

The Morley Corporation Bill contains a part relating to electricity and gas supply. The only reference to gas is in a clause authorizing the Corporation to refuse to supply where the applicant is in their debt for the same or any other premises.

The Newton and Llanllwchaian Urban District Gas Bill is to empower the District Council to supply gas and to purchase the undertaking of the local Gas Company. The Bill is promoted by virtue of an engagement to this effect in an Order of last year. The purchase price is to be determined by arbitration under the Lands Clauses Act, having regard to the actual cost only of the Order of 1899 and the compensation of displaced employees of the Company. Otherwise the Arbitrator is not to value the Company as a statutory undertaking. A clause is inserted protecting the Shropshire Union Railways and Canal Company. The maximum price of 15-candle gas is to be 4s. 7d. per 1000 cubic feet. Power of inspection of new fittings is desired, with liberty of appeal. The sum of £5000 is to be borrowed for gas-works extensions and improvement. Surplus profits are to go to the district fund.

The Ossett Corporation Gas Bill is to authorize the sale of the undertaking of the Ossett Gas Company to the Corporation; and to empower the Corporation to supply gas within the borough and certain adjacent places, all in the West Riding of York. The transfer is to be in consideration of a sum in gross determined upon the maximum statutory dividends of the undertaking, under the provisions of the Arbitration Act, 1889. The Corporation are to pay £400 towards the winding up expenses. The Manager and the Secretary, if of upwards of three years' service, are to be compensated for loss of office by a payment of two years' salary. The maximum price of 15-candle gas is to be 4s. per 1000 cubic feet. Consumers' deposits are to bear 3 per cent. interest; but prepaid accounts are to be credited with interest at the minimum rate of 4 per cent. Power is to be taken for the inspection of new gas-fittings intended to be covered up, subject to appeal. A clause permits the Council and the Horbury District Council to arrange for a mutual partition of the undertaking; the agreement providing that pending the conclusion of such an arrangement, a portion of the sinking fund shall be credited to the Horbury Council. Other neighbouring local authorities are to have the option of purchase. The sum of £25,000 is to be borrowed for gas-works extension and improvement. Surplus gas profits are to go to the district fund. The Corporation take power to make bye-laws with respect to the size and nature of consumers' gas-pipes, such bye-laws to be under the provisions of sections 182 to 185 of the Public Health Act, 1875. The form of deed of transfer of the undertaking of the Ossett Gas Company to the Corporation, given as a schedule to the Bill, is a model of conciseness of expression. It runs thus: "In pursuance and subject to the provisions of the Ossett Corporation Gas Act, 1900, and in consideration of £—— the Ossett Gas Company hereby grant, convey, and assign their undertaking unto the Mayor, Aldermen, and Burgesses of the borough of Ossett; to hold the same unto them their successors and assigns; and the said Mayor, Aldermen, and Burgesses do hereby accept the same accordingly. In witness whereof the parties hereto have hereunto affixed their respective common seals this—day of——19—."

A Bill of a special character is the measure intended to bear the short title of the "Metropolis Gas Act, 1900," but actually introduced with the heading "Gas Light and Coke, Commercial Gas, and South Metropolitan Gas Companies." This is the Bill the provisions of which were given very fully in last week's "JOURNAL" (p. 33). It is therefore unnecessary to reproduce the proposals here; and we only mention the Bill now for the sake of making our programme of prospective gas legislation for the coming session complete. The gravest clauses of the preamble relate to the statutory testing of London gas, which, it is declared, cannot be "satisfactorily or sufficiently" done at the prescribed testing-places; and to the rates of charge for prepaid supplies, which are asserted to be likely to defeat the statutory provisions regulating the price of gas. Part II. of the Bill proposes that any gas examiner may test gas at any time, anywhere, by means to be prescribed by the Referees. Notice of the intention to make such testings is to be given to the Company interested, specifying that the expedition will start from a certified testing-station at a particular time. "No person shall disclose to such Company, by such notice or otherwise, the place at which such tests are to be made." Prepayment meters are to be standardized, and also the fittings for use therewith; and the charge for them is to be fixed by the Board of Trade.

Mr. Julius Danckwerts, whose name has been frequently before our readers in connection with parliamentary and legal proceedings, has been made a Q.C.

DR. BUEB'S CYANIDE RECOVERY PROCESS.

LAST August we had occasion to comment on the interesting paper by Dr. Bueb dealing with the recovery of bye-products from coal gas, of which a translation was published at the time (see "JOURNAL," Vol. LXXIV., pp. 293, 308). It was pointed out that Dr. Bueb's process appeared to be virtually the same as that employed at Beckton, and as that devised by Rowland; and attention was incidentally called to the statements of a writer in the "Engineer" (see JOURNAL," Vol. LXIX., p. 895), who had asserted that the Beckton process was in many important particulars identical with that protected by Rowland. Probably the "Engineer" contributor had interpreted Rowland's specification in a very liberal spirit; and we do not propose to follow him in his attempt to prove the identity of Rowland's and the Beckton processes. Dr. Bueb, however, has taken exception to our remarks that his system closely resembles the Beckton process (see "JOURNAL," Vol. LXXIV., p. 769). We have compared the patent specifications filed by Rowland and Dr. Bueb respectively, and freely admit that the processes described in them differ in some essential points. If, therefore, the Beckton process is identical in many important particulars with Rowland's system—as the "Engineer" writer would have had us believe—clearly we must admit that Dr. Bueb's process is distinct from that used at Beckton. But if the Beckton process is not Rowland's—and we should, in common fairness, presume that it is not, for the Gaslight and Coke Company have, we understand, never paid a penny to the owners of Rowland's patent rights—then it is still conceivable that Dr. Bueb has but rediscovered what was known as to cyanogen recovery at Beckton even prior to 1895.

We say rediscovered advisedly; for we do not recollect having seen published a full account of the Beckton process. In his Presidential Address at the meeting of the Incorporated Institution of Gas Engineers in 1893, Mr. Methven gave an outline of the process (see "JOURNAL," Vol. LXI., p. 867); and his remarks on that occasion have probably been responsible for the prevalent impression that the Beckton system differs in only trifling particulars from Rowland's process. But Mr. Methven's remarks doubtless were intentionally vague, as the Gaslight and Coke Company did not wish to see other gas undertakings adopting the method, and by increased production spoiling the market for cyanides. Yet, even now, little more is generally known of the Beckton process than Mr. Methven divulged in 1893. But in the sequel, we hope to be able to show that it differs in certain respects from Rowland's process, and that the differences bring it into close analogy with Dr. Bueb's method. In doing this, we have not the slightest wish to detract from the merits of Dr. Bueb's invention; for we do not suppose that he had any special knowledge of the operations at Beckton. But it is right that the resemblances should be pointed out; and the way will then be open for Dr. Bueb or others to indicate the significance of whatever differences there are. We have been tempted to recur at this moment to the subject, by the publication in the "Journal für Gasbeleuchtung" of some further details of the practical working of Dr. Bueb's process, in the course of a paper by Dr. Scharrer, of Frankfort-on-the-Main. We will, however, first of all reproduce the more interesting portions of Dr. Scharrer's communication, which was originally presented to the annual meeting of the Mid-Rhenish Association of Gas and Water Engineers last year.

By the processes commonly in use hitherto for the recovery of cyanogen from coal gas, Dr. Scharrer says that the cyanogen was removed from the gas simultaneously with sulphuretted hydrogen, by means of the purifying material (oxide). But recovery of the whole of the cyanogen in the gas cannot thus be achieved; for only so much is recovered as the oxide converts into prussian blue. If the gas is imperfectly scrubbed, and ammonia passes forward in considerable quantity to the purifiers, the production of prussian blue is prevented, and the cyanogen becomes combined in the form of sulpho-cyanide, which is worthless. Moreover, a portion of the cyanogen in the gas has been removed in the condenser and scrubber, and is found in the gas liquor, also in the form of the objectionable sulpho-cyanide. Another portion of the cyanogen in the gas escapes absorption by the oxide, especially if the latter is all but spent. This portion is frequently by no means inconsiderable; and it is either taken up by the water in the gasholder tank, which is thereby rendered poisonous, or it corrodes the plates of the holder and the meter drum, and may even pass on and be consumed with the gas. The wet process is, Dr. Scharrer continues, far preferable to this dry process. It completely removes the cyanogen from the gas, which is thereby improved in respect of purity; and it gives a higher yield of cyanogen in a form which lends itself better to the working up of commercial cyanides. The wet process is very simple. The gas from which the tar has been extracted is washed with a concentrated solution of ferrous sulphate; and the ammonia is removed in the next operation. The cyanogen combines with a part of the ammonia present in the gas and with the ferrous salt, and forms therewith an insoluble double salt, which is deposited in the form of a thin sludge. It is desirable to modify the order in which the apparatus is set up, wherever the process is introduced.

Next to the atmospheric condenser, should come a Pelouze tar-extractor, which acts as well at from 85° to 105° Fahr. as at

ordinary temperatures. Following the tar-extractor, should come the cyanogen washer; after that a water condenser; and then the ordinary scrubbing plant. By this arrangement, cyanogen is recovered which would otherwise be lost. In works where a "Standard" or Ledig washer is already in use, its first compartments might be used for cyanogen recovery, and the remaining ones for the abstraction of ammonia. It is, however, preferable to use distinct cyanogen washers, the outlay on which will rapidly be recouped by the higher yield of cyanogen obtained.

The apparatus designed for the purpose resembles, according to Dr. Scharrer, a "Standard" washer of four compartments, with the agitators driven by steam power. On one side of the washer is the suction, and on the other the pressure connection, so that the absorbing liquid can be drawn or forced from one compartment to the next. Each compartment has a suction valve and a pressure valve. The suction side is connected with the tank in which the solution of iron is prepared and stored; while the pressure side is connected with a reservoir in which the cyanogen sludge produced is preserved until it is run off into barrels or tank-waggons. Cocks are fitted to each compartment, in order to afford a means of ascertaining if the compartment is full or empty. The washer needs but little attention—say, half an hour to an hour's time daily.

At starting, the fourth or outlet compartment only is half filled with the solution of iron, which in summer should have a specific gravity of about 1·133, but in winter should be more concentrated, having a specific gravity not above 1·15. After six or seven hours' working, the contents of the fourth compartment are pumped into the third, and the fourth compartment is filled afresh with solution of iron. After a further six or seven hours' working, the contents of the third compartment are pumped into the second, those of the fourth into the third, and the fourth is filled afresh. The same procedure is practised until all the compartments are charged. When the sludge in the first compartment is found by analysis to be saturated, it is pumped into the reservoir; and the contents of the posterior compartments are transferred to the next compartment, while the fourth is charged afresh. After about 350,000 cubic feet of gas have passed through the apparatus, the sludge in the first compartment is fit for pumping into the reservoir. The process abstracts from the gas cyanogen equivalent to 4 oz. to 6 oz. of yellow prussiate of potash, or to 2¾ oz. to 4 oz. of prussian blue, per 1000 cubic feet of gas dealt with.

Apart from this increased yield of cyanogen, the wet process has, in Dr. Scharrer's opinion, important indirect advantages. The removal of a portion of the ammonia from the gas by means of the cyanide washer, relieves the ordinary scrubbing plant, and the yield of ammonia is increased. Moreover, the oxide may be far more completely exhausted than hitherto in the removal of sulphuretted hydrogen from the gas, as it has only this—its proper—function to perform, and is not partially utilized in absorbing cyanogen and ammonia. The whole of the iron of the oxide is available for conversion to sulphide by the sulphuretted hydrogen, in place of a portion being combined with cyanogen. At gas-works in which the process has been in use for a year, the spent oxide has been found to contain over 50 per cent. of sulphur. This means that, compared with earlier results, the material has purified 30 per cent. more gas. Spent oxide containing over 50 per cent. of sulphur forms a good raw material for sulphuric acid manufacture, and is not worthless, as was the spent material hitherto produced. Purification can be effected simply with natural bog iron ore. Another advantage of the system is that the purified gas is entirely free from hydrocyanic acid, and does not therefore corrode meters and plates of holders. The process does not cause any reduction in the illuminating power of the gas.

Such is the account of Dr. Bueb's process given by Dr. Scharrer; and it must be confessed that from it one would say that the process was, so far as the account goes, identical with that used at Beckton. At Beckton, in 1893, a "Standard" washer was charged with a concentrated solution of sulphate of iron; and the gas issuing from the atmospheric condensers was led through this washer, and then passed on to a second "Standard" washer, which was devoted solely to the abstraction of ammonia. As Dr. Scharrer reports, it was found that the preliminary cyanogen washer relieved the work of the ammonia washer proper; and the filtrate from the sludge obtained in the cyanogen washer often contained as much as 6 per cent. of ammonia. The cyanogen, however, was not extracted by putting a solution of iron into the ordinary ammonia washer, but by means of an additional washer anterior to the latter. This has, we believe, been claimed as one essential difference between Rowland's process and the Beckton process; and Dr. Bueb, we notice (see "JOURNAL," Vol. LXXIV., p. 769), claims that his process differs essentially from Rowland's in precisely the same manner. The product of the Beckton cyanide washers was a sludge or mud, such as Dr. Bueb describes as the product of his system. On filtration, a liquor was obtained from it which was, as we have already said, rich in ammonia, but likewise contained ferrocyanide.

So far as we follow Dr. Bueb in the description of his process, we do not see that he avoids the production of such a liquor, rich in ammonia and ferrocyanide. He does not filter it off from the precipitate, but takes the sludge just as it is removed from the washer for working up to commercial products. Even so, the sludge was dealt with at Beckton, without preliminary filtration or separation of liquid from precipitate. We gladly admit that Dr. Bueb has set out in his recently issued patent specification (see "JOURNAL," Vol. LXXIII., p. 1370) the *rationale* of the process more clearly than any description of the Beckton system which has yet come to our notice; but then information concerning the Beckton process was purposely withheld from publication so long as a monopoly of its use was advantageous to the Gaslight and Coke Company. Changes have, however, occurred since this process was first adopted at Beckton, both in respect of the value of cyanogen products and the quantity produced from other sources; and no injury to the Company's interests ought now to be the result of a full disclosure of their practice in regard to cyanogen recovery.

We have said enough to show that the Gaslight and Coke Company's process follows very closely the procedure which Dr. Bueb has since devised; and we leave it to those directly concerned to point out substantial differences. There is scope for improved cyanogen recovery processes, notwithstanding the temporary lull in the demand for cyanides; and we hope that Dr. Bueb may yet be able to satisfy himself that his system is novel, and an improvement on those which have gone before.

THE DUTIES AND RESPONSIBILITIES OF AUDITORS.

PRESSURE on our space has prevented an earlier reply to an article on the above subject which appeared in the "Accountant" for the 16th ult., continuing what we have called—as our contemporary thinks, appropriately—our friendly discussion of the interesting question of an auditor's duties. Our contemporary is, as would naturally be expected of the journal of professional auditors, considerably exercised at our expression of the opinion that shareholders would be best advised to select for the post of auditor a man of good standing in the industry in which the company is engaged, preferably the accountant of another company. By what process of reasoning we arrive at such a conclusion, our contemporary is at a loss to perceive; and he asks what possible advantage could reasonably be expected from the change. Well, we should have thought that our line of reasoning was perfectly clear to anyone who had perused the various articles in which, during the past year, the subject of auditing has been dealt with. In considering the question of what qualifications auditors should possess—in addition to those of a certain holding in their company, and time to devote to the duties of the office—we expressed the opinion that the fundamental requirement of an auditor (over and above the foregoing, and in addition to the unimpeachable uprightness which is a *sine quâ non*) is a thorough and detailed knowledge of the whole system on which the accounts he has to audit are kept.

We then went on to express the fear that very few companies' auditors—and we were throughout speaking chiefly of the non-professional auditors elected by shareholders—even after many years' examination of the accounts in the accustomed fashion, much less at the time of their appointment, possess this most essential qualification, and to say that it is this primary deficiency in their equipment that gives to even such examination as they do undertake a superficial and unsatisfactory character. Our conclusion was that "only such men as have had years of experience of the system on which the books are kept of the particular (or analogous) classes of company they are called upon to audit, are really qualified for the work. The only possible alternative is the appointment of Chartered Accountants, who, by their training, are better qualified than other men to grasp the details of a business with which they have had no previous acquaintance. But unless the present system be materially amended, we decline to put any practical value upon the signature of any auditor, whether amateur or professional." The vital weakness of this system we had previously declared to lie in the unqualified reliance placed, at some stage or other in the process of auditing, upon the certificate of the very servants against whose possible dishonesty the whole purpose of auditing is directed. We have since given reasons for holding that the fact that the auditors of a company are Chartered Accountants is no sufficient guarantee that they will adopt an efficient system of audit. This opinion is only strengthened by the attitude of the "Accountant"—which represents the profession—towards the method of auditing brought to light by the Millwall Dock scandal.

Our contemporary, which in another part of the same article speaks so scornfully, but with perfect justification, of the apathy and ignorance of shareholders, and their incapacity to rightly judge the worth of an auditor, thinks to turn the edge of any criticism of the manner in which the Auditor of the Dock Company performed his duties, by pointing to the fact that the shareholders of the Company have expressly gone out of their way to absolve the Auditor in question from any breach or neglect of duty. We do not urge that there was any breach or neglect of duty in the case in point. What we contend is that there was a complete failure to realize the meaning of an auditor's duty—a failure all the more surprising in view of the opinions expressed by Mr. Justice Vaughan Williams in the case of the New Zealand Loan and Mercantile Agency Company. Our opinion upon the attitude of the Millwall shareholders was recorded in an article in the "JOURNAL" for the 7th of November

last, which has apparently escaped the notice of the Editor of the "Accountant." We take the opportunity of saying that the attitude of the profession towards auditors who adopt methods ludicrously inadequate for the discovery of fraud (the question of the character of the certificate given should not be considered—nothing but a full and satisfactory certificate should be permitted to a professional accountant) is, if it be indifferent, capable of very seriously depreciating the value of auditing in the eyes of the public, or rather of preventing a restoration of public confidence in the utility of auditors, which has been severely shaken of recent years.

It is, then, because we have no sufficient means by which to judge whether a professional auditor is likely to adopt an efficient or a farcical system of examination, that we consider that the accountants of similarly conducted concerns are the best qualified men to audit the accounts of such undertakings as gas and water companies. If they have not the qualifications to examine accounts, and judge of the fairness of valuations and depreciations, they are obviously not qualified to have charge of the accounts of a company of similar character to the one in need of an auditor. On the particular question of valuation of stocks, a man who, by reason of his employment, is thoroughly acquainted with the character and current value of the goods held in store by a company, is certainly better qualified to audit its accounts in that respect than a professional auditor. So also with the matter of depreciation. An auditor, says our contemporary, "cannot pose as a specialist in the value of land, plant, and machinery; and, if he has the assurance of the directors and other responsible officials of the company that the reserve which has been made is, in their opinion, adequate, he would be a bold man to—in any normal case—put in his 'inexpert' opinion against their opinion, which is at least supposed to be that of persons experienced in that particular class of business." Obviously, then, a responsible official, experienced in the particular kind of business in which a company is engaged, would be a more efficient auditor of its accounts than the inexpert professional auditor. In view of what has been urged in previous articles, we need scarcely say that from the view that an auditor should ever accept "the assurance of the directors and other responsible officials" of a company for the accuracy of any portion of its accounts, we entirely dissent. It is, in our opinion, the prevalent practice so to do that renders so much auditing perfectly futile; and we took the case of the Millwall Dock Company—with its Auditor under the "mesmeric influence" of Mr. Birt—as an example whereby to call attention to the worthlessness of such audits.

The "Accountant" remarks that, from the general tone of our articles, it imagines that the auditing of the companies for which we specially cater is at the present time in a very defective condition. We especially declared, in the article in the "Journal" for the 11th of April last, that we had confined our attention to, and drawn instances from, the accounts of gas undertakings in the Metropolis, not because we thought they were any less efficiently audited than those of the generality of large trading companies, but rather because criticism is usually more useful if it be particular instead of general in its aim. We further declared our belief that the vital weakness to which we had called attention—that of auditors relying upon the certificate of the very servants whose possible dishonesty it is their duty to detect—renders more or less valueless the certificate attached to the balance-sheets of nine out of ten public companies. We certainly are able to pronounce an opinion upon the manner in which gas and water companies' accounts are often audited—an opinion which we can assure our contemporary is not based upon surmise—with more certainty than upon the auditing of other companies. But the revelations in the cases to which reference has been made, and in others, and the failure of the profession to express clearly their absolute condemnation of the methods of auditing thereby disclosed, are sufficient to warrant our scepticism as to the value of the audits of other large undertakings. We may remark that in auditing, as in other professions, we do not deem a man to have necessarily performed his duties adequately, if he be acquitted of failure to fulfil his legal obligations. If the law does not take a sufficiently strict view of an auditor's duties, and auditors give occasion for the belief that they merely confine themselves to not breaking the law, the profession must suffer heavily in reputation.

In the previous article, we expressed the opinion that, in the case of firms of accountants with a large volume of business, the result was, not infrequently, that more work was undertaken than could be properly and carefully done—the bulk of it being left in the hands of irresponsible clerks, many of them none too well paid. The "Accountant" thinks we implied that no good auditing work is to be expected from a firm delegating the bulk of its work to clerks, and proceeds to state, with the authority it can well claim in such matters, "that, although necessarily a very large amount of the work transacted by the largest firms is perforce left to the supervision of senior clerks, those clerks cannot accurately be described as either irresponsible—being in many cases A.C.A.'s themselves—or as being insufficiently remunerated to secure good work." We willingly put our contemporary's statement on record, while disclaiming the interpretation of our remarks as implying that no good auditing work could be expected from subordinates. They were intended to convey the fact that, personally, we should prefer the service of a principal with adequate time at his disposal, to that of an overworked subordinate; just as we should prefer to be attended in sickness by a family physician with a comfortable practice, to being doctored by the qualified, but less experienced, assistant of a medical man with more patients than he knew exactly how to attend.

We are well aware of the difficulty that auditors have to face when they find themselves in disagreement with the management of a company, by reason of the tendency of shareholders to resent any criticism of a management that offers them a big dividend—whether justified by the financial position of the company or not; and we have frequently expressed regret at the indifference of shareholders to everything past, present, or future except the current dividend warrant. But the ignorance and apathy of shareholders does not relieve auditors of their responsibility to efficiently audit, and faithfully report upon, the accounts laid before them. We therefore cannot endorse our contemporary's conclusion that, if the results of auditing have, in some cases in the past, been unsatisfactory, "the blame is far more due to the apathy and ignorance of shareholders than to the neglect or incompetence of accountants;" and that "if any material improvement is to be effected, it must be for the most part looked for among the former, rather than the latter." If the indifference of shareholders tends to lead auditors into the temptation of being inefficient, it only behoves the auditing profession the more strenuously to resist the temptation, and the more resolutely to do their duty. We would rather see their organ urging this upon them than be labouring that hopeless personage, the average shareholder. We shall continue, so far as we are able, to arouse both shareholders and auditors to a livelier sense of their duties; looking, however, for reform on the part of the latter rather than on that of the former.

THE INTRODUCTION OF GASLIGHT INTO PAISLEY.

The recent adoption of the electric light in Paisley may be regarded as a fitting time for saying something about the introduction of gaslight, and of the method in which it was taken under municipal control.

At a public meeting held in Glasgow in November, 1816, it was agreed to constitute a joint-stock company to manufacture gas from coal, and to apply to Parliament for powers to do so. It was announced by the Company in March, 1818, that their works were in such a state of forwardness that they were able to supply gas to the city. Paisley being only about seven miles from Glasgow, many of the inhabitants made a point of going to the big city in order to see the new system of lighting in operation. The first movement that was made in the "weaving town," as Paisley then was, regarding the use of coal gas was in 1819, when Mr. James Williamson, a china merchant in the High Street, and others, applied to the Town Council for permission to convey gas by means of pipes across the streets opposite to their premises. This permission was most cheerfully given by the Council; and they expressed their readiness to afford every facility and encouragement to any measure of the kind.

The first steps for the establishment of a company in Paisley to make gas were taken in the month of September, 1821. The Council were asked by the promoters of the scheme to take some shares; but they declined to do so, with expressions of regret—alleging that the condition of the community's funds did not justify them in taking such a step. They nevertheless hoped that the undertaking would be beneficial to the public as well as profitable to the promoters. Sufficient funds, however, were obtained, and the promoters applied to Parliament for an Act for the better lighting of the town. The following was a part of the preamble of the Bill: "Whereas inflammable air or gas, coke, oil, tar, pitch, asphaltum, ammoniacal liquor, essential oil, pyroligneous acid, charcoal, and other products, may be procured from coal, oil, tallow, tar, peat, turf, rosin, wood, and other inflammable substances, and whereas the said inflammable air may be safely and beneficially used for lighting the streets," private houses, &c., "and the coke may be beneficially employed as fuel," and the oil, tar, and other inflammable substances already mentioned, "may be used and applied in various other ways with great advantage," &c. In due course, the Bill was passed, and the Paisley Gaslight Company so incorporated was authorized to raise £16,000 in shares of £5 each, and to borrow a further sum of £4000. The Royal Assent was given to the Act on May 30, 1823, and the first Directors of the Company were: Ludovic Houston, the "laird" of Johnstone, Governor; R. Farquharson, Deputy-Governor; and Messrs. Alexander Fullarton, James Buchanan, W. Waterston, John Orr, John Bell, James Wylie, Joseph Twigg, William Gilmour, James Jackson, and George Millar. Without any loss of time, operations were commenced; and the Directors applied to the Council on the 23rd of August in that year for permission to open some of the streets to lay pipes. In the following year, the greater number of the householders of Paisley were enjoying all the comforts to be derived from this vastly superior mode of supplying themselves with artificial light. Not only did they go in for a supply of gas as soon as the Company were in a position to give it, but during the early years of the history of the undertaking they followed the example of the first consumers of the gas to such an extent that in 1832 the Company obtained additional powers from Parliament to raise capital to the amount of

£16,000, in shares of £5 each, with power also to borrow half as much more. This money was required for the extension of the works in order to meet the increasing demand for gas.

When eleven further years had passed—viz., in 1843—a new Gas Company was formed; and on the 29th of January, 1844, the "interim" Directors applied to the Town Council to consent to their operations being carried on in the meantime without an Act of Parliament, and to allow pipes to be laid in the streets. On hearing of this application, the Directors of the existing Company desired the Council to give them an opportunity of stating their objections before coming to any decision upon the application. In due course the meeting took place; and the Council afterwards appointed a Committee to confer with the Directors of the old Company on the subject of ceding their works to the Council for the benefit of the public, which it had been announced they were willing to do on terms advantageous to the community. Some correspondence and meetings took place; and afterwards the heads of an agreement were passed for merging the Paisley Gaslight Company into a public Trust in connection with the Corporation. This was agreed to, and signed by both parties.

The leading terms of the engagement were that the Trust should be constituted with a view to securing cheap lighting for the town; that the £5 share of the Company should be valued at £8, which was the market price at the time; and that the shareholders should receive 4 per cent. thereon. Another condition was that the Board of Management should consist of twelve Trustees, eight of whom should be elected by the shareholders and four by the Town Council. Then, when one-fourth of the capital should be paid up, the Council would elect five, and when one-half six, Trustees. This system was to be continued till the end of the Trust. The Council were also to have power to terminate the Trust by paying out the shareholders, and to be entitled to borrow money on the works for the purpose. This arrangement was only to be carried into effect in the event of the new Company not obtaining their Act. The subject of this agreement, and the prosecution of the new Gas Bill, involved many public meetings, and caused much excitement in the town. The Bill passed the Committee of the House of Commons; but while pending in the House of Lords, an arrangement was made whereby, on payment of £3600 by the old to the new Company towards defraying expenses, it was agreed to except Paisley, within the parliamentary limits, from the new Bill. This arrangement was sanctioned by Parliament. Subsequently parliamentary notices were published, and a Bill was prepared to carry out the agreement between the Council and the old Company. The Bill, establishing the gas supply undertaking as a public Trust (passing through both Houses of Parliament without opposition), received the Royal Assent on June 30, 1845.

The price of gas in Paisley in 1844 was 7s. per 1000 cubic feet—said to be the cheapest in Scotland at the time. But the town has always been famed for its cheap gas.

PERSONAL.

The position of Assistant-Manager at the Cleethorpes Gas-Works has been obtained by Mr. R. Silcox, son of Mr. J. H. Silcox, Manager of the Pembroke Dock Gas Company.

Mr. H. B. Heath, who has been in the service of the Plymouth and Stonehouse Gas Company for upwards of thirty years, has been appointed Secretary, in succession to the late Mr. John Thomas.

Mr. G. R. Love, Assoc.M.Inst.C.E., of Dundalk, has been appointed Manager of the Guildford Gas-Works, in succession to Mr. E. P. Reilly. Applications for the position were invited in the "Journal" for the 5th ult.

Mr. Edward Hargreaves, of the Hastings and St. Leonards Gas Company, has been successful in obtaining the position of Superintendent of the Gas-Fitting Department of the Bombay Gas Company, advertised in the "Journal" for Dec. 12.

At the meeting of the Birmingham City Council on Tuesday, the recommendation of the Finance Committee, referred to last week, that Mr. Thomas H. Clare should be appointed City Treasurer, in succession to the late Mr. Hughes, was adopted without dissent.

Mr. Herbert Gandon, of the Crystal Palace District Gas-Works, has been appointed Superintendent of the Neepsend works of the Sheffield United Gas Company, in succession to Mr. A. Allan, applications for which position were invited in the "Journal" some weeks ago. He entered upon his duties yesterday.

Mr. Walter Donaldson has not long held the position of Secretary and Cashier of the Longton Corporation Gas Department. He was only appointed at the end of May last, and already he has tendered his resignation, which has been accepted. Mr. Joseph Speakman, a clerk at the works, has been appointed to succeed him, at a salary of £100 a year.

The Neath Town Council adopted last Thursday a recommendation of the Gas Committee to award a sum of £200 to Mr. B. A. Browning, Assoc.M.Inst.C.E., their Gas Engineer and Manager, in recognition of his services in connection with the extensions and improvements carried out at the gas-works in accordance with plans prepared by him, as described in the "Journal" for the 5th ult. The award was accompanied by some highly complimentary remarks.

As will be seen by the paragraph which appears elsewhere, the Gas Committee of the Manchester Corporation have appointed (subject to the formal approval of the City Council) Mr. John Gibson Newbigging, Assoc.M.Inst.C.E., Engineer and Manager of the Macclesfield Corporation Gas-Works, as Engineer to the Gas Department, in succession to the late Mr. G. E. Stevenson, at a salary of £800 per annum. The successful applicant for the position, the duties in connection with which were specified in the advertisement which appeared in the "Journal" some weeks ago, is a son of Mr. Thomas Newbigging, of Manchester, in whose office he served his articles. During the five years he was with his father acquiring a knowledge of gas engineering, he studied chemistry at the Owens College, under Sir Henry Roscoe, F.R.S. In order to obtain a practical mechanical knowledge of the construction and working of gas apparatus, he spent two years at the works of Messrs. J. & J. Braddock, of Oldham—working at the bench in the manufacture of gas plant of all kinds. His first appointment was as Assistant at Regent Road and Liverpool Street works of the Salford Corporation, whence he was transferred to the Bloom Street station, of which he was entrusted with the entire charge. In 1888, he was successful, out of a large number of applicants, in obtaining the position of Engineer and Manager of the Pará Gas Company, which he held for upwards of two years—relinquishing it only on account of the unhealthiness of the climate. In 1891, he visited the United States, with the view of extending his knowledge of the system of manufacturing carburetted water gas. Returning to England, he entered the service of the Macclesfield Corporation; and during the seven years he has been with them he has entirely remodelled and extended the manufacturing and distributing plant, at a cost of about £20,000; increasing the capacity of the works from 750,000 to 1,500,000 cubic feet per day. Under his management, the price of gas has been reduced from 3s. to 2s. 6d. and 2s. 4d. per 1000 cubic feet. In addition to his engineering acquirements, Mr. Newbigging has had considerable experience in parliamentary, assessment, and consulting work. As he is in the prime of life—being only 37 years of age—there is every probability that the Gas Committee will have for some years the benefit of his services, which we sincerely trust may ensure the continued prosperity of their great undertaking.

OBITUARY.

The death is announced of Mrs. Georgiana Laming, widow of the late Mr. Richard Laming, M.R.C.S., whose name was for some years before readers of the "Journal" in connection with the subject of gas purification. Mrs. Laming survived her husband by rather more than twenty years.

We regret to record the death last Wednesday, in his 71st year, of Mr. Thomas Trewhitt, Secretary of the Hartlepool Gas and Water Company. Deceased had not been in good health for some few months, having had a slight paralytic seizure in May last. This was followed by other attacks, to one of which he succumbed. Mr. Trewhitt was a native of Hutton Bonville, near Northallerton, and went to Hartlepool when he attained his majority. After being two years in a merchant's office, he entered the service of the Gas and Water Company in 1852, and was shortly afterwards appointed Secretary—a position which he retained till his death. He was one of the earliest members of the British Association of Gas Managers—his name being on the list of applicants for admission presented at the fourth annual meeting of the Association in 1867; and his connection with that body was never severed. He was also a member of the North of England Association of Gas Managers, of which he was President in 1881. The late Mr. Trewhitt was of a kindly, genial disposition, and had a large circle of friends in the Hartlepools. Testimony to his worth was borne by his appointment as a Justice of the Peace in 1883. He leaves a widow, two sons, and two daughters. The funeral took place last Saturday in the West Hartlepool Cemetery, amid many manifestations of regret; Mr. Trewhitt's courteous bearing having won for him the respect and esteem of his fellow-townsmen. A large number of private and professional friends were present, as well as the Mayor and Corporation of Hartlepool, and the Directors, officials, and employees of the Company.

The Production of Calcium Carbide.—In an article in the current number of the "Electrical Review" on the "Electro-Chemical and Electro-Metallurgical Industries in 1899," Mr. J. B. C. Kershaw points out that in the report upon calcium carbide which appeared in that paper twelve months ago, a list of 51 places was given where this product was already manufactured, or where factories were in course of erection. The number is now 93, distributed as follows: Works in operation (76)—France, 21; Switzerland, 11; Austria and Hungary, 8; Germany, 8; Italy, 7; United States, 6; United Kingdom, 4; Norway and Sweden, 4; Spain, 2; Russia, 2; Canada, 2; Belgium, 1. Works in course of erection (17)—France, 5; Switzerland, 3; Austria and Hungary, 3; Norway and Sweden, 3; Italy, 1; Russia, 1; Canada, 1.

NOTES.

The Lubrication of Machinery.

The oil expert of the "Ironmonger" expresses surprise that the oiling of an engine has not yet been made a special science. Bad lubrication means waste of power and fuel, many an engine driver squandering tons of fuel in the attempt to save gallons of oil; and it is easy enough to do. The evil of using too much oil is almost as bad. The first necessity is a good lubricant which contains nothing likely to injure the machinery. In this connection, the quality of viscosity of a lubricant comes into prominence. It was once thought that the specific gravity of an oil determined its lubricating value; but this idea has long been exploded. Yet it is not an easy matter to select a lubricant that possesses the exact degree of viscosity for a particular use. The chief lubricating oil used in this country is now American petroleum, which is sold in various grades for different purposes. Russian oil comes next in quantity. It is stated that water is sometimes mixed with lubricating oil—probably where the premium system of rewarding frugal enginemen is in vogue—but this is a very ill-advised proceeding on all accounts. In Germany, very exact specifications of lubricating oils, ignoring their origin, are prescribed. A close study of the detailed regulations laid down by railway companies for their supplies of lubricants is recommended to those purchasers of the article who wish to conform to the most enlightened practice in this regard.

The Portability of Oil Fuel.

According to the "American Machinist," the oil-engine is one of the prime motors best deserving the attention of mechanical engineers, judged on the basis of the potential power of the medium used as the source of energy. The following classification is given of this and other kinds of prime movers using stored energy, showing the comparative capacity of the different media for storage reduced to the standard of a pound weight. Thus, a good electrical storage battery will carry 15,000 foot-pounds per pound of "medium." Liquid air, expanded from 2000 lbs. pressure down to that of the atmosphere, will liberate 139,100 foot-pounds per pound. Good steam coal, in a steam plant of 12½ per cent. efficiency all told, will give 1,408,000 foot-pounds per pound of medium. Common kerosene, of 20,700 British thermal units calorific power, used in an oil-engine of 35 per cent. efficiency all told, will yield 5,593,000 foot-pounds of energy per pound of the medium. According to this valuation, kerosene oil is the most concentrated form of fuel available for the generation of mechanical power, and consequently the most suitable for carriage to long distances. It is 400 times as efficient as the best secondary electric battery—that is to say, all other things being equal, 1 lb. of kerosene is able to do as much work as 400 lbs. of storage battery. It is easy to carry out this calculation for the different descriptions of combustible gas suitable for use in internal-combustion engines, from the poorest blast-furnace product to the rich natural oil gas of Pennsylvania and Ohio—up to now the richest gaseous fuel ever offered to the uses of mechanical science.

Mechanical Coke Quenching.

According to a statement of the "Iron and Coal Trades Review," Herr Joseph Muller, of Mathias Colliery, Essen, has undertaken the mechanical handling of retort-oven coke in a truly heroic style. His arrangement includes taking hold of the red-hot coke as it is pushed out of the retorts, its immediate quenching in a bath of water, the raising it out of the water on to a grid, and its final loading into waggons or barges without any hand labour whatever. In order to effect this purpose, an iron water-tank is placed in front of the discharging end of the retort-bench with an overhanging ledge on the retort side. This tank is filled with water to the brim; and in it works a conveyor travelling in line with the retorts, but capable of being traversed sideways along the front of the bench. At the opposite edge of the tank, furthest from the retorts, there is a slope rising quite clear of the water and terminating in a grid stage. Beyond this, again, is the tip into the waggons or boats. This simple plan describes itself. As the coke emerges from the retort, it falls into the tank and upon the submerged conveyor. When it has gone halfway across the tank, it comes up out of the water, which thus drains off, while the coke is still hot enough to dry itself during the remainder of its travel. It is consequently almost dry when it is deposited on the grid, where it is freed from ashes and awaits tipping. Success is a question of adjusting the strength of the scantlings and the power and rate of movement of the conveyor to the requirements of the coke charges. One feature of the arrangement is that the quenching is done, if expedient, wholly under cover; a light roof sealed in the water keeping in all the steam.

The Efficiency of the Westinghouse Gas-Engine.

An elaborate report on the efficiency of the Westinghouse gas-engine was submitted by Mr. C. H. Robertson at the last meeting of the American Society of Mechanical Engineers. The engine in question was rated at 125 horse power, and forms part of the Merchants' Electric Lighting Company of Lafayette, Indiana, and is one of a pair using natural gas. It was laid down in 1898; and has three cylinders, 13 inches diameter and 14 inches stroke. The test was made between 7 and 12 p.m. on March 23 last; the time being chosen so as to take in a considerable load variation and register the performance under variable conditions. The object of the test was to secure reliable data respecting the power developed, gas consumption, speed regulation, and the amount of lost heat by the cooling water of the cylinder jackets and by the exhaust. The full particulars of the test are reproduced in the "Engineering Record." The natural gas which was used as fuel was analyzed, and contained 92·05 per cent. of methane and 1·15 per cent. of hydrocarbon and carbon monoxide. Nothing was done to secure special conditions for the test. The gaseous mixture in the cylinders was first 1 to 11 of gas and air, and at the last 1 to 12. The best thermal efficiency of the motor was 17·3 per cent., which is not high for a gas-engine, but is seldom equalled in steam-power plant. About one-fifth of the heat energy of the fuel reappeared as work in the cylinder; while three-tenths of it was absorbed by the jacket, and one-half passed out in the exhaust. The cylinders ran hot enough to dispense with the igniters for a part of the run. The natural gas is supplied to the Company at the price of 7 c. per 1000 cubic feet, and at the best was consumed at the rate of 14·71 cubic feet per brake horse power hour. The highest consumption was about double this.

Tests of Fireproof Building Construction.

During the last year, useful work has been accomplished at the testing station of the British Fire Prevention Committee, which is the first establishment opened for the express purpose of ascertaining the actual facts of the endurance of so-called fireproof building construction. It is a poignant satire upon the usual advertised proprietary systems and materials designed to resist fire, that these have hitherto been marketed upon the owners' valuation, with the not unnatural result that frequent disastrous conflagrations have demonstrated the difference between intention and realization in this connection. Speaking generally, the experimental work of the Committee has gone to show that the quality of being proof against catching or communicating fire, or not being destroyed or consumed by fire, is a question of degree. It was once held that building construction of non-inflammable materials was a safeguard against fire; but ample experience exists to prove that for a building to easily succumb to fire, although its materials will not actually burn, is as bad as a conflagration of the building itself and its contents. Architects have been slow to discriminate in this regard between the reasonable requirements of different classes of buildings—prescribing, say, the same floor construction for a common lodging-house as would be appropriate for a City warehouse. Practically, fire-proof building construction has branched out in the two directions of coke-breeze concrete and moulded terra-cotta. This observation refers to floors and ceilings. So far, the concrete construction only has occupied the attention of the Committee; the terra-cotta firms having held aloof. It has transpired, among other things, that the provisions of the existing Building Acts, which were chiefly based on *a priori* grounds, utterly fail to meet the stress of crucial experiment. Even in their first year of work, the Committee have succeeded in placing fire prevention building construction upon a more secure foundation of knowledge than was previously available to any of the general public.

Sir W. Crookes's Alarmist Address.

After a considerable interval, spent in the reception and refutation of certain criticisms, Sir W. Crookes has put forth in book form his ideas, given in his presidential address to the British Association at Bristol, concerning the coming scarcity of wheat in the earth, and the means of dealing with it. Hereupon, Sir R. Giffen falls upon him in "Nature," and attacks the conclusion arrived at by Sir W. Crookes, from fair premises, by the chain of reasoning made familiar by Malthus, Jevons, and others before him. It is obvious that with a larger ratio of the growth of consumption of any necessary of life, than that of its increased production, the realization of scarcity is only a question of time. This is how Jevons was able to predict the exhaustion of the British coalfields. Sir R. Giffen holds that all such speculations must only command limited acceptance, because they depend upon the assumption that the present conditions remain unaltered. Experience of these discussions since the time of Malthus has gone to show that, as yet, we are either too far away from the limits when shortness of the supply of food, coal, and raw materials generally will be felt, to realize the factors of the problem with any degree of precision; or we know too little as to the ultimate causes of existing conditions to be able to predict whether they will be soon changed or not. As regards Jevons's prediction, it is remarked that the growth of the demand has by no means continued at the rate found by him to prevail for his time; while the influence of the price of coal as a factor in production has diminished in consequence of the greater effectiveness of the machinery which coal is used to drive. Sir R. Giffen accuses Sir W. Crookes of disregarding the warning of experience against these precise forecasts in the Malthusian manner. As to the suggested remedy for too little wheat—the fixation of the nitrogen of the atmosphere—Sir R. Giffen observes that it is a subject which may well be entirely disconnected from the alarmist statistical papers to which it is generally attached.

TECHNICAL RECORD.

INSTALLATION OF INCLINED RETORTS AT THE LEIGH (LANCS.) GAS-WORKS.

About eighteen months ago, a Local Government Board inquiry was held at Leigh (Lancs.), with respect to an application made by the District Council for sanction to the raising of £25,000 for the extension of the gas-works, necessitated by the great increase which had taken place in the population and manufactories during the past few years. This was clearly shown by the figures submitted to the Inspector, on the occasion referred to, by the Clerk to the Council (Mr. P. Thomas). He showed that, whereas in the year ending March 31, 1888, the output of gas was about 54½ million cubic feet, and the number of consumers 1820, on the corresponding date in 1898 the figures were 110¼ millions and 4480 consumers—an increase to the extent of 101 per cent. At the date of the inquiry, the maximum daily make of gas was 607,000 cubic feet; but it was expected that in the succeeding winter it would be 700,000 cubic feet. The manufacturing capacity of the works had already been raised by the provision of 98 new 10-feet retorts in 1893; but it had been decided to replace them by 42 others of double the length. The Gas Engineer to the Council (Mr. John Foster) had devised a scheme for the projected extensions, and this he submitted to the Council towards the close of 1898, accompanied by a statement showing the advantages which would accrue by carrying it out. The detailed cost of the new plant amounted to £26,795; but deducting £3500 for old materials, the total sum required to be spent would be £23,295. The saving to be effected by the change of retorts was expected to be about £1002; in coke, £150; and in men's wages, £72—making a total of £1224. The tenders which had been received for the projected works were opened early last year; and it was resolved to accept that submitted by Messrs. Graham, Morton, and Co., Limited, of Leeds, for carrying out an installation of inclined retorts in the new retort-house. This building is shown in the accompanying illustration (fig. 1). It is



Fig. 1.—New Retort-House at the Leigh Gas-Works.



Fig. 2.—Charging Stage.



Fig. 3.—Drawing Stage.

150 feet long, 50 feet high to the eaves of the roof, and 88 feet span. It has been constructed entirely of red brick, relieved by stone courses; and it is of sufficient width to take the bench of retorts and the coal-stores alongside. The contract was started on the 1st of June last, and comprised the following work: Putting a new roof (slated) on the building; taking down the old retort-bench, and laying the foundations for, and erecting the new one, including the main piers, arches, furnaces, retort-fittings, superstructure, storage-tanks, elevating and conveying machinery, boiler and seating, economizers, main flue, &c.—all within the building. This work was completed on the 30th of September—less than five months from the start, which is certainly highly creditable to the Contractors. Figs. 2 and 3 show the charging and drawing stages of the new house, the retorts in which are 20 feet long and 26 inches wide at the bottom, tapering to 22 inches at the top; and they carbonize 7½ cwt. of coal per charge.

THE ELECTROLYSIS OF CAST-IRON WATER-MAINS.

Experience in the United States.

Some time ago, the Superintendent of the Metropolitan Water Company of Kansas City (Mr. G. B. Wing) detected signs of electrolysis on the pipes of the Company. He therefore requested Professor Lucien J. Blake, of the Kansas University, to make a thorough investigation of the subject. The following article by him, bearing upon the matter, recently appeared in the "Electrical World" of New York.

The effects of electrolysis from electric railways are generally considered as limited to those points where currents are leaving underground metallic structures, for a passage through the soil and thence through other conductors to the power-house. Voltage measurements have been relied upon to determine the regions within which currents are thus leaving the underground structures; and these measurements establish the so-called electrolytic danger areas. Recent observations and experiments of the writer prove, however, that effects of electrolysis upon water-mains are not limited to the above determined danger areas. If the mains were continuous metallic conductors, then indeed no electrolytic dangers would occur to them outside the above areas, and they might be allowed to form a part of the return circuit of the electric railway. Then bonding these mains to return feeders would be safe and advisable, just as now the metallic sheathings of underground telegraph and telephone cables are so bonded. But, unfortunately, the mains are not continuous conductors. Resistance at the joints in cast-iron pipes is sufficient at most joints to shunt a portion of any current allowed in these mains around the joint through the soil outside, or water inside, or through both. Thus on the positive side of joints the effects of electrolysis, both external and internal, are to be apprehended. To determine this as a fact beyond question, the writer has made, first, a series of measurements upon joint resistance in cast-iron mains, both in the laboratory and in the field; and, secondly, has discovered in many instances the actual electrolytic effects, both external and internal, near the joints.

Three lead-caulked joints, from a 6-inch cast-iron main, taken from the Kansas City water system, were measured by voltmeter-ampère-meter method, with the following results:—

	E.M.F. (Around Joint).	Current.	Resistance.
	Millivolts.	Ampères.	Ohm.
Specimen I. . . .	24	0·9	0·0266
„ II. . . .	45	11·4	0·0321
„ III. . . .	37	1·4	0·0264
			Aver. 0·0243

The resistance measured of a 12-feet length of this pipe gave 0·000354 ohm. The average resistance of these joints, then, is 79·9 times the resistance of one length of the pipe. The current was supplied from chloride accumulators; and Weston instruments standardized by Kelvin balances were used.

Measurements were then made upon a line of 6-inch cast-iron main which has been in use now for thirteen years, and is carrying water under about 80 lbs. average pressure. This main is in the city of Lawrence, Kansas, and 687 feet of it were measured. The following table gives the results:—

No. of Test.	Drop Around Joint.	Current.	Resistance.
	Millivolts.	Ampères.	Ohm.
1	983·3	1·80	0·546
2	1000·0	1·80	0·555
3	1466·6	1·80	0·543
4	1450·0	2·70	0·537
5	1566·6	2·70	0·580
6	1516·6	2·65	0·571
7	983·3	1·80	0·546
8	1000·0	1·80	0·555
			Aver. 0·556

Resistance of 57 lengths of 6-inch main at 0·000354 ohm per length of 12 feet, 0·021 ohm; resistance of 58 joints, 0·515 ohm. The total resistance of the 58 joints forms, therefore, 96⅛ per cent. of the total resistance of the 687 feet.

Measurements of each individual joint resistance were then made upon 399 feet of 20-inch cast-iron main which had been in use in Kansas City since 1882 under 100 lbs. pressure. This main crosses the Kaw River on a pipe bridge; and the housing was removed so that each joint could be measured. The readings were taken between midnight and 5 a.m., when but one "owl" car was running hourly upon the whole electric railway system, and an invariable voltage could then be supplied from storage cells. The experiments were so arranged that voltage drop could be measured around each joint and simultaneously around one pipe length, including its particular joint. In this way, resistances of joints in terms of pipe lengths were obtained. The total voltage drop around the joint in millivolts was 221; the total drop in the pipe, 29·4—in all, 250·4. The joint resistance in equivalent pipe length was 543$\frac{47}{50}$. Therefore the resistance of the joints was 88⅛ per cent. of the total resistance. The average of six direct measurements of the total drop of the above main gives 0·3 volt with a current of 9·2 ampères. This would give a measured resistance in 399 feet of the 20-inch main of 0·326 ohm. The calculated resistance of this amount of 20-inch main, exclusive of joints, is 0·0364 ohm. The joint resistance must make up the rest of the total measured resistance, or 0·2896 ohm. The joint resistances, therefore, form 88⅘ per cent. of the total resistance, which checks with the above within the limits of error.

It should be stated that, for this calculated resistance of the pipe, measurements were made to determine the specific resistance of the cast iron of the pipes. A Thomson's conductivity bridge was used, and the average taken of several measurements on two bars cut from the 20-inch main, which were respectively 500 mm. long and ½ in. by ¾ in. in section. The copper bar for comparison was commercial omnibus-bar ⅛ in. by ¾ in. section, 500 mm. long. The results gave an average of 56·5 times the resistance of copper of similar dimensions, and this number is used in the above calculations.

Measurements were also made on 400 feet of 36-inch main which was exposed in Kansas City. The total measured resistance, including the 34 joints, was 0·0103 ohm. The calculated resistance of the pipe alone is 0·000346 ohm. The joint resistance is therefore 96·7 per cent. of the total resistance. The current was from a storage battery, used after the railway power was cut off after midnight.

From the above direct measurements, it is evident that the joints in cast-iron water-mains form a large percentage of the total resistance of the mains, and prevent them from being considered continuous conductors in the sense a metallic sheathing of a cable is. The resistance conditions for shunting a current around the joints are therefore present in general upon water-mains. Furthermore, that such shunting actually occurs on cast-iron mains in use, and exposed to leakage currents from electric railways, has been proved by the writer by electrolytic effects discovered near joints, both inside and outside, on mains which he has taken up in Kansas City. A 12-inch pipe-line running at right angles to an electric railway, and which was negative to the rails, was found to be carrying a current of varying strength, and delivering it into a 36-inch main some 750 feet distant.

Electrolytic pittings were found on many sections near the joints, only on the positive side, where the current was shunted round the joints. Some of the pittings were ⅛-inch deep. The interior of the pipe could not be examined. Again, a length of 6-inch cast-iron main was taken up in another part of the city, and internal electrolytic effects were apparent near the joint. A chemical analysis of the material dug from the pits gave 22·3 per cent. of graphite and 49·7 per cent. of iron. A second length was removed and broken into, and a fresh fracture revealed internal electrolysis by the discoloration of the iron where the pitting was taking place, which was already ¼-inch deep, beginning from the inside. A number of similar cases were discovered, and are convincing proofs that cast-iron mains cannot convey currents without electrolytic damage when these mains form part of the return circuits of electric railways.

It is not the purpose of this paper to treat the general subject of electrolytic dangers to underground metallic structures, but to call attention to the fact that the use of grounded electric railway circuits is beginning to reveal these added dangers to cast-iron mains. The plan of occasional bonding of rails to water-pipes when the pipes are negative to the rails, and then, near the power-house, the further bonding of the pipes to return feeders, is sure to invite current upon the pipes, and thereby evidently intensify electrolytic effects at the joints. The insertion of insulating joints in the mains or an occasional non-conducting length, must act like joint resistance, and thus still further endanger the mains. So long as leakage currents are allowed to traverse the mains, it seems proved from the above that the mains are in danger; and corroborative evidence is accumulating in cities other than Kansas City, and is known to the writer. Nor does the asphaltum coating of the pipe protect it. Under the asphaltum, which remains bright and apparently intact, pittings will be found; and a fresh fracture or a careful scraping away of the coating will reveal spots of graphite structure left from electrolytic action on cast iron. It is obvious that all conduction by the pipes must be avoided to ensure immunity from electrolysis.

REGISTER OF PATENTS.

Retort-Lid Fasteners.—Holman, S., of South Kensington. No. 210; Jan. 4, 1899.

The patentee proposes to dispense with any cross-bars, and effect the securing and releasing of the lid by an eccentric and handle, which, when turned in one direction, effects the securing of the lid, and when turned in the other direction, releases it.

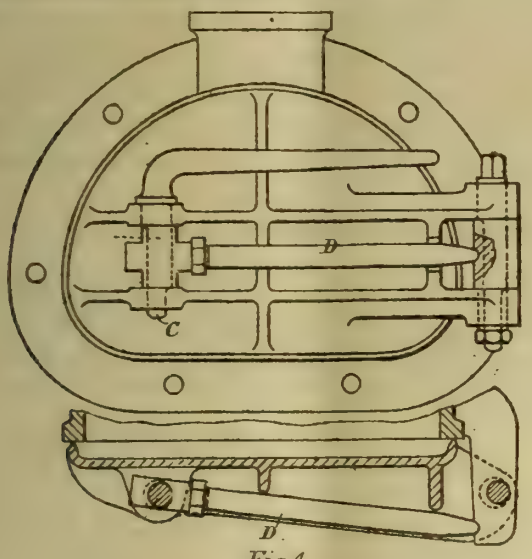


Fig. 1.

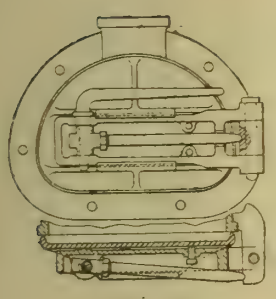


Fig 2.

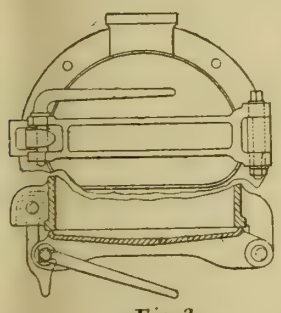


Fig. 3.

The arrangement represented in fig. 1 is as follows: In bearings in webs or lugs formed on, or fixed to, the lid, is mounted a pin C formed with an eccentric part, and provided with a handle for operating it. On the eccentric part of the pin is carried one end of a strut or lock-bar D, the other end of which bears upon a stop on some fixed part in proximity to the lid—preferably on a lug on the mouthpiece on which the lid hinges. After the lid is closed against the mouthpiece of the retort, the pin is turned in a direction which causes the eccentric part of the pin to force the strut or lock-bar D against the stop (the lug in the arrangement shown), which has the effect of pressing the lid firmly against the mouthpiece, so as to make a tight closure. To open the lid, the handle is turned in the opposite direction, so that the lock-bar D is released from the stop, and the lid is free to open.

The arrangement shown in fig. 2 is generally like that just described; but, instead of the webs or lugs being formed on the lid, the lid is made separately, and connected to the webs or lugs by guide-pieces, so that it can be slid longitudinally, and fixed by screws.

In both these arrangements, one lug only is required on the mouthpiece—viz., that on which the lid is hinged. But, if preferred, instead of using the strut or lock-bar D, the eccentric may be at the ends of the webs or lugs cast on, or secured to, the lid as shown in fig. 3—the webs and lugs projecting sufficiently to embrace a swivel-catch centered on the side of the mouthpiece opposite to the hinge—the catch being so formed as to engage with the eccentric part of the pin, so that when the pin is turned in one direction it, by pressure on the part of the catch on which it bears, forces the lid tightly against the mouthpiece, and when turned in the other direction releases the catch so that the lid can be opened.

Internal Combustion Engines.—Kitchen, J. G. A., of Manchester. No. 466; Jan. 9, 1899.

This invention relates, more particularly, to internal combustion engines in which a mixture of gas and air is drawn in, compressed, and exploded in a cylinder behind a piston, the reciprocating motion of which is converted into rotary motion; the chief object aimed at being "to make such an engine capable of having its power and speed varied when running by increasing or reducing the degree of compression of the combustible charge."

This is effected by varying the stroke of the piston, and compensating for the difference between the stroke and the sweep of the crank by the interposition between the piston and the connecting-rod of suitable link-work or lever motion working upon a moveable fulcrum. A cylinder is employed in length proportionate to the throw of the crank of the motor-shaft, and having a clearance space for using a combustion chamber of suitable proportions. The piston is connected with a link forming a lever, one end of which is mounted upon a bearing capable of having its position with respect to the cylinder varied so as to shorten the distance between the fulcrum and the point of connection of the piston-rod to the lever. These means may consist of a stationary slide, in which the bearing of the lever is held by a screw capable of moving it therein, or of an eccentric and worm adjustment. To the other or free end of the lever, is attached the connecting-rod.

The engine illustrated by the patentee in his specification is designed chiefly with a view to adaptation to motor-carriages, and is shown with a light tubular frame or bed, and other lightly constructed parts.

Internal Combustion Engines.—Hamilton, J. H., of Sandiacre. No. 1711; Jan. 25, 1899.

The first part of this invention relates to an arrangement for circulating water through the piston of an internal combustion engine; and the second part, to the valve which regulates the time of ignition, when a hot tube is used for igniting the charge. This latter consists of a small valve held to its seat against the pressure inside the cylinder by a spring, and pulled away from the seat by a lever operated by a cam. A nut is screwed on the valve; and the end of the lever works against the nut, the screwing on or off of which alters the time of ignition.

Extracting Naphthalene from Coal Gas.—Irwin, W., of Manchester, and Leather, J. P., of Burnley. No. 2318; Feb. 2, 1899.

Alluding to their proposal for "the purification of ordinary coal gas . . . to remove the naphthalene therefrom before the gas leaves the works," the patentees say that they "find that to treat or wash the gas with a large quantity of oil is an expensive process, and that to do so with oil alone also removes other illuminating substances from the gas, thereby deteriorating its quality; and that it is necessary to employ a mixed oil or spirit in very small quantities to successfully carry out the invention." Their present invention, therefore, consists essentially in treating the gas, after it has been cooled and freed from tar, with a small quantity of a mixed liquid capable of absorbing the naphthalene, and at the same time which will not deteriorate the quality of the gas by absorbing or removing benzol or other illuminating substances from it.

The liquid to be used in the process must possess the following properties or characteristics: (*a*) Practical freedom from naphthalene; (*b*) capacity for dissolving naphthalene; (*c*) capacity to give off at the ordinary temperature a vapour whose tension and effect on the illuminating power of the gas is such, that the loss of illuminating power occasioned by the extraction of naphthalene and other substances is more than compensated by the gain from other substances taken up by the gas from the liquid itself.

They find that suitable liquids possessing the above properties are obtained by mixtures of (*d*) Blast-furnace oil and low-boiling aromatic hydrocarbons; (*e*) heavy tar oil and low-boiling aromatic hydrocarbons. A convenient low-boiling aromatic hydrocarbon is ordinary 90 per cent. benzol.

They also find that good results are obtained from washing liquids having the following composition: (*f*) Blast-furnace oil 92 per cent.; benzol 8 per cent. (*g*) Heavy tar oil 92 per cent.; benzol 8 per cent.

The amount of the washing liquid to be used will depend upon the temperature of the gas under operation; as the lower the temperature to which the gas has been cooled, the less the proportion of naphthalene it will contain. Gas cooled only to 80° Fahr. is found to contain more than double the amount of naphthalene than gas which has been cooled down to 60° Fahr.

The following quantities of the wash-liquid are approximately what (according to the patentees) will be required to give the best results: Gas at 60° Fahr., 15 gallons per million cubic feet; gas at 70° Fahr., 25 gallons per million; and gas at 80 Fahr., 40 gallons per million.

When the oil or wash-liquid becomes saturated with naphthalene, the benzol or light, or low-boiling hydrocarbons may be extracted from it by distillation, and recovered for mixing with a fresh quantity of oil, or for future use.

The plant required is similar to that employed for the extraction of ammonia from gas; but the patentees specially recommend a washer in which the liquid can travel in a direction contrary to that of the gas, through a series of chambers, in each of which it is brought into intimate contact with the gas. Apparatus half the size of that usually employed for the extraction of ammonia from gas will, it is said, be found sufficient.

Gas-Motor Engines.—Nunn, F. C., of Sydenham, S.E., and White, T. H., of Carshalton. No. 2847; Feb. 8, 1899.

This invention relates to an arrangement of gas (or oil) motor engines, wherein the moving parts are balanced. For this purpose, the cylinder—conveniently horizontal—is fitted with two pistons connected to cranks on two shafts, each having on it a fly-wheel and a pinion. The two pinions gear with an intermediate wheel, of double the diameter of the pinion, on a shaft which works the valve gear. The cranks on the two shafts are so set that the two pistons approach each other in their instroke, and recede from each other in their outstroke. Between them are the combustion chamber and the inlet and exhaust valves, of ordinary construction.

Feeding Boiler and other Furnaces, and Removing Ash and Clinkers.—Abel, C. D.; a communication from La Compagnie Anonyme Continentale pour la Fabrication des Compteurs à Gaz et Autres Appareils, of Paris. No. 4309; Feb. 27, 1899.

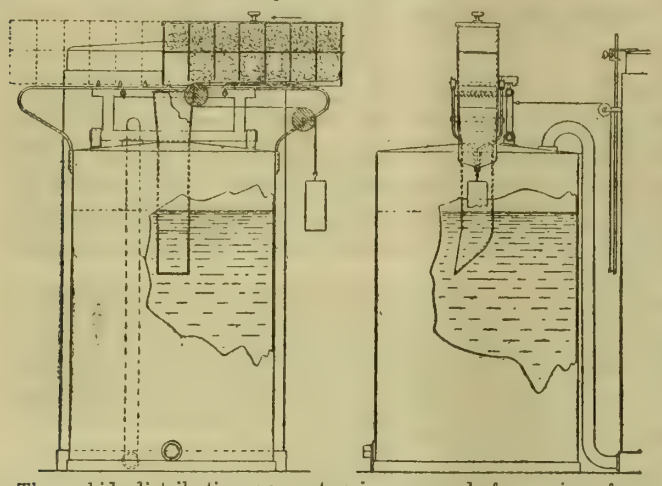
In this patented arrangement, there is employed apparatus which—as regards its main feature—is similar to that described in patent No. 12,586 of 1898 [see "JOURNAL," Vol. LXXIII., p. 1493], as applied to the feeding of gas-retorts; the fuel being raised by an elevator and delivered on to a continuous travelling apron or conveyor above the furnace, which, on the one hand, conveys it to the boiler furnaces, while on the other hand, after descending to below the furnaces, the conveyor also serves for receiving and conveying away the ashes and clinkers from the ash-pits.

For these purposes, the conveyor travels along a trough-shaped channel arranged in front of, and above, the boilers, in the bottom of which channel are openings from which shoots lead down to hoppers situated immediately above outward extensions of the fire-grates, so that the fuel carried along is made to descend through the openings of the channel down the shoots into the hoppers, and thence on to the fire-grates. The fire-grates (of any known construction) are caused

automatically to feed the fuel gradually on from the hoppers to the farther ends of the furnace, in such manner that, by the time it arrives near the fire-bridge, it is consumed to the condition of ashes and clinkers, which are discharged by the fire-grate into inclined shoots, which lead them down into a subterranean channel. Along this channel the conveyor travels in the contrary direction to its travel in the upper channel; so that the ashes delivered on to the conveyor are thus taken away by it, and discharged at any desired point, after which the conveyor ascends to the upper level again, to receive a fresh supply of fuel.

Generating Acetylene Gas.—Llorens, J., of Barcelona. No. 20,354 Oct. 10, 1899.

The generator in this arrangement (as shown) is composed of a reservoir filled with water to a convenient height, the top of which is provided with a pipe conducting the gas to the holder. The generator is provided, moreover, with a shoot or introduction pipe, the lower end of which is inclined, and receives at its upper end the carbide, which it lets fall to the bottom of the reservoir, throwing it therein sideways in order to avoid the generating gas escaping through the central pipe. The lower mouth of the latter is sealed by the water of the reservoir itself.

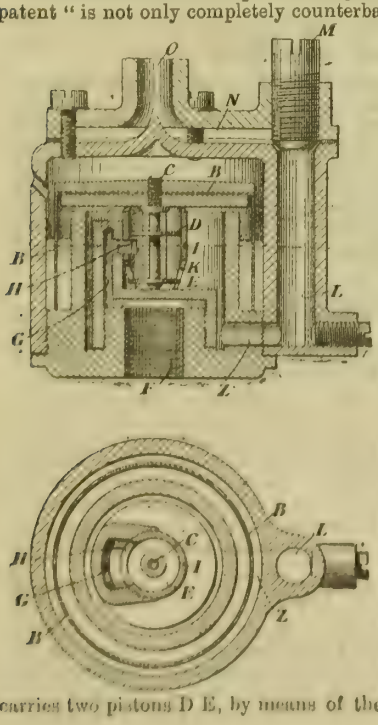


The carbide-distributing apparatus is composed of a carriage formed by a bottomless box travelling on rails. The box is divided by vertical partitions into several compartments, each of which is divided in two by a moveable horizontal partition. By these means, the number of compartments are doubled, and consequently also the number of carbide charges. The bottom of the distributing carriage is constituted by a band or strap, one end of which is fastened to the vertical back-wall of the carriage—the strap embracing the guiding rollers and ending in a weight, which gives it convenient tension and causes the carriage to advance. The carriage is mounted on wheels travelling upon rails arranged on both sides. By the action of the weight, the carriage tends to move towards the right, but is stopped by the action of locking mechanism.

When the bell of the gasholder descends, it draws a cord by its lower end; and this moves the distributing carriage over the funnel, and discharges the whole of the carbide it contains. The carbide, falling into the water of the reservoir, generates a quantity of gas which lifts the bell of the holder. The latter, in rising, slackens the cord, and draws the carriage back. This operation is repeated until the carriage has unloaded its last compartment, after which it has only to be returned to its original position and loaded again.

Regulator for Gases and Liquids.—Muhlenthal, S., and Löwenthal, M., of Berlin, and Hahn, T., of Kotzschenbroda, Saxony. No. 20,773; Oct. 17, 1899.

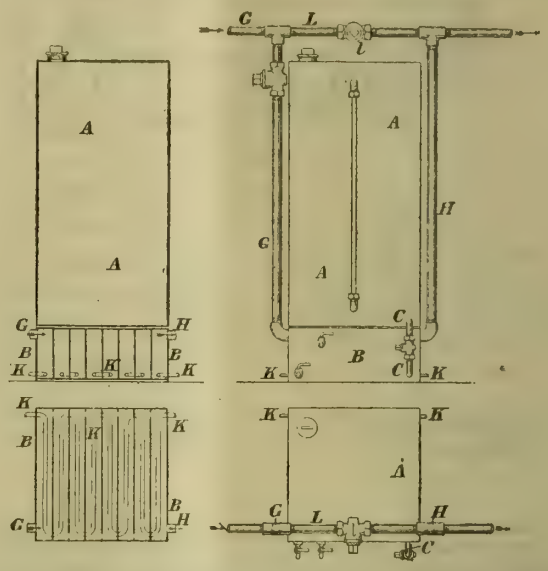
It is asserted that the pressure-regulator forming the subject of this patent "is not only completely counterbalanced, and permits of gases or liquids being delivered with a determinate amount of pressure, but it is also so constructed that, with the assistance thereof, the amount of the gas delivered, or that of the liquid entering the service-pipes, may be exactly regulated." The fluid (whether gas or liquid) arrives, in the first instance, between two pistons of equal size, one of which, according to its position, closes more or less an exit-opening. If the pressure exceeds a certain given amount, then, by the lifting of a bell or the like, a change of position of the two pistons may be provided for, and thereby the size of the opening for the passage of the fluid sufficiently altered, so that the fluid will arrive, under a certain given pressure, in a passage which, by means of a screw-valve, can be more or less closed, "so that only an exactly determined amount of the fluid can enter the service-pipes."



As shown, in the casing a bell shaped vessel B is provided, which, floating in mercury, carries two pistons D E, by means of the rod C. The gas entering at F arrives by a passage G, in order (after passing through the recess H of the tube I) to enter between the two pistons. As these pistons are of equal diameter, the same amount of pressure will be exerted on both. The gas then passes, further, through conical notches of the tube I, after leaving which it rises upwards beneath the bell B. The parts are now so regulated that, in case the pressure exceeds a certain amount, the bell will be somewhat raised. With the change of position of the bell, however, follows also a change in the position of the two pistons. The lower one will now regulate exactly the exit-openings K in the tube I, in correspondence with the amount of pressure, so that a decrease of pressure takes place, and the gas will enter the passage Z only at the desired pressure. The gas then passes from this passage through another passage L, from which it cannot, however, arrive directly into the service-pipes, but must first pass through the screw-valve M. This is now so arranged that the gas can only escape by the passages N and O in a pre-determined amount, in correspondence with the quantity it is desired to use. The gas will therefore first be regulated in its pressure, by means of the bell B, and the pistons D and E, and afterwards in its quantity, by means of the screw-valve M.

Carburetting or Enriching Gas.—Irwin, W., of Manchester. No. 20,792; Oct. 17, 1899.

This benzol carburettor consists essentially of two vessels, preferably one superimposed above the other—the upper one forming a holder for liquid benzol, and the lower one divided by vertical partitions into a number of compartments, which are filled with shavings, coke, or other suitable material, and fitted with suitable connecting-pipes, by which the benzol passes from the top chamber to the lower one, and the gas is led to and from the lower chamber.



As shown, the apparatus is constructed with an upper air-tight vessel A, to contain a quantity of benzol or other volatile enriching liquid, and a second vessel B immediately below, or in some other convenient position, so that the benzol can flow into it from the containing vessel A. The two vessels are connected by a pipe C. The interior of the enriching vessel B is divided by a number of vertical partitions into a series of compartments opening one into the other. In the compartments strips of absorbent material (such as flannel) are attached to the sides, or else shavings, pieces of coke, or other suitable materials may be placed therein, capable of absorbing the benzol as it flows through the compartments, so as to increase the surface with which gas comes in contact. The gas to be enriched enters the enriching vessel by the pipe G, flows through the several compartments, and out through the pipe H. In large installations, the vessel B is supplied with a coil of pipe K, through which water at a temperature of about 50° to 60° Fahr. may be run to maintain the enriching liquid in the vessel at an approximately uniform temperature.

The amount of liquid that flows into the lower chamber regulates itself automatically, to correspond with the amount of liquid absorbed by the gas, on the "bird-fountain" principle; while the gas-pipes G H are carried up above the level of the upper vessel, so as to prevent the possibility of the benzol finding its way into the gas-mains. The gas inlet-pipe is provided with a stop tap and a bye-pass L, so that the whole or any given proportion of the gas may be passed through the carburettor, or direct to the service-pipes.

APPLICATIONS FOR LETTERS PATENT.

25,567.—Gunning, J., "Automatically lighting and extinguishing lamps." Dec. 27.

25,633.—Griffith, H., "Acetylene gas-machines." Dec. 28.

25,688.—Keddie, C. E. R., and Solmersitz, E., "Automatically controlling lamps." Dec. 29.

25,710.—Urquhart, R. J., "Opening gas-cocks from a distance." A communication from the Actien-Gesellschaft für Fabrikation von Bronce-waren und Zinkguss vormals Spinn und Sohn. Dec. 30.

25,725.—Knoefkel, F., "Pressure-gauges." Dec. 30.

25,736.—Schaeffer, E., "Internal combustion engines." Dec. 30.

25,756.—Piperberg, H., "Coin-freed gas-meters." Dec. 30.

The Local Government Board and the South Staffordshire Water Company.—The Dudley Town Council have received a communication from the Local Government Board, stating that they have no power to hold an inquiry in reference to the complaint of the Corporation and other Local Authorities against the South Staffordshire Water Company, concerning the water supply, owing to the fact that the Com any work under parliamentary powers.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

How Far has the Gas Workers' Union been Recognized?

SIR,—In your issue for the 26th of December (p. 1562) there are references to the dispute which is proceeding in Glasgow as to the "recognition," of the Gas Workers' Union. A list is given of certain places in the London area in which it is said that "officials of the Union meet in amicable negotiation week by week with heads of departments." Your Scotch correspondent very properly points out that in the portentous list given "it is not said that the Gas Department is involved." It may therefore be asked: To what Union is reference here made; how are these "amicable negotiations" carried on; and what can there be to negotiate about "week by week?"

A further list is given of towns in the Provinces in which it is said that "the Union is recognized by the Town Councils." I submit that this statement is most misleading; and it would be interesting to know definitely by what Town Councils, and how and under what circumstances the Gas Workers' Union has been "recognized?" Does the Union fix and decide wages and work, and determine who shall and shall not be employed? If not, in what manner is the Union recognized?

It has been more than once shown that this much-vaunted "Conciliation" Board, as suggested by the Union, is a fraud; and some of us have a lively recollection of the Gas Workers' Union being "recognized" some ten years ago in the promotion of strikes which resulted in semi-starvation to scores of women and children, and disaster to both men and masters—and all this after the demands of the Union had been granted and accepted, and afterwards repudiated by the Union officials.

C. N.

Jan. 3, 1900.

Gas Purification in Germany.

SIR,—In your last issue, an article appears, entitled: "Gas Supply in Germany—The Crefeld Works." While admirably illustrating the progress of German gas manufacture, it seems to give the erroneous impression that, instead of natural oxide, preparations, chiefly consisting of ferric oxide, are probably used in the Crefeld Works. I can authoritatively state that the Crefeld Works, and with them most of the German gas-works, use bog iron throughout.

The German gas manager, having long ago discarded lime as antiquated, knows how to make a distinction in the right direction between artificial oxide and bog iron ore, provided the latter be of the best quality. He is aware that the absorbing powers of a material containing hydrated oxide of iron to the extent of from 80 to 90 per cent. do not compare favourably with those of a material which naturally contains 70 to 75 per cent., provided the latter shows the other necessary factors for making a first-class purifying agent—a minutely fine distribution of the iron through all parts of the material, combined with large porosity. Another point to be considered is that in an artificial oxide, matter has to be introduced by the manufacturers to increase the looseness of the material. This has to be done at the cost of presenting a surface much less capable of receiving sulphuretted hydrogen or cyanides to the entering gas; for, of course, all the particles of loosening material (useless for purification proper) represent so much surface the less for matter capable of absorbing impurities. Even in bog ore, the porosity is not always sufficient, or the percentage of iron may be more than abundant, but unequally distributed. Yet it is, in my opinion, easy for the manager to select the right stuff by looking *primâ facie* not for an excessively large quantity of iron, but for the following three points: (1) The largest possible porosity, to prevent back-pressure. (2) A sufficient percentage of iron—say at least 70 per cent. or upwards of Fe_2O_3,H_2O. (3) A fine distribution of the iron, so as to secure absorbing power for the whole surface presented to the gas on entering the purifiers. Any material showing these three qualifications must produce the best result, if the working conditions of the plant are right.

Lime cannot, of course, be entirely done away with, where the elimination of the sulphur compounds is compulsory; but even when using a primary lime purifier with a first oxide purifier, and then a sulphided lime vessel to follow, the oxide residue is likely to show enough cyanides to effect a more advantageous sale than for its contents of sulphur; and certainly all works free of restriction ought to employ oxide throughout, and an additional lime purifier in the last position only where the elimination of carbonic acid is required. Thus the purification will be marked by the greatest simplicity, cleanliness, and economy.

ERNEST E. MEYER.

Nightingale Lane, S.W., Jan. 5, 1900.

LEGAL INTELLIGENCE.

THE RATING OF RESERVOIRS.

In the "JOURNAL" for the 5th ult., we reported the proceedings in the House of Lords before the Lord Chancellor and Lords Macnaghten and Robertson, in the case of *The Hampton Urban District Council v. The Southwark and Vauxhall Water Company*, in which their Lordships affirmed a decision of the Court of Appeal to the effect that a certain reservoir was to be regarded as "land covered with water" within the meaning of section 211, sub-section 1 (*b*), of the Public Health Act, 1875, and be rated at one-fourth of the net annual value. The bed of the reservoir in question was composed of a thick layer of concrete in an artificial excavation, and was surrounded by an embankment, lined with concrete, which rose above the natural level of the ground and retained the water. The Court of Summary Jurisdiction decided in favour of the District Council, and ordered the payment of the full amount claimed, but stated a case. The Divisional Court held that the point at issue was covered by previous decisions (*Regina v. Birmingham Water-Works Company, Newport Dock Company v. Newport Local Board*, and *East London Water-Works Company v. Leyton Sewer Authority*), and reversed the decision of the Court below. The Court of Appeal upheld the decision of the Divisional Court. It was argued by Sir Edward Clarke and Mr. Courthope Munroe, on behalf of the District Council, that the cases relied on were decided upon earlier statutes than the Act of 1875, and that, if they governed the construction of that Act, they were wrongly decided, and should be overruled. The exception in the sub-section cited, it was contended, applied only to land naturally covered with water, and not to an artificial construction such as the one in question. At the close of the arguments for the Council, their Lordships gave judgment without calling upon the representatives of the Company (Mr. Cripps, Q.C., and Mr. Ryde). The following is the text of the Lord Chancellor's judgment, as given in the "Law Times."

I think that if one applies oneself to the particular matter, and only to the particular matter which your Lordships have to decide in this appeal, it seems to me that the question, whether asked in a Court of Law or in the most popular assembly in the world, must come to this: Is a reservoir "land covered with water"? I think it is; and I have heard nothing which induces me to suppose that the Legislature used that phrase in any other or different sense from that in which I should understand it as one of the ordinary subjects of the Queen using his own mother tongue in the ordinary sense. This is "land covered with water," and it seems to me that it would be a very extraordinary thing indeed if, after the use of this language in this sense, not for 38 years only, but ever since the earlier period from which this phrase was derived, one was to find out some new and extraordinary mode of construing these words, which would prevent it from being what it is. It is land covered with water. And it is a remarkable thing that when it was put to the learned Counsel more than once: If a reservoir is not land covered with water, what is it? I heard no other reply to that question than the statement that it is a reservoir. It is manifest that what it is attempted to do here is to put into the language of the statute, by construction, words which are not there. The only other meaning alternative to that given to it by the Court of Appeal is that you must put into the statute, by construction, some such words as "land covered with water, which is not made land covered with water by an artificial construction," or some words to that purport and effect. What foundation there is for taking that liberty with the language of the Legislature, and putting into the statute words which are not there, I am wholly unable to understand. I confess that the thing which puzzles me most about this case is the doubts which appear to have been entertained by the two learned Judges below (Justices Wright and Darling). I have not the least notion what they mean. To my mind the language of the statute is extremely clear, and is not susceptible of ony other meaning than that which has been put upon it by the Court of Appeal. The one point which occurred to me as susceptible of doubt was the words which follow, and which Lord Justice Rigby has commented upon: "Or used only as a canal or towing path." At first sight that would seem curious, no doubt. If "land covered with water" was enough, why should they have put in the word "canal" too? And if the words "towing path" had not been added, I should have thought it really was curious; but I think the explanation which has been given is quite satisfactory. The thing which was to be rated was the adventure—the whole construction; and if the Legislature had not put in these words, this question upon the rating would have arisen: You have got to rate the canal itself—that is to say, that part of the earth on which the water rests—at one rate, and the towing path, which is only ancillary to it, and is only useful as making part of the artificial construction by which the adventure of the company is carried on, at a different rate. Therefore, for these obvious reasons, the Legislature have not contented themselves by simply abiding by the phrase "land covered with water," but have added to it "canal or towing path for the same." I am wholly unable to understand on what ground we are asked to disturb, or throw any doubt upon, the construction of these words which has prevailed for a very considerable period. Speaking for myself, I must say that I should feel very great hesitation upon such a question in attempting to overrule the judgments of the learned Judges in the cases which have been cited to us in the Court of Queen's Bench. That was peculiarly the Court in which rating cases were decided, and very often decided under circumstances in which there was no appeal; so that in many cases the decisions there were final. And three of those learned Judges were Judges of very great eminence, and especially familiar with questions of rating. I desire to say no more. I think this case is abundantly clear. In my opinion, your Lordships ought to dismiss the appeal with costs, and I move accordingly.

Claim in Respect of Damages Caused by the Honley Explosion.

At the Halifax County Court last Friday, before his Honour Judge Cadman, an action was brought by Benjamin Taylor, of Elland, to recover from his employers, Messrs. R. Dempster and Sons, Limited, under the Employers' Liability Act, the sum of £234 for injuries sustained by the explosion at the Honley Gas-Works on the 4th of July last. Mr. A. W. Bairstow appeared for the plaintiff; and Mr. A. Powell represented the defendants. The plaintiff's case, as stated by Mr. Bairstow, and deposed to by witnesses, was that he was employed by the defendants at 27s. per week wages. On the above-named day, he, with three other men and the foreman, went to the Honley Gas-Works, where Messrs. Dempster had contracted to take out an old gasholder. When the men arrived, they found that the water had not been pumped out, and an attempt was made with pumps to do this. The manhole at the side of the holder was not, however, opened during this process. Afterwards the men proceeded to take off a portion of the top of the holder, when a spark came in contact with some of the explosive mixture. Ignition resulted, followed by an explosion; the plaintiff being blown 40 feet into the air, and his fellow-workmen being killed. Mr. R. Porter, Engineer and Manager of the Elland Gas Company, in support of the claim, said that, in his opinion, the fault to which the explosion was due was in not thoroughly ventilating the holder before handing it over to the men. For the defence, Mr. Powell contended that the holder was not safe in any way for destruction. He urged that negligence on the part of the defendants had not been proved. They were right in relying upon the Gas Company for the clearing of the holder. His Honour held that the defendants' foreman was negligent in starting to work so shortly after the manhole had been opened and the plug taken out. He gave judgment in favour of the plaintiff, and awarded him £100 and costs.

MISCELLANEOUS NEWS.

MANCHESTER CORPORATION GAS SUPPLY.

The Widow and Family of the Late Mr. Stevenson—Advance in Workmen's Wages—Extension of the Carburetted Water-Gas Plant—The Quality of the Gas—The Sanitary Condition of the Works.

At the Meeting of the Manchester City Council last Wednesday—the Lord Mayor (Mr. T. Briggs) presiding—some important recommendations from the Gas Committee came up for consideration.

Alderman Gibson, in moving that the proceedings of the Gas Committee, of which he is Chairman, be approved, said he had to call attention to two or three matters of considerable importance. One of these related to the widow and family of the late Mr. Stevenson, their Chief Engineer. Of course, the members of the Council all knew that on the 30th of October last, owing to the stupid action of one of their own workmen, there was an explosion of gas at the Rochdale Road works, which was disastrous in its results, inasmuch as Mr. Stevenson, who stood in the very forefront, carefully watching the operations going on, was the first to receive the full blast of the explosion, and was practically killed on the spot. No sympathy or recognition on their part, no act of theirs, could in the slightest degree recompense Mrs. Stevenson for the loss of her husband; but they could, at least in some measure, lighten the severity of the consequences by acting in what he conceived to be a fair, and probably generous, way towards her. To his mind, the matter presented two aspects—the legal and the moral. He was not, however, going to stay to inquire whether or not Mrs. Stevenson had any claim or ground of action against them, or what a jury might award. He preferred dealing with the question from the moral point of view; and he would ask "what they, as a large and prosperous Committee of a wealthy Corporation, ought to do under the circumstances. He should like to call attention to one or two facts. What would have happened if they had not had Mr. Stevenson, or some other equally competent man, in their service? In 1894, they borrowed £500,000, and had employed it during the past five years in developing the resources of the gas undertaking. The great proportion of this money was spent in accordance with designs and specifications prepared by Mr. Stevenson, and under his direct control and supervision. What would have been their position if he had not been there, and they had been forced to pay an expert, as had been necessary on many previous occasions? Many members of the Council would remember that before Mr. Stevenson's services were secured, the Gas Committee paid considerably over £2000 for the supervision of the construction of various works; and he had no hesitation in saying that if they had not had their late Engineer, or some other equally competent one, they would have had to spend anything between £12,000 and £15,000, which that gentleman had saved them by his competency and knowledge. What the Committee proposed was—"That the sum of £5000 be granted and paid out of the revenue account of this Committee for the benefit of the widow and family of the late George Ernest Stevenson, Engineer of the Gas Department, who was killed in an explosion at the Rochdale Road Gas-Works on the 30th of October last; such sum to be in settlement of all claims against the Corporation, and to be invested in the names of Trustees to be approved by this Committee in a £3 per cent. gas mortgage of the city rate, the interest to be paid to Mrs. Stevenson until her death or re-marriage, and the principal to be then divided among the children of Mr. Stevenson, including the issue of any child who may be dead, such issue taking their parent's share." It had been said, and it might be said, that they were proposing to pay more in this case than they would pay in that of an ordinary workmen. They must, however, remember, that while they were, of course, doing so, they were not paying more in proportion. No ordinary workman would have done for them what Mr. Stevenson had done. No ordinary workman could have saved for them £10,000 to £15,000. They paid Mr. Stevenson, while he was alive, in proportion to his work and ability; and in his (Alderman Gibson's) judgment, it was only just and fair that, seeing he was killed in their service, they should recompense his family in the same manner as they had paid him for his work, and in the same proportion. (Cries of "Agreed.") The next matter to which he desired to draw attention was that of the workmen's wages. The Committee recommended that the wages of all workmen employed in the Gas Department, other than artisans to whom Trade Union rates were paid, should be advanced at a uniform rate of 5 per cent., as from Jan. 1. This meant dividing among the workmen about £6000 a year. He should like to say that the question of advancing wages at all was suggested to the Committee by the Gas Workers' Union. He had no quarrel with Trade Unions; for, when properly conducted, they were of great value. It was only when the Secretaries of Unions told them not only what they ought to do, but what they should and should not do, that he personally would come into conflict with them. He was always delighted, and so were the Committee, to receive any advice; but they did not want any instruction. They proposed to give a 5 per cent. advance all round, which meant that they did not recognize whether or not the men belonged to a Trade Union, but only considered whether they were doing their work faithfully and well. If so, they were entitled to consideration at the hands of the Committee, whether they were members of an organization or not. The Committee did not want to prevent them from joining a Union; but they would not discharge them if they did not join one. Certain members of the Council had been somewhat exercised in their minds because there had been a discrepancy in the amount of money paid at the various stations for the same work—one rate at Rochdale Road, another at Bradford Road, and another at Gaythorn. There had certainly been an anomaly in this respect; but it had been remedied. On the previous day, the Committee had had an interview with some of the principal men from all the stations. They explained the position, and the Committee stated what they were prepared to do; and the men went away rejoicing. The members of the Council would further see that the Committee had accepted a tender for the extension of the carburetted water-gas plant at Bradford Road to the full capacity of the existing house—viz., 6 million cubic feet per day. At present they were only making 3 million cubic feet. When this was completed, they would, no doubt, be able to cope very fairly with the great increase that they now found was gradually taking place in the gas consumption in the city. It was very strange how, in spite of the competition of the electric light which must influence them in some way, there was a continued growth of the gas undertaking. They hoped that the enlarged plant would be ready for next winter. There had been some grumbling about the gas. It was a very extraordinary thing that, notwithstanding the Committee had reduced the price of gas during the last four years, and practically made the people a present of £50,000 a year, and supplied them with splendid gas—(Cries of "Question")—yes, splendid gas, of high illuminating power, at an extraordinarily low price, for 360 days in the year, without any complaint at all being heard, yet when a little fog came on the people forgot the great benefits they had enjoyed, and began to grumble. He could only say he was very much surprised that not only some of the public, but certain authorities seemed to forget the great efforts made for the promotion of the best interests of those whom they represented, and assumed that the Manchester Gas Committee were either the most incompetent or the most dishonest Committee that ever existed in that or any other Corporation. (Laughter.) He begged to move that the minutes of the Committee be adopted.

The Lord Mayor seconded the motion.

Mr. Boyle said he did not desire to quarrel with the decision of the Committee with regard to Mr. Stevenson, of which he quite approved, and he did not want to strike a jarring note. He wished, however, to say that the only fault he had to find was with respect to the policy pursued when the people who were injured were of lower standing than the late Mr. Stevenson. Would it not be better if the same kindly feeling could be extended in such cases, instead of legal proceedings having to be taken to enforce on the Committee the payment of the little instalments that were paid to the widows of men who were killed? If the Committee would face their responsibilities in such cases, and meet them in the same spirit as that which they had shown in connection with Mr. Stevenson, it would be much more satisfactory. What was the policy of the Committee with regard to workmen who had been injured in the course of their employment, and who had received a little compensation, but who, when they had recovered, were refused work by the Committee? Was it by the sanction of the Committee that men in this position were denied employment by the department.

Mr. Brocklehurst remarked that he, too, did not wish to quarrel with the Committee's recommendation, but to say a word as to the policy pursued towards the workmen. As Mr. Boyle had pointed out, there had in the past been a difference in the methods of treatment adopted in the case of their well-paid and lower-paid servants. A short time back, he pointed out that some workmen who had been injured were not being paid the amount to which they were entitled under the Workmen's Compensation Act. He was glad to find that since this had been brought to the notice of the Committee, a different policy had been pursued; but, as Mr. Boyle had suggested, it did not seem right that men should have to go to the trouble of taking legal proceedings to obtain what was readily and wisely granted to the widows and relatives of those in a superior position. With respect to the workmen's application, the Chairman of the Committee rather complained of the way the workmen's case was presented, and seemed to look on their intervention as a dictation.

Alderman Gibson: Not at all. I thought it only fair and just. I explained that we should never have thought anything about wages if it had not been suggested by the Workmen's Unions. Therefore, I think I gave them credit for having done good work for those they represent.

Mr. Brocklehurst said he was pleased to have this confession. The Gas Workers' Union had been of immense service in raising the wages of the whole of the workers employed in the manufacture of gas. He wanted to mention the question brought forward a short time ago, as to the treatment of members of the Union by responsible officials. One of their Superintendents had taken action with regard to members of the Union which, whether rightly or wrongly, had produced the impression that he was intimidating them from remaining in the Union. He hoped that, whatever might happen in the future, no such action would be taken, or allowed to be taken, by responsible officials of the Gas Department. He should also like to refer to another matter. He had recently visited the Gaythorn works, and found there was an almost complete absence of sanitary arrangements for the men employed by the Committee. He was going to say that the sanitary condition of the works was a disgrace—it was certainly not a credit—to the Gas Committee. He had seen other works which were models of their kind, and which might be imitated. He hoped this and various other important questions, as well as that of wages, would be taken into careful consideration by the Committee.

Mr. Johnson remarked that Alderman Gibson had mentioned the legal aspect of Mr. Stevenson's case, but had not gone into it. He (the speaker) would like to know, if Mr. Stevenson's family were entitled to compensation, what would be the amount under the Employers' Liability Act. Also, if in future the Committee intended to make this a precedent, whether all the workpeople employed by the Committee would be treated on the same liberal lines as those adopted in the present instance.

Alderman Gibson said he had heard with regret Mr. Boyle's observation respecting money having to be forced out of the Committee by legal proceedings. He might tell Mr. Boyle and others that he (the speaker) had done all that one person could do to tell these people how much better they would be served if they came to the Committee instead of going to a lawyer. In the case of the last man they had to deal with, his own lawyer admitted that he was acting foolishly. He preferred £75 to a job at 25s. or 30s. a week, on light work.

Mr. Boyle observed that he had been referring to the survivors of men who had been killed, not those who were able to go to work again.

Alderman Gibson said there had not been very many killed, and he should like to know of any instance where it had been necessary to use force to cause him to do that which was just. Could Mr. Boyle point out any particular case? Every member of the Gas Committee was desirous of doing the very best he could for the men, their widows, and others whom they left behind. As to Mr. Brocklehurst's remarks, the "model" works alluded to were, no doubt, those at Leicester. They could not have such works in Manchester. He admitted that there was perfect justice in what Mr. Brocklehurst had said with regard to the Manchester works; and the question was having his consideration. They could not do for their men here what had been done in Leicester; but a good

deal more could be done than had been, and it ought to have been done. Why had it not been done? The reason was that the Chairman and the members of the Committee had not been workers in a gas-station, and had no knowledge of these little matters. Many of the things referred to by Mr. Brocklehurst were right and proper, and should be carried out, so far as he could influence matters; and he thought the Committee would support him.

The minutes of the Committee were then adopted.

It may be added that Alderman Gibson had prepared a few particulars, which he did not read at the meeting, to show how, in spite of the competition of the electric light, the gas undertaking had grown. These particulars showed that, in 1894, 360,000 tons of coal were carbonized, and last year the quantity had risen to 426,000 tons—one ton of coal producing 10,000 cubic feet of gas. In 1896, the price of gas was reduced 3d. per 1000 cubic feet, and meter-rents were abolished at a loss of revenue of £50,000 a year. In 1895, the revenue was £567,000; in 1896, when the allowance was made, it dropped to £510,000; in 1897, it rose to £552,000; in 1898, to £553,000; and last year to £595,000—showing that the department had recouped themselves for the loss of the £50,000 in a little less than three years.

Mr. Stevenson's Successor.

At a meeting of the Gas Committee of the Corporation held on Friday, the question of the appointment of an Engineer to the Gas Department, in succession to the late Mr. Stevenson, was brought up for further consideration. At a previous meeting, held on the 8th ult., a Special Sub-Committee was appointed to report upon the applications received for the vacant post. The total number was sixteen, and four of these were selected from which to make a final choice. The Committee ultimately decided to recommend to the Council that Mr. J. G. Newbigging, Engineer and Manager of the Macclesfield Gas-Works, be appointed Engineer, and to take the management of the Rochdale Road Works for the time being. As most of our readers are aware, Mr. J. G. Newbigging is a son of Mr. Thomas Newbigging; and his salary as Manager of the Macclesfield works is £300 per annum, in addition to which he has a consulting practice. The post of Gas Engineer to the Manchester Corporation is worth £800 a year. The appointment will, of course, have to be confirmed by the Council. It may be mentioned that Mr. James Hill, Deputy-Manager of the Rochdale Road works, who was injured in the recent explosion, is still too unwell to attend to his duties. The Committee also received a deputation from the Withington District Council, headed by Mr. Blair, the Chairman. In the course of the interview, it was stated, on behalf of the deputation, that there had been a great many complaints respecting the gas supply, but that the quality and quantity of the light had recently been very much improved.

THE FATAL EXPLOSION AT THE DOUGLAS GAS-WORKS.

In the "JOURNAL" last week, we gave an account of the disastrous explosion which took place at the Douglas (Isle of Man) Gas-Works on the 22nd ult., and also a condensed report of the proceedings at the inquest. We are now in a position to notice them at greater length.

After the inquiry had been formally opened on the 23rd ult., and evidence of identification taken, the Jury visited the scene of the explosion, where they were met by several Directors of the Company, the Secretary and Manager (Mr. C. H. Kay), and their Advocate (Mr. J. M. Cruickshank). At the request of the High Bailiff, Mr. Kay explained the surroundings and the circumstances of the disaster, and said the entire damage was caused by the explosion of the ammoniacal liquor tank. The men Baird and Coole were in the employ of Messrs. Knox, and were fixing up a new pump by the scrubber. Mudie was in the Company's service, and practically had charge of the yard. The job was being done by day-work. Mr. Cruickshank said his instructions were to afford the High Bailiff and the Jury every possible facility for coming to a conclusion on the matter. He added that the Directors deeply deplored the loss of life which had occurred, and sincerely sympathized with the relatives of the dead men.

The inquiry was resumed on the following Wednesday, when, after the two medical men who had rendered assistance (Drs. Mackenzie and Marshall) had given evidence, Mr. Thomas Newbigging, the Company's Consulting Engineer, was called. He said he had acted in this capacity for about 17 years, during which time he had reconstructed the greater portion of the works. The two tar and liquor tanks were the only parts with which he had not had to deal. At one time, each of the two tanks contained a gasholder; but about 18 or 19 years ago, when the larger holders were erected, these two smaller ones were dispensed with, and the tanks were converted into storage wells for the tar and ammoniacal liquor. This was the practice in gas-works everywhere. Most of the gas-works throughout the kingdom had similar tanks, covered in a precisely similar way—that was to say, the roof was formed of brick arches, springing from cast-iron or rolled-iron girders or beams, which were supported on the tank wall and by brick piers built up from the bottom. The position of these tanks was the best that could be chosen. They were in a space at the back of a range of buildings, separating them from the retort-house and from the yard where most of the operations of gas making were carried on. They were also at the extreme end of the site from the gasholders. The use of lights in this portion of the works by the men employed by the Company was, he was well aware, strictly forbidden, as he had been told so by the men themselves. When the make of gas was heavy, as it was in midwinter, the tar and liquor came away at a high temperature. The lighter hydrocarbons were given off in a state of vapour, and when mixed with air were highly explosive. This was the condition of things when the explosion took place. It was this mixture of air and hydrocarbon vapour or gas which, on being fired by a light, produced the explosion. There could not be any spontaneous combustion. The gas would come through the manholes in the crown of the liquor-tank. There were two of them, each closed by a perforated grid. The light would have to be brought near to the outlet or manhole, before an explosion could take place. The tank was 14 feet deep. It would have tar at the bottom, then ammoniacal liquor above it, and gas floating on the top. A hot cinder would not ignite gas; it must be a flame or a very white light. Nor would smoking ignite it; but lighting a pipe with a match would. He should think a light would have to be within about a foot of the manhole for the vapour to ignite. He believed it was about 8 or 9 feet from the manhole to the pumps where the men were working. He spoke from experience and knowledge when he said that the management of the Douglas Gas-Works was of the best. He was always at the call of the Directors when they wished to see him. Mr. Kay had managed the works with distinction for many years, and with entire immunity from accidents until now. In his opinion, Mr. Kay had a thoroughly practical knowledge of gas plant, and had served a good apprenticeship, having been on the works since he was fifteen years of age. There was no necessity for using a light, as the work could all have been done in the daytime. In his view, the men were hurrying over it to get it done before the holidays. It was possible to put ventilating shafts into tar and liquor tanks. He always put them in when he constructed works of the kind; but at the majority of gas-works the ventilation was effected in a way similar to that at Douglas. His attention had not been drawn to the two tanks, which were the only remnants of the old works in existence. They were not defective. They were well covered; but the ventilation might have been better. Covered lamps were used on the works, but no safety lamps. It was not customary to use safety-lamps in gas-works; but it would be better if it were. It would be desirable, in any alteration, that the ventilation of these tanks should be improved by fitting shafts at suitable points, and of sufficient height to carry the gas over the buildings. He thought this would prevent the occurrence of such accidents as the one which they were investigating. Only about 20 per cent. of the gas-works had ventilation by means of shafts; but certainly it ought to be generally adopted. At the close of Mr. Newbigging's evidence, he was thanked by the High Bailiff for the satisfactory manner in which he had given it, as he had shown no bias whatever.

The next witness was Mr. Kay. He said he had been engaged upon the works for 25 years; and had been Secretary since 1886, and Manager since 1894. He was perfectly acquainted with the plant all through. The two tanks were converted in 1881, shortly after which time Mr. Newbigging became the Company's Consulting Engineer. There were no definite instructions on this occasion, but it was a strict rule given to all the Company's workmen that no naked light was to be used in the tar-yard or at the purifiers. The instructions were not posted up; but they were well understood by all the men. Mudie was the yard foreman, and he knew the rules. On the day of the accident he was in charge of the yard. He (witness) was not aware of any reason for the men working after dark; and, as a matter of fact, he did not know they were doing so, as he was away at tea when the accident happened. He was back at the works, however, by a quarter to six. One of the men who was working at the pump—John Coole—was formerly in the employ of the Gas Company, and he would know of the rule prohibiting lights in the tar-yard. It was ten or twelve years since Coole left their service. He (witness) could not say that any of the men were positively warned. He agreed with Mr. Newbigging as to the immediate cause of the accident. Mudie had been with the Company about twenty years, and if he saw a naked light in the tar-yard it would have been his duty to forbid it. The lamp used by Mudie was an ordinary closed one with a glass window. As a rule, smoking was prohibited; but in the yard in question this was not notified.

Alfred Hughes, an apprentice to Messrs. Knox, who was working with the men fitting up the pump, said that after dark, on the day of the accident, he saw Mudie standing over Baird with a lighted lamp, which he (witness) had obtained the previous day from the weighing office. It was a small moulders' light—a "duck" light—and nothing was said to him, or in his hearing, against using it. He was sent to another part of the works, and while there the explosion occurred. Nobody told him it was dangerous to take a naked light near the tank. [During the witness's evidence, a lamp similar to the one which it was thought had caused the explosion was produced. It was constructed of metal, and the wick protruded from the end of a spout.] Thomas Moore, a blacksmith in the employ of the Company, stated that he saw Hughes with the "duck" lamp unlighted in his hand, and told him he had better not take it to the place where they were working. He thought Hughes must have heard him. He (witness) knew the danger of naked lights; the Manager having warned him of it. They used a covered light when they went at night to examine the working of the pumps. A labourer named Cunningham said he heard Moore caution Hughes about the light; and Joseph Boyd, who was in charge of the weighing-house, deposed to giving Hughes the "duck" lamp, but said the lad did not mention where he was going with it. After two other witnesses had been called, the evidence was completed.

In summing up, the High Bailiff reminded the Jury that their duty was to find out the cause of the death of these men. The evidence was conclusive that they lost their lives in the explosion that took place—from shock and suffocation. They had also to consider the surroundings of the accident. Dealing with the question of management, he alluded to Mr. Kay's unblemished character as Secretary of the Company, but said it might, perhaps, be found necessary now that there should be a Manager as well. After again complimenting Mr. Newbigging on the unbiassed manner in which he had given his evidence, he said that had it not been for this evidence being tendered in so straightforward a manner, he would have been obliged to apply to the Governor to appoint an independent expert. Referring to the instructions alleged to have been given with reference to lights, he said he could not imagine that rules and regulations governing the lives of men employed in the gas-works should be conveyed simply by word of mouth. There ought to be a notice posted up in different places, such as was done in mines under the Metalliferous Mines Act. Messrs. Knox's men seemed to have been proceeding with their work unknown to the Directors or the Manager. The evidence given went to show that it was an open duck lamp that was used. Whether this was done with the knowledge of the Manager or not, was a question for the Jury to consider. Probably it was not used with his personal knowledge; but a Manager's responsibility did not end there. Was he simply to go home to his tea, and allow things to go as they pleased? It was his duty to see that there was a proper person left in charge. Otherwise, it would be very serious if a Manager was not to see that all the rules and regulations of the Company were attended to in his absence. It was clear there was carelessness on the part of somebody,

though he was not going to say it was culpable carelessness. It was very difficult to say how far a man was liable or culpable for his carelessness. That was the question for the Jury; and they were in a position to make such suggestions as they thought best to secure the safety of lives in future. Mr. Newbigging had recommended the ventilation of the tanks by means of shafts; and the recommendation would not be lost sight of by the public, even if it were not carried out by the Company. He referred to the sad bereavements caused by the disaster, and expressed the opinion that it was the duty of the Company to see that support was given to the widows and children of the unfortunate men who had lost their lives.

The Jury deliberated for nearly an hour, and returned a verdict to the effect that the deaths of the three men had been caused by shock and suffocation resulting from an explosion caused by the careless use of a naked light in the tar-yard, with the knowledge of the foreman of that part of the works. They attached to the verdict a recommendation that notices should be posted up, in a prominent position, in the works, as to the danger of using naked lights in the dangerous parts of the works; and that none but safety lamps ought to be used in the future in those places, as there had evidently been carelessness in the past management with regard to the use of lights. They further recommended that the tanks should in future be ventilated with shafts rising to a sufficient height in the air to avoid the risk of an explosion. The High Bailiff said the verdict was a very sensible one, and the rider at the foot of it such as he should have wished inserted if he had been on the Jury. He expressed the hope that it would be carried out. Mr. Cruickshank, on behalf of the Company, gave an undertaking that this would be done.

In view of the remarks of the High Bailiff at the inquiry reported above, it is satisfactory to find that the Directors of the Company have determined to provide for the widows and children left by the men Mudie, Coole, and Baird. Last Thursday, the Directors and their legal adviser met the widows, and gave a voluntary written undertaking to pay them each 10s. a week for life, or as long as they remained widowed, and 2s. 6d. a week for each child.

THE ROYAL AQUARIUM GAS EXHIBITION.

West's Patent Coke-Conveyors and Compressed-Air Motors.

There are a few points about two of the exhibits on the stand of West's Gas Improvement Company, Limited, at the Royal Aquarium Gas Exhibition, to which further attention may be called. Since the first visit of our representative, we have been informed that West's patent "Silent" coke-conveyor, of which a beautifully finished model is shown, is now being extensively adopted in gas-works. The chief characteristics of the conveyor are: It consists of an endless chain, which travels along the centre of a U, or other shaped, trough; the chain being provided with arms or scrapers, which, when drawn along the trough, will convey the coke or other materials deposited on the trough to any required point, where it may be discharged through outlets provided in the trough, or off at the end of the conveyor. It is fitted with Hunt's patent roller chain, which is specially adapted for dealing with gritty material, as the rollers prevent excessive wear and tear of the chain-wheels. It will be seen by a glance at the model that the wearing parts are specially designed; and, it has been proved in practice that the wear and tear is remarkably small. The conveyors do not break up the coke or make breeze, as the coke does not roll over in its passage along the conveyor, and no violent rubbing of the pieces against one another occurs. They are suitable for conveying coke from both horizontal and inclined retorts. This type of conveyor has been working some time at the Gaythorn Gas-Works of the Manchester Corporation; and we understand that it has been giving excellent results. We are also told that the Company have in hand a large contract for coke plant for the Nottingham Corporation Gas-Works, to the designs of the Engineer (Mr. W. R. Chester, M.Inst.C.E.). The motors on view are West's 4½-inch and 3½-inch double-cylinder compressed-air motors. They are fitted with Joy's patent reversing gear, and have all the working parts protected from dust; special attention being given to lubrication. The motors have been carefully tested by Professor Goodman, Assoc.M.Inst.C.E., of the Yorkshire College, Leeds, who remarked on the "immense superiority of the West motor over those of the three-cylinder type." He has, he states, tested it in conjunction with three-cylinder motors, and found that it only uses from one-third to one-quarter the quantity of air the others did in doing the same work, or, in other words, it did three to four times as much work with a given quantity of air in comparison with the others. The motors are used for driving West's compressed-air charging machinery, and a smaller type for the drawing machinery; also for hauling coke trucks and waggons, lifting purifier-covers, and many other purposes in gas and electric light works.

The Van Vriesland Ærogene Gas and Denayrouze Light Syndicate's Exhibit.

The extensive character of the combined exhibit of the Denayrouze Gas-Light Syndicate and the "Ærogene" incandescent gas-light somewhat belated its completion, and prevented full justice being done to it in our general notice of the exhibition last week. A few days since witnessed the perfecting of the installation of the lights and apparatus; and now we have pleasure in calling further attention to it.

Before specifically referring, however, to this demonstration of the value of these lighting systems, some particulars may be given (from printed information supplied) of the Van Vriesland ærogene gas. It is pointed out that it brings within reach of places not provided with ordinary gas-works, all the advantages of the incandescent light. In order that an apparatus intended to produce ærogene gas may be practically applied on a large scale, it is necessary that it fulfils a certain number of conditions, among others: "(1) Uniform and constant carburation in such a manner as to give a perfectly natural gas, burning without any variation of strength or flickerings of the flame. (2) Sufficient pressure to admit of distributing vertically, as well as horizontally, a gas which is heavier than air. (3) Absence of condensation of the carburetted liquid, or of impurities in the gas pipes. (4) Self regulation of the apparatus—that is to say, that it ought to be able itself to regulate its production of gas in such a way as to light or extinguish any particular number of jets without altering the strength of the flames of other jets. (5) Simplicity and strength in an apparatus intended not only for domestic purposes, but for public lighting." It is in face of these difficulties that, it is asserted, all previous systems have failed; and the Van Vriesland system has shown its superiority by having successfully solved them. The apparatus charges cold air with the vapours of suitable hydrocarbons, brings the mixture up to the required pressure, and is worked from a central place, whence it supplies gas suitable for incandescent burners, without any element of danger. It has been worked with benzol of ·880 specific gravity, benzene of ·700 specific gravity, and gasoline of ·650 specific gravity; and the gas produced has been freely used both in gas-engines and as an illuminating agent for incandescent burners. A gallon of gasoline of ·650 specific gravity, converted into ærogene, and used in incandescent burners, will, it is claimed, give 5000 candle-hours. A flame of 35 candles therefore burns 143 hours on one gallon of gasoline; and the cost of the gasoline being 1s. 8d. per gallon, it works out to 0·14d. per hour, which shows a very economical result. As the gas issues from the burners at a high velocity, no glass or other chimneys are necessary for enclosing the mantles; and the temperature of the flame being high, exceedingly small mantles may be used. Among other claims advanced for the apparatus are these: Being rotary, the pressure it gives is very regular. As it is fed automatically in exact proportion to its use of hydrocarbon, the gas produced has a constant composition. It is hermetically closed, so that no gas can escape from it—ensuring absolute safety. It produces no more gas than is required; when all gas consumption stops, the production of gas ceases at the same time. The apparatus requires very little driving power, and may be operated by any motor—viz., a weight raised by hand, clockwork with a spring, a small water-motor, or a small hot-air or gas engine. It occupies very little space; and its cost is moderate. For example, an apparatus capable of feeding 45 burners of 35-candle power each only requires a space of 5ft. by 3ft. Owing to its simplicity, the apparatus also possesses extraordinary strength. These are points of importance, especially in apparatus which is intended for application in private lighting. In Switzerland, ærogene gas has been adopted for the lighting of several railway stations; in Holland the village of Breukelen is lighted with it; and at a milk sugar works at Uitgeert, it is employed for driving a 10-horse power gas-engine. The gas may also be utilized for domestic and industrial heating; and, according to the following statement, with very great advantage: In the gold-refining works of Geneva, by its means, in a Perrot stove, a casting (melting) of 4 kilos. of gold has been obtained at an expense of about 30 centimes in three-quarters of an hour. With ordinary gas, the expense is 80 centimes; and the same work requires an hour and a quarter. In this country, the Denayrouze Light Syndicate has carried out an extensive installation of the Van Vriesland system at Brocklesby Station (Lincs.) on the Great Central Railway; and, from the same plant, gas is supplied to Ulceby Station (¾ mile distant) and to Habrough Station (1¾ miles away). From actual experiments, we are told, the cost of light used at the three stations amounts to, as nearly as possible, 2s. per 1000 cubic feet. As may be seen at the exhibition, the Van Vriesland carburettor can also be used for raising the pressure of ordinary gas for intensified gas lighting. This is simply accomplished by placing water in the carburettor instead of gasoline, connecting the gas supply to the air-inlet, and passing the gas through the apparatus to the same outlet as when used for oil gas. In this way, the pressure can be raised to any desired point by speed regulation.

With this general statement as to the merits ascribed to the ærogene gas system, we will turn to the exhibit, which will be found in the north-west gallery of the Aquarium. There a suite of spacious apartments has been constructed, to show the actual effect of interior illumination by, chiefly, Bandsept burners supplied by both ærogene gas and coal gas under pressure.. In all there are three rooms, an entrance hall, and machinery-room. The former are luxuriously furnished and decorated—in fact, in such rich style that there is a danger of the furniture and other appointments receiving as much attention from the casual visitor as the lighting arrangements themselves. But, of course, this will not be so in the case of the gas engineers and managers, and lighting superintendents who may visit the exhibit, and who will, with us, recognize that the exhibitors have made an admirable disposition of their lighting arrangements, and have secured a very pleasing and brilliant effect. Taking the rooms in the order in which they are visited, there is first the entrance hall, which is illuminated by a very artistically designed chandelier in the centre. It supports, in tiers, eighteen No. 1 Kern burners, and is supplied with the ærogene gas. One thing that will particularly strike the visitor about the rooms illuminated by this gas is that the light is beautifully soft; and even with an aggregation of lights in one spot, as in the entrance hall, the eyes do not suffer the slightest irritation. The first room is a splendid apartment, 40 feet square; and this is also supplied with ærogene gas. It is lighted by sixteen 3-light brackets disposed round the walls, and fitted with small Bandsept "Torch" burners. The second apartment (which is of smaller dimensions) is illuminated by a central pendant fitted with large "Torch" burners of 250-candle power; and the third room is fitted with eleven brackets, each supporting two small "Torch" burners. In all three apartments, a very effective display is made. The machinery-room will be an attractive feature for the professional visitor. A photometer-room is being fitted up; and lamps are being put into position containing various sized clusters of Bandsept burners, suitable for public lighting, and supplied with both coal gas and ærogene gas. Last week, the room was powerfully illuminated by a cluster of five Bandsept lights. A number of Bandsept burners are also available for close inspection; and a model of the Van Vriesland plant already referred to as being in use at Breukelen will claim attention. Interest will also be shown in one of the carburettors in operation as a pressure-raiser for ordinary coal gas. It is capable of increasing the pressure of the gas to 18 inches; but, of course, it can be regulated to any lower pressure—9 inches being about the pressure usually worked to. Overhanging the north-west gallery may be seen four clusters of three-light Bandsept burners of 250-candle power each, supplied by gas the pressure of which has been raised by this apparatus. As will be observed, its internal parts are simple; and their operation proceeds noiselessly and smoothly. Time will not be wasted in an inspection of the lighting arrangements and objects of interest to which we have referred, and which have been brought together by the Denayrouze Light Syndicate.

THE BRIGG AND SKIPTON ARBITRATIONS.

Mr. George Livesey, the Umpire in the Brigg Gas-Works purchase arbitration, has issued the joint award of himself and the two Arbitrators in the case, Messrs. H. E. Jones and E. H. Stevenson. It is for £24,300. The claim made by the Company's expert witnesses was £28,134, and for surplus works £1902; making a total (including 10 per cent. for compulsory purchase) of £30,036. The Council's expert witnesses gave the value of the works at £17,886, and excess works at £712, or a total of £18,598, excluding the 10 per cent.; or, if the 10 per cent. be added, a total of £20,457. The income claimed by the witnesses on behalf of the Company was £959. Deducting the Company's claim for excess works of £1902, the award works out at 23·35 years' purchase of the income claimed by the Company. There was no borrowed money.

The statement made in the "JOURNAL" for Dec. 19 regarding the Skipton award requires a little amendment. The following are the figures taken from the shorthand notes: Claim by the Company's witnesses, including excess works, £82,746; by the Council's witnesses, including excess works, £49,674. The award was £66,500. To each of these sums has to be added £4750 for the mortgage taken over by the Council. The income claimed by the Company, after deducting interest on the mortgage debt, was £3049; and the award works out at 21·8 years' purchase of this income of £3049. At a meeting of the Skipton Council on Thursday, it was reported that the undertaking of the Company had been formally taken over, and that a cheque for the amount of the award had been paid.

The following claims for compensation have been put in by officials of the Brigg Gas Company: Mr. G. Jack, Manager, £1721; Mr. F. C. Hett, Secretary, £562; Mr. C. Clark, Collector, £753; Mr. C. E. Torry, Auditor, £51. With the view of effecting a compromise, the Council have decided to make the following offers to the respective claimants: Mr. Jack, £400; Mr. Clark, £135; and Mr. Hett, £200—the claim of Mr. Torry being altogether ignored.

AMERICAN COAL-GAS STATISTICS.

Our American contemporary "Progressive Age" has been favoured with an advance copy of the portion of the twentieth annual report of the United States Geological Survey, which contains statistics relating to illuminating and fuel gas and residual products. The following table, given in their number for the 15th ult., has been compiled from them.

States.	Companies; number reporting.	Coal carbonised; total	Coal Gas.						Tar.			Coke.			Ammoniacal liquor.	Gas, coke, tar and ammonia.
			Gas made		Kind.		Average price.		Quantity; total.	Price per gallon.	Yield per ton coal.	Quantity; total.	Price per ton.	Yield per ton coal.		
			Total.	Per ton coal.	Illuminat'g	Fuel.	Illuminating.	Fuel.						Per cent.		
		Short tons.	Cubic feet.	Cu. ft.	%	%			Gallons.	Cts.	Gallons.	Short tons.			Value.	Total value.
Alabama	9	16,929	105,941,100	6,258	84	16	$1.74	$1.33	166,810	4.87	9.86	10,140	$3.295	59.9	....	$205,039
Arkansas	3	3,300	26,673,200	8,083	80	20	2.00	1.43	39,500	6.82	11.97	2,160	3.303	65.5	....	60,140
California	26	27,740	266,904,824	9,622	82	18	2.17	1.87	272,448	6.12	10.12	16,471	9.167	59.6	....	710,724
Colorado	4	16,931	154,990,300	9.154	75	25	1.53	1.03	192,900	5.60	10.00	9,948	3.764	65.1	$1,367	263,418
Connecticut	7	42,751	429,509,570	9,908	77	23	1.34	1.03	438,476	5.88	9.39	28,298	3.639	63 8	2,989	637,274
Delaware	3	6,458	58,736,800	9,095	75	25	1.04	1.03	133,000	4.33	12.16	4,134	2.624	64.0	1,000	78,893
Georgia	8	23,870	202,635,900	8,489	70	30	1.31	1.08	262,911	4.19	11.25	15,532	4.003	64.7	36,176	357,719
Illinois	26	55,850	508,561,350	9,106	67	33	1.33	1.16	674,758	3.08	11.51	34,280	3.291	61.4	3,163	724,498
Indiana	20	55,344	512,375,912	9,258	80	20	1.35	1.01	624,482	2.23	10.36	31,175	2.766	56.3	4,577	701,634
Iowa	13	19,657	184,677,047	9.106	70	30	1.54	1.39	224,010	3.99	10.04	12,157	4.464	58 3	....	322,382
Kansas	9	17,529	149,879,866	8,550	80	20	1.48	1.34	176,830	4.34	10.66	10,294	3.630	62.1	....	239,164
Kentucky	9	49,386	466,912,000	9.454	80	20	1.37	0.82	592,400	2.64	12.00	29,567	2.563	59.9	836	595,042
La. and Miss.	3	3,009	23,342,601	7,758	82	18	1.83	1.50	23,619	6.51	7.85	1,835	3.559	61 0	....	41,062
Maine	5	9,934	129,674,270	9,828	89	11	1.36	1.31	134,615	5.27	12.66	6,634	4.023	66.9	1,081	191,852
Md. and D. C.	5	7,639	70,090,400	9,175	94	6	1.40	1.12	106,100	3.78	13.89	4,721	2.325	61.8	25,715	137,553
Massachusetts	45	179,706	1,788,133,565	9,950	93	7	1.28	1.20	2,518,219	5.36	14.30	115,980	3.618	64.5	18,788	2,674,032
Michigan	21	56,882	536,570,736	9,433	64	36	1.19	0.98	685,589	3.65	11.51	46,480	3.491	63.6	10,264	734,548
Minn. and Neb.	4	16,038	178,599,000	9.547	86	14	1.40	1.33	181,564	2.82	11.32	9,809	4.167	58.5	....	282,695
Missouri	20	124,518	1,131,978,890	9,091	68	32	2.06	0.86	267,905	5.14	10.41	14,663	3.139	57.0	....	1,180,099
Mont. & N.Mex.	3	5,031	42,584,900	8,465	70	30	2 17	1.97	40,548	10.17	8.06	3,027	4.606	60.2	....	94,859
Nevada	3	815	6,939,900	8,515	98	2	4.48	2.97	8,750	9.09	10.74	363	14.168	44.5	....	36,825
N. Hampshire	4	13,160	125,419,893	9,530	95	5	1.46	1.40	159,383	5.73	12.11	8,731	3.000	66.3	578	212,058
New Jersey	13	25,173	239,909,555	9.421	90	10	1.59	1.42	325,921	3.77	12.88	15,689	2.868	58.6	1,682	390,059
New York	41	411,188	4,035,178,038	9.723	98	2	1.16	1.15	4,799,740	3.83	11.03	248,271	3.468	59.5	22,041	5,610,138
N.&S.Carolina	3	11,138	109,113,500	9.797	79	21	1.64	1.20	118,916	4.73	10,68	6,896	5.310	61.9	....	207,562
N. Dak., Utah & Wyoming	3	2,602	26,520,000	10,192	64	36	1.82	1.11	33,129	7.01	12.73	1,352	5.865	52.0	....	48,947
Ohio	41	299,353	2,935,993,358	9,808	86	14	0.96	0.83	3,901,258	3.11	13.59	205,947	1.852	68.8	90,037	3,159,376
Oregon	4	5,112	38,780,000	7,586	83	17	2.28	1.62	69,819	8.51	9.08	2,399	4.707	52.6	450	94,141
Pennsylvania	22	310,043	2,867,466,490	9,249	99	1	1.03	1.02	163,103	2.63	13.58	190,591	1.868	61.5	13,720	3,381,149
Rhode Island	4	50,669	499,814,400	9,864	73	27	1.18	1.11	646,130	4.91	12.75	33,608	2.650	66.3	13,483	702,593
Tennessee	8	34,511	304,944,820	8,836	84	16	1.49	1.14	393,445	3.34	11.40	22,636	2.886	65.6	9,380	452,905
Texas	11	15,393	144,970,500	9,418	62	38	2.14	1.51	173,304	6.81	11.26	9,461	5.013	61.5	140	302,701
Virginia	9	22,384	203,564,372	9,094	98	2	1 17	1.25	218,546	3.15	9.76	11,025	2.491	49.3	132	251,335
Washington	6	13,928	129,688,100	9,311	94	26	1.97	1.51	117,606	8.64	8.44	8,295	4.138	59.6	....	277,438
W. Virginia	5	17,530	151,416,900	8,637	98	2	0.82	1.28	231,806	2.62	13.22	11,186	1.351	63.8	2,717	125,511
Wisconsin	13	71,197	680,972,900	9.565	63	37	1.09	0.81	1,267,258	2.31	12.70	42,524	3.052	59.7	23,832	815,029
Total	433	2,042,698	19,469,464,957	9.465	87	13	1.19	1.03	24,384,798	3 70	12.55	1,216,279	$2.961	62 6	$284,148	$26,300,394

NOTE.—A further list of totals might be added. For example, the report gives the total value of tar recovered as $902,400; value of sulphate of ammonia made by the works, $10,430; total value of coke made, $3,601,121; total value of bye-products, $1,798,099; and of coal gas sold, $21,502,295. Of the 18,431,201,414 cubic feet of coal gas sold, 86·57 per cent. was for illuminating and 13·43 per cent. for fuel purposes. This seems small; but it is no doubt compiled from reports.

Commenting on the table, our contemporary said: Care seems to have been taken not to include water gas, oil gas, or gas made from other materials than coal; the oil-gas enricher being excluded, for example, from the column devoted to gas, made per ton of coal. It will be seen that there are 433 works in which coal gas is treated separately. There was a total of about 990 gas companies in the United States in 1898, according to the statistics in Brown's "Directory of American Gas Companies for 1898," and the distinctly coal-gas works are thus apparently nearly half the total. The report states that of the total 30,385,468,668 cubic feet of gas made, 38·64 per cent. was coal gas, 60·37 per cent. water gas, and 0·99 per cent. oil, resin, or wood gas. In 1894, there was a compilation made of the approximate annual output of gas companies in America; arriving at a total of 52,642 million cubic feet, 59·17 per cent. of which was water gas, and 40·83 per cent. coal gas. In the first place, the production has increased enormously since that time, and is now probably more nearly 80,000 than 50,000 millions. Again, the proportion of water gas has been increasing instead of diminishing, so that at present probably three-fourths of the gas made is water gas. The total average price is given as $1·16 per 1000 cubic feet. As the average of all gross prices is about $1·60, due weight being given to the quantity sold, it would appear that the average discounts were over one-fourth the gross price. The author of the report (Mr. W. B. Phillips) gives the average unaccounted-for coal gas as 5·33 per cent. of the total make; so that the leakage was somewhat less than this. In the table it will be interesting to note the influence of various qualities of coal upon yield and residuals. It is difficult to see why Massachusetts should obtain 14·3 gallons of tar per ton of coal while its neighbour, Connecticut, recovers but 9·39 gallons. The yield from some of the "lean" coals is also notable. These, however, are simply details and will no doubt be revised as the compilers get more expert in interpreting and verifying reports.

THE PRODUCTION OF AMMONIACAL LIQUOR AND SULPHATE OF AMMONIA IN THE UNITED STATES.

In a recent number of "Progressive Age," Mr. W. B. Phillips gave some statistics on the above subject, extracted from the official report of the Division of Mineral Resources of the United States Geological Survey, contained in the last annual report (for 1898-9). The following extracts from his article are interesting in connection with the table of coal-gas statistics given elsewhere.

Sixty returns were made as to the amount of ammonia liquor produced at gas-works in 1898; and, in addition, there were six reports from establishments not giving a separate account of the liquor, but stating the amount of aqua ammonia produced. The total quantity of ammonia liquor reported by the 70 establishments was 25,749,792 gallons, produced from 1,358,094 tons of coal, and valued at $284,148. The strength of

the liquor was stated in various ways—some giving it in ounces, some in degrees Twaddel, and a very few in the percentage of anhydrous ammonia. It would appear advisable to adopt a uniform system for expressing the strength of ammoniacal liquor based on a more accurate principle than the old ounce system or the Twaddel system, and certainly the percentage system is much to be preferred. What percentage of ammonia does the gas liquor contain? This question once answered, there is nothing more to be desired, except the guarantee that the method adopted for the estimation of the ammonia shall be such as to commend itself both to buyer and seller. Throughout the trade generally, gas liquor containing 1 per cent. of ammonia is considered as 4-oz. liquor, and this is well understood. It would be advisable, therefore, to discard all other ways of grading gas liquor in favour of the percentage system, for this is the basis on which the liquor is bought.

The total amount of gas liquor produced in 1898, as mentioned above, was 25,749,792 gallons, for the production of which 1,358,094 tons of coal were required. The output of liquor per ton of coal, as well as the price per gallon, depends upon the strength, so it is obvious that no general average can be obtained. The production per ton of coal carbonized varies within very wide limits—*i.e.*, from 0·2 gallon to 137·8 gallons—while the price per gallon varies from 0·3 c. to 18 c. Of liquor giving from 1 to 5 oz. of ammonia per gallon, there were made 23,767,678 gallons, or 92·4 per cent. of the total; from 5 to 10 oz., 1,027,102 gallons, or 4 per cent.; from 10 to 15 oz., 80,100 gallons, or 0·3 per cent.; from 15 to 20 oz., 214,850 gallons, or 0·8 per cent.; from 20 to 25 oz., 575,910 gallons, or 2·2 per cent.; from 25 to 30 oz., 45,752 gallons, or 0·3 per cent. The amount of liquor containing less than 10 oz. of ammonia, or 38·8 oz. of sulphate of ammonia, per gallon is 96·4 per cent. of the entire output. It is not customary in America to concentrate the liquor sold to the distilling companies above what is known as "30-oz. liquor," or 7·5 per cent. of ammonia. The amount of liquor concentrated above this strength is comparatively insignificant, although a little is carried to "80-oz.," corresponding to 20 per cent. of ammonia, or 27·83 oz. of ammonia (= 107·98 oz. of sulphate of ammonia) per gallon.

It is thought that the total production of sulphate of ammonia from gas liquor did not exceed 3000 tons in 1898. If all the liquor reported had been worked up into sulphate, the production would have been 11,974 tons. The difference between these figures—8974 tons—represents the sulphate that could have been made, but was not made because the ammonia distilled from the liquor was used in some other form. In other words, the 8974 tons represent 2316 tons of anhydrous ammonia obtained from gas liquor, but not made into sulphate. Besides sulphate, there are other valuable uses to which ammonia is put—*i.e.*, in ice factories, chemical works, &c.; and there is a large and increasing demand for it.

ELECTRIC LIGHTING NOTES.

The Stourbridge District Council have resolved to oppose the application of the Midland Electric Corporation for Power Distribution, Limited, for authority to distribute electricity in the district.

The recent failures of the Metropolitan Electric Supply Company to furnish their consumers with current are to be brought under the official notice of the President of the Board of Trade, who has consented to receive a deputation on the subject on the 17th inst.

At Leigh, the electric light supply was switched on for the first time last Tuesday. The installation has cost above £10,000. At present only the compulsory area is supplied; but extensions are already projected. The charges are 7d. per unit for the first hour, and 2½d. per unit after. The question of electric traction, it is said, is now being considered.

The foundation-stone of the power station in connection with the electrical undertaking of the Wigan Corporation was laid last Thursday by the Mayor (Mr. J. T. Gee). It is anticipated that the new venture will involve an expenditure of £85,000 for the purpose of electric lighting and £40,000 on two lines of tramways, to be further developed for the whole of the system; making a total outlay of between £300,000 and £400,000. The Mayor, in declaring the stone laid, said he expected that within a very short time they would not only be able to supply the borough itself, but also the out-townships. They had to prove to these townships that the Corporation could supply electricity with greater facility and as cheaply as they could produce it themselves.

In reviewing the past year's work of the District Council of Larne, the Chairman (Mr. D. M'Quillan) remarked that Larne claimed to be the second town in Ireland to adopt electric lighting; but, unfortunately, it could not lay claim to being one of the best or cheapest lit towns. However, the Council had appointed a Committee, who were at present considering the entire question of the public lighting of the district whether by gas, by electricity, or by both; and he hoped they might soon be in the position of other public bodies who were able not only to light the streets without cost to the ratepayers, but at the same time to pay over a nice surplus to the relief of the rates. On presentation of the account of the Electric Light Company for the half-season's lighting, amounting to £195 5s., considerable discussion took place; it being eventually decided to issue an order for the amount, and claim a recoupment in respect of unsatisfactory lighting.

The formal transfer of the undertaking of the Birmingham Electric Supply Company to the Corporation took place yesterday week, when Mr. E. V. Hiley (Deputy Town Clerk) and Mr. T. H. Clare (City Treasurer) paid over to Mr. J. C. Vaudrey (Managing Director) and Mr. R. A. Pinsent (Solicitor to the Company) a cheque for £120,000, and received in return the deed of conveyance of the assets of the Company. It is now about two years since the agreement to purchase was arrived at; but it was arranged that the Company should continue to carry on the business, receiving a profit of 6 per cent. for 1898, but handing over the profit for 1899. The accounts, which will be presented by the Electric Light Committee at an early date, will, it is understood, show that, even at the high price at which it has been purchased, the concern comes into the hands of the Corporation as a paying enterprise. The history of the Company practically covers a period of ten years. It was registered in December, 1889, with a capital of £200,000 in £5 shares, all of which has been called up. The Company started supplying current in April, 1891, and at the end of December carried forward a credit balance of £361. In 1892 a dividend of 3½ per cent. was paid; while in the succeeding years the dividends were: 1893-5 4 per cent., 1896 4½ per cent., 1897 5 per cent., 1898 6 per cent. The price at which the Company consented to sell to the Corporation was calculated on the basis of £10 10s. per share. The Corporation take over the staff of the Company; and Mr. Vaudrey becomes Electrical Engineer to the city.

Another of the series of explosions caused by faults in the electric cables of the city occurred near the Manchester Royal Exchange shortly before two o'clock last Friday afternoon. A terrific report startled the neighbourhood, and the stone flags in front of the Exchange were lifted for a distance of 20 yards. At the same time flames shot from a large opening near Bank Street. The officials of the Corporation Electricity Department were promptly on the scene. There were crowds of people on 'Change at the time, and thousands more quickly assembled in the streets. When the excitement had somewhat subsided, it was found that no one had been seriously hurt. This was a most miraculous circumstance, as a great many people were near the spot at the time of the explosion. The Fire Brigade were summoned, and they soon put out the fire. Mr. C. H. Wordingham, the City Electrical Engineer, who visited the scene shortly after the accident, explained that it was due to the fact that the old-fashioned rubber cables were liable, under certain conditions, to portions of the insulating material melting from excessive heat, and generating an explosive mixture. For some time past, his department had been busy in the removal of this class of cable from the streets; but of late there had been a slackening of the work from a desire not to interfere too much with the Christmastide business in the locality. The cable which was the cause of the explosion was a portion of a comparatively small section now waiting to be replaced, and it would be entirely removed before long. The accident caused a temporary resort to gas; but the supply of electricity throughout the city was not affected to any considerable extent.

From a report prepared by Mr. J. H. Rider, the Borough Electrical Engineer, it appears that it is already necessary to enlarge the Plymouth municipal electricity works in order to meet the demand for current. In addition to supplying the electric tramways and the arc lamps for street lighting, the machinery can serve 7500 8-candle power lamps at one time. There is, however, a demand for more than 12,200 lamps; and in order to provide for present and future requirements, Mr. Rider recommends that additional plant be provided to raise the capacity of the works to 25,000 lamps, in addition to the arc lighting and the tramways. He also proposes an extension of the cables in certain streets where they do not exist. In all, it is proposed that for private lighting purposes additional borrowing powers to the extent of £48,000 shall be obtained. This sum includes £10,720 which was spent of the sum originally borrowed for the construction of the works, and £12,500 for the extension of the buildings, which will then be adapted for further additions to the plant. A very modest estimate is formed by Mr. Rider of the profit which is to result from this outlay. The extra lamps should, he says, bring in a revenue of about £5000 per annum. But assuming that the Corporation can borrow the money at 2¾ per cent.—which is by no means certain now—and that 25 years is allowed for its repayment, the interest and sinking fund charges will come to £2750 per annum, while the additional wor ks charges will be about £1500 per annum. The net profit, therefore, will be only £740, or 1½ per cent. on the outlay. Whether the works charges—which Mr. Rider described as "coal, water, wages, &c."—include a renewal or depreciation fund, is not clear. If not, the realization of even so small a profit as £740 may be difficult. On the other hand, if the business continues to grow, future extensions can be carried out at less cost, because the buildings now to be erected will accommodate more machinery than is to be immediately installed.

The correspondence on the subject of the dangers of wood casing for electric light cables, recently initiated by Mr. Montague Crackanthorpe in "The Times," has been continued. On Monday last week, a letter appeared from Mr. Musgrave Heaphy, whose name is well known in connection with the formulation of the Fire Insurance Companies' rules in regard to electric lighting, which, it appears, have now reached their 29th edition. He said that "so safe are electrical installations when placed up in accordance with the well-known fire rules, that one of the greatest English Fire Offices, with many thousands of electrical installations insured with it, has never had to pay a shilling for loss with regard to any installation (so far as it can trace) when placed up in accordance with its rules." The first rule runs as follows: "Where practicable, all conductors in a building should be so placed as to be easily accessible, and capable of being thoroughly inspected whenever required. Conductors should not be run out of sight, such as between floors and ceilings, inside roofs, behind skirting boards, wainscoting, &c., if it can be avoided." Mr. Heaphy is an advocate for enclosing conductors in approved fireproof tubes or fireproof casing where they can be adopted; and he has devoted a great deal of attention to the subject. Unfortunately, he says, it makes the work expensive; and to compel all installations to be placed up in this manner, might to a large extent prohibit the use of electric lighting in this country. After all, however, it is not the wood casings that cause the fire, but the work that is inside them. He concluded his letter as follows: "My experience, which has been a very large and long one with regard to electric fire risks, is that no form of illumination is so safe as the electric light, if it is properly placed up; but if the requisite precautions are not taken, then it may be a cause of great danger. What I would earnestly advise anyone to do who has any doubt or fear on the matter, is to have the electrical work supervised by a consulting electrician (of whom there are many very competent men), and instruct him to see that the work is placed up in accordance with the advice of the Fire Office, and that afterwards the installation is not allowed to get out of order, as is often the case. I do not think then that any user of the electric light would have much cause for alarm." Another correspondent—Mr. A. Grove—after alluding to the fear which had been caused by Mr. Crackanthorpe's letter, made the following remarks: "Had your correspondent chosen, he could have had his wires protected by iron or steel pipes, or, if experimentally inclined, by one of the patent substances referred to in his letters. But, whatever is used for the purpose, foresight and good workmanship lie at the root of the matter. In common with all the details of electric lighting, the use of wood casing has been very much abused, and it has been made the medium of much scandalously bad work; but that is no reason why what is so useful a material when intelligently used should be condemned

altogether." Mr. Crackanthorpe replied to these correspondents in a letter which appeared last Wednesday. He said he had read their letters with some amusement, as both writers had unconsciously shown themselves to be of his own opinion. One advocated enclosing the conductors in approved fireproof tubes or casing; and the other said he (Mr. Crackanthorpe) could have had his wires protected by iron or steel pipes. This, he said, was precisely what he wished he had done. With regard to the rules of the Fire Offices, he characterized them as merely "a red herring across the path;" the practical question being: What are the actual requirements insisted upon by the Insurance Companies before granting a policy? He had under his eye a copy of those in use by one of the leading Companies, and it gave no caution as to laying wires between floors and ceilings; while with regard to wood casing it said: "In most instances, the use of wood casing or approved metal piping throughout is advisable, and if there is any risk of injury to the insulation of the conductors it [without specifying which, or hinting any preference between the two] must be used." Mr. Crackanthorpe went on to say that the revised rule quoted by Mr. Heaphy did, it was true, specify that "conductors should not be run out of sight, such as between floors and ceilings, &c., if it can be avoided;" but he suggested that the last five words had better be omitted in the next edition. Avoidance was always possible, and should not be left to the discretion of the electrical contractor. He closed his letter as follows: "It is not a little remarkable that neither Mr. Heaphy nor Mr. Grove makes the smallest allusion to Professor Silvanus Thompson's letter of Dec. 22, in which he declares that "he would not allow an inch of wood casing in his own house." One would have thought that the President of the Institution of Electrical Engineers was a foeman more worthy to be met in the open than an ignorant Q.C. While your correspondents fight under shelter of my fire, they obviously shrink from again drawing his." The subject has brought letters from several other correspondents.

THE MINERAL OIL AND PARAFFIN INDUSTRY OF SCOTLAND DURING THE PAST YEAR.

The following article on the above-named subject recently appeared in the "Scotsman."

The mineral oil and paraffin industry is confined to a narrow strip of Scotland, extending from the neighbourhood of Edinburgh westwards as far as Renfrewshire, and governed, of course, by the presence of shale strata in paying seams. The pick of the field is found in the counties of Mid Lothian and West Lothian. Workable plots occur in Fifeshire, Lanarkshire, and Renfrewshire; but these constitute the mere outposts of the main territory. Shale is found in many parts of the country, and at varying depths; but it is only within the bounds thus briefly sketched that the mineral is encountered in a thickness of seam and goodness of quality sufficient to induce the working of it on an industrial scale. Thickness and quality vary considerably even within the same field; and the constituents are never precisely alike in samples taken from different beds. Some give a rich yield of sulphate of ammonia, while they are less productive in oil and solid paraffin; with others it is the reverse. In the process of the distillation of the shale mineral, crude oil and sulphate of ammonia are first produced; afterwards the crude oil is subjected to an elaborate series of mechanical and chemical operations, whereby the manufacturer gets the more refined products and variants in a form suitable for being put on the market. These are burning oil (for lamps and oil stoves); lubricating oil; grease-making and gas-enriching oil; paraffin spirit (known as naphtha on the market), and paraffin scale—the last-named being a solid. The main consumers of paraffin scale are the candle makers of England and Scotland. By them this solid paraffin is further cleansed and refined into the beautiful product paraffin wax, which, though chiefly used for candle making, is also employed in many other ways, and partly as an art material. For the products thus enumerated, the year 1899 was truly a remarkable year. In the review of the industry for the year 1898, there was indicated the promise of better times for this long-time sorely-badgered manufacture. The reality has much more than justified the forecast then presented; for the year 1899 witnessed the advancement in market value of not one or two only of the products, but of the whole of them without exception, and that in no stinted fashion, as the following particulars will show.

As the year opened, sulphate of ammonia fetched fully £10 per ton—a fairly good price, having regard to the low values formerly ruling. It is a very volatile article on the market, changing almost every day, and sometimes several times in one day; being subject to no agreement among the producers, as is the case with some other products. On to the beginning of June the general tendency was to the rise; and to good purpose, too, for at that time it had mounted to £13 per ton—a gain of £3 within a period of six months. This summit was not long kept. But good values still ruled, though on a gradually descending scale; and makers were into September before the article fell below £12. In November, it made a dip down to £10 7s. 6d., but immediately recovered; and as the year was closing in, the figure was over £11. Altogether, a very satisfactory year it has been for sulphate of ammonia from the makers' point of view. But burning oil is still the foremost product of all the refining companies; being by far the bulkiest, and, therefore, the most profit-producing when values are satisfactory, and the most unprofitable when these values fall below the remunerative point, as they have sometimes done. This article is marketed under a mutual agreement between the various producers in Scotland. Each August brings these producers into conference, at which the price of burning oil is fixed for the coming winter season. The thing which governs these annual conferences is not mere inclination or expediency, but simply the condition of the American petroleum market. If it happens to be very low, the Scottish makers must stoop accordingly, or find themselves out of the market altogether. There is no choice. Too often the Scottish price has been thus pressed down to beneath the paying point; and company after company has gone under in consequence. But of late the over abundant American supplies have been decreasing in volume, while the markets of the world have been growing; and the Scottish makers find themselves nothing like so sorely pressed. In August, 1898, the season's price per gallon was fixed at 6d. and 6¼d., according to quality. This was not bad; but it might have been better if the course of the American market could have been foreseen. In August, 1899, American stiffness still holding, the Scottish makers found it open to them to ordain a substantial advance of ¾d. per gallon over the fixture of the previous year. This represented a great stride, for the figure of ¾d. a gallon, humble as it looks, means the addition of many thousands of pounds of revenue to the industry as a whole for the working year 1899-1900. Contracts were freely fixed at this advance, and values on the market have been well maintained.

The heavier oils of the manufacture are those suitable for batching and lubricating; and they also are largely ruled, as to the market condition, by the disposition of the American competitors, and the quantity imported by them. For some years Scottish lubricants have been permitted to maintain a fairly respectable grade, and now and again they have been the only item on the list of production which left any profit worth speaking of. When the year began, gravities from 865° to 895° were bringing in from £4 15s. to £6 10s. per ton. They were in brisk demand; and altogether this section was held to be in a healthy condition. But American lubricants continued to creep up, and they have so continued; enabling the Scottish makers to increase their values to such good purpose that the range now is from £6 to £8—representing an advance of 30s. per ton for the higher of the gravities, and quite 25s. for the lowest. A great lift this is for the industry, more particularly as the demand does not seem to have been in any way checked by the advance. Naphtha, as one of the products of shale, is always small of bulk. But it counts for something; and during 1899 it maintained quite a high value. The average for 1898 was 6½d. to 7½d. per gallon. But there has been almost a complete doubling of price since then; and 1s. per gallon is now being obtained. This product has no imported rival as in the other cases; and the industrial applications of it (apart from being an illuminant) are increasing every year. But, as regards the past year of advances all along the line, the most notable item, on many accounts, is that of solid paraffin, long sorely kept under by the heavy and cheaply-priced imports from America. There was some little betterment during 1898. But this was not enough for a sufficient margin of profit; and one or two of the works had still to produce at little more than cost price, if not at a positive loss. A further advance was registered just as 1899 began, making the range 1¾d. per pound for hard paraffin scale, up to 2½d. for semi-refined paraffin wax. It happened to suit the book of the American petroleum refiners to get as much for their scale and wax as they could; and accordingly, under informal agreement with the Scottish makers, there have been several further rises since—the last and most important being in November, after Mr. Bedford, of the American Standard Oil Trust, had visited Glasgow, and had friendly conference with the chiefs of the Scottish industry. The range is now the handsome one of 2¾d. to 3½d. per pound, according to the degree of refinement; and granting continuance, of which there is some reasonable prospect, there is in it salvation for even the most badly battered of the surviving companies. These solid paraffins comprise a large annual production, and there is much money in it, when the market rates are remunerative, as for years, till now, they have not been.

The above, on the face of it, is a very favourable—almost a glowing—account of the present circumstances of a great Scottish industry, which only the other day was on the brink of ruin. But there are drawbacks, of which account also must be taken, before a strictly proportioned view of the situation is obtainable. Costs of production have become dearer in every item of them, and very dear in the chief items. Large quantities of fuel are needed, and fuel has become very costly. Labour charges are all enhanced; and chemicals, of which there is a large consumption in the refineries, which likewise mounted, are still mounting. On companies that would thrive in the future, it is imperative to have their retort plant of the newest and most economical types; and the renewal of retorts runs into large outlays of capital. Some of the companies have managed, or are managing, to effect this; but others, more sorely burdened, are not sure about the necessary ways and means, and lag behind at a great disadvantage. What the precise effect of the higher market values is, will not be known till the annual balancing period in the spring of 1900. The balancing in the spring of 1899 proved only too surely that the time of struggle had not by that time ended. It has to be borne in mind, however, that, owing to the "forward" contract system so largely obtaining in the industry, it is possible for the benefits of a rise in market value not to be felt by makers until nearly a full year thereafter.

The Broxburn Company, which paid 7½ per cent. in 1898, and was the only concern paying anything at all that spring, bettered its shareholders by 1 per cent. in 1899; the rate of division being 8½ per cent., after fully providing for other burdens. The Oakbank Company resumed paying dividend with 5 per cent., which was a good mark to make. The Pumpherston Company did better than over the foregoing year; but had still nothing for the ordinary shareholders. The Holmes Company again showed a loss; but it was a very small one. The Linlithgow Company came out with a continued leakage of capital; but nevertheless the directorate showed itself in good hope for the future, providing the market improvement lasted. Young's Company was much the worst of the lot, with the serious deficiency of over £17,000, and at first carrying dismay into the ranks of the shareholders. Here, improved retorts are expected to do much for retrieval; and that confidence is not entirely killed has been shown by the advance in the value of the shares since the latest of the product rises in the market. The Clippens Oil Company have their works still closed, waiting finality in their action with the Edinburgh and District Water Trustees; and Directors and shareholders are living and waiting in the one hope of being awarded damages commensurate with the losses sustained. The Hermand Company—shut down for years owing to low market values—has now been reconstructed, and the works have been reopened. The Caledonian Company (of Tarbrax, Lanarkshire), which had been forced into liquidation by the pressure of bad times, though wisely kept on a going footing by the creditors, has also been reconstructed and rehabilitated, and now looks forward to being able to show a good balance in 1900. The Dalmeny Company—of small capital, and confined to the production of crude oil and ammonia only—balance at the end of October; and the announcement of the results was looked for daily as the year closed in. At the end of 1898, they announced a 5 per cent. dividend, and now it is likely to do better. In the old good times, the Dalmeny Company returned to the shareholders as high as 25 per cent. on one year's working.

As might have been expected, the remarkable year 1899 did not run its course without trouble to the companies of the wages agitation description. Miners, retort men, and others, were on the quest for higher rates, with a bettering market to back them; and masters generally made substantial concessions—only on the saving understanding, however, that they were not to be attacked again in this way till after the 1900 spring balancing. It is felt that the long-suffering shareholder should at last have some little return for his investment.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

When I wrote what appeared in the last number of the "JOURNAL" about the Corporation of Glasgow ascertaining the facts relative to the operation of Conciliation Boards elsewhere, I scarcely expected that the facts would begin to, so to speak, prove themselves. Yet so it is. Yesterday there appeared in the columns of the "Glasgow Herald," a letter by Mr. A. R. Cawley, Manager of the Llanelly Gaslight Company, in which he says:

I desire, by means of your paper, to take strong exception to several of his [Mr. Burgess's] remarks. First, that a London Executive is a steadying force; second, that it sits as a Court of Appeal; third, that before a district can enter upon a strike, it has to satisfy the London Executive that there is no alternative course open if justice is to be done. If the latter statement is correct, then I ask why the stokers at Llanelly Gas-Works were allowed upon two occasions (May and September, 1898) to cease work without notice. Both times the works were stopped before the questions in dispute were 24 hours old, and the town in darkness. Upon the latter occasion, Mr. Will Thorne, the General Secretary of the Gas Workers' Union, stated at an interview with the Directors of the Llanelly Gaslight Company that the men had been out on strike 24 hours before he was aware that there was any dispute. So "what price" the hird statement made by Mr. Burgess? The Directors upon both occasions offered to refer to arbitration; but it was refused in the latter case by the General Secretary of the Union himself, so that really the whole of Mr. Burgess's statements go overboard. I may here state that the questions that have been in dispute at Llanelly were very simple. The Company claimed as employers to use their own discretion in cases of promotion. The men claimed to say—and were supported by the Union—which men were to be promoted to any vacancy that might occur, they proceeding according to the rotation in which the men entered the service of the Company—qualifications not being taken into account. Instead of the London Executive being a "steadying force" in favour of conciliation, it appears to me to be more that of "domination." We have here at the Llanelly Gas-Works men employed who have not been engaged by the Company; but because they have been found employment in previous winters, the men who are members of the Gas Workers' Union insist upon them being employed this and future winters. The same state of affairs exists with regard to a number of men now working here who have on differe nt occasions been discharged for various reasons; the Union, by their support of the men, claiming to say whether the employees or the management were to have the right of judging when a man is doing his work satisfactorily or not. I think that your readers will agree with me that the foregoing actual state of affairs places a different light upon the objects of the Union to those advanced by Mr. Burgess.

In another of your issues, he names a number of places where the Union is recognized, of which one is Manchester. I think that his connection with the Union cannot date very far back, or else he would remember that exactly 11 years ago practically the same state of affairs existed there as now exists at Glasgow; but the Corporation of Manchester (the Salford Corporation also), in the interests of the gas consumers and the ratepayers, gave battle to the Union—the fight ending disastrously for the men, many of whom never again entered a gas-works. In regard to the signing of contract notes for a period to cover the winter season, I am strongly of opinion that it is the proper course to adopt at a gas-works—especially so when is taken into consideration the number of people who are dependent on the regular working of a gas-works. In all works there are a number of vultures in the form of idle, dissolute men, whose only qualification is a noisy tongue, and who only retain their situations by means of the terrorism which they impress upon other men, who, for fear of molestation, are forced to follow their lead and instructions, much against their own will. The signing of the contract notes is a means of preventing the terrorism to a great extent, and thus allows a workman to discharge his duties to his employers as he agreed to do at his engagement. Glasgow is not the only town where contracts of labour are signed. There are many, as inquiry will prove. During the past twelve months, workmen who are members of the Gas Workers' Union have upon three occasions, at two different works in this town (a tinplate works and a copper smelting works), ceased work without giving notice—in each case practically throwing down their tools. The public not being dependent upon either of the works, the proprietors were able to shut up the works for an indefinite period; and the result on the three occasions was that the strikes fizzled out, the men returning to work upon the same conditions as before.

I think that the Corporation of Glasgow, and your readers in general, will from the above, without much difficulty, be able to judge what will be the state of affairs in the Gas Department if the proposed Conciliation Board ever becomes an actual fact.

If a few more gentlemen who have had experience of what conciliation means would follow Mr. Cawley's example, and give their colleagues the benefit of their views, it might be possible to educate the Glasgow Corporation to a knowledge of the right in this matter, before they are called upon to consider the Conciliation Board proposals. Mr. Cawley's arguments are the more valuable in that they do not rest upon theory, but are based upon actual observation and experience.

To-day Mr. Burgess writes to the "Glasgow Herald" to say that he cannot answer Mr. Cawley's letter, as it contains statements of fact of which he has no knowledge; but that he has sent the letter on to the Central Office of the Union, and he asks judgment to be suspended until a reply is received. He then adds that he was only temporarily acting as District Secretary at Glasgow, during the illness of the Permanent Secretary, and that his duties terminated on Dec. 16. Verily, being only a temporary hand, Mr. Burgess had about as cool an assurance as has ever been manifested in his action with reference to the Glasgow Corporation's attitude towards their gas workers.

The proposal of a Committee, who have been considering the subject for a year and a half, was accepted by the Corporation of Glasgow this week, to the effect that the Corporation should form an insurance fund for the restoration of property belonging to them which may be destroyed by fire. From notes supplied by Mr. Nicol, the City Chamberlain, it

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 77.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 13	10½	Alliance & Dublin 10 p. c.	21—22	..	4 15 5
100,000	10	,,	7½	Do. 7 p. c.	14½—15½	..	4 16 9
800,000	100	Jan. 2	5	Australian 5 p. c. Deb.	100—102*	+½	4 18 0
200,000	5	Nov. 15	6	Bombay, Ltd.	5¾—6¼	..	4 8 11
40,000	5	,,	5	Do. New, £4 paid	4—4½	..	5 6 8
880,000	Stk.	Aug. 16	12	Brentford Consolidated	273—278	..	4 6 4
270,000	,,	,,	9	Do. New	210—215	..	4 3 9
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb.	124—128	..	3 2 6
220,000	Stk.	Sept. 15	11½	Brighton & Hove Orig.	250—260	..	4 8 6
226,320	,,	,,	8½	Do. A. Ord. Stk.	183—188	..	4 10 5
973,500	Stk.	Aug. 16	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Sept. 29	10	British	43¼—44½	..	4 9 10
50,000	10	Aug. 31	12	Bromley, Ord. 10 p. c.	25—27	..	4 8 11
75,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd.	9—9¼	+¼	6 6 4
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	98—100*	..	4 0 0
150,000	20	July 13	8½	Cagliari, Ltd.	28—29	..	5 13 10
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	13½—14½	..	5 10 4
50,000	50	Nov. 2	6	Do. 6 p. c. 1st Mort.	56—58	..	5 3 5
550,000	Stk.	Oct. 13	13½	Commercial Old Stock	305—310	..	4 7 1
200,750	,,	,,	10½	Do. New do.	240—245	..	4 5 9
200,750	,,	Dec. 14	4½	Do. 4½ p. c. Deb.	140—145	..	3 2 1
800,000	Stk.	Dec. 14	9	Continental Union, Ltd.	177—181	..	4 19 5
200,000	,,	,,	7	Do. 7 p. c. Pref.	178—183	..	3 16 6
51,600	Stk	Aug. 31	14	Croydon A 10 p. c.	335—340	..	4 2 4
168,400	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
556,000	Stk.	Aug. 16	5½	Crystal Palace Ord. 5 p. c.	130—135	..	3 17 9
60,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
486,090	10	July 28	11	European, Ltd.	21—22	..	5 0 0
854,060	10	,,	11	Do. £7 10s. paid	154—16½	..	5 0 0
14,993,075	Stk.	Aug. 16	4%	Gaslight and Coke	4 p. c. Ord.	104—106	..	4 12 5
2,000,000	,,	,,	3½		3½ p. c. max.	97—99	..	3 10 8
3,799,795	,,	,,	4		4 p. c. Con. Pref.	119—122	..	3 5 7
3,993,975	,,	Dec. 14	3		3 p. c. Con. Deb.	96—98	..	3 1 3
70,000	10	Nov. 15	8	Hongkong & China, Ltd.	13½—14½	..	5 10 4
3,000,000	Stk.	Nov. 15	10	Imperial Continental	212—217	..	4 12 2
473,600	Stk.	Aug. 16	3½	Do. 3½ p. c. Deb. Red.	101—104	..	3 7 4
75,000	5	Dec. 14	6	Malta & Medn., Ltd.	5—5½	..	5 9 1
560,000	100	Oct. 2	5	Met. of 5 p. c. Deb.	110—114	..	4 7 9
250,000	100	,,	4½	Melbourne 4½ p. c. Deb.	107—109	..	4 2 7
541,920	20	Nov. 15	3	Monte Video, Ltd.	11—12	..	5 0 0
617,946	Stk.	Aug. 31	9½	Newc'tle & Gatesh'd Con.	220—225	..	4 2 3
264,855	Stk.	Dec. 29	8½	Do. 8½ p. c. Deb.	104—107*	..	3 5 5
60,000	5	Sept. 29	7	Ottoman, Ltd.	5½—6¼	..	5 1 9

*Ex div.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
150,000	5	Nov. 30	8	Oriental, Ltd.	7—7½	..	5 6 8
135,000	5	,,	8	Do. New, £4 10s. pd.	6½—6¾	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.	1¼—1½	..	4 11 5
500,000	100	Dec. 1	6	People's Gas of Chicago 2nd Mtg. Bonds	102—106	..	5 13 2
851,070	10	Oct. 13	7	River Plate Ord.	10¾—11¼	+¼	6 4 5
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	98—100*	..	4 0 0
250,000	10	Sept. 15	10	San Paulo, Ltd.	12—13	..	7 13 10
135,000	Stk.	Sept. 15	10	Sheffield A.	249—251	+2	3 19 8
209,053	,,	,,	10	Do. B.	249—251	+2	3 19 8
447,427	,,	,,	10	Do. C.	249—251	+2	3 19 8
5,600,000	Stk.	Aug. 16	5⅓	South Metrop., 4 p. c. Cr.	133—136	..	3 18 5
1,520,000	,,	July 13	3	Do. 3 p. c. Deb.	101—103	..	2 18 3
120,000	Stk.	Aug. 31	6	Tottenham and Edmonton A. 5 p. c. B. 3½ p. c. 4 p. c. Deb.	141—143	..	4 3 11
250,520	,,	,,	4½		102—104	..	4 5 6
55,100	,,	Dec. 14	4		113—117	..	3 8 5
182,380	10	June 15	5	Tuscan, Ltd.	9—10	..	5 0 0
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.	101—104*	+6	4 16 2
				WATER COMPANIES.			
780,399	Stk.	Dec. 29	11	Chelsea, Ord.	305—310*	..	3 11 0
150,000	,,	,,	5	Do. 5 p. c. Pref.	157—162*	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	145—150*	+5	3 0 0
175,785	,,	Sept. 29	4½	Do. 4½ p. c. Deb.	148—153	..	2 18 10
1,720,560	Stk.	Oct. 18	7	East London, Ord.	200—205	..	3 8 4
654,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb.	145—150*	..	3 0 0
890,000	,,	,,	3	Do. 3 p. c. Deb.	98—100*	..	3 0 0
700,000	50	Dec. 14	7½	Grand Junction 10 p. c. max. 4 p. c. Deb.	107—109	..	3 8 10
310,000	Stk.	Sept. 29	4		131—136	..	2 18 10
708,000	Stk.	Aug. 16	14	Kent	348—353	..	3 19 4
160,000	,,	,,	7	Do. New, 7 p. c. max.	200—210	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.	293—297*	+2	3 10 8
400,200	100	,,	8	Do. 7½ p. c. max.	215—220*	..	3 12 9
350,000	Stk.	Sept. 29	4	Do. 4 p. c. Deb.	135—138	..	2 18 0
500,000	100	Aug. 16	13½	New River, New Shares	428—433	..	3 2 4
1,000,000	Stk.	July 28	4	Do. 4 p. c. Deb.	133—138	..	2 18 0
962,300	Stk.	Dec. 14	7½	South-wark and 5 p. c. Pref.	203—207	−1	3 12 6
126,600	100	,,	7½		190—195	..	3 16 11
489,200	Stk.	,,	5		160—165	..	3 0 7
1,019,585	,,	Oct. 13	4	Vauxhall 4 p. c. A Deb.	131—136	..	2 18 10
1,155,000	Stk.	Dec. 14	10	West Middlesex	290—295	..	3 7 9
200,000	,,	,,	4½	Do. 4½ p. c. Deb.	147—152	..	2 19 3
200,000	,,	Sept. 15	8	Do. 8 p. c. Deb.	100—103	..	2 18 10

appeared that the total net premiums paid in the last twelve years was £20,868; and the fire losses made good by the Companies in the same period was £7261. The average premium paid was 3s. 6¼d. per cent.; and the average of fire losses sustained, exclusive of fire-brigade charges, was 1s. 2¾d. per cent. The Committee recommended that a Committee should be appointed to manage and control the proposed Fire Insurance Department; that a fire fund should be established, into which all premiums received from departments for the property covered should be paid, and out of which all expenses incurred would be met; and that a reserve fund should be established to the amount of £30,000, contributed by the several departments of the Corporation. There was a good deal of criticism of the proposals; but, although they were far from being approved by many, no one moved disapproval of the Committee's recommendations, and so the Council unanimously approved of the scheme, and sent it back to the Committee to consider various suggestions which were made. The subject is one which, I should say, a Corporation ought to approach with caution. It was remarked by the advocates of the scheme that by it the expenses of management, which form a very large proportion of the Insurance Companies' outlay, would be saved. I very much doubt that. Once get the scheme established, and a fire or two occur, the heads of departments would begin to press for more efficient fire-prevention and fire-extinguishing arrangements. These would be provided; and the upkeep of them would require to be set off against the present annual charge for fire premiums. It is a scheme which, once started, can scarcely be gone back upon. Again, why stop short at property actually in the possession and occupation of the Corporation? In the matter of preservation from fire, the whole of the property within the city is in the hands of the Corporation, who, at great cost, maintain an establishment for attending to it. A few years ago the Corporation became bankers, by accepting deposits for fixed periods, known as loans. Why should they not extend their financial policy by becoming insurers of property against destruction by fire? It may be said that the scheme is too gigantic for the Corporation to work; but that argument is one which has no bottom. The saving in management expenses would be as great in the case of private as of Corporation property; and an insurance scheme would thus be a profitable investment. But, further, a colossal scheme is just what an ambitious town councillor likes, because it leads to office—and a title. Apart from these general considerations, however, there must be taken into account the particular questions of how such an insurance scheme would affect the various departments. A general Committee, such as is here foreshadowed, is apt to be rough-shod, and to have little compunction for the feelings of individual Committees. Say that a particular department were to obtain a majority upon the Insurance Committee, or a combination were to be formed against a certain department, would not the working results of some of the departments be thereby affected? And would there not be temptation to attempt some such courses? A Committee appointed to attend to a particular department might find part of their work taken out of their hands by the general Committee, and be thereby prevented from doing their work as they desired. In the matter, say, of levying the rate of charge for the insurance fund, were a rate proportionate to value to be adopted, how would the Water Committee fare? Nearly the whole of their property is impervious to fire; yet the Water Committee are wealthy, and it is easy to reach the argument that they could well afford to assist departments in which there was imminent risk of fire. How about the Gas Committee? Portions of the works under their charge are highly dangerous in the matter of explosions, which would be classed as fires; and other portions are not. Would the works be rated all alike? Most probably not at first, because it is to be presumed that the scheme, to start with, would be framed somewhat upon the lines of existing insurances. But should a fire occur in another department, and money be wanted, who can say what the general Committee might resolve upon in order to raise money? If the scheme be gone on with, the adjustment of the premium charges upon the various departments, so that they shall each bear the burden of its fire losses, and not throw it upon other departments, is almost a necessity. This is the initial difficulty to be faced. But over and above all, is it not open to remark that it is possible to over-municipalize it? An Admirable Crichton cannot always be at the head of municipal business; and if an Admirable Muddle should arise—a by no means infrequent official in the service of corporations—profits on paper would be converted into losses in reality. The figures submitted showed that in twelve years the Corporation of Glasgow paid in fire insurance premiums £13,000 more than they received in compensation for fires, Little more than £1000 a year loss. How much of the £1000, under the most favourable circumstances, would remain, after paying for a staff of clerks to manage, and maintaining a more efficient fire establishment? And in the event of the most unfavourable circumstances arising—say, a £100,000 fire—what would the loss be?

In supplement of what I wrote last week regarding the outcry about the scarcity of coal, I may state that I have information that in Fifeshire the pit mouths are congested with waggons filled with coal. It is said by the owners that the railway companies cannot carry it away. The real reason is that they have not orders for the coal. If the railway companies cannot carry coal, neither can they carry other goods; and yet there is no complaint that anything else, whether passengers or merchandise, is being delayed for want of engine power or of carriages or waggons. Further, if there should be such deficiency in this country, how could it extend to the Continent? Yet it is reported that the state of matters on the Continent amounts almost to a coal famine. I hold to my opinion that the coal broker is making a fortune, without any reason except that he knows how to rig the market.

The manufacture of carbide of calcium has developed a new danger, which is, as yet, shrouded in mystery. On the morning of Saturday last, work was started in the manufacture of the material in the works of the Aluminium Company at Foyers, Inverness. This seems to be done by charging a kiln with coke, lime, &c., and then turning upon the material a powerful electric current from an armature hanging over it. This armature was examined on Saturday morning, and was found to be in good order. Yet, in a very short time, the end of it suddenly dropped off, and fell among the molten material below. The weight was about 15 cwt. Its effect was to burst open the furnance doors, and to

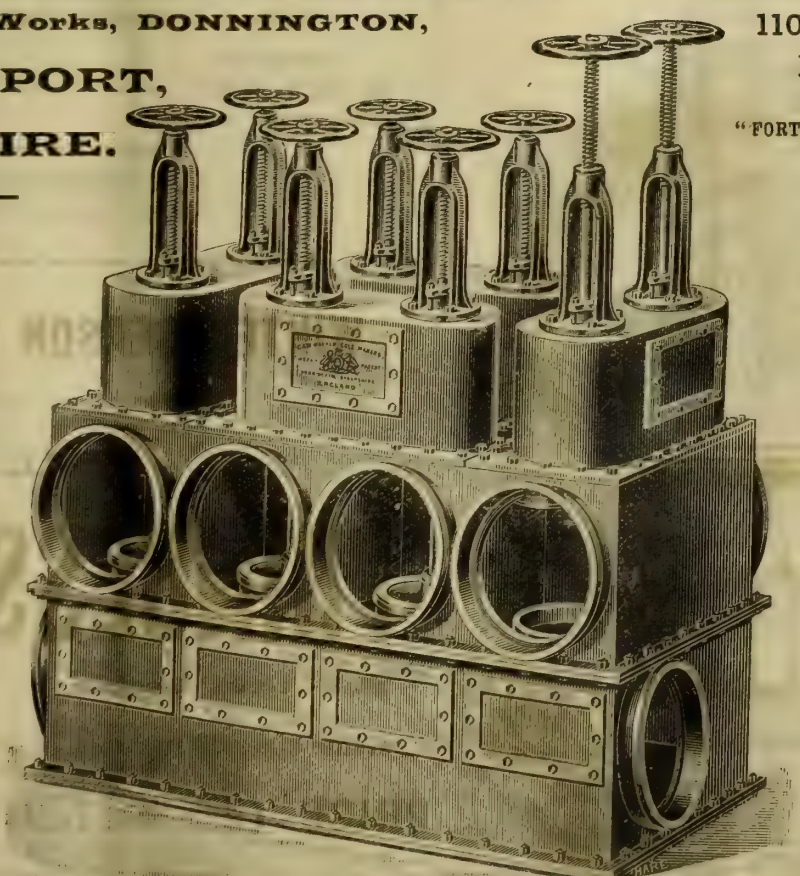
C. & W. WALKER, Ltd.

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Near NEWPORT,
SHROPSHIRE.

110, CANNON ST.
LONDON, E.C.

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TAR DISTILLING PLANT.
MOUTHPIECES.
WOOD GRIDS.



GASHOLDERS.
SPIRAL-GUIDED GASHOLDERS.
SCRUBBERS.
SULPHATE OF AMMONIA PLANT.
CONDENSERS.
VALVES.
TAR-BURNERS.

Weck's Patent Centre-Valve for Four Purifiers.

force out the incandescent contents of the kiln upon the floor of the works. Nine workmen were burned—chiefly by the heat of the air, not by contact with the "lava." Two of them were seriously injured; and one has since died. What so suddenly caused the end of the armature to fall off, has not yet been ascertained.

At an early hour on the morning of Saturday last, two sisters were found in their home at No. 161, Kent Road, Glasgow, in a state of illness, and unable to say what was the matter with them. The neighbour who made the discovery found that gas was escaping near their bed. A doctor certified that the women were suffering from gas poisoning. They fortunately recovered. As in many similar cases which have happened in Glasgow, gas was not used in the house.

Hitherto there have been but few penny-in-the-slot gas-meters fixed in the Glasgow area of distribution; but there is now some prospect of the condition of things being altered, for at a recent meeting of the Sub-Committee on Finance of the Corporation there was received a request for these meters to be placed in the houses of such of the properties belonging to the Glasgow Workmen's Dwellings Company as they may require. It was remitted to Bailie Fife (Chairman) and certain members to meet, at their request, representatives of the Company.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan.* 6.

Sulphate of Ammonia.—The market opened very quietly; and during the week considerable sales have been made at a decline on last week's prices. Near the close, however, buying in London having been reported for prompt and forward delivery at £11 per ton, Beckton terms, there has been a recovery, and the quotations have become £11 to £11 2s. 6d. per ton, f.o.b. at the ports, ordinary terms. The London quotation has also been advanced to £11 5s. per ton, Beckton terms, delivery up to March.

Nitrate of Soda is steady on spot, at 8s. per cwt. for fine quality.

LONDON, *Jan.* 6.

Tar Products.—The feature of the week is the marked improvement of carbolic acid, which is realizing a better price than it has seen for some years. The mode of carbonizing now generally adopted produces a tar which contains but a small percentage of carbolic acid as compared with former years; and although the quantity of tar dealt with is larger, it is doubtful whether there is any increase in the production of carbolic acid. The rock ahead of this article, however, is that it may be declared contraband, in which case its higher value would not be maintained. Benzols are very weak and lower. There is a fair demand for toluol, while both solvent and heavy naphtha are firm. Crude naphtha is weaker. Creosote is decidedly steadier, and a large business is reported at the price quoted below. Pitch continues active, with important shipments, though dearer freights are interfering seriously with implementing contracts. Anthracene shows no change. Few makers, however, will accept the market quotation for this article.

The average values during the week are: Tar, 16s. 6d. to 25s. 6d. Pitch, east coast, 34s.; west coast, 31s. 6d. Benzol, 90's, 7½d.; 50's, 10½d. Toluol, 90 per cent., 1s. 3d.; pure, 2s. Solvent naphtha, 1s. 4d. Crude, 30 per cent., naphtha, 4½d. Heavy naphtha, 1s. 3d. Creosote, 3½d. Heavy oils, 3½d. to 4d. Carbolic acid, 53's, 2s. 8d.; 60's, 3s. Crude naphthalene, 52s. 6d. Anthracene, nominal, "A," 4d.; "B," 2½d.

Sulphate of Ammonia.—This article has been somewhat lifeless during the past two weeks possibly owing to the holidays. There is now a little better tone noticeable; and although dealers are quoting lower prices, makers will not accept less than an average value of £11, less 3½ per cent. at all ports, while for forward delivery £11 7s. 6d. is quoted.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Business in the coal trade of this district is only slowly getting back into its normal condition, owing to the holidays; and during the past week there have been many complaints at the collieries that the men have turned up but very indifferently. The result has been that the output has been very much restricted; and the difficulty already experienced in meeting the requirements of customers—especially in all descriptions of fuel for manufacturing purposes—has been proportionately increased. At many collieries, the position brought about has been really serious, as both they and their customers have been put to the greatest inconvenience in obtaining even the barest supplies to keep works going. The statements, however, which have been so prevalent in the daily Press, as to a famine in coal, are altogether exaggerated; the position being one of delays in transit over the railways, rather than absolute scarcity of supplies. It is exceptional where any material stoppage of operations at works has been brought about by the impossibility of obtaining fuel of some sort or another to keep them going. The real state of affairs is perhaps more accurately represented by the fact that there has been no official upward move in prices with the commencement of the year, notwithstanding that a general advance was very strongly urged in many quarters. The feeling among leading collieries, however, is that it would be unwise, under temporary pressure, to put up prices, which would misrepresent the actual situation to the minds of the miners, and probably jeopardize the amicable arrangements now in hand for a continuance of the Conciliation Board, which has proved so satisfactory during the past two or three years. For house-fire coals, the demand is moderate, with prices firm at the full list rates of 13s. 4d. to 13s. 10d. per ton for best Wigan Arley, 11s. 8d. to 12s. 6d. for Pemberton four-feet and seconds Arley, and 11s. for common house coal. Common round coals have been in brisk request; and with rather a shortness of supplies for steam and forge purposes, are readily fetching 10s. 6d. to 11s. per ton at the pit, while for engine classes of fuel, in which the greatest scarcity has been

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experienced, all sorts of prices have been obtainable in the open market for prompt supplies. From 10s. 6d. to 11s. per ton has been paid for any description of engine fuel for immediate delivery; but the ordinary pit prices remain on the basis of 9s. 6d. per ton for best sorts, 8s. to 8s. 6d. for medium, and 7s. 6d. for common slack. For shipment, there has also been a shortness of supplies at the ports on the Mersey; and 12s. 6d. per ton and upwards has been got for steam coals delivered at Garston Docks, the High Level, Liverpool, or the Manchester Ship Canal.

Northern Coal Trade.—The scarcity caused by the holidays has tended to drive up the prices of several kinds of coal further; and the markets have been firm for all classes of fuel. In the steam coal trade this has been marked; and best Northumbrian steam coals have risen to about 17s. to 17s. 6d. per ton f.o.b. For steam smalls, there has been an advance which brings up the price to 10s. per ton—the highest quotation for a long period. Gas coals have been extraordinarily scarce; and where the need is pressing, high prices have been paid—as much as 17s. 6d. and 17s. 9d. per ton f.o.b. having been given for lots of a few hundred tons each, for delivery within the next ten days. Naturally, this has roused interest in some of the large contracts, which fall to be renewed in the next month or so, and which coalowners expect will in some measure follow the course of market prices. There is no change in the price of smithy coals. In regard to gas coke, prices are still unequal. There are old contracts that are running at low figures; and yet, on the other hand, as high a rate as 18s. per ton f.o.b. has been asked this week, though the medium quotation is possibly 2s. per ton lower, taking deliveries of all kinds into account. The output of gas coke is well taken up.

Scotch Coal Trade.—It is impossible to give any idea of what is being done in coal sales. The prices are what can be obtained; and therefore no quotations can be given. The situation is a most undesirable one, because one purchaser says he is getting his coal at only one-sixth advance, while another complains of the price being put up to him to the extent of one-half. There is nothing satisfactory about the present state of matters. There is a great abundance of coal, if only it could be disposed of. That there is no scarcity, is shown by the fact that the miners have not been called upon to work at all during the holidays. The shipments for the last week of the past year amounted to 210,368 tons—an increase of 27,483 tons upon the previous week, and of 36,471 tons on the corresponding week of last year. For the past year, the total shipments amounted to 8,982,709 tons—a decrease of 704,740 tons compared with 1898. The decrease is chiefly accounted for by the heavy export trade during 1898, brought about by the strike in Wales.

The Bagshot Gas-Works in the Market.—Acting upon instructions received from the Executors of the late Mr. R. Kemp, Mr. Alfred Richards will offer for sale, on the 30th inst., at the Mart, Tokenhouse Yard, the freehold gas-works at Bagshot. The property, which consists of two holders, a retort-house containing ten retorts, coal-store, condenser, two purifiers, and governor-house, together with the whole of the mains, will be sold as a going concern.

Additional Storage at the St. Anne's Gas-Works.—Owing to the need for increased storage, the Directors of the St. Anne's Gas Company have put in hand a new gasholder, which is to be erected in readiness for next winter. It will have a capacity of 250,000 cubic feet, and will store three times as much gas as the present holders are capable of containing.

Windsor Corporation Water Accounts.—The Borough Treasurer of Windsor (Mr. W. Beach) has issued his abstract of accounts for the year ending Michaelmas last. Regarding the water accounts (which are audited by Messrs. Lass, Wood, and Co.), it is shown that the profits have grown from £4593 in 1892-3 to £5698 in 1898-9. The working expenses have not increased much, having only risen from £1847 in 1892-3 to £2036 in 1898-9. The assets have also increased in like proportion. The total amount of capital that was authorized to be borrowed under the Corporation Act of 1884 was £194,780, of which £29,780 remains to be borrowed if necessary; and out of the sum actually borrowed there still remains £703. The general balance-sheet shows that the assets exceed the liabilities by a very considerable sum.

Dorking Water Company and the Local Authorities.—An important discussion affecting the future of the water supply of Dorking took place at a recent meeting of the Rural District Council. The question arose on the receipt of a letter from the Urban District Council inquiring whether the rural body would be willing to co-operate with them in a petition against, and opposing, if necessary, the Water Company's Bill to be brought before Parliament next session. Mr. Scales explained that a short time ago it was desired to purchase the water undertaking; and application was made to the Local Government Board to know really what were the Council's powers in the matter. The reply was that the Company having an area over and above the area of the Council, they could not purchase it themselves. Now in the Bill the Company were promoting there would be no clause to allow either or both Councils to acquire these works hereafter if they so desired; and the Parliamentary Agents advised that this was a very good chance to get one inserted. Colonel Lewin said he had no hesitation in moving that they definitely refuse to co-operate with the District Council in the way suggested. They had here an admirable illustration of the way in which public money was wasted. Here they had two Councils who, because they could not agree on a matter of public interest, wanted to spend perhaps £1000 to £2000 on lawyers. The Rural Council were willing and anxious to co-operate with the Urban Council in purchasing the undertaking; and the Water Company were willing to sell. He believed the Company had agreed upon a price which the Urban Council considered a fair one. After some discussion, Colonel Lewin moved that an offer be made to join the Urban Council in appealing to the Company to cause the desired clause to be inserted without recourse to legal proceedings; and this was passed. At a subsequent meeting of the Urban District Council, the accuracy of several of the statements made by Colonel Lewin was denied; and it was also asserted that a price for the Company's property had never been agreed upon. It was decided that a Committee should be appointed to meet a Committee of the Rural Council.

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Hastings Water Supply.—Last Wednesday, a Local Government Board inquiry was held at Hastings, by Mr. Walter A. Ducat, into the application of the Corporation for a loan of £1094 for works of water supply. The Town Clerk (Mr. B. F. Meadows) and the Borough Engineer (Mr. P. H. Palmer) explained that the works consisted chiefly of the extension of mains.

Bolton Corporation Water Supply.—The Bolton Corporation have received sanction from the Local Government Board to borrow £8034 for water-works purposes. Of this amount, £5000 is for the construction of filters at the Dingle reservoir; and the Board require that the filtered water should be tested from time to time, especially in rainy weather, with the view of ascertaining its probable action on lead—the result of the tests to be forwarded to Whitehall. The sum of £3034 is required for a new main to Middle Hulton, one of the eight townships recently added to the borough.

Ilfracombe Water Scheme.—At the statutory meeting of ratepayers, a large majority approved of the promotion of the Bill by which the Ilfracombe District Council are seeking for power to obtain a supply of water from Exmoor. There was, however, some opposition, led by two dissentient members of the Council, who contended that the present supply is adequate, and said that the cost which was at first estimated at £24,000, was now put down at £44,000. The voting showed that of those present about 100 were in favour of the scheme, and only eight against. A poll was demanded; and on the result will depend whether the Bill is further proceeded with.

The Lighting, Water Supply, and Sanitation of Colombo.—In the course of a paper on "Old and New Colombo," recently read by Mr. John Ferguson before the Society of Arts, he said: "As regards the amenities of the city, it cannot yet be said to be altogether well lighted, although gas, introduced twenty years ago (chiefly through the efforts of Sir John Grinlinton), with incandescent lamps, and even electric lighting of recent times in the Fort, hotels, clubs, &c., have made a great improvement. Colombo is a town of magnificent distances, and it is difficult to overtake its requirements fully in lighting. More important is a good supply of pure water; and this was brought in by Mr. Bateman and his lieutenant, Mr. Burnett, by a scheme which tapped a hilly region, specially reserved, some thirty miles off. The piping is now being duplicated so as to make the supply adequate for all requirements. But Bombay, in its experience of plague, the germs of which revel in a damp soil, has taught us the danger of an Eastern town becoming water-logged through provision, by means of adequate drainage, not being made to take away the waste or surplus water supply. Colombo—in the flat portion of its Pettah, or native town, especially—stands much in need of systematic drainage, and the present Governor has had a survey, report, and estimate from a leading London sanitary authority—Mr. James Mansergh, M.Inst.C.E.—on which, we trust, action may ere long be taken. The disposal of sewage by burning and burying is effectually carried out, and sanitation is as well attended to as it can be in a tropical town without systematic drainage, and with a people, many of whom do not understand that 'cleanliness is next to godliness.'"

The Proposed Purchase of the Cambridge Water-Works.—A private meeting of the 25 members of the Cambridge Corporation who, by their votes, authorized the promotion of a Bill to acquire the local tramway and the water-works undertaking, was held last Wednesday, when it was resolved by a good majority, in view of increased opposition to the Bill, to proceed no further in the matter. This, however, does not preclude the taking of the poll of ratepayers and owners; but no definite movement appears to have been made in that direction yet.

The Progress of the Mourne Mountain Water Scheme for Belfast.—During the past year, steady progress was made with the works for bringing to Belfast the new supply of water from the Mourne Mountains. The service reservoir at Knockbrickan, within a few miles of the city, is completed; and the main aqueduct, extending from the reservoir to Newcastle, including a tunnel 5580 yards in length, is practically finished. Good progress has been made with the boring of the tunnel under Donard Lodge. The entire length of the tunnel is 3767 yards, and 3330 yards have been got through; leaving a length of 437 yards to be driven. At the present rate of progress, the boring should be completed on the 1st of June. Two contracts for the laying of the large mains between the Knockbrickan reservoir and South Parade have recently been let, and a beginning has been made with the work. The iron pipes are being supplied by Messrs. R. Laidlaw and Son and Messrs. Roberts and Co.

The Exmouth District Council and the Water-Works.—A meeting of owners and ratepayers of Exmouth was held last Thursday to consider a resolution passed by the District Council in favour of promoting a Bill empowering the Council to purchase, by compulsion or agreement, the undertaking of the Exmouth and District Water Company, to construct additional works, to supply water within the Council's district, to borrow money for such purposes, and to oppose a Bill to be promoted by the Company authorizing them to extend their undertaking. The Chairman of the Council (Mr. A. A. Carter) presided, and opened the proceedings by simply stating the object of the meeting, and submitting a motion approving of the action of the Council. It was seconded by Mr. C. Salter, who contended that the water supply ought to belong to the town; that those who opposed the action of the Council were interested in the Water Company; and that, although the acquisition of the property might entail some sacrifice now, it would eventually lead to a reduction of rates. Other speakers having supported the motion, opposition was offered, on the grounds, among other things, that with electric lighting and sewerage schemes on hand, the Council had quite enough to do without the water undertaking; that the ratepayers of to-day would not benefit by the acquisition; that the district had been reasonably well supplied hitherto; that, at most, action should be limited to securing the insertion of a clause in the Company's Bill enabling the Council to purchase at a future time; that if the Council succeeded in their proposal the rates would be increased to 5s. 7d. in the pound; that the parliamentary expenses would amount to about £2000; that the plant of the Company, if taken over now, would have to be renewed and extended; and that no tangible benefit would accrue. Eventually, the motion was carried by 276 votes to 39. A poll was demanded, which will be taken in due course.

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Increase in the Price of Gas at Cinderford.—A further advance in the price of coal in the Forest of Dean (the fourth within three months) has resulted in notice being given by the Bilson Gas Company of an increase of 4d. per 1000 cubic feet in the price of gas.

Settlement of Compensation Cases at Manchester.—The Gas Committee of the Manchester Corporation have settled two claims in connection with accidents to workmen. In one case, a claim made by an employee named Henry Ashton (who had been injured by the falling of a main pipe upon him) has been satisfied by the sum of £75. The Committee have also paid £150 to the widow of the late Andrew Cavanagh, in full discharge of all claims consequent upon the death of Cavanagh at the Rochdale Road Gas-Works.

Installation of Water-Gas Plant at the River Plate Gas Company's Works.—Owing to the large increase in consumption in the district supplied by the River Plate Gas Company in Buenos Ayres, the Company have recently purchased additional property, and are carrying out large alterations at their manufacturing stations, particularly at their Corrales works, where, among other things, they are installing carburetted water-gas plant of 700,000 cubic feet daily capacity, supplied by the Economical Gas Apparatus Construction Company, Limited. The Gas Company's Chief Engineer, Mr. J. M. Rowbotham, is supervizing the work, and the extensions are in accordance with his own plans and specifications.

Gas Workers' Wages at Salford.—The Salford Town Council had before them last Wednesday, a recommendation of the Gas Committee that an advance be conceded at the rate of 5 per cent. in the wages of workmen employed at the various gas-stations and in the outdoor department, other than foremen and tradesmen. Alderman Phillips moved the adoption of the report, stating that it was ten years since any alteration was made in the wages at the gas-works; and all through this period the works had been excellently conducted. There was now a similar movement in regard to wages in Manchester; and it was desirable that Salford should travel on the same lines. Alderman Shaw seconded, and the resolution was agreed to.

Estimating the Value of Water-Works.—The appraisal of the plant owned by the Bristol and Warren Water-Works Company, of Rhode Island, was recently made by Mr. D. A. Baker, who was specially appointed for the purpose by the Supreme Court. The Company had an exclusive franchise for fifty years from December, 1881; while the town had the privilege of purchasing the works after they had been in use ten years. Mr. Baker reported that the following factors had been considered in appraising the Company's property: (1) The cost of reproduction of all the plant that could be conveyed to the town of Bristol, less depreciation. (2) The value of the plant as a going concern, and in full operation at the time of the transfer. (3) The goodwill of the plant. (4) The franchise for an unexpired term of 37 years. In estimating its value, Mr. Baker found the present worth of such an annuity as, in his opinion, the franchise would bring to the Company for 37 years. (5) The damages which should be allowed the town because of the Company's failure to fully carry out their contract.

Public Lamps and Sewerage Operations.—The Shrewsbury Gas Company have made a claim against the Shrewsbury Corporation for £1583, for damage alleged to have been done to the street-lighting plant through the carrying out of the Corporation's new drainage system. It has been decided to resist the claim.

A Practical Gas-Fitting Class at the Birmingham Technical School.—Some little time ago the Birmingham Corporation Gas Committee found there was a dearth of qualified gas-fitters in the city; and at their request, the Technical School Committee decided to remedy the defect as speedily as possible. Mr. S. R. Barrett, the Fittings Superintendent of the Gas Department, is engaged in the delivery of a course of theoretical lectures to the students at the Technical School; and at the close a practical class will be established.

Bilston Gas Company.—The annual meeting of this Company was held on Monday last week. The report was noticed in the "JOURNAL" for the 26th ult., and in moving its adoption, the Chairman (Mr. Thomas Holcroft) said the results of the year's working were as satisfactory as they could well be. The quantity of gas manufactured had been increased; and the Directors had been able to maintain the ordinary profits. Speaking of the contracts which had been entered into for the ensuing year, the Chairman referred to the higher rates demanded for coal, and said that they had still further risen since the contracts had been signed. It was impossible to tell what the higher value of coal would result in; but, in all probability, the price of gas would have to be enhanced. The motion was agreed to. It was also decided to declare dividends of 5s. 6d. and 4s. on the "A" and "B" shares respectively; interim dividends of the same amounts having been paid.

Prospective Extension of the Leeds Gas-Works.—At the meeting of the Leeds City Council last Wednesday, the Chairman of the Gas Committee (Alderman Lowden), in the course of some remarks upon the gas undertaking of the Corporation, stated that the Committee had not been behindhand in making provision for a possible increase in the demand for gas as the city and the population increased. During the last four years, the consumption had gone up by no less than 20 per cent.; and it was quite likely that before long they would have to ask the Council for big amounts to enable them to enlarge the works. The manufacture of carburetted water gas was engaging the attention of the Committee; and he thought the time had arrived when they should take some action to provide themselves with this great aid to illumination. They would also have to ask the Council for a considerable sum for the building of additional retort-houses. As far as they could calculate from the figures of the past three years, their present equipment was not more than sufficient to supply the needs of the next three. Alluding to the great difficulty experienced in obtaining coal at the various gas-works of the country, the Chairman said the Leeds works were fortunately situated in this respect. So far, they had not experienced much inconvenience. At the beginning of 1895 the coal in stock was 23,000 tons. Now it was no less than 44,000 tons; and he did not think there would be any scarcity experienced during the remainder of the present winter.

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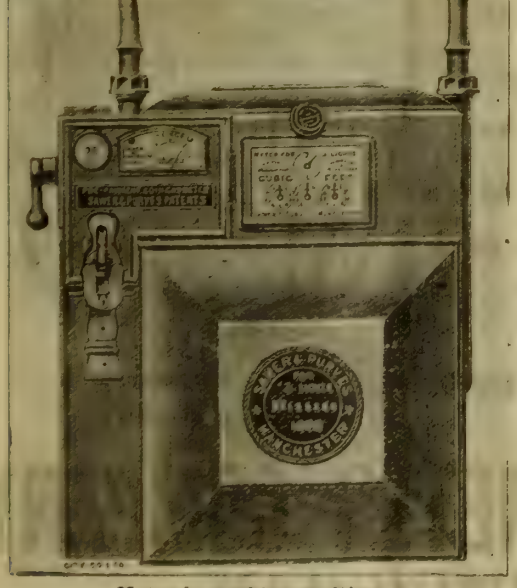
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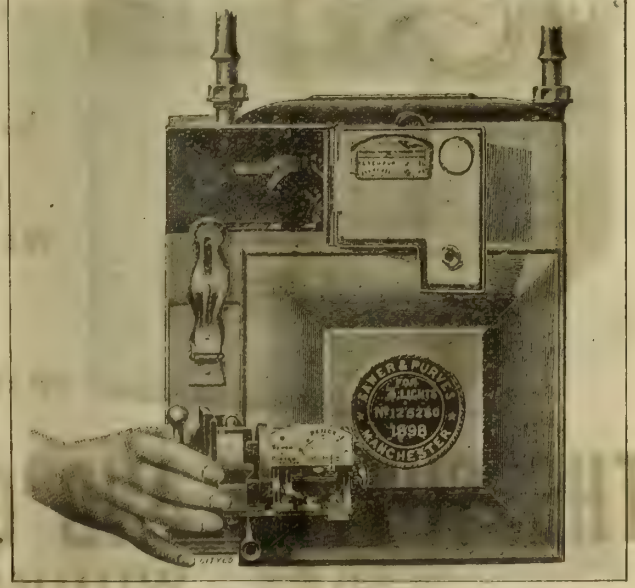
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Increases in the Price of Gas.—Owing to the prevailing dearness and scarcity of coal, the price of gas at Colnbrook, near Slough, has been increased 6d. per 1000 cubic feet. An advance of 5d. per 1000 feet has been made by the Horsham Gas Company.

Curtailment of the Public Lighting at Sheffield.—Owing to the difficulty in obtaining coal for keeping up the supply of gas at Sheffield, Mr. Hanbury Thomas, the General Manager and Secretary of the Sheffield Gas Company, last Thursday asked the Watch Committee of the Corporation to allow the lighting of the public lamps to begin one hour later than the fixed times until further notice. He said the Directors thought if this were done the public generally would accept it as an intimation to be careful in the use of gas until the existing difficulties have been overcome. The Committee agreed to have the lamps lighted half-an-hour later and extinguished half-an-hour earlier than the time stipulated for in the current contract.

Sulphate of Ammonia and Nitrate of Soda in the Past Year.—In his annual report on the chemical trade of the past year, Mr. T. Aikman, jun., states that the opening price of sulphate of ammonia was £10 5s., and the closing value £11 to £11 5s. per ton as in position. As high as £13 was touched in May, and in November £10 10s. was again reached. At no period of the year was there any accumulation of stock. According to Messrs. W. Montgomery and Co.'s report, the development of the nitrate of soda trade continued steadily throughout the year; but in the spring months, owing to the absence of sufficient supplies, a temporary check was experienced, and wide fluctuations in prices resulted. The visible supply amounts to 730,000 tons, against 703,000 tons last year. The total consumption of the world for the past three years has been as follows: 1897, 1,100,000 tons; 1898, 1,186,000 tons; and 1899, 1,330,000 tons. The shipments for the same periods have been 1,060,000, 1,260,000, and 1,360,000 tons respectively. The price on Dec. 31, 1899, was 7s. 9d. per cwt., as compared with 7s. 7½d. and 7s. 6d. on the corresponding date in the two preceding years.

Birkdale again Complains of the Quality of the Gas Supply.—The Birkdale District Council are not yet satisfied with the quality of the gas supplied to them by Southport. Moving the adoption of the minutes of the Lighting Committee at their meeting last Wednesday, Mr. T. O. Clinning said he thought the time had come when they must make the strongest protest possible against the disgraceful gas which had been supplied by the Southport Corporation. They should either urge the Electricity Committee to proceed with their arrangements for supplying the district with the electric light, or endeavour to seek the intervention of the Board of Trade. The Southport Corporation had never made the slightest excuse; and it was most unreasonable to expect Birkdale to accept the gas they supplied. Mr. Davey drew attention to the Inspector's report, which showed that the gas was only 14·98-candle power. If the Southport Corporation could not make gas, Birkdale, he thought, should apply to Parliament with the object of obtaining power to make it for themselves. He had gas-lights in his breakfast-room; and he could not see to read until they had lit four or five candles in addition. The minutes were adopted.

The Great Malvern District Council and the Link Gas-Works.—At the monthly meeting of the Great Malvern District Council last Tuesday, the sanction of the Local Government Board to the raising of £20,000 in respect of the Malvern Link Gas-Works was received.

Protecting the Leeds Water Supply.—In order to place the control of the watershed in the Washburn Valley under the complete control of the Leeds Corporation, and thus ensure that the streams feeding the city's reservoirs shall be free from contamination, it was resolved, at the Council meeting on Wednesday, to purchase certain farms and properties in the district at a total cost of £13,630.

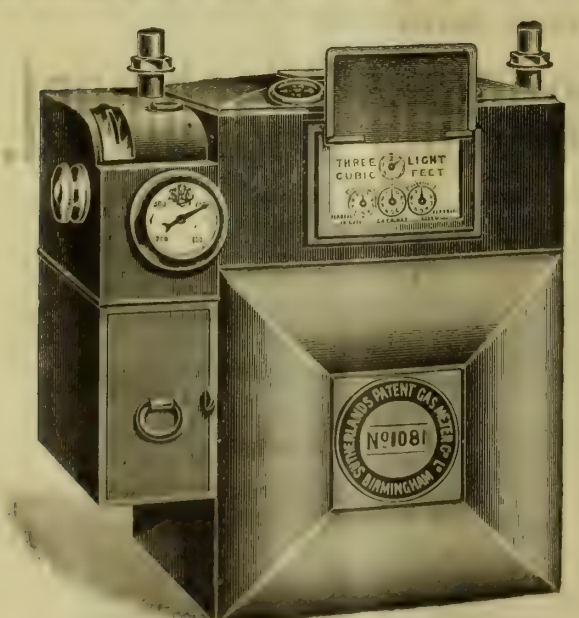
The Water Undertaking of the Dover Corporation.—In presenting the estimates for the year at the meeting of the Dover Town Council last Wednesday, it was pointed out that the water-works had yielded a profit of no less than £3500 on the year. This, together with a profit of more than £2000 on the Municipal electric trams, is equal to a reduction of 1s. in the pound on the town rates. The water is supplied at the rate of 10s. per annum per house of £20 rateable value—one of the lowest rates in the kingdom.

Manchester Corporation Water Supply.—At the meeting of the Water Committee of the Manchester Corporation last Thursday, statistics were presented which showed that during the year ending the 31st of December the average daily consumption of water was 32½ million gallons, as compared with 30¼ million gallons per day during 1898. The present stock of water is equal to a supply for 87 days; whereas at the end of 1898 it was estimated at 141 days' supply. The slight rainfall and snow of the present winter have yielded comparatively little water.

Kidderminster Corporation Water-Works Extensions.—After a somewhat exciting debate at the meeting of the Kidderminster Town Council last Wednesday, a recommendation of the Water Committee was passed accepting the tender of Messrs. Barclay, Sons, and Co., Limited, for engines for a new well in connection with the water-works. Their price was £2805; and the machinery is capable of raising 2000 gallons per minute. Certain amateur engineering members of the Council were anxious to have some of the antiquated plant removed from the old well to the new; but common sense prevailed.

The Price of Gas at Llanelly.—The price of gas to private consumers at Llanelly has been raised from 3s. 10½d. to 4s. 2d. per 1000 cubic feet—an alteration "which is caused by the greatly increased cost of wages and coal, which vary from 10 to 60 per cent." It was announced at a meeting of the District Council last Tuesday that the Company also intended to increase the price of gas for street-lamps and public buildings, which would make an additional sum to be paid by the Council of about £288 per annum, which is equal to a penny rate. Referring to the matter, Mr. Arthur Davies thought they could do nothing except enter a protest. The Clerk considered an agreement should be made with the Company which would prevent such an advance in price being sprung upon them. Mr. L. A. Williams could not understand why gas in Llanelly should be 33⅓ or 50 per cent. higher than in other towns farther removed from the coalfields. Eventually, it was decided to refer the Company's letter to the Highway Committee.

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Mid-Kent Water Company and the Supply of the West Ashford Rural District.—The West Ashford Rural District Council have ordered their seal to be affixed to an agreement with the Mid-Kent Water Company, under which the latter will supply the district. The Company are seeking power to supply Great Chart, Little Chart, Charing, Egerton, Hothfield, Kingsnorth, Pluckley, Shadoxhurst, and Westwell; and the Council have agreed not to proceed with their independent scheme, but to support that of the Company. The Company, on the other hand, have agreed to purchase and take over the water supply and works at Pluckley, and pay to the Council the whole costs, together with the lease of the spring and lands adjoining for 99 years from Sir H. N. Dering. The Council will transfer to the Company the lands acquired to enable them to carry out the now abandoned scheme. The Company will also repay to the Council the sum of £1697 expended on the Charing works, and forthwith commence, and proceed to carry out, all necessary works to enable them to supply water to the parish.

Proposed Extension of the Oldbury Gas-Works.—At a meeting of the Oldbury District Council on Friday, the Gas Committee stated in their report that the Manager (Mr. A. Cooke) had reported that it would very shortly be necessary to increase the manufacturing plant at the gas-works, and erect an additional holder. They had instructed him to obtain particulars and report to them again on the subject. Mr. Thomlinson, in moving the adoption of the report, said the production of gas last year was 106 million cubic feet, and as the works were only erected to supply between 60 and 80 millions per annum, they would have to do something to increase the plant before next October. Mr. Thompson asked if the money for these alterations would be raised by loan or out of revenue. Unless the money for the new holder could be borrowed, it would mean that the Gas Committee would not be able to provide anything in aid of the rates. Mr. Thomlinson said he did not think the Committee would ask the Council to pay for any new plant out of the revenue account, as the rising generation should certainly pay their share. The report was approved.

The Southampton Corporation and the Protection of their Water Supply.—The Southampton Corporation had a special meeting last Wednesday to determine as to the expediency of promoting a Bill to empower them, among other things, to make further provision for the protection from pollution of the water supply of the borough, and for this purpose to enable them to acquire compulsorily or by agreement, or to take on lease, lands in the parishes of Compton and Otterbourne; also to authorize them to make bye-laws for preventing waste. The Parliamentary Committee presented a report which embodied one from Mr. W. Whitaker, F.R.S., in which the acquisition of the lands in question was advocated; and the Water Engineer (Mr. W. Matthews) supported the proposition. The Mayor (Alderman Hussey) moved the adoption of the report; expressing the hope that the Council would have confidence in the Committee, and support their recommendation. The motion having been seconded, a discussion ensued in which it was contended that the purchase of the land was unnecessary, and, moreover, would only increase the already heavy rates. The Council divided, with the result that the motion was rejected by 22 votes to 10—five members being neutral.

The Sudbury (Suffolk) Town Council have decided to increase the storage at their water-works at a cost of £850.

The expenses incurred by the Newtown (Mon.) District Council in connection with the acquisition of the Water Company's undertaking amounted to within a few shillings of £4183.

According to the Bolton Corporation Year Book just issued, there are 37,643 gas consumers in the area supplied by them; and the population of the water limits is 252,000—the area covered being 41,875 acres, with a length of mains extending to 168 miles.

The Gas Committee of the Belfast Corporation have accepted the tender of Messrs. Thomas Glover and Co. for dry meters; and have divided the order for wet meters between Messrs. W. Parkinson and Co., Messrs. W. & B. Cowan, and Messrs. R. Laidlaw and Son.

In reference to the proposed augmentation of the Wallasey water supply, Mr. G. H. Morton, Geologist, of Liverpool, has advised the District Council that, if they sink two boreholes at Liscard to a depth of 800 feet instead of 600 feet as originally intended, with a 15-inch bore-hole, the supply will exceed a million gallons per day—giving a total supply from Liscard of 2 million gallons.

Mr. Gilbert Little, of Smethwick, confesses to having some doubts as to whether he desires to be known as a Scotsman or an Englishman, seeing that his life has been spent in about equal portions in the two countries; but, at all events, nearly all his hopes, interests, and associations, are now centred in Smethwick. The town has grown in importance of late years; the most recent upward movement being its incorporation. As it now possesses a Mayor, it occurred to Mr. Little that he might introduce into the municipal life of the borough an interesting custom from beyond the Border, and provide a pair of lamps to mark the residence of the Chief Magistrate. The lamps were designed by Mr. B. W. Smith, the Corporation Gas Engineer, and they were lit for the first time on New Year's night; one being started by Mrs. Lones (the Mayoress), and the other by Mrs. Smith.

We have received from Messrs. W. & B. Cowan, Limited, copies of their very neatly got-up diary and price list for the present year. The diary portion is followed by blank leaves for memoranda, letter and address registers, and pages ruled for entering cash received and paid. The Engineering Department of the Leeds Fire-Clay Company, Limited (of which Mr. F. C. Sugden is the Manager), have sent us one of their pocket diaries for this year. It contains illustrated notes on the construction of inclined and horizontal retort settings, particulars of the Company's gas apparatus and general engineering work, coal and coke breaking and conveying machinery, and fire-clay material, and some useful tables. We have also received the revised edition of the quarterly diary and table book of Messrs. John E. Williams and Co., paint, enamel, and varnish manufacturers, of Manchester, attached to which is a £100 insurance coupon in the Ocean Accident and Guarantee Corporation. This is the 23rd year of issue, and in its present form it possesses an additional claim to a place in a gas manager's pocket.

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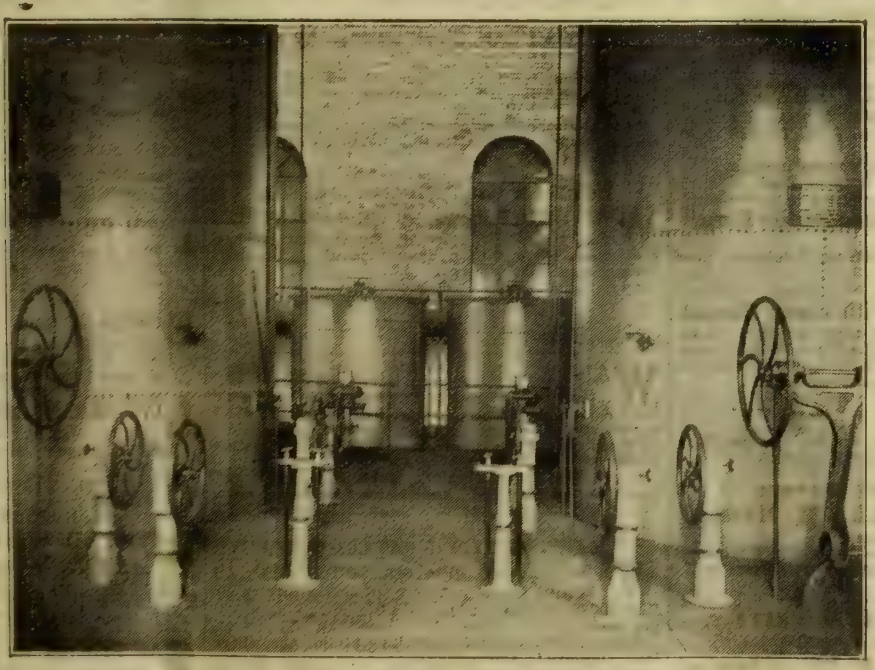
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CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE.
The Scarcity of Coal . . . 133
Questions of the London Gas Supply; Statistics of Trade in 1899 . 134
Coal Miners and the Workmen's Compensation Act; Gas-Works Traders' "Rings;" Unlovely Aspects of Trade Unionism . . . 135
WATER AND SANITARY AFFAIRS—
Will there be a Water Board for London?—Waste of Water . . 136
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market . . . 137
Electric Lighting Memoranda . . . 137
A History of Gas Prices in London . . . 138
Recent Publications . . . 139
The Proposed Gas Exhibition and Congress at the Paris Exhibition 140
Municipal Muddling . . . 141
The Coke Trade of Great Britain in the Past Year . . . 142
Water Bills for 1900 . . . 143
NOTES:—
The Temperature of Incandescent Bodies; Wind Pressure; The Diesel Oil-Engine; The Spontaneous Combustion of Coal; Rise in Price of Waste Fuel . . . 144
New York Street Railway Power-House . . . 145
TECHNICAL RECORD:—
Mr. J. T. Westcott on Labour-Saving Machinery in Gas-Works . 145
A New Incandescent Gas-Burner; The Dresden Water-Works . 146
The Incrustation of Iron Pipes at the Torquay Water-Works . . 147
REGISTER OF PATENTS:—
Incandescent Mantles—Sieverts, W. H. A. . . . 151
Strengthening Incandescent Gas Mantles—Blaasch, H. . . . 151
Purification of Coal Gas—M'Dougall, A. . . . 151
Burning Acetylene Gas—Wigham, J. R. . . . 152
Incandescent Gas Lighting and Heating—Greyson de Schodt, P. 152
Gas Lamps and Lanterns—Shaw, E. J. . . . 152
Incandescent Gas-Burner—Murinick, A. . . . 152
Patent Notices . . . 153
PARLIAMENTARY INTELLIGENCE:—
Private Bills (Session 1900)—Opposition on Standing Orders . . 153
LEGAL INTELLIGENCE:—
High Court of Justice—Chancery Division—Incandescent Gas-Light Company *v.* New Sunlight Incandescent Company . . 153
The Traffic in Infringing Incandescent Mantles . . . 153
Committal for Stealing Gas . . . 153
Embezzling Moneys of the Incandescent Gas-Light Company . . 154
Charge of Stealing Electricity . . . 154
Relaying Paving-Stones after Gas Connections . . . 154
MISCELLANEOUS:—
The Market for Sulphate of Ammonia during the Past Year—Messrs. Bradbury and Hirsch's "Annual Review" . . . 154
Fatal Accident at the Stoke Gas-Works . . . 156
Morecambe Gas-Works Transfer . . . 156
Proposed Gas Workers' Friendly Society in Glasgow . . . 156
The Halifax Gas Committee and Free Labour . . . 157
"Gas Fountain" Exhibition in Edinburgh . . . 157
Electric Lighting Notes . . . 157
An Arbitration Respecting the Dronfield Water Supply . . . 159
Notes from Scotland . . . 159
Current Sales of Gas Products . . . 160
Gas and Water Companies' Stock and Share List . . . 160
Coal Trade Reports . . . 161
PARAGRAPHS:—
OBITUARY: Mr. H. Legg; Mr. T. Hunter; Mr. John Hallam . . 144
PERSONAL: Mr. C. P. Myers; Mr. E. Howarth; Mr. W. C. Jones; Alderman Gainsford; Mr. C. E. Goddard; Mr. J. L. Fletcher; Mr. Harry H. Jones; Mr. C. F. Bennett; Mr. B. Marsh, J.P.; Mr. C. E. Nuttall; Mr. S. Brown, J.P.; Mr. T. Bower; Mr. W. Scott; Mr. Dugald Clerk; Mr. James Deas; Mr. S. G. Askew; Mr. A. T. Harris; Mr. W. R. Wilson; Mr. Walter Donaldson . 144
Wide Tendering . . . 137
Water-Meters and the Prevention of Waste Supply . . . 138
Semet-Solvay Bye-Product Coke-Ovens in England—Carelessness in the Use of Gas . . . 142
The Swiss Output of Carbide . . . 143
The Pig Iron Production of Great Britain and Germany . . . 144
Facilities for British Inventors—Mr. Boys' Lectures on "Fluids" . 145
Prospective Extensions at the Carlisle Gas-Works—"Electroid" Gas Condemned as Dangerous . . . 153
Sales of Shares—The Littlehampton Gas Company's Order . . 154
Carmarthen New Water-Works—Gas-Engines for Electric Plant . 158
St. Petersburg Water Supply—Eighty Years' Purchase for Land Forming a Watershed . . . 161
Large Gas and Water Consumption in Liverpool—Tuxford Gas-Works Flooded—Advance in the Price of Fire-Bricks, &c.—Clacton Gas and Water-Works Purchase—Wages and Gas Consumption at Heywood—The Warwick Rural District Council and the North Warwickshire Water Bill—Southport Corporation and the Water-Works—Bewdley Water Scheme—The Control of Watershed Areas—Benefits of Filtering Water—County Councils and Water Supply Questions . . . 162
Gas Companies' Opposition to the Bradford Corporation Bill—Fatal Gas Poisoning Case at Heckmondwike—Proposed Adoption of Water Gas at Oldham—Shortage of Gas at Southport—Proposed Extension of the Wantage Gas-Works—Record Gas Consumption at Croydon—Ripon Corporation Gas Supply—Gas Poisoning Fatalities in Belfast . . . 163
Reduction in Price—The Southampton Corporation and their Protective Areas Bill—The Sevenoaks Water Company's Provisional Order to be Opposed—The Financial Position of the Cowlyd Water Board—Additional Storage at the Colwyn Bay Gas-Works—Proposed Extension of the Smethwick Gas-Works—Gas Engine Explosion in Glasgow—Derwent Water Board—Suffocated by Gas 164

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EDITORIAL NOTES.

The Scarcity of Coal.

THE only subject many British gas managers can think about just now—or have thought of, for that matter, these many weeks past—is coal. Gas-works administration and gas management mean different things at different times. Often it is plain sailing, so that the usual director or the common—very common—councilman can lounge or bustle through his perfunctory duty in the board or committee room, according to his temperament, and feel that he is a Somebody. The officer who takes the business control, too, whether engineer, or secretary, or that comparatively scarce hybrid, a general manager, having bought his supply of coal for the year with his accustomed acumen, ordinarily troubles himself no further upon this score. The monthly deliveries come in, and the cheques go out; and there an end. Months ago, however, those wary and alert gas managers who had experience or forethought of the extreme delicacy and complexity of our coal mining, shipping, or railway transit arrangements, perceived signs which led them to think it might be just as well if the usual rate of summer delivery was increased. As the winter drew near, the contractors with one consent began to get behindhand with their consignments; and the stocks of coal at many gas-works suffered at both ends. Never was there so much gas wanted; hardly ever was coal so scarce. Ornamental directors and unpractical committeemen felt themselves "out of it." They knew nothing, nor could they do anything in the emergency. The responsible official had to quit his office, where it had been his habit to receive the coal people courteously or otherwise, as his nature was, like a despotic sovereign, and go to them and the shipping or railway folks hat in hand. It was not enough to have bought the coal, the trouble was that it did not come to hand. There has been a very sharp pinch for many a gas-works, big and little, which has felt nothing of the kind for a generation. We have heard of coal stocks which have been run down to a matter of days, where the output of gas is not on a scale that could be eked out by getting in a few cartloads of house coal from the nearest wharf. Besides, the house-coal merchants had none to spare, but were constrained to keep their own customers going by distributing single sacks of the precious fuel. In the case of London, the seaborne supply was sadly deficient; and the railway coal traffic seems to have failed miserably. Notwithstanding the opening of another coal-carrying railway into North London, which was to have worked wonders, it was impossible to get deliveries. All this goes to show that prudent gas management is not child's play, and also that an Act of Parliament is no substitute for a man with a head on his shoulders in the position of director of affairs. What the effect of the emergency purchases will be on the price of gas must shortly be declared. It is to be feared that some undertakings have been hard hit. There is no remedy but paying. Litigation in respect of broken contracts to deliver will not mend matters, for the contractors have done their best. Circumstances have been too strong for them, and for their customers also. It is at such times of stress that the personal element waxes large; and the gas manager who has never played the "jack-in-office" stands the best chance of being attended to when he has to beg instead of to command.

Naturally, the gas-works situated in closest proximity to the coalfields have suffered most from the shortage. They do not stock much, as a rule, and are not always aware in time of the nature of the prospects of the trade that surrounds them. The truth of the old saying that one must leave home to hear news of it applies in the coalfields as elsewhere. It is unhappily only too probable that the worst is not yet over; and we shall not be surprised to hear of restricted outputs of gas for some weeks yet. Still, the other Christmas traffic being over, coal is being passed along the railways again at something like the ordinary rate of despatch. That is one way of relief. Then, though the unprecedented activity of all manufacturing industries keeps coal in great demand, and colliers are certainly not getting any more coal to bank than they can help, the temptation to open more mines is irresistible, and supplies are sure to grow larger. Many pits, shut down because they did not pay at the prices of last year or the year before, are being started again; and there will be a great impetus to the

making of new ones. Several English coalfields are as yet undeveloped; and it will be time enough to talk of a "coal famine" when all that is possible has been accomplished in this direction. The indication, therefore, is that coal must fall in value, sooner or later. The passing pinch is not the coming on of the inexorable Fate predicted by Jevons, but is purely a temporary congestion. Prudent users of coal will therefore keep their heads cool, and limit their demands to the smallest margin over bare necessity. There is on the part of the public a tendency to fly to extremes amid such circumstances. No sooner do they realize that house coal has gone up 5s. a ton, than they rush to buy lest it rises another 10s., and thereby not infrequently help to bring about the effect they dread.

It is gratifying to observe that the newspaper Press of the country has, on the whole, preserved an attitude of calm restraint in dealing with this important topic of the hour, which does infinite credit to the good sense of its conductors, and will help materially to keep the public from panic. Here in London we are thankful to feel that sensation-mongers have had their day in the leading newspaper offices, and a sounder fashion of reasonable news reporting and discussion is prevailing. Whereas there used to be Editors having the ear of the public who seemed to think it smart to be always shouting "Famine" when a necessary of life became dearer, or "Plague" if the wasted water supply had to be husbanded, these hysterical gentry have been cleared out, almost to a man; and their successors are acting more like reasonable beings. Thus, the "Daily "Chronicle" has wisely gone to a leading member of the coal trade to learn all about the situation; and his last words were: "Preach no panic to the public." All will come right if there is no more push. This is sensible and helpful. If all newspapers, when topics are "burning," would only use their means of gathering information in the right way, and apply to the proper sources for it, the gain to their readers would be immense.

Questions of the London Gas Supply.

A CORRESPONDENT of a financial journal has been airing his views of Gas Company Regulation, which he calls an "argument for a general and clearly defined public policy;" and inasmuch as this is the first sound of that clamour of criticism which is certain to be evoked by the London Gas Bills of the year, it is worth at least passing notice. The anonymous writer, who styles himself "Engineer," gives some internal proofs in his letter that he has lived in the same parish with a gas-works. He is not, however, altogether sound in his data. He says, to begin with, that the Powers of Charge Committee of last session "were con-"vinced that the operation of the sliding-scale as applied "to Gas Companies had not been conducive to good man-"agement." This is a complete misrepresentation of the recommendations of the Committee on this head, as reference to the record will show. He declares that "the "initial price for the sliding-scale was fixed too high at "5s. per cent. for each penny above or below the initial "price." This is cryptic; but it is probably intended to mean that, with such a sliding-scale, the initial price was too high in some instances. The writer's opinion is that gas shareholders ought never to get more than 10 per cent. "consideration;" but this is to reject the sliding-scale altogether. On other matters of finance, the critic is worse than foggy. He thinks there is no independent audit of the London Gas Companies' accounts—never having heard of the Board of Trade; and he imagines that under the sliding-scale all capital charges are taken out of profits in excess of the dividend. There is more force in the criticism that Gas Companies who can distribute "12, 13, and "more per cent.," are not working on a commercial basis. We all agree that it would be a satisfaction to find a line of policy suitable for the regulation of all incorporated Gas Companies on such a basis; but, unhappily, there is no prescription of the kind before the public. The critic insists that there should be no derogation whatever from the 16-candle power standard of quality for London gas, as tested by the portable photometer, and safeguarded from sophistication by making 10 per cent. the maximum for carbonic oxide. He contends that "if a "lower illuminating power than 16 candles is ever intro-"duced, it would mean larger gas bills in proportion to "the units of heat absent in the lower quality of gas." The detail that the price would be proportionately less is overlooked. All this is to a certain extent interesting; and one wishes that the public would more often take pains to ventilate their notions on the subject. Part of the trouble is that London is such a heedless monster that nobody knows what to think of the things said and done in its name. London, or a conspicuous part of it, once had a cannel gas supply. This was given up without anybody feeling the worse for the loss; and it is open to be argued that, for 2d. per 1000 cubic feet off the price, London would be the gainer to take 14-candle gas instead of the present supply.

Some Statistics of Trade in 1899.

THE returns of the Board of Trade for the month of December, and the aggregate returns for the twelve months, were published last week, and form some basis for an estimate of the condition of trade in this country during the past year. It is, however, at best a very meagre and unsatisfactory basis; and our Board of Trade are by no means as enterprising or efficient as they might and should be in providing reliable and intelligible trade statistics. Unless and until statistics of production are obtained from at least the leading industries in the country, the condition of British trade can only be ascertained—or, rather, inferred—from various unofficial, and by no means always trustworthy reports. This want is especially felt in considering the state of trade in 1899; for there can be little doubt that the revival which has obviously taken place in not a few industries has been due to stimulated home consumption in a much greater degree than to the growth of foreign trade. The value of the imports for the year shows an increase of 3·1 per cent. over 1898; while the exports (excluding new ships sold to foreign owners, not estimated in 1898) were 9·9 per cent. more in value. The difficulty in regard to these figures—satisfactory, so far as they go—is to ascertain how much of the increases was due to greater volume of trade, and how much to higher prices. For instance, in December the exports of coal exceeded in value the corresponding figures for 1898 by 25·8 per cent., while showing an actual decrease in tonnage of 1·3 per cent. Iron and steel exports, on the other hand, increased by 38·5 per cent. in weight and 37·2 per cent. in money—an almost proportionate rise.

For more light upon the question of the extent to which the trade revival of 1899 was one of higher prices or one of greater volume, we turn to Mr. Augustus Sauerbeck's letter on the "Prices of Commodities" in "The Times" a few days since. He therein compares the average prices of 45 leading commodities in 1899 with his records for preceding years. His statistics show that the average of these prices last year was 6¼ per cent. higher than in 1898, and 11½ per cent. higher than in 1896 (the lowest year on record). The increase in 1899 was, says the writer, somewhat less than many observers had anticipated; but it is accounted for by an absolute decrease in the prices of food-stuffs. The most marked rises were in the two groups, minerals and textiles. The prices in the former were 30 per cent., and in the latter 43 per cent., higher than in 1898; but textiles were exceptionally low in that year, whereas minerals had already begun to advance. The inference, it would appear, is that our foreign trade has not increased very considerably in volume, but satisfactorily in value. The trade revival is chiefly an affair of home markets. We shall not, then, we think, be far wrong in saying that the main source of the revival in trade generally was the great activity in the iron and mining industries. The consequent increase in rates of wages gave the working classes greater spending power, which in large measure accounts for the prosperity of the textile trades. In short, the men have earned, and the women spent, more money; while the effect upon trade generally of prosperity in two of the staple industries of the country resembles that of casting a stone into a pond.

We have recently pointed out that the activity in the iron and steel trades has been in no small degree due to the large amount of shipbuilding that has been, and is, everywhere in progress. The returns just published by Lloyd's of the shipping launched in the United Kingdom last year certainly confirm that opinion. The total output for the year was 761 vessels of 1,585,381 tons displacement—figures which surpass all previous records. In some previous returns of this kind, we are told, the figures for 1889 have been taken for comparative purposes as a rough approximation to the maximum productive capacity of the shipbuilding yards of the United Kingdom. The fact

that the output of that year was in 1899 exceeded by 207,000 tons as regards merchant vessels, and by about 127,000 tons as regards war ships—in all an increase of over 26 per cent. as compared with 1889—"indicates "alike the remarkable character of the year's work, "and the great resources of British shipbuilders." The influence of this growth of shipbuilding on the engineering trades was further enhanced by the fact that in 1889 10 per cent. of the output consisted of sailing tonnage—requiring, of course, no propelling machinery—whereas last year all but 0·14 per cent. of the output were steam-propelled vessels. At the end of the year no less than 1,306,751 tons of shipping were in course of construction in our yards. This and the fact that Navy construction shows signs rather of general increase than of a falling off (the German Emperor appears to be on the high road to success in his plans for doubling his Navy) confirm us in the opinion that the engineering and metal industries will continue active for some time to come; and, despite the check upon many trades—particularly those providing articles verging upon or included in the category of luxuries—which will be the certain consequence of the war, we do not think that 1900 will see any considerable reaction from the activity of 1899.

Coal Miners and the Workmen's Compensation Act.

Some persons have funny ideas as to what constitutes evidence—more especially if they are politicians, or writers on political subjects, for whom the personal element always is the paramount consideration. Over and over again, the habitual reader of newspapers will stumble upon amusing examples of this amiable weakness. Once a public man attains the rank either of a saint or a "bogey," everything he does or does not do is adjusted to his reputation. Up to a point, a statesman's reputation depends upon his sayings and doings; but beyond this point, his reputation overbears everything recorded of performances in word or deed. To many people, Mr. Chamberlain is a "bogey;" and they hate the Workmen's Compensation Act chiefly for his part in it. The "Daily News" is of this frame of mind. Last Friday, this ably-conducted newspaper had a leading article condemning the Act in unmeasured terms—the remarkable thing being that the subject was introduced in connection with the proceedings of the Cardiff conference of the Miners' Federation, which unanimously passed a resolution calling for the extension of the Act to all trades! This is odd, for an Act described as completely falsifying the predictions of its authors.

The article goes on to condemn the Act as provocative of litigation to an extreme degree. As to this, it is instructive to read the testimony of the delegates at Cardiff. The motion under discussion was for the extension of the Act to other trades and workmen, and for the abolition of the fortnight's grace, with a minimum allowance. A delegate from North Wales said they were in this region "receiving "the full benefits of the Act, and had only had to go into "Court with two cases." A man from Cumberland testified that not a single case had been taken into Court. The Chairman agreed with this witness that the Act could be worked at a cost of one-third of a penny per ton of coal raised. The Vice-President of the Welsh Federation acknowledged that there was no difficulty in the working of the Act, either from the employers or the Insurance Offices. He only had the reasonable comment to make that claims should be promptly settled. A Scotch member complained of the smallness of the scale of compensation for young people. This was all the criticism of the working of the Act. Where is the condemnation here?

If the "legal editors" of the Act—meaning those painstaking lawyers who have made books upon it—do not like it, is this good evidence of its failure? The truth is that most of the dissatisfaction with the Act and the litigation has been over boundary questions. Problems of this kind will never be got rid of. The Trade Unions might be consulted on this head. Once let it be admitted that a man is protected by the Act, and there is no room for litigation worth speaking of. Make all workpeople claimants, and this boundary difficulty would not disappear; for it would often be asked, Who is a workman? It would be no easier to decide who is a "workman," than what is a "factory" within the meaning of the present Act. Next time the "Daily News" vents its dislike of the Act, it had better provide more evidence of its failure than was shown at the Cardiff conference. This is the second time we have convicted our contemporary of entertaining prejudice against the Act, without regard to the weight of evidence. The first time it was a question of the asserted excessive cost of working the Act; and we then disproved the imputation by referring to the fact of the willingness of Insurance Companies to renew policies for a second year at largely reduced premiums. The "Daily News" must try again at a fresh place.

Gas-Works Traders' "Rings."

Information has reached us of the recrudescence, among a certain order of purveyors of gas-works necessaries, of the attempt to control prices by the formation of "rings." An exposure of a trick of this kind appears in another column. There is no need to vouch for the genuineness of this information; those implicated will recognize their own handiwork. Once more, let us say, this practice is foredoomed to failure, and cannot be defended on any legitimate ground. Ten firms may join to make a price; but they can never tell that an eleventh will not spring up to snap the job on which they have set their hearts. This is a free country. All gas-works supplies are open to the market. If certain firms lay themselves out for doing the gas-works trade, they ought to be able to quote the very lowest prices. They can combine to keep their prices unnaturally high only at their peril. There are scores of manufacturers and dealers in commodities similar to those required in the gas industry, always ready to "chip in" if they only get wind of any jobbery in the gas connection. The only sure way of keeping a trade in a speciality is to do it better and cheaper than any outsider can hope to effect. Of course, the question of rings as against list prices is one of degree. There is no objection whatever to dealers in standard articles agreeing not to cut one another's throats by offering one commodity and then another at an unfair discount. Poaching is not sportsmanlike. On the other hand, the sportsman must act on the square, and not be greedy. It is to be hoped that the British Parliament will never be troubled with the demand for legislation on the lines of the American Anti-Trust Laws. Quite recently, most American makers of gas and water pipes formed themselves into a "Trust" and divided the land. There were six of them; and the "combine" has been declared illegal by the Supreme Court. Whether legal or not, we do not want anything of the kind here.

Unlovely Aspects of Trade Unionism.

Practical Trade Unionism has not added to its reputation of late. The most successful organization of the kind—the Miners' Federation—has been holding a conference at Cardiff, apparently to advertise the fact of the Federation having at last gained a footing in South Wales. Mr. Ben Pickard, M.P., presided over this gathering; and it is now to be supposed that "Mabon" and all the other Ancient Britons will have to take a back-seat at these celebrations of the glories of Trade Unionism. This is one of the penalties the Welshmen pay for the follies of 1898. Mr. Pickard pronounces against sliding-scales for the regulation of miners' wages. He graciously approves of the Welsh Conciliation Board, without the independent chairman once regarded by the colliers as indispensable; but he warns the men that they must keep up their local Unions, as a protection for the workers in every pit. Mr. Pickard is still committed to the academic cause of the Eight-Hour Day; and as this nostrum bears no concrete relation whatever to the working conditions of any coalfield in operation at the present time, he thinks it just the right thing for Parliament to enact. So much for the practicality of the practical man. Even the "Daily News," while thinking that, if the leaders of the Colliers' Unions do not like the sliding-scale, this means of regulating wages will have to be dropped, demurs to the assumption of the same individuals speaking with authority on the Eight-Hour question. Why this discrimination?

Leaving South Wales, it should be noticed that this present hour of national strain and stress has been selected by the Seamen's and Firemen's Union as an opportunity for renewing the late abortive attempt to prevent the sailing of ships from British ports. The Society tailors employed by a firm of military outfitters struck at what they thought would be a favourable moment for the enforcement of their claims, and were incontinently cleared out. It is reported that the adaptation of transports for the reception of the cavalry and artillery reinforcements so badly needed at the Cape, was in several instances delayed

by "labour troubles." Lastly, the Operative Bricklayers' Society have exhibited the fruition of bad counsels by turning upon their own representative in the London County Council—Alderman R. H. Taylor—and stopping his pay because he dared to decide temporarily a demarcation dispute in a sense not desired by his own Union. This is how all the fine-spun theories about Trade Unionism "pan out." Mr. W. C. Steadman, M.P., is also by way of experiencing the ingratitude of the "organized" workman. Like Mr. Taylor, the member for Stepney has an untarnished record as a Trade Unionist and public man. If the labourer is worthy of his hire, the Trade Union Member of Parliament or County Councillor is deserving of his salary. But the sense of common fairness and honesty of dealing between man and man has been so dulled by official Society dealings with the every-day questions of work and wages, that it does not respond to the appeal of domestic duty. The cases of Alderman Taylor and Mr. Steadman are not agreeable to contemplate.

WATER AND SANITARY AFFAIRS.

The first note of opposition to the Welsh Water Bill of the London County Council was sounded in the Private Bill Office of the House of Commons last Tuesday, when the announcement was made that a memorial had been deposited complaining that the Standing Orders of the House had not been complied with. The memorialist was a Mr. John Griffiths, the proprietor of a pump-room and hotel in a Breconshire parish possessing a name much less well known than that of this particular resident; and the nature of his allegations will be revealed when the matter comes before the Examiner on the 18th inst. Supposing he should be successful in sustaining them, we much doubt whether the Standing Orders Committee will allow the non-compliance of the promoters in this one case to jeopardize their Bill, assuming that its *raison d'être* can be justified. It is not, we think, the memorial of a Breconshire hotel-keeper that will bar the progress of the Bill, but something far more important. There was a rumour in Westminster last Tuesday that the long-awaited report of the Royal Commission had been issued, and that it was dead against the Welsh scheme; the existing sources of supply being considered sufficient for the next forty years. Nothing, however, had then been seen of the report at Her Majesty's Printers; nor has it since made its appearance. But a pretty general idea has been formed in certain quarters as to the nature of the Commissioners' recommendations. In the absence of the report, we must speak with all reserve; but we believe we are right in saying that the Commission advise that the water undertakings should be acquired and handed over to a specially constituted Water Board, composed of representatives of the Local Authorities within the existing limits of supply, with a Chairman and Vice-Chairman chosen by the Local Government Board. This, according to rumour, is the principal recommendation in the report; and it answers in a very straightforward manner the first question put to the Commission. But whether, in the existing condition of the political atmosphere, it is likely to be adopted and carried into effect by the present Government, we need not stay to inquire. It may possibly be deemed advisable to get rid of the complications brought about by the situation in South Africa before again taking up the water question; and considering the time which has elapsed since the Commission was appointed, a year or two will not make much difference. In the meantime, the water supply of London has been rendered more efficient by the intercommunication scheme; the works of the Staines Reservoirs Joint Committee are making rapid progress; and the Water Companies will shortly bring before Parliament a comprehensive project for providing for the future needs of the consumers. Whether the undertakings remain in the Companies' hands or are transferred to a public body specially created for their control, their efficiency must be maintained.

While we are waiting for the report and the opening of the parliamentary campaign, it may not be unprofitable to leave for awhile the discussion of the merits of projects for furnishing additional supplies of water, in order to consider how it will be possible to conserve and use more economically those already possessed. During the prevalence of the drought last summer, consumers of water, not only in the Metropolis, but in several Provincial towns where the supply is in the hands of the Local Authorities, had to be cautioned, by official notices and through the medium of the Press, against its misuse and waste. In this as in other matters relating to water supply "The "Times" did good service in pressing home the question of the necessity for checking waste, by presenting some interesting statistics and particulars showing how that waste arises, and how a great deal of it may be prevented by adopting suitable methods. The writer in our contemporary computed that at least 50 million gallons of water are wasted daily in London—*i.e.*, allowed to run away without doing good to anybody. In other words, twice as much water is lost in the Metropolis as would suffice for the supply of Birmingham; and, if conserved for a period of three months, it would be equal to an entire month's supply. He went on to show how, by the use of meters and by the proper inspection of premises, this great waste might be reduced without withdrawing a drop of water from any legitimate purpose, public or private, not excepting the watering of plants, the denial of which to the "poor East-ender" gave rise to so much pathetic writing in certain of the papers last year. His conclusion was that preventible waste takes place, from sheer carelessness, to the extent of about 10 gallons per head per day in London. Of course, defective closet fittings and taps left open are regular causes of waste. This was amply shown in the correspondence which took place in our columns during the autumn of last year. If this sort of thing continues, the suppliers of water—whether Companies or Local Authorities—will be compelled to take steps to have the offenders punished by the imposition of heavy fines, or to supply them only through meters. In such a matter as this, as the writer in "The Times" has pointed out, neither sentiment nor policy should be allowed to stand in the way of the public interest.

It is not, however, in these islands alone that the question of checking waste is demanding attention. In far-distant India, as we learn from a local paper recently received, the Municipal Authorities of Bombay have been greatly exercised on this and other matters connected with water supply. The services of Mr. Santo Crimp have been called in, and he has lately presented to the Corporation a report in which he discusses in a clear and lucid manner the points submitted to him—one being an augmentation of the available sources of water by the sinking of artesian wells. It appears that any development of the water supply of the city in the future will have to be effected by utilizing to the fullest extent the Tansa scheme, which Mr. Santo Crimp considers reflects the greatest credit on all concerned in it. It is not, however, with this portion of his report that we are now specially concerned, but with that in which he deals with the waste of water that goes on in the city. It is difficult for residents in climates such as ours to gauge the absolute requirements, in the matter of water supply, of residents in Indian cities; and therefore when we learn that 35 gallons per head per day are used in Bombay, we are not greatly surprised. The high temperature causes free use of water. At the same time, there are six cities —Poona heading them—whose populations seem to get on very well with 18 gallons; while the dwellers in Nagpore have to be satisfied with 7½ gallons. Allowing for any extra quantity required by the different conditions of life in the island city, there is a wide margin between 18 and 35 gallons; and Mr. Santo Crimp gives the reason for it. As a matter of fact, no less than 15 million gallons of water —equivalent to the entire supply from two of the sources— are wasted every day; and his frequent inspections of the city lead him to believe that "nearly all this is due to "leaky taps and services, and to the habit many people "have of leaving the taps open." He is of opinion that 20 gallons per head should be sufficient for the wants of Bombay. Therefore, it behoves the Water Department of the Corporation to set about reducing the consumption to the figure mentioned.

But how is this to be done? Water engineers in this country and in America will probably suggest the adoption of meters and a system of vigilant inspection. This might do very well for us and for our cousins across the Atlantic; but Mr. Santo Crimp says that it would not do in Bombay. He considers that the introduction of meters in the city would not be a popular measure; and therefore he advises the alternative remedy of repairing the defective pipes and fixing new taps. As the Corporation are said

to have an "insuperable repugnance" to the use of meters, they will doubtless favour the adoption of this remedy. Curiously enough, the late Water Engineer, Mr. S. Tomlinson, at one time advocated it; and, at his suggestion, a Water Waste Prevention Department was constituted as a part of the Municipal Administration. However, he soon discovered that they failed to stop the waste; and then he pinned his faith to water-meters. It appears from a letter in "The Times of India" (to which source we are indebted for the foregoing particulars) that up to now two forces have been in action to prevent their general adoption in Bombay. Owners of houses, the writer says, have reason to fear, from their previous experience, that meters would largely increase the cost of water, that their action would be capricious and uncertain, and that their frequent examination and repair would cause endless worry and inconvenience. They have therefore expressed a pretty firm determination not to permit their introduction. Furthermore, the Municipal Executive have been afraid that the general adoption of meters might have a disastrous effect upon the revenue; and they have taken into account the not inconsiderable expense of the staff employed in recording the registrations. He thinks the direct result of the introduction of meters would be to make it to the interest of houseowners to use as little water as possible, and to pay for the inventive faculty of plumbers in the use of water-saving appliances. Under existing conditions, it is certainly not to the consumers' interest to be economical with water. This is plainly observable both in and out of the houses, and especially at the public drinking fountains. To the leaky taps and the general dampness resulting from waste is attributed the low state of health of the poorer classes and the persistent prevalence of the plague. Unfortunately, they and the tenants of houses do not generally appreciate this. They only understand the necessity of using vessels for economizing water when, in the outlying districts, they have to lift it from wells.

It will be clearly seen, from what has been said, that the present system of open taps must be abolished; but, as far as we have been able to gather from the information to hand, no really practical remedy for the existing evils has been devised. This is the view of our Indian contemporary. It is thought locally that, admirable as are the main suggestions embodied in Mr. Santo Crimp's report on the water supply of the city generally, on this question of checking waste he has to a certain extent been led astray by lack of close acquaintance with the habits of the native population. "Constant pressure, better taps and services, "and a more efficient supervising staff, will never," our contemporary declares, "stop a waste which is caused by the "grossest laziness and carelessness, and which goes on in "every quarter of the native town." This being his view, we scarcely understand an opinion he expresses elsewhere that much good might be done by closer supervision by the Water Department of the Corporation—not in the way of summonses and cutting off the supply, but by "more "sympathetic dealing with the people at large, and by "the increased use of the gentle art of persuasion." We are greatly afraid that if water consumers are determined to be wasteful, they will not be "persuaded" to be otherwise though one went to them from the Corporation. It seems to us that they must be absolutely prevented, for the general welfare of the public, from indulging in their propensity.

The Index to Vol. LXXIV. of the "Journal," July to December, 1899, is now ready; and a copy will be forwarded (free) by the Publisher, on receipt of a post-card from any Subscriber.

Wide Tendering.—A correspondent sends us the following particulars in regard to some tenders recently submitted for fire-clay goods. The offers were sent in by five Stourbridge firms and a Yorkshire firm, and were based upon a detailed specification. All the goods were priced out. One Stourbridge tender was for £2441 0s. 10d.; the other four were each for £3002 2s. 6d.; and the Yorkshire firm's figure was £3315 8s. 3d. The order was placed with the parties who sent in the lowest tender—a first-rate firm of old standing. The reflection that naturally arises on looking at the figures is: If this firm can supply, at a fair profit, for £2441 the goods required, as no doubt they can, what must be thought about the extra £561 charged by the other firms in the same locality who submitted tenders? The fact that the tenders of the latter firms were all alike to a penny speaks for itself.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 160.)

Business last week on the Stock Exchange was extremely quiet from start to finish. At the opening, things felt dull at not receiving better news from the seat of war; but before the day closed, they brightened up a bit. Then came a long period of equilibrium, with hardly any movement, but with a good steady tendency. The favourable disposition was confirmed when it was seen that the fortnightly settlement was going through smoothly; and the progressive cheapening of money had a powerful influence. Thus, although business was small and subdued, prices all round had a nice advance; and Consols at the close were only just short of touching par. The chief source of this favourable tendency was in the Money Market, which moved by rapid strides from easy to easier. The reduction of the Bank rate from 6 per cent. (fixed on the 30th of November) to 5 per cent. became inevitable on Thursday—a reduction which was happily accentuated by similar movements in the Banks of France and Germany. In the Gas Market, business was decidedly quieter, and altogether in sympathy with the tone of the other departments in general; and, as in the preceding week, transactions were to a great extent confined to the big issues. Variations of quotation were very few and slight; and though there were as many in one direction as the other way, the prevailing tendency was more settled in favour of firmness. Gaslight issues had by far the greater share of all the business done, and were steady. The ordinary was not too strong at the opening, and marked 104; but it got better as time went on, and closed with 105⅝. The secured issues were fairly active; but they gave no sign of a move either way. South Metropolitan was rather jumpy at first, but soon settled down to good steady figures. Commercials were hardly touched. The Suburban and Provincial Companies were about as near to actual stagnation as they were in the preceding week; and the only change was a slight reduction in Alliance and Dublin. The Continental group were not active beyond a moderate amount in Imperial, which receded a couple of points. The remoter undertakings were little dealt in, and made no sign. Business in Water was at about its usual level. Prices were irregular—Chelsea improving, while New River and West Middlesex went back.

The daily operations were: Business was moderate on Monday, mostly in Gaslights and South Metropolitan. Imperial fell 1, and Alliance and Dublin ¼. Transactions were lighter on Tuesday, and Gas quotations did not move. In Water, West Middlesex dropped 2. Business was much restricted on Wednesday, and prices were easy. Imperial receded 1 more. In Water, Chelsea advanced 2; but New River was 3 lower. On Thursday, Friday, and Saturday transactions continued very moderate. No further changes occurred in quotations; and prices in general ruled pretty firm.

ELECTRIC LIGHTING MEMORANDA.

Electricians' Worries—Indiarubber and Copper—The Fuel Value of Towns' Refuse—Electric Light in Whitechapel.

The electrical industries are getting very uneasy on several independent accounts. First and foremost, like everybody else, they are at their wits' end for coal. True, they try to console themselves with the fond belief that the shortage of coal must hit the gas industry even harder than their own. But that reflection is open to several qualifying considerations; and meanwhile it does not help to make the wheels go round. The deficient quantity and exorbitant price of the best Welsh steam coal, which alone is suitable for the central stations of the most important electricity supply undertakings, is a terrible affliction in many ways. The very best of fuel is not too good for the needs of these establishments, cramped as they are for boiler house room and power. Besides, there is the policeman over the way or round the corner, with his eye on the top of the chimney; and penalties for creating a smoke nuisance are cumulative. Coke is out of the question. There is none of the oven variety to be had; and gas coke is not the drug it was. Liquid fuel? Unfortunately, mineral oils threaten to grow scarcer and dearer. Experience proves that what is called cheap liquid fuel does not long preserve this character. Buyers are pressed to take it at an "alarming sacrifice" when it suits the sellers' book to unload an embarrassing stock. But this operation once effected, up goes the price for future supplies; and the liquid fuel user pulls out his injectors in disgust.

The shortage of coal may be, and probably is, temporary. There is no real dearth of it in sight; although prices will be unsettled for some time to come. Electricity supply, however, is dependent on other necessaries besides cheap coal. Indiarubber and copper are also becoming "words of fear" to the electrician, who has never really loved the cable manufacturer. The electric light engineer has frequently spoken his mind respecting the indispensable cable men, and cannot forgive the latter for playing the part of the "still swine that eats up the draff." Cable makers do not read papers, nor trouble themselves about load-diagrams and differential methods of charging. All

they do is to fill orders, preferably for cash, and distribute comfortable profits. Nor are they greatly disturbed by the multiplication of discoveries that the early electric lighting insulated cables are not lasting so long as was once expected. Copper? Well; copper is a mystery. The imagination of electricians has always played round this necessary of their trade; and more than one bold schemer has suggested the sinking of something analogous to another National Debt in copper mains. For years past, rough copper was worth about £50 a ton; and the producers were not very prosperous. Some remarkable aspects of the copper trade have been discussed by Mr. R. G. Elwes in the "Financial News." The impressive fact is brought out that the commercial introduction of electric lighting in or about 1880 doubled the demand for copper for the decade. Ever since, the output has steadily increased, and is likely to keep up. Moreover, it is worth bearing in mind that, whereas the older uses of the metal (as for locomotive fire-boxes, the sheathing of ships, and utensils of different kinds) only amounted, as it were, to a lending of the material for the purpose—most of it coming into the market again later in the form of scrap—the electrical employment of copper absorbs it once for all. Mr. Elwes holds the opinion that for years to come, in the most favourable conditions, the value of copper is likely to rule just high enough to make it sensibly dear—say up to £75 per ton—without actually checking the demand. Meanwhile, it should be observed that mechanicians are dispensing with copper wherever possible, thereby abandoning it to the electricians.

A very serviceable and timely communication on the subject of the fuel value of towns' refuse has been made to the "Electrical Review" by Mr. Ed. C. De Segundo. The attention of members of local authorities should be directed to this statement, because it is more than likely that the dearness and scarcity of coal may be worked to the advantage of schemers of dust destruction-*cum*-electricity generation plants. It seems tedious to be always going over this ground again and again; but experience teaches that the ignorance of some local authorities in respect to such practical matters is almost invincible. Yet so long ago as 1888 the Local Government Board instructed Colonel Thomas Codrington to make a report upon the whole subject of the burning of towns' refuse with utilization of the heat evolved; and the result was to show that this heat cannot be rightly regarded otherwise than as a bye-product of extremely variable amount—the working in one locality being no guide to what may be achieved in another. Mr. De Segundo criticises recent papers and reports setting forth the value of refuse destructors, pointing out that the data do not agree with Colonel Codrington's figures. The character of the refuse, judged as fuel, varies enormously, not only from time to time, season to season, but from load to load. The proportion of moisture is always uncertain. The general conclusion is that the heat of refuse burning is purely adventitious. The first duty of the apparatus is to efficiently consume or cremate the offensive stuff it has to deal with in an innocuous manner. What to do with the heat evolved is a secondary consideration. And it must be so; for there are times when the refuse will not burn itself at all, and the accident of its being a better or worse combustible has nothing to do with the needs of any heat-utilizing plant attached to it. If the heat evolved abundantly at the periods of the best working could be saved or stored up for equalizing the output, there would be something more to say about it; but this cannot be done. From the point of view of the ratepayer, therefore—which should also be, but is not always, the standpoint of the local authority—the dust destructor remains merely one means among others for disposing of town refuse, and must be valued accordingly. The disposable heat is no asset.

One of the latest examples of the combination just discussed is the Whitechapel Vestry plant; the central station being situated next door to the destructor yard, "in the very heart of the district." There cannot be many localities of which this can be said. It does not sound very nice, even for Whitechapel; but perhaps it will save the Vestry something in cables. Another peculiarity of the undertaking is the system of charging for current supplied to private consumers, who will pay a penny per unit for all the current taken during the six summer months, and during the winter season according to one of two optional scales. The first scale provides for the continued charge of a penny per unit, with the addition of 1s. per month per lamp used. The second scale is based on charging 8d. per unit for the current taken during the first sixty hours per month, and 1d. per unit for the rest. The Vestry informs the public that ordinary shop and house lighting on these terms will work out at 2½d. per unit, "which is so much below the cost of gas that the District Board are assuring ratepayers that the saving by using electricity will repay the outlay on fittings in less than three years." The wonder is if this statement will go down in Whitechapel, where, if the people have money to spare for luxuries, electric lighting is not likely to be included in the category.

Water-Meters and the Prevention of Waste.—At the meeting of the Institution of Mechanical Engineers on the 26th inst., Mr. W. Schönheyder will read a paper on "Water-Meters of the Present Day, with special reference to Small Flows and Waste in Dribbles." The author will indicate the features of the various kinds of water-meters, and describe in detail the "Imperial" meter, one of which will be shown in operation.

A HISTORY OF GAS PRICES IN LONDON.*

THERE is no more engrossing study for professional economists as well as ordinary people than the prices of commodities, and how they have altered from time to time. In particular, the determination of the market value of a totally new article is always a curious question. It is easy to understand how the merchants who introduce a novel commodity, or a product, to compete on something like common ground with another article of the same kind already in the market, are fain to attract purchasers by selling it a little cheaper, or else manifestly offering better value for the money, than the old stuff. But when it was a case of supplying the market with something absolutely new, as illuminating gas, and delivering it to the consumers' own door, in a fashion that had never before been thought of, it can readily be understood that the price to be charged could not be arrived at by any such simple process. We are so accustomed nowadays to the principle of house-to-house distribution of necessaries, that it is hardly possible for us to realize the force with which the compulsory adoption of the principle as an essential feature of the new industry of gas manufacture and supply must have struck our forefathers in the years before Waterloo. It was probably this obligation to solve the problem of distribution as well as to work out the system of manufacture, that made the way of the pioneer gas companies so arduous. For this reason, the original contracts entered into between the companies and their daring customers were based on mere guesses at what was a reasonable charge. From the start, gaslight was so vastly superior to the whale-oil or colza lamps or the tallow candles of the period, that there was a good market for it; hampered only by a not unreasonable fear of the strange and subtle gas. The companies and their customers made special bargains, on the principle of renting the light, not buying the gas. Mr. Rostron, who has performed the timely service of placing upon record the historical facts of the Metropolitan gas industry, has omitted to mention this, the earliest phase of the question of price. It is not, perhaps, very material to the actual issue now awaiting the attention of Parliament; but it is well that gas-works administrators, at least, should not forget that at first, and for a long period (covering the lifetime of the original pioneers of the industry), the business was the provision of light—nothing more nor less. If this condition of the gas makers' trade had persisted, we should now be witnessing a very different state of things from that existing in gas-lit towns. The development of gas-burners would be in the hands, and to the advantage, of the suppliers instead of the consumers of gas. The only trace of this state of the industry that remains to us is the preservation of the term "rental" to signify the totality of the sales of gas by measurement and contract.

Science, however, is measurement; and no manufacturing industry can be regarded as placed upon a sound and safe basis until it is brought under rule and measure. When the London Gas Companies ceased letting out gaslight upon a rental charge, and took to selling gas instead, they very soon found themselves subjected to parliamentary enactments designed to bring order into their finances, and to protect the public against being unfairly exploited by what it was realized would become a powerful and lasting "interest." At this critical juncture, as we have had previous occasion to show, Parliament was inspired with the wise determination to regulate the price of gas indirectly by formulating the maximum rate of dividend and the amount of other permissible capital charges at the command of the proprietors, instead of undertaking to say at what price it should be sold in every particular instance. Unfortunately, the intention of Parliament was in many cases frustrated. It was the time of competition in gas supply; and the safeguards of the Gas-Works Clauses Act, 1847, were looked upon as too remote from the immediate solicitude of the consumer for gas at something like his own notion of a fair price. The temptation to new gas companies was therefore to "give it a name." Thus, the Great Central Gas Consumers' Company owed their existence to the offer to be bound down to supply gas at never more than 4s. per 1000 cubic feet. This was in 1850; and the circumstance of the then existing Companies, although they had for years been under the conditions imposed by the Act of 1847, standing out for 6s. per 1000 cubic feet must be scored against the practical efficacy of this statute.

It began to appear within a few years of the admission of the Great Central Company—the symbol of competition in gas supply based on the best technical and commercial working—to the circle of Metropolitan Gas Companies, that the virtue of competition was exhausted. At the competition-made figure of 4s. per 1000 cubic feet, the industry seemed to have reached a deadlock. The Companies could hardly pay their way; and "the hole in the bucket" was discovered to be the undue diffusion of the distributing plant, its unnecessary multiplication, and its poor quality. Voluntary districting arrangements followed; and the financial circumstances of the Companies began forthwith to mend. Unfortunately, the public did not participate in this

* "The 'Powers of Charge' of Metropolitan Gas Companies. A History of the Question of Price in London from the Introduction of Gas Lighting to the Present Time." By Laurence W. S. Rostron, M.A., B.C.L., Barrister-at-Law. With a Preface by George Livesey, M.Inst.C.E. London: Walter King; 1900.

benefit. Some of the Companies who had thus escaped the pressure of competition put up their price; and this proceeding naturally caused more public agitation. The outcome was the famous Metropolis Gas Bill of 1860, which Mr. Rostron intelligently discusses. The Act when passed was declared to operate more in favour of the Companies than of the public; and it was reputed a failure because it did not punish extravagance and bad management. And so the agitation for better external regulation went on. The public had had enough of competition, which saddled London with thirteen Companies, most with excessive capital burdens; while the desideratum of good business management was certainly not forthcoming as a redeeming feature of the competitive *régime*. Utter chance seemed alone to determine whether a part of London should be decently served with gas or not. A few of the Companies had kept their capital low, and were blessed with capable administrators; and in their districts gas was comparatively cheap and generally satisfactorily. Two of these Companies, or the policies which dominated their small originals, have survived; the others have become absorbed. The new policy of amalgamation, designed to economize the cost of administering the supply by thirteen Companies, has not completely resulted in preserving the fittest.

The rest of the tale is a narrative of successive attempts to realize the original intention of the Legislature, as defined in the report of Lord Cardwell's Committee in 1867. Mr. Rostron is careful to let the parliamentary record speak for itself; and a painful story it is. Originally, the payment of a 10 per cent. dividend on the pioneers' capital was permitted; but for many years it was an ideal that seemed unattainable. No sooner was it secured, by stopping the waste of competition, than it was erected into a right. This made it difficult to link the attainment of the maximum dividend to the observance of "due care and management" of the business. A high degree of security for the maximum dividend proved to be antagonistic to the rule of leaving bad management to the natural punishment of bankruptcy. Then the sliding scale was proposed; and while one party accepted it as almost a counsel of despair, others rejected it, and yet another took to it as a panacea for the gas troubles of the Metropolis. One of Mr. Rostron's best chapters is that in which he reproduces the arguments that prevailed with Mr. W. E. Forster's Committee in 1875, and presumably weighed with the Commercial and Ratcliff Companies, who were the first to accept the recommendation of the Committee.

Here we judge it best to leave Mr. Rostron's book. He ventures to criticize the sliding scales of the London Companies by their results, as to which it is fairer to direct inquirers to the text. The circumstance of the author being a son of one of the South Metropolitan Directors, and having had the advantage of Mr. Livesey's assistance in reading his manuscript, lends authority to his statement of the subject. The book is provided with an index; and is distinctly one to be procured and studied by everybody who may be interested in the subject.

RECENT PUBLICATIONS.

The Prevention of Factory Accidents. By John Calder. (Longmans, Green, and Co.)

In this work the author, who has had an engineering experience of seventeen years, and was until recently one of H.M. Inspectors of Factories, has set himself to supply the need of a handbook dealing with the practical aspects of industrial accident prevention. In view of the very considerable liability now imposed upon employers in respect of accidents to their workmen, and of the various obligations laid upon them by the law to provide appliances calculated to reduce the risk of accidents, Mr. Calder's book will be welcomed by all users of mechanical power. The wonder is that the gathering together of the law on the subject, coupled with practical suggestions for the minimizing of accident risks, has not been done before. It has certainly been very well done now.

In the early part of the work an account is given of the number of persons employed in the various factory industries of the country, and of the accidents occurring in each of the employments. This is followed by a digest of legislation dealing with accidents to, and safety of, employees; while at the end of the book the actual text of those portions of the Factory Acts which relate thereto is given, and the various clauses are collected from their respective statutes and arranged in an intelligible manner together. The laws governing workmen's compensation for injuries are also summarized, and explained at some length. Mr. Calder gives his opinion of the Workmen's Compensation Act, based on the first year's operation. He declares himself very favourably impressed with its provisions and working, and takes the common-sense view of the litigation that has arisen from its administration:

> Notwithstanding the numerous adverse opinions expressed during the last two years as to the probable value of the measure, the benefits in relief from actions at law, and pecuniarily, which it has conferred on three and three-quarter millions of operatives in ordinary factories, and also upon half as many workers in mines, quarries, docks, railways, and other places, are very real and extensive. They have, however, been largely overlooked, owing to the remarkable facility with which the great majority of claims have been settled extra-judicially, and the very general abstention from recording such agreements in the County Courts. . . . These results [the small number of judicial arbitrations, compared with the total number of accidents, the absence of friction in the application of the Act, and the prompt settlement of claims by employers and insurance undertakers] are in striking contrast to the costly legal proceedings . . . which are annually instituted at Common Law and the Employers Liability Act, 1880, throughout the Kingdom, in connection with factory accidents, and many of which are unsuccessful.

Such testimony, from a practical man with personal experience of the working of the respective Acts, is very gratifying to those who wish well to the legislation of 1897. The main part of the book is occupied with an examination into the causes of accidents, followed by a most useful account, fully and clearly illustrated, of the most approved and successful appliances for the safeguarding of engines and machinery generally, and of dangerous machines in particular. The whole constitutes a useful, as well as an interesting and well-written, handbook.

Digest of Cases under the Workmen's Compensation Act. By James Weir, M.A. ("Insurance Observer.")

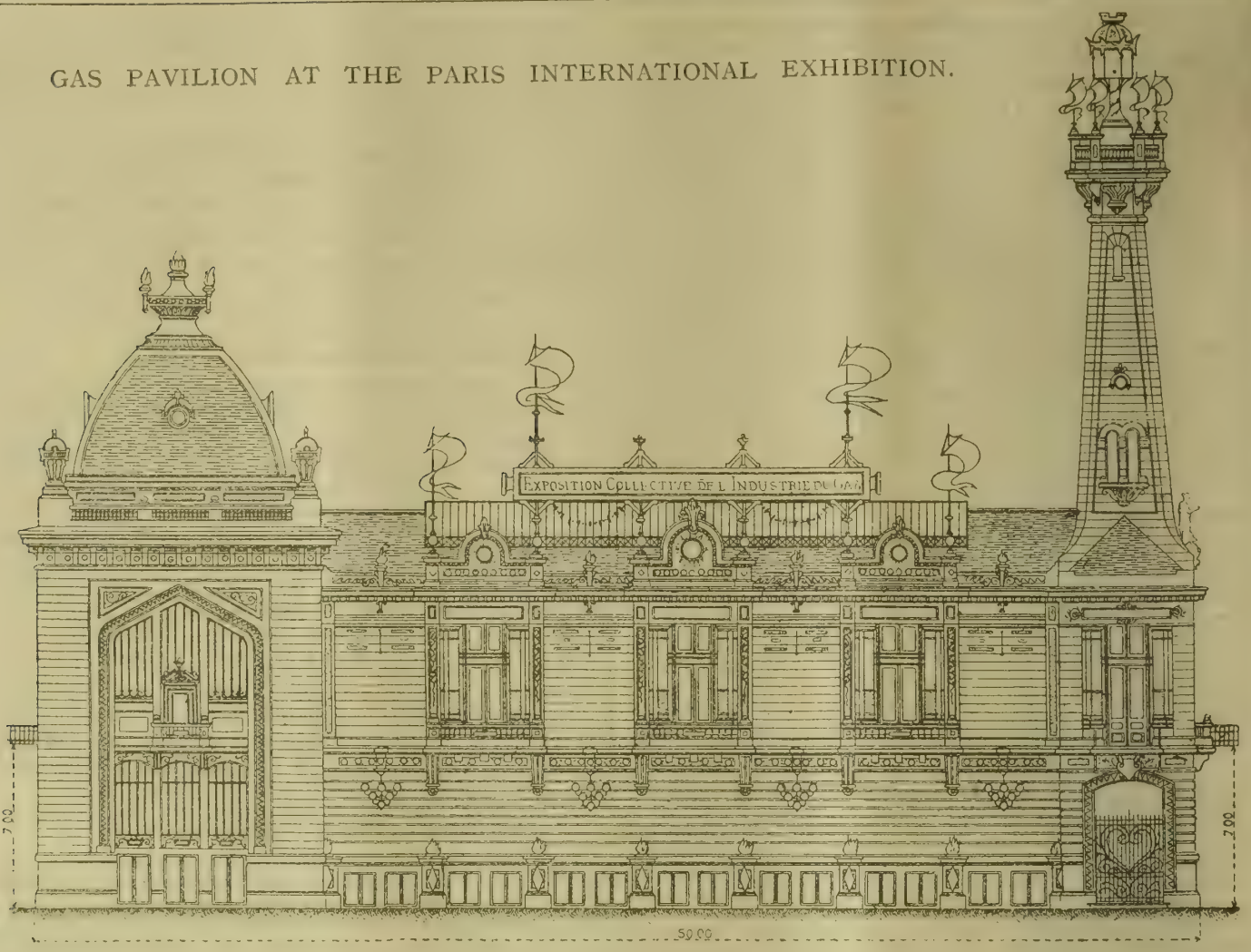
This is a reprint, with alterations and additions, of a series of articles which appeared in the "Insurance Observer" between April and September this year. The author starts with the text of the Workmen's Compensation Act, 1897, and the Factory and Workshop Act, 1895, and then gives a digest of the cases which have arisen. He states in his preface that his object has been to present "a short view of the actual results of a year's litigation" under an Act which has given rise to probably more contention in the Courts than any one which has been placed upon the Statute Book. This statement is borne out by the 56 cases tabulated, all of which went to the Court of Appeal. The first group of cases relate to employments to which the Act applies, and turn upon the troublesome words "on or in or about;" the next, upon accidents coming within the Act. Then we come to a number of cases under sub-section 2 of section 1, where compensation to a workman is disallowed if the injury can be proved to be attributable to his "serious and wilful misconduct." The fourth group of cases deal with workmen and their dependents; and the fifth, with the scale and conditions of compensation. The final group relates to procedure and kindred matters.

Water-Works for Small Cities and Towns. By John Goodell. ("The Engineering Record," New York.)

Notwithstanding all that has been written on water-works construction and water supply generally, sufficient evidence was afforded to the proprietors of the above-named publication—by letters addressed to the Editor—that further information was needed, to justify them in requesting Mr. Goodell to prepare a book on the subject, to form one of their "series." This he has done; and the outcome is the work now under notice. At the very outset he explains that it does not contain any new theories, or any references to methods of construction or design which have not proved satisfactory in actual use. So that he may presumably be regarded as a fairly safe guide. But, if there is a lack of originality, there is a good deal of information, not easy to be obtained, brought into the book; and in dealing with his material, the author has endeavoured to make it useful to all who, whether technically or administratively, have the supervision of water-supply undertakings.

With this introduction, we will glance at the results of Mr Goodell's labours. The author deals first of all with surface water, and gives statistics as to the yield of catchment areas. He describes and illustrates the method of gauging brooks to ascertain their flow, and then offers a few remarks on the analysis of water. The succeeding chapters are devoted to storage. Beginning with earth dams, the author emphasizes the importance of bestowing the greatest attention upon their construction, as otherwise they may be a source of danger to people living below them. He considers the qualities of the materials employed in this work, and describes the minor details of reservoirs. Timber and masonry dams are next dealt with; and he then leaves the subject of construction, to indicate the special features of water drawn from rivers, ponds, and underground sources. Well-sinking is described at some length; and so are pumps and pumping machinery. A chapter is devoted to the air-lift method of raising water, which, though not by any means new, has been made a commercial success within the past few years. The clarification and purification of water receive due attention at the author's hands; but he declines to pronounce definitely as to the advisability of employing mechanical or sand filters. Each case must necessarily be dealt with on its merits, and after a careful study of local conditions, cost of plant, and other matters. Having procured, stored, and purified the water, Mr. Goodell explains how it is distributed. In these chapters he takes up the subjects of the flow of water in pipes, reservoirs and their linings, water-towers, and standpipes and their substitutes. On the question of the quantity of water to be provided, his figures of 40 to 60 gallons per head are rather higher than those to which we in England are accustomed. The provision of water for fires—a subject which, the author says, receives inadequate attention in books on water-works construction—is considered; a series of tables, containing the results of experiments with "fire-streams," extracted from the "Transactions" of the American Society of Civil Engineers, adding value to this part of the work. The concluding chapter in the book is devoted to the water-works department generally; the author touching upon financial matters, the checking of waste, and the maintenance of the works. The book, on the whole, presents a good idea of American practice.

GAS PAVILION AT THE PARIS INTERNATIONAL EXHIBITION.



ELEVATION.

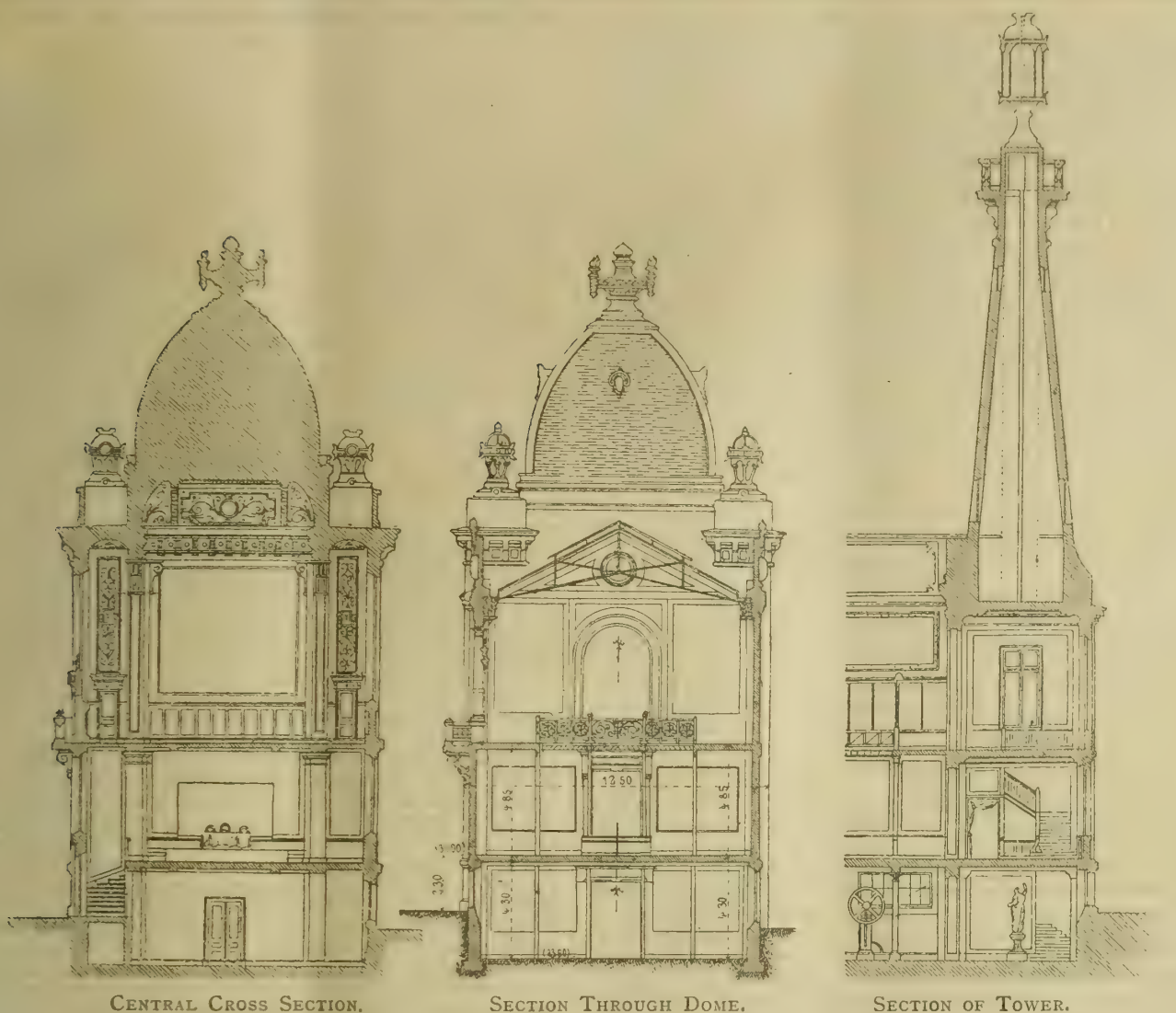
THE PROPOSED GAS EXHIBITION AND CONGRESS OF GAS ENGINEERS AT THE PARIS EXHIBITION.

IN previous issues of the "JOURNAL," reference has been made to the project set on foot by the Société Technique du Gaz en France to hold, in connection with the forthcoming Universal Exhibition in Paris, an international congress of engineers and others interested in the progress of the gas industry. An Organizing Committee was formed, with M. Vautier, the President of the Society, at its head; MM. Bertrand, Lebon, and Violle being the Vice-Presidents, and M. Delahaye the General Secretary. Among the foreign corresponding members are Dr. Bunte, Messrs. A. Dougall and W. T. Dunn, of the Gas Institute, Messrs. F. D. Marshall and J. W. Helps, of the Institution of Gas Engineers, Mr. G. G. Ramsdell and Mr. A. E. Forstall, of the American Gaslight Association, Herr A. Hegener, of Cologne, Herr C. Kohn, of Frankfort, Herr L. Körting, of Hanover, Herr W. von Oechelhaeuser, of Dessau, M. Pouchain, of Rome, Mr. Eugene Vanderpool, President of the Society of Gas Lighting, M. Solanges, of Milan, Herr Weiss, of Zurich, and Herr Wunder, of Leipzig. Other names will be added as soon as the necessary permission has been received by the Committee.

The date fixed for the congress is the 3rd of September and the two following days; and, with the view of making the gathering as successful and as profitable as possible, the Committee have issued a circular setting forth its objects, and inviting the co-operation of their colleagues. They point out that it will be the first international congress devoted solely to gas matters, and will afford an opportunity for an interchange of views on some of the most important questions connected with the manufacture and utilization of this universally employed agent for furnishing light, heat, and power. Moreover, it will favour the formation of private and professional friendships which cannot but be profitable to the industry at large. The Committee have not deemed it necessary at the present stage to settle definitely the programme of the congress. They have simply drawn up a list of questions which they consider may be usefully discussed; and they invite suggestions as to others. Promises of papers should be received by the 15th prox., and the text of the communications by the 1st of June, in order that they may be printed and distributed before the congress. They may be written in French, English, German, or Italian; but the Committee would prefer the use of the first-named language. The Congress card will cost 20 frs., and it will entitle the holder to attend all the meetings and any visits which may be arranged, and to receive a copy of the "Transactions" when published. The administrative and technical staff of the Paris Gas Company, the members of the Société Technique and those of the several Associations of Gas Managers who pay annual subscriptions, will be exempt from payment of this fee; but they will not receive the publications connected with the congress unless they are present.

Among the questions suggested by the Committee for discussion are the following: (1) The principal causes of incandescence with gas. (2) The photometry of the incandescent gas-light. (3) The relation between the luminous intensity of an incandescent burner and the lighting and heating power of gas. (4) The improvements effected in inclined retorts, the different methods of employing these retorts in large works and in various countries, and the technical and economical results obtained by this system as compared with machine stoking. (5) The prevention of naphthalene obstructions. (6) The relative advantages of dry and wet meters. (7) The best method of extending the use of gas for lighting, heating, and motive power, in competition with electricity and petroleum. (8) The encouragement of stokers in ensuring economy of retort-heating and higher yields of gas. (9) Professional training for foremen, deputy-managers, and managers of works. (10) The present position of motors actuated by ordinary or poor gas. (11) The chief causes of the increase in the production and utilization of the bye-products of gas manufacture during the second half of the nineteenth century.

In connection with the Exhibition, it is intended, as our readers are aware, to have on view a representative collection of gas appliances in a building specially erected for the purpose in the grounds, as was done on the occasion of the Exhibition held in 1889. It was thought by the Committee of the Société Technique that those who are engaged in the supply of gas should show they are quite capable of holding their own against their competitors, and that the best way of demonstrating this was to bring together under one roof samples of all the best appliances for the utilization of gas. An Executive Committee was formed, under the presidency of M. Eugène Lebon; M. Picard, the Commissary-General of the Exhibition, granted a site in the Champ de Mars for the proposed building; and plans for it were prepared by M. Georges Roussi, and approved by M. Picard. In order to obtain the funds necessary for carrying out the object, an appeal was made to parties interested in the projected demonstration; and 265,000 frs. (about £10,600) had been subscribed up to the end of last year. The Compagnie Centrale du Gaz (MM. E. & A. Lebon) head the list with 30,000 frs., and the Paris Gas Company follow with 20,000 frs.—



CENTRAL CROSS SECTION. SECTION THROUGH DOME. SECTION OF TOWER.

other companies and firms connected with the gas industry contributing sums ranging from 17,100 frs. down to 20 frs. A start was made with the building, which is now roofed in, and ready to receive the exhibits. It will be called, as on the previous occasion, the Gas Pavilion. A good idea may be formed of its architectural features from the accompanying illustrations, which have been reproduced from the current number of the "Journal des Usines à Gaz," to which we are indebted for the particulars here presented. It will be situated within a few yards of the Porte Rapp, and will stand parallel to the Avenue de la Bourdonnaye, so that it will not be any very great distance from the Eiffel Tower.

In the interior arrangements of the building, the object which the Committee have kept steadily in view has been to afford the general public facilities for forming an exact idea of the variety of uses to which coal gas lends itself. In the central portion of the Pavilion, in the basement, and on the ground and first floors, distinct installations will be arranged; the whole presenting for the inspection of the visitor all the known methods for the utilization of gas. The portion of the building surmounted by the dome will contain the rooms set apart for practical demonstrations and the meetings and conferences to take place during the congress, and also the laboratory. The basement is divided into two parts—the cinematograph exhibition room, and a room in which will be shown the appliances for the industrial and domestic use of gas. In the passage leading to the former room there will be fourteen compartments—two for culinary and heating appliances, one for a gas-engine (a dynamo and accumulators furnishing the current for the incandescent lighting in the exhibition-room and the arc light for the lantern views), ten for various kinds of gas appliances, and one reserved. The lighting will be by gas consumed under the ordinary conditions—*i.e.*, with flat-flame, argand, and incandescent burners of different consumptions. On the ground floor will be the great hall, situated above the exhibition-room. It will be so arranged as to serve for laboratory purposes as well as for cookery lectures and demonstrations; and it will be a typical example of lighting from the ceiling. The rectangular hall on the ground floor will be divided off into apartments in which the use of gas will be shown with prepayment meters, and as applied to boilers and stoves, the lighting of kitchens and dining-rooms, and for washing, ironing, and bath heating. The lighting of the hall will be done principally by Welsbach burners; and the centre will be occupied by stands upon which will be shown various models and samples of small goods, collections of burners, &c. The first floor consists of a double gallery leading to the conference-room. Along this gallery will be placed drawings and designs representing the progress of the gas industry in all countries during the past century. Glass cases will contain scientific and industrial publications, specimens of the raw material and residuals of gas manufacture, the secondary products of the latter, and other interesting exhibits.

The foregoing presents an outline of the general arrangements already made in connection with the congress and the collective gas exhibition. But fuller details may be had by applying to M. Th. Vautier, 65, Rue de Province, Paris.

MUNICIPAL MUDDLING.

THE year 1900 seems likely to witness a further development of the eager campaign of the Municipalities in the wide field occupied by industrial enterprise. More particularly is the policy of annexation foreshadowed in relation to Water Companies. To many county councillors, Provincial as well as Metropolitan, the idea of extended empire seems to possess a well-nigh irresistible attraction. Like Alexander of old, they sigh for new worlds to conquer—oblivious, too often, of the practical question of their fitness or unfitness to administer the additional territory after wresting it from its original proprietors. There is, however, one large town in which during the current year the Water Company, though long coveted by the Municipality, is likely to be left in peace and quietness. The Corporation of Portsmouth have for years past hankered after possession of the property of the Portsmouth Water Company. There have been many negotiations, reports, discussions, deliberations in Committee, meetings between Committee and Board of Directors—in a word, much cry and little wool. But the *status quo* remains unchanged; and, as we have said, it bids fair to show no alteration, at least for another twelvemonth. The truth seems to be that the Portsmouth Corporation are more ambitious than businesslike; and the extraordinary results of their interference with other local undertakings has lately attracted so much attention among the ratepayers that any attempt to buy up the water-works would, on popular as well as on financial grounds, encounter strenuous opposition.

A good many years ago, an Electricity Supply Company was formed in Portsmouth; and the usual application was made to the Board of Trade for a Provisional Order. Then, and not till then, the Corporation stepped in and exercised the prior right of claiming an Order which is conferred by the Electric Lighting

Acts on municipal bodies. In the result, of course, the Company's project had to be abandoned, and the shareholders lost the money already expended. It was represented that the Corporation would achieve great things with the electric lighting in their own hands. To put it mildly, they have not done great things. They have, however, a central station on which a large sum of money has been expended; and the possession of the station recently suggested to some brilliant committeemen the idea of utilizing superfluous motive power for the purpose of working the local tramcar service by electricity. In the first place, as a detail, it became necessary to acquire the tramways hitherto worked by horse power, and owned by the Provincial Tramways Company. To this end a Bill was promoted, and in due course was passed; thereby enabling the Corporation to take over and work the tramways undertaking on and from the 1st inst. But though the 1st of January has come and gone, the Tramways Company are still in possession of their undertaking. It appears that the Company also worked a number of omnibuses, and, as we gather from local journals, hearses and funeral carriages in addition. The Directors therefore contend that, if the Corporation take over the tramways, they must acquire the Company's undertaking as a whole. They decline to part with the tramlines and tramcars and at the same time to be left in possession of the omnibuses and hearses.

Hence a deadlock, which would be absolutely ludicrous if it were not such a serious matter for the ratepayers. The Special Act authorizing the transfer seems to be ambiguous in its terms; and already there is talk of litigation with the view of getting the Act interpreted, which would mean an expenditure of much money and no little loss of time. The outcome of this extraordinary example of blundering is difficult to foresee. One point among others is, however, admitted—viz., that apart from the controversy with the Tramways Company, another development of the original scheme will be necessary. There will be large outlay required for a new electric station. The existing plant is not, after all, to be available! However, the Corporation must catch their hare before cooking it; and they have not caught it yet. At the stroke of midnight on Dec. 31, 1899, the Committee attended in solemn form at the Tramways Office to take over the new purchase. They were received politely and regaled with champagne; but, otherwise, they were sent empty away. The Directors of the Company sit tight; and the Corporation have now to choose between costly litigation and the undesired acquisition of a number of omnibuses and hearses. If, in the result, they choose the latter, the hearses might appropriately be used for the funeral of their ambitions. They have, in truth, afforded an unusually grotesque display of meddling and muddling. Their achievements in respect of electric lighting and the tramway service scarcely justify the belief that they would improve on the present excellent administration of the local water supply.

Semet-Solvay Bye-Product Coke-Ovens in England.—The "Colliery Guardian" recently gave the following as the net return from 100 tons of English coal treated in Semet-Solvay bye-product ovens: 70 tons of coke, at 14s. a ton (less cost of raw coal, 4s. 9d. a ton, and labour, stores, &c., 2s. 9d. a ton), £15 12s. 6d.; steam raised (equivalent to that produced by 13 tons of coal at 3s. 6d.), £2 5s. 6d.; tar, 4·75 tons at 20s., £4 15s.; sulphate of ammonia, 1·25 tons at £7 15s. (less £3 for acid, labour, &c.), £9 13s. 9d.; light oil, 303 gallons, at 5d. (less labour, chemicals, &c.), £4 16s. 3d.—total return, £37 3s. Nothing has been allowed for establishment charges or for depreciation. The finished benzols have been calculated in the terms of light oil for the sake of convenience; and the figures are stated to be from actual practice. The net revenue per oven per annum in bye-products at present prices is, therefore, 1750 tons, at £19 5s. per 100 tons, or a net return of about 50 per cent. on the recovery or chemical portion of the plant—that is, on the sum spent to recover the bye-products.

Carelessness in the Use of Gas.—Mr. W. P. Gerhard, of New York, who is known in England as the author of some little books on gas lighting and fitting, deals, in the current number of "Cassier's Magazine," with some of the dangers arising from carelessness or ignorance in the use of gas. He expresses the opinion that, notwithstanding the universal introduction of gas lighting, there are still many persons who would be benefited by receiving plain instructions on the use of gas in the household, and that gas companies would benefit themselves and the public by paying more attention to this matter. He points out that, among available statistics, numerous instances may be found of death or accidents due to faulty management of gas. Among the more remote causes, he finds the following mentioned: In one of two adjoining rooms, supplied with gas from one prepayment gas-meter, a man retired for the night when the gas supply from the meter was exhausted, but forgot to close his gas-burner. The occupant of the adjoining room came home late at night, dropped a coin in the slot of the meter, and obtained a fresh supply of gas, which meanwhile escaped in the adjoining room, killing the occupant. Escapes of gas and explosions have also happened in the use of gas cooking-stoves, where boiling water, running over the vessel, extinguished the flame. The so called independent gas connections, with two keys, may lead to accidents by the wrong one, from any cause, being turned by mistake.

THE COKE TRADE OF GREAT BRITAIN IN THE PAST YEAR.

In the first number of the "Iron and Coal Trades Review" for the present year, an article was devoted to the above subject. We learn therefrom that during the year there was a remarkable increase in the demand for coke, which, meeting a supply that could not be readily augmented to any very considerable extent, has caused an absolute scarcity of that product over a large part of the year. This increase of demand was more especially due to the larger output of pig iron, which probably absorbed about 500,000 tons in excess of the consumption of 1898. Foundry requirements were also materially larger; while the foreign demand was in excess of that of any previous year—due chiefly to the insufficient home supply available from the German blast-furnaces. The prices of coke steadily increased all through the year, until in December good blast-furnace coke was fetching 25s. per ton at the ovens, against 15s. to 16s. per ton at the beginning of the year. In some cases, for immediate delivery, higher prices have been realized. The pressure on coke manufacturers continues to be as great as ever, and still higher prices are regarded as probable. An increase of 9s. to 10s. per ton in the market value of coke was naturally keenly felt by consumers; and it induced some fears as to difficulties in adjusting the cost of the production of pig iron and foundry products to selling prices. Of the 20s. or so by which pig iron advanced during the past year, something like one-half went to the coke manufacturers. Under these circumstances, coke makers did a more profitable business in 1899 than any other class of manufacturers. To the same trade situation is due the fact that small coal available for the manufacture of coke greatly appreciated in value. Speaking generally, this description of coal has more than doubled in value since the beginning of 1899.

A large amount of attention continues to be given to the comparative merits of beehive and bye-products coke-ovens; and the latter systems made decided progress during the year. The principal processes now before the British coke makers are the Otto, the Simon-Carvès, the Semet-Solvay, the Coppée, and the Collin. With all these to choose from, it will be admitted that the coke industry has a sufficient range of choice. The Otto system, which is the one that has made such decided advances and is so largely adopted in Germany, has only lately entered the field in this country; but several important installations are already in hand. The same remark equally applies to the well-known Coppée system, which has established itself firmly in public favour, more especially in the South Wales coalfield. The total number of Coppée ovens built in this country up to the present time is 2296; and these are capable of coking from 50,000 to 52,000 tons of coal per week. The Semet-Solvay system has been taken up by ten of the principal coke manufacturing concerns in this country, and Mr. John H. Darby, who has the system in hand, is making steady progress with it. The Semet-Solvay coke-ovens which have so far been built in the United Kingdom number 425, and some 25 more are in course of erection. These ovens will have a capacity of more than 500,000 tons of coke per annum.

The Simon-Carvès system of coke-ovens with recovery of bye-products, which is now being developed by the Simon-Carvès Bye-Product Coke-Oven Construction and Working Company, Limited, of Manchester, was, it will be remembered, first introduced by their Chairman, the late Mr. Henry Simon, of Manchester, at Messrs. Pease's collieries near Darlington in 1882. This original installation, after seventeen years of continuous working, is still in operation. A large number of these bye-products coke-ovens have been built, not only by Messrs. Pease, but also at various other collieries and blast furnace works in this country; and similar installations are now being erected for the Barrow Hematite Steel Company, Messrs. John Brown and Co., Messrs. J. & J. Charlesworth, and the Monckton Main Coal Company. These ovens have demonstrated the small cost in maintenance which properly constructed bye-products coke-ovens entail—a circumstance which cannot be readily appreciated until ovens of this class have been at work for a long number of years. At the Wharncliffe Silkstone Colliery, one of the most modern installations of bye-products coke-ovens on the Simon-Carvès system was started some months ago. The installation consists of one battery of 35 ovens and the necessary apparatus and plant for recovering the tar, ammoniacal liquor, and crude benzol; also a plant for the manufacture of sulphate of ammonia. To supply these ovens, about 1400 tons of coal weekly, or say 72,000 tons per annum, are required. In addition to the valuable bye-products recovered from the gases in the process of coking, the quantity of coke made by this system from the same quantity of coal is considerably more than that obtained with the beehive ovens—an important factor in view of the present demand for blast-furnace coke.

The following figures, representing tons, will give an approximate idea of the joint capacity of production of the special systems of coke-ovens now in use in this country: Coppée ovens, 1,800,000; Semet-Solvay ovens, 500,000; Simon-Carvès ovens, 450,000; Otto ovens, 350,000; Collin ovens, 120,000—total, 3,220,000 tons. As, however, the total output of coke in the United Kingdom is probably not less than 14 million tons, it is obvious that there is a large field still to be cultivated in this direction.

WATER BILLS FOR 1900.

The following Bills have been deposited in the Private Bill Office in respect to water supply.

The Bristol Water-Works Bill is chiefly to extend the powers of the Company for the protection of the purity of their waters. It is proposed to empower the Company to make and enforce bye-laws for ensuring the purity of any drainage area in which they are interested. Such bye-laws are to be sanctioned by the Local Government Board. Landowners and occupiers injuriously effected by the bye-laws are to be compensated. Certain agreements have been entered into by the Company and the Rural District Councils of Axbridge and Clutton with respect to this matter, and are scheduled in the Bill.

The Crowborough District Water Company's Bill is to transfer to, and vest in, the Company the undertaking of the Gas Company of similar name and nearly coterminous district. Additional capital to the amount of £24,000 is required, with the usual borrowing powers. The gas undertaking is to be transferred in consideration of the exchange of equal shares to the same nominal value, share for share. Any difference between the two Companies is to be settled by arbitration under the Arbitration Act, 1889. The accounts of the undertakings are to be kept separate; and the name of the Company is to be changed to the Crowborough District Water and Gas Company.

The Dorking Water Bill is to empower the Company to raise additional capital to the amount of £16,000, from which they are to repay the sum of £1667 expended out of revenue on capital account. The new issue is to be 7 per cent. ordinary or 5 per cent. preference capital, carrying the usual borrowing powers.

The East Shropshire Water Bill is to incorporate a Company with a share capital of £72,000, and power to borrow £18,000, for the supply of water to the parish of Shifnal and the neighbourhood, on the borders of Shropshire and Staffordshire. The supply is to be made effective in five years. The works to be authorized include wells and pumping-stations in the parishes of Blymhill, Sheriff Hales, and Shifnal. The powers of compulsory purchase of lands are to be for seven years. Rates for domestic supply are to range from 8 to 6 per cent., with 9 per cent. for inns. Water supplied for domestic purposes is not to be used for power, under a penalty of 40s. The maximum price for meter supplies is to be 1s. 6d. per 1000 gallons, with a minimum payment of 8s. per quarter.

The Exmouth and District Water Bill is to sanction the issue of £65,000 of additional 7 per cent. capital, with the usual proportion of loan. New works are to be constructed, including an impounding reservoir on Bicton Common for impounding the Budleigh Brook; and another at Withycombe for collecting the waters of the Dalditch Brook. The works are to be completed within five years.

The Fishguard Water and Gas Bill proposes to change the name of the Company to the North Pembrokeshire Water and Gas Company, and to extend the district of supply to the parishes of Newport and Dinas. Additional capital powers to the amount of £24,000, with the usual proportion of loan, are desired. Extra works are contemplated, including an impounding reservoir to be formed upon the Pontfaen Brook, partly in the parish of the same name and partly in the parish of Llanychaer. These works are to be completed within seven years.

The Great Berkhampstead Water-Works Bill is to incorporate with statutory powers a Company formed in 1864 for the supply of this district, on the borders of Hertfordshire and Buckinghamshire. An Order was obtained in 1885, under which the capital was defined as consisting of £7000 of 10 per cent. capital and £10,000 of 7 per cent. capital, with £4250 borrowed money. The existing capital is to be consolidated and converted into 4 per cent. ordinary stock, with the addition of £40,000 of the same stock. The borrowing powers are to be £8500 on the ordinary consolidated stock of £35,000, and one-fourth of the amount of the new issue. The existing water-works are to be maintained; and additional lands are to be acquired by agreement.

The Higham Ferrers Water Bill is to incorporate a Company for the supply of the borough named, in Northamptonshire, with a share capital of £72,000, and power to borrow £18,000. The works are to comprise a storage reservoir in the parishes of Sywell, Mears Ashby, and Ecton, with a pumping-station near the old Sywell Mill. The water to be taken is that of the Sywell Brook, a tributary of the River Nene. The works are to be completed in five years. The Local Authorities jointly, but not severally, are to be authorized to purchase the undertaking after twenty years. In this event, the arbitration is to be in accordance with the provisions of the Lands Clauses Acts with respect to the settlement of questions of disputed compensation; and the arbitrator is to have regard to the probable increase in the consumption of water, and consequent increase in revenue, for a period of not exceeding ten years from the date of the arbitration. Power is sought to lay mains in the district of Rushden, but not to supply water, except in bulk to the District Council. The rates for domestic supply range from 9 to 6 per cent.

The Llandrindod Wells Water Bill is to extend the limits of supply of the Company, and to authorize the construction of new works, mainly in the parish of Cefullys. The waters to be taken are those of several springs and brooks that can be collected by the proposed works; subject to the proviso that the Company shall allow sufficient water to flow into every usual water course below the works, so as to enable all persons who have hitherto had the use and enjoyment of the waters to continue the same. The works are to be completed within five years. The waters of the River Ithon are to be taken for power purposes, the Company erecting a 2-feet weir for this object; but the waters are to be returned to the river before it reaches a certain property. The rates for domestic supplies are to range from 6 to 5 per cent. The Company need £7000 of additional capital, to carry the usual borrowing powers.

The Mid-Kent Water Bill is to extend the limits of supply by the Company to include a large number of parishes named. The supply throughout the added district must be made effective within six years. New works are contemplated, including two wells and pumping stations in the parish of Charing. The Company desire to raise £55,000 of additional capital, with the usual borrowing powers. A clause is proposed for giving the Company authority to collect samples and make inspections for the purpose of preventing pollution of the sources of supply. The Company also wish to be empowered to acquire private water-works, wells, &c., within their limits, on such terms as may be agreed upon.

The North Warwickshire Water Bill is to enable the Company to extend their limits of supply to parishes and places adjacent to the existing statutory area. Additional water-works are contemplated, comprising two wells and pumping stations in the parish of Menden, and one each in the parishes of Stoneleigh and Weston-under-Wetherly. These works are to be completed within seven years. The Company require £20,000 of new share capital, with the usual proportion of loan.

The Rickmansworth and Uxbridge Valley Water Bill is to extend the Company's limits of supply over a scheduled district. Additional capital to the amount of £150,000 is desired, with one-fourth loan.

The St. Alban's Water-Works Bill is to authorize the Company to acquire additional lands and water rights and easements during the next seven years. The trustees or governors of settled estates are to be empowered to treat with the Company. The limits of supply are enlarged. The Company desire to raise £80,000 of additional 7 per cent. capital, with the usual borrowing powers. The Company propose to erect workmen's dwellings on their own land.

The South Essex Water-Works Bill extends the limits of supply to certain places within the rural districts of Billericay and Ossett. The Company desire to raise £400,000 of new capital bearing a 5 per cent. maximum dividend, with the usual borrowing powers. New works are to be constructed within five years, including pumping stations at Heydon and Horndon-on-the-Hill. Local Authorities interested in certain works are to have the right to demand supplies in bulk at a year's notice, in quantity not exceeding 25 gallons per head of population.

The Southport Water Bill is to enable the Company to raise £60,000 of additional capital. A high-level pumping-station and service tank are to be made in the parish of Aughton, to be finished within seven years. The completion of a service reservoir in a period exceeding the statutory limitation is to be confirmed.

The Sutton District Water-Works Bill is to enable the Company to acquire additional lands and take other measures for the protection of their sources of supply. It is intended to forbid any local authority or person sinking any new or deepening or enlarging any existing well or pumping-station within a scheduled area, which is the limits of supply of the Company. The Company are not to supply water outside their own limits.

The Westgate and Birchington Water Bill is to define and extend the limits of supply of the Company in agreement with a local rearrangement of parish boundaries. New adits are to be made for collecting water, subject to certain restrictions. The works are to be completed within seven years. The Company require £20,000 of additional share capital, with the usual borrowing powers.

The Wetherby District Water Bill is to enable the Company to extend their service to an enlarged district under the control of the Tadcaster Rural District Council, and to East Keswick, by consent of the Leeds Corporation. Additional capital to the amount of £40,000 is desired. Wells and pumping-stations are to be put down in the parishes of Bardsey-cum-Rigton, and Thorner and Barwick-in-Elmet. The works are to be completed in seven years. Special provision is made for severance and the acquiring of easements in regard to property.

The Woodbridge District Water Bill is to incorporate a Company with a capital of £20,000, and the usual borrowing powers, to supply such portions of the parishes of Woodbridge and Melton as are situated to the westward and northward of the Great Eastern Railway. The service is to be made effective within six years. The works to be authorized include a well and pumping-station in the parish of Woodbridge, and are to be completed within five years. The rates for domestic supply are to range from 8 to 6 per cent.

The Swiss Output of Carbide.—A recent report on the commerce and industries of Switzerland, states that 1720 tons of carbide were exported from that country in 1898, of which Germany took 1073 tons and France 346 tons. In the preceding year, only 736 tons of carbide were exported from Switzerland.

OBITUARY.

The death is announced, at the age of 56, of Mr. HENRY LEGG, who for about 15 years had been Manager of the Herne Bay Gas-Works.

The death is announced as having taken place at his residence, London Road, Yorktown, of Mr. THOMAS HUNTER, for many years Secretary of the Yorktown and Blackwater Gas and Coke Company. Mr. Hunter was 85 years of age.

The recent death is announced of Mr. JOHN HALLAM, who was connected with the Nottingham Water-Works for upwards of fifty years. He entered the service of the Water Company under the late Mr. T. Hawksley; and when the transfer of the undertaking to the Corporation took place in 1880, he went with it, and became the General Superintendent of the Water Department—a position which he relinquished about nine years ago. Deceased was in his 75th year.

PERSONAL.

Mr. C. P. MYERS, of Kirriemuir, has been appointed Manager of the Troon Gas-Works.

Mr. E. HOWARTH, of Milnthorpe, has been appointed Secretary and Manager of the East Ardsley Gas Company.

Mr. W. C. JONES has been appointed Engineer and Manager of the Brierley Hill Gas-Works, in succession to the late Mr. J. Ward.

Mr. C. E. GODDARD having relinquished the secretaryship of the Sunbury Gas Company, Mr. J. L. FLETCHER has been appointed his successor.

On the 4th inst., at St. John's Church, Putney, the marriage took place of Mr. HARRY H. JONES, Engineer and Manager of the Wandsworth and Putney Gas Company, eldest son of Mr. Henry E. Jones, of Stepney, with ALICE, younger daughter of the late Mr. Edgar Burstall.

Alderman GAINSFORD, being greatly occupied with his new duties in connection with the Derwent Water Board, has retired from the office of nominee Director of the Sheffield United Gaslight Company; and, at the meeting of the City Council last Wednesday, Mr. C. F. BENNETT was elected his successor.

The Directors of the Kingston-upon-Thames Gas Company have selected Mr. B. MARSH, J.P., who has for some years been Deputy-Chairman, for the position of Chairman, rendered vacant by the death of Mr. P. Jones. Mr. C. E. NUTTALL, J.P., succeeds Mr. Marsh; and Mr. S. BROWN, J.P., has been appointed to the vacant seat upon the Board.

The Hartlepool Gas and Water Company have appointed Mr. T. BOWER, who has filled the position of Engineer for fifteen years, Engineer and General Manager of the Company's undertakings, including Humsworth Burn. Mr. W. SCOTT, who has been for twenty-five years the Company's Assistant-Secretary, succeeds the late Mr. Trewhitt in the secretaryship.

At the meeting of the Institution of Civil Engineers last Tuesday, it was announced that Mr. DUGALD CLERK had been transferred from the class of associate members to that of members. The monthly ballot which took place on the same occasion resulted in the election of Mr. JAMES DEAS, of the Water Engineer's Office, Warrington, as an associate member.

Mr. S. G. ASKEW, of Llanrwst, has been selected, out of 45 candidates, for the position of Manager of the Droitwich Corporation Gas-Works. The retiring Manager, Mr. A. T. HARRIS, who has been appointed Engineer and Manager of the Market Harborough Gas-Works, has been granted an honorarium of £30 for extra services in connection with recent extensions and alterations at the gas-works.

Mr. W. R. WILSON, late pupil and assistant to Mr. T. N. Ritson, Engineer and Manager of the Kendal Corporation Gas and Water Works, has been appointed Assistant-Manager of the Colne Gas-Works. Mr. Wilson has passed the City and Guilds Examination (Honours Grade) in Gas Manufacture, and holds South Kensington certificates in organic and inorganic chemistry, building and machine construction, and light.

Mr. WALTER DONALDSON has been appointed Manager of the Lymm (Cheshire) Gas-Works. This is the Mr. Donaldson whose resignation from the position of Secretary and Cashier of the Longton Corporation Gas Department was intimated in our issue last week; and we are asked by him to point out, in order to prevent any misinterpretation of the reference we made to his brief tenure of office at Longton, that his abandonment of the position was not due to any strained relations between him and the Gas Committee or officials, but was entirely in consequence of his appointment to Lymm.

The Pig Iron Production of Great Britain and Germany: A Correction.—The figures quoted from the "Zeitschrift für angewandte Chemie" in the article on "Gas Supply in Germany" in the "JOURNAL" for the 2nd inst. (p. 22), for the productions of pig iron in various years in both Great Britain and Germany, should clearly refer to "thousands of tons" instead of "tons" as given in the article. The error was inadvertently transcribed without correction from a table which appeared in the pages of our German contemporary.

NOTES.

The Temperature of Incandescent Bodies.

The "Proceedings of the German Physical Society," give an account of estimations of the temperature of incandescent bodies made by Herren O. Lummer and E. Pringsheim. The law of radiation of black bodies was in the first instance determined as closely as possible by a radiometer, and measurements of temperature with the thermometer. The truth of the law was then assumed, and conversely the unknown temperature of various bodies was estimated. The incandescent bodies were enclosed in a hollow sphere, silvered and polished inside; and rays were allowed to pass out, through a small opening only, to the spectrobolometer. The observations showed that the temperatures of the bodies examined were as follows:—

	Absolute Temperatures.
Electric arc light	between 4200° and 3750°
Nernst lamp	,, 2450° ,, 2200°
Welsbach light	,, 2450° ,, 2200°
Electric incandescent light	,, 2100° ,, 1875°
Candle	,, 1960° ,, 1750°
Argand lamp	,, 1900° ,, 1700°

Wind Pressure.

It would scarcely seem probable, on the face of it, that the modern practice of cycling would possess the property of teaching constructing engineers anything outside itself. Yet in truth a good deal of valuable mechanical science has been evolved from the experiences of cyclists. Not to mention anything an engineer can learn from the pneumatic tyre or the ball bearing, it is abundantly confirmed that the old chain and sprocket gear is a highly efficient means of transmitting power. One of the most valuable lessons of bicycling for the engineer, however, is the importance and valuation of wind pressure. The resistance of the air is the chief obstacle to the travel of the bicycle; and Professor R. C. Carpenter recently experimentally determined that this resistance corresponds well with the following formula: $R = \frac{AV^2}{200}$; where R is the resistance in pounds, A is the area exposed normal to the line of motion, in square feet, and V the velocity in miles per hour. It may be assumed that the same result applies to the case of wind and a fixed structure.

The Diesel Oil-Engine.

An important future is confidently predicted for the oil-engine, which is credited with being able to push the gas-engine hard as an economical prime mover of moderate size. Of all oil-engines, few have aroused so much theoretical interest as the Diesel engine, for the reason that the inventor claims to have based his motor upon a new theory of combustion. According to this proposition, steam and all other gas and air engines are defective in principle, and consequently imperfect in economy. Herr Diesel's idea is to compress the air charge to a very high degree, and then introduce into it the charge of combustible. This principle is theoretically applicable to any gaseous liquid, or powdered combustible; but actually up to now only oil has been used. A very large quantity of air is employed, instead of only so much as is required to ensure complete combustion of the charge. So much heat is developed by compression, that the charge is self-igniting. Experiments are in progress with coal gas and the cheaper gas made in producers. The Diesel engine is made for England by Messrs. Mirrlees, Watson, and Yaryan, Limited, of Glasgow. The consumption of Royal Daylight oil is stated to be 0·47 lb. per brake horse power per hour.

The Spontaneous Combustion of Coal.

Herr R. Grimm has made an interesting communication to a recent number of the "Zeitschrift für Angewandte Chemie," which has a direct bearing on the phenomena of the spontaneous ignition of slack coal. A quantity of coarse furnace refuse and flue dust containing a considerable amount of unburnt coal, was exposed for some time to the weather. The action of air and water, abetted by additions of hot refuse, produced incandescence within the heap, which assumed the appearance of a diminutive volcano. The surface opened in fissures 2 inches wide, in the lowermost parts of which could be seen beautifully shaped crystals of sulphur, and an incrustation of sal-ammoniac upwards of ½ inch thick. Steam issued from the fissures; and sulphur and sal-ammoniac were deposited around them. The sulphur was in monoclinic crystals upwards of ⅛ inch long. Ferric chloride was not detected in the sublimed products. The production of such products from the nitrogen and the sulphur of coal has been previously observed; but such fine crystals as were obtained in this instance have rarely, if ever, been noticed in similar cases. Ammonia salts constantly occur among the products of the distillation of coal; and Herr Grimm gives the following equations to explain the separation of sulphur from the mass:—

$$FeS + H_2O = H_2S + FeO.$$
$$2H_2S + SO_2 \text{ (arising from } FeS_2) = 3S + 2H_2O.$$

Rise in Price of Waste Fuel.

An instructive illustration of one of the commonest, yet at the same time least understood, operations of the economic law of supply and demand, is furnished by some observations of the "Engineer" on the course of the South Yorkshire coal trade in 1899. It is remarked that the vast development of the coke

trade of this region has been such as to render it of scarcely secondary importance to the coal trade itself. A great change has come over the values of all kinds of small coal, slack, and smudge, which has made the whole trade a profitable one. Large sums of money have accordingly been sunk in coke-ovens and appliances. The rise in coke for the year has been quite 50 per cent. But this is only part of the story. Great as has been the advance in the price of coke, the worth of slack and smudge coal has risen more. The latter commodity, which a few years ago was unsaleable at 6d. or 1s. per ton, is now worth 5s. to 6s. 6d. per ton at the pits, for coking. This has also caused a large number of disused thin-seam collieries and "day-holes" to be reopened and worked at a fair profit; whereas when prices were at their recent level, they lost money. A long range of over 100 coke-ovens which have lain idle, and have been in the hands of the bailiffs for over five years, were being delegated as the year ended. All this record is pregnant with meaning. Among other things, it goes to show what little reliance can be placedupon "rubbish" values for coal, or, indeed, for anything else which happens to be a temporary "drug." All schemes for utilizing waste products are liable to this revulsion—that as soon as a use is found for what was useless, its price goes up.

New York Street Railway Power House.

The street railway system of New York City has the peculiarity in common with the London tramways, that the cheap and hasty overhead trolley wire has never been permitted on Manhattan Island. People who have taken at their own valuation the electrical specialists committed to the advocacy of this method of tramway working, are seldom aware of the circumstance that the "backwardness" imputed to the Metropolitan tramways is paralleled in the Empire City of America. The reason is the same in both cases—the overhead trolley wire was not considered good enough for the streets of the capital. Delay, however, has not been so much time thrown away. The Metropolitan Street Railway Company of New York have been able to feel their way to the best system; and, having found this, the Company are acting upon their conviction in a characteristically whole-souled style. The modern development of the multiphase alternating-current system of generating and transmitting electricity at high potentials, and converting it at substations into 500-volt direct current wherever desired, has made it possible for the Metropolitan Company to locate the main generating station on the tide water. Here coal can be delivered and ashes removed at the smallest cost; while plenty of water is available for condensing. Consequently the new power-station of the Company is to be the biggest thing of the kind in the universe. Full particulars of the building and machinery are published in the "Engineering Record" for Dec. 23 last. It is instructive to learn that the Engineers of the Company are under no delusions as to the possibility of obtaining power cheaply by burning refuse fuel, or anything of this kind. The maximum capacity of the station will be 60,000-horse power, in units of 4500-horse power, manufactured by the E. P. Allis Company. The boilers are carried on three floors, with the coal-bunkers overhead. They are of the standard Babcock and Wilcox type, fitted with Robey automatic stokers. The current will be sent out at 6600 volts. Mr. F. S. Pearson was the Consulting Engineer for the work.

Facilities for British Inventors.—Mr. Ritchie, the President of the Board of Trade, has appointed a Departmental Committee "to consider various suggestions which have been made for developing the benefits afforded by the Patent Office to inventors, and report." It is to consist of Mr. F. J. S. Hopwood (Chairman), Mr. Edward Carpmael, President of the Chartered Institute of Patent Agents, Mr. C. N. Dalton, C.B., Controller-General of Patents, Mr. J. A. Kempe, Deputy Chairman of the Board of Customs, and Mr. S. E. Spring-Rice, C.B., of the Treasury. Mr. Arthur Neeves, of the Board of Trade, is to be Secretary of the Committee.

Mr. Boys' Lectures on "Fluids in Motion and at Rest."—At the third of the Christmas lectures on the above subject delivered at the Royal Institution last Tuesday by Mr. C. Vernon Boys, F.R.S., he dealt with the flow of water in pipes. After explaining how the flow could be doubled by the use of an expanding mouthpiece, the lecturer went on to speak of the cause of the noises heard in domestic water-pipes. The British plumber, he said, arranged these pipes with sharp bends; and the result was that at the corners the water attained a high velocity. Hence at these points the pressure became very low. Water, like other liquids, would begin to boil if the pressure were sufficiently reduced, without any application of heat, and when it was quite cold; and so water sometimes boiled in this way in domestic water-pipes. This fact having been experimentally demonstrated, the lecture was concluded with an account of the Venturi water-meter, which was described as one of the most beautiful inventions made in modern times to overcome an apparently insuperable difficulty. Its construction was based on the principle that if a water-main was constricted at a certain point, the pressure fell from the wide to the narrow place. From the difference between the pressures at the two points the velocity of the flow could be calculated; and thus, the size of the pipe being known, the quantity of water passing could be measured, as was automatically done by this meter.

TECHNICAL RECORD.

LABOUR-SAVING MACHINERY IN GAS-WORKS.

In an article which appears in recent issues of our American technical contemporaries, Mr. J. T. Westcott, Manager of the Economical Gas Apparatus Construction Company, Limited, deals with the subject of the improvements which have of late years been effected in the plant of gas-works, especially with reference to the saving of manual labour. In order to enable the reader to appreciate more clearly the nature of the labour-saving machinery at present in use, he gives first of all a brief survey of the earlier arrangements of gas-works, and then points out that the principal saving has been effected in the retort-house. He deals with this saving in connection with horizontal retorts operated by manual labour and by machinery, inclined retorts charged and drawn by gravity, and combined coal-gas and water-gas plants. He remarks that horizontal retorts charged and drawn by manual labour would scarcely come within the range of his article, except for the fact that recently the advantages of scoop charging and manual charging and drawing machines have been appreciated, even in small works. He explains that the scoops are usually arranged in a carrier suspended from an overhead trolley by means of a chain pulley; thus allowing the scoop to be taken to any point in front of the several beds of retorts, and raised or lowered to the height of any retort. The scoop is usually of steel, made in a half circle, and provided at the end with a small roller. It can be run on a little waggon to the coal-store, and filled and taken back to the retort-house, where it is placed on the carrier and charged. A roller in front of each retort permits of ease in manipulating. A still better arrangement is where the scoop runs, by means of an overhead trolley system, from the coal-store to the retort-house and back again, and is not allowed to be taken from the carrier to the waggon. This method is said to reduce somewhat the cost of the labour of carbonizing per ton; and an unskilled labourer can become a very efficient charger in a short time.

Passing on to deal with mechanical stoking, Mr. Westcott says: Manual charging and drawing machines are frequently worked in conjunction with conveyors, hereafter described, and at works larger than those where a scoop charger is used. There are various types of these machines, which vary in details, but accomplish the same purpose. Some charging-machines are made with adjustable, and others with fixed hoppers, all for the same purpose, and briefly as follows: The manual charging-machine is a square, upright frame on wheels, running on tram-lines laid parallel to, and in front of, the retort-bench. On one side of the machine is a hand-wheel and gear, by means of which it is propelled. On the other side is another hand-wheel and gearing for hoisting and unloading an adjustable coal-hopper from one tier of retorts to any other. The coal supply for the retorts is received into the adjustable hopper on the charging-machine, from the overhead fixed hoppers. The adjustable hopper, being suspended by means of chains, is free to move vertically between the four uprights of the frame. The charger, when out of the retort, rests on a light frame suspended from the coal-hopper. Directly over the charger, at the bottom of the hopper, is a feeder-box for supplying the charger with coal. The charger consists of a light carriage, running on three wheels, having two semicircular scoops at the bottom. The scoops are arranged to turn over in opposite directions, by the twisting of a long driving-rod about half way round in one direction. This charger goes half the length of the retort at one time, and enters the retort twice for a complete charge. A moveable platform is used for working the top tiers of retorts. The drawing-machine is similar to the charger in that it is propelled along tram lines in front of, and parallel to, the retorts; and it consists of a frame on three wheels. The hand-rake for drawing the charge is raised or lowered to the retort required by means of an adjustable bearer-bar parallel to the retorts, and guided by two of the frames of the drawing-machine. With this manual machinery, 45 retorts can be charged and drawn in as many minutes, without requiring half as much fatigue as ordinary hand labour would involve.

The author next shows how power machinery is applied to the charging and drawing of horizontal retorts; his remarks on this subject being as follows: In the manufacture of gas, it is necessary to bring the coal from the pit to the gas-works, from there to the retorts in which it is placed, and, after being subjected to a high heat, taken out as coke and removed to the yard. With the improved methods, this is accomplished by means of various types of machinery. The designs of the particular classes of conveying machinery required for the handling of all coal coming to and leaving the works need to be somewhat varied to suit the local requirements. There are several installations in vogue, and at a great number of gas-works partial installations. Sometimes the coal is elevated and conveyed by means of band conveyors; at others, by means of tray and pan conveyors; and at others it is brought to the works and deposited into self-tipping waggons which discharge into a coal-breaker. From here, by means of a chain bucket conveyor, it is elevated and discharged into another self-tipping waggon or buggy, running on an elevated tramroad extending over the entire length of the coal-sheds. When the buggy reaches the point for the proper trimming of the coal, it is automatically

discharged, and returned to the conveyor to be refilled. When the coal is brought by water instead of by rail, a chain bucket conveyor is sometimes used to remove it from the ship to the breaker, from which it is taken to the coal-shed, as previously described. The coal is delivered from the sheds to the retort-house by means of an inclined shoot discharging into a hopper, worked in conjunction with a bucket elevator which conveys the coal to buggies running on girders over the tops of the fixed hoppers in the retort-house. The coal is then discharged into these hoppers, which are arranged at the top along the entire length of the retort-house; thus making them available for any one of the settings. From these hoppers, it is fed into the adjustable coal-hopper of the charging-machine.

The power charging-machines are operated by steam, compressed air, or water, and are fitted with propelling gear for travelling up and down in front of the retorts. They are of various kinds. Some have fixed, others adjustable hoppers, which, by means of gearing, are raised or lowered to suit the various tiers of retorts. The weight of coal in a charge is regulated by a feeder-box, with which the hopper is provided. A frame suspended from the hopper carries the charger, which is driven in, and withdrawn from, the retorts by a compressed-air cylinder, a rack-and-pinion chain drum, and chains. The scoop of the charger enters each retort twice, turning alternately in opposite directions; thus ensuring the coal being deposited equally over the entire base of the retort. The hot coke is taken from the retort by drawing-machines, which are fitted with travelling and hoisting gear, by means of which the rake-bar frame can be raised and lowered to convey the rake-bar and head to the several tiers of retorts. They are fitted with compressed air and controlling cylinders, and rack-and-pinion chain drums for the various operations. The motive force—*i.e.*, air, steam, or water—is conveyed from the receiver, boiler, or accumulator, by means of suitable tubes and fittings, to the hose-drum in connection with each charging and drawing machine. The hose, leading from the drums to the machines, is especially designed to convey the force used. The drum works automatically, and the hose is supported at frequent intervals to prevent unnecessary strain. Sometimes the power is conveyed by means of endless wire or ordinary rope; the rope being overhead, and driven by a gas or steam engine placed in an adjacent room. The coal can be supplied to the charger and a full charge completed in the retort in 30 seconds; or 120 retorts may be charged per hour. This, in comparison with the old method, is a paramount economy of labour as well as of gas; the latter saving being due to the short space of time the mouthpieces are open. The coke is carried from the cellars of the retort-house to the outside of the building on a conveyor, where a douche of water is made to play upon it as it drops. It is then raised on an inclined conveyor to the coke-breaking machinery, which consists of a circular frame composed of perforated plates having different sized meshes, and placed at a suitable angle. Two railway waggons can be run underneath this screen; the small coke falling into one, and the breeze into the other. A third waggon, placed under the lower end, receives the larger pieces of coke that have traversed the entire length of the screen. It will be observed that, except for actuating machinery, no manual labour need be employed on the coal from the time it leaves the mines until, as coke, it leaves the gas-works.

With regard to inclined retorts, Mr. Westcott remarks that this method of carbonizing coal has been attended with many experiments and failures, but at the present time numbers of installations are working successfully, and additional ones are being erected. He goes on to say: Inclined retorts are placed at an angle of 29° to 34° for the best working; varying according to the physical condition of the coal. The coal is delivered in several ways to the overhead hopper in the retort-house by elevating and conveying machinery similar to that previously described. Some of the recent installations do away with the trimming of the coal in the yard. A measuring chamber is placed immediately beneath the coal-hopper, and one above each vertical line of retorts. The weight of the charge can be adjusted as required. The same quantity of coal is put each time into the retorts. Travelling shoots are provided for conveying the coal from the measuring chambers to the retorts. The charging is accomplished by simply drawing a lever, which allows the coal to fall from the measuring chamber down the shoot and slope of the retort, the impact being regulated by a wing placed in the mouth of the shoot. Usually a little assistance is required to draw the coke, owing to caking and other reasons; but, after it is once disturbed, it quickly runs down the slope, and discharges itself by elevating and conveying machinery. The retorts are charged and drawn by means of gravity, which dispenses with charging and drawing machinery. Very little is left to the discretion of the operator; and in the best installations, none of the coal or coke is handled by manual labour—the only labour required being for the placing of the shoot and the drawing of the lever.

On the subject of installations of ordinary retorts combined with carburetted water-gas plant, the author points out that any one of the three systems previously described may be used in conjunction with this plant. The last-named system of manufacturing gas is greatly in vogue in America, and is also being favourably considered by European engineers; many installations being at work in England and several on the Continent. Anthracite coal, or a portion of the coke, is taken from the yard and used in the generator of the water-gas plant for making gas; or, better still, the hot coke from the retorts is immediately used in the generator. In one or two instances, water-gas generators have been placed in the same building, and very close to the mouths of inclined retorts—a part of the hot coke discharging directly into the generators. The remainder of the coke is handled by conveying machinery. Mr. Westcott concludes this portion of his article by saying that carburetted water-gas apparatus possesses several advantages not found in the manufacture of coal gas, some of which are the high candle power gas that can be made and the small amount of labour needed. The plant itself requires much less ground-space, and usually, for the same capacity, a smaller expenditure of capital.

With reference to the proportionate quantity of gas which can be made by one man in a working day by the various systems considered, including all labour upon the works, Mr. Westcott gives the following figures: Horizontal retorts, charged by hand, 17,000 cubic feet; manual charging and drawing machines, 25,000 cubic feet; power do., 30,000 cubic feet; inclined retorts, 35,000 cubic feet; carburetted water-gas plant, 50,000 cubic feet.

The remainder of the article deals with the rest of the plant used in the manufacture of gas; reference being made to the raising of the purifier covers and the conveyance of the purifying material by machinery, and also to the regulation of the governors by means of clockwork or electricity, as instances of the use of labour-saving appliances in gas-works.

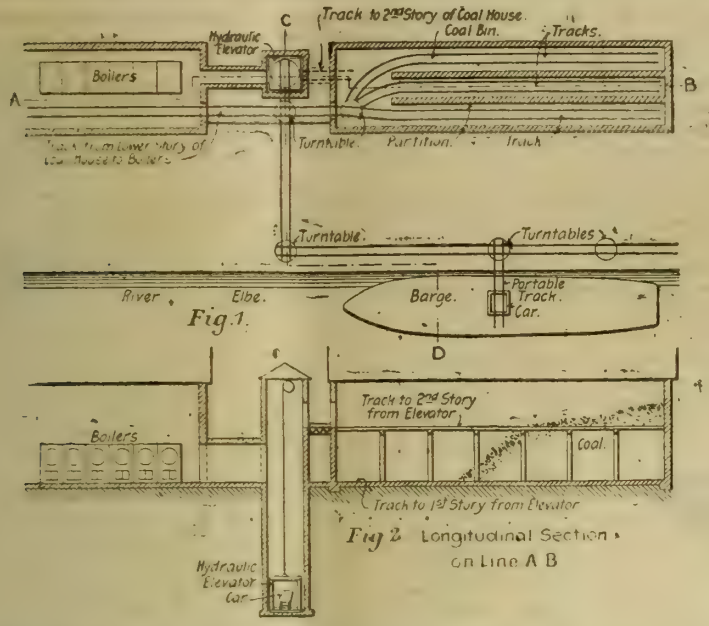
A NEW INCANDESCENT GAS-BURNER.

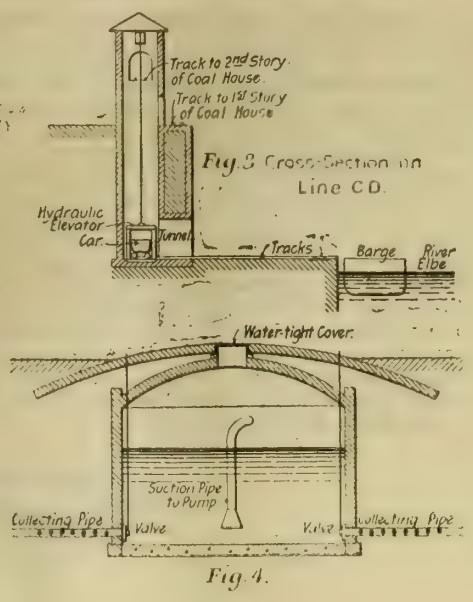
The Intensified Gas-Light Company, Limited (whose high-pressure system we have frequently noticed), have introduced a burner for incandescent lighting at ordinary gas pressures which is worthy of a trial by gas engineers in comparison with other makes. We have seen the burner in use, and were pleased with its achievement. Its special feature is the manner in which the air is admitted and directed on to the current of gas as it issues into the burner. The gas-injector in the stem of the burner is conical in form; and the lower of two rows of air-ports in the case are drilled at an angle following that of the exterior of the gas-injector. Consequently, the air passing in these lower inlets takes an upward course, and converges on to the point at which the gas is injected. In other forms of incandescent burners, the air passes into the burner in a lateral direction, and then turns upwards, which must cause a little friction. To what extent this is detrimental, we do not know; but any impediment to a direct air supply cannot be an advantage. Therefore, the Intensified Gas-Light Company must be credited with having made an improvement in this respect; and to it is largely ascribed the high duty obtained by the burner. The upper part of the burner is detachable from the lower; and through the two portions forming the joint is another circle of air-holes, which may be partially or wholly closed by simply turning the upper part of the burner. In this way, the air supply can be readily adjusted to suit gas of any quality. The mantles used with the burners are the "C" Welsbach, which are supplied under a licence which the Company hold with the Welsbach Company. The consumption of gas varies from 2½ to 3½ cubic feet per hour; and the duty obtained is placed at from 23 to 25 candles per cubic foot, according to the quality of the gas. Tests corroborating this have been carried out, with some of the first burners made of this type, by Mr. C. Buckley, the Corporation Gas Inspector of Leeds; and he is making further experiments at the present time. The stems of the burners are cast; and the whole is well finished. They have a good appearance, and it is safe to predict for them a long life in use. They are suitable for both street and interior lighting, and are supplied with or without a bye-pass.

THE DRESDEN WATER-WORKS.

Recent numbers of the "Engineering Record" have contained articles on European sanitary engineering by Mr. J. H. Fuertes, a member of the American Society of Civil Engineers. In the issue of that publication for the 30th ult., he described the water-works at Dresden; and the following particulars are extracted from the article.

Prior to the year 1875, Dresden was supplied with water from public and private wells and from springs. Some parts of the city also had an auxiliary supply of questionable quality for trade purposes. In 1875, the works at Loschwitz, which were erected in four years from the plans of Herr Salbach, the Consulting Engineer, were opened, and the older supplies were abandoned. The water is obtained a considerable distance from the city on the right bank of the River Elbe. It is collected in a long perforated pipe paralleling the shore of the Elbe, and is supposed to come from under the Stadt-wald—an extended tract of uninhabited land belonging to the city, and lying on the hill above the works. The water-level in the wells is permanently lower than the bed of the Elbe; and the fluctuation in the level of the river does not affect that of the water in the wells. When the pumps are running at their normal speed, the water-level





in the wells falls something like 3 feet. The water is taken by the pumps from two main wells, each about 23 feet in diameter and 16 feet deep. The collecting-pipes which feed the wells follow the river bank in each direction; the total length being about 4700 feet. On this line of pipe are six smaller wells, each about 8 feet in diameter. These wells are all lined with cut sandstone masonry, plastered water-tight with cement mortar, and covered with cast-iron tops. The perforated pipe diminishes in size as it gets farther from the pump-wells; reducing from a diameter of 25½ to 22 inches, and then to 18 inches. A section of one of the wells and pipe is given in fig. 4. Each section of pipe has valves for regulating the flow of the water to the pump-well.

There are three complete sets of pumps, two in each set, and each set is rated at 170-horse power. There are two suction-pipes and two force-mains, each 25½ inches in diameter. The latter lead to the reservoir on the hill about 200 feet higher than the works. The valves and bye-passes are so arranged that either pump or any combination of the pumps may act independently or in concert, and draw through either suction-pipe or deliver through either force-main. The boilers are smoke consuming, and have stepped grates with inclined fires and an artificial draught of hot air.

The reservoir is divided by a partition in the middle into two basins, so that one may be cleaned while the other is in service. Each section is cleaned about once a year. From the reservoir, a 25-inch and a 30-inch pipe lead to the city. It will be seen that everything is in duplicate; and this reduces to a minimum the danger of an interruption in the supply of water to the city. The height of the water in the reservoir is recorded continuously by an automatic recording device situated in the engine-room, and operated electrically.

The River Elbe is closed to navigation in the winter, and as all the coal used at the works is delivered by boat, it is necessary to provide for storing enough to last through the cold season. In order to have the coal stored above the flood height of the river, it is necessary to elevate it about 30 feet after unloading from the barges. Fig. 1 shows a ground plan, and figs. 2 and 3 sections of the coal-store. The boats are unloaded into small cars running on a track along the river. The cars are pushed to an elevator which raises them to the store, which has a double system of tracks for the trucks—one on the floor at the same level as the boilers, and the other about 9 feet higher and above the lower tracks. Turn-tables at all the junctions and crossings of the tracks enable the cars to reach any part of the house.

These works, which cost nearly £400,000, have in late years been taxed very heavily to deliver enough water to supply the demands of the city; and in 1894, Herr Salbach prepared plans for additional works to be located on the other side of the Elbe, and farther up stream. These plans, with certain modifications suggested by the Water-Works Authorities, and by the Consulting Engineer to the city, Herr Klette, to whom Mr. Fuertes was indebted for many professional courtesies while in Dresden, were approved in 1895. As in the older works, the water is to be derived from underground sources; but the manner of collecting it differs from the plan adopted at those works. In the new ones, it is to be collected in a number of wells, and pumped directly from them to a reservoir. Each well is to be sunk on a cast-iron shoe 16½ feet in diameter and 14 feet high. The shoe will be perforated by a system of slots to admit the water, and is to be treated with an asphalte coating on all the surfaces. The cast cylinder is to be sunk into the water-bearing layer of gravel, and will carry on its top a water-tight masonry wall laid in cement mortar, which will extend about 5 feet above the ground. The well will be covered with a cut granite top having a water-tight removable iron cover. A suction-pipe, 14 inches in diameter, with a foot valve at the lower end, will reach to within about 6 feet of the bottom of each well. The weight of the pipe will be carried by a girder spanning the well. The ventilation of the wells will be provided for by a system of pipes. The suction-pipes from the different wells will be coupled together and provided with the necessary valves, so that any well may be placed in service or in reserve.

THE INCRUSTATION OF IRON PIPES AT THE TORQUAY WATER-WORKS.

In the "JOURNAL" for Oct. 31, we noticed very briefly the paper on the above subject read by Mr. W. INGHAM, the Borough Water Engineer of Torquay, at the meeting of the Institution of Mechanical Engineers on the previous Friday, in the new buildings of the Institution at Storey's Gate, St. James's Park. We now give practically the whole of the paper, which is on a subject dealt with by the author at the meeting of the British Association of Water-Works Engineers rather more than two years ago.

The water supply to Torquay, Newton Abbot, St. Mary Church, and Cockington is obtained from a tributary of the River Teign, which rises in the granite hills on a western spur of Dartmoor. Two storage reservoirs, containing 297 million gallons, have been constructed there, and the water is conveyed by two cast-iron mains to Torquay. The old main, laid in 1858, is 14 miles in length, and was first scraped in 1866. It is 10 inches in diameter as far as Newton Abbot, and 9 inches forward to the foot of Chapel Hill, where it is reduced again to 8 inches between that point and the service reservoir. This main was not coated with any protective material; and within twelve months of being laid, it began to show signs of corrosion. Dr. Angus Smith's coating was unknown at the time the pipes were laid, and no one thought that the pure water from the Dartmoor hills would cause such a quick and deleterious action on the pipes. It was therefore with considerable surprise that at the end of eight years the delivering power of the mains should be reduced to 51 per cent. of their full discharging capacity.

A report was then submitted by the Engineer; and the question of taking up the pipes in ¼-mile sections and coating them was considered. But as this was thought to be too expensive, some other way out of the difficulty had to be found. It was at this period that Mr. Appold was consulted, and the idea of sending a scraper through the main was first suggested; and, being accepted, he received instructions to have a scraper made. The outcome of this was the scraper shown in fig. 1, p. 148. The subsequent improvements (figs. 2 and 3) were due to Mr. Box and Mr. William Froude; and the scrapers have not been altered since 1873. The scraper now in use is fig. 3. It is 3 ft. 8 in. in length, and consists of two parts; the front portion being the knives and springs supported by a framework, and the rear two pistons. These pistons are made of brass, and are about 1 inch less in diameter than the pipe. Immediately behind these pistons are leather discs strengthened by segmental iron plates. They are made rather larger than the diameter of the pipe; and the pressure of the water acting on them propels the machine forward. The rear portion of the scraper is connected to the front by a swivel joint, which has a considerable amount of play so as to pass round curves easily. Just in front of the joint there is a cylindrical guard, formed of flexible steel segments, which protects the piston leathers. The steel knives are four in number, and are kept in position by steel springs. From the nose of the scraper four pieces of steel project backwards, which serve to keep the scraper concentric with the pipe. The knives press outwards against the inside of the pipe with a force of about 48 lbs.; and, having a backward as well as a radial motion, they give way on meeting a projection which causes a pressure on the point of the knife of 60 lbs.

The knives are rather more than one-fourth of the circum-

ference in length, and are in pairs diametrically opposite to each other; one pair being about 4½ inches in advance of the other. They are V-shaped, and the scraper moves bodily round if they meet with a ferrule or anything of that kind. The two pistons already referred to are placed at such a distance apart that they will cover the largest hole of any branch-pipe from the main; otherwise the water would rush past the pistons and cause the scraper to stop. The force required to drive a 10-inch scraper at Torquay is from 350 to 400 lbs., or about 5 lbs. per square inch; but for the smaller scrapers the pressure required would be much more, because the area of a small pipe compared with the circumference is much less than in the larger sizes. For instance, comparing a 6-inch with a 10-inch, the area of the 6-inch is 28·3 inches, and the circumference is 18·86 inches; while that of a 10-inch is 78·6 and 31·4 inches respectively. The ratio of the area to the circumference in the 6-inch pipe is nearly 1½: 1; and in the 10-inch, 2½: 1. Therefore, if 400 lbs. would move the 10-inch scraper, 667 lbs. would put the 6-inch in motion if the rust were similar in both cases.



Fig. 1.

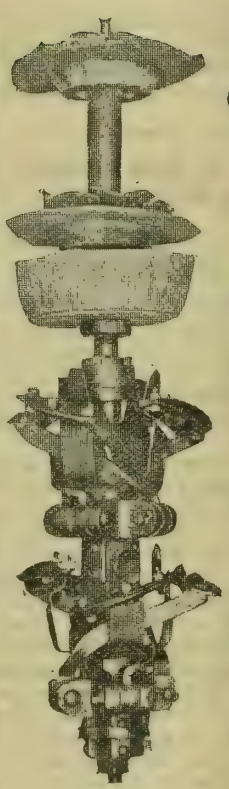


Fig. 2.

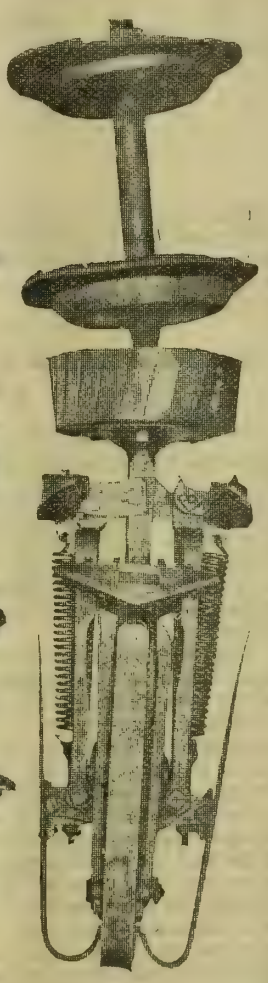


Fig. 3.

At the Torquay Water-Works, the scraper is inserted where the head due to water is only 3 feet; but when the wash-out pipe in front is opened, a partial vacuum is created, and the actual head is then 3 feet *plus* the difference between the atmospheric pressure and the pipe pressure in front of the scraper. Where scraping is necessary, it is not advisable to have the radii of curves in the pipe-line under 30 feet, although in well proportioned scrapers 15 times the diameter of the pipe will be sufficient. For pipes under 5 inches in diameter, water-pressure scrapers cause considerable trouble, and do not act very well. In laying pipes which will eventually require scraping, it is recommended that the jointing be carefully watched, to see that no lead finds its way into the pipe. Stones, chisels, and rubbish of all kinds are taken from newly-scraped mains, and cause considerable annoyance and trouble before the wash-out or hatch-box is reached. Before scraping is commenced, pipes and double collars should be placed alongside the main, in case the scraper sticks and the pipe has to be cut out. Cutting tools, spades, picks, lead, yarn, fire-basket, hand-pump, and a full complement of pipe-laying tools, should accompany the men when scraping.

The approximate cost of scrapers, hatch-boxes, and wash-outs may be taken as follows:—

	10-Inch. Each.	6 Inch. Each.	4-Inch. Each.
Scraper complete	£23 0 0	£10 10 0	£1 15 0
Hatch-boxes	6 6 0	4 0 0	2 0 0
Wash-outs	5 0 0	3 10 0	2 10 0

A 6-inch wash-out will be quite sufficient for a 10-inch main, a 4-inch for a 6-inch, and a 3-inch for a 4-inch. The 4-inch scraper would be of the Kennedy pattern. It is difficult to give the price of scraping any main, without knowing the full particulars of the pipe-line; but the following list, taken from Mr. Barr's paper on the "Scraping of Water-Mains," read before the Institution of Engineers and Shipbuilders in Scotland in March, 1897, will be of interest. The cost of scraping at Kendal and Torquay have been added; but in the latter case the cost is for labour only.

Table I.—*Summary of Scraping Water-Mains by Water Pressure.*

Year.	Name of Place.	Diameter of Main.	Length of Main.	Total.	Cost per Yard.	Gain in Delivery after Scraping.
		In.	Miles Yards.	£	d.	Per Cent.
1877	Oswestry	7	1 440	121	2·93	54·40 (*a*)
		6	4 660			
1878	Lancaster	8	1 1500	30	2·20	56·10 (*b*)
1880	Durham	12	1 586	91	9·10	.. (*c*)
1880	Bradford	18	4 1100	634	18·60	55·60 (*d*)
1881	Halifax (N.S.)	12	1 573	91	9·30	..
1882	Exeter	10	2 0	192	6·50	..
		12	2 0			
1883 1885	Whitehaven	13	2 1056	516	11·10	27·60 (*e*)
		11	3 1232			
1885	Bristol	6	1 785	35	3·30	.. (*f*)
1886	Denbigh	6	1 880	150	13·60	.. (*g*)
1887	Omagh	6	2 792	53	2·90	300·00 (*h*)
1887	Halifax	6	0 776	21	6·50	..
1888	Ulverston	6	1 0	72	9·80	..
1890	Dundee	15	2 0	256	17·40	.. (*i*)
1890	Dumfries	9	1 0	113	3·00	.. (*j*)
		8	4 0			
1890	Scarborough	8	1 440	62	6·70	..
1891	Newport	10	0 1080	50	11·10	.. (*k*)
1891	Lanark	7	6 880	75	1·57	33·70 (*l*)
1891	Guisborough	6	1 0	36	1·84	..
1891	Newport	5	0 75	‡	..	..
1892	Rouboux	24	5 594	242	6·10	‡
1892	Burntisland	8	3 1320	252	9·02	43·00 (*m*)
1893	Bridge of Allan	6	1 0	..	..	35·00
1893	Thurso	6	3 0	..	..	7·00
1894	Stirling	8	3 1320	..	..	.. (*n*)
1894	Inverkeithing	5	2 880	..	..	.. (*o*)
1894	Waterford	13	8 0	211	3·11	40·00 (*p*)
1895	Cupar, Fife	7	3 880	67	2·60	52·00 (*q*)
1895	Merthyr Tydfil	14	5 617	318	8·01	30·00 (*r*)
1896	Cowdenbeath	6	3 1405	90	3·26	23·00 (*s*)
1896	Merthyr Tydfil	12	6 770	178	3·76	82·00 (*t*)
1896–7	Kendal	6	1 1430	54	4·08	.. (*u*)
		4	0 830	22	6·32	.. (*v*)
Yearly*	Torquay	10 & 9	14 0	†	0·10	28·00 (*w*)
1896	Do.	10	15 0	21	0·20	28·50 (*x*)

* Commenced in 1866. † The total cost of the scraping in 1866–7 was no less than £1200. ‡ 16-feet head taken off pumping-engine.

Obstructions.—(*a*) Large stones, lead, and defective pipes. (*b*) Peaty matter. (*c*) Lead, spade, hard spike, and waggon spring. (*d*) Stones, lead, crow-bar, &c. (*e*) Mussels, stones, and lead. (*f*) Stones. (*g*) Stones, gravel, and lead. (*h*) Lead and defective castings. (*i*) Wood and stones. (*j*) Stones. (*k*) Lead. (*l*) Lead, wood, and stones. (*m*) Piece of wood 2 ft. 3 in. by 5 in. by 5½ in., lead (4¾ lbs.), and stones. (*n*) Stones and lead and piece of broken pipe. (*o*) Lead. (*p*) Pieces of broken pipe, rope. (*q*) Piece of broken rope, rabbit. (*r*) About 400 stones. (*s*) Lead. (*t*) Pieces of broken pipe, lead, and stones. (*u*) Lead, rust, and peaty matter. (*v*) Rust and peaty matter. (*w*) Rust in the form of nodules. (*x*) 35 lbs. of lead, stones, &c.

In comparing the cost of scraping, the length of the main should be taken into consideration, for it will be found cheaper to scrape long pipes than short ones. If the pipe is an uncoated one, a greater force will be required to remove the nodules than in the case of those which are coated. The first scraping will also be found more difficult than the subsequent ones; and, once commenced, the pipes require scraping afterwards at short intervals. At Torquay this is done on both trunk mains every year, and the delivery is increased about 28 per cent. even after so short a period. The scrapers can be easily followed, when the mains are about 3 feet deep, by the rumbling noise they make. There is a considerable variation in the sound made when passing over different classes of land; but the men soon get used to it. As a rule, seven men take part in the scraping at Torquay, and these are placed 20 or 30 yards ahead of one another, and run along as the machine progresses. The reason of so many men being required is owing to the variations in the speed of the scraper, for if it rushes past any one or two of them, the next man ahead locates it. If the scraper is lost, there is considerable trouble in finding it again; so it pays to have a few extra men about to avoid losing it. Moreover, if the scraper sticks, they are required to excavate, and cut out the pipe. If the scraper stops, it is usual to open the last wash-out, and then shut it quickly. The impetus thus obtained often carries it past the impediment; but care should be exercised to see that the ram action is not too great, to force the pipe-joints or to burst the pipes. Should this be unsuccessful, a wisp of hay may be inserted, which makes practically a water-tight piston, and thus increases the pressure on the scraper. If this fails, tapping the main with a hammer where the scraper has stuck often causes its release. When these methods have been tried and end in failure, the only course is to cut out the pipe. If desired, the scraper can be examined at any hatch-box by inserting an iron cup to catch it. If after examination it is found in good condition, the hatch-box cover is bolted down again and the work recommenced. Where wash-outs are necessary in towns, they

are usually connected with the sewer; and if this is done, it is advisable to trap the sewer, and construct a brick pit, with a ventilating grating so as to allow the escape of sewer gas if the water of the trap is evaporated.

The depth at which the old main from the Tottiford intake to Torquay is laid is about 3 feet, except for a distance of 180 feet, where it increases to 18 feet at the deepest point. The difference in head between the intake and the lower or Chapel Hill service reservoir is 468 feet; and the average gradient is 1 in 157. The first hatch-box is about eight miles from the intake, and the second one at the foot of Chapel Hill, at Torquay, nearly six miles farther on. Wash-outs are placed at the bottom of all valleys, and the speed of the scraper can be regulated by opening or shutting down the valve. The scraper moves more quickly when on a down grade than it does on an up grade, due to its weight (132 lbs.). Air-valves are placed on most of the elevations; and it may be of interest to know that these have a considerable effect on the speed of the scraper. They ought to be shut off when the scraping is in hand, because the air rushes in when the water is withdrawn from the pipe; and instead of a partial vacuum we get the atmospheric pressure against the scraper. These air-valves were fixed in 1897, and since then the amount of corrosion has decreased somewhat. This is probably due to the gases escaping instead of being carried along by the water.

The cost of scraping the old main is about £10, and works out at 0·1d. per lineal yard. This is a very low figure, and is perhaps the cheapest piece of scraping in the country. The men engaged are thoroughly in touch with the work, and no difficulty is experienced in following the scraper at any part of the line, except for about 180 feet where the pipe is some 18 feet below the surface of the ground. The scraping is done during the day; but where the line passes through Newton Abbot, operations are commenced early in the morning, before much traffic is on the road. It is very exciting to follow the scraper over hill and dale, and especially so if the wash-out pipe in front has been fully opened. A speed of 7½ miles per hour can be obtained for about three-quarters of a mile on one part of the line.

The theoretical delivery of the old main is 595 gallons per minute according to Box. Prony's formula gives 616 gallons per minute. The following table gives the discharges of the mains before and after scraping:—

TABLE II.—*Delivery of Mains before and after Scraping.*

Year.	Old Main, Laid in 1858.		New Main, Laid in Sections from 1878 to 1891.	
	Delivery in Gallons per Minute into the Chapel Hill Reservoir.		Delivery in Gallons per Minute.	
	Before Scraping.	After Scraping.	Before Scraping.	After Scraping.
	Gallons.	Gallons.	Gallons.	Gallons.
1866	317	454	..	..
1867	—	564	..	..
1868	—	624	..	..
1869	423	659	..	..
1870	471	668	..	..
1871	496	684	..	..
1872	499	681	..	..
*				
1896	550	698	516	663†
1897	600	693	..	..
1898	586	708	705	835‡
1899				

* No records. † Delivery into Warberry reservoir. ‡ Delivery into Chapel Hill reservoir.

Eight years after the pipes were laid, the delivery was only 317 gallons, or 51 per cent. of Prony's delivery, the head lost being about 351 feet. The present delivery, after scraping, is 708 gallons per minute, or 92 gallons more than given by Prony's formula. This increase can only be accounted for by the corrosion of the main itself, and as the delivering power of a main varies as the 2·5 power of the diameter when head and length are constant, the main must have been enlarged from 10 to 10½ inches diameter in 41 years.

After twelve months, it is found that the nodules are about ⅛ to ⅜ inch in height; but the effect is such that the 10-inch pipe has only the delivering capacity of a 9-inch one. This is due to the eddies developed in the water by the nodules, and also to the much larger surface exposed to friction. For instance, taking a pipe 10 inches in diameter which is covered with nodules as in fig. 4 (which shows the incrustation in one year), the surface exposed to the friction would be approximately 35 inches, whereas the circumference of the pipe would be only 31·4 inches; the increase being about 11 per cent. Working out the cubic contents of the nodules as shown on the section, it is found that 24 cubic inches of rust is formed per lineal foot of pipe; and as the length of the main is 24,352 yards, we get 1014 cubic feet of nodules. Now, as the nodule contains 49·03 per cent. by weight of iron, and a cubic foot of the incrustation weighs 93 lbs., the total loss of iron in the whole length of the main is no less than 21 tons per annum. This can be checked by taking the area of the inside of the main and multiplying it by ¼ inch, which is the thickness of the iron lost by corrosion in 41 years. This calculation gives 20·5 tons for one year, and compares very favourably with the first one, being only about 2½ per cent. lower.

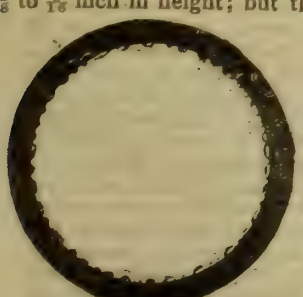


FIG. 4.

If, before the scraping is commenced, a pressure-gauge is fixed at different points in the pipe-line and the pressure plotted on a section, the condition of the pipe can be arrived at by comparing it with the theoretical hydraulic gradient of the pipe. The points on the section will show certain dips below the theoretical gradient, owing to the greater loss of head due to friction. If the dip is gradual, it shows that the rusting is even throughout; but if the line rises and falls, the rusting will be worse where the dip is largest, and smallest where it is least. Special obstructions, such as a badly-run joint or a heap of stones, would only show the dip at that point, and would recover itself immediately after passing it.

[The author produced a diagram showing the theoretical gradient of the main and also that due to incrustation. The state of the pipe was seen to be worst at a point about three miles from the intake; while it was in fairly good condition two miles from the Chapel Hill reservoir at Torquay. He explained that the greater corrosion on the first section of the main was probably due to two causes—first, to the water being impregnated with a higher percentage of gases on the first section, which increased the corrosive action; and, secondly, to the mains being washed out more at the end nearest the town, and some portion of the rust being washed away.]

During the summer of 1896, it was found necessary to scrape the new 10-inch main (which was coated with Dr. Angus Smith's composition) for the first time; and the deliveries into the Warberry reservoir before and after the scraping were 516 and 663 gallons per minute respectively, giving an increase of 28·5 per cent. For scraping purposes, this main is divided into two lengths similar to the old main. It was laid in sections as required, having been commenced in 1877 and completed in 1891. The difference in head between the intake at Tottiford and the Warberry service reservoir is 306 feet, and gives a hydraulic gradient of 1 in 264. During the scraping operations, the scraper got safely through; but on arrival at the first hatch-box—eight miles from where it was inserted—it was found to be broken and badly strained. When, however, it is mentioned that 35 lbs. of joint lead, some yarn, and a bucketful of stones were in front of it, it is surprising that the scraper came through at all. The rear piston disc, two knives, and one spiral and one longitudinal spring, were broken; and it cost £7 10s. to repair the damage before the second length of piping could be scraped.

The actual time taken to scrape the 14 miles of pipe was three hours for the first eight miles and three hours for the second section of 6 miles, or an average of 2½ miles per hour. There are seven scour-out valves on the 8-mile, and seven on the 6-mile section. These are left open after the scraper has passed until the water becomes clean. It is here that the time is lost, for in some cases this takes 20 minutes. A margin of time also has to be left between the opening of the next scour-out and the one which has been reached, as the leading men cannot be seen on any part of the line. It is found that the greater the velocity of the water passing through the pipes, the greater is the corrosion and incrustation, so long as scouring action is avoided. In the Torquay mains, the velocity of the water is rather high; being 3½ feet per second in the 10-inch length of the old main, and 4·32 feet per second in the 9-inch portion, while in the new main it is 4 feet per second.

An analysis of a sample of rust taken from the main in May showed that it contained iron to the extent of 49·03 per cent.; leaving 50·97 per cent. for matter deposited. This latter amount is composed of lime, organic matter, silica, carbonic acid, &c.; so it is easy to trace where the different constituents were obtained for building up the nodules. A portion of the carbon, sulphur, and silicon is no doubt obtained from the cast iron of the pipe; while the other portion is extracted from the solid matters carried in the water. The nodules of rust are made up of a series of layers; and these appear to increase in hardness the farther they are from the centre. The centre portion of the nodule is generally soft material, and when dry goes to a fine powder. The fact of there being a series of layers, suggests that they are built up periodically like the rings in the harder kinds of timber. This must be due to the variations of heat, magnetism, greater acidity of water at one time than another, or some organic impurity in the water. The oxygen extracted from the water must, we know, pass through the outer layers before it reaches the iron of the pipe; and the outer layer is always less oxidized than the inner. Whenever a nodule is cut off the pipe immediately after the water has been drawn off, the top layer will be found of a dark colour, while the inside will be the well-known brownish-red colour of iron rust. As soon, however, as the nodule has been taken away from the water and begins to dry, this dark layer changes by oxidation into the brownish-red colour of the interior.

The chemical action in the formation of rust is as follows.

The iron is first attacked by the carbonic acid and water, and this forms ferrous carbonate, thus—

(1) $Fe_2 + 2CO_2 + 2H_2O = 2FeCO_3 + 2H_2$.

The ferrous carbonate is then dissolved by the excess of carbonic acid in the same manner, as carbonate of lime is held in solution by chalk water. Ferrous carbonate, being a very unstable compound, is quickly oxidized by the oxygen in the water, and forms ferric oxide (Fe_2O_3) and carbonic acid gas, thus—

(2) $2FeCO_3 + O = Fe_2O_3 + 2CO_2$.

It will therefore be seen that a similar amount of carbonic acid gas is given off in No. 2 as is used in No. 1; so it follows that a small quantity of carbonic acid suffices to keep up the reaction. Ferric oxide is not magnetic, but ferrous carbonate is; and no doubt this magnetism plays a very important part in the rusting of water-pipes.

The incrustation or deposit varies considerably in different districts. At Southampton, where the water is derived from wells sunk in the chalk, the coating is of pure calcium carbonate, which is very pretty to look at, and forms a desirable interior surface from one point of view, if not from the other of reduction of pipe area. At Bath, the water (which is an upland surface one) is obtained from the oolite and lias formations, and the deposit is composed of $CaCO_3$, $CaSO_4$, and Fe_2O_3. At Brighton, with water from the wells in the upper chalk, there is very little deposit or rust; while at Leicester, where it is obtained from an upland gathering-ground of slate rocks and red marls, they are compelled to scrape the mains. At Nelson and Burnley, the water is from the millstone grit; and both are upland supplies. In these cases the mains require scraping; and in the first, an accumulation of thirteen years' rust reduced the delivery of a trunk main from 1,120,000 to 811,000 gallons per day. At Stroud, with well water from the Mitford sands and blue lias, they are troubled with a deposit of lime.

Where well waters are derived from the old red sandstone formation, there is not, as a rule, much trouble with either incrustation or deposit; but water from the greensand causes rust in some cases. Speaking generally, it may be laid down with a fair approximation to the truth that well waters have not so great an action on pipes as those from upland gathering-grounds; but where the water is soft, the corrosive action will be greater. Filtered water has also less corrosive power than unfiltered.

The liability of cast iron, wrought iron, and steel to oxidize is as follows: Cast iron, 100; wrought iron, 129; steel, 133. All engineers who ever have to deal with soft upland water supplies should take these figures into careful consideration when designing their pipe-lines.

Whatever protective covering is applied to pipes, soft waters will cause rusting within a few years of being laid. At Torquay, six years is the outside limit when this commences; so every precaution is taken to see that the pipes are well coated. The alkalies, alkaline carbonates, and ammonia have a slight dissolvent action on Dr. Angus Smith's composition. The Torquay water is a trifle alkaline at times; while at others it is slightly of an acid character, probably due to peat. At the same time there is always a small amount of free ammonia present, and probably that is the reason of coated pipes rusting within such a comparatively short period.

In some pipe foundries it is to be regretted that those in charge do not study this subject of rusting sufficiently, and therefore fall into the error of supposing that a little preliminary rusting before the dipping takes place does not matter. For water from granite districts especially the question of rusting is paramount, and water engineers should insist upon the pipes being free from scale and rust before dipping. The method usually adopted in this country is to heat the pipes in an open cylindrical stove of brickwork at the bottom of which is a fire, and when the pipes have attained a heat of about 600° Fahr. they are dipped in composition near boiling-point. The pipes are left in this composition until they have acquired the temperature of the liquid, and are then taken out and allowed to cool while hanging. Any portion of the coating which is damaged while the pipes are being handled should be painted with a natural asphalte dissolved in bisulphate of carbon.

The following process has been recommended for steel pipes: During rolling it is found that the surface of the steel is changed into a magnetic oxide (black oxide), which resists corrosion but soon scales off. This scale should be removed by placing the pipes in a sulphuric acid bath, followed by one of lime water immediately before the plates are riveted up, and then dipped in nearly boiling asphaltic composition. The composition should be natural asphalte, containing a large proportion of bitumen, with just sufficient creosote oil added to make what is necessary to produce when cold a smooth, plastic, and strongly adhesive varnish.

Much has been done to get a satisfactory coating to pipes; but there is still considerable room for improvement, and it is hardly necessary to point out that a fortune awaits the man who can invent something that will withstand the action of soft waters.

In opening the discussion upon the paper, Mr. H. M. Brunel stated that he was present when the plan of scraping the main was first tried in 1866, and had advised upon the laying of the new main at Torquay, but had had nothing to do with the actual process of scraping, either in the case of the old main or the new one. He pointed out, however, that it was the incrustation of the original Torquay main which had led to a revision of our theories of the nature of hydraulic resistances. Mr. W. Froude had shown that it was the incrustation which caused the defect in the capacity of the pipe, and that the previously held opinion that the roughness did not very much matter was erroneous. Mr. G. F. Deacon said he did not think that the presence of gases in the water was really responsible for the corrosion of the main conveying it, but that acids were the cause of it. Soft water was generally found to be the most corrosive, from the fact that it was usually the most acid. The nodules referred to by Mr. Ingham were formed not only on cast-iron, but also on steel and wrought-iron pipes, in exactly the same way. Each nodule appearing in a coated pipe always covered a minute puncture in the coating; and to avoid this, he had adopted the practice of dipping a pipe twice on coating it. Nodules were, however, not the only cause of a diminution in the discharging capacity of a main. The so-called "peaty" deposit was also a source of trouble. It was not really peat, but oxide of iron and manganese; and was common when upland water was passed through cast-iron pipes. Two or three years ago, he was consulted in regard to a reduction in the capacity of the upper Vyrnwy main from the lake to the Oswestry filter-beds, a distance of 13 miles. The daily discharge had fallen from between 16 and 17 million gallons to between 12 and 13 millions. A thorough examination showed that the retardation could not be accounted for by nodules; but the peaty deposit was found in the scour-boxes. The material had been investigated by Dr. Campbell Brown and Professor Boys; and, though final conclusions had not yet been arrived at, it was shown that a bacterium was responsible for its production. As the Vyrnwy pipes had been very carefully coated, he did not like to have them scraped, but thought that possibly brushing them would prove effective. The brush used consisted of a shaft, on which was mounted a drum, nearly fitting the pipe, which served to drive the whole forward. Two other drums, each 2½ inches less in diameter than the pipe, were mounted on the same shaft, and armed with bristles of whalebone, arranged screw fashion, so that water going past tended to rotate the brushes. The water flowed at the rate of a mile an hour, and the brush moved forward at about one-third of this rate. Between the brush and the pipe the water therefore flowed at a much greater speed, and the brushes were thus efficiently rotated in opposite directions. With this appliance the whole distance to Oswestry was traversed, with the result that the discharge of the main was again brought up to its original standard. In his paper, the author had mentioned that the incrustation was less with filtered than with unfiltered water. This he (Mr. Deacon) could confirm. Filtration reduced the acidity of the water, and almost entirely prevented the production of the deposit to which he had referred. Mr. Charles Hawksley remarked that apparently the author had estimated the benefit of the scraping, and also the enlargement of the pipe due to corrosion, by comparing the actual discharge after scraping with that calculated by a particular formula. This seemed to him to be very unsatisfactory. With respect to the coating of pipes, this was unfortunately often done ineffectively; the pipes not being allowed to remain sufficiently long in the coating bath to acquire the proper temperature. With a view to preventing the oxidation of the pipes before coating, his late father had adopted the practice of having the pipes proved with oil in place of water. Mr. E. M. Eaton said the subject of the paper was one upon which he had had extensive practical experience at Sheffield. The water there, being obtained from the moorland, was very soft, and corrosive effects were most remarkable. When he first went to Sheffield, several miles of service-pipes were nearly choked, the free diameter being reduced to the thickness of a tobacco-pipe. To clean these 3-inch or 4-inch pipes, he had adopted ordinary spring flue scrapers, mounted at the end of ¾-inch gas tubing. With this a gang of four men could clean 100 feet of pipe each way in a single night; the cost for a 4-inch pipe being 10d. per yard run. This method had, however, to be abandoned in the residential districts of the town, as the loosened iron oxide and peaty matter caused constant complaints from consumers; but it was still used in the poorer districts. For larger mains, up to 12 inches in diameter, he used a scraper of the Glenfield model, and found it very satisfactory; from ½ to ¾ mile of 9 to 10 inch main being cleaned and closed up again in a single night. He was unable to agree with Mr. Deacon that the nodules arose from a fracture in the coating of the main, as he had examined hundreds of cases. In Sheffield, at all events, the nodules seemed to be laid down from iron in solution. Each tubercle, in fact, had a fragment of moss or peat as its centre, surrounding which was a very friable layer of iron oxide, followed by layers of harder oxide. He had found painting pipes to be more efficient in checking tubercular corrosion than the ordinary process of coating; but it was expensive. At the same time, he did not attach too much importance to this, as his experience was that, sooner or later, nodules would appear on even the most perfect of coatings. In replying to the discussion, Mr. Ingham remarked that much of the success of the process he had described was due to Mr. Weekes, his predecessor at Torquay. When it was first proposed, difficulty was expected in following the progress of the scraper; and, in consequence, the plan was adopted of fixing a cord to it. Speaking generally, he thought that all the experience at Torquay was on a line with

Mr. Deacon's observations. He had examined scores of tubercles, and always found the puncture referred to. In uncoated pipes, the nodules formed one sheet. With respect to the microbe solution of the problem, he thought there was something in it; and at Antwerp similar troubles had arisen from what appeared to be bacterial action. As to Mr. Hawksley's objection to the comparison of an actual with a calculated discharge, he might say that careful experiments made by Mr. Box had shown the latter to be very nearly correct in the case of the Torquay main. Mr. Eaton's price for pipe cleaning at Sheffield seemed very high, as at Kendal it was only 6½d. per yard run. The Glenfield scrapers referred to closely resembled those of Appold, to whom the original idea was due. He might remark that Mr. Sandeman had recently told him that scraping the Plymouth mains had increased the discharge by 36 to 37 per cent.

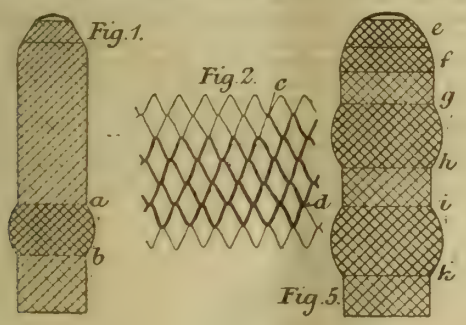
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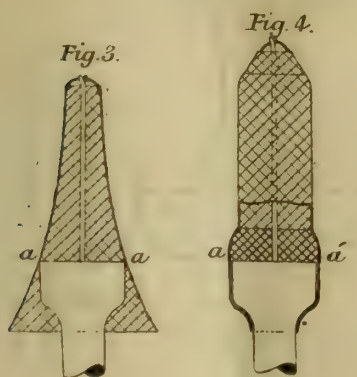
Incandescent Mantles.—Sieverts, W. H. A., of Hamburg. No. 26,254; Dec. 12, 1898.

This invention relates particularly to the strengthening of incandescence mantles, in the first place, where the bodies are liable to rub against the edge of the burner; secondly, at the upper edge—more especially upon the border of the edging of net frequently employed; and finally, in the middle of the mantle.

It is a common experience, the patentee remarks, that mantles become torn upon the edge of the burner, and also blackened, very shortly after they are first used. "This appearance is explained upon consideration of the fact that the incandescence bodies, as soon as they are lighted, become longer owing to expansion; while, when the flame is extinguished, they contract. The incandescence body thus moves downwards and upwards upon the ignition and extinction of the flame respectively. As, in addition to this, the incandescence body is also drawn inwards by the flame, and rubs against the burner, it soon wears away at its lower portion. This defect may be remedied by making the incandescence body of very much stronger or reinforced fabric at the place where it is liable to come in contact with the burner, or by impregnating it with a very strong liquid at that point."

A further defect pointed out by the patentee as inherent in incandescent bodies as hitherto made, is that they become sharply contracted or collapse after being in use a short time. "Owing to this deformation, the body soon loses its illuminating power to a marked extent, because the illuminating surface becomes smaller, and the incandescence body is no longer at the periphery of the flame. This defect is attributable to the suction caused by the flame; and it may be obviated by reinforcing the incandescence body between its summit and the crown of





the burner, by means of a strengthening strip of greater or less width parallel with the edge of the burner crown," in the manner already described. It is also advantageous to provide similar strengthening at the summit of the incandescence body—especially at the border of the net edging frequently employed. Owing to the provision of this reinforcement (the incandescence body will withstand the suction caused by the flame), it may be held away from the edge of the burner; and this is also the case when the lower portion of the incandescence body fits tightly around the burner, so that the rubbing and consequent wearing and blackening at the edge is rendered completely impossible. As, in consequence of the greater concentration of the impregnated mass, the body is not drawn in towards its centre, it also resists the suction of the flame at its upper portion. It is claimed that it therefore retains its original form for its entire length, and consequently also its full degree of luminosity.

Fig. 1 shows an incandescence mantle which, at the portion between *a* and *b*, where it comes into contact with the burner, is reinforced by meshes of material. Fig. 2 shows a portion of an incandescent body having reinforced meshes from *c* to *d*. Fig. 3 shows a mantle which, by the action of the flame, has been drawn inward, and which at *a* is in contact with the burner-head. Fig. 4 shows a mantle constructed according to this invention, and attached to a bunsen burner. Fig. 5 shows an incandescent body provided, according to this invention, with thick mesh at its upper portion *e f*, at its middle portion *g h*, and at the portion *i k* nearest the burner-head.

Strengthening Incandescent Gas-Mantles.—Blaasch, H., of Hamburg, No. 27,342; Dec. 27, 1898.

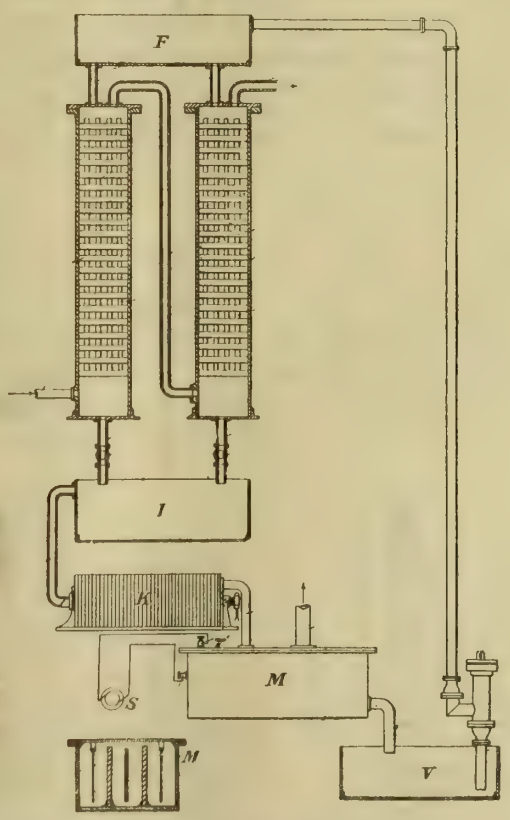
This process for rendering mantles for incandescent gas lighting more strong and durable, consists in suddenly cooling them, after they have been incinerized and formed on the gas-flame, and while in a glowing state. A suitable liquid for the purpose is distilled water; but there may also be used distilled water having a small percentage (say, 1 per cent.) of a soluble salt of one or more of the earth metals—such as cerium, lanthanum, neodymium, praseodymium, yttrium, thorium, beryllium, erbium, terbium, scandium, samarium, aluminium, or the earth alkali metal magnesium.

Purification of Coal Gas.—M'Dougall, A., of Fallowfield. No. 2502; Feb. 3, 1899.

This invention relating to the purification of coal gas, has for its object "to provide a continuous process for such purification, simultaneously with the recovery of certain bye-products and their utilization," by using certain solutions (which may be acidified or not) of the persalts of iron, manganese, or chromium, or of mixtures of solutions of these metals in wet scrubbers. On these solutions coming into contact with the foul coal gas in the scrubbers, chemical reactions ensue whereby free sulphur is precipitated, and simultaneously the persalt solutions are converted to protosalt solutions. The free sulphur can be removed from the liquid by settling or filtration.

The invention further consists in oxidizing the protosalt solutions to persalt solutions by electrolysis. When a suitable current is employed, reactions ensue, with the result that hydrogen is given off at the kathode, and at the anode the protosalt solutions are oxidized to persalt solutions, so that they may be again available for use—the process being continuous. The hydrogen evolved may be employed for lighting, heating, balloon, or motive power, or other purposes.

The condensing towers or scrubbers shown are fitted with cross boards, and are connected to the main from the retorts by inlet and outlet pipes; while the upper part of one tower is connected to the lower part of its adjacent tower by a central pipe. An overhead tank F, adapted to contain the persalt solution, is arranged to communicate with the top portion of each tower. The bottom of each tower communicates with a collecting-tank I, which in turn communicates with a filter-press K, and lower still with an electrolytic regenerating vat M.



This vat consists of a closed-in vessel divided by porous partitions into compartments adapted to contain the liquid to be regenerated. The inner compartment contains the anode, which may consist of a number of plates of platinized carbon or thin sheets of platinum or other suitable material; while the outer compartments contain the kathodes which consist of sheets of lead or other suitable material. The current for the vat is furnished by a continuous-current dynamo S; and the vat itself is fitted with a pipe by means of which the liquid may be drawn off into a tank V, and a pump for returning the regenerated liquid to the overhead tank.

The operation of the apparatus is as follows: The tank F is filled with a solution (which may be acidified or not) of a persalt of iron, manganese, or chromium—for example, ferric chloride or ferric sulphate. The liquid flows down through the scrubbers or condensers, where it meets the stream of foul gas which passes into the scrubbers by the inlet-pipe at

the lower end. Owing to the action of the sulphur compounds in the gas, the ferric chloride or sulphate solution becomes converted into a solution of the corresponding protosalt or ferrous salt, with precipitation of sulphur. The protosalt solution, carrying with it the sulphur thus formed, passes into the collecting-tank I. Part of the sulphur may be recovered by settling in this tank, but the greater part is recovered from the filter-press K, through which the protosalt solution passes on its way to the vat. The protosalt solution in the vat under the action of the electric current is oxidized to persalt solution at the anode, with evolution of hydrogen at the kathodes. The hydrogen passes off into the electrolytic vat, and may be collected and mixed with air and a proportion of ordinary coal gas to provide the motive power of a gas-engine, which may be employed to drive the dynamo. The regenerated persalt solution which is formed in the vat is drawn off into the collecting-tank V, from which it is pumped into the overhead tank F, to be utilized again in purifying the gas.

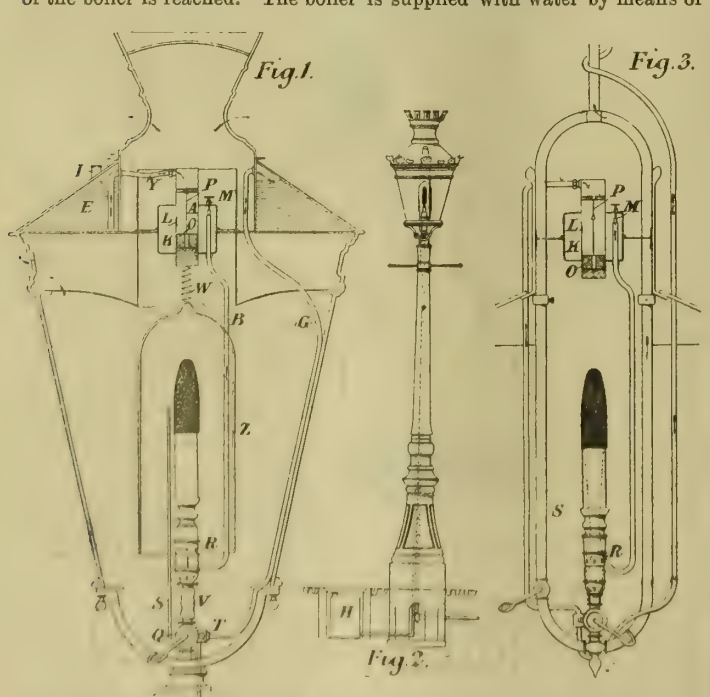
Burning Acetylene Gas.—Wigham, J. R., of Dublin. No. 4365; Feb. 28, 1899.

One of the objections to acetylene as heretofore used, the patentee remarks, is that it "has always been necessary either to burn it at full cock or to turn it out altogether, inasmuch as when turned down so as to reduce the consumption and make a small flame which can be turned up again in a moment, carbon is deposited on the jet, causing smoke and unpleasant smell, and interfering with the proper consumption of the gas when turned up again." His invention, therefore, consists "in attaching to each acetylene burner, of whatever kind or shape it may be, a high-pressure needle-hole jet as a stand-by, fed by the gas at the full pressure of the gasholder; the flow of gas when burning being not interrupted by the intervention of any valve or tap." The gas through this jet enters the air with such velocity as to ensure perfect combustion, and prevent the deposit of carbon; and at the same time the needle-hole jet, being fed at high pressure, resists extinction by currents of air. Thus the ordinary burner may be turned off, leaving this small stand-by jet alight; so that, in order to relight the gas, it is only necessary to turn on the ordinary tap, when the gas will be ignited by the stand-by.

Incandescent Gas Lighting and Heating.—Greyson de Schodt, P., of Namur, Belgium. No. 13,674; July 1, 1899.

This invention relates to a method of obtaining flames of "a high thermic degree" by the injection of superheated steam; the result of the injection being, in the first place, to increase the suction of the air, and secondly to impart to the mixture "the active force requisite for energetic combustion, and finally to obtain the decomposition of the steam beneath the mantle in the presence of carbon. This decomposition gives rise to the production of hydrogen, and of oxide of carbon, which combine with the air in developing a very high temperature."

The invention is said to be applicable to public or street lighting, and also for private or domestic lighting and heating. For the former, in the upper portion of an ordinary street-lamp (fig. 1) is arranged a small boiler, consisting of a boiler-tube A and a vessel K; the two reservoirs being in communication by means of an aperture L. Within the boiler-tube is provided a float O, the rod of which is formed by a needle-rod P, which closes the passage for the feed-water immediately the water-level of the boiler is reached. The boiler is supplied with water by means of



water under pressure, which enters the boiler through the tube Y, which is immersed in the circular reservoir E. This reservoir, which may be filled with water through the aperture I, is in communication, by means of the pipe G, with the reservoir of compressed air H (fig. 2). The pressure of air in this reservoir is obtained by means of a hand-pump, or in any other suitable manner. When the burner is lighted, the small quantity of water contained in the boiler A becomes rapidly vaporized; the steam produced passes into the vessel K; and thence through the tube B into the burner—issuing therefrom through the curved outlet R. An adjusting screw M is adapted to regulate the passage of the steam.

The burner employed is one of the kind which consists of a "parabolic mixing suction-device," surmounted by the burner proper, having the form of an inverted truncated cone as employed for intensive illumination.

The admission of the gas takes place through a two-way cock Q, enabling ignition to be effected by means of the row of perforations in the pipe S. The cock is provided with a wheel gearing with a pinion, which displaces the air-cock T in such a manner that when ignition occurs the boiler is supplied, while when the lamp is extinguished the supply ceases. A piece of india-rubber tubing V, and a spring W, isolates the burner, which is supported by the lyre Z, from all vibration.

Under the influence of the air pressure introduced into the reservoir E through the tube G immediately the cocks Q and T are opened, water is able to penetrate, by the pipe Y, into the boiler A. When a certain quantity of water has entered the boiler, the float O rises and closes the passage for the admission of water by means of the needle-rod P. As during this time the burner has been ignited by means of the perforation in the pipe S, the heat of the products of combustion will have vaporized the water, and the steam will escape through L, and enter the feed-water heater K. From there, the superheated vapours pass into the pipe B, which conducts them beneath the burner. They carry with them there a certain quantity of air, which enters into the mixture in such a manner that (when this latter reaches the point of combustion) each gaseous element is accompanied by elements of air saturated with the vapour. "At the moment when combustion takes place, the carbon of the hydrocarbon contained in the gas is liberated; and in the presence of the steam, water gas is formed in proportion as the combustion takes place." It follows from this that the added steam serves, not only as a conveyor of air, but more particularly as a powerful agent for the production of high temperatures.

For the purpose of private illumination (see fig. 3), water obtained from an ordinary water supply will be most frequently employed—being conducted to the boiler by means of a fine flexible tube. The arrangement does not differ appreciably from that for public illumination; and the operation is similar.

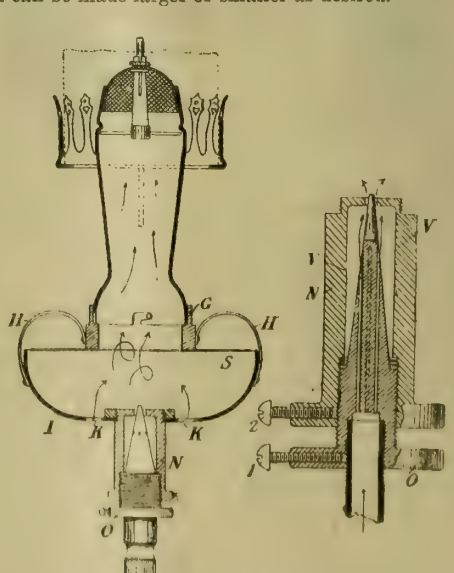
Gas Lamps and Lanterns.—Shaw, E. J., of Walsall. No. 14,948; July 20, 1899.

This "invention" relates (1) to the provision, in gas lamps or lanterns, the burners of which are fitted with bye-passes, of a rotatable valve, by means of which gas may be caused to pass (*a*) to all burners in the lamp, (*b*) to any one or one set only of burners, or (*c*) to feed only the bye-passes to all the burners—the valve in all three positions allowing gas to flow to the various bye-passes; and (2), in the globes of gas lamps and lanterns, the use of a ball or sphere of glass or other suitable material normally located in a seat in the lowermost portion of the globe (where a hole is made for the lighting torch), and acting as an automatically closing device.

Incandescent Gas-Burner.—Murinick, A., of St. Petersburg. No. 20,423; Oct. 11, 1899.

This invention relates to a pressure-regulating and anti-shock arrangement of incandescent gas-burner, as shown in the engraving—a longitudinal section and the inlet-nozzle on a larger scale.

The body of the burner (preferably of the shape shown) is attached by means of bayonet catches, or in any other convenient manner, to a ring G, provided below with a perforated plate S, and connected at several points to a metal dish I by means of springs H. The dish has several air-holes K; and a support N is screwed on and made fast to the dish, so that the nozzle O can be screwed into it. The nozzle has in it several vertical apertures V, through which the gas escapes. The closed end of it can be screwed into or out of the circular aperture P at the top, so that its free area can be made larger or smaller as desired.



In consequence of the gas escaping vertically through the holes V, says the patentee, the gas current maintains its maximum force, as it is nowhere checked. It has, moreover, the advantage that, as the gas escapes in the form of a ring, the inner and outer surfaces of the hollow cylinder of gas thus formed have considerable chance of mingling with the surrounding atmosphere.

The method of operation of the device is as follows: If, for instance, the gas pressure is very great, the screw 2 is loosened, and the support N screwed down. The aperture P thus becomes smaller, and the escape of gas diminishes. This adjustment of the nozzle can be fixed by the screw so that the flame burns uniformly. If, on the contrary, the pressure of gas is too low, the support N is screwed upwards, and the aperture P becomes larger. It should be noted, the inventor remarks in conclusion, that after the exit of the gas through the aperture, there is a primary intimate mingling with air in the dish I, which is further considerably

augmented in the lower part of the body of the burner. The mixture then (as indicated by the arrows) arrives together at the incandescent mantle.

APPLICATIONS FOR LETTERS PATENT.

23.—Edmundson, J. W., "Production of artificial light for street lamps and ordinary illumination." Jan. 1.
28.—Johnston, A. J., "Gas-tap." Jan. 1.
67.—Millar, F. J. M., "Cooking and heating stoves." Jan. 1.
74.—Richmond, E. W. T., Thornton, H. M., and Richmond and Co., Ltd., "Gas-fires." Jan. 1
92.—Howard, A. H., "Pipes." Jan. 2.
100.—Hounsell, B. W., "Regulating the supply of gas." Jan. 2.
109.—Barker, R. W., "Gas-stoves." A communication from V. W. Blanchard, and E. K. Stow. Jan. 2.
131.—Craven, R. E. P., "Fluid pressure regulating valves." Jan. 2.
133.—Lake, H. H., "Time-indicating meters." A communication from G. Pedrazzini. Jan. 2.
179.—Mayrisch, E., "Gas purifying apparatus." Jan. 3.
194.—Lancaster, E. W., "Purifying acetylene gas." Jan. 3.
234-5.—Snell, C. S., "Compressing or intensifying gas." Jan. 4.
250.—Engelke, W., and Meyer, F., "Dry gas-meters." Jan. 4.
296.—Burnett, J., "Controlling the supply of gas to burners." Jan 5.
334.—Chandler, S., jun., & J., and Kirkham, Hulett, and Chandler, Ltd., "Gas-governors." Jan. 5.
352.—Piatt, A. D., "Acetylene-lamp." Jan. 6.
366.—Lieske, M., "Acetylene gas generator." Jan. 6.
367.—Crankshaw, M. A. & H., "Gas-shades." Jan. 6.
388.—Earl, S. J., "Acetylene generators." Jan. 6.

PARLIAMENTARY INTELLIGENCE.

PRIVATE BILLS (SESSION 1900).

Opposition on Standing Orders.

Last Tuesday was the final day for depositing at the Private Bill Office of the House of Commons, memorials complaining of non-compliance with Standing Orders in the case of the first hundred Bills in the General List of Petitions. On that day, memorials had been received in regard to the petitions for the London Water (Welsh Supply) Bill, the South Essex Water Bill, and the South Essex Water Board Bill. In the case of the first-named Bill, the memorial was deposited on behalf of John Griffiths, the proprietor of an establishment consisting of a pump-house, hotel, and grounds situated in the parish of Swarafog, Breconshire. The memorials in respect of the South Essex Water Bill were from the Barking Urban District Council, the Rural District Councils of Ossett and Romford, and from Grays Thurrock and Ilford. In the case of the South Essex Water Board Bill, the memorialists were private parties.

The following Bills, the petitions for which are among the first hundred, will not be opposed upon Standing Orders: Aberdeen Police and Improvements Bill, Bedford Gas Bill, Bradford Corporation Bill, Cambridge Corporation Bill, Chelsea Water Bill, City of London (Various Powers) Bill, East London Water Bill, East Stirlingshire Water Bill, Exmouth and District Water Bill, Glastonbury and Street Gas Bill, Glastonbury Corporation Gas Bill, Grantham Gas Bill, Great Berkhampstead Water Bill, Halifax Corporation Bill, Hastings Corporation Bill, Higham Ferrers Water Bill, Ilfracombe Improvement Bill, London Water (Purchase of Companies) Bill, Margate Corporation Bill, Morecambe Urban District Council (Gas) Bill, North Warwickshire Water Bill, Oldham Corporation Bill, Ossett Corporation Gas Bill, Ossett Gas Bill, Redhill Gas Bill, Rotherham Corporation Bill, St. Albans Water-Works Company Bill, Southport Extension and Tramways Bill, Walsall Corporation Bill, Westgate and Birchington Water Bill.

Prospective Extensions at the Carlisle Gas-Works.—The Gas Committee of Carlisle and their Engineer (Mr. C. B. Newton) have under consideration the question of extending the gas-works. During the last few weeks, there has been more gas sent out from the works than during any previous similar period; and the works are really now inadequate to supply the demand. It is understood that the ultimate cost of the extension will be something like £96,000; but the expenditure at present contemplated is about £32,000 or £33,000. A report by Mr. Newton is to be circulated among the members of the Gas Committee, who will hold a special meeting to consider it.

"Electroid" Gas Condemned as Dangerous.—A short time ago, a great deal was made in the papers of an installation of "electroid" gas at Hunmanby, near Filey, by the Electroid Gas Lighting Syndicate. The installation has recently been brought under the notice of the Chief Inspector of Explosives, who has investigated the matter with the aid of skilled advice. His opinion has been expressed in a communication addressed to Mr. Charles Gray, Clerk to the Bridlington Rural District Council. It is to the effect that "any system involving the admixture of air with acetylene gas is attended with very grave danger to the public." The letter goes on to state that in the present instance the apparatus and system of using it are attended with danger, and the writer suggests "that a warning should be issued to the licensees to the effect that the licence will be revoked or will not be renewed (according to the terms in which the licence was granted)." The Inspector of Explosives, it is stated, proposes to advise the Secretary of State to take the steps necessary for the issuing of an Order in Council prohibiting the mixing of acetylene with air or oxygen in the same way as the compressing of acetylene has been prohibited. The Clerk to the Council has been instructed by the Executive Committee to reply to the letter, and point out that the Council did not employ an expert prior to granting the licence, but that they were assured by the promoters of the scheme that there was not the slightest reason to apprehend any danger if a licence was granted.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Friday, Jan. 12.

(*Before Mr. Justice* Byrne.)

Welsbach Incandescent Gas-Light Company, Limited, v. New Sunlight Incandescent Company, Limited.

This action, which is brought for infringement of the plaintiffs' patent of 1893, which covers the manufacture of mantles made of thorium with a small proportion of cerium, came before the Court on a summons by the defendants for leave to administer interrogatories to Mr. Moeller, Mr. De Fonblanque, and Mr. Mackean, as officers or members of the plaintiff Company.

Mr. Bousfield, Q.C., and Mr. Neill appeared for the defendants; Mr. Moulton, Q.C., Mr. Terrell, Q.C., and Mr. Walter for the plaintiffs.

It appeared from Mr. Bousfield's statement that the defendants, by their objections, alleged that the patent in question, which was taken out by Mr. Imray as a communication from Mr. Moeller, who was then abroad, was anticipated by the former Welsbach Company, the predecessors of the present plaintiffs, by the use by them of a fluid for impregnating mantles, sent to them by Dr. Welsbach, which was substantially of the same composition as that claimed in the patent. They therefore desired to administer interrogatories to the gentlemen named, with the view of discovering the facts. The arguments occupied a long time; Mr. Moulton and Mr. Terrell contending that the interrogatories ought not to be administered at all, inasmuch as they referred to matters alleged to have occurred before the plaintiff Company came into existence, and which therefore could not be within the knowledge of any members or officers of the Company as such, and that the Company were not bound, even if the Secretary were interrogated (which was the usual practice), to obtain information from any present officers or members as to matters which happened before the Company was formed.

Justice Byrne, in giving judgment, said he did not think it was right to administer the interrogatories to the gentlemen named, simply because they might, *aliunde* their present connection with the Company, have acquired certain information. At the same time, he thought some of the interrogatories might fairly be administered to the Secretary of the Company; and he gave leave so to do, but without prejudice to his taking any objections he might be advised as to answering.

Mr. Bousfield asked leave to appeal.

This was granted, on condition that notice was given at once, so that it might come on in the present week, or on the earliest day the Court of Appeal were taking interlocutory business.

The Traffic in Infringing Incandescent Mantles.

At the Westminster Police Court on Monday last week, before Mr. Francis, David Felix, a hairdresser's assistant, was charged with assaulting Sidney Albert, of Percy Street, Tottenham Court Road, at 1, Dartrey Terrace, Chelsea, on the previous afternoon. Mr. P. Conway appeared for the prosecutor; and Mr. F. Hill defended. Prosecutor, who described himself as a traveller in incandescent mantles, stated that on the 5th and 6th inst. he saw a Mr. Barnard, who had a barber's shop at 1, Dartrey Terrace, Chelsea, with respect to a "little matter of business." Barnard was the prisoner's employer. In pursuance of an appointment made as to the sale of some "stuff," witness again went to the barber's shop at three o'clock on the Sunday afternoon, and was admitted the private way—the door of the shop being closed. When witness was inside, Barnard locked the doors. Prisoner was present, as also were a Mr. Solly Benjamin and another gentleman. There was a conversation about incandescent mantles; and then all the men present attacked witness. The Prisoner struck him a blow on the left temple; Benjamin hit him over the top of his head, breaking his hat in several places; and the unknown gentleman remarked that he had a "six shooter" in his pocket which he intended to use. He (Albert) rushed about to escape, and screamed as the prisoner pushed his head through the glass panel of a door. In this position his cries attracted the attention of the police, who came to his assistance, and obtained access to the premises by unlocking the door from the inside, through the broken glass. Cross-examined by Mr. Hill, prosecutor said the "little matter of business" he had on hand was the sale of infringing Welsbach mantles. Mr. Barnard also dealt in mantles. He (prosecutor) admitted that he was trying to do business in infringing mantles, which came from Rotterdam; but he would not acknowledge that it was in consequence of his trying to foist these articles on Mr. Barnard that he was ordered to leave the premises. A policeman stated that his attention was attracted by the smashing of glass, and he saw prosecutor's head and chest through the glass panel—the prosecutor being punched by the prisoner. For the defence, Mr. Barnard said the prosecutor persistently called at the shop, trying to sell infringing mantles at 2s. 6d. a dozen. On the Sunday afternoon in question, Albert was ordered out of the place, and was finally ejected by the accused. The glass window was broken by the prosecutor using his elbow. After other witnesses had given evidence, Mr. Francis said prosecutor had no marks of serious assault, and he had evidently gone to the shop on a peculiar errand. He (the Magistrate) believed Albert was ordered out of the place. He discharged the accused.

Committal for Stealing Gas.

At the Lambeth Police Court, on the 6th inst., Thomas Whitley, a print colourer, of Teather Street, Camberwell, was charged with stealing a quantity of gas, value 3s., the property of the South Metropolitan Gas Company. Mr. Passmore prosecuted; Mr. W. H. Armstrong defended. For about two years the prisoner had been a customer of the Company; the gas with which he was supplied passing through a "slot" meter. On visiting the prisoner's premises, for the purpose of removing the money, Mr. Bryant, a collector in the employ of the Company, noticed that the meter was loose. This led to an examination, and it was found that an arrangement had been made, by the insertion of a small piece of

piping, whereby the gas could be carried from the main into the service-pipe of the house without passing through the meter. When seen by by Mr. M'Leod, one of the Company's inspectors, the prisoner assured him that nothing of the sort had happened prior to the 21st of December; and on the way to the station the accused admitted that he had been very foolish. In addressing the Court in mitigation of punishment, Mr. Armstrong asked the Magistrate (Mr. Hopkins) to take a lenient view of the case. The prisoner had been a week in prison, and had never before had a charge of any sort or kind brought against him. Mr. Passmore, for the Company, said the offence of which the accused was charged was a very prevalent one, but it was difficult of detection, because those who resorted to it were careful, by the time the visit of the inspector became due, to remove all trace of any improper connection. Mr. Hopkins remarked that, as the Solicitor for the Company had said, the offence was difficult to detect; and when a man was fairly caught committing it he must take the consequences. The prisoner would have to go to prison for two months.

Embezzling Moneys of the Incandescent Gas-Light Company.

At the Brighton Quarter Sessions on Monday last week, George Henry Whiston, traveller, was indicted for feloniously embezzling moneys received by him on behalf of his employers, the Welsbach Incandescent Gas-Light Company, Limited, at Brighton. Prisoner pleaded guilty to having taken the money, but said it was not with any felonious intent. Mr. Day, who prosecuted, said the accused travelled for the above-named Company, but had failed to account for different sums received on their behalf. At prisoner's request, two cheques were made out to him, and he cashed these. He also endorsed a third, which was cashed for him. The prosecutors had no wish to press the case. Mr. E. E. Humphreys, in defending, asked for leniency on the ground that his client was in straitened circumstances. Out of his salary of £1 per week and 15 per cent. commission, he had to pay travelling expenses and keep a wife and two children. Prisoner's home was sold up, but his friends were prepared to repay the money. Prisoner, who received a good character, was sentenced to three months imprisonment, with hard labour.

Charge of Stealing Electricity.

The calendar at the County of London Sessions last week contained the name of Alfred John Harrison, who was accused by the Hammersmith Vestry of having stolen electricity by diverting in a skilful way the current from the cable supplying his house by a contrivance of his own, so that it did not pass through the meter. In addressing the Grand Jury, the Chairman (Mr. W. R. M'Connell, Q.C.) told them that such a device, improperly fitted up, amounted to the stealing of electricity in the same way that an unauthorized connection with a gas-pipe before it reached the meter meant theft of gas. After careful consideration, the Grand Jury returned "No bill." Mr. Bodkin, who had been instructed to prosecute, asked if all the witnesses had been called before the Jury came to a conclusion. Mr. J. Dix, Deputy-Clerk of the Peace, replied in the affirmative. Mr. Bodkin asked if they also had a certain letter written by defendant read to them. The two Jurymen presenting the bill replied that the contents of the document referred to were made known to them. His Lordship thereupon dismissed the witnesses for the prosecution from further attendance, and the defendant was informed that he need not wait to surrender.

Relaying Paving-Stones after Gas Connections.

At the Edmonton County Court last Tuesday, before his Honour Judge Paterson, the Tottenham and Edmonton Gas Company were sued on behalf of Zelia Maud Tuck, a little girl who sustained injuries in September last by tripping over a paving-stone, for £50 damages. It was stated that the stone had been improperly relaid by the Company's men after making a connection, and was ⅝ inch above the level. Plaintiff was carrying some panes of glass, and when she fell they were broken, and she was severely cut. Witnesses were called who stated that the stone was dangerous to pedestrians. The Company denied responsibility. The men who relaid the stone said it was level when they left it two days before the accident; and a witness who saw the girl lying on the pavement said she was some distance from the stone, which was only ½ inch out of the level. Mr. A. E. Broadberry, the Company's Engineer, stated that he had found stones as much as ⅝ and ⅞ inch out; and Mr. James Randall, the Secretary, and Colonel Murphy, the Surveyor to the District Council, mentioned that the Council's practice was to reset the stones after the Company's men had taken them up. The latter witness testified that the stones were not badly laid by the Company. The Jury returned a verdict for the plaintiff for £30 damages and costs.

Sales of Shares.—Messrs. T. Edwards and Sons, of Newcastle, recently sold £5000 of consolidated stock of the Staffordshire Potteries Water Company, at prices ranging from £180 to £200 per £100 of stock. Some £8 shares (£6 10s. paid) in the Dartmouth Gas Company were lately sold at prices ranging from £13 10s. to £14 each.

East Preston and the Littlehampton Gas Company's Provisional Order. On Monday last week the East Preston Parish Council met to consider the Littlehampton Gas Company's proposed application to the Board of Trade for a Provisional Order to construct additional storage works, extend their limits of supply, and raise further capital. The following resolutions were passed: (1) That in no part of this small parish is there a sufficient number of houses to make it worth the while of the Company to bring gas so far from their works at present, nor is it likely to be the case for several years to come; (2) that the highways cannot be successfully lighted; (3) that, after inquiry among a number of ratepayers, no one desires to have gas except the tenant of the village inn. In view, therefore, of the probable improvement in the manufacture of water gas and the cheapening of electricity, it is not right that the parish should pledge itself to any scheme which might restrict the power of adopting any better or cheaper method of obtaining light in the future. The Council submit that the parish of East Preston should not be included in the area of supply.

MISCELLANEOUS NEWS.

THE MARKET FOR SULPHATE OF AMMONIA LAST YEAR.

Messrs. Bradbury and Hirsch, of Liverpool, have sent out their "Review of the Market for Sulphate of Ammonia during 1899."

Messrs. Bradbury and Hirsch open their report with expressions of congratulation on the prosperous working of the past year. They say that twelve months ago they looked for an improvement upon 1898, though that year showed a very substantial advance upon 1897 and 1896; but neither they nor anyone else anticipated at the time that the average price for 1899 would exceed that for 1898 by £1 16s. 2½d. per ton—the result actually achieved. They discuss later on the causes which have operated in the direction of the desired end. Here they simply say that the average price for the year is the highest since 1894; and express the hope that 1900 may prove to be at least equally satisfactory. So far as can be seen, the position seems to be pretty well assured, at any rate for some time to come; and they trust that when they write their next "Review" the war cloud which now claims the anxious interest of all British subjects may have long since passed away. They go on to say that the general trade of the country has not been so prosperous for more than a quarter-of-a-century as it is now; and there are no indications of decline in the near future. On the contrary, in many departments work is so far in arrear that sustained activity throughout 1900 may with some confidence be predicted, though dear money will doubtless tend to cripple unhealthy enterprise. A famous English statesman once advised his countrymen to "keep their eye on chemicals." There has been a "boom" in chemicals. But in this country the coal and iron and kindred industries are probably a better index of general prosperity; and in these trades there has been extraordinary activity. What is true of British industries is true of those of all the more progressive nations; for, in these days of quick and cheap transit, immediately the tide of prosperity or the pinch of adversity is felt in one quarter of the world, it begins to react upon all the rest. Having regard then to the condition of the trade of the world, as well as to that of the United Kingdom, and to the improved position of the farming interest, there seems to be every prospect of another prosperous year. In their last "Review," Messrs. Bradbury and Hirsch pointed out that, owing to a combination of circumstances, manure manufacturers covered the bulk of their 1899 requirements in mineral phosphates during the spring and summer months of 1898, at, to commence with, the low level of prices previously current, and subsequently at a moderate advance; so that they entered upon the 1899 season in a very favourable position. In 1898, manure manufacturers were able to advance their prices for superphosphates; and in 1899 they scored a further advance of 2s. 6d. to 5s. per ton, according to grade, but even that is scarcely adequate in view of the increased cost of materials. No doubt the high price of sulphate of ammonia in relation to nitrate of soda deterred them from purchasing this material for forward delivery to any large extent; and although they are not likely to get in at the level some of them anticipate, they can perhaps hardly be blamed for taking the chance. In other respects they have mostly bought well; and, if the demand for manures should come up to expectations, the season should be a profitable one.

With regard to nitrate of soda, Messrs. Bradbury and Hirsch say the history of this trade was uneventful throughout 1899; but in one respect they think it is now in a healthier condition than it has been for some years past. The production in 1899 was barely equal to the quantity shipped; and with past experience in their mind, producers will probably not be in too much haste to upset the balance of supply and demand now that it is in the way of being adjusted.

In their last "Review," the authors suggested that although the visible supply appeared to be ample, the quantity in the interior on the Continent was much reduced, and that consequently if the season came early, there was certain to be a squeeze before the end of April—there not being, in visible supply, room for an increase in consumption on anything like the scale of that of January-April, 1898. The season, however, came late, and notwithstanding the reduced stocks in the interior on the Continent when the year commenced, deliveries from the ports, Continental and United Kingdom, only exceeded those for January-April, 1898, by 30,000 tons, while the actual consumption over that period was probably 20,000 to 30,000 tons less. But cargoes were making long passages; so that stocks at the ports at the end of April were reduced to 50,000 tons, and at intervals, both in March and April, they were almost exhausted. During the two following months the demand was heavy, and deliveries exceeded those for May-June, 1898, by 45,000 tons—that is, by about 33 per cent.; so that deliveries over the six months exceeded those for January-June, 1898, by nearly 10 per cent. The visible supply (stock and afloat) at the end of 1899 was about 728,000 tons; at the end of 1898, 706,000 tons; and at the end of 1897, 645,000 tons. The visible supply was 68,000 tons in excess of the actual deliveries January-April, 1899, which were 660,000 tons. But deliveries after April were unusually heavy, owing to the lateness of the season; and so late a season cannot be counted upon safely in the coming spring. Had last year's spring season been early, it is probable that at least 30,000 to 40,000 tons more nitrate of soda would have been required by the end of April; and the authors think it will be prudent to take 700,000 tons and not 660,000 tons as a basis in estimating the probable requirements of Europe for January-April, 1900. If this is done, it will be seen that there is only a surplus of 28,000 tons. To this must be added shipments in January by steam and sail which may arrive before the end of April; but, on the other hand, losses at sea and late arrivals must be deducted. They calculate, therefore, that the margin will not exceed 50,000 tons; and, given an early season, they think this may prove to be dangerously small. Present prices, therefore, seem to be amply justified, and some further advance not at all improbable. Moreover, they think importers and dealers may consider a firmer attitude justifiable; and this would, of course, tend to harden prices. Even at a substantial advance on the present level, nitrate of soda would still be the cheapest source of nitrogen.

Coming to sulphate of ammonia, Messrs. Bradbury and Hirsch say that, on the surface, the position at the end of 1898 corresponded rather

closely with that at the end of 1897; and it was argued that the collapse in prices which occurred in the spring of 1898 was bound to repeat itself in 1899. But, as they pointed out, closer scrutiny disclosed differences sufficiently important to justify the opinion that prices would be maintained and probably improved. There was in February a set-back from the advance achieved in January, occasioned by the lateness of the season and consequent postponement of Continental buying; but heavy shipments to Spain saved the situation, and from the end of February up to the end of April there was a steady advance in values, in spite of the persistent efforts of "Bear" operators to depress the market. The "Bear" element was quite out in its reckoning; but, by selling ahead at a discount on spot values, the natural advance in spot prices was retarded. Consumers, however, gauged the situation correctly for the most part, and bought steadily until towards the end of April, when, supplies becoming restricted, the speculative game was abandoned, and within a month prices had advanced about 35s. per ton. In May, large speculative purchases were made for July-December delivery at up to £12 7s. 6d. per ton f.o.b. Leith; and this proved to be the highest point reached during the year in the forward position. In June, there was a reaction from the feverish heat in May; and, undisturbed by speculation, the market pursued a normal course—prices gradually declining right on to the end of July. August was entered upon with minimum production and increasing demand; and there was a recovery of about 6s. 3d. per ton in values. In September, however, speculation again made its prejudicial influence felt—at first cautiously, but later, when the Beckton price was dropped for October-December delivery, with such boldness that eventually the confidence of foreign buyers was upset, and sales at any reasonable price became extremely difficult. Taking their cue from London makers, who, in October, repeatedly dropped their price for delivery up to the end of the year, "Bears" went "one better" all the time, and made large sales for delivery up to and including spring months. They pursued the same line up to the middle of November, in the absence of any further concession from makers. The spot price had declined from £12 5s. per ton at the end of August to £10 7s. 6d. per ton at the middle of November; and sales were reported to have been made abroad in the forward position in November at the equivalent of £10 12s. 6d. per ton f.o.b., though makers refused to sell below £11 per ton, or the equivalent, f.o.b. Two otherwise insignificant purchases for January-March delivery—one at £10 15s., and the other at £10 16s. 3d. per ton, Beckton terms—about the 14th of November, constituted the turning-point; and at once the whole aspect of the market was changed. Onward to the middle of December there was a scramble for supplies; the market advancing £1 per ton from the lowest point. Within the same period, there was large buying in the forward position up to September; and up to £11 15s. per ton was repeatedly paid, f.o.b. Leith, for January-June delivery. Beckton price meantime advanced to £11 10s. per ton, at which figure considerable sales were made for January-March delivery. At this point forward speculative buying ceased, and it was not afterwards resumed, although at the close makers would have accepted lower prices. During the second half of December, the spot market also drooped, owing largely to severe weather and interruption of inland transit on the Continent; and the closing quotation, f.o.b. Hull, was £11 per ton. The average price for the year was £11 5s. 9¾d. per ton f.o.b. Hull, against £9 9s. 7½d. per ton in 1898, and £7 18s. 4¾d. per ton in 1897. The past year's working was therefore highly prosperous; and although at the outset the situation was promising, nothing like the result actually achieved was anywhere anticipated. And if the average prices of nitrate of soda at Liverpool—£7 19s. 7d. per ton in 1899, £7 11s. 3d. per ton in 1898, and £7 15s. 5d. per ton in 1897—be taken as a basis of comparison, it will be observed that the average price of sulphate of ammonia in 1899 stands out in a still more satisfactory light; and it will be interesting to inquire to what causes it must be attributed, and to what extent the same or other forces may be reckoned upon in the coming year's business. Messrs. Bradbury and Hirsch attribute it, in the first place, to the policy of makers, adopted in 1897 and since persisted in, in disposing of their output as it has become available, or beforehand, and keeping their bins clear—thus rendering it impossible for speculation to obtain the upper hand; in the next place, to the absence of any important increase in production; and perhaps most of all to the remarkable increase in Spanish and Colonial consumption, apart from which it is doubtful whether prices could have been maintained even at the opening level. The importance of this increased consumption will only be appreciated when the further marked shrinkage in demand from all nitrate of soda consuming countries, the United States excepted, is taken into account. Nitrate of soda has been much the cheaper article per unit; and it has, of course, been used in place of sulphate of ammonia where it could be substituted to advantage, as it always will be under like circumstances. In their "Review" for 1898, Messrs. Bradbury and Hirsch tabulated the exports to the principal nitrate of soda consuming countries for three years; they now give the figures over a longer period, and add similar particulars of shipments to the other importing countries. The totals are as follows: In 1894, 103,338 tons; in 1895, 111,700 tons; in 1896, 126,025 tons; in 1897, 152,981 tons; in 1898, 136,936 tons; and in 1899, 140,371 tons.

Messrs. Bradbury and Hirsch estimate the production of sulphate of ammonia in the United Kingdom during 1899, from all sources, at 202,000 tons, apportioned as follows:—

	Tons.
Gas-works	133,000
Iron ,,	18,700
Shale ,,	37,300
Coke and carbonizing works	13,000
	202,000

Of this production they reckon that England contributed 128,200 tons; Scotland, 71,000 tons; and Ireland, 2800 tons. The production during the previous five years was as follows:—

	1898.	1897.	1896.	1895.	1894.
Gas-works	130,000	133,000	127,500	119,600	113,500
Iron ,,	17,700	18,000	16,500	14,600	10,000
Shale ,,	37,300	37,000	38,000	38,300	33,000
Coke and carbonizing works	11,500	10,000	9,000	7,000	3,500
Totals	196,500	198,000	191,000	179,500	160,000

The production in 1898 from gas-works proved to be below their estimate, and, for the first time since records have been kept, showed a decline on the preceding year. Notwithstanding electric lighting and the use of water gas and other illuminants in recent years, the production of sulphate of ammonia from gas-works continued to increase up to 1898, though in varying ratios, from year to year; and, having regard to the condition of trade in that year, the shrinkage in the output of sulphate of ammonia is somewhat puzzling to the authors. They noted last year, and called particular attention to the fact, that whereas the ratio of increase in the production of sulphate from gas-works was 6 per cent. in 1896 as compared with 1895, the ratio in 1897 as compared with 1896 was only 4 per cent.; but they did not anticipate that the 1898 production had fallen below that of 1897, knowing, as they did, that in many large trade centres there was an increase in the consumption of coal gas of 5 per cent. and upwards. No doubt the extended use of other illuminants was, they say, the main cause of the shrinkage; but they are inclined to think that the comparative immunity from fogs in the winter months was also a contributing factor. In 1899, there was a slight increase in production from gas-works; but the authors' estimate of the United Kingdom production from all sources shows an increase of only 5500 tons over that for 1898. The production from coke and carbonizing works was rather larger than that for 1898; but the output from shale appears to be about a fixed quantity. The rapid expansion in output from all sources experienced between 1893 and 1897 has entirely disappeared; and although the proceeds from sulphate of ammonia are an important item in the revenues of producers, the rate of output is determined by considerations quite apart from the market price. Messrs. Bradbury and Hirsch have reason to think that the stock of sulphate in makers' hands at the end of 1898 did not exceeed 4000 tons, and that their estimate of the home consumption, which can only be approximately ascertained, was put too high. There was a further falling off in home consumption in 1899, owing to advanced prices over the spring months and to the smaller requirements of manure manufacturers for compounds; the tendency being still, with foreign buyers in particular, in the direction of making their own mixtures. Exports show an increase of 3500 tons, as compared with those for 1898. The year's working therefore shows—

	Tons.
Stock brought forward from 1898	4,000
Production in 1899	202,000
Available supply	206,000
Exports in 1899	140,500
Home consumption in 1899	58,500
Stock carried forward to 1900	7,000
	206,000

Although the stock in makers' hands is rather more than a bare working stock, it is understood that part of this is sold, and that shipment has been delayed owing to interruption of inland transit on the Continent. Probably the quantity so delayed amounts to 2000 tons—the difference between the shipments in December, 1898, and those in December, 1899. Practically, therefore, the year 1900 is entered upon with but a bare working stock; and, as purchases have probably also been delayed, Messrs. Bradbury and Hirsch say the outlook for January is decidedly promising. If a more extended view is taken, the increase of production in the United Kingdom cannot well exceed some 3000 tons between January and June, so that statistically the position is a strong one, while other conditions seem to favour a high range of prices over the spring season. With regard to the relative merits of sulphate of ammonia and nitrate of soda, Messrs. Bradbury and Hirsch think they cannot do better than refer their friends to Mr. J. Muir's admirable essay, which gained the prize of £500 offered by the Sulphate of Ammonia Committee, in which they say the subject is exhaustively treated.* They say it is, perhaps, too elaborate for a farmer's handbook; but the question is discussed at length and in intelligible terms. Mr. Muir does not try to prove too much, or to go farther than his facts will carry him. He establishes the superiority of sulphate of ammonia on the whole, and especially in regard to yield and keeping properties, provided it is used with the knowledge and judgment he seeks to inculcate. He admits, however, that for certain crops and under certain conditions the unit of nitrogen in nitrate of soda is equally effective, and that for certain other crops it is superior to sulphate of ammonia. These are conclusions which, as the authors point out, the more intelligent and enterprising users had already arrived at by experiment; but, now that the subject has been authoritatively dealt with, farmers will, they say, be able to proceed with more exact knowledge, and therefore greater confidence. For the present, however, they are afraid that the relative dearness of sulphate of ammonia will prevent a larger use of it when nitrate of soda is the alternative. In the situation, as a whole, they think producers may find reason for a hopeful attitude, though £1 per ton advance in price over that at the end of 1898 must necessarily make some difference in consumption, even where nitrate of soda is not in question.

The "Review" concludes with the usual record of the course of the market month by month; and this is followed by the customary tabulated statistics. The first table contains the comparative weekly prices of sulphate of ammonia and nitrate of soda last year. In the week ending Jan. 7, sulphate was 10s. 2¼d., and nitrate 7s. 9d. per cwt.; on April 1, the prices were 10s. 10½d. and 8s. 9d.; at Midsummer, they were 12s. 3¾d. and 8s. 3d.; at Michaelmas, they were 11s. 6d. and 7s. 9d.; while at the close of the year they were 11s. and 8s. respectively. The second table gives the average prices per ton of good grey (24 per cent.) sulphate, f.o.b. Hull; the figures ranging over 33 years—1867 to 1899. The following are the averages for the past ten years: 1890, £11 9s.; 1891, £10 15s. 5d.; 1892, £10 1s. 10½d.; 1893, £12 11s. 4½d.; 1894, £13 3s. 8½d.; 1895, £9 15s. 4½d.; 1896, £7 18s. 0½d.; 1897, £7 18s. 4¾d.; 1898, £9 9s. 7½d.; and 1899, £11 5s. 9¾d. The third table shows the average prices per hundredweight of 95 per cent. nitrate of soda, in Liverpool, for the past ten years. They are as follows: 1890, 8s. 2d.; 1891, 8s. 9½d.; 1892, 8s. 9½d.; 1893, 9s. 5½d.; 1894, 9s. 4½d.; 1895, 8s. 2¼d.; 1896, 7s. 11½d.; 1897, 7s. 9½d.; 1898, 7s. 6¾d.; and 1899, 7s. 11¼d.

*See "JOURNAL," Vol. LXXIV., pp. 163, 223, 287, 359.

FATAL ACCIDENT AT THE STOKE GAS-WORKS.

The latter end of the past, and the beginning of the present year have unhappily been marked by an unusual succession of accidents in gas-works. The latest addition to the list was made about noon last Wednesday, when an accident occurred at the Stoke Gas-Works which was unfortunately attended by fatal results. A new retort-house was in course of construction; the contract being in the hands of Messrs. Dempster and Sons, Limited, of Elland, with Mr. H. P. Embery, a builder, of Fenton, as sub-Contractor. When completed, the building will be 120 feet long and 70 feet wide; but only a portion of it—62 feet of the entire length—was being put up. The walls were practically finished, and seven iron principals had been placed in position for the support of the roof. Each principal was to carry about 60 bars. About half this number had been attached; and the work of fixing the remainder was proceeding. Within the building, a commencement was being made with the retort-benches. While this was going on, and while some bricklayers were at work on scaffolding at the end of the building, at a height of something like 34 feet, there was a sudden gust of wind, which was very high at the time, and its effect was to overturn the end principal. In falling it knocked over five of the others; but the seventh, though thrust out of position, did not fall. The mass of ironwork crashed into the house, bringing down the scaffolding with all upon it. A number of the stokers who were at work in the adjoining retort-house immediately ran to the new building to ascertain if any personal injury had been caused. They found in the centre of the house a bricklayer named Peter Plumb, a married man living at Newcastle, who had been erecting the retort-bench. It was at once seen that he was dead; one of the principals having fallen upon him. Six other men were more or less seriously injured—James Wheatley, William Lamb, and Thomas Mapp, bricklayers, and John M'Gann, a labourer, who were knocked off the scaffolding; and John Sherlock and Charles Crowther who were working underneath. Plumb's body was conveyed to the police station to await the inquest; and the injured men, after receiving attention from doctors who were promptly upon the scene, were removed to the Infirmary. Our latest information is that two of the men who were only slightly injured are now walking about; but of the other four sufferers, who were detained at the Infirmary, two are in a serious condition. They are, however, considering the nature of their injuries, doing very well; and the House-Surgeon feels exceedingly hopeful that they will recover.

An inquiry into the circumstances attending Plumb's death was opened by Mr. W. H. Adams, the Deputy-Coroner, on Friday afternoon. Messrs. Dempster and Sons were represented by Mr. Hurd; Mr. Embery, by Mr. W. F. Holtom; while Mr. J. B. Sproston appeared on behalf of the relatives of the deceased. Mr. J. H. Walmsley, one of Her Majesty's Inspectors of Factories, was in attendance; and the Town Clerk (Mr. J. B. Ashwell) watched the proceedings for the Corporation. The first witness called was John Armitage Garside, of Huddersfield. He said he was a plater and erector, employed at present at the Stoke Corporation Gas-Works by Messrs. Dempster. At the time of the accident, he was standing in the centre of the new retort-house. The walls were up, and seven principals were in position. He was looking up when suddenly there came a gust of wind, causing him to remark to one of the men that it seemed wild up where he was. Scarcely had he said the words than all the principals began to fall towards the south side of the building. He ran to get out of the way; and the next thing he saw was that they were on the ground. Deceased was working on the foundation of the new retort-bed, and was a little to the south of the centre of the building. After the fall, witness went to the place where the deceased had been, and found he was dead. The first of the principals was put up on the 3rd inst., on the south side next to the gable end. The practice in getting principals up was first to get one in position, and then attach guy-ropes. A second principal was then put up, and purlins were put on—five on each side. Another principal was got up, and five more purlins were put on, cross-jointed, and bolted. This proceeded until the last principal was up, and then they started to put purlins on the side nearest the works. They had three parts of these done when the accident happened. All the purlins on were completely bolted at the time, and he considered that what they did was sufficient. At the shoe of the principals holes were bored, in which they sometimes put bolts; but they would not have put them in in this case. He did not consider it necessary. The Coroner asked if the fact of the holes being bored did not look as if the engineers thought it necessary that the principals should be bolted to the beds on which they rested. Witness replied that this was not so. The principals usually came to them with the holes bored, but the bolts were seldom put in. Asked how he accounted for the accident, he said there came a strong gust of wind, and he accounted for it by that. It had been very stormy all the morning. In cross-examination by Mr. Holtom, witness said to his mind the accident could not in any way be attributed to the brickwork, which was well set. Very few bricks had fallen. Mr. J. W. Broadhead, Managing-Director to Messrs. Dempster, said the bolts referred to by the last witness would have been used in this case, but they were quite unnecessary; it was simply waste of time, labour, and materials to put them in. If they had been used in this instance, it would have been simply because they were specified in the contract. Some specifications provided for them; but why they should do so, he did not know. He was not sure that some were not in when the accident happened; but it was not usual to fill them in with lead until all the other work of fixing had been completed. They were always leaded afterwards, for adjustment purposes. If all these bolts in the shoes had been fixed and leaded, it could not have made the slightest difference to the accident happening. It was a sort of miracle to him how the accident did occur. He could only account for it by an extraordinary gust of wind. To his mind this alone was the cause of it. Other evidence was given by Frank Wood, Edward Whiteley, and William Heald. The former said he heard a strong gust of wind, which shook the purlins badly. He ran out of the house, and the crash came while he had his back to the building. Whiteley stated that there was a gust of wind so strong as to cause him to drop the angle-iron he had at the time. A few minutes afterwards he found that the principals were moving, and he leapt to the wall just in time to escape the fall. The Jury returned a verdict of "Accidental death," everybody being exonerated from blame; all the necessary precautions having (apparently) been taken to prevent such an occurrence.

MORECAMBE GAS-WORKS TRANSFER.

An extraordinary meeting of the Morecambe Gas Company was held last Thursday, when the purchase price agreed upon between the Directors and the District Council for the sale of the undertaking was formally ratified. The Directors were authorized to take the necessary steps to protect the interests of the Company during the progress of the Council's Bill through Parliament next session. The purchase price agreed upon is £141,000, which will be further increased by the amount of the reserve fund and the balance in hand on July 1 next, and by the valuation of the materials on the premises at that date. The Council pay all the costs of the transfer and negotiations. A resolution authorizing the promotion of a Bill to empower the purchase of the concern was passed at the last meeting of the Council, with only one dissentient—Mr. Johnson, who considered the agreed price an unreasonable one.

According to the "Lancaster Guardian," a good many Morecambrians are dubious, and not without reason, about the purchase of the undertaking. "Whether," says our contemporary, "the price agreed to be paid for the works is likely to be remunerative is a question upon which grave doubt has been expressed in several quarters, especially in view of the fact that electric lighting is an established thing, and that the District Council themselves are the largest consumers of the new illuminant. The agreed price is put at £141,000—practically three times the amount of the capital and loans of the Company. But this will not be the total sum; for there remains to be added the value of the stock-in-trade on the premises, the costs of the negotiations for transfer, of getting the Bill through Parliament, and so on. Roughly the gross cost may be put at £145,000—a figure which will probably be under the mark rather than over. It is not likely that the Council will be able to borrow the money at a less rate of interest than 3½ per cent., or that a longer period than forty years will be allowed for the redemption of principal and interest. Assuming that they are able to get the amount from an assurance company under these conditions, and on what is called the annuity principle, the sum to be set aside each year for the repayment of principal and interest will be something like £6790. Supposing that only thirty years be allowed for redemption and interest, the annual payment will be larger still, probably £7800 odd. Of course, the Council may be disposed to borrow the money from the Public Works Loan Commissioners; and in that case it would probably be advanced under a sliding-scale—the payment being considerable in the earlier years, but gradually diminishing towards the close of the period. But averaged over the whole period, the annual payment will not differ greatly from those already mentioned. The gross profits of the Gas Company for the year ending June 30 last are put down as £5483. The general result of the acquisition of undertakings of this sort by local authorities is a considerable improvement in management, greater economy in working, and a corresponding increase in the profits; and though this may be the case at Morecambe, it is probable that a very considerable period will have to elapse before the undertaking can be regarded as a paying concern from the standpoint of the ordinary ratepayer."

PROPOSED GAS WORKERS' FRIENDLY SOCIETY IN GLASGOW.

A Meeting was held towards the end of the past year of a Special Sub-Committee of the Glasgow Gas Trust on the subject of a proposed Friendly Society for the men employed in the Gas Department. Having considered the matter, under the remit made to them by the Gas Committee on March 29, 1899, the Sub-Committee passed the following minute, recommending that such a Society be instituted by the Department on lines similar to those upon which the Friendly Societies in connection with the Tramways Department has been established:—

1.—The membership to be optional, and to be confined to the workmen employed in the various gas-works, the meter-repairing department, and the streets-mains department, who are in receipt of weekly wages. All workmen on leaving the service permanently to cease to be members, and will receive back a proportion of their contributions.
2.—The objects will be: (1) mutual relief of members in case of sickness or accident; (2) allowance on the death of a member; (3) allowance on the death of a member's wife; (4) medical attendance and medicines to members; and (5) contributions to infirmaries and kindred institutions.
3.—Weekly contributions by the members, augmented by a contribution from the Gas Committee.
4.—The Committee of Management to be composed of members elected by the Society, and nominees of the Gas Committee, in proportion to their contributions.
5.—The funds to be placed in the hands of two Trustees—viz., the Chairman of the Gas Committee for the time being, and the General Manager for the time being of the gas undertaking, who will appoint the Secretary and Treasurer.

As the Corporation have no statutory power to contribute to the funds of the proposed Society, the Special Sub-Committee also agreed to recommend that, in the first Bill to be hereafter promoted in Parliament by the Corporation, the requisite authority should be asked for making such contributions. The Special Sub-Committee further agreed to recommend that, as the statutory powers of the Corporation Gas Department to pay any superannuation allowances are restricted to certain officers and servants of the old Gas Companies who are still in the service of the Corporation, parliamentary authority should at the same time be applied for to establish a superannuation fund in connection with the Gas Department which will be compulsory, and applicable to all the servants of the department, and also for authority to take over and appropriate for the purposes of the fund the money handed over by the old Gas Companies to the Corporation for benevolent objects, which on May 31, 1899, amounted to £3386.

The Special Sub-Committee, in submitting the recommendations contained in this minute, pointed out that it is not intended that the adoption of either or both of the schemes proposed should exempt the Corporation from their responsibilities under the Employers' Liability

Act, 1880, and the Workmen's Compensation Act, 1897. In order to accomplish this end, it would be necessary that one or other of the proposed schemes should comply with the requirements of the "contracting-out" clause of the last-mentioned Act, one of which is that the Registrar of Friendly Societies should certify that the adopted scheme "is, on the whole, not less favourable to the general body of workmen and their dependents" than the provisions of the Act, with reference to compensation claimable under the same for fatal or other accidents.

The minute above referred to is expected to be brought before an early meeting of the Gas Committee, and eventually submitted to the Town Council.

THE HALIFAX GAS COMMITTEE AND FREE LABOUR.

There was much talk, at a recent meeting of the Halifax Corporation, over a contribution of £5 5s. made by the Gas Committee to the funds of the Free Labour Association. It appeared in a lump sum of £23 17s. 3d., which came before the Corporation in an item of "accounts under £2." Mr. Parker objected to this, and asked why the amount was not paid in the usual open way. The Chairman of the Committee (Alderman Woodhead) said he could not answer the question; but there was nothing secret about the Committee's accounts. Mr. Parker went on to say that, having had this explanation, he must move that the accounts under £2 be referred back to the Committee. He felt sure the members had not understood that they had voted this five guineas as a subscription to the Labour Protection Association. That body was connected with the Free Labour Association, the object of which was, avowedly, the smashing of Trade Unions. As members of the Council, their business was not to represent a clique' or any side whatever, but the whole of the burgesses; and the Gas Committee, he submitted, had no more right to pay a subscription out of the rates to an Association for smashing Trade Unionism than they had to pay one for building it up. Mr. Maude, in seconding the motion, urged that, before making such a subscription, the Committee ought to have sought the sanction of the Council. Other speakers having expressed the same views, Alderman Woodhead expressed surprise that there should be two opinions about entrusting the Committee with the expenditure of five guineas. He contended that, if any outlay was ever incurred in the interests of the ratepayers, this subscription was of that character. The Council knew perfectly well that, if they had not had actual threats, they had had veiled threats that there was going to be a strike at the gas-works. They would have blamed the Committee if they had not taken every possible precaution to ensure a supply of gas being given to the town in any eventuality. That any member of the Council should get up and say that five guineas spent in this way was wrongful expenditure, astonished him. The subscription was not paid to bolster up any Free Labour Association. It was a legitimate expenditure in the interests of the ratepayers, incurred by a Sub-Committee, and sanctioned by the full Committee without comment. Something had been endeavoured to be made out of it that evening which did not belong to it at all. The Accountant (Mr. Nicholl) having explained that the inclusion of the item in the accounts under £2 was the result of an error, Mr. Parker said it was a funny proceeding. For anything the Council knew, they might have been subscribing to half-a-dozen associations to which they might object. He was opposed to the Council taking sides in matters of this description. The motion was carried with only one dissentient—Alderman Woodhead.

"GAS-FOUNTAIN" EXHIBITION IN EDINBURGH.

The Edinburgh evening newspapers last Friday contained reports of an exhibition in the office of Mr. John Macdonald, No. 88, Queen Street, of the "gas fountain" invented by M. Bouchaud-Praceig, and referred to in the "Journal" for the 26th ult. (pp. 1553-54). Besides the inventor, there were present Sir Edward Reed, K.C.B., the Chairman of an English Syndicate, Baron de Watteville, a Director of the original French Syndicate, and Mr. Ward, the Advising Engineer to the Company. The apparatus by means of which the process of producing the gas is carried out is a tin canister or "fountain"—the larger size shown being about 20 inches high and 6 inches in diameter, not unlike a biscuit-box in appearance. Two tubes project from the top—one entering the canister, and no more, to let in air; the other being carried through the fountain to the bottom, and serving to carry the gas off. Packed in the canister are a number of little squares of wood of absorbing properties so great that each will contain nearly its bulk of liquid. This is the apparatus as it comes from the manufacturer. All that is required to convert it into a real "gas fountain" is to pour into it a quantity of petrol, or other gas-producing liquid, when, the air entering by one of the top tubes, gas is at once generated, and flows, as required, from the other tube. A number of such "fountains" were employed in the demonstration—one in connection with a cooking-stove, another in conjunction with an ordinary gas heating-stove, and others for the purpose of supplying the illuminant to reading and table lamps of various shapes and sizes. Completeness was lent to the exhibition by the fact that the company had the opportunity of witnessing the practical application of the method to traction. The oil-tank and carburetter and their connections having previously been removed from one of the cars of the Edinburgh Autocar Company and a "fountain" and pipes fixed in their place, the vehicle was seen running along Queen Street very nicely. Mr. Ward gave a full explanation of the invention; pointing out its advantages owing to the portable nature of the apparatus. He laid emphasis on the fact that there was no danger of combustion or explosion—a fact which was demonstrated in a very interesting fashion by the inventor; and he claimed that whether for lighting, heating, or motor power, the system had advantages in point of cost over others which are known. It is stated that a canister 20 inches in length is capable of supplying a light of 10 candles for 200 hours; and the cost of the charging liquid is expected to be only about 1s. 9d. per 1000 cubic feet.

ELECTRIC LIGHTING NOTES.

The Eastbourne Town Council have entered into possession of the undertaking of the local Electric Light Company. A cheque for £88,135 has been paid over to the representatives of the latter; the sum including £6000 on account of capital expenditure agreed to be borne by the Corporation.

The Alfreton District Council have not secured much satisfaction out of a circular they recently issued to ascertain the feeling of the ratepayers on the question of adopting the electric light. The number of papers distributed was 751. Those in favour of electricity voted up to the number of 181; while 106 voted, but did not promise to use it. The votes against the scheme numbered 56; 28 signed, but did not answer the questions; and 380 papers were returned blank.

A special meeting of the Gloucester City Council was held last Tuesday, when tenders were accepted for extensions to the electric light installation. The original plant provided for 12,000 8-candle lamps for private lighting; and of these all are taken except 229, though they will not be available, as the works will not be finished before next winter. It was resolved to apply to the Local Government Board for power to borrow a further sum of £9425 for such extension, and £8575 for a refuse destructor.

Recently, at considerable expense, the Congregational Church at Rake Lane, Liscard, was fitted with the electric light, and the new illuminant for a time gave satisfaction. On the evening of last Sunday week, however, when the time came for lighting up, the attendant found the supply of electricity cut off, owing, it is presumed, to some defect in connection with the cable. Fortunately gas-brackets had been retained at each end of the church, and these were brought into requisition; but the body of the church was enveloped in gloom.

At the meeting of the Redditch Rural District Council last Tuesday, the Lighting Committee drew attention to the failures of the electric light in the town, both in the public lamps and among private consumers. Mr. Hiscock stated that in one street there had been practically no light for a fortnight, and there had been several failures for longer or shorter periods since the electric lighting scheme was put in operation. The opinion was expressed by several members that the public would be chary of adopting the light in its present unreliable form. It was finally decided to apply for sanction to borrow £8000 in connection with the extension of the electric lighting scheme.

The Dartmouth Town Council do not appear to be overburdened with enthusiasm for the electric light, which has been forced upon their attention by one of the Companies who are exploiting the smaller towns in the West of England. At a meeting of the Council last week, the question was referred to a Committee composed of the Mayor and two other gentlemen, who were authorized to call in an expert. The Town Clerk remarked that he had already called two meetings to consider the subject. At the first the Mayor attended, and waited half-an-hour for others to put in an appearance; but no one came. The second meeting was attended only by the Town Clerk. The members laughed at this; and their whole attitude towards the scheme suggests that they had little faith in its realization.

The City of London Electric Lighting Company have deposited a Bill in which they ask for the curious power to abolish their depreciation and reserve funds, and to apply those already accumulated for these purposes in any way that "the Board of Directors may determine." The preamble to the Bill states that the obligations to provide the funds were undertaken by their predecessors, and were adopted by the Company in consideration of the Commissioners of Sewers granting them the exclusive right of supplying electricity for private purposes within the City of London during a period of 21 years. Now that opposition has been fostered, the Directors contend that it is just and expedient, in the above circumstances, that the Company should be relieved from the obligations imposed on them in relation to their accounts, and the setting aside of depreciation and reserve funds.

Mr. G. C. T. Bartley, M.P., wrote to "The Times" last Friday as follows on the subject of a new electric light danger: "Last week, when turning on the electric light on my study table, it exploded with a report like a pistol. The socket of the lamp was blown out, and the glass, in myriads of atoms, sent in all directions. Fortunately, a tilted shade saved my face; but I must have had some of the dust in one eye, for I am still confined to my room and cannot even read. The lamps had been supplied by the Westminster Company a week or so before Christmas, when they changed all the lamps on doubling the voltage of the current. They say doubling the voltage has nothing to do with the accident. But they cannot explain it; and I think users of the electric light should be warned, as this danger exists, to put some protection on the lamps which they use close to their faces, as I certainly shall do for the future."

There is a little irritation in the Sheffield City Council over the position taken up by the Local Government Board in connection with the Council's application for sanction to borrow £100,000 for the purposes of their electric light undertaking. The Board have determined to comply with the application only so far as it relates to the borrowing of £71,120. The sums which the Board have excluded from the loan are: Prospective expenditure on machinery, £12,280; steam-boilers, steam-pipes, condensers, &c., £9000; and machinery connected with proposed public lighting, £7600—making a total of £28,880. The Board defer giving a decision as regards these sums until the Town Council are in a position to furnish more precise information as to them; and in connection with any application which may hereafter be made for sanction to a further loan for the purposes of the undertaking, they state that they will require to be furnished with full particulars of the expenditure of the loan now sanctioned.

At last Wednesday's meeting of the Woking Urban District Council, the Electric Light Committee reported that they had considered the draft Provisional Order of the Woking Electric Supply Company, Limited, and decided to ask for the insertion of the following clauses and amendments: (1) A clause giving the Council power to purchase at the end of 15 years the portion of the undertaking then within their district, upon the terms of section 2 of the Electric Lighting Act, 1888. (2) Section 15 of the Order of 1899 to be so extended that no works be carried out in private streets without notice to, and deposit of a plan with, the Local Authority. (3) Section 32 of the general Order to be so amended that a

revision of prices may be applied for after each three years, instead of after each seven years. (4) The cost of public lighting, including maintenance and repairs (but not erection of standards), shall not exceed £3 per lamp per 25-candle power for 2000 hours; and an addition to that effect be made to clause 34 of the Act of 1899. (5) The maximum for each unit over and above 20 units to be 7d. instead of 8d.; and the fourth schedule to the special Order to be amended accordingly. The Clerk was authorized to instruct Counsel to settle clauses and amendments, and to advise.

There was a failure of the electric light at Southampton on the evening of Saturday, the 6th inst.; and the occurrence occasioned considerable inconvenience in many directions. The arc lamps in the main streets went out at 6.30, and simultaneously the light failed in business establishments and private houses. In about half-an-hour the street-lamps were alight again, and connection was re-established at the two theatres, the Royal Southampton Yacht Club, and buildings in the upper part of the town. With regard to the High Street and the lower district, however, it was found impossible to set matters right; and the tradesmen who did not close their shops were obliged to adopt such illuminants as could be procured at short notice. They presented in some cases a very strange appearance. For instance, a chemist had a long row of candles on the edge of his counter; and to prevent the grease from running about, had stuck the ends in pill-boxes. According to a statement reported to have been made by the Chief Electrical Engineer (Mr. F. H. Chaplin), the cause of the accident was a particularly bad short-circuit on some of the old copper-strip; and it had not been located on the following morning, though the staff had been hard at work since the failure.

It is fortunate for the Manchester Royal Exchange that, when electric lighting was introduced a few years back all through the building, the precaution was taken of retaining complete the system of gas lighting, as on several occasions it has proved very serviceable, and prevented serious inconvenience on 'Change and in other parts of the building. During the course of a week, there have been no less than three breakdowns in the lighting, on each occasion on the principal market days. The first, as already mentioned in the "Journal," was caused last Friday week by an explosion in the electric mains immediately outside the building, which at once put out all the lights; while occurring as it did just at "high 'Change," it caused no little excitement among the members, and a temporary stoppage of business until the cause was ascertained, and the Exchange again lit up by means of gas. On the following Tuesday, there was another breakdown, which fortunately occurred when business was practically over; but the whole of the building and the offices lighted by electricity were for a time put in darkness, and their old friend gas had again to be brought into use. Last Friday there was a third failure, and the gas supply had again to be requisitioned. On this occasion the matter was, as on the previous Friday, more serious. The breakdown occurred about four o'clock, the time of second 'Change. The members were plunged in darkness until the gas could be lighted; and the electric light had not been restored when the Exchange closed.

At the Town Hall, Oldham, last Wednesday, Mr. H. Percy Boulnois, one of the Inspectors of the Local Government Board, held an inquiry with respect to the application by the Corporation for leave to borrow £36,000 for the purpose of paying for extensive additions to the electric light station, the erection of a new boiler-house, and extension of the plant. The Town Clerk (Mr. A. Nicholson), in opening the case for the applicants, said the extensions of the generating station were rendered necessary by the fact that the Corporation were at present unable to cope with the demand for energy. The electric lighting had been the most satisfactory work the Corporation had taken in hand. This was the fourth time the Corporation had had to apply for borrowing powers to extend the station. With the completion of the present scheme, the whole of the site of the station would be built upon; and the Corporation intended to establish a new station on the other side of the railway line some little distance away. The total capital expenditure to date was £57,109, and the total borrowing powers amounted to £52,000; so that the Corporation had over-expended by £5109, against which, however, they had a sum of £5159 in reserve. The Electrical Engineer (Mr. Newington) said the increased demand since the 25th of March was 37 per cent. Mr. Stephen Wall, a ratepayer, while not objecting to the expenditure, expressed disapproval of the practice of proceeding with works first and then applying for leave to borrow the money for them. In this case, he said, large contracts had been let and partly carried out. The Inspector said he should certainly have to report on this matter to the Local Government Board.

According to Alderman Radford, the Chairman of the Electricity Committee, the Plymouth municipal electricity undertaking is expected to establish a record. In moving the adoption of the report, which the Committee presented to the Town Council yesterday week, recommending that £48,000 be borrowed for the extension of the works, he predicted that at the end of the first six months' working the Committee will be able to pay all their expenses, together with the instalment of interest and sinking fund for that time. If this expectation is realized, the Plymouth works will, he explained, be the pioneer in paying their way in the first six months after being established. With an increased output—which the proposed new capital expenditure is to provide for—the cost of working will be relatively cheaper; and if by the beginning of next winter the Committee are able to supply all the demands made upon them, they will, he prophesies, be able, even in the first year of working, to hand over a considerable sum in relief of the rates. As previously explained in the "Journal," the Plymouth electricity works are the first in the kingdom which have been established and set to work under the conditions which now find most favour with electrical engineers—viz., a tramway as well as a lighting load. The demand for current for lighting purposes has exceeded expectations; but the Corporation are their own best customers, as, in addition to the current for the tramways, they are users of a good deal for arc lamps in the streets and for the lighting of the various municipal buildings. In the Municipal Offices, Guildhall, Markets, Free Library, and other departments, gas is being displaced by electric light; and this will no doubt continue until all the buildings over which the Corporation have control are lighted in this way. The original estimate of the capital outlay on the works was £45,000; but the actual cost was £55,720, and additional works were sanctioned which brought the expenditure up to nearly £60,000. The new works now needed will cost £35,000; the balance of £13,000 which makes up the proposed loan of £48,000 being required to meet the expenditure already incurred in excess of the first estimate.

The Sudbury (Suffolk) Town Council have received a report from Mr. W. C. C. Hawtayne on the subject of the electric light scheme for the town. Very naturally, in this gentleman's opinion, the town offers a good field for electricity supply; but other people who know the town as well as, if not better than, Mr. Hawtayne may hold a contrary view. Altogether, he considers the town far superior to many where the establishment of similar works have been remunerative. It would be interesting to know the names of the towns comprised in that word "many," and the extent of their success. He advises that certain streets be lighted; and he believes that, "within a few years" (which is rather an elastic expression), consumers will be connected to the mains using about 8000 8-candle power lamps. But not to commit himself too far, Mr. Hawtayne in his report only considers the connection of 6000 lamps. It is very clear, however, that even this sanguine expert does not anticipate that there will be a very rapid influx of customers, for he says: "The lighting can be effected quite as economically as with gas; the only *slight* drawback being that mains must be laid in streets in which very little demand will be made at present by private consumers. It will not, therefore, pay to lay larger mains than absolutely necessary; *the roads being re-opened when a demand arises* for the laying of additional mains for supplying private consumers." In connection with the first part of this statement, it may be noted that the proposed compulsory area comprises about a dozen streets, in only three or four of which anything approaching a reasonable demand is likely to arise. The cost of the undertaking he puts at, in round figures, £16,300. As to the financial results of the working, he estimates that each of the 6000 private lamps will consume 16 units per annum, or a total of 96,000 units; and, adding 10,500 units for public lighting, the total output will be 106,500 units. Then, he says, it will not be necessary to charge more than 5½d. per unit, "now generally reckoned as the equivalent of gas at 2s. 9d. per 1000 cubic feet." Mr. Hawtayne should have added after the word reckoned "by electricians," as the accounts of electricity consumers do not appear to always bear out the assertion as to the two-and-ninepenny equivalent. Anyway, on Mr. Hawtayne's figures, the revenue would amount to £2473; and the profit and loss account would show a net profit of £309 13s., after allowing for repayment of capital and interest. In a quarter or a third of a century, if the present councillors are spared that time, they will have the joy of seeing, when the loan is all repaid, that the profits will be materially increased—that is, of course, assuming a profit is made before then. Supposing 6000 private lamps are not connected, and supposing 16 units per annum are not consumed per lamp, where will that lean profit of £309 13s. be? Is such a return as this worth the risk in a town like Sudbury? The report also deals with the question of tacking on to the electric lighting scheme a refuse destructor, at an additional cost of £2000. In urging the adoption of this destructor project, Mr. Hawtayne refers to Epsom as being a town similar to Sudbury. Electricians and gas people seem to look at places through different spectacles. Both Epsom and Sudbury have small populations; but Epsom exceeds Sudbury by something like a thousand. And in these comparisons it is not so much the size as the character of the population. The bulk of the people of Epsom are wealthy compared with the inhabitants of Sudbury; and this is reflected in the respective positions of the gas suppliers. At Sudbury, there are only about half the number of gas consumers that there are at Epsom, and the latter town has a consumption four times that of the former. Considering that a 16-candle gas is supplied at Sudbury as against 14½ candles at Epsom, the difference in the price is not great. It is, we believe, 4s. 7d. and 4s. at Sudbury, against an all-round charge of 3s. 8d. at Epsom. This small difference does not account for the better position of the one compared with the other in the number of consumers and the average consumption per consumer. It is that one town possesses a better-class population than the other; and if electric lighting is adopted in Sudbury, we venture to predict that the Town Council will see in time that there is truth in this. However, the present position at Sudbury is this: The few members of the Town Council who appear to dominate their fellow councillors have decided, for some occult reason, that there shall not be a public meeting on the subject; but a canvass is to be made of the persons likely to become consumers. The result of this canvass will determine future action.

Carmarthen New Water-Works.—These works, which will cost something like £25,000, exclusive of unforeseen necessaries, are satisfactorily progressing, thanks to the activity of the Surveyor, and the facilities afforded him by the Corporation. The works indeed are so far complete that last Tuesday the Mayor (Mr. Walter Spurrell, J.P.), and most of the members of the Town Council drove to the Rock and Fountain—a very appropriate name for the basis of such a supply—and formally affixed the last joint to the pipes, and turned on the water.

Gas-Engines for Driving Electric Lighting Plant.—At the last monthly meeting of the Chesterfield Town Council, Alderman Clayton moved—"That it be a recommendation to the Electrical Energy Committee to consider and report on the desirability of using gas-engines for the purpose of the generating station to be provided for the borough." He said he had been informed, by people competent to express an opinion on the matter, that gas-engines could be as effectively employed for the purpose mentioned as steam, and quite as cheaply; and he was also informed that the people with whom the Committee were in treaty for the supply of the generating plant were the makers of the best gas engines on the market. If, as he had been informed by experts was the case, gas engines could be employed as cheaply as steam-engines at the electricity generating station, their plain duty was to have them. Mr. Markham, in supporting the motion, said it was desirable to know exactly how far the town intended to go into the electricity business. For a small generating plant of (say) 200 horse power, gas-engines were preferable to steam-engines; but for a plant of 500 to 1000 horse power, steam was the most desirable agent. He did not believe there would ever be a great demand for electricity in Chesterfield; and if it was not intended to utilize it as a power for working tramcars, he considered gas-engines would be best for generating purposes.

AN ARBITRATION RESPECTING THE DRONFIELD WATER SUPPLY.

On Friday, the 5th inst., and the following Monday, the Town Clerk of Nottingham (Sir Samuel G. Johnson), who is standing Arbitrator of the Derwent Valley Water Board, sat at the Guildhall, Nottingham, to arbitrate in a dispute as to the water supply, between the Dronfield District Council and the Chesterfield Rural District Council. Sir Samuel was asked to decide whether the Chesterfield Council, as successors of the Chesterfield Board of Guardians, had fulfilled their obligations under an agreement dated Oct. 16, 1880, and made between the Guardians and the Dronfield Local Board, now the District Council. He was also desired to consider a claim relating to an agreement between the Authorities for Dronfield to pay £3500, and receive a supply of water, and in addition to contribute a certain sum towards the cost of maintenance of the works. It appeared that the sum of £3500 was paid by the Council; but for some reason or other from 1883 until Michaelmas, 1898, no demand was made by the Chesterfield Council for any contribution in respect of maintenance. The amount was estimated by the Engineer; and as a result an account was ultimately submitted to the Dronfield Council for £545 3s. 1d. At the close of a mass of argument and evidence, the Arbitrator said he sympathized very much with both public bodies in the position in which they were placed. No doubt both Authorities were well advised. But it must be patent that Dronfield and Chesterfield were so situate that they must work to their common advantage; and unless a way was found to do this, he could see nothing but perpetual litigation between the two bodies. He impressed upon both that his feeling was that they ought to come together in an amicable and friendly spirit, and, in the future, settle their disputes without litigation. He should, therefore, extend the time before he gave his award, in order that the parties might come to some agreement between themselves. The learned Counsel concerned intimated that the views of the Arbitrator should be laid before the Authorities.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Mr. Joseph Burgess, retired from the active conduct of the agitation among the Glasgow Corporation Gas Workers, as stated last week, transferred to the Central Office of the Gas Workers' Union the task of replying to the letter of Mr. A. R. Cawley, Manager of the Llanelly Gas Company. The reply, such as it is, has come from Mr. W. Thorne, the General Secretary of the Union, and it appeared in the "Glasgow Herald" last Wednesday. It was as follows:—

My attention has been called to a letter from Mr. Cawley, Manager of the Llanelly Gas-Works, which appeared in your issue of the 2nd inst. [*ante*, p. 96]. In this letter, Mr. Cawley tries to throw discredit upon the management and policy of the Gas Workers' and General Labourers' Union because the stokers at his works threw down their tools without notice. But as he does not give the reasons why the men did this, perhaps you will be good enough to allow me space to give their reasons for doing so.

In January, 1898, the management posted up a notice to the effect that when the time came for shortening hands, the men would be put off from the shift which had produced on an average the least gas per ton of coal. Such a notice was bound to give offence to the men. A few days before this notice was issued, a petition had been presented to the Directors asking for an increase of wages for the stokers. The notice was, however, withdrawn after the men had given notice to leave their work; but the advance of wages was refused. About the same time, a man by the name of Ben Davis was discharged without any notice being given to him, but he was eventually reinstated. In May, 1898, and again in September of the same year, the management tried to take advantage of the men by not allowing the senior hands to be promoted, which had been the custom long before Mr. Cawley came to manage the works. In November, 1898, another petition was presented asking for an increase of wages. Again this was refused; but the men took no action. In November, 1899, a similar petition was presented and refused, until the men gave in their notices to cease work, when an advance of 5d. per day was conceded. Your readers will therefore see that the men have been very patient during the past two years. It is true they have put down their tools on two occasions, but not without good cause.

Previous to Mr. Cawley taking charge of the works, the men never had cause to complain, because they were treated by the late Manager as men, and any grievance they may have had was always listened to. We have never objected to foremen or managers saying as to whether the men were doing their work as it should be done, but we do say that there are two sides to every question. Some gas managers want the same amount of cubic feet per ton of coals carbonized, irrespective of whether the gas is in the coals or not. Bad coals make bad coke, and this causes dull heats, so that the coals are not properly carbonized, and this means so much less gas from each ton of coals. Then the blame is thrown on the men. The tests that are made in the large gas-works of the different kinds of coal show that some is much more rich in gas than others.

The minds of the members of the Manchester Corporation have been changed since 1889, and they now deal with matters sent them through the Union, instead of ignoring them, as they formerly did. Only last week they granted some concession to some of their employees, which was applied for on the men's behalf through the Union. When the men gave in their notices in 1889, they did so according to the agreement which then existed; but the executive of the Union did not know of this till seven days afterwards. When we were made acquainted of this I went to Manchester at once, and prevailed upon the men to withdraw their notices, but when I saw the Mayor he would not accept the withdrawal. Still, we survived the defeat, and are some 10,000 members stronger than we were then.

I would here inform Mr. Cawley that at works and factories where the management treat their men as men we do not have any of these quarrels. But when you have a domineering manager or foreman, then trouble is bound to occur. Mr. Cawley does not tell your readers the causes of the disputes at the copper-works and tin-plate works. When he does, then I will answer him.

In conclusion, let me tell Mr. Cawley that, if he will show less venom towards his men, and treat them as they should be treated, he will always have our hearty co-operation in getting the men to fulfil their obligations to the Company.

The letter reminds me of the legal adage: "No case; abuse the other side." Mr. Thorne, it will be seen, does not refute any of Mr. Cawley's statements, but rather confirms some of them; and then he accuses him, first of not managing the works as the men (the Union) would like, and, secondly, of having venom towards his men. The first point is just that which is in dispute everywhere where the Union erects its head. A manager who is capable of doing his work does not require the assistance of the Union—indeed, he will not have it, because the moment he allows anyone outside to have a say in the control of the works, he abdicates his position, and becomes only joint manager. A weak man may tolerate such a state of matters; but a strong man will not. The second point grows out of the first. If a manager is weak, and gives way always when his workmen ask anything, he is, of course, in their opinion, a good man; but if he insists upon having his own way, he is put down by the Union as having venom towards his men. Now, it scarcely follows that because a manager sees fit to refuse a petition by his men, he is actuated by a desire to cut them off from earning a livelihood. Mr. Thorne would have been nearer the reality of the case if, instead of adjuring Mr. Cawley to show less venom, he had urged the men to show more regard for the interests of their employers. That, however, is not the policy of the Union. Their view is not that masters and workpeople should co-operate in bringing out the best result possible, but that there should be a position of antagonism clearly defined between them, frequently breaking out into open hostility; and with the Union officials standing between, the industries of the nation are not to be peaceful occupations, but men are to work with their fighting weapons always at hand. Their greatest enemy is always the man who gives them the employment by means of which they live. It is said that in proportion to the strength of the affection which a lunatic previously had for those about him, is the hatred which he manifests towards them after losing his reason. A Trade Union policy is thus a policy of industrial lunacy. Mr. Thorne is a poor apologist for the policy. If Mr. Cawley should consider it advisable to take any notice of Mr. Thorne's letter, he should have no trouble in showing the poverty of the reasoning in it. He will have difficulty, however, in getting hold of statements of fact, for they are very meagrely introduced.

The Falkirk Gas Commissioners had before them this week a report by the Works Committee, to the effect that a gas consumer had damaged a meter and had used a rubber pipe as a bye-pass; and that in other two instances gas-meters had been disconnected without notice having been sent to the Gas Manager. One of these two meters has been lost. Bailie Cook Rennie, who presided, said he had seen the man who had used the rubber pipe, and had arranged the matter with him on very favourable terms. The man had laid himself open to a very serious charge, had the matter been put into the hands of the police; but he did not wish to bring his name before the public. The way the incident happened was that the man had a slot meter; and being unable to get a penny inserted, he attached the rubber pipe, and used the gas through it. He had now paid for the damage to the meter, and for the gas he had used. The Commissioners approved of this policy. I doubt the wisdom of the step. If the Commissioners believed that the man took the gas in a manner which was contrary to the statute—that is, that he stole it—there was no need to deal gingerly with him. If they believed that he did the thing innocently, and he had paid for it, it was cruel to bring the matter up at a public meeting, because, although the name was suppressed, it will be known all over Falkirk by this time. Besides, in dealing with this man as they have done, the Gas Commissioners have morally given up their right to prosecute anyone who may be found doing as he did.

Weather of more than ordinary darkness continues to prevail. Last Saturday was one of the darkest days I ever remember to have seen. Lights were burning till 10 o'clock in the forenoon, and again by shortly after 2 o'clock in the afternoon. In this state of matters, gas consumption is going up all round. It is reported that at Dunfermline the output during the past month amounted to 598,900 cubic feet more than in the corresponding month of 1898—an increase equal to 5·24 per cent. At Perth, the report of Mr. A. Wilson, the Gas Engineer, submitted this week, was to the effect that there had been an increase in the output of gas during the eight months which have elapsed of 97,484,200 cubic feet—equal to 10·99 per cent. Last month was the most trying in the history of the gas undertaking, and taxed the resources of the works and staff to their utmost. By strenuous efforts, the city had been kept supplied with gas, though on four occasions, notwithstanding the reduction of pressure, when 10 o'clock at night arrived, there was only one hour's supply left. After that time, they began to gain upon the demand. Mr. Wilson considers the worst to be now passed. At Peebles, the increased output during December was 444,600 cubic feet, and since May 3,306,000 cubic feet. This is chiefly due to the liberal terms given for the introduction of gas-cookers, a policy which the Commissioners have adopted as affording an eligible investment of spare funds. At Peterhead, the Manager (Mr. G. Keillor, junr.) has reported an increased output of gas for the year to date of 12 per cent.

Mr. G. R. Hislop, Gas Engineer to the Paisley Gas Corporation, has submitted a report to that body upon the subject of stair-lighting, in which he states that the number of stairs and closes in the town lighted with gas and oil and the number without any light whatever, were as follows: Stairs lighted by gas 1198; by oil, 383; without any light, 750—total number of stairs, 2331. Mr. Hislop ventured the opinion that the example of Leith or Greenock might with advantage be adopted, wherein the periods of lighting are eight months and nine months respectively per annum, with lighting shortly after sunset and extinguishing just before sunrise. The number of gas-jets necessary to light the Paisley stairs satisfactorily was computed at 5828; and allowing 124 for each lighter employed, 47 men would be required to overtake the work of lighting and extinguishing, which would occupy about two hours morning and evening. If in Paisley lads were employed as in Leith, and reckoning on the basis of a nine months' lighting season, the charge of 10s. per light would permit of a wage of 8s. 3d. per week being paid, 10s. 3d. per light 9s. per week, or 11s. 2d. per light 12s. per week. The total annual amount payable by landlords at, say, 10s. 3d. per light, would amount to £2986 17s., of which sum the lighters at 9s. per week would receive £825, or at 12s. per week £1100, out of a total annual charge of £3253 19s. 4d. The Corporation agreed, by a majority, that the report be printed and afterwards transmitted to the Burgh Commissioners for consideration.

I have seen a report in which it is said that the Burgh Commissioners of Portsay a few months ago finally took over the acetylene-gas plant from the Manchester Acetylene and Carbide Company; that two of Frank's patent purifiers have been put in, with the result that the haze so much

complained of has almost disappeared, and the new illuminant is giving general satisfaction; and that the Commissioners have dispensed with the services of their Burgh Surveyor and Water Officer, and have appointed a Gas Manager who will perform all these duties, and devote his whole time to the work of the burgh.

The Inverness Town Council met on Monday night. The first item of business related to the extensions of the Corporation gas-works, to which I referred in October last. The Committee had been considering the proposals of Mr. Thomson, the Gas Engineer, since then; and they now recommend their adoption. Mr. J. L. Guild, the Convener of the Committee, said it had been resolved to proceed with the conversion of the second half of the retort-bench into a regenerative system, at a cost of about £2000. At the present time, the gas-works were kept going at full pressure; but the alteration would give them sufficient retort power for a long time. The condensers were unequal to the work required of them; and it was necessary that they should be replaced by new ones. The cost would be about £500; but it would be more than made up by the results which would be derived. The coal storage accommodation was too small; and it was proposed to erect a coal-shed which would give all the accommodation required. The total cost of the alterations would be about £3000. Some might ask, Mr. Guild said, why they should incur such an expense at the gas-works, in face of the introduction of electric light. But the experience of other towns where electric light had been installed was that the demand for gas increased; and he saw no reason why a similar result should not be experienced in Inverness. The fact that they were taking a larger area into the town would increase the demand for gas. The recommendations of the Committee were agreed to unanimously.

A vivid contrast to the harmonious procedure at Inverness, is to be found in a report of a meeting of the Dunbar Town Council, held on Wednesday night. It ran as follows: "Sitting as Gas Commissioners, the Board passed the gas report, which was short and satisfactory. Some points of minor importance were discussed; Bailie Smith again coming into antagonism with members of the Board. The meeting became rowdy. Members rose and left, maintaining a running discussion as they went; and at last Bailie Smith was left almost alone, protesting to the last. It was difficult to know what decisions were arrived at." All this was over questions of minor importance. What sort of scene would there be over more important matters? Bailie Smith was at one time Convener of the Gas Committee; and it must be admitted that he made a good Convener. But he does not seem to have forgiven his supercession in office.

A letter has been received by the North Berwick Burgh Commissioners from the North British Railway Company, stating that the cost of the siding accommodation at the site of the new gas-works will be £385, exclusive of works which fall to be executed by the Commissioners; and that the Commissioners must take all risks in connection with the laying of the main gas-pipe along the line of the railway, and pay £5 a year as wayleave. Another letter was submitted, from the Law Agents of the owners of Dirleton Estate, intimating that they refuse to entertain any proposal for the purchase of a new site for the gas-works unless the Commissioners (the Burgh Commissioners) complete their agreement with regard to the water to be supplied to houses on the estate. Several members expressed great disapproval of the intimation, as the water supply has nothing to do with the proposal to erect a new gas-works. Consideration of the letter was held over.

The Broughty Ferry Gas Commissioners have assented to the recommendation of a Committee to advance the wages of their gas stokers by ½d. per hour. The Troon Gas Commissioners have agreed to advance the wages of their gas stokers by 1s. per week.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan.* 13.

Sulphate of Ammonia.—In the early part of the week, prices continued to harden; and towards the close, the advance has been very rapid—quotations being now £11 10s. to £11 12s. 6d. per ton delivered f.o.b. at the ports. The reopening of inland navigation on the Continent occasioned larger buying, to start with; but it is understood that the placing of considerable Colonial orders in London has afforded the later upward impetus. Production has been freely offered; and all parcels have been readily taken up. A large forward business has also been done, at up to £11 15s. per ton, ordinary terms, f.o.b. Leith, and £11 10s., London, Beckton terms; and higher prices are now required.

Nitrate of Soda is firm at 8s. per cwt. for refined quality on spot.

LONDON, *Jan.* 12.

Tar Products.—The apprehension that carbolic, cresylic, and picric acids would be proclaimed as contraband goods has unfortunately turned out to be too true; the Royal Proclamation having to-day been issued to this effect. It remains to be seen how far it will influence the value of these articles, which are, however, very scarce, both in makers' and buyers' hands. Nineties benzol is flat; and the few buyers there are quote very low prices. For 50's, there is a little better demand; but the price of it is lower. Pitch shows a tendency to better values; and there are many buyers now who will purchase for the remainder of 1900. Freights are a little easier, and more plentiful. Solvent is firm; and creosote is steady. Anthracene is weak; and naphthalene salts are fairly firm.

The average prices obtaining during the week are: Tar, 17s. to 25s. 6d. Pitch, east coast, 34s.; west coast, 32s. Benzol, 90's, 7d.; 50's, 10d. Toluol, 90 per cent., 1s. 2d.; pure, 2s. Solvent naphtha, 1s. 4d. Crude, 30 per cent., naphtha, 4⅜d. Heavy naphtha, 1s. 2½d. Creosote, 3½d. Heavy oils, 3⅜d. Carbolic acid, 50's, 2s. 8d.; 60's, 3s. Crude naphthalene, 50s. to 55s. Anthracene, nominal, "A," 4d.; "B," 2½d.

Sulphate of Ammonia.—This market opened strong in the earlier part of the week, and has daily shown increasing firmness since. Makers are now asking £11 10s. to £11 15s., less 3½ per cent., according to port of shipment; and for forward delivery at least 5s. more will be required. A large business was done in the middle of the week at prices ranging from £11 7s. 6d. to £11 10s. f.o.b., bags included.

The Lighting Corporation, Limited, successors to the Wenham Company, intimate that, on account of the continued increase in the cost of production, all prices have been withdrawn.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 137.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 13	10½	Alliance & Dublin 10 p. c.	20¾—21½	−½	4 17 8
100,000	10	,,	7½	Do. 7 p. c.	14¾—15½	..	4 16 9
300,000	100	Jan. 2	5	Australian 5 p. c. Deb.	100—102	..	4 18 0
200,000	5	Nov. 15	6	Bombay, Ltd.	5⅜—6½	..	4 8 11
40,000	5	,,	6	Do. New, £4 paid	4—4½	..	5 6 8
880,000	Stk.	Aug. 16	12	Brentford Consolidated	273—278	..	4 6 4
270,000	,,	,,	9	Do. New	210—215	..	4 3 9
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb.	124—128	..	3 2 6
220,000	Stk.	Sept. 15	11½	Brighton & Hove Orig.	250—260	..	4 8 6
226,320	,,	,,	8½	Do. A. Ord. Stk.	183—188	..	4 10 5
973,500	Stk.	Aug. 16	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Sept. 29	10	British	43½—44½	..	4 9 10
50,000	10	Aug. 31	12	Bromley, Ord. 10 p. c.	25—27	..	4 8 11
75,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd.	9—9½	..	6 6 4
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	98—100	..	4 0 0
150,000	20	July 13	8½	Cagliari, Ltd.	28—29	..	5 13 10
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	13½—14½	..	5 10 4
50,000	50	Nov. 2	6	Do. 6 p. c. 1st Mort.	56—58	..	5 3 5
550,000	Stk.	Oct. 13	13½	Commercial Old Stock	305—310	..	4 7 1
200,750	,,	,,	10½	Do. New do.	240—245	..	4 5 9
200,750	,,	Dec. 14	4½	Do. 4½ p. c. Deb.	140—145	..	3 2 1
600,000	Stk.	Dec. 14	9	Continental Union, Ltd.	177—181	..	4 19 5
200,000	,,	,,	7	Do. 7 p. c. Pref.	178—183	..	3 16 6
51,600	Stk	Aug. 31	14	Croydon A 10 p. c.	335—340	..	4 2 4
168,400	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
555,000	Stk.	Aug. 16	5½	Crystal Palace Ord. 5 p. c.	130—135	..	3 17 9
60,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
486,000	10	July 28	11	European, Ltd.	21—22	..	5 0 0
354,060	10	,,	11	Do. £7 10s. paid	15½—16½	..	5 0 0
14,993,075	Stk.	Aug. 16	4⅝	Gas-light & Coke	4 p. c. Ord.	..	4 12 5
2,600,000	,,	,,	3½		8½ p. c. max.	..	3 10 8
3,799,735	,,	,,	4	and Coke	4 p. c. Con. Pref.	..	3 5 7
8,993,975	,,	Dec. 14	3		3 p. c. Con. Deb.	..	3 1 3
70,000	10	Nov. 15	8	Hongkong & China, Ltd.	13½—14½	..	5 10 4
3,800,000	Stk.	Nov. 15	10	Imperial Continental		−2	4 13 0
473,600	Stk.	Aug. 16	3½	Do. 3½ p. c. Deb. Red.	101—101	..	3 7 4
75,000	5	Dec. 14	6	Malta & Medn., Ltd.	5—5½	..	5 9 1
560,000	100	Oct. 2	5	Met. of	5 p. c. Deb.	..	4 7 9
250,000	100	,,	4½	Melbourne	4½ p. c. Deb.	..	4 2 7
541,920	20	Nov. 15	3	Monte Video, Ltd.		..	5 0 0
617,946	Stk.	Aug. 31	9½	Newcastle & Gateshd Con.		..	4 2 3
251,856	Stk.	Dec. 29	3½	Do. 3½ p. c. Deb.		..	3 5 5
60,000	5	Sept. 29	7	Ottoman, Ltd.	6½—6¾	..	6 1 9
150,000	5	Nov. 30	8	Oriental, Ltd.	7—7½	..	5 6 8
135,000	5	,,	8	Do. New, £4 10s. pd.	6½—6¾	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.	1½—1¾	..	4 11 5
500,000	100	Dec. 1	6	People's Gas of Chicago	2nd Mtg. Bonds	..	102—106	..	5 13 2
851,070	10	Oct. 13	7	River Plate Ord.		..	10¾—11½	..	6 4 5
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.		..	98—100	..	4 0 0
250,000	10	Sept. 15	10	San Paulo, Ltd.		..	12—13	..	7 13 10
135,000	Stk.	Sept. 15	10	Sheffield A.		..	249—251	..	3 19 8
209,053	,,	,,	10	Do. B.		..	249—251	..	3 19 8
447,427	,,	,,	10	Do. C.		..	249—251	..	3 19 8
5,600,000	Stk.	Aug. 16	5⅓	South Metrop., 4 p. c. Ord.		..	133—136	..	3 18 5
1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb.		..	100—102*	+½	2 18 10
120,000	Stk.	Aug. 31	6	Tottenham and Edmonton	A. 5 p.c. B. 3½ p.c. 4 p. c. Deb.	..	141—143	..	4 3 11
250,520	,,	,,	4½			..	102—104	..	4 6 6
55,100	,,	Dec. 14	4			..	113—117	..	3 8 5
182,380	10	Jan. 12	5	Tuscan, Ltd.		..	9—10*	+½	5 0 0
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.		..	101—104	..	4 16 2
				WATER COMPANIES.			
780,899	Stk.	Dec. 29	11	Chelsea, Ord.		+2	3 10 6
150,000	,,	,,	5	Do. 5 p. c. Pref.		..	157—162	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75		..	145—150	..	3 0 0
175,785	,,	Sept. 29	4½	Do. 4½ p. c. Deb.		..	148—153	..	2 18 10
1,720,560	Stk.	Oct. 13	7	East London, Ord.		..	200—205	..	3 8 4
854,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb.		..	145—150	..	3 0 0
390,000	,,	,,	3	Do. 3 p. c. Deb.		..	98—100	..	3 0 0
700,000	50	Dec. 14	7½	Grand Junction	10 p. c. max. 4 p. c. Deb.	..	107—109	..	3 8 10
310,000	Stk.	Sept. 29	4			..	131—136	..	2 18 10
708,000	Stk.	Aug. 16	14	Kent		..	348—353	..	3 19 4
160,000	,,	,,	7	Do. New, 7 p. c. max.		..	200—210	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.		..	292—297	..	3 10 8
406,200	100	,,	8	Do. 7½ p. c. max.		..	215—220	..	3 13 9
350,000	Stk.	Sept. 29	4	Do. 4 p. c. Deb.		..	135—138	..	2 18 0
500,000	100	Aug. 16	13⅓	New River, New Shares		−3	425—430	−3	3 2 9
1,000,000	Stk.	July 28	4	Do. 4 p. c. Deb.		..	133—138	..	2 18 0
902,300	Stk.	Dec. 14	7½	South-wark and Vauxhall	Ord. 7½ p. c. max. 5 p. c. Pref. 4 p. c. A Deb.	..	302—307	..	3 12 6
126,500	100	,,	7½			..	190 195	..	3 16 11
489,300	Stk.	,,	5			..	160—165	..	3 0 7
1,019,585	,,	Oct. 13	4			..	131—136	..	2 18 10
1,166,066	Stk.	Dec. 14	10	West Middlesex		−2	288—293	..	3 8 3
200,000	,,	,,	4½	Do. 4½ p. c. Deb.		..	147—152	..	2 19 3
200,000	,,	Sept. 15	8	Do. 8 p. c. Deb.		..	100—102	..	2 18 10

*Ex div

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Notwithstanding the strong opposition among the miners in Lancashire to the continuance of the Conciliation Board on the terms which had been conditionally agreed to by the Federation officials and the representatives of the Coalowner's Association, it had been generally confidently anticipated that the Federation conference at Cardiff would honourably carry out the preliminary agreement already come to. These anticipations have been fully realized; the agreement in question, notwithstanding the instructions given by most of the Lancashire districts to their representatives to vote against it, being, according to the official report, unanimously confirmed. This decision to continue the Conciliation Board for a further period of four years from the present date, will be received with general satisfaction throughout the trade, as ensuring another settled period of freedom from wages and labour disputes, which prior to the formation of the Board so frequently caused disruption of ordinary business operations. At present, the market remains in a very unsettled and unsatisfactory condition, owing to the continued general scarcity of supplies. This, to some extent, has been due to the very indifferent way in which the men have been working in many of the Lancashire districts, as apparently they have not cared to settle down pending the result of the Cardiff conference. Collieries generally have been able to meet requirements of customers for house-fire coals out of stock; but with regard to all other descriptions of fuel, excessive difficulty has been experienced in keeping works and manufactories going from hand to mouth, while all sorts of special prices have had to be paid in the open market to secure odd lots for prompt delivery. For the moment, list rates are altogether nominal. Some extraordinary figures are reported as having been obtained for temporary supplies of gas coal—as much as 14s. 6d. to 15s. 6d. per ton at the pit. For ordinary steam and forge coals, consumers have had to pay from 12s. to 13s. per ton at the pit, and for engine fuel from 10s. 6d. to 11s. 6d.; while for shipment, 15s. has been about the average figure for steam coals, delivered at the ports on the Mersey. These prices are, of course, only temporary; and it is probable the market may, in the course of a week or so, get back into something like its normal condition. But the question of a further general upward move in prices is still being pushed forward in some quarters; and as miners are at once to receive a further advance of 5 per cent. in wages, it is not improbable that there may be some re-arrangement of list rates. As regards coke, the advance of 1s. 6d. per ton which was put on with the commencement of the month has in no way checked the pressure of orders. Manufacturers now state that there would be no difficulty in getting an advance of 2s. 6d. per ton, which some of them urged should be put on. Supplies continue short; and best foundry cokes are readily fetching about 30s. per ton at the ovens, with furnace qualities selling at 23s.

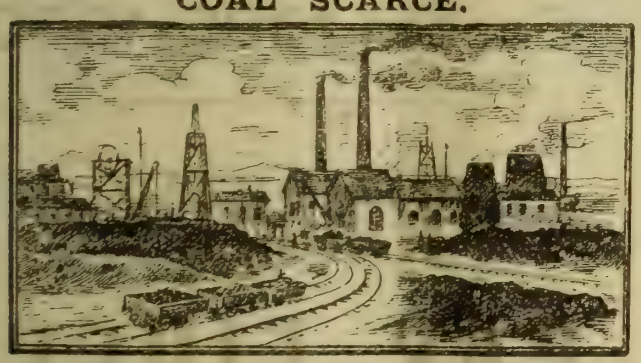
Northern Coal Trade.—The coal trade is very active; and though the output is now fuller, and has reached its normal extent, there is a demand that quite takes up the production, and that has allowed the prices of some classes of coal to advance. Best Northumbrian steam coals have risen to 18s. per ton f.o.b., and even higher prices have been quoted; while steam smalls are from 10s. to 10s. 6d. In the gas coal trade there is a demand that is still above the output. Contracts take up the bulk of this output; but for any extra supplies high prices are obtainable—about 18s. 6d. per ton f.o.b. being the current quotation. Some contracts are now under negotiation, and for one for export it is believed that 17s. 6d. per ton f.o.b. has been offered and accepted. It will thus be seen that the gas coal trade is extremely active; and though the quantities now being sent out are very heavy, it is probable that there will be no relief until after the end of this month. Gas coke is firm, with a strong inquiry, and with rather irregular prices for export. From 15s. to 16s. 6d. may be taken as medium quotations for f.o.b. supplies of gas coke.

Scotch Coal Trade.—The year has opened auspiciously for the coal-owner. Prices have not been so high since 1873, when there was a strike. The railway companies have been charged with not providing facilities for the traffic in coal; but now the blame is being thrown upon iron and steel masters, who are said to be keeping the railway waggons. If the railway companies dared to charge demurrage, the waggon supply would soon be equal to requirements; but they are afraid to offend traders by imposing such dues. Apart from the present strained condition of the trade, the outlook appears to be good. There are numerous inquiries for shipment, at prices much below those which are current. A further advance of the miners' wages by 12½ per cent. has been agreed to by the joint board of masters and men. The prices quoted are: Main 13s. to 13s. 6d. per ton f.o.b. Glasgow, ell 14s. 6d. to 15s. 6d., and splint 14s. 6d. to 15s. The shipments for the week amounted to 76,499 tons—a decrease of 133,869 tons upon the previous week, but an increase of 15,173 tons upon the first week of last year.

St. Petersburg Water Supply.—The question of supplying St. Petersburg with water from Lake Ladoga was raised lately at a sitting of the Municipal Council. As the city lies only 40 miles west of the lake, it ought not to be a very difficult or costly work to lay the necessary water-pipes along the almost level banks of the Neva.

Eighty Years' Purchase for Land Forming a Watershed.—It appears from an inquiry made by Mr. Worth at the meeting of the Darwen Town Council on Monday last week, that a big price is going to be paid by the Corporation for the land forming the watershed area. The councillor asked whether it was true the price would be equal to 80 years' purchase; and Mr. Tomlinson referred to it as a "grievous burden" on the town. The Town Clerk said the price to be paid was that agreed upon. They must be perfectly fair and just to everybody; and it was quite open to the Corporation to have gone to arbitration. It did not seem right that the ratepayers should be led to believe that they had made a bad bargain; for he believed that the town had saved money by making this agreement. The statement was received with laughter.

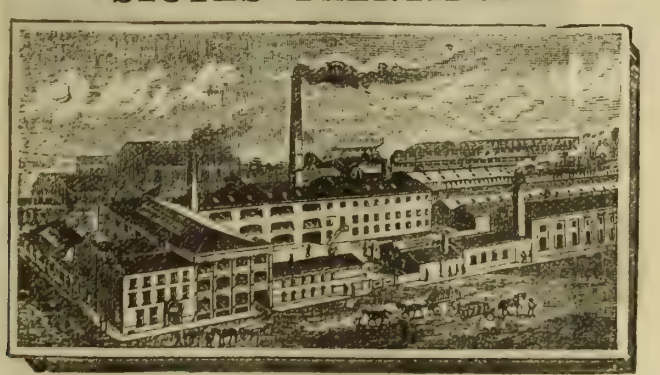
COAL SCARCE.



There is a tide in the affairs of men (and Gas Companies), which, taken at the flood, leads on to fortune.

Julius Cæsar IV., 3.

STOVES PLENTIFUL.



N.B.—Perhaps the Reader will supply the Advertisers' Name.

Large Gas and Water Consumptions in Liverpool.—In the week ending the 30th ult., the gas consumption in Liverpool was 122 million cubic feet; the quantity of water sent out in the same week being 216⅓ millions, or about 37½ gallons per head of the population—the highest figures on record for the city.

Tuxford Gas-Works Flooded.—Very heavy rain has fallen in North Notts, and in several places the River Idle overflowed its banks, and other water courses flooded the land. At Tuxford the gas-works were flooded to such a depth last Sunday week that the fires were put out and the inhabitants had to resort to other means of lighting.

Advance in the Price of Fire-Bricks, &c.—The manufacturers engaged in the fire-clay trade of the Staffordshire and Worcestershire district have advised their customers of a general advance of prices. Fire-bricks are increased 5s. per 1000; fire-clay, 1s. per ton; gas-retorts, 6d. per foot; blast-furnace bricks, 5s. per ton; and all other fire-clay goods, 10 per cent.

Clacton Gas and Water-Works Purchase.—At the meeting of the Clacton District Council last Wednesday, a letter was received from the Public Works Loan Board, agreeing to advance £100,000, required by the Council for the purchase of the gas and water undertakings—at 3 per cent. for £46,250 (to be repaid in 40 years), and at 3¼ per cent. for £53,750 (to be repaid in 50 years). The tender of Messrs. S. Cutler and Sons, amounting to £2450 for the supply of a new gasholder, was accepted. It was stated that the present holders were totally inadequate to meet the demand.

Wages and Gas Consumption at Heywood.—In the minutes which the Gas Committee presented to the Heywood Town Council last Thursday, it was reported that it had been resolved that the wages of the gas stokers should be increased 3d. per shift; that the wages of the labourers be advanced ¼d. per hour; and that the wages of the meter inspectors be increased 1s. per week. In moving the adoption of the minutes, Mr. Firth stated that December had been the heaviest month they had ever had for gas consumption. The consumption was 20,200,000 cubic feet, against a total of 18,483,000 feet for the corresponding month. The minutes were approved.

The Warwick Rural District Council and the North Warwickshire Water Bill.—At the last monthly meeting of the Warwick Rural District Council, it was reported that the General Purposes Committee, in conjunction with the district councillors for the parishes affected by the North Warwickshire Water Bill, had met, and reported that they had considered the scheme of the Bill, which included the parishes of Stoneleigh, Baginton, Bubbenhall, Weston, Wappenbury, Eathorpe, Cubbington, Hunningham, and Offchurch, within its area of supply, and proposed to sink wells at Stoneleigh for the supply of water for the parishes. The Committee recommended that the Council should object to power being given to private companies for the execution of works which they themselves were prepared to carry out when necessary. The Committee instructed the Clerk (Mr. C. H. Passman) to lay before the Local Government Board and the Warwickshire County Council details and particulars of their objections to the scheme.

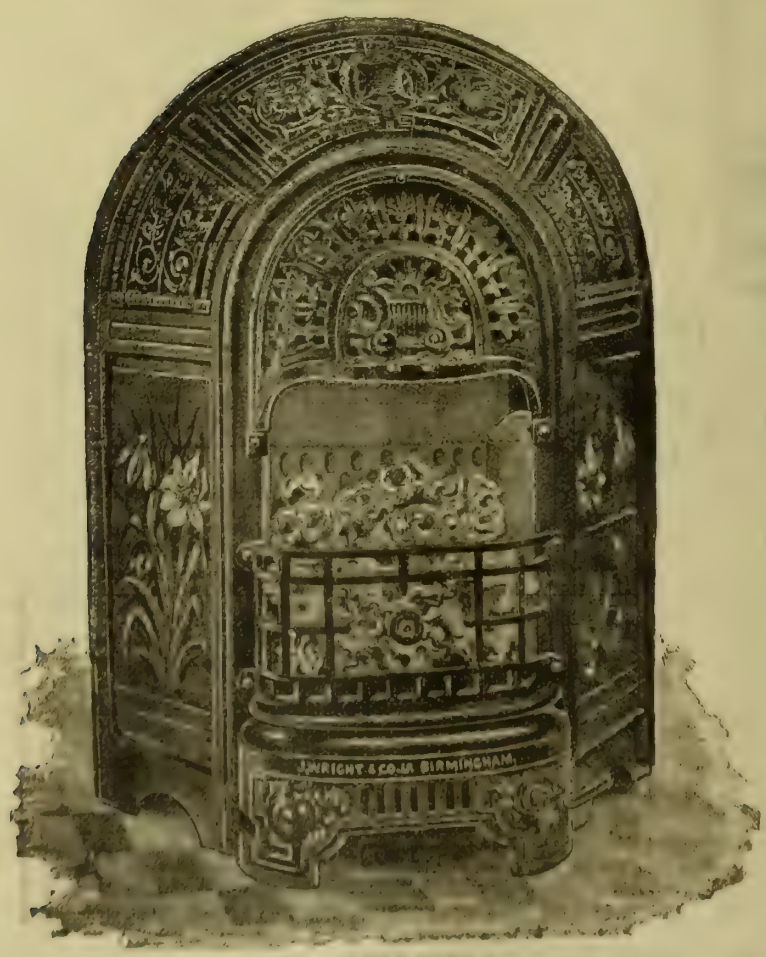
Southport Corporation and the Water-Works.—The Southport Corporation have resolved to oppose the Bill which the Water Company are promoting in the forthcoming session of Parliament. Within the last few weeks, it may be stated, the Corporation have approached the Water Company, asking if the Directors were willing to discuss the question of the purchase of the undertaking; and the Directors have declined.

Bewdley Water Scheme.—The Bewdley Town Council have resolved to ask the sanction of the Local Government Board to the borrowing of £12,000 for carrying out a scheme of water supply. It is the work of Mr. R. E. W. Berrington, of Wolverhampton; and it involves pumping the water from a well at Blackstone to a reservoir at Mount Pleasant, thence by gravitation; a second pumping-station and reservoir being necessary for supplying Long Bank.

The Control of Watershed Areas.—The condition of the law as affecting sources of water supply which are becoming necessary for local consumption was recently discussed by the Water Committee of the Cardiff Corporation. The subject was brought forward in a circular-letter received from the County Councils Association; and Mr. C. H. Priestley, the Water Engineer, commenting upon the matter, pointed out that great injustice was being done in some parts of the country by the abstraction of the water naturally belonging to the inhabitants, and said some provision seemed necessary to check and prevent its appropriation in future. Resolutions were adopted favouring the protection of rural districts and the establishment of Joint Water Boards.

Benefits of Filtering Water.—The beneficial effect of water filtration upon the typhoid death-rate of a community afflicted with polluted water is strikingly shown by figures given in the report of the Massachusetts State Board of Health for 1898. From 1887 to 1892 inclusive, the number of deaths from typhoid in the City of Lawrence ranged from 47 to 60 per annum—a rate per 10,000 of population of 11·44 to 13·44. The filter plant was put in operation in the latter part of 1893, and the typhoid deaths for that year fell to a total of 39 and a rate of 7·96 per 10,000. In 1894, the first full year the filter was in service, the deaths were 24, and the rate 4·75 per 10,000. There has been a steady diminution since, until in 1898 there were but eight deaths from typhoid fever in the city; giving a rate of 1·39 per 10,000 of population.

County Councils and Water Supply Questions.—The following resolution passed by the Devon County Council has been circulated among similar bodies: "That this Council press on the Local Government Board the necessity of introducing into Parliament without delay, a Bill investing District Councils with the necessary powers for obtaining water compulsory where it cannot otherwise be obtained at a reasonable cost, and that this resolution be forwarded to other County Councils, inviting their co-operation." The Sanitary Committee of the West Riding County Council are considering the resolution passed at the last meeting of the British Association of Water-Works Engineers relative to the control of water-supply sources, with a view to definite and practical proposals on the question being laid down. The Committee are of opinion that the matter is of great importance.



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Gas Companies' Opposition to the Bradford Corporation Bill.—At a meeting of the Directors of the Airedale Gas Company, the Eccleshill Gas Company, the North Bierley Gas Company, and the Clayton, Allerton, and Thornton Gas Company, yesterday week, the gas purchase clauses of the Bradford Corporation Bill were discussed. It was decided to offer strenuous opposition to the Bill, and to engage Counsel for the purpose.

Fatal Gas Poisoning Case at Heckmondwike.—Mr. P. P. Maitland held an inquest at Heckmondwike yesterday week, on the body of William Senior, aged 76, a retired cloth weaver. It appeared that deceased, who was a widower, resided alone; and on the previous Tuesday he was not seen about as usual. On the door of his residence being burst open, he was found in bed in an unconscious state; the room being full of gas. It was found that the gas-tap was open; deceased having apparently turned it too far, in putting out the light. He lingered until Saturday night, being practically unconscious all the time. A verdict of "Accidentally poisoned by gas" was returned.

Proposed Adoption of Water Gas at Oldham.—At the close of a recent meeting of the Gas Committee of the Oldham Corporation, Alderman Harrop mentioned that, when last the question of the adoption of water gas in Oldham was considered, he opposed it on the ground that the proposal was inopportune. Seeing, however, that coal had reached a very high price, and might eventually go higher, he thought it time that the Committee began to consider their position in reference to the matter. He suggested that the Chairman (Mr. Letham) and the Engineer (Mr. J. Chadwick) should look into the matter. The Chairman said water-gas plant would certainly help them in times when they were hard pressed. He noticed that Belfast would not have been able to cope with the recent great demand for gas had it not been for the assistance rendered by the water-gas plant. The matter was left in the hands of the Chairman and the Engineer.

Shortage of Gas at Southport.—Southport, like other places, suffered lately from a short supply of gas; not, however, owing to the scarcity of coal, but to lack of oil. At the meeting of the Town Council last Wednesday, Dr. Isherwood, the Chairman of the Gas Committee, offered some explanation of the matter. He said the last time they ran short of gas was four years ago, and they determined then that they would have a water-gas plant, which could be brought into action in a very short time. They obtained the plant; but, unfortunately, when they were most anxious to use it, they ran short of material necessary for its utilization. A tank of oil which should have arrived on a certain day was sent off without directions. Their Gas Manager (Mr. J. Booth) became very uneasy on account of its non-arrival; but he fully expected it the next day. As it did not come, he went off to Liverpool, and ran about from place to place, and at last found the tank of oil in a siding at Aintree, undirected. That missing tank accounted for everything. When the Manager found it, he asked for a special engine to be put in, and the tank reached Southport on the day that the complaints began to come in thick and fast. He thought, notwithstanding what had been said in the town, the gas supplied by the Corporation had been both plentiful and good.

Proposed Extension of the Wantage Gas-Works.—The quantity of gas consumed at Wantage last year was nearly a million cubic feet more than it was in 1897; and though the whole of the retorts were kept at work the week before Christmas, the demand for gas was so great that it could not be properly met. It is intended to enlarge the works; and plans are being prepared for presentation at the next meeting of the District Council.

Record Gas Consumption at Croydon.—Notwithstanding the competition of the electric light at Croydon, the Gas Company's sales last month exceeded anything reached before the introduction of the newer illuminant. On Saturday, the 23rd, the output was a "record" one—being within a few thousands of 4 million cubic feet. The sales for the month were 20 per cent. higher than those for December, 1898; the increase over the entire year being 9·4 per cent.

Ripon Corporation Gas Supply.—At the last monthly meeting of the Ripon Corporation Gas Committee, the Manager (Mr. E. E. J. Anderson) reported that, although the past month had been one of great anxiety to nearly every gas manager, on account of the difficulty experienced in getting coals, he had fortunately an ample supply, though, to prevent a collapse, he was compelled to get outside help. He asked for additional storage, as he had barely room for a fortnight's stock of coal, whereas he should have space for twice this quantity. The make of gas in December was 5,417,000 cubic feet, as compared with 4,322,900 cubic feet in December, 1898; being an increase at the rate of 5 per cent. The gas made from March 25 last to Jan. 1 this year was 28,262,000 cubic feet; in 1898, 23,654,900 cubic feet; and in 1896, 21,850,300 cubic feet—being an increase over 1898 of 4,607,100 cubic feet and over 1896 of 6,411,700 cubic feet, or more gas than was made altogether in nine months of the year 1879. The total cost of manufacture last year showed a slight decrease as compared with 1898.

Gas Poisoning Fatalities in Belfast.—The Belfast Coroner (Mr. E. S. Finnigan) recently held an inquest on the body of Sarah Houston, who died at 32, St. Kilda Street. The evidence showed that the deceased had been on a visit from Cookstown to her aunt. Her uncle, Joseph Brisbane, who works out at night, on returning home on the morning of the 3rd inst. found the gas escaping in the kitchen. On going upstairs, he found the deceased lying in bed unconscious. Medical assistance was procured; but she did not regain consciousness, and died on the morning of the 4th. Deceased had been left to turn off the gas before retiring. The Jury returned a verdict to the effect that death was due to gas poisoning, in accordance with the medical evidence; no blame being attributable to anyone. A rider was attached, requesting the Coroner to call the attention of the Gas Committee of the Corporation to the number of deaths from gas poisoning that have occurred since the introduction of water gas, in the hope that they will take steps to minimize as far as possible the amount of carbon monoxide in the gas. It has since transpired that Mrs. Brisbane, the aunt of the deceased, has died. She was also affected by the escape, and the excessive vomiting that followed brought on premature childbirth; and both the mother and child eventually succumbed.

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Reduction in Price.—At the meeting of the Matlock District Council on Monday last week, a notification of a reduction in the price of gas of 2d. per 1000 cubic feet was received from the Gas Company, to whom a vote of thanks was passed.

The Southampton Corporation and their Protective Areas Bill.—At a special meeting of the Southampton Town Council held last Wednesday, a motion submitted by the Mayor (Alderman G. A. E. Hussey) to proceed with the Bill for empowering the Corporation, among other things, to purchase land to protect their sources of water, was rejected, owing to the requisite majority of the Council not being obtained. There were 24 votes in its favour, and 27 were necessary.

The Sevenoaks Water Company's Provisional Order to be Opposed.—At the last meeting of the Sevenoaks Urban District Council, the Committee appointed to consider the proposal of the Sevenoaks Water-Works Company to apply for power to raise additional capital made the following recommendations: (1) That the necessary steps be taken to represent to the Board of Trade that the 7½ per cent. limit on the rateable value of property, now charged by the Company for the supply of water, be reduced to 6 per cent. (2) That the necessary steps be taken to obtain the insertion in the Provisional Order of a clause enabling the Council to acquire compulsorily, at such time as might be deemed advisable and at a fair and equitable price, the undertaking of the Company. (3) That as soon as a copy of the draft Provisional Order was obtained, the amount of new capital asked for be carefully considered by the Council, with a view to making such representations to the Board of Trade as the Council might deem advisable. The report was adopted.

The Financial Position of the Cowlyd Water Board.—The Conway and Colwyn Bay Joint Water Supply Board have for a long time been endeavouring to obtain the sanction of the Local Government Board to the borrowing of a sum of £30,000 for the purposes of their undertaking. Impatient at the delay which has taken place, the Joint Board have carried out a considerable portion of the works in respect of which the loan was applied for. This proceeding has just received a severe setback from the Superior Board, who have imposed on the managers of the Joint Board a penalty as a punishment for spending money before obtaining sanction to borrow it. In a letter recently received by the Clerk to the Cowlyd Board, the Superior Board point out that the loan already sanctioned has been exceeded in expenditure by £13,457, and that in this sum is included money, the borrowing of which they were not prepared to sanction. Further, the total expenditure included law and other costs. Before coming to a decision on this portion of the application, the Board require tax bills of the law costs, and vouchers for the other bills. But as the works have already been carried out, the Board, in accordance with their usual practice, have decided to deduct from the amount they are inclined to grant the equivalent to the sum which would by now have been repaid had the loan been sanctioned and raised at the time the works were executed. The fine imposed on the Cowlyd Board for undertaking works before receiving the sanction of the Superior Board amounts to £2097. The total sum sanctioned is £14,591.

Additional Storage at the Colwyn Bay Gas-Works.—The Colwyn Bay and District Gas Company's consumption continues to increase at a rapid rate. This has made it necessary to add considerably to the existing gasholder capacity. Tenders were invited for an 80-feet telescopic gasholder and steel tank, and that of Messrs. R. Dempster and Sons, Limited, of Elland, has been accepted. The work is to be carried out under supervision by the Company's Engineer, Mr. J. C. Pennington.

Proposed Extension of the Smethwick Gas-Works.—At the last meeting of the Smethwick Town Council, the Gas Committee recommended that the Town Clerk (Mr. W. Shakespeare) should be instructed to take the necessary steps for enabling the Committee to borrow the remaining £13,000 authorized by the Provisional Order of 1893, and also for obtaining another Order sanctioning the borrowing of a further sum of £50,000 to carry out the railway siding scheme, extend the manufacturing and distributing plant, and make other improvements which may become necessary.

Gas-Engine Explosion in Glasgow.—On the afternoon of Thursday last, an explosion took place in connection with a gas-engine at the works of Messrs. Murray, M'Minnie, and Co., brassfinishers, Glasgow. Two men—John Livery and Donald Macmillan—were starting the engine, when shortly after they had ignited the gas an explosion occurred, scattering the fly-wheel and different parts of the engine to a distance of 14 feet, and rendering the men unconscious. After receiving medical attention, they recovered, and were able to go home. The gas is supposed to have accumulated under the bed-plate of the engine.

Derwent Valley Water Board.—A meeting of this Board was held at Sheffield last Thursday. Most of the business transacted was of a formal character. The Clerk was instructed to obtain the insertion of a clause in the Rotherham Corporation Bill of this year for the protection of the interests of the Board, and was also requested to keep a record of all matters relating to water supply in the area to be supplied by the Board. Messrs. Crowther, of Huddersfield, were appointed the surveyors to take the levels and make the necessary surveys of the sites for the Ronksley and Howden reservoirs in the Derwent Valley. It was also resolved to hold the meetings of the Board at Derby, Leicester, Nottingham, and Sheffield, in rotation, on the last Thursday in each month, till further notice.

Suffocation by Gas.—A distressing accident was discovered at Tunstall last Saturday. On Friday evening the neighbours in a house next door to that occupied by a Mrs. Vernon and her daughter detected a strong smell of gas. Three persons in the house were taken ill. The neighbours on the other side of Mrs. Vernon also noticed the smell; and two people there were taken ill. It was observed on Saturday that Mrs. Vernon's house remained shut. She had said she was going to a relative's at Longton; but, inquiry there showing she had not arrived, her house was broken into. Mrs. Vernon was then found in the kitchen dead, suffocated by gas. Her daughter was upon a sofa, almost suffocated, and she died on Sunday. A steam roller had been used on the road; and it is supposed that the leakage of gas was caused by the fracture of a main.

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SWINDON (New Swindon Gas Co.)	120,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000
WINDSOR STREET WORKS, BIRMINGHAM (Second Contract)	2,000,000
HALIFAX	1,000,000
TORONTO	250,000
OTTAWA	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
TORONTO (Second Contract; Remodelled)	2,000,000
BELLEVILLE	250,000
OTTAWA (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000
BUFFALO, N.Y.	2,000,000
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.,	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
LEICESTER	2,000,000
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CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE.
The Labour Market and the Coal Difficulty 191
The Breakdown of the Electric Lighting Acts 192
The Bank-Rate 192
State of Trade Unions in 1898 193
The Work of the Liberty and Property Defence League 193
Building Lines and Wide Streets 193
The Prospects of the University of Birmingham 193
WATER AND SANITARY AFFAIRS—
The Final Report of the Royal Commission on the Metropolitan Water Supply 194
The Quality of the London Water Supply 195
Water Companies and the Use of Fire-Plugs and Hydrants . . 195
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market 196
Electric Lighting Memoranda 196
Gas Examination in Paris 197
Death from Currents of Electricity 198
Recent Publications—"Good Citizenship;" "Signalling across Space without Wires" 198
Water Bills for 1900 199
NOTES:—
Cinder Concrete Floors 201
The Strength of Foundations 201
Evidence for the Econometer 201
TECHNICAL RECORD:—
A De Brouwer Coke Conveyor and a Carburetted Water-Gas Plant at the Crystal Palace Gas-Works 202
The Everett Coke-Oven Gas Plant 205
REGISTER OF PATENTS:—
Automatically Operating a Valve at any Predetermined Time—Stenhouse, A., and Whitehead, E. A. 206
Coin-Freed Gas-Meters—Beechey, C. G., and Wright, A. T. . . 206
Purifying Gases and Obtaining Bye-Products—Theisen, E. . . 207
Incandescent Burners and Mantle Supports—Duncan, J. H. H. . 208
Acetylene Generators—Boult, A. J. (M. de Lasserve) 208
Prepayment Attachments for Gas-Meters—Brooks, A. G. (The New Haven Novelty Machine Company) 208
Automatic Gas Lighters—Killing, C. 208
Acetylene Gas-Burners for Use with Incandescing Mantles—Johnson, J. Y. (La Compagnie Française de l'Acétylène) 209
Patent Notices 209
CORRESPONDENCE:—
Tar and Liquor Storage Tanks 209
The Scarcity of Coal 209
PARLIAMENTARY INTELLIGENCE:—
Private Bills (Session 1900)—Opposition on Standing Orders . . 210
LEGAL INTELLIGENCE:—
Supreme Court of Judicature—Court of Appeal—Welsbach Incandescent Gas-Light Company, Limited *v.* New Sunlight Incandescent Company, Limited 210
High Court of Justice—Queen's Bench Division—Sheldrake *v.* Duncan 210
London County Council *v.* East London Water-Works Company 211
Winding Up of the Mantleless Incandescent Gas Corporation, Limited 212
An Action for Damages Dismissed 212
Recovery of Money Alleged to have been Paid to a Water Company under Duress 212
Defective Electric Lighting in Marylebone 212
MISCELLANEOUS:—
Rejection of the Proposed Conciliation Board at Glasgow . . . 213
Metropolis Gas Supply—The Chief Gas Examiner's Report . . 213
Serious Explosion at the Wiener Neustadt Gas-Works 213
The Deaths from Gas Suffocation near Tunstall—Inquest . . . 214
A Gas Worker's Paradise 214
The Defective Electric Lighting in Marylebone—Deputation to the President of the Board of Trade 214
Electric Lighting Notes 215
Metropolis Water Supply—The Royal Commission and the Future Control of the London Water Undertakings 216
Notes from Scotland 218
Gas and Water Companies' Stock and Share List 218
Current Sales of Gas Products 220
Coal Trade Reports 220
PARAGRAPHS:—
PERSONAL: Lord Farrer; Mr. Charles Meiklejohn; Mr. George Swinburne, Assoc.M.Inst.C.E.; Dr. H. Bunte; Mr. William Croxford; Mr. William Mann; Mr. John Croxford 201
OBITUARY: Mr. C. Pallister, J.P.; Major Eliot Hodgkin; Mr. Thomas Roberts; Mr. Charles Bell; Herr Julius Quaglio; Herr C. F. Rammelsberg 201
The Exportation of Picric Acid—Combined Refuse Destructors and Power Plants 194
Rainfall in the Past Year—The Derwent Valley Water Scheme . 195
Reports of Gas Associations for 1899 196
An Unsuspected Cause of Rust—Coal Mining in South Russia . . 200
Institution of Gas Engineers—The Dividend of the Gaslight and Coke Company 201
Explosion of a Gas-Main at Douglas (Isle of Man) 209
New Loan for the Birmingham Welsh Water Scheme 212
The Second Victim of the Stoke Disaster—St. Ives Corporation and the Water-Works—Sale of Stocks and Shares 217
Crowborough District Water Company 219
Electrolysis of Water-Mains in Manchester—Gas Workers' Wages at Hinckley—Fatal Gas Poisoning at Perth—Leigh Corporation Gas Supply 221
The Rating of Reservoirs—Bingley Gas Affairs—Bradford Corporation and Outlying Gas Companies—The Lighting of Leeds Streets—The Hill Brow Water Company, Limited—The Rival Gas Bills at Ossett—The Skipton Gas-Works Purchase—Incandescent Gas Lighting in Darmstadt 222
The Lighting and Watching Act—The Coal Conciliation Board—Extensions at the Leek Gas-Works—The Proposed Gas Company for Heswall—Carburetted Water-Gas Plant at Bournemouth—Shortage of Coal and Increased Gas Consumption at Hunstanton 223
Improved Position of Manchester's Stock of Water—Plymouth Water Supply—Water Supply of Wallasey from the Liverpool System—Increase in the Price of Gas at Durham—Cleveland Water Company—Water-Supply Projects in Essex—A Large Leakage from the Thirlmere Water-Main 224

EDITORIAL NOTES.

The Labour Market and the Coal Difficulty.

THE report of the Board of Trade upon the state of such portion of the Labour Market as their statistics cover in the month of December, shows that employment continues good all round, and especially so in the coal mining and iron and steel trades. The percentage of men unemployed in the Trade Unions making returns continues to be lower than at any similar period of the year since 1889. The war's demand upon the working classes is, of course, partly responsible for the smallness of the number of men unemployed; but the prime cause is still, without doubt, the revival of trade. In almost all those industries for which such statistics are available, it is to be observed that the number of men employed, and the average number of days or shifts worked, was higher at the end of 1899 than it was at the end of the previous year. We refer again to the condition of the Labour Market, and especially to the statistics in point, chiefly to remark that these statistics, so far as the coal trade is concerned, tend largely to discount the excuse that is frequently put forward at the present time by colliery owners who are—and which of them are not?—largely in arrear with their deliveries, that their failure to fulfil their contract obligations is due to the disinclination of the miners to work so many days in the week, at the present high rates of wages, as they worked when lower rates prevailed. We have before pointed out that, as the estimated output of coal in the United Kingdom for 1899 was something like 10 per cent. higher than in 1898, it was obvious such a state of affairs as was depicted by contractors could not be ruling in every district.

Turning to the Board of Trade report on Coal Mining in December, we find figures bearing on this point which, while not covering the whole industry, refer to sufficiently large numbers of miners to be fairly representative, and which are decidedly instructive. Returns relating to pits at which some 445,469 workpeople were employed show that these pits were worked, on an average, 5·65 days per week in the four weeks ended Dec. 23 last, as compared with 5·64 days in November, and 5·54 days a year ago. Or, taking another table, it is seen that, of the workpeople referred to, 37·8 per cent. were working full time, and 54·9 per cent. were working from five to less than six days per week, in December, 1899, as against 31 per cent. and 57·2 per cent. respectively in December, 1898. That is to say, 92·7 per cent. were employed at pits working five or more days per week (and the figures were the same for November as for December), as compared with 88·2 per cent. in the corresponding month of the previous year. When we add that this improved working is shown, by a further table, to have prevailed in every district except two in England—namely, Yorkshire, where the average number of days worked was 0·01 less, and Derbyshire with an average less by 0·04 day—and in all but one small district in Scotland, it will, we think, be seen that there is much ground for adding a considerable "pinch of salt" to the excuse of "idling miners" put forward by defaulting contractors. The fact is there is simply one explanation of the shortage of coal—namely that, while the output for the year 1899 was greater than ever before, the demand was still more in excess of that of previous years; and collieries, to use an expressive piece of Yankee slang, "bit off more than they "could chew."

The difficulties of employers in regard to the supply of labour continue to be aggravated by the prevalence of the severe epidemic of influenza, from which all classes are suffering, and which is carrying off wholesale those who have outrun the allotted span of threescore years and ten. The returns published by the Registrar-General since we referred to the subject a fortnight ago have been eloquent of the seriousness of the epidemic. The death-rate in the 33 principal towns in the kingdom, which was 18·9 per thousand at the beginning of December, rose steadily, until, for the week ended the 6th inst., it reached 30·9. The following week, which is the last for which returns are available, showed a decline to 29 per thousand, while in London (where the death-rate had mounted in six weeks from 19·4 to 37·1) the rate fell 3·8 per thousand. We may hope, therefore, that—although the deaths from influenza itself were highest in the latest return, the figures for the Metropolis for the four weeks being 69, 193, 316, and 340—the worst is past, and that the temporarily disabled

workers may now soon find their way back to their duties. Gas Companies have, we learn, been severely handicapped by sickness at this, the busiest season of the year; one of the largest undertakings having something like 10 per cent. of its employees absent at one time, chiefly through the ravages of influenza. It is at such times that the advantages of membership of a sound Benefit Society, and the liability of Slate Clubs with no adequate reserve funds to fail their members just when their help is most needed, become strikingly apparent.

The Breakdown of the Electric Lighting Acts.

The disappointment of the West-end population with the public electric lighting is quite pathetic to witness, especially from the safe 'vantage-ground of a gas-lit interior. We have dealt in another column with some of the features of the existing situation, with special regard to the interests more immediately concerned. It is permissible, however, to discuss it here in a general way. Matters have come to a climax with the particular Electric Lighting Company implicated; the London County Council having just triumphantly brought off a prosecution for default, and secured a penalty. This kind of thing cannot long be borne by any supply undertaking; so that, unless the Metropolitan Electric Supply Company can pull themselves together in time, they will find their prospects gravely affected by their vicissitudes of the autumn. The recent deputation to the President of the Board of Trade, sufficiently dealt with elsewhere, was not remarkably disingenuous; but, unfortunately for themselves, the Directors of the Company had not been quite straightforward in their excuses for the undeniable shortcomings of their system. Apart altogether from these petty and interested considerations, there stands the main question of whether electricity supply from a central station—the term is no longer to be used in any topographical sense—is suitable for anything else than a "fancy" trade. It is admitted by "The Times" that, "of all the lights in use, the electric "light is the most irritating and depressing when "the supply is insufficient. Deficiency of other lights "causes obscurity, but leaves things in their normal rela- "tions. Electric light with insufficient voltage acquires "an abominable orange tinge, which may be warranted "to give the most tastefully decorated drawing-room the "aspect of a dungeon. But if the Companies choose to "supply electricity three or four volts below standard, there "is apparently nothing to be done except by strong-minded "people who switch off the whole thing and light a few "cheerful lamps." The writer then goes on to gibe at the Board of Trade for its failure to deliver the public from a worse tyranny than that of the Gas Companies—"these "miserable relics of dark ages in which the public was "sacrificed to monopolists." The Gas Companies have simply been succeeded by traffickers in a system in which "the badness of the light makes no appreciable difference "in the bill." There is sufficient lucidity in the mind of the writer to enable him to perceive that neither competition nor municipalization is a remedy for the evil. Two Electric Lighting Companies are not together more reliable than one; and municipalized supplies are certainly no better than others.

The important point to be laid hold of, and kept in remembrance, is that the much-vaunted Electric Lighting Acts have completely failed to protect the interests of the consumers all along the line. The cardinal feature of the Acts, in which they departed most signally from gas legislation, was their construction on the principle of limited time of exploitation. In addition, the undertakers were not to be allowed to introduce into their systems anything to the prejudice of the consumer. These statutory arrangements have now been in operation long enough to enable the public to see how the theory has worked itself out in practice. The result is not flattering to the experimentalists in legislation who imagined they were going to put in the shade the Gas Acts from 1847 onwards. Whatever effect the principle of limited duration may have on the finances of an Electric Light Company—and this has not yet been fully disclosed—it absolutely fails to benefit the consumer in the smallest degree. That Electric Lighting Company would be happiest who should so contrive all their plant of every kind that the whole would tumble into dust, like the wonderful "One-Hoss Shay," on the day after the expiration of the Provisional Order. With regard to the enactment against doing anything to the prejudice of the consumer, the recent increase of voltage of the current sent out is a violation of the spirit, even if not the letter, of the Act. Indirectly, consequentially, and remotely, the change may be to the ultimate advantage of the consumer, as tending to reduce the capital burden of the undertakers. But this benefit, such as it is, will only begin to reach the consumer in the shape of a reduction of a half-penny per unit, or so, on the price of current after the proprietors have had their full and back dividends. That is to say, a change of system to the highest legal voltage to-day will possibly benefit the consumer ten or a dozen years hence—if the economy is not meanwhile absorbed in the charge for depreciation, which is more than likely. The immediate difference, whatever it is, is all against the consumer. We recently published an article describing the state of the incandescent electric lamp industry, and have nothing to change from. The natural and necessary improvement of the manufactured article, which follows from the development and expansion of the trade under the forcing of commercial competition, has in this case no reference to the needs of the lamp user. The march of improvement has been in the direction of the production of a lamp to suit the high-voltage current, and to sell at a reasonable price. It is so difficult to do this, that economy of current, which was being sought after ten years ago, has been ignored by common consent.

The consumer, however, suffers not only from broken lamps and a high consumption of current at the fashionable increased voltages. He is also victimized by the enhanced effect of variations of pressure at the higher limits. When central station lighting was starting at 52 volts, variations of this pressure were of comparatively little importance to the lamp user. This original voltage, by the way, was the best all round for the incandescent electric lamp. When the supply companies put up their pressure to double this figure, it was a little hard on the lamp makers; but the latter rose to it, and met the demands on their skill and resourcefulness. Meanwhile, the consumer was made to feel that a variation of 5 per cent. in the voltage was a matter of some importance to him. Still, the different parties to the connection rubbed along fairly well. The regulation of generating machinery kept pace with the advance of pressure; and as no customers of an Electric Lighting Company in the United Kingdom knew anything better, they had no legitimate grievance on this head. Nowadays all is changed, and for the worse. A drop of a few volts in the high-pressure terminals reduces the lamps to the irritating condition described by "The Times;" and the meter registers all the same. The "Pall Mall "Gazette," commenting on this state of things electrical, declares that, if it is not mended, "indignant heads of "families will be compelled to fall back on the dull but "constant ministration of the Gaslight and Coke Com- "pany." The alternative is not so bad as all that. These ministrations are not necessarily "dull," although they are virtuously constant. This is an Age that is pleased with change; and a change from electric light to gas will not be a reversion, but a step forward into greater brightness.

The Bank-Rate.

The directors of gas undertakings, and of all other commercial concerns, will congratulate themselves that the raising of the bank-rate to 6 per cent. on Nov. 30 last so far succeeded in its purpose of maintaining a sufficient reserve of gold in the country as to justify the Bank of England in reducing the rate to 5 per cent. on the 11th inst., and further to 4½ per cent. on Thursday last. It is unfortunate that the period of extraordinarily dear money should have come at a time when Gas Companies are almost invariably indebted to their bankers. The first winter quarter is one of heavy outgoings for coal and wages, but of light receipts for gas (for a summer quarter's consumption); and the Company that does not need to borrow then is but indifferently financed. Gas managers must, however, be thankful for small mercies—that the 6 per cent. rate only ruled for six weeks—and remember that a temporary loan, even at that rate, is cheaper than a permanent balance of floating capital equal to the needs of the pinch of the year. With trade still, in the main, so flourishing, and in view of the need of the Government of heavy loans in the near future for the prosecution of the South African Campaign (there appears little chance of it costing the country much short of a hundred millions), there does not seem to be any immediate prospect of a

return to the cheap money of a year or two since, which many good people fondly imagined to have come to stay. In fact, anything under 5 per cent. must not be grumbled at. We shall see what March and April—another heavy borrowing season for Gas Companies—have in store.

State of the Trade Unions in 1898.

Another of those remarkable statistical compilations of the Chief Labour Correspondent of the Board of Trade has been presented to the Department by Mr. H. Llewellyn Smith, and may be bought by the rest of the world. It is the report for the year 1898 upon the membership and finances of the Trade Unions of the United Kingdom. This annual report is a more logical and instructive statement than the Departmental story of the strikes; the subject-matter being more suitable for statistical treatment. Mr. Llewellyn Smith recounts with satisfaction that "the "number of Trade Unions dealt with is no less than 1267, "with a membership of 1,644,591." The popularity of Trade Unions is plainly dependent upon their successful conduct; as it is noted that the groups of trades showing the most important increases of membership were Building and Mining, while those showing the greatest decline are Railway Service and Engineering. The report has been well done; a persevering effort having been maintained for eleven years to render the facts instructive in the fullest possible degree. It has not yet been found practicable to ascertain the exact financial liability of the individual member to his Union, nor of the Union to each of its members. A new feature has been added to the present report, which is an advance in this direction, in the shape of a table giving for 100 Unions the rates of entrance fees and subscriptions paid by members, and the scales of benefit to which they are entitled on all accounts. This is information not previously available. The railway men have apparently learnt by unpleasant experience that the delights of Trade Unionism are not for them. Of course, if there are compensations, these do not appear in this place. Those further developments of the Trade Union idea known as Trade Councils and Federations of Trade Unions do not appear to grow very fast. The number of Trade Councils rose by only one during the year; but the Federations fell off. The number of purely fighting Unions does not increase; and those which make strike benefit the chief end of their existence have been driven by necessity to add other kinds of assistance to their programme. These are the so-called New Unions formed upon the basis of threepenny weekly payments; and the extra benefits usually take the form of "legal assist- "ance" and sometimes of funeral allowances. The membership of the Gas Workers' and General Labourers' Union shows a considerable addition since 1895, which was the low-water period of this organization. The rival Union, which includes Brickmakers by name, is only a tithe as popular. Between them, the special Gas Workers' Unions claim to have upwards of 47,000 members. The weaker numerically is financially the stronger; but it does not seem to spend money on strikes. The Gas Workers laid out £5810 on "dispute benefit;" nothing on sick, accident, superannuation, or funeral benefit; £485 was given to other societies; and working expenses swallowed up £7797. This record is surpassed by the Union of Employees of Public Authorities, who spent out of their income of £1662, no less than £1136 on the upkeep of the machine.

The Work of the Liberty and Property Defence League in the Past Year.

The seventeenth annual report of the above-named organization, which has just been issued, shows that it is continuing its operations on the well-known lines. Lectures have been arranged in co-operation with the Individualist Club; pamphlets have been issued; and the work of the Parliamentary Department has been effectively prosecuted. At the beginning of last year the attention of the public was directed to the subject of Municipal Trading by means of a discussion at the Society of Arts on a paper read by Mr. Dixon H. Davies, noticed in our columns at the time; and, as a practical result, the League took active steps to obtain the appointment of a Parliamentary Committee to inquire into the whole question. Upwards of four hundred petitions on the subject, signed by employers, traders, property-owners, and ratepayers throughout the country, were presented to Parliament. The Government have given a definite assurance that the Joint Committee, the promise to appoint which remained unfulfilled when Parliament rose, shall be nominated next session. A long list of Bills opposed by the League is classified under several heads. The League opposed the measures dealing with the State inspection and registration of boilers and the qualification of persons in charge of them. Various efforts were made to extend the Workmen's Compensation Act; and this met with the League's strong opposition. In addition to its activity in Parliament in opposing measures, the League was engaged in supporting the General Power Distributing Company's Bill, by which it was proposed to authorize the supply of electrical energy over a large area in the county of Nottingham and the adjacent counties. Owing to the opposition of certain Municipalities who feared that the Company's competition might injuriously affect their own electrical enterprise, the Bill was thrown out on second reading. In the concluding remarks of the report, it is pointed out that, by securing the co-operation of all who are individually opposed to State Socialism, and by concentrating into a system of mutual defence the forces of the Defence Associations of the various industries in the country, and of independent companies and corporate bodies, the League seeks to resist all attempts on the part of the State or the Municipalities to restrict freedom of contract and of labour, harass private enterprise, or unduly interfere with the rights of property.

Building Lines and Wide Streets.

The interests of property are not always in harmony with the laws, although the latter are popularly supposed to be usually kind to the former. The difficulty of providing improved housing accommodation for the working classes in towns is very largely due to the fact that overcrowding pays the landlords, who can show huge profit rentals, and consequently high value, for property which ought not to be allowed to cumber the ground. Yet, how is the line to be drawn? The question is easier asked than answered. Recently, in recording the fact that the Wandsworth and Putney Gas Company had triumphed over the pedantic care of the London County Council for the integrity of the building frontage of an obscure lane in the riverside regions of Wandsworth, we allowed ourselves a little mild sarcasm at the expense of the County Council. We remarked on the inconsistency of this prosecution of the Gas Company with the laxity that had allowed such fine arteries as the Euston and Marylebone roads to become narrowed by building over the original forecourts. There has not been long to wait for the justification of the authority. Immediately term opened, the Court of Appeal had to deal with a case from the Pentonville Road, where the owner badly wanted to build over the forecourts of certain premises. This experience is universal, wherever business invades a thoroughfare once of residential character, with gardens in front of the houses. First, the occupier puts up a show-board behind the garden railings. This soon develops into a shed, and then into a shop. Finally, the whole building is brought forward to the new frontage-line. The old Metropolitan Board of Works tried to combine the interests of commerce and aërial sanitation by licensing these advanced buildings so long as they were not more than one storey high. It really was a choice of evils; for a decent shop was better than the squalid forecourt it usually covered. The County Council, however, are confronted with a conspiracy of property-owners and speculators to set the law at defiance and push forward the building line for all purposes to the edge of the pavement. This has now been satisfactorily checked in the Pentonville Road case; and it is to be hoped the principle will hold good, for the value of these wide channels through the mass of bricks and mortar is inestimable.

The Prospects of the University of Birmingham.

It has been our pleasant duty to lend such advocacy as we could command to the cause of the University of Birmingham, the principles and objects of which were again expounded last week by Mr. Joseph Chamberlain, as President of the Court of Governors of the Mason University College. For those who have to do work in the world which is ever so slightly elevated above mere drudgery, the idea of a University devoted to the highest development of practical knowledge possesses immense attraction. It is not that men of the workaday world despise the old University system, which has been happily described as the cultivation of useless knowledge. There are other things in the world besides work for wages; and

it is to be hoped that the day is far distant when men will dispense with the hoary and beautiful old foundations where for so many generations scholars have pursued uncommercial culture, and men have at least been taught that wealth is not everything, even in this world. But it has long been known that the ancient Universities are no places for men who want to learn things immediately useful in the great world outside the study or the cloister. Originally, as should always be borne in mind, even the Universities were places of practical education. In ages when all law and diplomatic writing was in Latin, a competent knowledge of this language possessed a very real value. Similarly, when the study of Greek was revived, it was because this tongue was the depository of all known truth in both science and religion. We have long since sounded these two wells of knowledge, and now only take a turn at the pumps for the sake of the exercise. Men of affairs now understand that there are things recorded in French and German which stand to them in just the same relation as Roman law and Greek philosophy stood to their forefathers; and accordingly they learn these languages for what they are worth. As Englishmen, however, with a world-language of their own, our people have no need to become as profoundly detached from their native tongue as if they were born Finns, or even Danes.

Practical science is ample enough to provide all necessary scope for University teaching strictly oriented to the useful and the known, without referring to the insoluble fascinating questions of origins, purposes, and ends which underlie religious and literary studies. Birmingham will have its Professorship of Brewing to set off against the Chair of Philosophy of an older order. After all, good beer is as much a necessity of mankind as the "quantification "of the predicate." Mr. Chamberlain expressed a wish for schools of electrical engineering, railway engineering, and railway management. The last, at any rate, is badly needed. It should not be too much to hope for a Chair of Gas Engineering, if the ideal is to be realized of every important trade having its own particular school. Why not? There are, in every big industry and trade, general principles which it behoves successful practitioners to know, but which in the ordinary way it is nobody's business to teach. Some few men are always discovering them afresh for themselves, and are apt to plume themselves upon their sharpness until they accidentally ascertain, to their discomfiture, that others knew them before. In order to save time and effort, every student fresh to the task ought to be able to begin, with preparation, where his precursor left off. That is the way to hand on the "Fiery Cross;" and it is the office of a University to facilitate the proceeding.

The Exportation of Picric Acid.—By a recent Order in Council, Her Majesty has prohibited the following articles from being either exported from the United Kingdom or carried coastwise: Picric acid (trinitro-phenol), trinitro-cresol, carbolic acid (phenol), and cresyllic acid (cresol).

Combined Refuse Destructors and Power Plants.—At a recent ordinary meeting of the Institution of Civil Engineers, Mr. C. Newton Russell read a paper on the above subject. He dealt with refuse destruction particularly in reference to its employment for raising steam, and gave details of ten combined plants, the data of which all tended to prove that a considerable amount of energy in the form of heat is to be obtained from the burning of ordinary domestic refuse. The results obtained from eight combined plants in England and two abroad were furnished; the Shoreditch plant being described in considerable detail, as the largest of its kind in operation. The total amount of refuse destroyed during a period of twelve months was about 26,200 tons, of which 92 per cent. was ordinary domestic refuse, and 8 per cent. trade refuse, consisting of straw, paper, &c. The average cost of burning the refuse during the second year of working was 2s. 6·9d. per ton. The amount of electric energy absorbed in dealing with it was 4·98 Board of Trade units per ton per annum. With one boiler and two refuse furnaces, it was possible, by burning ordinary refuse, to evaporate 2888 lbs. of water per hour, from and at 212° Fahr. The average calorific value of various tests was 0·99 lb. of water per pound of refuse. The heating surface of each boiler was 1300 square feet; the refuse grate area was 25 square feet, and the coal grate area was 27 square feet. The total amount of energy sold by meter to consumers was 1,031,348 Board of Trade units, including 131,140 units supplied to the refuse destructor. The total amount of coal consumed in burning the refuse was 1344 tons, valued at £1308 14s. 8d. The item of cost per ton for interest and for redemption of land and plant—not usually taken into account in connection with refuse destructors—was a matter for serious consideration, and in the case of Shoreditch, where land is very expensive, the charge worked out at practically 1s. per ton.

WATER AND SANITARY AFFAIRS.

The long-expected final report of the Royal Commission on Water Supply was published yesterday. We briefly indicated last week the nature of its principal recommendation as to the future control of the undertakings of the London Water Companies; and we reproduce elsewhere the portion of the report dealing with this matter. It will be seen that it bears out our statement that the Commissioners would advise the placing of these undertakings under the control of a Water Board specially constituted for the purpose, with a Chairman and Vice-Chairman appointed by the Local Government Board, in order, as the report says, "that the influence of the Executive "Government should be continuously felt." We now learn something in regard to the constitution of the proposed Board. It is to be of a permanent character, and composed of thirty members—ten to be appointed by the London County Council, four by the Conservators of the Thames, two by the Lea Conservancy Board, and two each by the County Councils of Middlesex, Surrey, Essex, Hertford, Kent, and the Common Council of West Ham. The Chairman and Vice-Chairman are to receive "adequate salaries;" and a sum is to be set apart for division among the members according to the number of their attendances. The duty of the Board will be to acquire by agreement, or, failing this, by arbitration on the terms usual in cases of compulsory purchase, the undertakings of the eight Water Companies, and to carry them on. In the event of Croydon and Richmond desiring to be independent of the Board, and supply themselves, provision is made for the severance of the portions of the Companies' works in their districts, and the transfer thereof to the Local Authorities of those places. The purchase of the undertakings is to be effected by the issue of 3 per cent. stock; and the Chamberlain of London is to transfer to the Board all the proceeds of the sinking-fund clauses which have of late years been inserted in London Water Companies' Acts. After the purchase, these clauses will, of course, be repealed. The Commissioners think that, if Parliament would dispense with a sinking fund, the purchaser "would be able, by maintaining the present charges, "to pay his way," and that "the growth of the water "revenue would render it possible to reduce the charges "for water sooner than such reduction could take place "under the management of the Companies, through the "attainment of their maximum dividend and the payment "in full of their back dividends." But if the Board are unable to pay the interest on the stock without increasing the charges, they are to be authorized to do this up to the level of the Lambeth Company; and the Commissioners think it would not be "unreasonable" to empower the Board to levy a rate-in-aid of a limited amount in the event of any deficiency arising in the income. The proceedings of the Board are to be brought "periodically and auto-"matically" under the observation of Parliament. The Board are to prepare an annual report and statement of accounts (the latter to be subject to independent audit); and both are to be included in the annual report of the Local Government Board.

The report is dated the 30th ult.; and its general contents may be briefly summarized. It begins by setting forth the terms of the reference to the Commission, which was appointed on May 1, 1897. They were, it may be remembered, to inquire whether, having regard to financial considerations, and to present and prospective requirements as regard water supply in the districts within the limits of the Metropolitan Water Companies, it was desirable, in the interests of the ratepayers and the consumers, that the Companies' undertakings should be acquired and managed by one or several authorities; to what extent division of the works between different Local Authorities was practicable and desirable; what additional powers of control should be exercised by Local Authorities in the event of the undertakings not being acquired; and whether the existing distributing systems could be connected. The Commissioners then describe their method of procedure, and offer some preliminary observations on the general question of the water supply of the Metropolis; going back to the Duke of Richmond's Commission in 1869. They next deal with the financial position of the Water Companies, and discuss terms of arbitration. The contentions of the London County Council and the financial results of arbitration are afterwards fully considered; this

portion of the report occupying rather more than eighteen pages. The opinions of the Local Authorities on the purchase question are fully reviewed; and the cases of purchases by Provincial Corporations examined. In the next portion of the report the Commissioners deal at some length with the present and prospective requirements of Water London, and their bearing upon the expediency of purchase. As to the Welsh scheme of the London County Council, the Commissioners express the opinion that it will be much more costly than providing additional water from the Thames, and that it is unnecessary to incur this extra cost now, "as the supply from the Thames will be "adequate in quantity and quality up to 1941." The next matter taken up bears upon the authority by whom the purchase of the undertakings is to be effected; and the opinion is enunciated that it should not be the London County Council. The recommendation in this regard has been dealt with in the preceding paragraph. The Commissioners pass on to consider the question of conferring additional powers of control over the water supply. The suggestions made by the London County Council and the Water Committee of the Corporation of London are duly examined, and the subjects of drawing water from the Thames, the Lea, and wells, and its storage, filtration, and distribution, are discussed. The conclusion is come to that it is "unnecessary to impose any restriction upon "the taking of flood water from the Thames; and that it "may safely be left to the discretion of the Engineers of "the Companies how soon after a flood they will draw "water from the river." The Commissioners think the Official Water Examiner should have the right of entry upon the works of the Companies, to which he is now admitted by courtesy (though it is acknowledged that no impediment has ever been thrown in his way), and penalties should be imposed for disobeying his orders. Questions of control in regard to pressure, fittings, and waste are next investigated; and the opinion is expressed that the various measures of control suggested should certainly be "kept "alive in the event of purchase." The question of the practicability of connecting the Companies' systems of supply having been dealt with by the Commission in a special report, it is dismissed in a few lines. Finally, the Commissioners record their appreciation of the efficient manner in which their Secretary, Mr. Cecil Owen, has discharged his duties.

It is gratifying to find that the first report presented to the new Official Water Examiner, Mr. Charles Perrin, M.Inst.C.E., by Sir William Crookes and Professor Dewar, on behalf of the London Water Companies, bears ample testimony to the vigilance with which those who have the management of the Companies' undertakings look after the arrangements made for ensuring the supply of water of proper quality. The report is moreover of special interest, as it deals not only with the water sent out for consumption in the past month, but also with the supply for the entire year. The shorter period is soon disposed of; for all the samples taken were found to be "clear, bright, and "well filtered." Though bacteriology as applied to the examination of water is no longer recognized by the Local Government Board, the Companies' Chemists have not discontinued their practice in this regard. Last month they examined 536 samples of water; and they pronounce the general supply to have been "admirable from a bac- "teriological point of view." Not only at the end of, but throughout the whole year, signs of efficient filtration were manifest. In the case of the water of the Thames Companies, the mean of the first six months was 32 bacteria per cubic centimetre; the New River and Lea supplies containing respectively 18 and 25. During the second six months, the numbers were 22, 12, and 14; giving 27, 15, and 20 as the means for the two periods. Sir William Crookes and his colleague remark that as water containing 100 bacteria per cubic centimetre when in the clear-water wells would be regarded by the highest authorities as "properly filtered," the supply to London must be considered as "exceptionally good." As to the chemical composition of the Thames water, the quantity of organic carbon was highest in January—0·227 grain per gallon; but from June till October the figures occupied the second and third places of decimals. Dr. Thorpe, reporting to the Registrar-General, gives, on the whole, a good account of the water supply last month. The samples taken from the Thames were of "fair," and those from the Lea, distributed by the New River and East London Companies, of "good" and "fair" chemical quality. It may be gratifying to East-enders to learn that the water supplied to them was, in respect to organic matter, slightly better than any of the Thames-derived supplies.

Very definite and straightforward answers were given by Justices Bruce and Phillimore, in the Queen's Bench Division of the High Court of Justice last Friday, to the questions put to them in the special case stated in an action brought by the London County Council against the East London Water Company with respect to the use of water from fire-plugs. It will be seen, by the report which appears in our "Legal Intelligence," that the plaintiffs sought for a declaration by the Court that the hydrants, fire-plugs, and other apparatus provided by the Company, as required by statute, ought not, without the consent of the Council, to be used for any purpose other than the supply of water for extinguishing fires and for the purposes set forth in section 37 of the Water-Works Clauses Act, 1847—*i.e.*, cleansing sewers, drains, &c. In the summer of 1897, certain streets in the Company's district were under repair, and the parties who were doing the work were allowed to use the hydrants there for obtaining the water required for the operations. This proceeding, in the absence of an agreement sanctioning it, or of the consent of the Council, it was submitted was illegal. The enactments bearing upon the question in dispute are specified in our report, and therefore need not be given here. It was contended on behalf of the Council that, under the Act of 1847, they were entitled to exclusive user of the hydrants for the purpose of extinguishing fires. It was pointed out, however, for the Company, that there was nothing in any of the Acts relied upon which restricted their powers with regard to the user of the hydrants. Mr. Justice Bruce answered in the affirmative the first question put to the Court—as to whether the fire-plugs and hydrants could be lawfully used, in the absence of an agreement, for other purposes than extinguishing fires; remarking that there was nothing in the Acts cited limiting the powers of the Company in respect to the use of their own water. In the answers to the remaining three questions, his Lordship expressed the opinion that the Company could not only use the water for what purpose they pleased without the consent of the Council, but could permit other persons to do so. Mr. Justice Phillimore held the same view. He said the statutes cited imposed certain obligations upon the Company with regard to hydrants, but did not restrict, as it had been contended they did, their right to use them for any other purposes than for extinguishing fires. The Council lost their case, it seems to us, through interpreting too widely the terms of section 4 of their General Powers Act of 1894.

Rainfall in the Past Year.—The aggregate rainfall during the year just closed was deficient over the whole of England; the deficiency amounting to about 6 inches in the Channel Islands, 5 inches in the South of England, and 4 inches in the East and South-west of England. There was a slight excess in most parts of Scotland and Ireland. The total rainfall in the neighbourhood of London for last year was 22·1 inches, which is 2·4 inches less than the average; and during the last seventeen years there have only been three years with an excess. It was deficient in eight months; the driest month of the year being August, with a total measurement of 0·35 inch, which is the driest August for at least sixty years. During the three summer months there was a deficiency of rain exceeding 4 inches. The only months with an excess of rain were January, February, April, and November; and, except in the two latter months, the excess was unimportant.

The Derwent Valley Water Scheme.—Readers will probably remember that, under the provisions of the Derwent Valley Water Act of last year, the Derwent Valley Water Board are authorized to construct six reservoirs in the valleys of the Derwent and the Ashop, in Derbyshire. As the execution of these and the subsidiary works will occupy a good many years, a commencement will be made as soon as practicable. Instructions have already been given for taking the levels and surveying the sites of the first two reservoirs; and, as will be seen by an announcement which appears elsewhere, the Board are desirous of receiving applications for the position of Engineer. He will be responsible for the designing and construction of the works, and will have to reside in their neighbourhood, so as to personally superintend the whole operations. The engagement will continue (subject to the services being satisfactory) till the completion of the two reservoirs above referred to; and it may be permanent. The gentleman appointed will have a staff of assistants; and the works will be subject to the inspection of a Consulting Engineer, to be appointed by the Board, as may be desired.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 218.)

Business on the Stock Exchange last week was on a very moderate scale all the time. The attitude of both professional operators and the investing public in general was one of "wait, and do nothing till you see." Of course, all eyes are turned to South Africa; for upon the events there of the next few days depends the fate of all the markets. Every now and then a cheery rumour gave a slight fillip to prices here and there; but a real rise never got hold of anything hardly except Consols, and they were moved up for other reasons. Rails were much damped by evidences of heavy working expenses, which are not likely to grow lighter. The relief of the Money Market progressed another stage; for on Thursday the Bank of England rate was lowered to 4½ per cent. from the 5 per cent. rate which had lasted just a week. Indications point to even greater ease; and if we can have a 4 per cent. rate, coupled with an African triumph, the markets may have a happy future. In the Gas Department, business showed no marked disposition to increase its volume, though on one or two days things looked as if they might brisk up a bit. Changes in quotation were not numerous; but with one exception they were in the upward direction. In Gaslight issues, the ordinary began slowly to improve on its figures of the preceding week, and then moved a little faster on dividend rumours. The announcement later on that the dividend would be maintained, and nearly £54,000 added to the amount carried over, was received with satisfaction; and the closing mark was 109. The increase is all very well, but it is not enough to face a reduction in the price of gas with, coupled with present prices of coals and commodities. South Metropolitan was extremely quiet, but steady. In Commercials, a single transaction in the new, at a good average figure, was all. In the Suburban and Provincial group, nothing was touched, except Brentford, which had a rise. Crystal Palace was put back a couple of points, bringing it just in line with South Metropolitan, in advance of which it had recently been left standing. The Continental group was generally quiet. Imperial was asleep all the week until Friday, when it awoke into some activity, and gained two points. Union and European were steady and unmoved. Among the remoter undertakings, none gave a sign except Buenos Ayres, which made a good recovery. In Water, a few transactions were marked here and there at the old prices, and not a change was made in any quotation.

The daily operations were: Business in Gas on the opening day was decidedly restricted; but the general tendency was firm, and Gaslight ordinary rose ¼. There was more animation on Tuesday, especially in Gaslight ordinary, which advanced 1 more. Buenos Ayres improved ½. Wednesday's dealings were almost wholly in Gaslight issues, which were steady. Crystal Palace receded 2. Thursday was about the quietest day of the week; and figures were unchanged. Friday was active and buoyant, with rising prices. Imperial advanced 2, Gaslight ordinary 1, Brentford old 2, Buenos Ayres ¼. Everything was firm on Saturday; but quotations closed without further rise.

ELECTRIC LIGHTING MEMORANDA.

The Burden of Marylebone—Competition no Remedy—Why not Try Gas?—The Vanity of Summonses.

There is no need to seek far for topical matter this week. The only important electric lighting question before the public at the present time is the wide-spread disappointment of those who have put their trust in central station undertakings for a light when they wanted it. On Wednesday last, the aggrieved customers in the parish of Marylebone of the Metropolitan Electric Supply Company made up a deputation to the President of the Board of Trade, with the object of bringing their several grievances formally before the Department. This, as the "Daily News" admiringly noticed next day, was really two wonderful events. First, some 600 persons and firms actually combined to state a grievance—"a rare example of interest in purely parochial affairs in London." Secondly, it is regarded as remarkable that they should have carried their complaint to the Board of Trade. For what could the Department do to help them in their hour of need? Simply, nothing more than offer a little sympathy and some cold advice, which might have been had with much less trouble. Mr. Ritchie obligingly told the deputation that the only real remedy for the defaults complained of was "competition," which could be provided either by a private Company or the Vestry. This, with all respect to the Minister, sounds very much like preaching to the converted, or playing to the gallery, or anything else that means telling people the very thing they most want to hear. We confess to feeling some curiosity as to who "worked" this deputation. There is actually a would-be competing Electricity Supply Company in the market for Marylebone; and the Vestry can take the job in hand any year after they have settled with the Metropolitan Company. There are thus two mutually antagonistic interests united in the simple cause of making the most of the grievance against the Metropolitan Company. Which of them was it that spurred on the Marylebone doctors and shopkeepers to pour their sorrows into Mr. Ritchie's sympathetic ear? It would take a good deal to convince us that the deputation was strictly spontaneous.

Besides, the nostrum of competition is altogether beside the mark. To suggest it as a remedy for electric light extinctions is about as practical as the proposal of certain Russian rural communes for dealing with a plague of locusts which visited this part of the world some years ago. The impoverished peasantry begged for Government help in their troubles; and when asked to name their own ideas of what should be done, all they could suggest was that agriculture should be included in the curriculum of the Imperial Universities. This was somewhat remote; but so is the notion that the electric lighting, say, of the Middlesex Hospital can be rendered less uncertain by admitting a competing undertaking into the district. If it could be asserted truly of any excluded system of electricity supply that it had never been known to break down, the argument for the expediency of admitting it would be unanswerable; but everybody knows that all systems are equally unreliable. When we say that everybody is aware of the fact, we mean all the technicians, who are ready to swear by monopoly or competition according as their own interests are affected. They have claimed so much for the advance of electric lighting that the general public might be pardoned for overlooking the circumstance that, in the one point of reliability, the method of lighting still stands exactly where it did. The public, not only of London, are beginning to awake to this truth; but the electricians, however bitterly they may fight among themselves, will try all they know to distract the public mind from the only lasting cure for occasional electric light extinctions, which is to leave the light alone altogether.

This is the common-sense remedy. It is idle for the surgical staff of the Middlesex Hospital to join the procession of those who have axes to grind at the competition mill, and make believe that competition will serve their own disinterested purposes. They are not obliged to light the Middlesex Hospital with electricity. Fashionable churches, workhouses, and other public and private establishments where there is no lack of money can indulge in the luxury of electric lighting; but they must bear the defects of its qualities. It is doubtless convenient in the casual ward to turn the button by the door and flood the apartment with light; but there must be no grumbling if the light occasionally goes out of itself without troubling the switch. It is its nature to. The "Daily News" sees that central station supply must sail very close to the wind at periods of maximum demand, if the plant and the working are to be economical. We may take a little credit to the "Journal" for establishing this point against the "Electrician;" but really it is self-evident. The only difficulty lies in satisfactorily determining the coefficient of relative sufficiency of plant to possible demands. The "Electrician" admits that the present troubles of the Metropolitan and other undertakings will "serve as a warning to supply undertakers, whether company or municipal, to stay their hand when tempted to accept new consumers before they are in a position to supply them." Would our esteemed contemporary kindly define this position, and in particular say if a consulting engineer is justified in calculating upon full revenue returns from a hypothetical lamp connection 30 per cent. above the capacity of the generating plant? If not, why not?

The "Daily News" makes the same point of the excusable reluctance of suppliers of electricity to admit inadequacy of power to the demand. But this is not all. Whether plant is overworked or not, the extinctions come pretty much the same. If it is not a breakdown at the station, then it is a burst-up of a main; and the consumers' grievance is all one. Our daily newspaper contemporary very wisely opines that what the electric lighting industry wants is economical and efficient storage for their electricity; and it suggests that "the corporations should combine to offer a very tempting premium to scientific men to solve this problem." Aha! There's the rub! As the other swan would say. As if such a premium were not always on offer, amounting to wealth "beyond the dreams of avarice." The "Electrician" meanwhile remarks that the aggrieved consumers have their remedy. They can take out summonses against the Company, and get them postponed for three months. No, there is no real consolation in a summons for the man who has been denied the light he wants. If it comes to this pass, he will drop the whole thing sooner than be plagued with legal proceedings. Penalties are not for constitutional weaknesses. People in business do not require the stimulus of penalties for default to impel them to do their best for their customers, and at the same time for themselves; and the law never yet turned a weak market into a strong one. Therefore, although we have no special regard for the Metropolitan Electric Supply Company, we have no love for those who are attacking it through the Board of Trade and the Law Courts for doing what the assailants could not avoid doing themselves if similarly situated. The whole affair is cant.

Reports of Gas Associations for 1899.—As will be seen by an announcement which appears elsewhere, the above-named work is now ready. As most of our readers are aware, it presents in a convenient form for reference a record of the work of the Provincial Associations last year, and thus forms a companion volume to the "Transactions" of the two London Institutes. The text is followed by lists of officers and members of the Associations; and there is an index.

GAS EXAMINATION IN PARIS.

The photometrical programme of the London County Council, based as it is on the declaration that the existing statutory arrangements for testing the illuminating power of the gas supply of London are unsatisfactory, naturally suggests an inquiry as to how the gas consumers of other capital and important cities are protected in this respect. We have therefore taken measures for obtaining, from reliable sources, some fresh and apposite information illustrating actual European practice in legal gas testing, having regard especially to the views of the County Council of what is necessary and expedient for London. The first example must be Paris, the "City of Light," where also the duties of local government are very seriously regarded.

The relations between the City of Paris, represented by the Prefect of the Seine and the Municipality, and the Paris Gas Company are regulated by the provisions of the famous "Treaty" which bears the date of February 7, 1870. This official document is published by the Prefecture of the Department of the Seine. It will continue operative in all matters arising out of the gas supply of the French capital until Dec. 31, 1905. By chapter 2 of the Treaty, it is required that the gas supplied must be the product of coal. No other gas may be distributed without the formal written consent of the Prefect of the Seine, after deliberation by the Municipal Council. The gas must be perfectly purified; and its illuminating power should be such that, when burnt under a pressure of 2 to 3 millimetres of water at the mean rate of 105 litres (3·708 cubic feet) per hour, it shall give a light equal to that of a Carcel lamp burning 42 grammes of purified colza oil per hour.

The Company are required to find the apparatus and provide the testing places where the gas is examined daily for illuminating power and purity. The prescribed gas-burner is the Bengel, of porcelain, with thirty holes, burning the gas under the stated pressure, with a chimney 20 centimetres high, 49 millimetres diameter at the base, and 52 millimetres diameter at the top. The flame must be adjusted to equal the light of the Carcel, used under the conditions specified in an instruction of Messrs. Dumas and Regnault, annexed to the Treaty. This instruction resembles in form those of the London Referees. It bears the date Dec. 12, 1860; and has never been varied one jot or tittle. It describes, with illustrations, the Carcel and the Bengel (or as it is here spelt Benghel) burner, giving all the measurements serving to standardize the apparatus. The Bengel burner is a simple argand without any cone, but with the lower open part of the chimney gallery closed by a sheet-metal apron, pierced with air holes. Before being used for testing, every burner must be compared with the sealed standards.

The operation of making a test comprises the lighting and the measurement. The lighting of the Carcel is quite a business. A new wick is to be used, cut to the level of the wick-tube. These wicks have to be kept dry, in a box of quicklime if necessary. The lamp is exactly filled with oil, and lit with the wick turned up to 5 or 6 millimetres high. Then the chimney, which is shouldered and capable of being slid up and down in its socket, is mounted in place. The wick is next turned up to its full regulation height of 10 millimetres, and the chimney adjusted so that its shoulder is 7 millimetres above the level of the wick. Thus the lamp should burn 42 grammes of oil per hour; but it is allowed a variation of 4 grammes above or below the standard rate without losing its legal value. Both the lamp and gas must be lit and allowed to burn full on for half-an-hour before the test is made.

It will not escape notice that complete reliance is placed upon the performance of the Carcel, after adjustment, with the sole guarantee of the rate of consumption of the oil. All is correct when the lamp burns 10 grammes of oil for 25 litres of gas burnt by the Bengel. The two lights are equalized by regulating the flow of gas by means of a micrometer cock, which must be attended to throughout the duration of the test, marked by the seconds alarm clock. Three observations are made, at half-hour intervals, and the mean result taken. The normal rate of consumption of the lamp being 42 grammes of oil per hour, and a consumption of 10 grammes being the test quantity, it follows that the period of every observation should be 14 min. 17 sec. The seconds clock shows the actual time occupied in burning the 10 grammes of oil, from which it is ascertained whether the lamp is functioning within the legal margin. The test meter is verified every eight days, in the presence of an agent of the Company. An error of 1 per cent. in registration is permitted, compared with the standard holder. The purity test is only for sulphuretted hydrogen by acetate of lead paper.

All testing apparatus is formally taken over from the Company by the City Engineers, and can only be used after it has been verified and checked by the agents of the City and those of the Company. The testing-stations are to be at the district distributing stations of the Company, or in the vicinity, and in rooms of which the agents of the City alone have the keys. The district stations selected for the purpose are chosen, with the consent of the Company, about the middle region of the distributing system supplied by the gas-works corresponding with the district station. There are to be as many testing-stations as the Municipality thinks fit to require; but at least one for every gas manufacturing station, and two for the most important.

The testing is to be done between the hours of eight and eleven at night. Every day an order-sheet, forwarded by the Director of Highways of the City of Paris to the gas examiners, designates the stations at which tests are to be made that evening. The number of tests should be the same for all the works. The District Superintendent, or one of the Engineers of the Company, has a right to be present during the testing, and to take note of the results; but he is not to interfere with the conduct of the operations, for which the testing officer is solely responsible. If the gas consumption, which ought to be 25 litres, as already stated, should exceed 27·50 litres, the fact must be immediately notified to the Prefect of the Seine and the Company.

The results are still further averaged: The mean of the tests of every month should be equal to 25 litres in round numbers. To arrive at this mean, to every works is assigned at the beginning of the year a co-efficient proportional to the mean fraction representing the share of this works in the total output for the public lighting. When the mean for a month is above or below the normal, a report is made in the following month of the same quarter of the amount of compensation due by the Company or by the City. At the end of every quarter, the account of the proportional compensation for all the works is cast; and if there is a deficiency, the Company pay to the City the value of the missing light, based on the price of gas supplied for the public lighting (15 centimes per cubic metre) less the octroi-duty of 2 centimes per cubic metre, and on the mean monthly consumption of the same streets for the corresponding period. Over the whole year the Company pay damages for light not supplied, thus determined, at the price or value of the difference for the first two quarters. If a deficiency occurs again, in either or both the two latter quarters of the same year, the damages are doubled.

These preceding provisions are only put in force if the deficiency exceeds 10 per cent. This figure corresponds to the margin allowed in the testing—from 25 to 27·50 litres consumption to the Carcel—before an actual default is registered and notified. Within this limit, no deduction for bad light on the price of gas supplied can be demanded. If the figure is exceeded in the tests for two consecutive nights, further proceedings are to be taken after a delay of five days, in the shape of a check testing in the presence of agents of the City and the Company. In case of disagreement, there is an appeal to a Government Engineer, named for this duty by the Council of the Prefecture at the commencement of every year. From the day when the deficiency of illuminating power in excess of the 10 per cent. margin is denounced by the City to the Company, if it is repeated ten days following, or during any fifteen days of the same month, the Company are mulcted in five times the value of the light not furnished. This forfeiture applies both to the public lighting and to the private consumption. Exception is also allowed for cases of *force majeure*, provided that when the Company are aware of any causes likely to injuriously affect the illuminating power of the gas, they are to immediately notify the same to the Prefect of the Seine. We cannot recall an instance of forfeiture by the Company under these articles. The results of the testings are made public four times a year, in a manner determined by the Prefect. There are no constitutional means of altering these provisions while the Treaty lasts.

A number of printed forms, issued by the Prefecture, provide for the returns to these orders. The first is a sheet to be entered up with all the results of a day's testing. The first column gives the name of the gas-works, followed by the testing-station or stations at which its gas is examined. There are seven works, and twelve testing-stations. Thus, gas sent out from La Villette is tested: (1) At No. 208, Rue du Faubourg St. Denis; (2) at No. 33, Rue de St. Quentin; (3) at No. 27, Rue du Château-d'Eau. The figures are entered by the Inspector of Gas Lighting; countersigned by the Engineer of the General Lighting Service; and attested and forwarded to the Administration Director of the proper department, by the Chief Engineer of Streets and Lighting. Another return is for the results of occasional tests, made at the same stations during the daytime, which is done twice a month; but as these results have no legal force, they are not reckoned in with the lawful ones. A third paper gives the "co-efficients" of the different works; and is for recording the quarterly averages. Besides these office papers, every gas examiner enters his own work in forms from which the average returns are compiled, having special forms for "bad reports." Lastly, a form of authorization is filled up for every agent of the Company who is admitted to a testing-station.

All these regulations are rigorously carried out. It will be observed that the testings are meant to be a check upon the gas sent out from the different works, taken at a point midway in the district. With this object, the service is taken whenever possible from a leading main. In practice, a testing-station is never put at a less distance than one kilometre from the works whence the gas is supplied, though there is no law for this regulation. The service pipes to the testing apparatus are special to this use, and are not metered in the ordinary way. The only meter used is the test meter. The gas examiners are nominated by the Prefect of the Seine, acting as Mayor of Paris. They are paid by the Municipality, at 5 frs. or 4 frs. per night's test, according to class. The staff numbers 22, whereof ten have by seniority attained the first class, who are paid 5 frs.; seven belong to the second class, at 4 frs.; and five are extra men at the lower rate. Testers are allowed in addition 60 centimes a night for omnibus fares; and they go the complete round of all the stations in turn.

DEATH FROM CURRENTS OF ELECTRICITY.

The recent accidents due to electric currents at Bradford, Middlesbrough, and Bolton, have led Dr. W. S. Hedley to deal, in the "Electrical Review," with "The Cause of Death from Electric Lighting Currents," considered not only in relation to the electrical question of prevention, but to the medical one of "first aid." As to the latter, he says it must be regretfully confessed that some simple, ready, and effective means of resuscitation after electric shock are still wanting. Some six or seven years ago D'Arsonval expressed the opinion that persons suffering from such shock should be treated as the apparently drowned—that is to say, by artificial respiration, begun early and patiently continued. Dr. Hedley says that in this respect there has been practically no advance, not because the subject has been simply left alone by medical men and physiologists, but because, from the point of view of treatment, there has not as yet been any practical outcome of their labours. The latest contribution to the physiology of death by electric shock reaches us in the form of a painstaking experimental investigation by Dr. Robert Cunningham, of New York; but, unfortunately, he has nothing better to offer in the way of treatment than what is admittedly an impracticable procedure. As an inquiry into the mechanism of death by electric shock, however, his experiments are interesting and instructive. Dr. Hedley tells us that, by means of blood-pressure tracings and other tests on dogs, with "the continuous finely pulsatory 116-volt current," he has satisfied himself that death from electric lighting circuits is due to sudden arrest of the circulation from fibrillar contraction of the heart; and in rare instances (when an electric current of considerable intensity and duration traverses only the cerebro-cervical portion of the nervous system), death may take place by asphyxia.

In order to assign a proper value to these views, Dr. Hedley points out the utility of bearing in mind what has been said and done by previous experimenters. He reminds us that, in 1894, D'Arsonval considered that an electric current produces death either (1) by the disruptive action of the current mechanically altering the tissues; or (2) by the occurrence of a central paralysis of respiration constituting a special form of asphyxia. Dr. Tatum, of New York, experimenting in 1890, came to the conclusion that such currents kill by acting chiefly or entirely on the actual substance of the heart itself. Dr. Lewis Jones, a few years later, considered that death begins at the heart, and that the action of the current is upon the heart muscle rather than upon any of its nervous mechanisms. Drs. Oliver and Bolam, following in the wake of these experiments, subsequently arrived at exactly the same conclusion. Dr. Bleile, of the Ohio State University, was of opinion that death in such cases is entirely due to the fact that the current produces a contraction of the arteries through an influence on the nervous system—that is to say, through an effect on those nervous centres which control the diameter of the arteries; and that a constriction of the arteries so produced throws in an impediment to the flow of blood which the heart is unable to overcome. The late Sir George Johnston thought that the fatal obstruction is not in the systemic arterioles, but is due to a constriction of the pulmonary arterioles—the latter being excited to contract by the entirely deoxygenized blood. Dr. Hedley himself has, in the "Electrical Review" and elsewhere, expressed the opinion that death may be brought about in some instances by arrest of respiration, and in others by sudden and primary stoppage of the heart's action.

This subject also has been investigated by MM. Prévost and Batelli, who, in March last, found that the electric current threw the heart into the condition known as *delirium cordis*, or fibrillar contraction. Dr. Cunningham, although of opinion that death sometimes occurs from asphyxia, holds that death by direct action on the heart is vastly more frequent, not because the muscular substance has been killed or paralyzed by the current, but probably "because the balance of the intra-cardiac co-ordinating mechanism has been destroyed." He considers that the instantaneous and total extinction of the arterial circulation which the blood-pressure tracing shows, results from a "practically instantaneous cessation of the co-ordinated rhythmical contractions of the ventricles of the heart." In his experiments, he found that usually a current of from 0·6 to 0·65 ampère was sufficiently strong, when passed across the chest, to kill the majority of the dogs, whether large or small. He thinks that some other factor "apparently residing in the heart, and probably physiological in nature," is also at work. Dr. Hedley points out that the latter remark would probably apply to any kind of injury inflicted on any kind of animal. It is obvious that the effect of any form of violence to a living being must to some extent be determined by the physiological resistance of the individual. The above experiments tend to prove: (1) That a dog may be killed by passing a strong continuous current for a more or less lengthy period (1·1 ampères for a minute) through the brain and upper part of the cervical spinal cord, the death in such a case being due to asphyxia; and (2) that a weaker current for a shorter time (0·3 ampère for six seconds) traversing the heart will, by sudden and permanent stoppage of the heart, produce death. It is in this way that death usually occurs. In such cases the central nervous system dies from anæmia.

Dr. Cunningham is of opinion that death by electric shock is not instantaneous, inasmuch as one nervous centre at least—viz., the respiratory—"continues to act more or less perfectly for some moments after the cessation of a lethal current.' Having seen three cases, and read of sixteen others, of recovery after electric shock, there seems to be "ample time before loss of consciousness occurs for the recipient of the shock to become fully aware of the fact that he is, or has just been, in contact with an electric current." Generally speaking, the sensation was described in these cases as not particularly painful, and resembling that produced by a strong medical coil. Usually a sensation of "tremendous pressure across the chest is also felt." Dr. Hedley says the sequence of events in such cases seems to be somewhat as follows: As the accidental contact with the live wires, rails, brushes, &c., is made, more or less pronounced general muscular contractions immediately occur. After a deep inspiration and expiration, respiration may perhaps stop, but soon begins again. A temporary arrest of heart action and fall in blood pressure is also immediately manifest. In slight cases, the normal heart beat is soon recovered; but more or less syncope frequently occurs, which disappears on the restoration of the circulation. Where contact has been made with conductors carrying currents of considerable intensity, duration, and electro-motive force, and the result does not prove fatal, "possibly none of the current, or undoubtedly but a very small portion of the current, traverses the heart." But "when the current through the body is a strong one—for instance, one of from 1 to 8 ampères—and passes through the heart," fibrillar contraction ensues, and spontaneous recovery is in the highest degree improbable.

RECENT PUBLICATIONS.

Good Citizenship: Twenty-three Essays by Various Authors on Social, Personal, and Economic Problems and Obligations. Edited by the Rev. J. E. Hand. (George Allen).

It has, on occasion, been the duty of the "Journal" to comment upon, and to lament, the indifference towards, and ignorance of, the serious industrial and economic problems of the day displayed by the Church. It therefore affords us especial pleasure to welcome this book, which is an attempt on the part of some of the clergy—assisted by lay writers—to remove that indifference and enlighten that ignorance. The Editor, it will be seen, is a cleric; a special preface is supplied by Canon Gore; and there are some dozen other prominent churchmen included in the list of writers. The authors are, in general, chosen for their special knowledge of their subjects, and have been given a free hand, coupled with individual responsibility for their articles. The bond of union—the common purpose—is stated to be to show "that a worthy citizenship must have its basis on a Christian and ethical foundation, and that all classes of men should apply their religious motives to the purposes of citizenship;" the essays being further intended to call the attention of citizens to the many problems with which it is their duty to cope, and to afford some guidance to the would-be-worthy citizen as to the direction in which he may find their wise solution. It is not a matter of surprise that the authors have been infinitely more successful in pointing to the questions than in supplying the answers. It is so easy to see that "something is wrong," so difficult to say how to put it right. We think that not a few of the writers have missed the object of their work, because they have, strange to say, failed to see that so many of the "wrongs" can never be righted from without, but that the one thing needful for the solving of these problems, and for the removal of many of the sources of human misery and suffering, is the elevation of the nation through the better understanding and fulfilment of his duty by the individual. This is, indeed, more clearly seen by the Editor, who points out, in his very able introduction, that "improvement in the government and in the governed must go together. Neither can move far in either direction without dragging the other with it. The driving-wheel of all human machinery is Character;" and, while men may and certainly will differ as to what reforms may be needed, all can agree that "what is first needed is an intelligent citizenship to appeal to, a public opinion based on sound knowledge, on careful study, and on high moral principle." We much prefer in this book those essays the authors of which content themselves with pointing out conditions of society which are obviously contrary to humanity and morality, or with indicating spheres of work in which a citizen may do useful service and where high moral principles would work revolutions, to those whose authors merely seize the opportunity to air their own pet schemes of reforms. If only citizens can be stirred to the duty of studying the problems dealt with in this book (and that we take to be its prime object), they will find plenty of experts ready with schemes designed—whether calculated or not—to solve those problems.

To illustrate our preference, we may mention two essays that, coming next one another, afford a striking contrast; the one fulfilling, the other missing, its purpose. Mr. J. T. Dodd's paper on "The Poor-Law" is admirably suited to instruct the ignorant or thoughtless citizen in the valuable and difficult character of the work that he might undertake as a Guardian of the Poor; setting forth the powers and duties of the Guardians, and showing to what a large extent the humane treatment of the destitute and aged depends upon the conscientious performance of those

duties and the just exercise of those powers by the citizens who hold the office. The essay on "Old Age Pensions," by Mr. G. L. Gomme, on the other hand, is certainly not calculated to interest or inform the supine reader. There is, in fact, no attempt at an explanation of the problem. The short ten pages consist merely of an advocacy of two little plans of Mr. Gomme's—one of enforced enlistment for the able-bodied beggar (the beggars' brigade and the criminals' corps would, indeed, be valuable additions to the British army!), the other of providing funds for old-age pensions by taxing enclosed common lands. We can only say that the citizen who previous to reading Mr. Gomme's article was ignorant of the facts of the gigantic problem of the aged poor, and of the history of the movement in favour of State provision of pensions therefor, would simply wonder whatever the author was talking about.

It is obviously impossible to compress into a notice of anything like wieldy dimensions, an adequate review of a book comprising twenty-three essays upon as many subjects, all of them of great interest to the student of present-day Social and Economic problems, and most of them subjects of keen controversy, or to make an exhaustive examination of the opinions expressed by the various authors. We must be content to mention—and that very briefly—the essays dealing with subjects of the most direct interest to readers of the "JOURNAL." Chief among these come Mr. J. A. Hobson's two papers on "Capital" and "Labour." Mr. Hobson is a well-known and able writer on Economics; and these essays have the merit of being written thoughtfully and with distinction. The writer has, indeed, therein made good his claim to be considered a "disinterested student of industrial facts and laws." Recognition of these merits in the writer does not, however, imply agreement with his conclusions, which, in fact, we are, in more than one instance, utterly unable to accept, and which, since Mr. Hobson's essays will probably constitute the foundation of not a few sermons, it is necessary to dispute. While effectively destroying the claim of Labour to the "whole product of labour," Mr. Hobson yet believes that the worker has a further claim upon the product of his handiwork than the wages paid him in exchange.

> The workers who are obliged to live round a factory, who spend the best part of their lives within its walls, give out their personal skill and energy in tending its machinery, who are even more deeply interested in a success or failure, which means food or starvation, than the capitalist, to whom it means riches or poverty—these people have as real a property, as true an ownership, in the business as the men who bought and set up the machinery. Legally, we know well they have no claim; they may have laboured for generations in the mill, and the caprice or self-interest of the owner may throw them on the street. This purely legal view of property so dominates the mind and imagination of most people, that they cannot bring themselves even to admit that the muscle, skill, industry, and character of a body of workers, which have helped to build up and carry on a successful business, involve any rightful property in that business. Yet this view begs the whole moral question; it assumes that a legal position is morally sound, whereas that is the very issue. . . The fact that the employer can sell the name, the goodwill, and the premises, or clear away every stock and stone of the building, is merely testimony to an immoral interpretation of ownership.

Really, this is simply fantastic, sentimental nonsense. The idea that if you employ a master-builder to build you a house, for the materials of which you pay him, for the designing of which you pay him (or the architect), for the labour expended upon the erection and the supervision of the erection of which you pay the bricklayers, carpenters, and others (through the builder), yet finally, that builder and those workmen have the moral right to a part ownership of that house by reason of the muscle, skill, and industry put into its construction, needs only to be stated to be destroyed by its own absurdity. Yet where is the difference between the builded house and the built-up business? If a worker have some property in the product of his labour over and above the wages paid him, it matters not what that product be, or whether he work in a mill or for a private person. If the wages paid be insufficient for the worker to provide thereout for his old age, the fault lies in the rate of wages, not in the legal theory of ownership. We are certainly strongly in favour of employers adopting schemes for pensioning their aged workmen; but this is only the payment of deferred wages, not the recognition of a claim to part-ownership of the business. That can only be obtained by the investment of wages in the concern.

Mr. Hobson proceeds to argue in favour of State control of capital—of "public enterprise" in lieu of private—and supports his contention by the statement that "it is evident that no man in society is strictly capable of self-support, even as regards the production of the bare necessaries of physical life for himself and his family. At every step he is dependent upon the support of the entire industrial community, and, in a still closer way, upon that of the fellow members of his trade and locality." If this were merely intended to mean that, in the complicated conditions of modern life, no man can live solely on the results of his labour, it would be accepted as a truism; but when it is seen that Mr. Hobson holds that the working-classes do not receive for their labour an equivalent enabling them to be self-supporting, we must say that in our opinion he entirely fails to prove his contention. Mr. Hobson apparently confounds the "means of self-support" with the possession by everyone of an equal share in the wealth of the community. Gas-manufacture is certainly one of the "large mechanical routine industries" which Mr. Hobson would like to see worked by public enterprise; but gas workers are quite capable of providing more than the bare necessaries of physical life for themselves and their families.

We are conscious that we have only been able to deal very inadequately with Mr. Hobson's arguments; but we have already exceeded the space we intended to devote to this review. We can only now mention that Mr. Gomme has a second article—on "The Municipality"—in which he proposes to abolish the word "profit" from municipal finances, only, however, to substitute that of "taxation." Consumers of gas, and users of telephones or trams are to be charged more than cost price for those necessities, in order to provide a source of indirect taxation (a plan likely, of course, to lead to economical municipal administration!). Miss Mona Wilson writes on "Factories and Workshops," and incidentally negatives much of the impracticable advice given by the Rev. J. Carter in his paper on "The Economic Duty of the Consumer;" while other writers deal with other aspects of social life which are beyond our scope to review. Of the whole, we must say it is more interesting than instructive, but is valuable as evidence of a desire on the part of the Church to pay greater attention to its practical duties.

Signalling across Space without Wires. By Oliver J. Lodge, F.R.S. ("Electrician" Printing and Publishing Company, Ltd.)

This is the third edition of Professor Lodge's description of the work of Hertz and his successors in connection with the above-named subject. The first portion of the book consists of the revised notes of a lecture delivered by Professor Lodge before the Royal Institution on June 1, 1894; and this is followed by an account of the later applications of Hertzian wave experiments to wireless telegraphy. In this connection, Popoff's demonstration in 1895, Slaby's overland experiments a few years later, and the more recent exhibitions of Marconi are described. There are seven appendices, two of which are devoted to the photo-electric researches of Drs. Elster and Geitel and Professor Righi. Those of our readers who desire reliable information on this interesting subject will find it in the book under notice; the name of Professor Lodge being an all-sufficient guarantee for the accuracy of the contents.

WATER BILLS FOR 1900.

THE following Bills of Municipal Corporations and Local Authorities relate wholly or in part to water supply.

The Airdrie, Coatbridge, and District Water Trust Bill proposes to constitute and incorporate a Water Trust for the Burghs named, and parts adjacent, in the county of Lanark. The Airdrie and Coatbridge Water Company supply the district, and last year obtained an Act in which the promotion of this purchase Bill was arranged for on the customary terms. The constitution of the Trust is prescribed, and the appointment of officers provided for. Members of the constituent Authorities are excluded from office under the Trust. The amount of the purchase price is to be ascertained by arbitration under the Lands Clauses Acts, and is to cover the reasonable costs of obtaining the Company's last Act, the costs of winding up the Company, and compensation of the officials. The distribution of the purchase money is to be in accordance with a scheme to be framed by the Directors and approved by the proprietors. Objectors are to have a right of appeal to an arbitrating counsel. The District Committee of the Lower Ward of Lanarkshire are to have power to purchase the portion of the water-works in their district. Water is to be supplied by meter for other than domestic purposes at prices varying from 7d. to 5d. per 1000 gallons, according to quantity. A sliding scale is proposed for making the price of metered supplies depend upon the domestic water-rate for the time being. Additional water capital to the amount of £50,000 is required, repayable in sixty years. The money may be raised by the creation and issue of redeemable stock under the Local Authorities Loans (Scotland) Acts, 1891 and 1893. The Trustees may also borrow from their bankers on current account any sum not exceeding one-half of the approximate amount of their yearly revenues. A professional auditor is to be appointed and paid.

The Barnsley Corporation Bill is to enable the Corporation to make deviations in constructing the lines of pipes authorized by their Water Act of 1896, and to take over certain obligations of the Corporation of Sheffield under an Act of 1896. Easements only for the proposed deviations may be acquired. The Corporation of Sheffield are to pay the extra cost of one pipeline deviation; and are to relinquish to the Barnsley Corporation the right to make the Knoll Brook works authorized in 1896. The period of time for this work is extended. Agreements between the Corporations are to be concluded in furtherance of the objects of this part of the Bill.

The Bury and District Water-Works (Transfer) Bill is to constitute and incorporate a Joint Water Board, consisting of representatives from the Councils of the boroughs of Bury, Haslingden, and Rawtenstall, the urban districts of Radcliffe, Ramsbottom, Little Lever, Whitefield, and Tottington, and the rural district of Bury. The Board are to take over the water undertaking of the Bury Corporation. The constitution of the Board is duly set out. Members of the Board are not to have any interest in the contracts of, nor draw any emolument from, the work of the Board, except as shareholders of a company, and

then not to have any vote in the matter. The Chesham reservoir at Bury is to remain the property of the Bury Corporation. The capital sum of £90,000 is to be withdrawn from the indebtedness of the Corporation, and charged upon the Board. Other provisions are made for adjusting the finances of the undertaking. All surplus profits on the supply are to go in reduction of the domestic water-rate. The price of water supplied for public purposes is to be settled by the Board, and to be uniform throughout their limits. Officers are to be continued. The unexhausted water capital powers of the Bury Corporation are to be exercised by the Board.

The Cambridge Corporation Act contains a part relating to water. It proposes that the undertaking of the Water Company shall be transferred to the Corporation on such terms and conditions as may be agreed upon or be determined by arbitration under the Lands Clauses Acts. The rates for domestic supplies are to range from 5 to 4 per cent. Power is to be taken for borrowing the requisite amount of money for buying out the Company, to be repaid in sixty years. Surplus water profits are to go to the district fund.

The East Stirlingshire Water Bill is to empower the Eastern District Committee of the County Council of Stirlingshire to construct water-works for the supply of their district. The proposed works comprise an intake in the Buckie burn and a reservoir in the parish of St. Ninians, with a pumping-station in the parish of Slamannan, and a number of subsidiary works. The waters of the Buckie burns are to be taken, subject to the provision of compensation water. The works are to be completed in from five to ten years. Special arrangements are to be made with the Bonnybridge eastern and central water districts; and certain distributing plant belonging to the Falkirk and Larbert Water Trustees is to be purchased. A clause deals with the compulsory supply of water for domestic purposes within the district. The District Committee are to lay the mains, and compel owners and occupiers to provide service pipes and take the water. Domestic supplies are strictly defined. Where metered supplies are enforced, the domestic water-rate is not to be levied; but the District Committee must elect on which basis to charge. The County Council are to pass the rates made by the Committee; and may levy a public water rate of not exceeding 3d. in the pound. The County Council are to finance the Committee until they are in receipt of revenue.

The Edinburgh District Lunacy Board Bill is to empower the Board to make water-works in the county of Linlithgow, comprising two storage reservoirs on the Brox burn, and an intake on the Linen Faulds burn. The water rights of the Bathgate District Committee are protected. Certain lands are to be acquired in order to protect the sources of supply from being polluted. The works are to be completed within eight years. The Board desire power to supply water to the Asylum or elsewhere in six parishes, and beyond them in bulk.

The Exmouth Urban District Water Bill is to authorize the District Council to purchase the undertaking of the Company by arbitration under the Lands Clauses Acts. The officers are to be compensated. The rate for domestic supplies is to be 6 per cent., with special rates for shipping and for metered supplies. The undertaking is to be improved at an estimated cost of £4000.

The Falkirk and District Water Bill is to provide for an additional supply of water to the burgh of Falkirk. A reservoir is to be constructed on the line of the stream known as the Earl's burn; and a second similar work on the Little Denny burn. Certain water-works authorized in 1896 are to be abandoned. Compensation water is to be discharged into the channel of the impounded water courses under particular guarantees. The additional works are to be completed within ten years. Main-laying powers are to be taken. The Trustees require to borrow £110,000 for the purposes of the Bill. Areas are to be added to the limits of compulsory water supply.

The Halifax Corporation Bill contains a part relating to Water. Certain lands in the drainage area necessary for the protection of the source of supply are to be acquired and held. Such lands may be leased under suitable conditions. Occupied houses in the borough without a proper water supply are to be dealt with summarily as nuisances. The sum of £20,000 is required for the purchase of water lands.

The Hamilton Burgh Bill is to amend an Act of 1878, and make the public water-rate leviable on all lands and premises within the limits. Underground gas and water pipes are to be charged one-fourth. Water and gas rates are to be primary charges on bankrupts' estates.

The Hemel Hempsted Corporation (Water) Bill is to make further provision for the purchase of the Hemel Hempstead water undertaking by the Corporation. The water-works are in the hands of the Hemel Hempstead Water-Works and Laundry Company, Limited, who obtained a Provisional Order in 1896. It is proposed that the Company should sell their undertaking to the Corporation at a price to be determined by arbitration under the terms of the Arbitration Act, 1889. The Corporation will not supply at constant pressure for a year after the transfer. Additional water capital to the amount of £15,000 is required, repayable in sixty years. Surplus profits are to be divided between the Corporation and the outlying area in rateable proportions. The share of the latter is to be applied in reduction of the rate; while the former may be so applied or diverted to the district fund in the discretion of the Corporation.

The Menstone Water-Works (Transfer) Bill is to authorize the Rural District Council of Wharfedale to purchase the undertaking of the Menstone Water-Works Company, in accordance with the terms of the Company's Act of last year. The amount of the purchase money is to be determined by arbitration under the Lands Clauses Acts with reference to the purchase and taking of lands otherwise than by agreement; but the arbitrator is not to have regard to the fact of the Company being incorporated by Act of Parliament. The Council are to pay the taxed costs of obtaining the Company's last Act, with 4 per cent. interest from the beginning of the present year; and also the taxed costs of the winding up. Officers wishing to retire are to be compensated with a payment of two years' salary. The Council are to give notice to treat within three months. Additional water capital to the amount of £5000 is required, repayable in sixty years. Surplus water profits may be carried to the credit of the special expenses account of the contributory place of Menstone.

The South Essex Water Board Bill is to constitute and incorporate a Joint Water Board, consisting of representatives from the Councils of the urban districts of Barking Town, Grays Thurrock, Ilford, and Romford, and the rural districts of Orsett and Romford, all in the county of Essex, and to vest in such Authority the undertaking of the South Essex Water-Works Company. The constitution of the Board is defined, with curious provisions respecting disqualifications. Under certain conditions, the Brentwood Urban District Council and the Billericay Rural District Council are to become constituent Authorities. The arbitration is to be under the Lands Clauses Acts. New works are contemplated, including wells and pumping-stations at Roydon in the district of Epping, at Nazeing, and also at Netherall and other places named. These works are 34 in number; and are to be completed in fifteen years. Additional capital to the amount of £950,601 is allocated to the purchase of land and the execution of new works, and £306,000 for the extension and improvement of the undertaking. Surplus profits are to be applied in the reduction of the rates. The costs of the Bill and of the opposition of constituent Authorities to the South Essex Water Bill, 1899, are to be paid by the Board out of moneys raised under the Act.

The Spalding Water Bill is to authorize the Urban District Council of Spalding to acquire the undertaking of the Spalding Water-Works Company, originally incorporated in 1860. In 1890, power to purchase the undertaking was acquired by the South Lincolnshire Fen Water Company; but the power has remained unexercised, and is now to be repealed. The limits of the Bill are the urban district of Spalding. The arbitration is to be under the Lands Clauses Acts. The supply need not be constantly laid on under pressure. Rates for domestic supply are to be 8 and 7 per cent., with 8 per cent. for inns. Supplies for domestic and other purposes may be by meter, according to a scale of minimum charges. Additional water capital to the amount of £10,000 is required. The powers given to the District Council under the Bill are to be cumulative.

An Unsuspected Cause of Rust.—A writer in the "Scientific American" mentions the case of a highly-polished screw-cutting lathe becoming completely covered with a coating of rust under conditions which seemed to preclude all possibility of the presence of damp. Investigation, however, revealed the fact that for several days prior to the oxidation a gasoline furnace had been in prolonged use by some plumbers for the purpose of melting pots of lead for making leaded joints. This furnace had been placed upon the floor, 10 or 15 feet from the lathe, with no chimney or other means of ventilation. The water vapour generated by the combustion of the gas from the gasoline found a condenser in the polished steel of the lathe, the surface of which it immediately converted into rust. The use of ordinary illuminating gas in an unventilated building will cause a certain amount of vapour to condense in a similar way; but the evil may be minimized, if not entirely obviated, by the use of incandescent mantles.

Coal Mining in South Russia.—Before the members of the Manchester Geological Society a short time since, Mr. J. Crankshaw, F.G.S., read a paper on "Coal Mining in South Russia," dealing chiefly with the coal mines of the Jusowo district, which is the centre of the bituminous coalfield of the Donetz basin. He said few of the pits were more than 200 yards deep; they were rectangular in shape, and about 13ft. 6 in. by 5 feet, lined with timber, with one or two partitions. The workable seams varied in thickness from 72 to 15 inches; but the average was about 24 inches. The coal was generally of a good appearance, light in weight, with a fibrous fracture, and was described as "fatty" coal. Some of the seams yielded coal with a high percentage of gas; but it was also rather high in sulphur—ranging from 0·77 to 2·5 per cent. A large proportion of slack was produced; but this did not seem to be of much importance, as the same price was obtained for the coal, independently of size. The cost of getting and carting was equal to 58½d. to 69¾d. per ton, put in railway trucks. The selling price of the coal was equal to 8s. 1d. to 11s. 8d. per ton at the time of the author's visit, and had gone up considerably since. The average profit was quite 4s. per ton. Every encouragement was being given to schemes proposed by Englishmen and to the employment of English capital.

PERSONAL.

The estate of the late Lord FARRER has been valued at £119,290, including personalty of the net value of £102,936.

Mr. CHARLES MEIKLEJOHN, Engineer and Manager of the Rugby Gas-Works, has been installed W.M. for the present year of the Lodge of Rectitude, No. 502.

Mr. GEORGE SWINBURNE, Assoc.M.Inst.C.E., of the firm of Messrs. J. Coates and Co., Engineers, of Melbourne, and Managing-Director of the Colonial Gas Association, Limited, has been elected Director of the Metropolitan Gas Company of Melbourne.

We have pleasure in announcing that Dr. H. BUNTE, Professor at the Technical College at Carlsruhe, and General Secretary of the German Association of Gas and Water Engineers, has been created a Privy Councillor. He is well known to our readers as the Editor of the "Journal für Gasbeleuchtung," and the author of many valuable technical papers.

Mr. WILLIAM CROXFORD, who was for many years Secretary to the Brentford Gas Company, has been obliged, through failing health and advancing years, to resign that office. He is succeeded by Mr. WILLIAM MANN, the former Accountant to the Company. Mr. JOHN CROXFORD, a nephew of the retiring Secretary, has been promoted from the post of Cashier to that of Accountant. The newly-appointed Secretary is the eldest son of the late Mr. William Mann, who was Chief Engineer of the City of London Gas Company at Blackfriars, until that Company's amalgamation with the Gaslight and Coke Company in the year 1870.

OBITUARY.

The death occurred on the 14th inst., of Mr. C. PALLISTER, J.P., Chairman of the Northallerton Gas Company. Deceased was one of the founders of the Archer Lodge of Freemasons, No. 1337, at Northallerton, and was twice W.M.

The death is announced of Major ELIOT HODGKIN, who took a prominent part in the management of the Pulsometer Engineering Company, Limited, from its formation. Deceased met with an accident in the hunting field on the 8th ult., and succumbed to it last week.

At the age of 64, Mr. THOMAS ROBERTS passed away at Portmadoc last Saturday week. The deceased gentleman was well known throughout North Wales; and in South Carnarvonshire and Merionethshire he was connected with several water-works in the capacity of Engineer.

We regret to record the death, last Wednesday, from chronic bronchitis, aggravated by an attack of influenza, of Mr. CHARLES BELL, Manager of the Hemsworth Gas-Works, of which Messrs. Clayton, Son, and Co., Limited, are the owners. Deceased was highly respected and held in great confidence by the firm.

We regret to have to announce the death of Herr JULIUS QUAGLIO, of Berlin. He was one of the pioneers of water-gas manufacture, and was responsible for the plant first erected at Frankfort-on-the-Maine and Essen. He became widely known in connection with a pamphlet which he wrote entitled "Water Gas, the Fuel of the Future."

The death is also reported of Herr C. F. RAMMELSBERG, at Berlin, on the 28th ult. Deceased was a Chemist of cosmopolitan repute, best known for his knowledge of mineralogy; but he had also made valuable researches on the constitution of the double salts of ammonia, of double cyanides, and of lead-chamber crystals. He retired in 1891 from the position of chief of one of the chemical laboratories of the University of Berlin.

NOTES.

Cinder Concrete Floors.

Tests of a very cheap cinder-concrete flooring are reported from Chicago, in connection with some building operations in which this method of fire-proof construction was used. It appears that when the floors were made, doubts arose as to their strength. And little wonder, for the construction appears to be of the lightest description. The main framework of the floors was 12-inch rolled iron beams, at 6 feet centres. Between these beams the concrete arches were turned; the span being 5 ft. 10 in., while the rise was 8 inches, and the material 3 inches thick at the crown. The concrete was composed of 1 part of Portland cement, 3½ parts of coarse sand, and 6½ parts of cinders or small coke. Buried in this concrete was a sheet of No. 20 B.W.G. wire cloth, stiffened by $\frac{7}{8}$-inch rods woven into it every 9 inches. The rods ran transversely to the floor beams; and being cut to the length of the arch, were simply sprung into their place between the girders. It is not reported how the wire cloth and its rods were placed; but it may be imagined that after half the thickness of the concrete arch had been laid on the centering, the iron reinforcement was put in and the rest of the concrete laid over it. Twenty-seven days from the laying, a section of arch, 3 ft. 10 in. wide, was separated out for testing, by cutting it through from beam to beam. But even then the concrete was green; for the cinders, as usual, had the effect of delaying the setting. After a cushion of sand and planks had been placed upon the separated portion of the arch, it was loaded up with dead-weight until there was 1239 lbs. per square foot on it. The deflection of the crown of the arch under this load was ¼ inch, which remained constant for the six days of the test, when it was considered that the floor had proved its strength, and the load was removed.

The Strength of Foundations.

Mr. S. Anglin, Master of Engineering at the Royal University of Ireland, has had occasion to investigate the subject of the strength of foundations in a practical manner; a large mill under construction in Germany having failed. His attention was also drawn to the shutting up by the authorities of a town in Massachusetts of an extensive tenement house, because the foundations were too weak to bear the walls. Mr. Anglin classifies foundations in three general orders—rock, firm earth, and soft earth. A good ordinary rock foundation will bear anything up to 20 tons per square foot; while the solid mother rock sometimes met with in cuttings for reservoir and tank dams has practically no limit of strength. Under the head of firm earth may be included hard clay, clean dry gravel, and clean, sharp sand. It is desirable in England that the foundations should be carried at least 3 feet below the surface of the ground for sand and gravel, and 4 feet for clay, in order that they may not be weakened by the disintegrating effects of frost and wet. Different authorities vary much in their estimate of the load that this class of foundations will bear in safety. The German rule is 2½ tons per square foot. With good clay, well protected from the air and water, double this load can be safely provided for. The load on the London clay beneath the foundations of the Nelson Column in Trafalgar Square is not more than 1·3 tons to the square foot. Gravel and sand have borne 12 tons to the square foot. The former will not hurt if it is wet, because it does not run. Sand, on the contrary, must be kept from running by draining or piling. The tower of the Hamburg Water-Works is actually built on a quick-sand enclosed in a ring of sheet piling going below the level of saturation. Very soft ground must be piled. The City of Belfast has many examples of heavy buildings on the weakest of all possible foundations, rendered quite safe by artificial means.

Evidence for the Econometer.

Mr. A. Bement writes to "Engineering" from Chicago to recommend the principle of checking the operation of industrial furnaces by sampling the waste gases for carbonic acid. He states that he has employed Arndt's econometer with complete success in all cases, and contends that a proper understanding of the indications of the instrument affords evidence of the due proportioning of the air entering the furnace. In certain experimental work, the object of which was to produce perfect combustion without excess of air, the fuel being bituminous coal, it was found possible to get the proportion of carbonic acid up to 19; but it fell to 7·3 in three minutes, owing to the coal being supplied to the fire in such quantity that the oxygen of the air was insufficient to burn up all the hydrocarbons given off. After several attempts, the right way of stoking was hit upon, and the proportion of carbonic acid remained constant at 19. In cases of ordinary boiler firing, the effect of varying thickness of the fire is immediately indicated by the instrument; and it is found that about 10 per cent. of carbonic acid is about the maximum for this kind of work, with the furnace employed. Taking all his experiences together, Mr. Bement concludes that the determination of carbonic acid alone affords a most convenient and positive guide for the avoidance of carbonic oxide, as well as excess of air. He therefore contends that the determination of carbonic acid only, by the continuous indications of the gravimetric instrument, is of more value as a guide for working furnaces at the highest efficiency than any form of chemical analysis. He uses it, indeed, in preference to chemical analysis, even when the latter is going on for other purposes at the time. This, of course, does not apply to the ascertainment of the heat-balance, for which the best obtainable analytical work is not complete or comprehensive enough, except for the attainment of merely approximate results.

Institution of Gas Engineers.—The annual general meeting of the Institution will be held on the 3rd prox.; but, as usual, only the formal business, consisting of the reception of the report of the Scrutineers and the election of President, Vice-President, members of Council (to replace those retiring), and Auditors, will be transacted. The meeting will then be adjourned till May 1, when the members will assemble at the Institution of Civil Engineers to deal with technical questions.

The Dividend of the Gaslight and Coke Company.—We learn from the Secretary and General Manager of the Gaslight and Coke Company, Mr. John W. Field, that the accounts for the half year ending Dec. 31, 1899, show that (subject to audit) the balance to the credit of the net revenue account will enable the Directors to recommend the payment of a dividend at the statutory rate of £4 18s. per cent. per annum, carrying forward a balance of £193,333 8s. 4d. This time last year the balance to the good was £53,759; while in August it was £139,557 19s.

TECHNICAL RECORD.

A DE BROUWER COKE-CONVEYOR AND A CARBURETTED WATER-GAS PLANT AT THE CRYSTAL PALACE GAS-WORKS.

The Crystal Palace District Gas Company supply an extensive area, containing a residential population. The needs of that population, the natural depreciation to which plant must yield with time and service, the circumstances of the labour market, and the necessity of meeting expanding business with a minimum increase in manual labour, have all combined to render inevitable a large scheme of extension and improvement. It was to this work that Mr. Sydney Y. Shoubridge found it necessary to devote himself soon after his installation as Engineer of the Company; and now section by section it is being, and will be, taken in hand as occasion admits and necessitates. The preparatory plans perfected, the early part of last year witnessed the signing of the first contracts. To-day the works comprised in those contracts are practically completed—somewhat behind the stipulated time, it is true, but the fault (oft-heard in many places during the past year) rests with the state of the iron and steel trade, and is not actually attributable to any remissness on the part of the contractors. The works which are now almost out of the hands of the latter consist of a complete carburetted water-gas plant and a De Brouwer coke conveyor and elevator; and it is with these, and not prospective work, that the present article will deal.

The De Brouwer Coke-Conveying Plant.

While from the point of view of magnitude and of capability as a gas producer the carburetted water-gas plant is of foremost importance to the Company, the De Brouwer coke-conveying plant—this being its first adoption in this country—possesses an interest for English gas engineers which, for the moment, overshadows the claims to attention of the more imposing water-gas apparatus. Therefore, upon the coke-conveyor we will first pen the information at command. It would not be news to readers of the "Journal" to be told that the merits of this conveyor have obtained for it an extensive use on the Continent; but it may be interesting to many to learn that it was the opportunity which was afforded Mr. Shoubridge of witnessing the operation of the plant at the Hague Gas-Works, at the time of the visit of the Institution of Gas Engineers, that induced him to advise his Directors to adopt the De Brouwer system in preference to home-invented competitors. This is a tribute to the value to English gas engineers of opportunities for investigating the work and practice of their Continental brethren. Although Messrs. Jenkins and Co., Limited, of Retford, have now been "sole makers" of this form of conveyor for a considerable time, this is the only example of the plant that has so far been erected in this country; and, had the members of the Institution not seen it at work on the Continent, it might possibly have been some time longer before the system obtained a footing in this country—gas engineers, like other human beings, having an inclination for a little ocular demonstration of the value of a thing before they invest their money in it. But now that the De Brouwer apparatus has established itself here, doubtless more will soon be heard of it—in fact, we know that several engineers of important gas-works who are contemplating laying down coke-conveying apparatus are delaying their plans pending the opportunity of being able to personally observe the performance of the Crystal Palace plant.

It is not many years ago that we heard it said that a really good coke-conveyor, which should be a help and not a hindrance on a gas-works, was a desideratum. Of late there has been quite a spurt in the equipment of retort-houses with plant for automatically removing the coke; and there are at the present time, in actual operation in gas-works, several examples of different makes of coke-conveyors, between which it is now merely a question of the "survival of the fittest." In the De Brouwer conveyor, Mr. Shoubridge thoroughly believes that he has secured a very valuable help in facilitating the work of the retort-house, and in lightening its cost. Among other points which struck him when he saw the plant in operation at the Hague works were its simplicity, and the almost entire absence of friction and rattle. The latter was rather a conspicuous and irritating feature of some of the older forms of pan conveyors, which were blessed with so many parts and so much weight that they gave endless trouble in working, and no little expense was involved in the constant replacement of worn-out portions. In this respect, the De Brouwer conveyor stands out in marked contrast; and it is Mr. Shoubridge's impression that it is destined to succeed on this very score—that there is, so far as he has been able to judge, so little wear and tear about it. Without pursuing the general subject further, we will at once proceed to describe the plant laid down at the Crystal Palace works.

The conveyor has been constructed for dealing with the coke from No. 4 retort-house. This house occupies a position in the works where the works railways narrow towards the main junction communicating with the South-Eastern Railway. A double line of railway passes close to one end of the house, and a single line close to the other end. On both sides of the house, there are large coal-storing spaces, and several buildings containing boilers and other machinery. The coke yard at the end where the double line is, is limited in extent by other branches of the railway passing to other portions of the works, and the space at the opposite end is only narrow on account of the boundary. The retort-house floor is at the same level as the coke yard; but there is a basement below, in which the furnaces and regenerators are built. The stoking is done by means of West's compressed-air machinery; and the coke has, until recently, been wheeled out to one end of the house, which is fitted with eighteen beds of eight through retorts, 20 feet long.

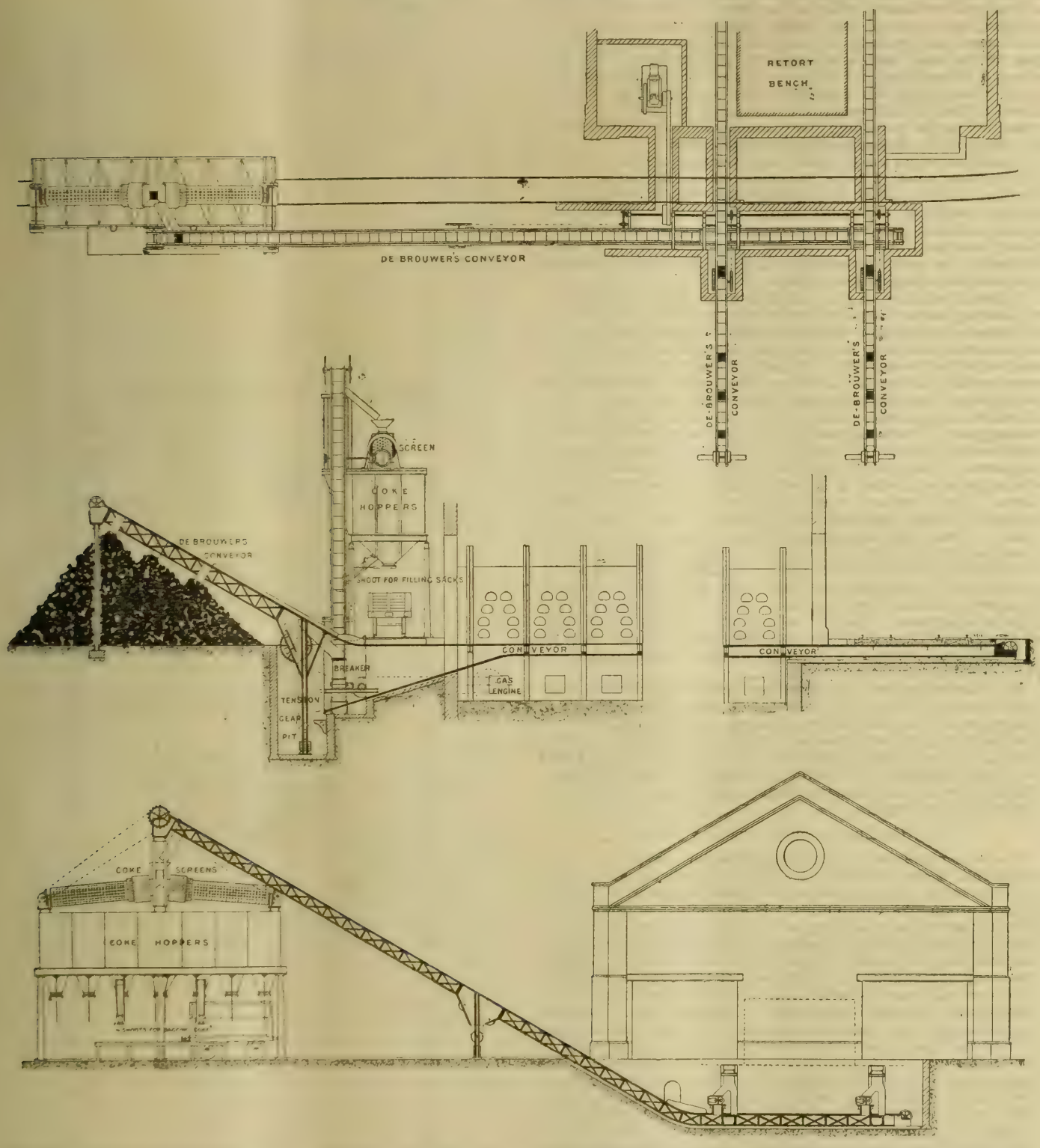
The drawings on p. 203 show the plant in side and end elevation and plan. The plant is designed to take the coke from each side of the retort-bench, and quench it thoroughly at the end of the retort-house outside. The coke from each conveyor, after having all the quenching water drained out of it on the sloping end of the conveyors, falls into a return shoot, which delivers it either to a coke-breaker or direct to the horizontal part of the inclined cross conveyor, which then conveys the coke to the screens for separating the breeze and dust. Underneath the screen is placed a large storage hopper, capable of taking twenty-four hours make of coke, and divided into eight compartments, of which one holds breeze dust, another clean breeze, four others screened broken coke, and the other two large coke. By an arrangement of slides in the screens, six of the compartments can be filled with unbroken coke separated from breeze and dust. The storage hopper is supported on columns spanning the railway; and each compartment has a door at the bottom with levers, by moving which the coke can be loaded into railway waggons or carts placed underneath. The doors are of considerable size, but can be moved with the greatest ease, as they run on a simple arrangement of rollers. At one side of the supporting columns, there is a platform raised above the ground to the level of the bed of the coke carts or vans; and by means of side shoots from the conical bottoms of two of the compartments of the hopper, the coke is filled into bags, which are then taken on sack trucks, and placed in the coke-vans backed up to the platform for the purpose. The bagging shoots have an arrangement at the outlet end for holding the bags open, and clips for keeping them in position. The clips act automatically, so that the bag, when slipped under them, is held fast and gripped tighter as the load increases. A platform weighing-machine is placed under each bagging shoot at the level of the platform, so that the bags can be weighed and accurately filled with the required quantity of coke.

The long sloping ends of the two retort-house conveyors are for two purposes. Firstly, they provide a means of continuing the use of the retort-house conveyor when the storage hopper happens to be full. This may easily occur from want of railway waggons, from a block on the railway, or on Sundays and holidays. Secondly, they are fitted with slides, by opening which coke can be stored over the whole space at the end of the retort-house to a depth of 20 feet.

In this installation, therefore, the coke, amounting to 80 tons per day, can be drawn from the retorts, dropped into the conveyor, carried to the outside of the retort-house, get thoroughly quenched there, pass into the coke-breaker if broken coke is wanted, or pass direct to the cross conveyor, be elevated to the top of the screens, go through the screens where the coke and breeze and dust are separated, be stored in overhead hoppers, and be loaded into carts or railway waggons, without any hand labour at all, except the opening of the doors in the hopper to let the coke fall out into the waggon.

The conveyors in the retort-house consist of two troughs—one on each side of the bench—built up of steel plates and angles. The troughs are a little over 2 feet wide, and are let in level with the floor-plates. The troughs are continuous from end to end of the house, under the railways outside, and up the sloping ends to the top; the horizontal portion being joined to the slope by a curved piece, of which the radius is considerable and the curve very easy. In this trough a transmitting chain is laid. The chain is formed of two lines of links kept apart by means of round iron stay-bars at intervals, so that each line of links runs close to the sides of the trough, where there is placed a line of angle-steel to form renewable pieces to take the wear. The chain rather resembles a rope ladder than anything else we can think of at the moment. It is continuous throughout the length of trough up to the top of the slope, where it passes over two pulleys or rollers keyed to a shaft running in bearings. The chain then returns inside the lower member of the latticed structure, and then engages with the two sprocket wheels of the driving mechanism. It next takes a course round a weighted tension roller, and up a sloping angle steel roadway to the underside of the girders supporting the retort-house floor. The angle roadway is bolted to these girders, and takes up a space of 4 inches below them, extending from end to end of the retort-house. The chain then passes round another pair of rollers, and so back into the trough in the retort-house floor. Water is run into the trough at the end of the retort-house, from a plain pipe, so that the water follows the coke as it is moved along by the chain. At the commencement of the sloping end, there is fixed another water-pipe for the purpose of making good the rapid evaporation which takes place from the quenching of the coke. As soon as a "draw" is completed, the water is allowed to run into the trough until it is filled to a depth of ¼ or ½ an inch, when both taps are closed. Immediately before the commencement of the next "draw," the driving apparatus is started, and the chain travels very slowly towards the sloping

THE DE BROUWER COKE CONVEYING AND ELEVATING PLANT AT THE CRYSTAL PALACE GAS-WORKS.



end, and returns underneath the floor. The coke is then drawn out of the retorts, and falls directly into the trough, the whole width of which is clear, except for about 1½ inches at each side, where the chain runs. Owing to the forward motion of the chain, one of the stay-bars comes against the heap of coke, and sets it in motion; and it continues to move forward by sliding gently along without showing any tendency to turn over, or move at all except bodily. No doubt the small amount of water in the trough serves to lubricate the way, as well as to keep the trough and chain quite cool. The moving heap of coke pushes the water in the whole length of the trough before it, and so fills the portion at the foot of the slope to a considerable depth; and the sides are considerably deeper there to allow for this. As soon as the coke (which is still red hot in the mass, though quite quenched at the bottom for an inch or two) arrives at the foot of the slope, the water is pushed still further up the slope until the action of gravity overcomes the resistance to backward flow through the mass of the coke; and then the water falls back over the top of it, and through its mass, quickly quenching it thoroughly—the rapid and somewhat turbulent evaporation of the water causing the operation to be more complete. While the quenching is going on, the coke is being moved forward up the slope; and as soon as it gets above the surface of the water, the surplus moisture immediately drains out of it, and runs back down the slope, while the heat still left in the coke evaporates a further portion, and makes it practically dry a few feet above the foot of the slope. There is no waste of water out of the trough, except that lost by evaporation in quenching; and none overflows into any other portion of the apparatus.

The operation of the conveyor and the quenching of the coke have been described somewhat minutely, because of the exceedingly simple means employed to attain a thoroughly satisfactory result. There is nothing more complicated than a couple of plug cocks and two pieces of plain pipe used in the whole operation of quenching—no sprays, nor roses, nor any other delicate parts. Indeed, the prominent feature of the whole of the mechanism is its simplicity. For instance, an inspection of the conveyor at rest would lead nine out of every ten competent men to say that such a plant would be more likely to smash the coke than to move it, especially at the inclined end; yet the fact is that the coke is pushed along in a manner which can only be described as practically perfect.

Great credit is due to M. De Brouwer for the three chief features of his patent: First, the idea of placing a remarkably simple and light transmitting apparatus in a trough in such a way as to cause the larger lumps of coke to push the breeze and small pieces forward. Second, the supply of water to the trough to keep the parts cool, and the use of the water at the

delivery end of the plant to quench the coke thoroughly, together with the inclined end for draining and drying the coke, to prevent its being saturated and waterlogged. Third, the sloping end continuous with the horizontal portion to act as an elevator, and save all the endless trouble, wear and tear of machinery, and crushing of coke which arises from the dropping of the coke from a conveyor to an elevator. Then the absence of anything but the merest puff of steam inside the retort-house must add comfort to the workmen, and tend to increase their healthiness; the enormous volumes of steam generated at the quenching place outside indicate conclusively the relief of the atmosphere of the retort-house.

The apparatus at the Crystal Palace works is driven by means of a 14-horse power Tangye gas-engine placed in a room under the floor of the retort-house, and driving a line of shafting outside the walls of the house under the railway. There are separate friction clutches for starting or stopping either of the three conveyors, and claw clutches for controlling the coal-breakers; the levers for working the clutches being all brought to convenient stands above ground.

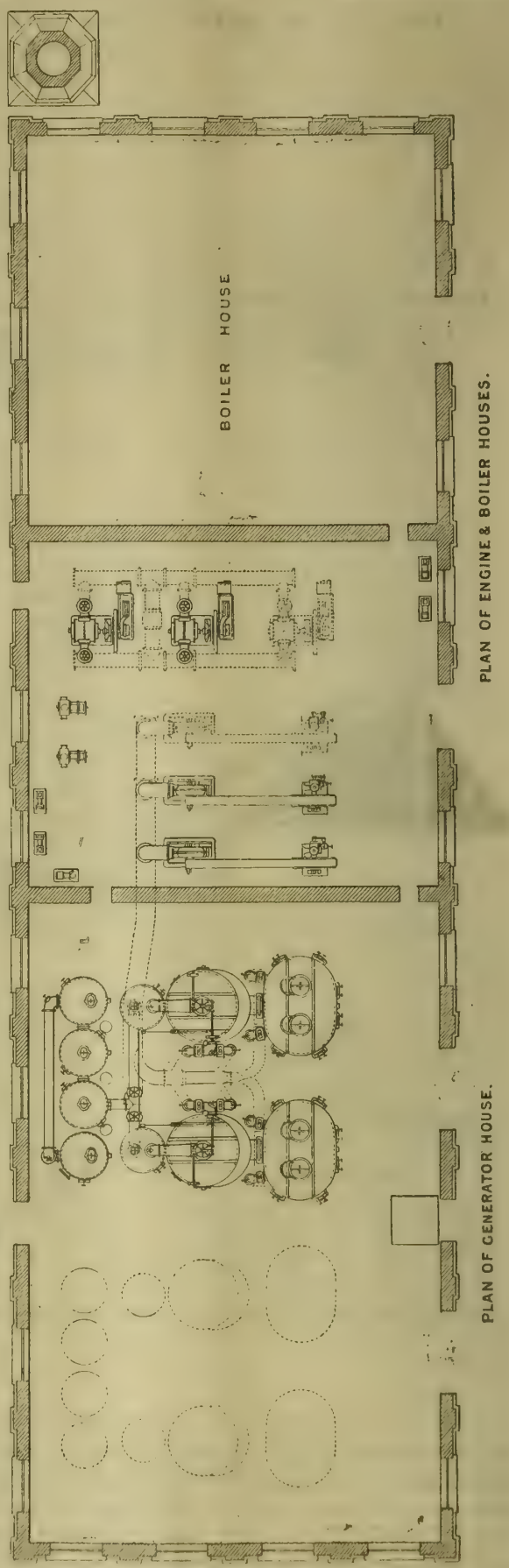
A fact illustrative of the vast difference between gas-works engineering on the Continent and that in England has come to our knowledge during a visit to this plant. Nearly every English engineer who had seen the conveyors at work in Belgium came over with the thought that success on the Continent did not mean certain success here, because the retort-houses there are mostly short, and the apparatus is therefore made light. Considerable criticism was spent on the chains forming the transmitting part. The ever-present subject of wear and tear of the structure also seemed to weigh heavily in the minds of English engineers. The troughs on the Continent are made of two side angle-irons riveted to a bottom plate, on which the coke moves. The destruction of this plate in the course of years means to English engineers the practical renewal of the whole plant. It was only after much disappointment in getting the conveyor adopted that Mr. Jenkins hit upon the very simple, and consequently efficient plan of making the wearing portion of the troughs easily renewable, and quite distinct from the permanent structure. This is done by placing in the trough a plate forming a false bottom. The difficulty of the strength of the chain was met by making the links proportionately stronger, and all of forged steel instead of castings; all holes being bored and pins turned exactly to gauge.

Mr. Shoubridge and his Directors deserve the thanks of the Gas Industry for having the courage to adopt the first of these conveyors on this side of the Channel; and we trust they will find the machinery as successful in their case as it seems to have been in a large number of places on the Continent. We would also bear testimony to the thought and practical skill which Messrs. Jenkins and Co. have spent on the design and construction of the apparatus.

The Carburetted Water-Gas Plant.

We now come to the carburetted water-gas plant, which, although it is given second place here, is really of superior importance to the Company in that it forms a powerful addition to their productive capabilities. The principal portion of the plant is housed in a building which, while it does not possess any particularly striking structural features, is interesting from the fact that the whole of the bricks and even the artificial stone copings and finials (composed of fine granite chippings and portland cement) were made on the works by the Company's own men, who also did the constructive work. In passing, it may interest readers to learn that the works are situated on a bed of clay some 60 to 70 feet in depth; and in order to utilize this, to give employment to their men during the slack season, and to profitably dispose of the spoil from excavations, the Company have put down a complete brick-making plant, with the result that last year something like 2 million bricks were produced. Returning to the subject in hand, the disposition of the buildings and water-gas plant will be seen on the accompanying plan. The generator-room is 93 ft. by 58 ft. 3 in. by 40 feet, inside measurements. It has an iron and slate roof; and is exceedingly well lighted. Adjoining is the engine-room, the dimensions of which are 50 ft. by 58 ft. by 20 ft.; and next to it is the boiler-room, which is 56 ft. by 58 ft., and the same height as the engine-room. These buildings and the machinery have all been designed for four sets of plant, equal to a daily production of 5 million cubic feet of carburetted water gas. At present only half the space is occupied with two sets of plant, capable of producing together 2½ million cubic feet a day.

The plant, which has been constructed under the Merrifield-Westcott-Pearson patents, was supplied and erected by the Economical Gas Apparatus Construction Company, Limited. It has only been at work a few weeks, and during that time not fully; so that there has not been an opportunity of thoroughly testing its performance. But so far as Mr. Shoubridge has been able to judge, the work has been carried out very satisfactorily; and the plant has, in actual work, considerably exceeded its nominal output. This promises well for the satisfactory fulfilment of the contractors' guarantee, which is to the effect that the plant shall give an efficiency equal, if not superior, to that of any yet erected. The generators are oval in shape, built of tank steel, with the usual double fire-brick linings, and asbestos non-conducting material between the fire-brick and the shells. They have hopper bottoms for removing



THE CARBURETTED WATER-GAS PLANT AT THE CRYSTAL PALACE GAS-WORKS.

the ashes, also stoking-holes for removing the clinkers from the grate-bars, and two coaling-holes on each generator for the equal distribution of the fuel. The superheaters and fixing chambers are in one shell; the superheaters being oval, and the section of the fixing-chambers circular—the total height being 38 feet. These also have the usual substantial fire-brick lining and asbestos non-conducting material between the fire-brick and the shell. They are divided into two compartments by fire-brick arches, supported from the foundations, so that no strain can come upon the shells; the superheaters and fixing-chambers being filled with checker bricks. Each compartment is provided with an air-blast connection, which enables the operators to control the heats, and keep them at the proper temperature in each chamber. The carburetting chamber is an open space between the other two.

The generators and superheaters are connected together with water-cooled valves and short connections. The valves are so

arranged and connected up with hand wheels, racks, and pinions that, by opening one, it closes the other; at the same time reversing the steam to the generator—gas then being made up or down in the generator according to the position of the water-cooled valves. The water gas leaves the generator either at the bottom or top, passing to a flue in the superheater common to both openings. It then travels down the flue to the bottom of the superheater, and up through a mass of hot checker brick, where it is superheated to about 1500° or 1600° Fahr. At the base of the fixing-chamber, or just below it, the water gas comes into contact with a finely divided stream of oil sprayed into the chamber by an improved oil-injector, arranged at equal distances around the shell. The injector sprays the oil, in the form of a batswing gas-flame, in a thin wide sheet; and the hot water gas vaporizes it, and mixes with the oil vapours, carrying them through the beehive arch and the hot checker bricks of the fixing-chamber, where the oil is fixed, and converted into permanent gas. It then passes off through the gas-outlet and take-off pipe to the washer; thence through the oil-heater to the scrubbers, condensers, and relief holder. There are two scrubbers and two condensers so arranged that the gas passes through both scrubbers and both condensers. The oil is heated before entering the vaporizing-chamber by the hot gas on its way from the washers to the scrubbers; the oil-heater being placed between the wash-box and the scrubbers, and the gas giving up part of its heat to the oil. It is claimed that, by this mode of heating the oil, better results and a more uniform temperature are obtained, as the oil-heater coils do not become clogged up with lampblack and pitch—thus saving considerable time and annoyance in cleaning.

Reverting to the generator, another advantage claimed is that, with a greater area of grate bar and a shallow fire bed, an increased make of gas from a given amount of fuel is obtained; or, in other words, less fuel per 1000 cubic feet of gas produced is required. This is accomplished by blowing the generators so as to produce just sufficient carbonic oxide to keep the superheater and fixing-chamber at the proper temperature to fix the oil and burn the excess carbonic oxide to carbonic acid in the generator, and storing the heat in the fuel to decompose the steam, allowing no carbonic oxide to escape to smoke-stack.

There are several other improvements in the plant, such as the valves in the wash-boxes, which are so connected up that, when the stack-valve is open, the valve in the wash-box is closed over the end of the dip-pipe, preventing any escape of gas to the fixing-chamber. When the stack-valve is open from loss of seal in the washers, or other causes familiar to gas makers, with this arrangement the water can be entirely drawn out of the wash-boxes, and the valve opened without any danger of an explosion, which is liable to take place by the gas igniting in the take-off pipe.

Coming next to the engine-room (the dimensions of which have already been stated), we think we may say, without fear of contradiction, that it is one of the brightest engine-rooms in connection with water-gas plant in the kingdom. The walls are built of glazed bricks, with ornamental dado and frieze. The floor is tiled; and the roof is lined with stained boards. The room is well lighted with side windows; and near its apex a portion of the roof is also glazed. The machinery comprises two Sturtevant gas blowers, strap-driven by two Tangye engines, of the high-speed inverted type (350 revolutions), made specially for this class of work. There are also two of Messrs. Waller and Co.'s four-blade exhausters and engines, each capable of dealing with 100,000 cubic feet of gas an hour, and used for pumping the gas out of the relief holder, and forcing it through the purifiers and meter into the storage holder. A number of other pumps for oil and water complete the equipment of the room. The machinery is all in duplicate—one set being sufficient for working the water-gas plant so far erected; the other set being kept in reserve.

In the adjoining boiler-house, there are two boilers, 30 feet long by 8 feet diameter, fired with breeze and tar made in the water-gas plant. They are fitted with a forced-draught arrangement; but this is hardly a necessity when firing with tar, because the house is provided with a good chimney, 120 feet in height. Under the conditions prevailing here, that very difficult operation of burning tar without smoke is accomplished. By means of two small valves, the steam and tar sprays are under complete control.

A unique and most important feature in promoting the efficiency of this water-gas plant is the method of re-circulating the water, and dealing with the tar. All the effluent liquor from the apparatus is run off into a specially designed tar-separator (placed underground), where the tar automatically works its way into one compartment, from which it runs out of its own accord into a tar settling-tank. From here it is pumped to the feed-tank in the boiler-room for use as fuel, or, preferably, taken to the tar-well for sale. The effluent water from the separator runs into the water-tank, from whence it is pumped and re-circulated over and over again through the washers and scrubbers—thus in a short time becoming saturated with the different components of the gas. The condenser water is re-circulated and made use of; so that the only water which has to be provided after the plant has once been started is that required for the boilers.

Within a convenient distance of the generator-house is the oil-storage tank, 60 feet diameter by 25 feet deep, and capable of holding 442,000 gallons. The oil is sent to the works in tank-waggons, and pumped from them into the storage tank, from which it is pumped to the carburetting chambers as may be needed from time to time.

The gas passes from the condensers and scrubbers to an existing holder, which is used as a relief holder, and from there it is exhausted and forced through a set of new purifiers. The house in which these are located is a skeleton structure, made of steel stanchions and girders, built in three stages—the purifiers being on the second stage, with a revivifying-floor above. The latter is constructed of breeze concrete, strengthened by pieces of old gas-tubing, somewhat on the principle of the Monnier system. The contractors for the ironwork and purifiers were Messrs. C. & W. Walker, of Donnington. The purifiers, five in number, are each 40 ft. by 22 ft. by 4 ft. 9 in. without lutes; each vessel having two lids, with india-rubber joints, similar to the plan adopted by Mr. Henry Green, at Preston. Two light travelling cranes have been provided for lifting the lids. In emptying the purifiers, the material in the case of oxide falls through openings in the bottom of the boxes, into trucks on rails beneath, which convey it to a hoist at one side of the structure, which raises it to the revivifying-floor above. When revivified, the material is returned to the purifiers from the upper floor by means of shoots. Three of the purifiers are charged with lime and two with oxide. The connections throughout are 24-inch; and the purifiers are all controlled by means of Weck centre-valves. Close to the purifier-house is the meter for the carburetted water gas. It is built on Mr. Livesey's brick-tank principle, was supplied by the Gas Meter Company, and has a capacity of 100,000 cubic feet per hour. Adjacent to this, a photometer-house is being erected.

Projected Inclined Retort Installations.

This ends our notice of the completed extensions and improvements, and now just a few words in conclusion as to the next steps to be taken in the remodelling of the works. At the present time, one of the old retort-houses, the settings in which were quite worn out, has been razed to the ground, and a new building is to be erected and furnished with inclined retort plant similar to that Mr. Shoubridge put in at Salford. It is hoped the house will be finished in time to assist in meeting the demands of next winter. Eventually, if Mr. Shoubridge's intentions are consummated, the whole of the horizontal retort-settings on the works now worked by hand will, as they reach the end of their profitable working life, be converted to the inclined retort system. Sufficient has been said to show that the Crystal Palace Gas-Works will, in the near future, contain one of the best equipments on modern lines of any similar establishment near London.

THE EVERETT COKE-OVEN GAS PLANT.

The Installation at Boston, U.S.A.

In "Progressive Age" for the 1st. inst., there appeared an article by Dr. F. Schniewind, of the United Coke and Gas Company, on the composition of the gas produced by the above-named plant, which is now being supplied to two gas-works in Boston (U.S.A.). It may be remembered that a description of the plant, prepared from articles contributed by Dr. Schniewind to our American contemporary, was given in the last volume of the "Journal" (pp. 1114, 1176); but when he wrote them no data were available in regard to the composition or physical properties of the gas. As it is at present in regular use in Boston, he has been able to obtain them, and place them on record. The sample tested was taken at the Allston works of the Brookline Gas Company, and was examined by Dr. J. F. Wing, Chemist of the Boston Gas Company, in the presence of several prominent gas men. The illuminating power was found to be 21·1 candles; the composition of the gas being as follows:—

	Per Cent.
Illuminants (C_mH_n)	6·6
Marsh gas	40·3
Hydrogen	37·2
Carbonic oxide	7·3
Carbonic acid	0·4
Oxygen	..
Nitrogen	8·1
Total	99·9

The gas was part of the first ten hours' production, and had been treated only by the condensing plant, and purified by oxide of iron and lime. It had not been enriched. The organic sulphur, according to determinations made by the State Gas Inspector, amounted to less than 8 grains per 100 cubic feet, whereas the law allows 20 grains. The purified gas was free from sulphuretted hydrogen.

Dr. Schniewind thought it would be of interest to compare the Everett gas with other illuminating gases; and he selected for the purpose carburetted water gas of average candle power, ordinary London coal gas (average of three companies), gas usually supplied in the United States (average of ten cities), and

coke-oven gas of the New England Gas and Coke Company. The following are the figures:—

	Carburetted Water-Gas.	London Coal-Gas.	American Coal-Gas.	Everett Coal-Oven Gas.
Illuminants (C_mH_n)	12·82	3·43	6·19	6·6
Marsh gas	18·88	33·88	37·41	40·3
Hydrogen	37·20	52·85	46·38	37·2
Carbonic oxide	28·26	5·34	5·53	7·3
Carbonic acid	0·14	0·65	0·52	0·4
Oxygen	0·06	0·23	0·25	..
Nitrogen	2 64	3·94	3·72	8·1
	100·00	100·32	100·00	99·9
Candle power	22 0	16·4	16·17	22·1
Calorific value (B.T.U.)	749·9	648·8	734·00	749·7
Specific gravity	0·582	0·376	0·429	0·5

Dr. Schniewind says that it is evident from this table that the coke-oven gas as now produced at Everett is even superior to standard coal gas. It is only natural, therefore, that everybody connected with the enterprise feels elated over the results. It should be understood, however, that it is not expected to maintain such a high candle power as at present, for reasons to be explained later on, in connection with the quantity of gas produced. At present, the coking time of the ovens is about 32 hours. This will be materially reduced. The surplus gas is only taken during the first ten hours, and amounts to 2900 cubic feet per gross ton of coal. At this rate the plant is not yet operating under the best heat economy, which could hardly be expected after so short a period of operating the gas department. The illuminating value of the gas is constantly decreasing with the progress of the coking operation. Any increase in the volume of the surplus must therefore necessarily add gas of a lower candle power, whereby the average will be somewhat reduced. How much this will be, the near future will tell; but it is expected that the illuminating power, even of the maximum surplus, will not fall below 17 to 18 candles. At the time the article was written, there were 200 of the entire 400 ovens in operation. The remaining 200 were to be started within four to six weeks. After starting the first batteries, it was found that certain red brick in the foundations of the ovens was of such poor quality that it had to be replaced by fire-brick. This delayed the starting of the plant to its full capacity. Considering the novelty of the enterprise, the fact that, beyond this unimportant change, no serious trouble of any nature has been encountered, but that, on the contrary, the starting of the colossal plant in all its departments took place without any hitch, speaks creditably for all parties connected with its design and management. The tar has proved to be of excellent quality; there is no difficulty in keeping the sulphate of ammonia above the usual standard of 25 per cent. ammonia; and the coke for all purposes has met with remarkable success. The bulk of the production is now used under the locomotives of the Boston and Maine and Boston and Albany Railroads. The President of the former Railway Company (Mr. L. Tuttle) has expressed the opinion that it is a perfect locomotive fuel. Dr. Schniewind states that experience has confirmed this good testimony. It has, he says, proved entirely satisfactory to the Railway Companies, and more so to their patrons. The results of using the coke under stationary boilers are shown by the following test, extending over 36 hours, made by a large consumer:—

Coke used	7,743 lbs.
Water actually evaporated	86,720 ,,
Equivalent water evaporated from 212° Fahr.	90,016 ,,
Water evaporated per pound of coke used	11·275 ,,
Equivalent water evaporated per pound of coke used from 212° Fahr.	11·705 ,,
Salt water pumped	2,312,442 gals.
Salt water pumped per pound of coke used	299·5 ,,
Average temperature of feed water	206·5 degs.
Average temperature of heat in the flue	437·5 ,,
Draught in the flue	0·25 in.
Average steam pressure	113·5 lbs.
Average water pressure	65·0 ,,
Coke used per sq. foot of grate surface	78·54 ,,
Percentage of refuse in coke	7·08 ,,

Furthermore, the coke is stated to be successfully used by foundries. Large export shipments have been made to Mexico and Canada, where it is used, instead of Connellsville coke, by copper, nickel, and silver smelters. A large crushing plant is also in operation for the manufacture of crushed and screened coke of various sizes. For all these purposes the demand for coke is constantly increasing, and orders have been booked ahead for the larger part of the product of the current year. This proves conclusively that the demand for smokeless fuel exists, and also that the Otto-Hoffmann coke meets it. The New England Gas and Coke Company find themselves, after a few months' operation, in the enviable position to refuse the acceptance of coke orders on account of their inability to fill them. Dr. Schniewind thinks it may be predicted, without running the risk of being over-sanguine, that the Otto-Hoffmann process is destined to play an important part in the solution of the great problem of supplying in large cities light, heat, and power from one central station.

REGISTER OF PATENTS.

Automatically Operating a Valve at any Predetermined Time.—Stenhouse, A., and Whitehead, E. A., of Broken Hill, New South Wales. No. 26,792; Dec. 19, 1898.

This invention has for its object to provide apparatus for operating a valve whereby (say) the supply of gas flowing through a pipe may be turned on or started automatically at any predetermined time. It consists essentially in the employment of a valve in the supply-pipe, arranged in such a manner that it tends to close or open (as the case may be) on the application or release of tension of a cord connected directly to, or indirectly with, it and with the drum of an alarum mechanism of a clock; intermediate mechanism being in some cases employed between the drum and the valve. The apparatus may be used (for instance) for operating incandescent burners having pilot-lights, and with the object of making the lighting and turning out of street-lamps automatic. In this case, the patentees remark, it is not only necessary to be able to turn out the light at any time determined upon, but also to turn it up again at any predetermined time. To enable this to be done, they have designed an "alarum" mechanism of which the timing portions are in duplicate—one to control the turning on of the valve, and the other its turning off.

The ordinary valve or cock has a two-arm lever, and attached to each arm is a chain or cord. To one of the cords is secured a heavy weight; and to the other is attached a cord-gripper, to be described later. The weight must be sufficiently heavy to overcome the friction of the valve and the weight of the cord-gripper. The clock employed has an ordinary dial and two indicator dials, on which are marked the times of opening and closing the valve—their faces showing 24 hours. An endless cord passes round, and is driven by, the alarum drum of the clock, and runs through the cord-gripper and over guide-pulleys set in suitable positions. One of the pulleys has its spindle set in a slot, and is provided with a thumb-screw, by means of which it may be moved in the slot so as to put tension on the endless cord. A fixed plate is provided with pins, one at each end, and is set in such position as to actuate the cord-gripper at the top and bottom of its stroke.

The cord-gripper consists of a plate having guide-holes through which the cord passes, and eccentrics between, bearing against the cord. The eccentrics are set on pins fixed in the plate, and have levers attached, which are connected at their free ends with toggle-links meeting at the centre of the plate upon a pin. A flat spring is fixed at one end to the pin on the plate; and at its other end it presses upon the pin connecting a lever with a toggle-link so as to continually exert a force upon the levers towards the cord, and so cause the eccentrics to grip the cord.

The action of the apparatus (which is described in the specification in connection with a series of detail drawings—23 in all) is as follows: At the time for which the apparatus is set to turn on the valve, the "alarum" mechanism for the purpose is set in motion by the clock, and winds up the endless cord, which, being automatically gripped by the cord-gripper, pulls on the valve-lever cord. This action, however, is only permitted to continue through a sufficient distance to open the valve; and then the mechanism ceases to work. When the time arrives at which the valve is to be closed, the "alarum" mechanism for the purpose is set in motion by the clock; and the endless cord is again wound up until the toggle of the gripper strikes the bottom pin on the fixed plate—so releasing the cams, and freeing the gripper from the endless cord. The weighted valve-lever then overcomes the friction of the valve and the weight of the gripper, and pulls the gripper up until the toggle has been thrown over to its original position, by striking the top pin of the fixed plate. By that time, the valve is closed, and the gripper is ready to operate for the next opening of the valve. This cycle of operations goes on automatically day after day, for as many days as the clock is made to go without rewinding.

Coin-Freed Gas-Meters.—Beechey, C. G., and Wright, A. T., of Liverpool. No. 27,123; Dec. 23, 1898.

According to this invention, the meter-mechanism is so arranged and adapted that it can be operated, and the meter set to supply gas, by the introduction of either pennies or halfpence, or coins having different sizes and values.

The carrier (as shown in the engraving, p. 207) is in the form of a small cylinder, with a transverse slot or chamber parallel with—and, say, through—the axis, into which slot coins fall when passed into the meter. The coin rests, when introduced, on a suitable support; and when the carrier is rotated, it is forced inwards or displaced in the slot of the carrier by an inclined bar, so disposed in relation to the carrier that, as it revolves, the back edge of the coin will bear on the displacer bar, and it will be forced forwards out of the slot on the opposite side. Hence, if there be any sticky matter on the coin, it will not stick in the slot. As the coin is pressed through the slot of the carrier, its projection on the opposite side increases; and at this edge it acts upon a tappet on a lever or arm (whose return action is effected by a weight or spring), and having a pawl or the like engaging with a toothed wheel, constituting the primary actuated or setting wheel of the mechanism. Connected with this toothed wheel—whose plane is vertical, and its axis parallel with that of the carrier—there is an inclined projecting device working in connection with a pin on the wheel, and by which the shaft is given longitudinal movement in either direction. And through it, by suitable levers or connections, the gas governing valve is opened when the apparatus is used after having been stopped by all the gas paid for having been consumed, and the slot closed when the full complement of coins which the mechanism is adapted to receive has been introduced. For instance, when the latter condition prevails, the spindle will be pulled or pressed outwards.

The teeth of the primary setting wheel, as well as the diameter of the coin-carrier and parts connected with it, are so proportioned that the amount of coin, in the case of a halfpenny, projecting from the carrier-slot will move the main setting wheel one tooth's distance, while the portion projecting in the case of a penny will move it twice this amount, or the distance of two teeth.

In front of the setting wheel, there is a dial and stationary pointer; the dial revolving with the wheel, and passing the pointer. The dial indicates

the number of pennyworth's of gas paid for and unconsumed which exist at any moment.

The spindle, which is operated by the travelling pin, and having the longitudinal movement referred to, is revolved by the meter in passing gas, through a train of toothed wheels, with price-change gear therein; the toothed wheel on the spindle being loose, but working the spindle by a carrier on the wheel, acting on the spindle, and so arranged as to allow

Fig. 1.

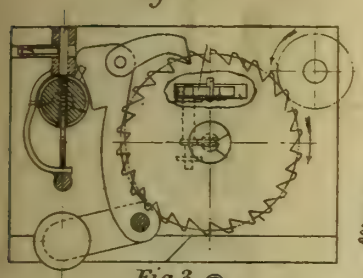


Fig. 2.

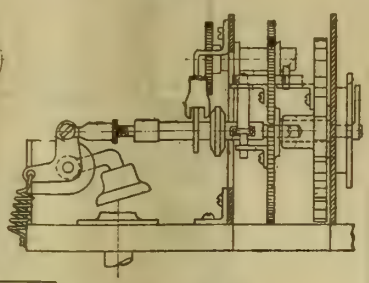


Fig. 3.

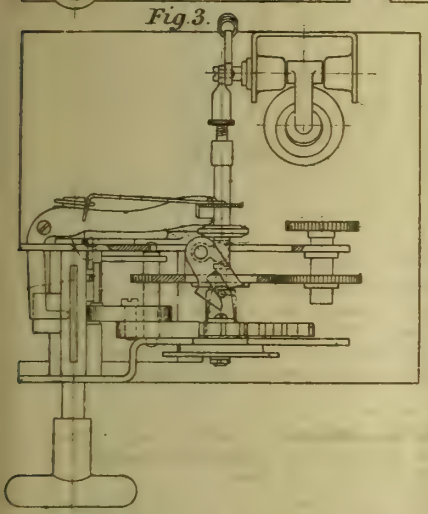
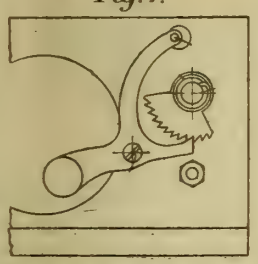


Fig. 4.



of this longitudinal movement. When all the gas paid for has been consumed, the pin working in connection with the primary setting wheel will cause the shaft to move longitudinally, and close the gas-valve.

The slot-closing lever, in one case, as well as a lever for operating the gas-valve, are moved by a small disc or wheel, which works through the forked ends of these levers. Then when the gas-valve is shut by its lever, the slot will be open; and the opening is effected by its lever when gas is used after the complement of coins has been introduced.

A ratchet wheel and pawl are provided on the coin-carrier to prevent the carrier being turned backwards. There is also furnished a projection in the path of the coin, which the coin would come up against so long as it is not discharged from the carrier; and it prevents a second actuation of the mechanism by the same coin. There is further provided, in connection with the pawl and primary setting tooth wheel, a pawl-locking device, consisting of a projection on the frame of the apparatus, under which the end of the pawl comes when at the outer end of its stroke. By this means, the pawl cannot be jerked out of contact with the wheel by any sudden movement, and so the wheel is locked at the end of the normal movement by its own pawl.

Another characteristic of the invention is the employment of a spring in connection with the primary setting wheel, actuated through the hand-operated part, and which is coiled up and put under strain when actuating the meter, while it is adapted to assist the meter when passing gas, so that the automatic mechanism does not put any extra work on the meter. Or, the spring may be of such strength as to assist in driving the meter, so as to increase the pressure of gas supplied through it.

In one case, one end of a coil or bent spring would be connected with the setting wheel actuated by hand, and the other with a shaft or part driven by the meter; so that when the spring is put under tension at one end, this stress extension is transmitted through the other end to the part of the mechanism driven by the meter.

The engraving illustrates the invention above described, as applied to a gas-meter. Fig. 1 is a sectional front elevation; fig. 2, a side elevation; and fig. 3, a plan of the apparatus. Fig. 4 is an outside view, showing a part of the reverse side to that illustrated in fig. 1.

Purifying Gases and Obtaining Bye-Products.—Theisen, E., of Baden-Baden, Germany. No. 27,389; Dec. 28, 1898.

In his specification, the patentee remarks that various methods have been proposed for obtaining an energetic reciprocal action between gases and liquids brought in contact by centrifugal action; and such a method was described in his patent No. 16,726 of 1892. But in many cases the action of the gases merely upon the surface of the liquid is not sufficient, even when such surface is increased by imparting a corrugated form thereto. The present invention, therefore, has for its object to produce a more energetic reciprocal action between gases and liquids; and "it relates more particularly to the treatment of waste gases from coke-ovens and the like, for the purpose of effecting the rapid purification and cooling thereof, as also for obtaining strong ammonia and benzene, which operations require a much more intensive reaction between the gas and water than was possible with apparatus heretofore proposed, at any rate, if it be desired to carry out the process with moderate-sized apparatus." The absorbing and cooling property of the washing liquid when operating during a very short time is increased, according to the present invention, by producing at the first contact of the hot gases and the liquid a strong evaporation, accompanied, if necessary, with pulverization of the washing liquid. In thus producing a very intimate mixture of the waste gases to be treated with the steam produced, the action is greatly increased by, to a certain extent, a molecular division of the bodies. By this means, the absorption of the ammonia is considerably accelerated, and also the cooling is greatly facilitated. The process, therefore, has to be so conducted in the first division of a centrifugal apparatus that an energetic evaporation and intermixture of the produced steam with the waste gases can take place—that is to say, as little washing liquid must be

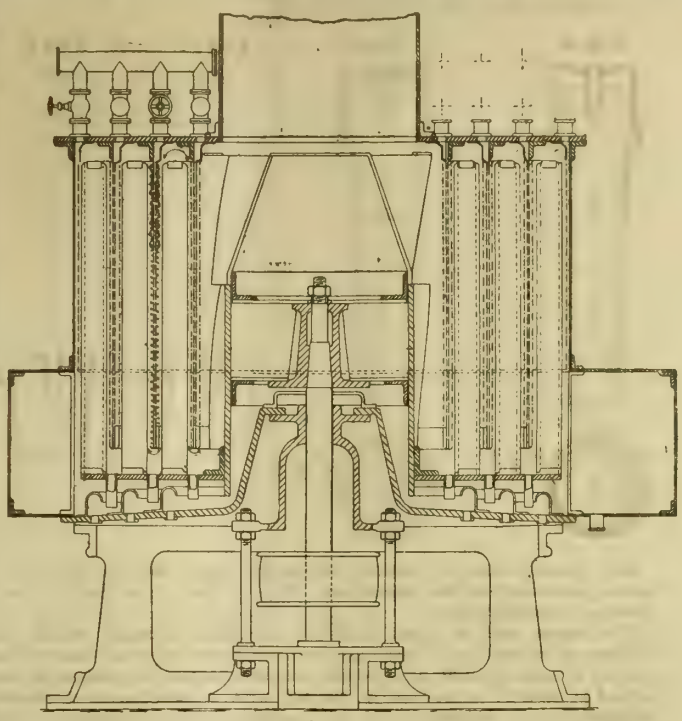


Fig. 1.

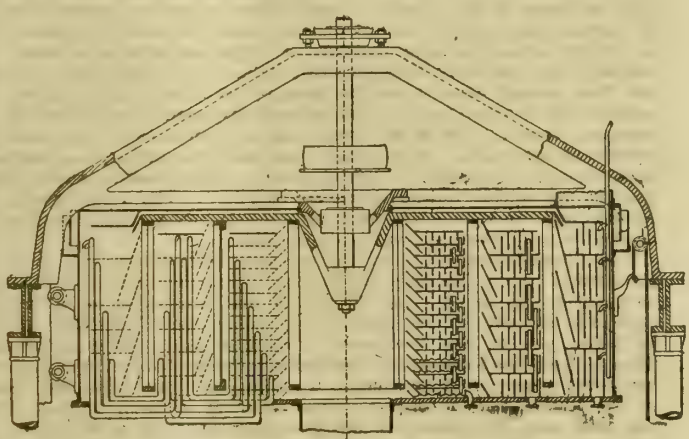


Fig. 2.

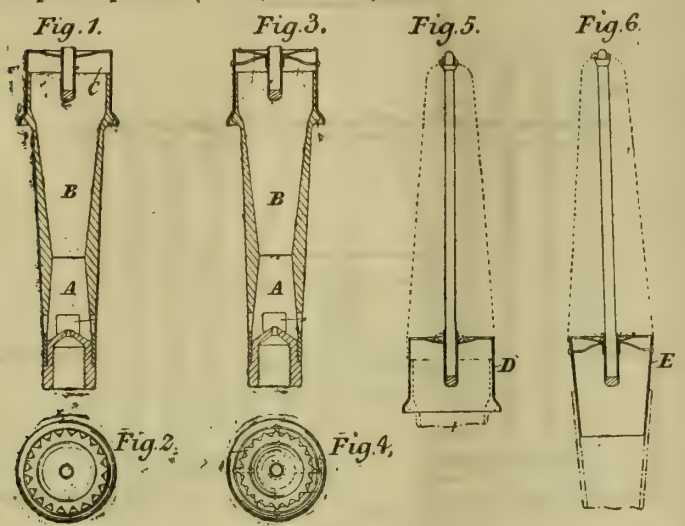
supplied as possible. It will be advisable to heat this in the first instance by suitable means, either externally to or within the centrifugal apparatus; and arrangements must be provided to cover a maximum extent of surface with a minimum of water or other washing or absorbing liquid.

The ideal arrangement would be that only so much water is supplied as is required for evaporation; so that in the first division no discharge of liquid would take place. This, however, as the patentee remarks, cannot be practically attained. At the second stage of the process, on the other hand, a strong cooling action is sought to be obtained, whereby the previously generated steam is condensed, together with the constituents absorbed thereby. This condensation can also be effected by simple surface-action, producing an effectual separation of the watery particles. By such a treatment of coke-oven gases, washing liquors are obtained which are to a considerable extent enriched with ammonia, but not so perfectly as is desirable, both for its advantageous subsequent utilization, and for purifying the gases to the greatest possible extent. For this purpose, the washing liquid is subjected to a second treatment by centrifugal action, together with the gases, in such manner that the gases are made to penetrate through the liquid over extended surfaces; the arrangement being such that the weaker liquid is brought in contact in the outer compartments of a centrifugal apparatus with the most purified gases, and in then travelling in the direction towards the axis of the apparatus become more and more enriched by contact with the more impure gases. In particular, the arrangement is such that several concentric stationary compartments are provided, consisting of syphon-like cells; and in the spaces between the compartments centrifugal blades are made to revolve, which exercise on the inner side a sucking action, and on the outer side a forcing action, on the gases. In this way, it is possible, not only to force the gases through all the cells of all the compartments from the interior to the exterior, but also at the same time to produce a continuous flow of the liquid from the outer compartments to the inner ones, on account of the increasing pressure towards the outside producing a difference of liquid level in the inner and outer cells. By this means, the requisite reversed direction of the gas and liquid is obtained.

Fig. 1 shows a vertical section of the apparatus for carrying out the first stage of the above-named operations; and fig. 2, a similar view of the plant for the second stage.

Incandescent Burners and Mantle Supports.—Duncan, J. H. H., of Coleman Street, E.C. No. 631; Jan. 10, 1899.

This invention has reference to bunsen burners suitable for burning a mixture of air and gas in contact with a mantle or other refractory body, for producing light by incandescence—for instance, such as are described in the patent of F. de Mare, No. 10,497 of 1894—and to further improvements in the invention which is the subject of a former application by the present patentee (No. 27,205 of 1898).



Figs. 1 and 2 show, in vertical section and plan, one construction of burner according to this invention. Figs. 3 and 4 are similar views, showing a modification.

The upper end or head of the burner-tube, through which the mixture of air and gas is supplied, and which comprises a lower conical portion A with air-inlet, an inverted conical intermediate portion B, and a head portion C, is provided at the top with a plate having a notched, serrated, or like periphery (such as is already in use in burners of this class), arranged either in contact with the wall of the head of the burner-tube, as shown in figs. 1 and 2, so as to form therewith a series of holes of angular shape, or at a short distance from the wall, as shown in figs. 3 and 4, so as to form therewith a single annular hole having a notched inner periphery, through which holes the mixture of air and gas can flow upward direct from the burner-tube below, and be burnt in contact with a mantle above, and without any internal perforated shell, such as is shown in De Mare's specification, or such as is now used in burners of this class. In this way, there can be obtained, in a simple manner, says the patentee, "a flame having a high heating power, and specially suitable for incandescence gas lighting." The irregular edge of the said plate is, or may advantageously be, slightly bevelled, so as to be inclined in an upward and outward direction.

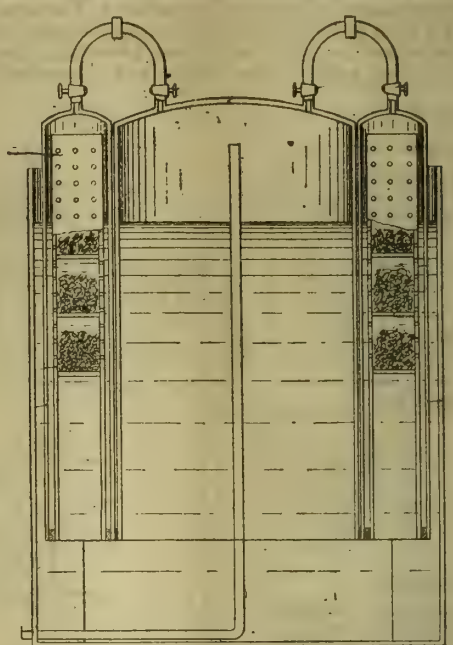
Figs. 5 and 6 show a form of apparatus in which the top plate, having the notched or serrated periphery, is supported by a suitable holder such as a cap D (fig. 5) or a plug E (fig. 6), that is adapted to be readily applied to the part of the upper end or head of the burner-tube, either by fitting over or into the same. To the central portion of the top plate is fixed the lower end of the mantle support, to the upper end of which the upper end of the mantle is permanently fixed; the lower end of the mantle fitting loosely around the cap or lower holder. The top plate may be formed in one piece with the cap, as in fig. 5, or separate from it, as in fig. 6. The arrangement is such that the top plate, cap, or holder, mantle support, and mantle constitute practically one article, that can be readily packed and transmitted from place to place, and be readily handled with little liability of breaking the mantle, or of setting it in an inefficient position on the burner-tube. The central portion of the top plate, which is solid, is provided with a socket, and the mantle support is fixed therein by plaster of paris, steatite, cement, or like material; such material serving also to retard the escape of heat from the centre of the burner along the mantle support. The top of the mantle may be fixed to the support by like material.

Acetylene Generators.—Boult, A. J.; a communication from M. de Lasserve, of Issac, France. No. 4054; Feb. 23, 1899.

This acetylene apparatus comprises a bell serving as a gasholder, and two or more generators so connected with the holder as to ascend and descend with it. The vessels containing the carbide are preferably arranged (as shown) diametrically opposite to each other on the bell or holder, which therefore ascends and descends with them as one body. They are all immersed together in the same water; and as soon as the bell has descended sufficiently, owing to the consumption of its gas, for the water-level to reach and wet the carbide charges, the bell becomes again filled with gas and rises. The vessel into which the bell and generators extend or are immersed is connected to the bell when the operation is about to commence. Each generator is composed of a bell or outer vessel, provided in the interior with a second vessel or cylinder, perforated at its upper part, and carrying the carbide on trays, baskets, or the like.

The gas as produced passes through tubes provided with taps and connecting joints into the holder, the tubes of which are also provided with taps; and from the bell the gas flows through a tube to the distributing pipes or place of use.

In order to start the apparatus, the bell is made to descend in the vessel partly filled with water; the taps on the top of the bell being left open. The carbide having been distributed on the trays or receptacles of the perforated cylinders, the bells are fastened to them by suitable means. The gas-generators are then placed in the tank or outer vessel, leaving the taps on the top of the generator-bells open. They are closed only when the water from beneath has reached the carbide, which position may be indicated by a mark on the outside of the gas-generators. The generators are then connected up to the gasholder bell, and the joints screwed together. The generator-taps are gradually opened, to let some of the air out; and the carbide becoming attacked by the water, genera-



tion of gas begins. The gas given off enters the main bell, and causes it (together with the generators) to ascend; the carbide being thereby raised out of contact with the water. The generation of gas thereupon stops, until the consumption or drawing off of gas from the main bell causes the whole to again descend, and the process to be repeated until all the carbide is exhausted.

Prepayment Attachments for Gas-Meters.—Brooks, A. G.; a communication from the New Haven Novelty Machine Company, of New Haven, U.S.A. No. 21,175; Oct. 24, 1899.

A very general indication only can be given of the scope of this invention, as the specification filed in respect to it extends to no less than 16 pages, embracing 32 distinct claims; and there are seven sheets of detail drawings. It may suffice, however, to say that the attachment constituting the subject-matter of the application involves in its construction a rotative slidable shaft controlling the action of the gas-regulating valve; the shaft deriving its movement to open the valve from a toothed operating wheel loosely "splined" on the shaft, and a money-carrier mounted loosely to be rotated on the shaft freely in but one direction. The money-carrier has an engaging device, which, acted upon by a coin thrust into the money-carrier, is made to couple the money-carrier temporarily with the toothed wheel, so that rotation of the money-carrier by hand will rotate the toothed wheel and its shaft, and at the same time effect the sliding of the shaft in a direction to open the valve. The extent of rotation of the shaft and its consequent longitudinal movement depends on the greater or less extent of its rotation, while the coin in the money-carrier acts to effect the coupling of the money-carrier with the toothed wheel by or through the engaging device—the time being governed by a "delivery regulator." This device is under the control of the operator, and is capable of being adjusted from time to time as the price of gas varies, to thereby ensure the delivery to the consumer of a quantity of gas the equivalent of the unit coin used. The regulator is cylindrical, and surrounds the money-carrier. It is provided with a stop, whereby the money can be discharged through a throat or opening in the regulator, and from thence pass into a tray or box. The organization of parts is such that it can be applied to any of the existing types of meters without changing the latter.

Automatic Gas Lighters.—Killing, C., of Düsseldorf, Germany. No. 22,027; Nov. 3, 1899.

Giving a brief review of former inventions in the same line, the present patentee says: Döbereiner produced "igniting pills" by mixing porous earthenware or clay and spongy platinum with water, so as to form a paste, which was then moulded into balls of the size of peas, subsequently dried and calcined. J. F. Duke impregnated ready-made meerschaum-pills with a solution of a platinum salt, which was then dried and reduced by means of suitable gases. J. Perl discovered that the igniting pills produced in this manner soon lost their capacity of igniting gases; and to avoid this defect, he treated the pills (after impregnating with platinum chloride, drying, and reducing) with dilute hydrochloric acid and finally with boiling water. His own (Killing's) experiments have shown that these automatic igniting pills work very well if they are used in the first instance—always with the aid of one or more wires—for igniting a small auxiliary flame, which in its turn ignites the main gas current, and is subsequently extinguished, so that the igniting pill is no longer touched by the flame. They are useful, also, in case the igniting pill directly lights the main gas current, and immediately afterwards is switched out of the reach of the flame by means of a thermostatic spring. Such pills will not stand prolonged exposure to the flame.

In order to produce fireproof igniting pills, he proposes to proceed as follows: Pills made from meerschaum or other porous mineral matter are first impregnated with a solution of a salt of a rare earth—preferably a thorium salt; subsequently dried and calcined. The pills will thus be coated in their pores, as well as outside, with a thin layer of a refractory rare earth, in the shape of an oxide remaining behind after calcination. The pills prepared as described are then impregnated with platinum chloride, dried and reduced. Instead of applying the two solutions consecutively, a soluble salt of a rare earth may be added to the platinum

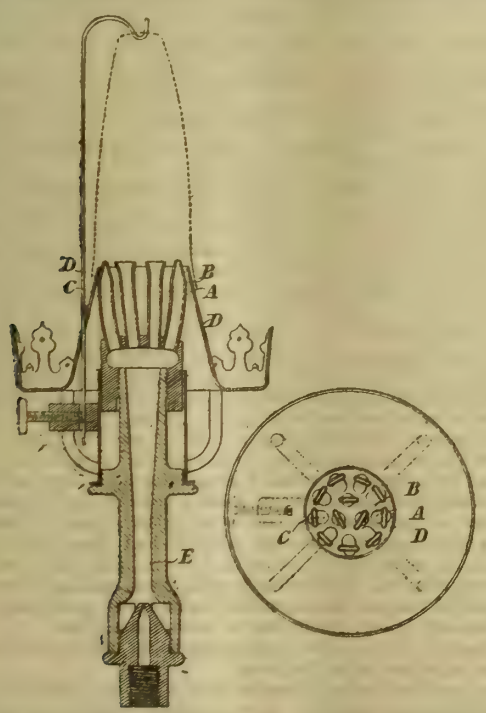
solution, and the pills impregnated with this double solution, subsequently dried and reduced.

Dwelling on the merits of his discovery, the patentee remarks: In the case of combustible woven fabrics saturated with a solution of thorium and platinum salts, it is frequently observed that after prolonged use the igniting mass gives off particles of dust—probably in consequence of its frothy condition—and that this loss increases with time, apparently owing to the vibrations caused by each ignition. The fine dust of platinum black, when it settles on the mantle, reduces its luminosity to such an extent, that the light (which at the beginning may be equal to 70 Hefner candles) will in some cases drop to 25 or 30 candles. Such a dispersion of the platinum black in the shape of dust will not take place in the case of meerschaum pills, "consequently the use of pills which have been manufactured by the process described above constitutes an important industrial progress in comparison with the use of woven igniting fabrics."

Acetylene Gas-Burners for Use with Incandescing Mantles.—Johnson, J. Y.; a communication from the Compagnie Française de l'Acetylène, of Paris. No. 23,032; Nov. 18, 1899.

The object of this invention is to provide means for overcoming certain difficulties existing when mantles of rare earths are employed with mixtures of acetylene gas and air. The patentees propose that the mixture of acetylene and air should escape through orifices narrow enough to prevent back-firing through them. But this alone is not sufficient, they remark, as if, through a sufficiently narrow orifice, a completely combustible mixture of air and acetylene gas (say, one of 93 per cent. of air and 7 per cent. of acetylene) issues at a speed of 4 metres per second, corresponding to about 1 millimetre of pressure, the propagating or spreading velocity is upwards of 6 metres, and the flame will tend to re-enter the orifice at a speed of 6 metres *minus* 4 metres. The flame is checked by the cooling effect produced upon it by the walls of the orifice; but these walls gradually become so heated that back-firing takes place. This would be prevented from occurring if the speed with which the mixture of air and acetylene escapes exceeds the propagating or spreading velocity (6 metres in the example given). It is, however, very difficult in the case of injectors arranged for the usual acetylene pressure—from 12 to 13 centimetres of water—to obtain an adequate amount of energy to ensure the passage of the mixture through the narrow orifice of the burner at so high a speed. To overcome this difficulty, the mixture of air and acetylene is so proportioned as to contain less air than is theoretically necessary for complete combustion. In such a mixture, the spreading velocity of the flame is under 6 metres; and it therefore becomes possible to cause the mixture to issue at a rate of speed practically equal to that of the spreading velocity. The heating of the material in which the orifices are formed is then kept sufficiently low; the heat imparted thereto being abstracted at an almost equal rate by the heat-conducting property of the material. "But as the gas mixture is not sufficiently rich in air, it would not be capable of illuminating the mantle in a manner satisfactory on economical grounds."

In the burner shown in the accompanying engraving, the orifices are formed by tubes A B C arranged at considerable intervals apart, and surrounded by a convergent outer tube D, the wider end of which is downwards, and admits external air, while its narrower upper end is



within the lower part of the mantle. The air issuing through this narrower end is distributed around the centre tubes and the flames therefrom, and effects complete combustion of the gas.

The tubes, in order to prevent an inward return of their flames, should (the specification remarks) have very small diameters; and, even then, it would be impossible to overcome by the power of the injector alone the resistance they would offer to the passage of the gas mixture. To reduce this as much as possible, while at the same time increasing the efficiency of the injector, instead of employing tubes which theoretically should be 1 millimetre in diameter at most, tubes are employed which are of a diameter of several millimetres each, and which consequently offer far less resistance to the passage of the gas mixture. These tubes are flattened at their outlet ends, so that their sectional outline is approximately rectangular, and so narrow as to prevent back-firing.

The passage into which the acetylene is injected consists of a narrow cylindrical portion E, flaring at its lower part, and continued above by a conical portion, the walls of which are slightly inclined. Into the cylindrical part, through its lower flaring end, the air and gas pass from the injector at a high speed; but in the conical part, the speed of the mixture of gas and air becomes gradually lessened, and its pressure increased.

APPLICATIONS FOR LETTERS PATENT.

402.—Joel, H. F., "Street lamps and reflectors." Jan. 8.
410.—Duff, E. J., "Gas-producers." Jan. 8.
479.—Parsons, R. C., and Belfield, R., "Utilization of the heat developed by explosion or ignition of a combustible gas." Jan. 8.
541.—Eisenhuth, J. W., "Air and gas engines." Jan. 9.
602.—Winterflood, J., "Water-heaters." Jan. 10.
755.—Tatham, J. E., and Cope, J. L., "Gas-burners." Jan. 12.
756.—Croizat, V., "Lighting and extinguishing street-lamps." Jan. 12.
769.—Bryant, C. H., and Augspurg, G. T., "Compressing gas." Jan. 12.
770.—Hein, R., and Hahn, T., "Gas pressure-regulators." Jan. 12.
792.—Birch, G., "Incandescent gas-burners." Jan. 13.
796.—Alba, F. de A. "Gas or oil engines." Jan. 13.
797.—Hislop, R. F., "Lighting and extinguishing gas-lamps." Jan. 13.
810.—Hunger, F. O., and Espenhayn, W., "Liquid meters." Jan. 13.
829.—Gillett, E. H. J. C., "Starting gas and other engines." Jan. 13.
830.—Peck, W., "Carburetting air." Jan. 13.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Tar and Liquor Storage-Tanks.

Sir,—In connection with the recent accident at the Douglas Gas-Works, Mr. Newbigging stated in his evidence that he always put ventilating shafts into tar and liquor tanks. He also suggested the ventilation of such tanks generally. The subject of ventilating these tanks is, in my opinion, a debateable one. I have always made it a practice to keep all tar and liquor boshes, wells, and storage tanks, as far as possible closed up, not allowing any ventilation. It has frequently been demonstrated that the gases evolved from the tar and liquor wells are of an explosive nature. Further than this, if the gases are allowed to escape through ventilating shafts, or by other means, considerable loss of ammonia is occasioned. Not only so, but the ammonia gas has a deteriorating effect upon everything with which it comes in contact; leaving a well-known bluish tint on the surface exposed to its action.

It would be interesting to know what is the general practice prevailing. I have certainly not come across ventilating shafts, or even open gratings which may be sources of danger. Perhaps I have misunderstood Mr. Newbigging's point.

Edward A. Haeman.

Huddersfield, Jan. 19, 1900.

The Scarcity of Coal.

Sir,—I have been much impressed with the justness of the remarks on the above subject in the last issue of the "Journal;" and I will, with your permission, offer a few observations thereon. I presume that many, like myself, who bought ample coal supply in the proper season, have experienced serious difficulty in getting anything like their contract quantity during the past few weeks; and as the evil has by no means entirely abated, the question naturally arises as the how it is to be prevented in the future. If we have to get in all our coal in the summer, we shall need much ampler storage accommodation and increased means of moving the material expeditiously. In my opinion, it is a matter to which the immediate attention of all concerned, whether manufacturers of gas plant or engineers of gas-works, ought to be directed.

Most managers who have written, as I have done, to coalowners to urge on deliveries, have had letters putting all the blame on the railway people. I should be glad to hear if those who depend on water carriage have had any difficulty in getting supplies. But, whether or not, I have a good many private trucks running to and from the colliery and the works; and I find the only delay is on the return journey. I am pleased to say that since the fog I have had no difficulty in getting coal in and unloaded in three days from the date of the invoice, each inclusive; but I find that these waggons are eight and ten days on the return journey—that is, between the date of discharge and date of invoicing again. The coincidence is remarkable, and leads one to suspect that there is some truth in the remark lately made to me jocularly by a colliery official. "You don't expect us," he said, "to send you coal under contract when we can get 7s. or 8s. a ton more for it in the open market." There is not, I think, the slightest doubt that the collieries, with some brilliant exceptions, have sold contract coal, at advanced prices, to people who have not contracted; and they are now blaming the Railway Companies for a fault which is by no means wholly theirs. I do not for a moment contend that the Companies are free from blame in this matter; but when one hears reports of customers of Colliery Companies pressing forward with offers of even more than advanced list prices for coal, one is scarcely surprised at there being often no coal to spare for contract supplies. I hope all managers who have been suffering in a similar manner to myself will endeavour to locate the principal cause of the evil, with the view of bearing it in mind when they are next buying coal.

Verax.

Jan. 20, 1900.

Explosion of a Gas-Main at Douglas (Isle of Man).—On the evening of Saturday, the 13th inst., the 8-inch gas-main running along Victoria Street, Douglas—the principal thoroughfare in the town—exploded opposite the Salisbury Hotel. There were a good many people in the street at the time; but fortunately no one was injured. The supply to the hotel was cut off; and, in order to repair the fracture in the pipe, which it was thought had been caused by a traction-engine, part of the town had to be deprived of its gas supply.

PARLIAMENTARY INTELLIGENCE.

PRIVATE BILLS (SESSION 1900).

Opposition on Standing Orders.

On Tuesday last, the final day for despositing memorials complaining of non-compliance with Standing Orders in the case of the second hundred Bills in the General List of Petitions, no memorials had been received in respect of those in which our readers are interested. The following Bills will not, therefore, be opposed on Standing Orders: Airdrie, Coatbridge, and District Water Bill, Barnsley Corporation Bill, Bristol Water Bill, Bury and District Water-Works (Transfer) Bill, Cleethorpes Gas Bill, Crowborough District Water Bill, Dorking Water Bill, Dublin Corporation Bill, East Shropshire Water Bill, Exmouth Urban District Water Bill, Falkirk and District Water Bill, Falkirk Corporation Gas and Extension Bill, Gaslight and Coke Company Bill, Hamilton Burgh Bill, Hartlepool Gas and Water Bill, Kingston-upon-Thames Gas Bill, Lambeth Water Bill, London Sea Water Supply Bill, Maidenhead Gas Bill, Menstone Water-Works (Transfer) Bill, Metropolitan Water Companies Bill, Motherwell Water Bill, Mountain Ash Water Bill, Newport (Mon.) Gas Bill, Ramsgate Corporation Improvement Bill, Rickmansworth and Uxbridge Valley Water Bill, Scarborough Corporation Bill, Southport Water Bill, Sutton District Water Bill, Taunton Corporation Bill, Tottenham Urban District Council Bill, Wandsworth and Putney Gas Bill, West Bromwich Corporation Bill, Wetherby District Water Bill, Wolverhampton Gas Bill.

The memorial of Mr. John Griffiths, complaining of non-compliance with Standing Orders in the case of the petition for the London Water (Welsh Supply) Bill, came before one of the Examiners on Thursday, and was adjourned till next Friday.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE.—COURT OF APPEAL.

Wednesday, Jan. 17.

(*Before the* Master of the Rolls *and Lords Justices* Vaughan Williams *and* Romer.)

Welsbach Incandescent Gas-Light Company, Limited, v. New Sunlight Incandescent Company, Limited.

This was an appeal by the defendants from the decision of Mr. Justice Byrne on the 12th inst. (see *ante*, p. 153).

Mr. Bousfield, Q.C., and Mr. Neill appeared for the appellants; Mr. Moulton, Q.C., Mr. T. Terrell, Q.C., and Mr. Walter represented the respondents.

Mr. Bousfield said this was an appeal in an action brought by the plaintiffs to restrain infringement of their 1893 patent, on an application by the defendants to administer interrogatories to two Directors and the Chemist of the Welsbach Company. The patent of 1893 was taken out by Mr. Imray as a communication from Mr. Moeller, the Managing Director of the Company's predecessors, for a particular improvement in incandescent lighting—viz., making mantles of a certain fluid composed of 98 per cent. of thorium and 2 per cent. of cerium. In 1891 and 1892, the plaintiffs' predecessors were receiving from Germany a new lighting fluid from Dr. Welsbach for the manufacture of mantles; and the defendants' case was that this fluid was practically identical with the 1893 patent.

Lord Justice Romer: I suppose you want to prove anticipation.

Mr. Bousfield said that was so. Defendants' case was that the plaintiffs were getting this thorium and cerium from Germany, and making mantles from it; and that in 1893 Mr. Moeller went abroad and sent a communication to Mr. Imray. The interrogatories were directed to this point. In 1897, a reconstruction took place—the business of the Company being passed over to the plaintiff Company; and Mr. Moeller, Mr. De Fonblanque, and Mr. Mackean's services were transferred to the new Company. His application was for leave to interrogate these gentlemen, who had been connected with the old Company, in preference to the Secretary of the new Company, who knew nothing of what took place in 1892 and 1893.

After a long discussion, their Lordships dismissed the appeal; stating that the point raised was an extremely important one, and might have to be determined at some future date, after it was seen how the Secretary answered the interrogatories.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Friday, Jan. 19.

(*Before Mr. Justice* Lawrance *and a Special Jury.*)

Sheldrake v. Duncan.

This was an action to recover damages for slander uttered by the defendant, who is Chairman of the New Sunlight Incandescent Company, at a meeting of shareholders held on March 9, 1899, in respect of the plaintiff, Mr. J. H. Sheldrake, formerly Manager of the Sunlight Company, and now in the employ of the Welsbach Company. The slander complained of was contained in the following passage of Mr. Duncan's speech: "In the past year, the turnover would have been considerably larger than it was had we not been met by two circumstances which bore upon us very badly in the beginning of the season. Our Manager [meaning the plaintiff] was taken away by the opposition [meaning the Welsbach Company] who offered him just double the amount of money that we were paying him. He was under contract for five years. But he snapped his fingers at the contract, and took the other position; and we felt we should not be doing much good by keeping a discontented man, and we were hardly prepared to give him the money that the other people [meaning the Welsbach Company] offered him. I do not know that we did right in not forcing him to stop, because we had great difficulty in finding anyone to replace him; and it was not till after a good many months that we hit upon our present system of management, which has continued ever since."

Mr. Dickens, Q.C., and Mr. Carrington appeared for the plaintiff; Mr. Carson, Q.C., and Mr. F. Abrahams represented the defendant.

Mr. Dickens, in opening the case, said that the plaintiff was a well-known gas engineer and gas expert; and his only object in bringing this action was to clear his character from the aspersion cast upon him by Mr. Duncan, which could not fail otherwise to have a bad effect with the various gas companies and gas interests with which plaintiff was connected.

Plaintiff was then called, and examined by Mr. Carrington. He said he was a Gas Engineer, and had been engaged in the industry for many years. He was introduced by Professor Lewes to Mr. Duncan, the present Chairman of the Sunlight Incandescent Company, in November, 1896. They discussed the management of the concern. Mr. Duncan, who was then a Director, said they had been obliged to get rid of their Manager. Terms were discussed; and £600 a year, and commission on profits after the payment of 6 per cent., was agreed to. An appointment was made to meet the Directors of the Company on the following day. At that meeting, he asked for an agreement for three or five years; but the Directors said they would not offer more than a twelve months' engagement, and it appeared that they had had to pay £1000 to terminate a previous engagement of the kind. After he had been with the Company about a week, a written agreement for five years was sent to him; but he never signed it, as by reason of the condition in which he found the Company he was rather timid of being tied. He continued in the service of the Company until October, 1897, when Mr. Duncan wanted to claim for the Company a patent witness had taken out. Mr. Duncan then called attention to the agreement; but witness pointed out that it had never been signed. Mr. Duncan then said he would draft an agreement under which witness and the Company should share in the benefit of the patent. In November, witness was approached by the Welsbach Company, who wanted to know if he was tied to the Sunlight Company. Witness replied that he did not consider that he was, as he had never signed an agreement, and his year would close on Nov. 23. On Nov. 15, he received the second draft agreement from Mr. Duncan, dated Nov. 1, 1897, which provided for a year's service by witness, and contained a provision also that in the event of Mr. Sheldrake making discovery of any inventions and improvements in connection with incandescent gas lighting, the same should be forthwith communicated to the Company, who should have the option (to be exercised at any time within three months, by notice in writing) to take over the benefits of such improvements, Mr. Sheldrake to have one-fourth share of such benefit. Mr. Duncan had also drafted an addition in pencil, to make the operation of this clause retrospective. On the 16th, witness met Mr. Moeller, the Manager of the Welsbach Company, and agreed to a five years' agreement for £1000 a year without commission; the Company to have the benefit of witness's inventions and patents, subject, of course, to the approval of the Directors. When witness communicated this fact to Mr. Duncan, the latter asked what his Company were to do for a Manager; and witness said he would do all he could to initiate his successor into the business. Mr. Duncan subsequently wrote that he considered plaintiff not only morally, but legally, bound to the Sunlight Company for five years. Witness wrote in reply that he did not consider himself bound; and he afterwards saw Mr. Duncan on the subject, and gave an undertaking as to not divulging trade secrets. He continued until the end of the year in the employ of the Sunlight Company, and then went to the Welsbach Company. Until March, 1899, he heard nothing either from Mr. Duncan or the Sunlight Company as to the circumstances under which he had left. He had previously been approached by the Welsbach Company, but was then under agreement. Personally he had never approached the Welsbach Company. On March 9, his attention was directed to a report in the "Financial Times," where the following passage appeared: "There were one or two other matters that had told against them during the past year. In the first place, their Manager had been tempted to go over to their rivals by the offer of twice the remuneration he was receiving; and he had snapped his fingers at the five years' contract he was under with the Company. This had caused a good deal of difficulty, as it was only within the last six months that the Directors had been able to secure proper management." In consequence of demands for an explanation by the Welsbach Company, witness communicated with his Solicitors.

In cross-examination by Mr. Carson, plaintiff said that the Welsbach Company and the Sunlight Company were rivals; and in his own time there had been a good deal of litigation between them. At the date of his arrangement with Mr. Duncan, nothing was said about a five years' agreement depending upon his services proving satisfactory in the first year; but he had written to Mr. Duncan making a proposal to that effect. He received nothing in excess of £600 a year by way of commission on the profits, as the Company were working at a loss. Witness did not sign the first agreement, because after he had been with the Sunlight Company for some time he found that the mantles being made were not as they ought to be. In the first month it was nothing but goods coming back; and he was very dissatisfied at having ever gone there. His object in not signing the agreement was to leave himself free.

Mr. Carson: If you could get nothing better, to stay on there; if you could get anything better, to leave?

Witness said he had no intention of leaving; nor did he seek anything. He asked for better terms as to commission, and discussed the matter with Mr. Duncan. A general meeting of the shareholders was held on Oct. 26, 1897, at which he was present; and Mr. Duncan spoke of the advantage to the Company of having secured his services. Notwithstanding this, within a month he went over to the rival "shop;" the fact being that he could not get a proper arrangement with the Sunlight Company.

Re-examined by Mr. Dickens: Witness had no notice from the Sunlight Company that they intended to exercise the five years' option; and Mr. Duncan did not suggest it in conversation. It was understood in October, 1897, that a draft agreement was to be drawn up before anything further was done in the matter. On Nov. 16, Mr. Duncan knew that he had been negotiating with Mr. Moeller; but there was no suggestion then made that the Company wished to exercise their option, and Mr. Duncan did not hint that witness had done anything dishonourable. He was asked by the Secretary of the Sunlight Company three times to sign the

first agreement; but, as he had told Mr. Duncan, he did not sign because the goods sold were not as advertised. There was, for instance, no "white mantle" as advertised.

This being the plaintiff's case,

Mr. Carson submitted that there was nothing to go to the Jury on the question of slander. No special damage had been shown; and no charge had been made against the plaintiff in his capacity of engineer. The remarks of the Chairman at the general meeting in 1897, rather showed the great loss the Company sustained in losing him. In the first place, to say that a man had broken his contract was not slander; secondly, he contended that the occasion was privileged—the occasion being the address of the Chairman to his shareholders explaining the circumstances under which the Manager had left.

Justice Lawrance: That is a question for me.

Mr. Carson said there was no evidence of express malice.

Justice Lawrance: That is a question for the Jury. That the occasion was privileged, I think there can be no doubt; but whether the communication was privileged, will depend upon the finding of the Jury.

Mr. Carson said if his Lordship held that the occasion was privileged, there was nothing to go to the Jury, unless there was evidence of express malice, of which there was none. There was nothing to indicate that Mr. Duncan had anything but a feeling of friendship towards plaintiff, and this feeling was shown on every occasion in which he came into contact with him, and in the handsome words spoken at the meeting of the shareholders in October, 1897. To say, therefore, that Mr. Duncan was actuated by malice, was absolutely absurd. On the other hand, what did the Jury think of the plaintiff having made terms with the Welsbach Company without the knowledge of his employers? There were very few expert persons who could be secured to carry on this new business of manufacturing the "Sunlight" mantles; and no doubt Mr. Duncan and his Board were upset as the result of the plaintiff's leaving. The business was thrown out of gear; and six months elapsed before the Company could put it again on a satisfactory basis. The profits hoped to accrue from the energetic management of Mr. Sheldrake in the early part of 1898, were not realized; and consequently next time Mr. Duncan met his shareholders—in March, 1899—he had to give an explanation of what had happened as regarded Mr. Sheldrake. He was bound to do this, as otherwise he could not justify what he had said on the previous occasion. Slander and libel actions should have a real and substantial basis, and not be brought in respect of what a man said in the performance of his duty to his Company. Mr. Duncan had had no object except to properly inform his own shareholders of what had occurred.

Defendant, in answer to Mr. Abrahams, said he was now Chairman of the reconstructed Sunlight Company; and in 1896 he was a Director. For years past the Sunlight Company had been in litigation with the Welsbach Company in respect of patents. Plaintiff was engaged for a year, with the option to the Company of subsequently retaining his services for five years. The agreement was sent to the plaintiff, but never signed. With regard to plaintiff's patent, he was under the impression that it was covered by the agreement—especially as he knew that it had been in part worked out during the time plaintiff should have devoted to the Company, and to some extent by their servants—and he therefore claimed the patent as belonging to the Company. He then found out, for the first time, that Mr. Sheldrake considered it was not covered by the agreement; and reference to the agreement showed that Mr. Sheldrake had not signed his part of it. This brought out the further fact that the reason he had not signed was, as plaintiff had stated, that he was not going to get anything upon the commission, and that therefore the agreement would be a bargain for £600 a year net, without any increase. Witness admitted that the business had not been as prosperous as expected, and discussed the question of how to compensate plaintiff for that. Partly, the compensation proposed was that plaintiff was to have 25 per cent. royalty on any inventions he might submit to the Company; and the Company were to do away with the engagement by which they were to pay dividends before allowing plaintiff a share in the profits. It was further proposed that plaintiff should have £250 in cash on account of royalties. The Company's Solicitor was instructed to prepare a draft agreement on these terms. The announcement of the engagement of the plaintiff with the Welsbach Company came upon the Directors quite as a surprise. In making the remarks referred to at the meeting in March, 1899, he had no animosity or ill-feeling towards Mr. Sheldrake; and he had none now. He had no other object in making the statement to the shareholders than to explain to them the facts; and he considered he was justified in the language he used.

In cross-examination by Mr. Dickens, witness said he did not wish, at the meeting in March, 1899, to impute dishonourable conduct to the plaintiff, but only that he was ignorant of business usages and of his legal position. He thought plaintiff's action in going to the Welsbach Company was wrong; and he intended to convey that impression. He intended also to convey the impression that the Welsbach Company had done a dishonourable thing. It was not sufficient, in his opinion, to say at the meeting that the Company's Manager had become the Manager of the Welsbach Company, because to engage so valuable a Manager without securing him for a term of years would be considered a most unbusinesslike transaction. The speech was submitted before delivery to the other Directors; and it was agreed that what he was going to say with regard to Mr. Sheldrake was the minimum of what might be said. It was quite possible that, when Mr. Sheldrake first entered into negotiations, he wanted a five years' agreement without any option at all. He denied that the Company declined to give notice to continue the agreement for five years because it was found that they had no control over plaintiff's patents. The Company did not wish to have a five years' agreement, though they were willing to accede to it; but he considered it was to their advantage to have a year's agreement, with six months' notice.

Mr. Dickens, in reply, said that no doubt the secret of Mr. Duncan's remarks at the meeting in March, 1899, was that he wished to make an attack on a rival undertaking. There could be no question that, both in law and in honour, Mr. Sheldrake was absolutely free to make any fresh arrangement. The occasion of Mr. Duncan's remarks was no doubt privileged; but the occasion was exceeded when Mr. Duncan gave a wrong and distorted version of the facts, and created an entirely erroneous impression among his hearers.

Justice Lawrance, in summing up, said that no claim could be made under the contemplated five years' agreement, because the option was never carried out; and it was obvious to any man of business that Mr. Sheldrake was perfectly free to make another arrangement, if the Company did not exercise their option. Then it was a question whether to say that Mr. Sheldrake "snapped his fingers at the contract" was a fair way of viewing his action. It was for the Jury to say whether defendant had exceeded his privilege, through being actuated by some indirect motive—such as anger with the Welsbach Company, or disappointment at his Company having done so badly. If the Jury thought the words were slanderous by reason that they imputed dishonourable conduct, plaintiff would be entitled to damages.

The Jury found for the plaintiff, and awarded him one farthing damages.

Saturday, Nov. 20.

Mr. Carrington announced that, after the rising of the Court, the Jury had returned a verdict for the plaintiff; and he had now to ask for judgment and for a certificate for a Special Jury.

Mr. Abrahams observed that Mr. Carrington had not mentioned the amount of the damages awarded, which was one farthing; and under these circumstances, he had to apply to his Lordship to deprive the plaintiff of costs. The order provided that the costs should follow the event, unless the Judge for any cause should otherwise direct. He submitted that there was good cause in this case for depriving plaintiff of his costs. Plaintiff brought this action to vindicate his character, and alleged that he had been seriously slandered. The Jury had treated the complaint with contempt, and by their award had indicated that the action ought never to have been brought. It might be that they took the view that this was simply a squabble between two rival Incandescent Gas Companies, and that the action had been put forward on behalf of the Welsbach Company. The power to deprive a successful plaintiff of his costs had no doubt been given with a view to discouraging actions for libel or slander, unless serious injury had been done to a man's character.

Justice Lawrance said that he was not inclined to interfere. No doubt, under ordinary circumstances, if a man brought an action for slander, and was awarded only one farthing damages, it might be said that the case ought never to have been brought. Anyone sitting on the Bench was a good deal nearer to what went on among the Jury than those in the body of the Court; and he (the learned Judge) could not help hearing one gentleman say yesterday that he quite agreed with the summing up. There had no doubt been a compromise between the Jurymen; and he thought the attention of the Jury had been diverted from the real point—the real point being that plaintiff was slandered. The Jury found, indeed, that plaintiff was slandered; but when they came to the question of damages, they shifted their ground from the plaintiff altogether, and dealt with the matter on the ground that it was a squabble between two rival Companies. His view of the matter was that plaintiff ought not to suffer for that; and therefore he would not interfere.

Mr. Abrahams: Your Lordship simply gives judgment, and certifies for a Special Jury.

Justice Lawrance: Yes.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Friday, Jan. 19.

(*Before Justices* Bruce *and* Phillimore, *Sitting as a Divisional Court.*)

London County Council v. East London Water-Works Company.

In this case, Mr. English Harrison, Q.C., Mr. J. H. Drydale, and Mr. Daldy appeared for the London County Council; while Mr. C. A. Cripps, Q.C., M.P., and Mr. R. B. Acland represented the East London Water Company.

Mr. Harrison said this was a special case, which had been stated by concurrence of the parties, raising certain questions of law for the opinion of the Court. The case stated that an action was commenced on Nov. 7, 1898, by a Writ of Summons, whereby the plaintiffs claimed a declaration that hydrants, fire-plugs, and other apparatus, provided or to be provided by the defendants pursuant to section 32 of the Metropolitan Fire Brigade Act, 1865 (28 and 29 Vict., cap. 90), and section 34 of the Metropolis Water Act, 1871 (34 and 35 Vict., cap. 113), or pursuant to either of these sections, ought not, in the absence of any agreement under section 4 of the London County Council (General Powers) Act, 1894 (57 and 58 Vict., cap. 212), or alternatively without the consent of the County Council, to be used for any purpose other than the supply of water for extinguishing fires, or alternatively for any purpose other than the supply of water for extinguishing fires and the purposes specified in section 37 of the Water-Works Clauses Act, 1847, and an injunction of the Court and any further or other relief to which plaintiffs might be entitled. The six hydrants to which the action more particularly related were situated in Dalston Lane, Queen's Road, Downs Road, Well Street, and two in Brooksby's Walk. In and between the months of July and September, 1897, the streets above referred to were respectively in course of being paved with wood and channelled; and the defendants from time to time during those months, without having obtained or asked the consent of the plaintiffs, used, and allowed those engaged in the operations to use, these hydrants for the purpose of obtaining from the water-mains by means of such hydrants, a supply of water for the operations of paving and channelling. Plaintiffs contended that the hydrants in question were provided, at the public expense, specially for the purpose of extinguishing fires, and could not (save pursuant to an agreement under section 4 of the London County Council General Powers Act, 1894) lawfully be used, or at any rate could not be lawfully used without the consent of the plaintiffs, except for the extinguishing of fires; and alternatively could not be used for any purposes other than those specified in section 37 of the Water-Works Clauses Act, and ought not in any event to be used by persons other than servants of the defendants. Defendants contended that they were entitled to themselves use the hydrants for all purposes, and at such times and in such manner as they thought fit. Defendants had used, or permitted to be used, the hydrants for giving temporary supplies of water

during paving and other similar works, and during severe frosts, and other exceptional circumstances; and they had been requested to cease and discontinue such user, but had refused to do so, and had continued to allow the use of the hydrants for the purposes above specified, without any agreement with, or consent of, the plaintiffs. The hydrants in question were provided by defendants, at the request of the Metropolitan Board of Works, in March, 1888, and shortly after that time—the request having been made under the provisions of section 32 of the Metropolitan Fire Brigade Act, 1865, and section 34 of the Metropolis Water Act, 1871. The costs, charges, and expenses of the defendants for providing the hydrants had been paid them by the Metropolitan Board of Works or by plaintiffs as their successors. Subsequently the cover of number 1976 required to be raised to the level of the new pavement; and the work was executed by the defendants, and afterwards paid for by the plaintiffs. Save in this one instance, no works of maintenance or repair had been executed upon any of the hydrants. The hydrants in question were appliances attached to the water-mains in districts where such mains were kept constantly filled with water under pressure, for the purpose of enabling water to be drawn from the main at the point where the hydrant was placed. In defendants' district, as in most other parts of the Metropolis, a constant supply of water under pressure was now afforded; and consequent upon the introduction of this system, and the invention of the hydrant, the old fire-plugs were replaced by hydrants. As far as the Metropolis was concerned, the old fire-plug had therefore practically ceased to be used as a means of obtaining water to extinguish fires, though many still existed. The hydrants were designed and constructed with a view to their being certain in action and easy to manipulate; but unless the valve which they included was properly replaced, there was a liability to leakage of water, and in cold weather to the possible disablement of the hydrant by freezing. The hydrants were of a pattern specially selected by the County Council to meet the requirements of the Fire Brigade, and were periodically tested by the Fire Brigade. There were now in defendants' district some 3885 of the hydrants, of which 3585 had been provided by the Company at the request of the County Council or their predecessors. The remaining 300 had been provided by defendants of their own motion, and at their own expense; and no question arose as to these. The questions of law for the opinion of the Court were: Whether these hydrants, fire-plugs, and apparatus provided by defendants, in the absence of any agreement under the London County Council (General Powers) Act, 1894, could lawfully be used for any purpose in addition to the supply of water for extinguishing fires. Secondly, whether such additional user was limited to the purposes specified in section 37 of the Water-Works Clauses Act, 1847, or to any, and what, other purposes. Thirdly, whether such additional user might take place without the consent of the London County Council. Fourthly, whether such right of user was confined to the defendants themselves, or might, with the permission of the defendants, be exercised by persons other than the defendants. He now contended that the Council were entitled to the exclusive use of the hydrants for the purpose of extinguishing fires, and quoted the various sections applicable to the question. Section 32 of the Metropolitan Fire Brigade Act, 1865, provided that every Water Company to whom the Act applied "shall provide at the expense of the Metropolitan Board of Works—of whom the London County Council were the successors—in any mains or pipes within the Metropolis, plugs (declared in the Metropolis Water Act, 1871, to include hydrants and other apparatus for a supply of water from the Company's pipes in case of fire) for the supply of water in case of fire, at such places, of such dimensions, and in such form as the Board may require; and the Fire Brigade shall be at liberty to make such use thereof as they may deem necessary for the purpose of extinguishing any fire." Section 4 of the London County Council (General Powers) Act, 1894, provided that "it shall be lawful for the Council to enter into, and carry into effect, any agreement with the Companies' supplying water in London and the Vestries and District Boards of Works in London, or any of them respectively, with respect to the use of fire hydrants for flushing and other purposes;" and that the Company owning the main or pipe with which the hydrant was connected and the Local Authority (if any) to whom the hydrant belonged should be a party to such agreement. Section 37 of the Water-Works Clauses Act, 1847, provided that the Water Companies should, "in all the pipes to which any fire-plug shall be fixed," "provide and keep constantly laid on, unless prevented by frost, unusual drought, or other unavoidable accident, or during necessary repairs, a sufficient supply of water for the following purposes, that is to say—For cleansing the sewers and drains, for cleansing and watering the streets, and for supplying any public pumps, baths, and wash-houses."

Mr. Cripps contended there was nothing in any of the Acts above referred to which restricted the powers of the defendants with regard to the use of the hydrants; and he quoted the judgment of Lord Esher in *Moore v. Lambeth Water-Works Company*.

After further argument, their Lordships gave judgment.

Justice Bruce said he was clearly of opinion that the first of the questions they were asked to decide should be answered in the affirmative. The section of the Water-Works Clauses Act, 1847, and the other Acts referred to in the discussion, imposed certain obligations upon the Water Companies; but there was nothing in them limiting the powers of the Companies in respect to the use of their own water. As to the remaining questions, he thought 2 and 4 should be answered in the negative, and 3 in the affirmative.

Justice Phillimore concurred, and said various specific obligations were imposed upon the Water Companies; but the only inference that could be drawn from the provisions imposing these obligations, was that there were no other obligations imposed on them, the whole matter being created and regulated by statute. The plaintiffs contended that there was implied a further highly burdensome obligation upon the Companies—that they were not to be allowed to use the hydrants for any other purpose than that of extinguishing fires. He did not agree with that proposition. There was nothing in the case which suggested that any mischief would arise by reason of the use by the defendants of the hydrants for the purpose for which they had used them. The hydrants belonged to the Water Companies, subject to their user by others; and independently of the statutes the Companies would have control over them. Therefore, there being no restriction in the statutes with regard to defendants' right to use them, the plaintiffs' claim failed.

Judgment was accordingly entered for the defendants.

Winding Up of the Mantleless Incandescent Gas Corporation, Limited.

In the Chancery Division of the High Court of Justice last Wednesday, Mr. Justice Wright made an order for the compulsory winding up of the above-named concern. The petitioner was represented by Mr. Dunham.

An Action for Damages Dismissed.

In the list of the cases to come before Mr. Justice Day and a Special Jury in the Queen's Bench Division of the High Court of Justice last Thursday was that of *White v. The Gaslight and Coke Company*, which it was understood was an action to recover damages for personal injuries. When the case was called on, Mr. Vaughan Williams, who, with Mr. Danckwerts, Q.C., appeared for the defendants, said he believed no one was present on behalf of the plaintiff, and therefore he should ask that the action be dismissed with costs. The plaintiff was called, but did not answer. His Lordship thereupon acceded to the learned Counsel's request.

Recovery of Money Alleged to have been Paid to a Water Company under Duress.

Last Wednesday, his Honour Judge Sir Horatio Lloyd gave judgment at the Wrexham County Court in an action brought by Mr. E. S. Clark, colliery proprietor, of Oak Alyn, Gwersyllt, against the Brymbo Water-Works Company, for the recovery of £25 18s. The action was to recover a sum of money alleged to have been paid to defendants as water-rate under legal duress, and in order to induce them to give plaintiff a supply of water for domestic purposes. The plaintiff objected to the amount of the Company's assessment, which resulted in the supply of water being cut off. His Honour said it was *primâ facie* necessary for plaintiff to show duress; but if payment was made with full knowledge of the facts, it could not be recovered. The money was paid with a full knowledge of the facts—that was clear from the correspondence. But plaintiff said that he paid under duress to induce defendants to give him a supply, as they were legally bound to do. He was at a loss to know how it could be said that the plaintiff was under legal duress in paying the money. Having first paid or tendered the proper rate, plaintiff would be in a position to demand a supply; but it seemed to him that the payment was made voluntarily. The plaintiff had a remedy in the provision of a penalty for refusing to supply. If the Company wrongfully exercised their powers, they were under penalties which went to the pocket of the injured party. On these grounds, he should give judgment for the defendants.

The Defective Electric Lighting in Marylebone.

At the Marylebone Police Court last Friday, before Mr. Curtis Bennett, the Metropolitan Electric Supply Company, of Baker Street, were summoned by Mr. J. W. Godfrey, on behalf of the London County Council, for having, on various dates from October to December last, failed to supply electric energy to the premises of Sir Felix Semon, physician, of 39, Wimpole Street, Mr. H. T. Butlin, consulting surgeon, of 82, Harley Street, and Mr. A. A. Hudson, barrister, of 28, Weymouth Street. Mr. Daldy appeared for the prosecution; Mr. Muir for the defence. Mr. Daldy stated that the Council had received many complaints of the Company having failed in their contract to provide a continuous supply of electric energy for the use of their customers, and that the persons named in the summons were representative of the bulk. The Company, on a previous occasion (*ante*, p. 34) had pleaded as an excuse for their default that difficulties in connection with the construction of their new works at Willesden had occurred, over which they had no control. But he (Counsel) put it that the Company had undertaken new business which they were unable to execute except at the expense and inconvenience of their other customers, and to the benefit of the Company. This failing of the light had proved very serious, both in business and in private life. He maintained that the Company could have no answer to the complaints made, for they were compelled by statutory obligations to fulfil their contracts with their customers. Mr. Hudson and Mr. Butlin gave evidence of the supply of electricity being stopped for varying periods on different dates, on one or more occasions as long as six hours. Mr. Muir, for the defence, denied that the Company had extended their operations at the expense of their other customers. The failure had arisen from other causes. The learned Counsel then explained the nature of difficulties which had had to be overcome in connection with the erection of works at Willesden—difficulties which, he said, no amount of human foresight could anticipate, and which the Company had no power to prevent. Since the 15th of December the supply had been constant, and measures had been adopted whereby it would be impossible for failures to recur in the future. He called Mr. E. Cunliffe Owen, the Secretary, and Mr. Todd, the Chief Engineer of the Company, who bore out these statements. His Worship said it was clear the Company had done their best under very trying circumstances, but, nevertheless, they had not complied with the conditions under which they had obtained their very extensive powers from Parliament, and therefore they were liable to a penalty. They would be fined 10s., with 23s. costs on each of the six summonses; making a total of £9 18s.

New Loan for the Birmingham Welsh Water Scheme.—The Finance Committee of the Birmingham City Council report that they have been in negotiation with the Prudential Assurance Company for the advance of a loan to the Corporation for the purchase of land and the execution of works, the extension of mains, and other water-works purposes authorized by the Water Act of 1892. The Company have agreed to advance a loan of £500,000 on the following terms: The amount to be advanced in two instalments of £250,000 each, the first instalment to be paid forthwith, and the second instalment on or before April 7 next; the loans to bear interest at the rate of 3¼ per cent. per annum; the principal sums to be repayable to the Company in three years from the date of each respective advance; and to be secured on the revenue of the water undertaking and on the borough fund and rate.

MISCELLANEOUS NEWS.

REJECTION OF THE PROPOSED CONCILIATION BOARD BY THE GLASGOW TOWN COUNCIL.

At a Meeting of the Corporation of Glasgow on Thursday last—Lord Provost Chisholm presiding—the subject of the formation of a Conciliation Board was under discussion.

Mr. G. Mitchell, in terms of notice, moved that a Committee be appointed to consider and report as to the best method to avoid disputes between the Corporation and their employees. He held that with a system of arbitration they would avoid any little friction which occasionally arose in the departments.

Mr. Battersby seconded the motion. He believed the adoption of such a system as was proposed would prevent those old and destructive methods which had estranged workmen from employers and employers from workmen. A progressive Corporation like Glasgow should be ready at all times to engage in such progressive work. If such a system were adopted by the Corporation, it would have an enormous influence on industrial enterprise in the city and the country.

Mr. Paton said that, as the Convener of a department which had a big interest at stake, he thought the motion, instead of tending for peace, simply tended towards war. He therefore considered it his duty to move the previous question. The motion seemed extremely innocent; but it was by no means so innocent as it looked. His experience was that when a dispute arose between the department and their workmen, by far the best plan was to allow the department to deal with the workmen themselves. He thought the tendency of the Town Council in all departments had been kind, considerate, and conciliatory towards the workmen; and he believed the workmen were fairly well satisfied with their position. Only in extreme cases, when they were interfered with by outsiders, who came in for the purpose of meddling with things with which they had nothing to do, was a little agitation got up, and trouble caused. If he wanted any illustration of the wisdom of the course he suggested, he would simply refer to the last case they had before them. The fact was that the movement of the gas workers never had a shadow of life in it, because the men knew that the Corporation wanted to use them well; and the result was that, apart from outside agitation, they would have had no trouble. If the Corporation appointed a Committee of the kind asked, it would simply give an inlet to the agitator, and open the door for bringing in those who were not familiar with the matter under dispute.

Bailie R. Anderson seconded the amendment. In the trade with which he was connected, he had had considerable experience in negotiations with workmen both as to wages and to working conditions; and he had never yet had occasion to bring any outside influence to bear upon the subject. They were always able to settle the matter amicably.

Mr. Forsyth supported the motion. He supposed that the trade with which Bailie Anderson was connected was prepared to recognize the Union; but Bailie Anderson, as a member of the Water Committee, was not prepared to recognize the Water Committee's men as members of a Union.

Bailie Anderson rose to order, and objected to Mr. Forsyth putting words into his mouth. He denied the right of Mr. Forsyth to make such a statement.

Mr. Forsyth said he would just point to this fact—that the employees of the Water Committee became affiliated to the Gas-Workers' Unfon. That body sent a communication to the Water Committee; and Bailie Anderson was one of those who spoke against the recognition of the Gas Workers' Union. If this did not indicate that he was not prepared to recognize the Union among their own men, he did not know what it could be. Again, he considered an injustice had been done when they referred to the agitator. It was impossible for the men themselves to work out their own salvation individually, and so they formed a Union, and appointed a Secretary, who represented the men in all dealings with the employers. That Secretary was, therefore, known and characterized as an agitator. Men who had been earnest in their efforts to alleviate the miseries of the workers of the country had always been characterized as agitators. He was aware that the Corporation employees had a more steady tenure of employment than those outside generally had; but as far as perfection went, he did not think Bailie Anderson would claim anything like that for any of their men.

Mr. Stewart thought that the very simplicity of the motion should recommend it to the acceptance of the Corporation. Conciliation had been carried on for years in connection with almost every trade and industry. Lord Rosebery had sat on one Committee in England for three years; and some of the best brains in the country had tried to solve the labour question by means of conciliation. In consequence of the growth of the city and the increase in the number of persons employed by the Corporation, the time must come when a board of level-headed men would be required to discuss grievances which arose.

Mr. W. Martin said that an insuperable objection to the motion was that it interfered with the prerogative of the members of the Corporation. The members of the Corporation undertook a serious responsibility when they were elected; and if they appointed any board apart from themselves, they would be very justly held responsible by the citizens if anything went wrong. Since he was elected a member of the Corporation, he had had an opportunity of doing something in the way of conciliation in connection with the Parks Department. The members could not forget that they were there as representatives of the ratepayers, and that the employees of the Corporation were not engaged for the commercial purpose of enabling them to pay a dividend or make a profit on behalf of shareholders. They were there in the discharge of a public trust in which the interests of the ratepayers were concerned; and they could not allow any outside body to interfere between them and the ratepayers.

Bailie W. F. Anderson said he was as much opposed to disputes as anyone; but he had to ask Mr. Stewart and Mr. G. Mitchell this question: Did they consider that the recent representations made to the various Committees on behalf of the police, the scavengers, the gas workers, and so on, would have been better considered, and more justice done to these men, by the appointment of an outside board who knew nothing about the men's duties, or the responsibilities put upon the Council?

Mr. Stewart said he never proposed that an outside board should be appointed. What he wanted was a Committee of the Council.

Bailie Anderson remarked that Mr. Stewart was a democrat, and what he supposed he wanted was a selection of gentlemen from various Committees, who were to come in and interfere with any Committee who they thought were not competent or capable of doing their own duty. The fact that there were twenty applicants for every vacancy in the Corporation service was proof, if proof were needed, that it stood well with the public.

Mr. Cronin said he had had twelve years' experience of Conciliation Boards, of which some of the largest and wealthiest employers in the West of Scotland were members; and there was not one of them who would not admit that their establishment was the best thing that ever happened in their business. If this was the case, he did not see why the Corporation employees should not have some medium of submitting any abuses that might exist. They did not propose that any agitator should be called in; they simply asked that a Board of Conciliation should be formed on the lines on which members of the Corporation had similar boards in connection with their own business. The members might reject the motion; but they would bring it forward again and again until it was carried.

Mr. W. Stevenson said Mr. Cronin had held out a threat as to what would happen if the motion were not carried; yet he disdained being an agitator. They could have no better proof of what would happen under a Conciliation Board than their experience on the Gas Committee. They were told that if they did not pay off a certain employee because he did not belong to the Society, they would strike. They did strike on Sunday morning; and their places were filled in the afternoon.

On a division, the amendment was carried by 34 votes to 18.

The Gas-Workers.

Ballie W. F. Anderson, who had a motion on the agenda to the effect that it be remitted to the Gas Committee to consider the propriety of forming a Conciliation Committee from their own workers, said it was unnecessary to propose the motion, as he understood that the workers had appointed a Committee to confer with Mr. Foulis.

METROPOLIS GAS SUPPLY.

Dr. A. W. Williamson's Quarterly Report.

The following is an extract from the report of Dr. A. W. Williamson, F.R.S., the Chief Gas Examiner for the Metropolis, on the quality of the gas supplied to London during the quarter ended the 31st ult.

The average illuminating power in standard sperm candles at each of the testing-places was as follows:—

The Gaslight and Coke Company—	
Fenchurch Street, E.C.	16·5
Kinghorn Street, Cloth Fair	16·4
Dorset Buildings, Salisbury Square	16·3
Millbank Street, S.W.	16·8
Ladbroke Grove, W.	16·5
Vincent Terrace, Islington	17·0
Carlyle Square, S.W.	16·3
Camden Street, N.W.	16·3
Kingsland Road, N.E.	16·7
Spring Gardens, Charing Cross	16·4
Vinery Villas, St. John's Wood	16·2
Lambeth Road, S.E.	16·3
Hornsey Road, N.	16·1
George Street, Hampstead	16·7
Commercial Gas Company—	
Wellclose Square, E.	16·7
South Metropolitan Gas Company—	
Hill Street, Peckham	16·7
Stoney Lane, Tooley Street	16·4
Lewisham Road, S.E.	16·4
Blackfriars Road, S.E.	16·3
Burrage Road, S.E.	16·4

It will be seen from these results that the average illuminating power of the gas at all the testing-stations was higher than the parliamentary standard—viz., 16 candles. Sulphuretted hydrogen was not reported to have been present in the gas at any of the stations during the quarter. The average quantity of sulphur in other forms than this was considerably less than that permitted—viz., 22 grains—at all the testing-places. Excesses of sulphur were reported by the Gas Examiners at Stoney Lane on the 23rd of October (24·4 grains), and at Blackfriars Road on the 12th of December (22·6 grains). With these exceptions, the limit allowed was not exceeded on any occasion. Ammonia was generally present in the gas throughout the quarter, but only in slight quantities. The limit allowed—viz., 4 grains—was not exceeded on any occasion.

SERIOUS EXPLOSION AT THE WIENER NEUSTADT GAS-WORKS.

The London papers early last week contained a brief notice of an explosion which took place in the gas-works at Wiener Neustadt, a town of 25,000 inhabitants situated about 31 miles from Vienna, on the 14th inst. The works, which are in the hands of a private Company, were visited last Wednesday by Mr. F. Martin, Engineer of the Sonnwendgasse station of the Imperial Continental Gas Association in Vienna, who has sent us the following particulars of the accident: On Sunday, the 14th inst., at 8.45 p.m., a violent explosion took place in the purifying-house at the Wiener Neustadt Gas-Works. The lids of three of the purifiers were hurled off the boxes, and the house was completely wrecked, as well as the adjoining valve and meter room. The condensers standing at the back of the purifying-house were found to be blown out of their upright position, and leaning against the scrubbers. Some hundreds of the windows in the District Court House, situated about 80 yards distant,

were shattered by the concussion, which was succeeded by a fire among the ruins. This was promptly extinguished by the local Fire Brigade. Fortunately there was no loss of life, nor was anyone injured; and the destruction to plant will be at least partially covered by the insurance. Thanks to the prompt steps taken by the Chairman of the Board (Herr Inewein), who was ably assisted by Herr Stempkowski, of the firm of Franz Manoschek, the plant was so far repaired that, contrary to general expectation, on Tuesday evening the town was lighted almost as usual.* As to the circumstances immediately preceding the explosion, it is only necessary to state that the purifying-house and the adjoining valve and meter room were lighted from the outside by common lanterns, some of them having Welsbach, and the others ordinary burners. The man in charge left the valve-room to oil an engine and visit the gasholders, of which there are four, and then went on to another building. Before he had time to return to the valve-room, the explosion occurred. The inference to be drawn as to its cause is obvious.

THE DEATHS FROM GAS SUFFOCATION NEAR TUNSTALL.

Coroner's Investigation.

On Monday last week, Mr. John Booth, the County Coroner, held an inquiry at Sandyford, near Tunstall, on the bodies of Betsy Vernon (63), and Minnie Vernon (20), her daughter, who met with their deaths by gas suffocation, as briefly reported last week. It was stated that Mrs. Vernon was a widow, of independent means, and that she resided with her daughter, next door to a son-in-law, named William Colclough. Recently some repairs have been executed in the roadway in front of Mrs. Vernon's house; and a few days prior to the lamentable occurrence, a steam-roller was at work there. The weight of the machine is supposed to have injured the gas-mains, and so caused an escape of gas. On the evening of Friday, the 12th inst., a strong smell of gas pervaded the two houses adjoining that of Mrs. Vernon; and, upon investigation, it was found that gas was entering the rooms through the floors and the wainscoting on the walls. Owing to the volume of gas, it was impossible for the inmates of the houses to close their doors and windows during the night; and even then several people were overcome by the gas, and medical assistance had to be obtained in order to restore them. Colclough and his family were said to have suffered considerably from the effects of the gas; and during the night, when his family were ill, Colclough knocked upon the dividing-wall between his own house and that of Mrs. Vernon in order to attract her attention, but failed to do so. He then went outside and knocked at the door and front window, but without success, though he could see a light in the kitchen. He came to the conclusion that his mother-in-law had gone to visit a daughter at Longton. No further notice was taken of the occurrence until the Saturday night, when, nothing having been seen or heard of Mrs. Vernon or her daughter, Colclough effected an entrance into their house; and in the kitchen he found Mrs. Vernon lying on the floor dead, and her daughter, Minnie, on the sofa in a state of unconsciousness. Assistance was obtained, and efforts were made to restore Miss Vernon, but they proved unavailing. Other evidence was given, which showed that, during the week previous to the occurrence, the smell of gas had been noticed in the house; but no one thought there was any danger. The Jury returned a verdict that the deaths were due to asphyxiation caused by coal gas, evidently from a breakage in the gas-main. The Foreman added that the Jury regarded the matter as an accident, for which no one was to blame. [There are, according to the evidence, two peculiar features in this case. One is that there should have been a light in the kitchen and no explosion occurred; and the other that the residents should have allowed the gas to continue to accumulate in their houses without, apparently, calling attention to it.]

A GAS WORKERS' PARADISE.

It may be remembered that in the course of the discussion which took place in the Manchester City Council on the 3rd inst. (*ante*, p. 90), one of the speakers referred to the insanitary condition of the Gaythorn station, which he said was not creditable to the Gas Committee. He added that he had seen other works which were models of their kind, and which might be imitated. The Chairman of the Committee (Alderman Gibson) admitted the justice of the observations, but said the Committee could not do for their men in Manchester what was done for those employed in the "model" works alluded to, which he presumed were those at Leicester. He offered some explanations as to why the men had not had more done for them, and said the matter was having his consideration. In view of this special reference to Leicester, it may not be uninteresting to reproduce from the "Sheffield Independent" an account by a correspondent of a visit he paid, in the company of a friend, to the gas-works in the Midland town. It is as follows.

Our first introduction was to what was described as "The Old Messroom." This is a comfortable upper room, in close proximity to the retort-house. Plain, homely tables of deal occupy the centre. At the side opposite the entrance, a bright fire was burning as we entered. This is flanked by the ovens in which the men's dinners and other meals are cooked. An attendant is appointed by the Gas Committee both to cook these and also to fulfil the other duties generally pertaining to the office of caretaker. Hot and cold water is provided for the necessary ablutions of hands and face. There was an air of comfort about the room. From this building we proceeded to "The New Messroom." This is a lofty hall some 78 feet by 24. Here again a cook-attendant is kept permanently in charge. Fifteen tables, flanked with forms, run longitudinally from one end to the other. It is fitted up with the usual cooking and other arrangements. In an adjoining room there are thirteen white enamelled hand-basins and five baths. Each man provides his own soap and towel. There is also a supply of pegs for clothing, and of lockers for other possessions.

We were next ushered into what was described as "The Lecture Hall." This is a room some 68 ft. by 30 ft. The floor is covered with linoleum. Polished tables are ranged on each side of the central passage. These are used for reading, games, &c. A circulating library of books is deposited on the shelves just above the tables. The tables themselves are provided with newspapers and magazines. The walls are covered with maps, framed prints, and pictures. The centre of the room is occupied by a bagatelle table. We were informed that this is shortly to be replaced by one for billiards. A raised platform stands at the further end, on which is placed a desk for lecturers and speakers. An upright piano gives evidence of singing and music. On the wall behind the platform, a magic-lantern sheet, 16 feet square, is rolled up; and in the centre of the hall there is the usual stand with lime-light attachments for the purposes of pictorial displays. As affording a measure of the interest taken by the men in the institution, it may be observed that the tables as well as other articles of furniture were made by the carpenters employed in the works. A review of the purposes to which the "Lecture Hall" is put almost inclines one to the opinion that it has been incorrectly named. It ought to be known as "The Gas Workers' Club." It is here that they meet nightly. They hold whist matches, play cards, chess, dominoes, and bagatelle. They bring their wives with them and have concerts and amateur theatricals. It may be well imagined that smoking is not prohibited. The only taboo placed by the Committee is on strong drink and language. The Committee of Management are appointed by the men from among themselves. The institute is for all practical purposes their own. The upkeep of it is provided by a voluntary weekly subscription of one penny. It has been found from actual experience that it is sufficient for the purposes of maintenance. The institutions of the Leicester Gas-Works are not exhausted by the club, dining-halls, lavatories, baths, and the other things which we have summarized. The gas workers have a brass band of their own. It is composed of thirty-four men, and is absolutely self-supporting. It is maintained by voluntary subscriptions, and the proceeds of public concerts. The character of the music discoursed by the band may be gleaned from the fact that its services are invoked at the concerts provided by the Municipality.

Another institution is the ambulance corps. The vast majority of the men employed in the works have joined this; but there is a special staff of thirty who are looked upon as the "crack team," if the phrase may be allowed in such a connection. As before indicated, the greater number of the men have passed the third examination in the principles of first aid. The teaching of ambulance duties has produced both a moral and financial result. It has given the men something definitely useful to learn during their spare hours, and has thus kept them out of the public-house. It has also enabled them to get their slight wounds dressed on the spot immediately after an accident, and has in this way saved the loss of time and wages which a visit to the Infirmary oftentimes induced. When the men were once outside the building, it was found that they did not return as speedily as was desirable. Meeting with boon companions, they remained to waste time away; and the journey to the Infirmary was frequently made the beginning of a drunken bout. All this is changed with the advent of the Ambulance Corps. Wounds are dressed on the spot; and now that they have had experience of the latter plan, they prefer it to that formerly in vogue. It is now a matter of some difficulty to induce them to attend the Infirmary, even for the treatment of accidents which the ambulance specialists think to be beyond their powers and skill. As Mr. Alfred Colson, the Manager of the works, expressed it on the occasion of our visit, "Ambulance work pays." The same may with equal degree be said of every one of the provisions made by the Leicester Corporation for the comfort, health, and happiness of their gas workers. For the last ten years, the Leicester citizens have benefited to the tune of from 6d. to 8d. in the pound from the profits of their gas-works.

THE DEFECTIVE ELECTRIC LIGHTING IN MARYLEBONE.

Deputation to the President of the Board of Trade.

Last Wednesday, the President of the Board of Trade (the Right Hon. C. T. Ritchie) received a deputation of residents in Marylebone on the subject of the defective supply of electricity in the parish by the Marylebone Electric Supply Company, to which reference has already been made in the "Journal." He was accompanied by Sir Courtenay Boyle, the Permanent Secretary, and Mr. A. P. Trotter, the Electrical Adviser to the Board. Two memorials were presented, representing 600 complainants.

Dr. Fletcher Little, in introducing the deputation, said that for several years past the supply of current had been very unequal, and occasionally it had failed altogether. For the past two or three months the failures had been of almost daily occurrence, and sometimes they had happened twice a day; the duration of the failure frequently extending over several hours. Sometimes the Company had given notice of their intention not to supply during several hours in the afternoon; but in the majority of cases the failure had taken place absolutely without notice. When the failures occurred, other light had, of course, to be hastily obtained. In many establishments, when the electric light fittings were put in the gas-fittings were removed, and the supply of gas was cut off. In those cases, lamps and candles had to be found and lit in the dark. The injury thus occasioned to all classes was manifest. There was a sudden cessation of work; and in some cases there was danger to life, especially in commercial establishments where large quantities of inflammable materials were displayed or stored. Representations had been made to the Company on the subject of these failures; but as they had not resulted in putting an end to the state of things complained of, the parties affected approached the President of the Board of Trade. They had to pay a high price for their electricity as compared with other parts of London. In Shoreditch, the price was only half that charged in Marylebone. Measures had been taken, by summoning the Company, to bring about a better state of affairs. The Vestry recently, under pressure, took out a summons for penalties for the Company's default, and the Magistrate adjourned the summons for three months. In a case of that kind, they were advised that it was hopeless for them to proceed by summons; for the penalties, if inflicted, would not compensate them for the damage they had sustained, but would go to the general public.

* It was stated in some of the London papers that, owing to the explosion, the town would have to remain without gas *for weeks!*—Ed. J.G.L.

The private consumers had no claim against the Company for any failure to supply them. They prayed the President to introduce, either in a Provisional Order or a Bill, a clause placing the Company in the same position as other trading companies, and giving the consumers a right to compensation for their breach of contract and duty to them. They would then be able to protect themselves.

Dr. E. A. Fardon, representing the Middlesex Hospital, said that during the past twelve months the authorities of the hospital had been put to very serious inconvenience by the deficiencies of the Company. The quality of the light supplied—the voltage—had been so low that when the lamps were turned on they gave hardly sufficient light even for necessary purposes. This entailed the turning on of an extravagant number of lamps. The effect upon the lamps of a fluctuating voltage such as they were accustomed to, was very destructive. Frequently during the latter weeks or months of the past year they had had the light entirely extinguished without the slightest warning. One might imagine what the effect of this was in a hospital where operations were very often carried on at all hours of the day. Their operating theatre, which relied upon the electric light for its illumination, had on more than one occasion been plunged into immediate darkness in the midst of very important operations.

Mr. Ritchie asked if there had been any amelioration of the situation since the 15th of December, and if they had had any reason to complain of total failure of light since that time.

Dr. Fardon said the 12th of December was the last time a failure occurred during an operation; but on the 20th and 23rd, as well as on the 4th of January, the hospital was plunged into darkness—once for 45 minutes.

Mr. T. W. Baker said that the fluctuations in the voltage had been frequently between 92 and 109 and 110 volts. The lights on the previous afternoon were so bad that at a place of worship gas had to be used.

Mr. J. Lewis, who was announced as the largest single ratepayer in Marylebone, said that on Dec. 6 his lights went out at 4.40 p.m., and remained out till 7.50 p.m.; on Dec. 7 they did so from 4.45 till 5.15; on Dec. 8 from 5.20 till 7.30; on Dec. 11, 12, 13, and 14, from 4 till 8; and on Dec. 15 from 3 till 4. Subsequently to the 15th of December, they had gone out only for 10 minutes or so at a time.

Mr. Ritchie said he thought the complaints had been so universally acknowledged and so clearly established that it was not really necessary to elaborate the subject or to trouble gentlemen to make speeches upon it. The names of the gentlemen who signed the requisition to himself and the composition of the Committee who had been formed were such as to make it quite apparent to everybody that the matter was one of very great importance, and one in which, if it was at all possible to find a remedy, a remedy should be found for the complaints. These were that the supply was often inadequate, and that sometimes it altogether failed. No one could have seen the correspondence in the Press without feeling that there must be some legitimate ground of complaint; and it was not only in the Press that those complaints had found utterance. He had had representations from various quarters—from public bodies and private persons, and had had individual experience himself, not in his own house, but in a friend's house, where he was dining one night. A hurried resort had to be made to candlesticks and lamps of all kinds, sorts, and descriptions; and he had heard of similar experiences from many personal friends. So that, having regard to all these facts, and to the deputation and to the memorials he had received, there could be no question at all that the complaint was a very substantial one, and well grounded. The Board of Trade had communicated with the Company more than once; and he had received a letter that morning from them in which they said there was no reason to apprehend any further failures. The Company stated that since the 15th of December there had been no ground of complaint. [Dr. Little: They state what is not correct.] He found, according to the statement of Dr. Fardon, that there was a total interruption on the 20th and 23rd of December, as well as on the 7th of January. Mr. Baker had said that so recently as the previous day the light was so unsatisfactory as to render it necessary that gas should be turned on in a chapel where the electric light was fitted. Complaints had also been made by Mr. Lewis of interruptions; but all the instances he adduced had been prior to the 15th of December. There had not only been complaint of the want of light, but also of its quality; and, so far as he could understand, this point was not by any means limited to the period ending with the 15th of December. It was alleged that even up to the present time the quality of the light was complained of. What the deputation had related had been also stated to him privately by a gentleman who had been a sufferer, and who said that, in place of having, as before, to use three or four lights, he now had to turn on seven, and that he got a light not so good as it was when he was using a much smaller number. Those complaints were very serious. According to the admission of the Company themselves, they certainly were greatly lacking in foresight, and much to blame, he thought, in not having seen what the development of their supply would be, and in not having properly provided in time for the demand that would be made upon them, because he understood that inefficient light was just as costly as efficient light. It seemed, therefore, to him that they had great reason to complain, not only because of the inadequacy of the light, but because they had to pay as much for the inadequate light as if they were given proper light. In a pamphlet the Company had sent to him, they had gone through the various periods during which they acknowledged that there was an inefficient supply; and they accounted for it by the large increase in the demand, and by the fact that their plant was not adequate to cope with the calls upon it. They were undoubtedly right when they said they took very strong and drastic steps to provide plant which should be equal to the demand; and they incurred very large expenditure on their Willesden works, which they said were completed on the 15th of December, since which date, they alleged, no real ground of complaint had been communicated to them. It would be his duty to inform the Company of the statements made there that day, and to point out that they differed from that made by them in their letter. There had not been any suggestion as to what the Board of Trade could do in the circumstances. Dr. Little had asked the Board to bring in a Bill or provide in a Provisional Order for damages for breach of contract; and he seemed to think that lighting companies were specially exempted, under the common law, for neglecting to fulfil their contracts. They were, however, just as liable as any other companies for any breach of contract between themselves and their customers. This suggestion, therefore, it was unnecessary for him to adopt. It was further said that the price charged was a very heavy one, and largely in excess of that paid in other parts of London. There was some remedy provided for excessive charges; and the Board of Trade, on application being made to them by the Local Authority, could review the charges and act accordingly. If they considered them to be in excess, they could provide for decreasing them; but in regard to the special complaints the deputation had brought there, he was afraid the Board of Trade had practically no power. The Board issued regulations, and they were binding upon the Company. They required them to maintain a constant supply. In case of default, the Company were liable to penalties, unless it were shown that default was caused by inevitable accident or by *force majeure*. So that any aggrieved person might take action. Action has been taken by summons; and the Magistrate allowed the penalties to hang over the heads of the Company for reasons stated in his decision. These penalties, he (Mr. Ritchie) presumed, would come up again; and though it was very little satisfaction to those who suffered that the Company should be fined, on the other hand it would have, he hoped, some effect upon them in inducing them to do their duty and provide adequately for the necessities of the case. He had said the Board of Trade had really no power to compel. The only power was that of summoning the Company before a Magistrate, and getting them mulcted in penalties. The only real remedy for defaults of this kind, with regard to quality, sufficiency, and price, was competition. Parliament had more than once endorsed the action of the Board of Trade in granting Provisional Orders both to local authorities and to districts already supplied by a company. The year before last, the Vestry of Marylebone applied to the Board for an Order to start an alternative supply. The policy of the Board was, where a *primâ facie* case was made out, to take such steps as would enable Parliament to come to a decision on the application that had been made. Accordingly, they granted an Order to the Vestry of Marylebone. This Order was read a second time, and was referred to a Committee. Unfortunately for the deputation, in that Committee the Order did not receive confirmation. He presumed the Committee considered that no *lâches* had been established on the part of the existing Company; and, this being so, it was not in the public interest that another Order should be given to the Vestry. No complaints were brought before the Committee, though some had been made in the House of Commons by those who spoke in favour of the second reading of the Bill. Since then they had had complaints of the inadequacy of the light supplied in the City of London. An inquiry had been held, the reasonableness of the complaints had been established, and a Provisional Order had been granted and confirmed by Parliament. There was at the present moment an application before the Board of Trade by a Company; but the Marylebone Vestry objected to the granting of the Order, on the ground that a Company were already in the field, and that a new one would break up the streets and increase the difficulties already experienced in finding places under the streets for necessary public works. Of course, the Board would have to consider the objections of the Vestry, and then deal with the question in the way they deemed best in regard to the public interest. He thought the deputation would have done some good in ventilating the subject, and in showing how burdensome the present state of things was, and how necessary it was that some remedy for it should be found. It would show the Company the gravity of the issue; and he hoped it would spur them on to make such alterations as would improve the quality of the supply, and also provide against the deficiencies which had been of such frequent occurrence, certainly previous to the 15th of December.

After some further conversation, the deputation thanked Mr. Ritchie for his reception, and withdrew.

ELECTRIC LIGHTING NOTES.

Plans have been approved by the Keighley Town Council for buildings and plant in connection with their electric lighting scheme; the estimated cost being £12,510.

The Sevenoaks District Council have determined, on a report by Mr. W. C. C. Hawtayne, to apply for an Electric Lighting Provisional Order, and to oppose an application for an Order by the Electrical Power Distribution Company.

Mr. W. O. E. Meade King, of the Local Government Board, held an inquiry on Tuesday as to the application of the Worcester City Council for sanction to a loan of £4000 for electric main extensions, meters, and indicators. There was no opposition.

There was a long discussion at the meeting of the Limerick Corporation on the 11th inst. on the proposition to adopt Mr. Enright's report on the proposed scheme for supplying the city with electric light, and to ask for a Local Government Board inquiry with a view to borrowing the £20,000 required for the work. Eventually it was decided by 28 votes to 4 that the report be adopted and an inquiry asked for; a motion to limit the scheme to £10,000 having been defeated.

Asked, at the meeting of the Huddersfield Town Council last Wednesday, how it happened that, since the reduction in the price of electricity, consumers' bills had been heavier, Alderman Calvert, the Chairman of the Electric Lighting Committee, returned a somewhat ambiguous answer. He said that, since the reduction in the price of the light, the cost of coal had gone up considerably; and therefore the effect of the reduction could not yet be fully appreciated. We entirely fail to see what the price of coal has to do with the question put to the Alderman, if the reduced charges to the consumers are being continued.

A somewhat novel prosecution took place at Exeter a few days ago, when a youth was summoned for extinguishing a public lamp. At half-past two in the morning, the defendant opened the box at the base of one of the electric light posts, switched off the arc light, and turned on the incandescent side lights. The Town Clerk grimly remarked that if, in committing this piece of folly, he had touched an unguarded wire, the defendant would have been the subject of an inquiry by a jury in another Court. This information as to the danger of the practice, supplemented as it was by a fine of 10s., should be sufficient to restrain any tendency to practical joking of this kind on the part of the youth of Exeter.

The Douglas Town Council had a three hours' debate on Wednesday, the 10th inst., on the recommendation of a Special Committee that the

site at the foot of the quarry behind the gas-works should be acquired for electric lighting works. Strong opposition was shown to the proposal; some members favouring a site at Belle Vue, and others one at the Council's Ballaquayle Water-Works, which, it was claimed, would be central. The recommendation in favour of the quarry site was rejected by 12 votes to 10. The Committee were appointed to carry out the electric installation on the lines laid down by Professor Fleming, and they contended that their duties were ended by the negativing of their recommendation.

Just now Elland is much concerned about electric lighting and electric tramways; and the arrangements have almost reached a deadlock, owing to the Elland District Council and the Halifax Corporation being unable, so far, to come to terms. Some time ago the District Council decided to apply for a Provisional Order to enable them to supply electricity in the district. This step was taken after a private Company had sought to establish a local station. Recently the Halifax Corporation decided to extend their tramway service to Brighouse. To reach that borough, it will be necessary to go over practically the full length of the Wakefield main road, which is in the Elland district. Bearing in mind their Provisional Order, the District Council demanded power to supply the electric current for the trams when in their district. The Halifax Tramways Committee now refuse such a concession, but suggest that they should establish an electricity station at Elland, and supply current in bulk to the Local Authority at the rate of 2¾d. per unit.

"The Development of Electricity as an Illuminant" was the subject of a lecture given under the auspices of the Liberal and Conservative Associations of the Spinney Hill Ward at the Melbourne Hall, Leicester, last Thursday week, by Mr. Alfred Colson, Manager of the Corporation Gas and Electric Lighting Works; the proceeds being devoted to the fund for the families of Leicester reservists called out for active service. There was a large attendance. The lecturer first discoursed on the laws and attributes of electricity, showing the gradual growth of a science which, although its study had been practically confined to the nineteenth century, was known to exist some 2000 years ago. He then gave particulars relating to the discovery and early history of electricity and its development, as its adaptability for practical uses was discovered. As a practical illustration he referred to the electric lighting installation in Leicester, and showed by means of cartoons the machinery in use. During the evening, Kipling's "Absent-Minded Beggar" was recited; the collection amounting to £11 13s. Including this sum, it was anticipated the amount handed over to the fund would be about £30.

In our "Notes" last week, reference was made to the new danger to which users of the electric light are exposed by the bursting of the bulbs of incandescent lamps, and the glass flying into the eyes. The "Electrical Review," alluding to the matter, says: "The explanation seems to us to be afforded by the expulsion of the lamp 'socket,' or rather the cap. This points most distinctly to a short-circuit in the holder, which, at 200 volts, would act with explosive violence. Such a short-circuit sometimes occurs when the cap is being inserted into a live holder—indeed, we have quite lately heard of more than one case where a lamp has exploded in the act of insertion into a holder without first switching off. A cap properly fitted into a bayonet holder is not easily knocked out, nor is it likely to be short-circuited; but if it is carelessly inserted, it may be left in such a position as to provide the requisite conditions for a short, which would blow out the loosely-held cap, and by the shock fracture the bulb. The danger, therefore, lies in carelessness in putting the lamp in place, and neglecting to switch off before doing so. To suggest that the act of switching on a 200-volt lamp is likely to cause an explosion, is absurd."

Last Thursday afternoon, a meeting of users of electric light in New Cross and Deptford was held at the Goldsmiths' Institute, New Cross, under the presidency of Mr. Sidney Webb, to consider what steps should be taken to improve the supply of the illuminant. Mr. J. S Redmayne, Secretary of the Institute, stated that from tests taken there it was found that the voltage fluctuated between 100 and 75; and he believed the Board of Trade stipulated that companies must not supply at less than 4 volts below 100. There was also the great danger of the light going out suddenly when the students were busy with the machinery. Several gentlemen expressed their strong dissatisfaction at the way in which they were supplied. The Chairman said no doubt the cause of the inadequate and uncertain supply was the fact that business had increased so fast during the past year that it was altogether beyond the power of the Company to cope with it. But, notwithstanding this, they were going on booking customers. Vestries or district boards had power to take proceedings against any company for every default; and he suggested that they should be instituted by the Greenwich District Board. He also suggested that every customer should deduct 25 per cent. from his bill, and ask the Company to sue for it. A resolution was passed that the suggestions of Mr. Webb should be carried out.

Last Thursday, the Mayor of Stockport (Mr. Thomas Webb) formally opened the electricity works established by the Corporation on the site of the old Millgate Gas-Works; but current has now been supplied for some little time. The lamps installed are equivalent to 7700 of 8-candle power each, and 36 arc lamps for public lighting; the total plant capacity being equivalent to 13,000 8-candle power lamps, not including the accumulators or spare engine. The number of customers has increased from 30 on the opening day to 120; and the Committee controlling the department, of which the Mayor is Chairman, trust to be able to present at the close of the financial year a report showing that the undertaking has at least paid its way (a most unusual thing for the first year of electrical undertakings). Meanwhile the consumption of gas steadily and rapidly increases; and it is anticipated that the output for the current financial year will show a higher percentage of increase than has been met with throughout the history of the undertaking. In the year ending 1879, the make of gas was 232,204,800 cubic feet; and for the year ending March last, it was 609,965,500 cubic feet. The heaviest day's make of gas in 1879 was 1,284,600 cubic feet; and in the present winter it has reached 3,474,500 cubic feet. The heaviest day's consumption in 1879 was 1,433,300 cubic feet; and in the present winter 3,801,500 cubic feet.

The St. Helens Corporation are likely to find that their views on the Lancaster Electric Power Bill will be at variance with those of the other authorities concerned in this measure. The Lord Mayor of Manchester has convened a conference of representatives of Corporations for to day to consider the Bill; and the St. Helens Parliamentary Committee have deputed a few of their number to attend. Their instructions are to support any action of the Association of Municipal Corporations, which has for its object the protecting of their rights and privileges in the matter of supplying electric light and power; but they are not to agree to any proposals which will have the effect of preventing the extension of cheap electrical power throughout the country. It is thought by the Committee that it would be a great advantage to have cheap power for the neighbourhood; and if it was found that the Company could in the future sell power cheaper than the Corporation, then the latter should have the right to ask them to supply them, if they wished it, in bulk, for the purpose of retailing it at a small profit to the inhabitants. It is considered that, if the Company get powers, and can supply more cheaply than the Corporation, manufactories will be established outside the town to use this cheap power. Therefore the Committee are of opinion that it would be far better, instead of opposing the Company, that the Corporation should have authority to buy from them; so that the manufacturers might be induced to go into the town instead of outside.

Since the Leeds Corporation purchased the business of the Yorkshire House-to-House Electricity Company, Limited, about a year ago, they have aimed at extending the works in such a way as to adequately meet the growing needs of the city. For the purpose of ascertaining the best means of at once improving the mode of supply and enlarging the means of production, the Electric Lighting Committee not long since instructed Messrs. Hopkinson and Talbot to draw up a report. The report, which has just been prepared, divides itself into three heads—finance, the provision of power in the area at present occupied by the Corporation mains, and the extension of electric current into other districts. On the question of finance, it has been decided to postpone a decision, in order to secure further expert advice. With regard to the provision of power in the area at present covered by the mains, it has been decided to recommend that the Corporation should not introduce any other system of current into that area, and that, seeing the great improvements that have been made in single-phase motors, the Corporation should provide motors of this type for hire, which, though suffering some disadvantages in comparison with motors on other systems, are capable of providing power for those who might want to use them. In reference to the question of the future extension of the works, it has been agreed to ask the Council to at once proceed to develop the Britannia Mills site, and provide plant and machinery for producing current on the two-phase system at 50 alternations, as suggested by Messrs. Hopkinson and Talbot. The Britannia Mills, which adjoin the electric lighting works, were taken over by the Corporation from the House-to-House Electricity Company at the time of purchase. The price, it is interesting to recall, was £217,420, paid in 5 per cent. irredeemable stock. What the cost of the extension now proposed may be, it is, of course, impossible accurately to state; but it is roughly calculated at about £100,000.

Some correspondence has been going on in the "Bexhill Chronicle" on the subject of the electric lighting of the town. A writer under the not very euphonious name of "Tyke" was strong in the praise of the Brighton system of charging and in his advocacy of the electric light as the "poor man's" light. But he has been pretty conclusively answered by "A Visitor," who ventures to think that a prepayment gas-meter will answer the working man's purpose better than an electric lamp, as cooking as well as lighting could be done through the same agency. He points out that, on modern principles, it is quite possible for a gas-lighted house to be as healthy and clean as one electrically lighted—indeed, much more so under certain circumstances. "Tyke" ventured to make some comparisons between the cost of gas and that of electricity; putting 4½d. per unit as equivalent to gas at 2s. 8d. per 1000 cubic feet. "Visitor" puts him right on this matter. Gas has to be supplied of 15-candle power; and any consumer can obtain this quantity of light from his gas, if he burns it properly. The electric incandescent lamp equivalent to the 5 cubic feet of gas required for the production of the 15-candle light is the 16-candle power size, which may be taken as using 60 watts of current per hour. Now, 60 watts, at 4½d. per 1000 watts, cost 0·27d.; but 5 cubic feet of gas at 3s. 6d. per 1000 cost only 0·21d., or equal to 60 watts of electricity at 3½d. per unit. He clinches his argument by pointing out that, in order to compete with incandescent gaslight, electricity would have to be supplied in Bexhill at about 1d. per unit. The Local Authority have obtained the sanction of the Local Government Board to incur an initial expenditure of £20,000 on their electric light undertaking. With a knowledge of the local circumstances, "Visitor" expresses surprise that a consulting engineer could be found who would recommend such an outlay, and that the loan should have been granted. He thinks electric light works could have been established for a smaller sum, with more hope of early success.

METROPOLIS WATER SUPPLY.

The Future Control of the London Water Undertakings.

In the article on "Water and Sanitary Affairs" in the "Journal" last week, it was mentioned that the Royal Commission on Water Supply, presided over by Lord Llandaff, would advise Her Majesty that the London Water Companies' undertakings should, if purchased, be handed over to a specially constituted Water Board. This statement is borne out by the final report of the Commission, issued yesterday. Pending the fuller notice of the document (which occupies 77 pages) which will appear in subsequent issues, we give the portion specially bearing upon this subject. It is as follows.

Having come to the conclusion that it is not desirable that the London County Council should be the purchaser of the water undertakings, we have now the more difficult task of reporting what authority or authorities should, if the policy of purchase is adopted at all, acquire and manage those undertakings. We put aside, at once, the notion that several authorities should become the purchasers. Whatever advantage, financial or administrative, can result from purchase, will arise from the amalgamation of the sources of supply and the means of distribution in one hand, so that both may be used and applied with the greatest economy, and with a view to the needs of every part of Water London. We have already commented at length on the impracticability of severance of the water undertakings even among the counties which are within Water

London, and have stated our view that, since severance is a necessary consequence of purchase by the London County Council, it forms a strong objection to purchase by that body.

In the Metropolitan counties, the feeling against purchase by any representative Water Board or Water Trust, constituted on the basis of population and rateable value, appears to be as strong as against purchase by the London County Council. The outside counties think they would, under such a Board or Trust, be as completely in the hands of London as if London were the sole purchaser. The representatives of those counties put their objection to purchase by a Water Trust on the ground that London would have the preponderance on such a Trust; and also on the ground that the Water Trust would have to levy rates in their county, and that any one county would be powerless to resist a resolution by the Trust to draw more largely upon the supplies of water in the county for the benefit of other parts of the water area, or to use the roads of one county rather than another for laying down pipes, or to give greater privileges to one county than to another.

It is, perhaps, unnecessary to give any better proof of the practical difficulty of creating any Water Trust, based on strictly representative principles, than is afforded by the history of the Government Bill of 1896. That Bill created a Water Board, on which the London County Council had barely as much preponderance as population and rateable value would have suggested; such Board to have powers of control, and also powers to promote Bills for the purchase of the water undertakings. The expenses of the Board were to be defrayed by the Metropolitan counties, in proportion to the total annual value, as determined for county rate purposes, of the parishes in each county within the Metropolitan water area which were wholly or partially supplied by any Metropolitan Water Company. The Government were obliged, however, under pressure from the Metropolitan counties, to insert in the Bill, in its progress through the House of Lords, a clause enabling any such county to take itself out of the Water Trust, and have independent control of its own water supply; and the Bill was ultimately dropped.

The conflicting opinions on the subject of purchase, which the Local Authorities of Greater and Water London and other witnesses have expressed to us in the course of our inquiry, and which we have already reviewed—and, indeed, the whole history of the question with which we are dealing—have made us fully aware of the great difficulty which exists in devising any Water Board, for the purpose of acquiring and managing the water undertakings, which will be accepted by the various interests concerned and by Parliament. Nevertheless, our consciousness of the great importance and intricacy of the questions relating to the future water supply of London which are before us, the immense scale on which the works will have to be constructed, and the financial arrangements made, the difficulty of obtaining, from eight different Companies, that unity of action which is so necessary for bringing such operations to a successful issue, and our recognition of the importance of bringing about, by purchase, absolute coalescence of the eight Water Companies and their interests, having led us to the conclusion that in such purchase and in management by a single public authority, a satisfactory solution of this great question may be found, it becomes our duty to put into concrete form, to the best of our ability, the suggestions we have to make.

We think the Water Board should be a permanent, and not a fluctuating body, consisting of not more than thirty members, selected on account of their business capacity, and, if possible, their knowledge of matters connected with water supply, and so constituted as not to give a preponderance to any of the conflicting interests concerned.

We think that the size and importance of the area to be dealt with takes the duties of the Water Board out of the category of purely municipal or local functions, and makes them a matter as much of national as of local concern. For this reason, we deem it necessary that the proceedings of the Board should be brought periodically and automatically under the observation of Parliament, and that it should include delegates of the Local Government Board, in order that the influence of the Executive Government should be continuously felt.

The London County Council should appoint (say) ten members of the Board; the Conservators of the River Thames, four members; the County Councils of Middlesex, Surrey, Essex, Hertford, and Kent, the Lea Conservancy Board, and the Common Council of the Borough of West Ham, should each appoint two members; and the Local Government Board should appoint the Chairman and Vice-Chairman. The appointing authorities should be empowered to fill any vacancy caused by death or resignation of their representatives, who should hold office for a definite term of years. The Chairman and Vice-Chairman should receive adequate salaries; and a sum should be allotted annually for division among the other members of the Board, according to their attendances, as is now done in the case of the Conservators of the River Thames. The Board should be empowered and required to acquire the undertakings of all the eight Metropolitan Companies, either by agreement or, failing agreement, by arbitration, on the terms usual in cases of compulsory purchase; taking over all the existing powers and obligations of the Companies. The boroughs of Croydon and Richmond appear to us to be reasonably entitled, if they desire it, to be made independent of the Board, and to supply themselves, taking over any works of distribution in their district belonging to the purchased Companies.

In order to meet the expenses of purchase, the Board should be entitled to issue a 3 per cent. stock secured on the water charges of the whole water area. This should be made a trustee investment, transferable at the Bank of England. The Chamberlain of the City of London should be directed to transfer to the Board all the proceeds in his hands of the Chamberlain's sinking-fund clauses, which should be repealed at and from the date of the purchase of the several undertakings. The price of purchase should be payable in cash at the option of either the vendors or the purchasers. By agreement, the vendors may be paid in the stock of the Board.

If Parliament thinks it necessary to apply to the Board the rule generally applied to municipal bodies who levy a loan on the security of the rates, and to require them to provide a sinking fund of their own, then the probability of a deficit, which we pointed out in an earlier part of this report, will arise. In that case it will be necessary, and in any case we think it will be prudent, to empower the Board to increase the water charges which the Companies are entitled to demand up to (say) the Lambeth level, if the interest on their stock cannot otherwise be paid. We think it would not be unreasonable to empower the Board, in case of a deficit in their income, to levy a rate-in-aid of a limited amount. A rate-in-aid, which in effect supplements the insufficiency of charges for domestic water supply, is unjust to those ratepayers who have at their own cost provided themselves with a water supply, and take nothing from the Companies. This is the case with breweries and other industrial establishments in London. But there are public purposes, such as extinguishing fires, watering streets and roads, flushing sewers, supplying public baths and washing-houses, which benefit all ratepayers, whether they are domestic consumers of water or not, and in consideration of which all ratepayers may be fairly called upon for some contribution, proportionate to the service rendered.

It may be that the Water Board will have occasion to look to the rates for further assistance, if, for instance, they have to incur considerable expenditure, not immediately remunerative, in order to make prudent provision for the future wants of the water area. This is the contingency which arouses the fears and excites the opposition of counties such as Middlesex and Kent. The only suggestion that occurs to us by which this opposition may be quieted is this: Assume that the Water Board has to borrow £10,000,000 at an annual charge (say) of £300,000 for interest. If this charge be distributed among the six counties concerned, in proportion to the number of supplies they are respectively taking from time to time, the contribution asked from each will be roughly proportioned to their own needs, and not to the needs of other counties. This contribution could be demanded by precept issued to the several County Authorities by the Water Board, and would be raised by them from the Local Authorities of the parishes which are within the area of Water London, and are wholly or partly supplied by the Board—either by means of an equal rate based on the county assessment, sufficient to cover the requisite contribution, in the same way as special rates are now raised by counties, or by rates levied in the several parishes in proportion to the number of supplies on account of which water-rents are received. Under this system, Hertfordshire, for instance, which takes very few supplies, would make a comparatively small contribution to any such expenditure. It is true that the difference of rateable values, in the different counties, would make some difference in the amount each individual ratepayer would have to contribute. If, for instance, two counties had the same quantity of supplies, and were, therefore, called upon for the same amount of contribution from an approximately equal number of ratepayers, but the average rateable value per house was higher in one county than in the other, then the householder in the low-rated county would have to pay more in the pound than the householder in the highly-rated county. Any attempt to adjust this difference would be attended with much difficulty. It is a question of policy, which it is not for us to determine, whether it will be best to enable the Water Board to meet deficiencies of revenue by such recourse to the rates, or wholly by increase of the water charges.

If the Water Board are required by Parliament to institute a sinking fund, we think it should not be done by the method of accumulation. The Water Board will have to deal with, and provide for, a debt so large that to accumulate and manage a sinking fund of that magnitude may be a matter of great difficulty. It would be better to provide that the debt should be extinguished by annual drawings. If these drawings were postponed (say) for twenty years from the date of the issue of the stock, the liability to redemption would affect its issue price and its value as a trustee stock but slightly, if at all. This method would, in our opinion, be preferable to a system of borrowing on terminable annuities.

In the event of the Water Board not having any power given to them to obtain money from the rates, it seems to be a fairly open question whether the principles on which Parliament has usually acted require that the Board should be subjected at all to the condition of providing a sinking fund or its equivalent, and whether they might not be left to redeem their debt by purchases in the market, when the condition of their revenue makes this course possible and expedient.

The Water Board should be required, by statute, to draw up an annual report of their proceedings and a statement of their accounts, in such form as may hereafter be determined. The latter should be duly audited by an independent auditor; and both should be included in the annual report of the Local Government Board which is now presented to Parliament.

The Second Victim of the Stoke Disaster.—William Wheatley, one of the four men removed to the Infirmary suffering from serious injuries received in the accident at the Stoke Corporation Gas-Works on the 10th inst., died last Friday. He had sustained a terrible fracture of the skull, part of the brain being destroyed; and he died without having regained consciousness.

St. Ives Corporation and the Water-Works.—At a meeting of the St. Ives (Cornwall) Town Council a fortnight ago, the Mayor (Mr. E. Hain) reported that the water-works had been transferred from the Water Trustees, in whom they had formerly been vested, to the Corporation. It was decided to mortgage the undertaking to the bank to cover an overdraft of £4300, and to make a water-rate of 1s. in the pound. It was explained that the alteration of the assessment under which the rate is levied from the gross rental to the net rateable value would involve an increase of about 3d. in the pound. The Water Committee hoped, however, that with this rate they would be able to cover the whole expenditure, including the repayment of the year's instalment of the loan.

Sale of Stock and Shares.—At the Mart, Tokenhouse Yard, E.C., last Tuesday, Mr. Alfred Richards submitted to public competition, by order of the Directors, £5000 of ordinary stock of the Guildford Gas Company, ranking for a standard dividend of 5 per cent. per annum, subject to the sliding-scale. The bulk of the stock was placed at £112 per £100; a few lots fetching £112 5s. Some new ordinary stock of the New Swindon Gas Company, the last dividend on which was at the rate of 5 per cent., was sold for £119 10s. per £100 of stock. By instructions received from the Directors of the Southend Water-Works Company, Mr. Richards also offered a new issue of £10 shares in the Southend Water Company, ranking for a maximum dividend of 7 per cent., and the last dividend being at the rate of 5½ per cent. per annum. They were sold at the following prices: 90 at £13 15s., 250 at £13 17s. 6d., 250 at £14, and 10 at £14 2s. 6d. per share.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

For the present, so far as the Corporation of Glasgow are concerned, the suggestion to establish a Conciliation Board between the Corporation and their workpeople is scotched. On Thursday, the Corporation rejected the proposal by 34 votes to 18. There are 75 members, so that an absolute majority of the Town Council was not obtained; and the proposal may be made again, after six months. Besides, we have the assurance of one of the members that it would be brought forward until it was carried. But for these two circumstances, I would be disposed to say that the matter had been killed outright. My feeling is, however, that little more will be heard of conciliation until, probably, the eve of the next municipal election; and the Corporation may effect much before then, in thwarting outside influences. In this connection, it is observable that the Gas Committee of the Corporation are leading the way, in their Friendly Society proposals. So much is this the case that, when the motion for the appointment of a Conciliation Board for Corporation workers in all departments had been defeated, and it came to be the turn of Bailie W. F. Anderson to propose a remit to the Gas Committee to consider as to the appointment of a Conciliation Board for gas-workers, he said it was unnecessary to move it, because he understood that the workers had appointed a Committee of their own number to confer with Mr. Foulis. From this, it would appear that the agitators' occupation in Glasgow is gone, for the present at least. The wind has been taken out of their sails. Mr. Foulis has blanketed them with his Friendly Society. In the discussion upon the general proposal, the Gas Committee were not prominent. The rejection of the motion was moved by Mr. Paton, Convener of the Tramways Committee, and was seconded by Bailie R. Anderson, of the Water Committee. It was only as the discussion was closing that Mr. W. Stevenson, the Sub-Convener of the Gas Committee, gave his opinion upon it. Needless to say, he was adverse to the appointment of an outside Board. The experience of the Committee justified this. One of the chief supporters of the conciliation proposal was Mr. Cronin, who said he had had twelve years' experience of conciliation; and the largest manufacturers in the West of Scotland admitted that the establishment of Conciliation Boards was the best thing that had happened in their businesses. Mr. Cronin is a professional conciliator. Being so, I daresay he is also a professional municipal representative. They are a class who ought not to be encouraged. They are also a class who are very persistent in pressing their addresses upon the electors; and it is therefore the more necessary that no opportunity of endeavouring to repress them be allowed to pass. A Corporation of Cronins would be a close Corporation indeed, to all except those of their own class. It is well for the Corporation of Glasgow that they have not yet allowed the control of any of their Committees who are large employers to get into the hands of the professed friends of labour, because, if they had, there would not have been the solidarity which there was in resisting this week's proposal. That would have been a misfortune, because, apart from the merits of conciliation, the proposal here was unworkable, and would soon have led to confusion, or worse. Perhaps there was skill—cunning, it may be—in the framing of the recent labour movement; or perhaps it was only the outcome of circumstances. But we know that the Gas Workers' Union embraces the telephone workers; and it was stated in the Council on Thursday that the employees of the Water Committee had affiliated with the Gas-Workers' Union. A general Conciliation Board would have represented the gas workers, the water employees, the tramway workers, the lamplighters, the scavengers, and perhaps more. A dispute in any one department would, through the ubiquitous Gas-Workers' Union, have brought the workers in all the departments to exercise pressure upon the Conciliation Board. More than this, while the Corporation workers would have been obliged to accept the decisions of the Conciliation Board, the telephone workers, the general labourers, and the *omnium gatherum* of the Gas Workers' Union would not be under any obligation at all; and any member of the Conciliation Board who might have such members of the Gas Workers' Union in his employ, would be subject to pressure from them, with the alternative of having his private business dislocated. Conciliation Boards might not be so worked; but there is a possibility that they would, and the Corporation of Glasgow are wise not to run the risk of having to face such a situation.

A very concrete illustration of the ways of labour agitators is afforded by their action in connection with the carriage of coal to the Aberdeen Gas-Works. The work is being done by a steamship chartered by the Corporation, by which method a considerable saving is being effected. The coal is free on board, and is therefore loaded by the vendor. The Corporation have to take delivery in Aberdeen Harbour; and they have let the discharging of the vessel to a professional contractor. Those who say they have the interests of labour at heart are not satisfied with the rate of wages this contractor is paying; and they have approached the Corporation on the subject. It is this matter which is before the Gas Committee, and as to which complaint was made a week or two ago that they were taking too long time to settle it. Unable to find satisfaction at home, the agitators have endeavoured to have the loading of the vessel blocked at the port of shipment. A circumstantial account was put in circulation this week, to the effect that the National Union of Dock-Workers had effectually blocked the loading of the steamer at Bo'ness; that she had, in consequence, to be sent to Leith, where, the men being unaware of the position of affairs, loaded her; but that, if she returned to Leith, she would be blocked there also. Nothing could be more explicit; but the whole story is denied to-day. It is stated that someone arrived at Bo'ness and endeavoured to create an agitation there against the loading of the vessel, but was unsuccessful, as the vessel was loaded and despatched in the customary manner; that she was sent to Leith to take on a cargo which had been contracted to be shipped there; and that she would return to Bo'ness on her next voyage. I can only account for the story of the blocking of the vessel arising by assuming that an erroneous report had been sent on to Aberdeen as to what took place at Bo'ness—such a message, for instance, as would be calculated to give backbone to the movement in Aberdeen. What I want to call attention to, however, is that this is not a movement among the men who do the work at Aberdeen. The vessel has all along been discharged with great promptitude. The men employed by the contractor are willing to work, and do work. The Union are anxious to prevent them working; and when they could not induce them to

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 196.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
690,000	10	Oct. 13	10½	Alliance & Dublin 10 p. c.	20½—21½	..	4 17 8
100,000	10	,,	7½	Do. 7 p. c.	14½—15½	..	4 16 9
800,000	100	Jan. 2	5	Australian 5 p. c. Deb.	100—102	..	4 18 0
200,000	5	Nov. 15	6	Bombay, Ltd.	5¾—6¼	..	4 8 11
40,000	5	,,	6	Do. New, £4 paid	4—4½	..	5 6 8
880,000	Stk.	Aug. 16	12	Brentford Consolidated	275—280	+2	4 5 9
270,000	,,	,,	9	Do. New	210—215	..	4 3 9
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb.	124—128	..	3 2 6
220,000	Stk.	Sept. 15	11½	Brighton & Hove Orig.	250—260	..	4 8 6
226,320	,,	,,	8½	Do. A. Ord. Stk.	183—188	..	4 10 5
973,500	Stk.	Aug. 16	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Sept. 29	10	British	43¼—44½	..	4 9 10
50,000	10	Aug. 31	12	Bromley, Ord. 10 p. c.	25—27	..	4 8 11
75,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd.	9¾—10½	+¾	5 17 1
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	98—100	..	4 0 0
160,000	20	July 13	8½	Cagliari, Ltd.	28—29	..	5 13 10
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	13½—14½	..	5 10 4
50,000	50	Nov. 2	6	Do. 6 p. c. 1st Mort.	56—58	..	5 8 5
550,000	Stk.	Oct. 13	13½	Commercial Old Stock	305—310	..	4 7 1
200,750	,,	,,	10½	Do. New do.	240—245	..	4 5 9
200,750	,,	Dec. 14	4½	Do. 4½ p. c. Deb.	140—145	..	3 2 1
800,000	Stk.	Dec. 14	9	Continental Union, Ltd.	177—181	..	4 19 5
200,000	,,	,,	7	Do. 7 p. c. Pref.	178—183	..	3 16 6
51,600	Stk.	Aug. 31	14	Croydon A 10 p. c.	335—340	..	4 2 4
168,400	,,	,,	11	Do. B 7 p. c.	265 270	..	4 1 5
555,000	Stk.	Aug. 16	5½	Crystal Palace Ord. 5 p. c.	128—138	−2	3 18 11
60,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
486,090	10	July 28	11	European, Ltd.	21—22	..	5 0 0
854,050	10	,,	11	Do. £7 10s. paid	15¼—16¼	..	5 0 0
14,993,075	Stk.	Aug. 16	4%	Gas-light & Coke	4 p. c. Ord.	106—109	+2½ 4 9 11
2,800,000	,,	,,	3½		3½ p. c. max.	97—99	.. 3 10 8
3,799,785	,,	,,	4		4 p. c. Con. Pref.	119—122	.. 3 5 7
3,993,975	,,	Dec. 14	3		3 p. c. Con. Deb.	96—98	.. 3 1 3
70,000	10	Nov. 15	8	Hongkong & China, Ltd.		13½—14½	.. 5 10 4
3,800,000	Stk.	Nov. 15	10	Imperial Continental		212—217	+2 4 12 2
478,800	Stk.	Aug. 16	3½	Do. 3½ p. c. Deb. Red.		101—104	.. 3 7 4
75,000	5	Dec. 14	6	Malta & Medn., Ltd.		5—5½	.. 5 9 1
550,000	100	Oct. 2	5	Met. of Melbourne	5 p. c. Deb.	110—114	.. 4 7 9
250,000	100	,,	4½		4½ p. c. Deb.	107 109	.. 4 2 7
541,920	20	Nov. 15	3	Monte Video, Ltd.		11—12	.. 5 0 0
617,946	Stk.	Aug. 31	9½	Newcastle & Gateshead Con.		220—225	.. 4 2 3
264,855	Stk.	Dec. 29	3½	Do. 3½ p. c. Deb.		104—107	.. 3 5 5
60,000	5	Sept. 29	7	Ottoman, Ltd.		5¾—5¾	.. 6 1 9

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
150,000	5	Nov. 30	8	Oriental, Ltd.	7—7½	..	5 6 8
135,000	5	,,	8	Do. New, £4 10s. pd.	6⅝—6⅝	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.	1½—1⅝	..	4 11 5
600,000	100	Dec. 1	6	People's Gas of Chicago 2nd Mtg. Bonds	102—106	..	5 13 2
851,070	10	Oct. 18	7	River Plate Ord.	10¾—11½	..	6 4 5
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	98—100	..	4 0 0
250,000	10	Sept. 15	10	San Paulo, Ltd.	12—13	..	7 13 10
135,000	Stk.	Sept. 15	10	Sheffield A.	249—251	..	3 19 8
209,063	,,	,,	10	Do. B.	249—251	..	3 19 8
447,427	,,	,,	10	Do. C.	249—251	..	3 19 8
5,600,000	Stk.	Aug. 16	5½	South Metrop., 4 p. c. Ord.	133—136	..	3 18 5
1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb.	100—102	..	2 18 10
120,000	Stk.	Aug. 31	6	Tottenham A. 5 p. c. and B. 3½ p. c.	141—143	..	4 3 11
250,520	,,	,,	4½		102—104	..	4 6 6
55,100	,,	Dec. 14	4	Edmonton 4 p. c. Deb.	113—117	..	3 8 5
182,380	10	Jan. 12	5	Tuscan, Ltd.	9—10*	..	5 0 0
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.	101—104	..	4 16 2
				WATER COMPANIES.			
780,399	Stk.	Dec. 29	11	Chelsea, Ord.	307—312	..	3 10 6
150,000	,,	,,	5	Do. 5 p. c. Pref.	157—162	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	145—150	..	3 0 0
175,785	,,	Sept. 29	4½	Do. 4½ p. c. Deb.	148—153	..	2 18 10
1,720,560	Stk.	Oct. 18	7	East London, Ord.	200—205	..	3 8 4
654,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb.	145—150	..	3 0 0
390,000	,,	,,	3	Do. 3 p. c. Deb.	98—100	..	3 0 0
700,000	50	Dec. 14	7½	Grand Junction 10 p. c. max.	107—109	..	3 8 10
310,000	Stk.	Sept. 29	4	4 p. c. Deb.	131—136	..	2 18 10
708,000	Stk.	Aug. 16	14	Kent	348—353	..	3 19 4
160,000	,,	,,	7	Do. New, 7 p. c. max.	200—210	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.	292—297	..	3 10 8
406,200	100	,,	8	Do. 7½ p. c. max.	215—220	..	3 12 9
850,000	Stk.	Sept. 29	4	Do. 4 p. c. Deb.	135—138	..	2 18 0
500,000	100	Aug. 16	13½	New River, New Shares	425—430	..	3 2 9
1,000,000	Stk.	July 28	4	Do. 4 p. c. Deb.	133—138	..	2 18 0
902,300	Stk.	Dec. 14	7½	South-wark Ord.	202—207	..	3 12 6
126,500	100	,,	7½	7½ p. c. max.	190—195	..	3 16 11
489,300	Stk.	,,	5	and 5 p. c. Pref.	160—165	..	3 0 7
1,019,686	,,	Oct. 13	4	Vauxhall 4 p. c. A Deb.	131—136	..	2 18 10
1,155,066	Stk.	Dec. 14	10	West Middlesex	288—293	..	3 8 3
200,000	,,	,,	4½	Do. 4½ p. c. Deb.	147—152	..	2 19 3
200,000	,,	Sept. 15	8	Do. 8 p. c. Deb.	100—102	..	2 18 10

*Ex div.

stop, their next endeavour was, by getting other men to deprive themselves of wages, to ensure that there would be no unloading to do. They have, fortunately, been foiled in the meantime; but there is no guarantee that, nothing daunted, they will not before very long return to the attack.

At the Dumfries Gas Commission this month, Bailie Currie, the Convener of the Gas Committee, stated that consideration is to be given to the terms of their policy of insurance under the Workmen's Compensation Act. Power has been given to renew it on the most favourable terms obtainable. Bailie Currie, however, stated that some Corporations were not renewing their policies, as they considered that they did not come under the Act. They do well to renew their policy. On this subject, I would like to refer all who are interested to a decison in the Court of Session this week, in which it was laid down that a man in charge of a water-cart, employed in the repair of a road in Berwickshire, was engaged in an engineering work, and came within the scope of the Act; the conclusive condition which made him so being that a road-roller, which was under steam, was also employed in the work. The accident happened in the afternoon, at which time the roller had gone off to work at some distance, at a job for which water was not required; but the injured man was brought under the protection of the Act by the fact that during the dinner hour the engine and the water-cart stood beside each other at the side of the road. This is the widest decision I have seen as to the scope of the Act; and, of course, it makes it clear that if there is any sort of power machinery in a gas-works, the works—at least in Scotland—are engineering works, and are under the Act. The decision would seem to leave no ground of escape from the conclusion that a mainlayer, if he went out from the gas-works in the morning to his work, would be also under the Act.

At the meeting of the Dumfries Commission, one of the members complained that the gas they were being supplied with was the worst in any town in Scotland. The absurdity of this ill-favoured remark is apparent when it is considered that the speaker could not be aware of the quality of the gas supplied in every town in Scotland. If the gas has not been quite up to the usual standard of late, there is the explanation which had just been given—that the output during December was the largest which had ever been sent out in one month. It was over 12 million cubic feet, and was so large that the Manager (Mr. G. Malam) had had great difficulty in keeping up the supply. There was also the fact that it was almost impossible to get coal delivered, and that, in addition, the price of coal had been raised to them by 3s. 6d. per ton. The complaint, further, was made in the afternoon, just when the gas was lighted, and when the pressure, as was pointed out, was not fully on. But he was taken seriously; for on the same evening the representative of a local newspaper, accompanied by Mr. J. S. Thomson, the Sub-Convener of the Gas Committee, paid a visit to the gas-works, saw the gas tested for illuminating power, and published a half-column of information about the works. From this, I ascertain that the Commission aim at supplying gas of not less than 26-candle power; but that on the night of the visit, it was 29·80 candles, and had been as high as 30·07 candles. The average during November had been 26·91 candles; and during December, 27·13 candles. The standard prescribed is 14 candles. Coal and oil (the Peebles process) are used; and the yield per ton of coal is 10,300 cubic feet, or 250 cubic feet above Mr. Malam's estimate. Now, whatever grumbles may be made, I think that every impartial person must be convinced that in Dumfries the gas undertaking is in a most prosperous and satisfactory position.

Mr. S. Stewart, the Engineer to the Greenock Gas Trust, reported to the Trust this week that, owing to the dark days in December, there was very considerable difficulty in meeting the demand for gas. It was therefore of the utmost importance that arrangements should be made this year to meet an increased production. Mr. T. Mitchell, the Convener of the Gas Committee, said that the demand during the past two years had been quite phenomenal. The increase in that time had been nearly 40 million cubic feet, which was more than the increase in any previous four years. In the last nineteen years, the quantity of gas made had nearly doubled. Since the price of gas was reduced two years ago, the number of new consumers had been 1000. The matter was remitted to a Committee.

Mr. Thomas O'Neill, Manager of the Dunbar Gas-Works, writes to correct an error in the paragraph in last week's "Notes" referring to a meeting of his Council. He says that Bailie Smith is still Convener of the Gas Commissioners, and has been so for many years; and he also points out that the questions which Bailie Smith ineffectually tried to bring before the notice of the Council were not of "minor," but of very material importance—entailing, as they did, proposed alterations in the works, &c.

Crowborough District Water Company.—An extraordinary general meeting of this Company was held last Wednesday, for the purpose of authorizing the issue of further capital. The Chairman (Mr. S. R. Dennis) proposed a series of resolutions to empower the issue of 500 £10 preference shares and 500 £10 new ordinary shares. He said the Directors, after going fully into the affairs of the Company and the prospects of the extensions, had decided to recommend that the present issue should be £10,000. Mr. Langridge seconded the motion. Mr. W. A. Hounsom proposed, as an amendment, that 500 new ordinary shares of £10 each be created, provided that no steps be taken until 28 clear days after the next half-yearly meeting. The speaker at some length severely criticized the manner in which the Company had been conducted, and alleged, among other things, that at the half-yearly meeting on Feb. 14 last it transpired that the Directors had illegally voted themselves fees amounting to £150. He did not say that he was going to quarrel with the Directors being thoroughly well paid for the work they did; but he did say it was entirely wrong that they should take such an action. He objected to any preference stock being created; the £5000 being ample. Mr. Preston seconded the amendment, which was ultimately unanimously adopted.

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CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan.* 20.

Sulphate of Ammonia.—The activity at the close of last week has disappeared. But the market has been fairly steady; and the quotations remain at £11 10s. to £11 12s. 6d. per ton, f.o.b. at the ports. Production continues to be disposed of as it becomes available. In the forward position, £11 15s. per ton, ordinary terms, f.o.b. Leith, has again been paid for January-June shipment; and that is the closing value. For January-March, Beckton terms, £11 12s. 6d. per ton is quoted.

Nitrate of Soda tends to harden for cargoes due and near at hand; and on spot the quotation for fine quality is 8s. per cwt., *ex*-quay.

LONDON, *Jan.* 20.

Tar Products.—Benzols are weaker; 90 per cent. being almost unsaleable. Some confusion exists in respect to quotations for benzol. The quotation made here, with the other products, is for wholesale quantities and for ordinary purposes. For small quantities, and especially for a quality specially prepared for enriching gas, somewhat higher prices are being obtained, depending very much, however, upon the position. Lower prices are being offered for carbolic acid, as the proclamation against its export has entirely stopped its shipment. The demand, however, in Great Britain continues good; and it is possible that, when the first excitement is over, carbolic may again see the higher price it attained last week. The other liquid products are in moderate request; while pitch is quoted a little dearer.

Average quotations during the week are: Tar, 17s. to 25s. 6d. Pitch, east coast, 34s. 6d.; west coast, 32s. 6d. Benzol, 90's, 7d.; 50's, 10d. Toluol, 90 per cent., 1s. 2d.; pure, 2s. Solvent naphtha, 1s. 4d. Crude, 30 per cent., naphtha, 4⅜d. Heavy naphtha, 1s. 2½d. Creosote, 3½d. Heavy oils, 3¾d. Carbolic acid, 50's, 2s. 8d.; 60's, 3s. Crude naphthalene, 50s. to 55s. Anthracene, nominal, "A," 4d.; "B," 2½d.

Sulphate of Ammonia.—There has been a steady and improving inquiry during the past week; and the advanced prices are well maintained. The value at all ports is about £11 10s. to £11 12s. 6d. per ton, less 3½ per cent.

The Ashton, Stalybridge, and Dukinfield Joint Water Committee are appealing to consumers to exercise care in the use of water, as there is only half the quantity in the reservoirs that there was this period last year.

It was reported at a meeting of the Wigan Corporation Gas Committee last Wednesday that one of the employees of the department (Private Archibald Coates) was about to leave for service with the South Lancashire Hussars. It was resolved that his wife should be allowed the sum of 12s. per week, together with 2s. per week for each child. The Gas Workshops Committee of the Leeds Corporation have decided to pay to the sister of Mr. A. M. Thompson (Assistant Superintendent of the Meter Department in Meadow Lane), who has volunteered with the Yeomanry, half the amount of his weekly wages.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The continued scarcity of supplies of all descriptions of fuel, except some of the best qualities of round coal, and the exceptional pressure of requirements all round for general manufacturing purposes, coupled with the further increase in the wages of the miners, have brought about the inevitable advance in prices. To this reference was made last week as being more than probable; and it is now evident that this further upward move has only been held back pending the final settlement of the arrangements for a continuance of the Conciliation Board. In fact, in the West Lancashire district the advance was decided on at a private meeting last Friday week; but the issue of circulars was held in abeyance until after the meeting of the Conciliation Board in London on Tuesday last, when the final agreement between the Miners' Federation and the Coalowners' Association was come to. On the day of the issue of circulars by the West Lancashire collieries, the Manchester coalowners also decided to make a general advance in prices; but some irregularity in the market is likely to be caused from the fact that, while in West Lancashire prices have been advanced 1s. 3d. per ton on best Wigan Arley, and 1s. 8d. on other descriptions of fuel, the advance in the Manchester and Salford district is limited to 10d. per ton on all sorts, although the leading Manchester colliery firms intimate that in outside districts, where the full West Lancashire advance has been put in force, they will also increase their prices to a similar extent, ranging according to circumstances from 1s. 3d. to 1s. 8d. per ton. This advance will bring the average pit prices to 14s. 6d. and 15s. per ton for the best round coals, 13s. to 14s. for medium qualities, 12s. to 12s. 6d. for common sorts, 9s. 6d. to 10s. for medium slack, and 10s. 6d. to 11s. for best qualities. It is as yet too early to form any definite opinion as to the effect of this advance on the market. At present, it can only be stated that collieries are all short of supplies; and for the moment it is less a question of prices than of consumers obtaining sufficient quantities to keep their works going, which in many cases they are barely able to do. The restriction of the output is likely to become an important factor in the immediate future. Since the last advance in wages, it is estimated that generally throughout Lancashire the output of the pits has been quite 10 per cent. below the average "get;" and with the further increase of 5 per cent. in wages now conceded, the general opinion is that there will be a corresponding reduction of the output, which must necessarily tend to increase the difficulties—already quite serious enough—with regard to adequate supplies for iron making and general manufacturing purposes. The demand for shipment has also been much above the average; and with special prices obtainable—15s. per ton being about an average figure for ordinary steam coal delivered at the ports on the Mersey—there is a strong inducement for collieries to withdraw coal from the inland trade, as they can obtain better prices at the ports than from home customers. With regard to gas coals, there is not much doing outside contracts, to afford any reliable basis as to the effect the advance in prices may have upon this branch. Where, however, any quantities beyond

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contract deliveries are required, with the present shortness of supplies, special prices, as reported last week, have to be paid—ranging in some cases from 14s. to 15s. per ton at the pit. These, of course, are simply temporary prices governed by the present exceptional conditions; but when existing contracts have to be renewed, it is tolerably certain that collieries will demand an advance of not less than 2s. 6d. to 3s. per ton over last year's prices. As to coke, in one instance in the Manchester district prices have been advanced 10d. per ton, following the upward movement in coal; but so far there has been no general alteration in list rates. Lancashire Coke Makers' Association prices remain unchanged; and at the ovens ordinary furnace cokes average 23s. to 23s. 6d., and foundry sorts 30s. per ton.

Northern Coal Trade.—There is a strong demand for coal all round, though prices are slightly easing off from the high rates brought about by the scarcity after the holidays. Best Northumbrian steam coals are now 19s. 6d. per ton f.o.b., and steam smalls are 11s. 6d. per ton; and even higher prices than these have had to be paid to ensure supplies in the last few days. Gas coals are still scarce; for though the consumption is now rather less than it was, there is a good deal of leeway to be made up, and contracts that are behindhand in delivery will take a very large proportion of the output for some time. Prices for quantities beyond these contracts are high, but are rather difficult to define exactly; about 18s. 6d. per ton f.o.b. being the nearest approach to a medium price that can now be given under the circumstances. There is little alteration in the gas coke trade; and prices are still irregular, according to the scarcity of the supply at a given period. About 15s. 6d. to 16s. 6d. per ton is the f.o.b. rate now generally quoted for export. A contract for gas coal for Copenhagen, to the extent of about 80,000 tons, is believed to have been given to four Durham collieries, at about 15s. per ton f.o.b.—a very great advance on the prices of last year.

Scotch Coal Trade.—At present, the coal trade is in such a dislocated condition that it can scarcely be described. It has been agreed, by the Conciliation Board, to give the miners an increase of 9d. per day in wages; and although the calculation has been made public that the rise in wages will only add about 3½d. to the cost of a ton of coal, coalmasters have, in more places than one, been meeting and agreeing to raise the price by 2s. per ton. It is reported that forward demands are strong, and that current rates are being obtained; but the periods are not mentioned, and the report is doubtful. By most people current rates are regarded as only temporary. They are: Main, 14s. per ton f.o b. Glasgow, ell 15s to 16s., and splint 15s. to 15s. 6d. The shipments for the week amounted to 137,491 tons—an increase upon the preceding week of 60,992 tons, and upon the corresponding week of last year of 5102 tons. For the year to date, the total shipments have been 199,990 tons—an increase upon last year of 20,365 tons.

The Municipal Council of Paris have adopted a proposal made by M. Daix to light the Place de la Concorde with acetylene gas during the forthcoming Exhibition.

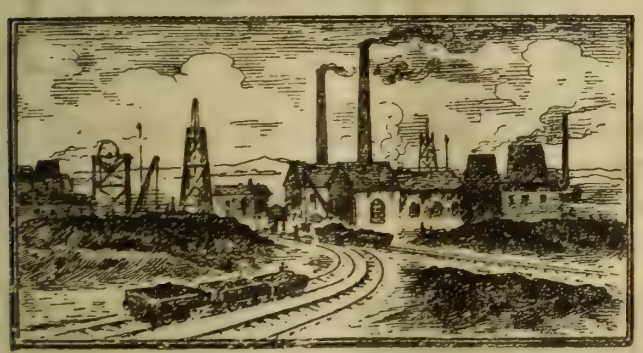
Electrolysis of Water-Mains in Manchester.—At the meeting of the Water Committee of the Manchester Corporation last Thursday, attention was drawn to the probable injurious effect of electricity on the water-mains. It was contended that already there is danger to the mains of the city from the electric light installations, and that this will be considerably augmented by the adoption of electricity as the motive power on the tramways.

Gas-Workers' Wages at Hinckley.—The Gas Committee of the Hinckley District Council have decided to recommend an increase in the wages of their employees from 4s. 9d. to 5s. per day, and time-and-a-half for Sunday labour from six a.m. to ten p.m.; also that the weight of coal be reduced from 60 cwt. to 50 cwt. This will mean an increased cost of £113 a year, while, irrespective of this, during the past year £300 more was paid in wages than in the previous year. The Chairman stated, at the meeting of the Committee at which the resolution was passed, that notwithstanding this £300 increase, and £500 extra for coal, consequent on the price rising, the Committee are sanguine they will make a profit this year, although £800 was generally considered a good profit to make on the works.

Fatal Gas Poisoning at Perth.—Early on the morning of Sunday, the 14th inst., a case of gas poisoning was discovered to have taken place in a house at Perth, occupied by Thomas Cross, dyer's finisher, which resulted in the death of one young lad and the narrow escape of another. Thomas and Alexander Cross, aged 17 and 14 years respectively, occupied one of the rooms in the house, and when they retired to bed on Saturday night everything seemed to be right. Early the next morning, however, their mother perceived a strong smell of gas, and examination revealed that it was proceeding from the lads' room. On opening the door, Mrs. Cross discovered that the room was full of escaped gas. Alexander lay in an unconscious condition, while Thomas had succumbed to the effects of gas poisoning. Alexander's life was saved. Examination showed that the gas had not been properly turned off, and consequently there had been an escape during the whole night.

Leigh Gas Supply.—Mr. E. P. Burd, one of the Inspectors of the Local Government Board, held an inquiry at the Town Hall, Leigh, last Friday, into the application of the Corporation of Leigh for sanction to borrow additional money for the purpose of their gas undertaking, and to substitute 3 per cent. per annum or less for the 4 per cent. per annum as the rate of accumulation of the sinking fund provided under the Provisional Order of 1881. The Town Clerk (Mr. Thomas) recounted the history of the gas undertaking, and stated that, as the suggestion for the alteration of the rate of interest came from the Local Government Board, he need not say anything more than that it was obviously the fair and proper thing to do. The Corporation had borrowed altogether for their gas undertaking £125,000. All this had now been expended; and they wished for a further loan of £50,000, in consequence of the rapid development of the town and the great increase of 16 million cubic feet in the consumption of gas during the year. It was imperative that the Corporation should extend their works to meet the growing demands of the town. No opposition was offered to the application.

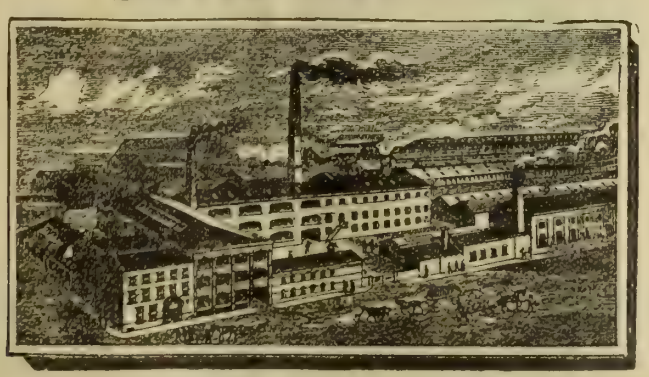
COAL SCARCE.



There is a tide in the affairs of men (and Gas Departments), which, taken at the flood, leads on to fortune.

Julius Cæsar IV., 3

STOVES PLENTIFUL.



N.B.—Perhaps the Reader will supply the Advertisers' Name.

The Rating of Reservoirs.—At a recent meeting of the Hampton District Council, it was resolved, on the motion of Mr. Allbliss, "That, in view of the recent decision of the House of Lords respecting the rating of reservoirs [*ante*, p. 89], the Council convene a conference of Local Authorities affected thereby; and that it be referred to the Parliamentary Committee of this Council to take the necessary steps, and to report the result of the conference."

Bingley Gas Affairs.—At the meeting of the Bingley District Council yesterday week, the Gas Committee reported that the resignation of Mr. G. D. Malam, the Gas Engineer and Manager, had been accepted with great regret; and steps had been taken to obtain applications for the position, which would be considered at a special meeting. Mr. Smith complained of the deficient and unsatisfactory state of the gas supply during the past few weeks. Mr. Gatecliff said the fact was the unsatisfactory state of things had been due to the condition of the exhausters. The Committee were fully alive to the situation; and though it would not be possible to remedy matters this winter, they would take the necessary action. He mentioned that there had been a large increase in the call on the gas-works, which were turning out millions of cubic feet more than previously.

Bradford Corporation and Outlying Gas Companies.—The Parliamentary Committee of the Bradford City Council yesterday week discussed matters relating to the promotion of the Corporation Bill. Arrangements were completed for proceeding with the measure; and some discussion took place with regard to the threatened opposition of the several District Gas Companies. It is proposed to apply to Parliament for powers to purchase the undertakings of the Clayton, Allerton, and Thornton Company, the Eccleshill Gas Company, the Airedale Gas Company, and the North Bierley Gas Company, and to purchase gas in bulk from the Drighlington Gas Company. Reference was made to the fact that the Companies have combined for the purpose of opposing the Bill. But it was mentioned that there was a desire among some of them to come to terms; and the Committee accordingly decided to open negotiations with a view to bringing about an amicable settlement.

The Lighting of Leeds Streets.—Within a short time, the whole of the public thoroughfares in the centre of Leeds will be lighted by electricity; and some of the main approaches to the city by means of incandescent gas-lamps. At the present time, schemes are being carried out for extending the system of electric illumination from New Briggate to Sheepscar Police Station, and from the Great Northern Railway Station to Kirkstall Road, near the junction with West Street. The Street Lighting Committee have also been authorized to prepare plans for the lighting by electricity of Duncan Street and Lower Briggate. With reference to improving the lighting of the main arteries of the city—such as Woodhouse Lane, Chapeltown Road, Roundhay Road, Kirkstall Road, and Dewsbury Road—the Committee have sanctioned the getting out of an approximate estimate of the cost of the erection and maintenance of incandescent gas-lamps. The result of experiments in Park Row has influenced the Committee in their decision.

The Hill Brow Water Company, Limited, has been formed with a capital of £2000, in £5 shares, to carry on at Liss, in Hampshire, Rogate, in Sussex, and elsewhere, the business of a Water Company, and to take over the concern formerly carried on by R. Crafts, deceased, at Hill Brow, Liss.

The Rival Gas Bills at Ossett.—On Thursday, the Ossett Town Council held a meeting to confirm the resolution passed on April 12 last for the promotion of a Bill now deposited in Parliament for the purchase of the works and undertaking of the local Gas Company. The confirming resolution was passed; and the Council afterwards unanimously resolved to oppose the Company's Bill for the extension of their capital and powers. One of the speakers strongly objected to the Company's proposal to adopt the sliding-scale, with 3s. 6d. as the standard price. A statutory meeting of owners and ratepayers was subsequently held to sanction the opposition of the Corporation to the Company's Bill.

The Skipton Gas-Works Purchase.—At the meeting of the Skipton District Council on Thursday, a communication was read from the Public Works Loan Commissioners, sanctioning a loan of £71,250 for the purchase of the gas-works, the loan to be repaid in principal and interest in 40 years. The Clerk reported that the taxed costs of the Act of Parliament amounted to £2700; and to repay this in ten years would mean an annual payment of £316 11s. 6d. The maximum working capital would be £2000; and to repay this in principal and interest in 30 years would mean £120 a year. It was estimated that the costs of arbitration would be £3500, which would be paid off in 45 years, at the rate of £142 15s. 5d. a year. The total payment in respect of loans would be £3775 per annum. To meet this was a profit of £3712, which was increased to £3828 by striking off expenses incurred by the Gas Company, and which would not be incurred by the Council. It was therefore estimated that there would be a balance to the credit of the town if the profits were not seriously interfered with by the probable increase in the price of coal, &c.

Incandescent Gas Lighting in Darmstadt.—The Municipality of Darmstadt have issued a report on the public lighting of the city by incandescent gas-burners in the year 1897-8. Of the total of 1766 lamps, 1742 were fitted with these burners, of which 1754 were in use—four lamps having two, and four others three burners. These burners represented 3,931,606 hours of lighting, during which time 6577 mantles and 4006 glasses had to be replaced. The average life of the mantles was 598 hours; that of the glasses 981 hours. The former lasted 74 hours longer than in the preceding year, but the glasses were less durable. This is explained by the fact that during part of the year some ordinary glasses were used in place of the Jena chimneys previously employed. The latter are now exclusively used. It was found that the mantles and chimneys did not last so long in the lamps against which the ladder had to be placed for cleaning, as in those subjected to the shaking caused by traffic in the streets. There were 141 lanterns which did not require renewals during the whole of the year. The duration of the burners and chimneys in these lamps, therefore, was 5565 hours; being 3830 hours for the all-night, and 1735 hours for the mid-night lamps.

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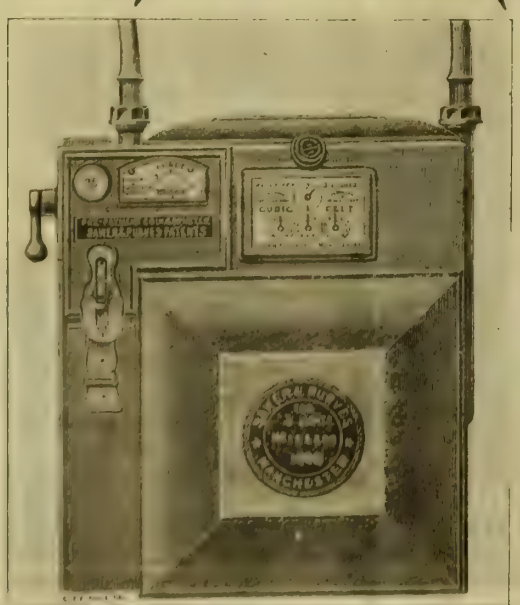
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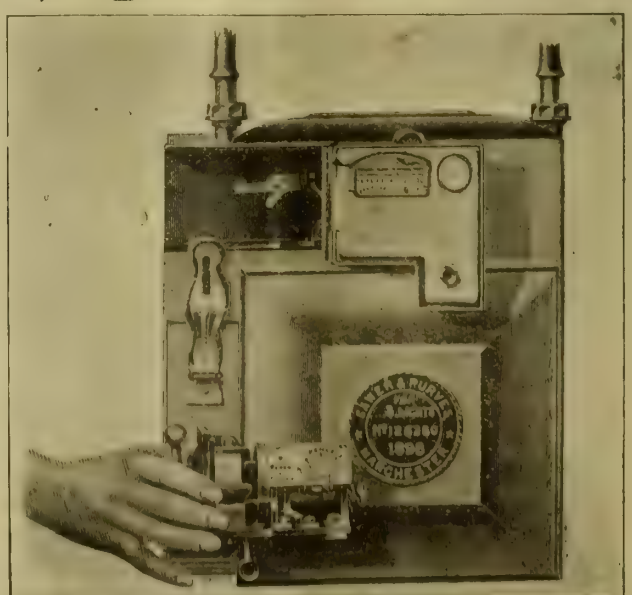
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The Lighting and Watching Act.—The "Local Government Journal" recently contained the following observations on the above subject: "We have before commented upon the difficulties experienced by Parish Councils in administering the Lighting and Watching Act, 1833. One of the latest cases to hand raises the question of how a parish council should proceed when it is desired to extend the public lighting beyond the area for which the Act was adopted. There is no provision in the Act to meet such a contingency, nor is any procedure laid down by which a lighting area can be enlarged. The result is that before any such extension of operations can be carried out the Act must be formally 'abandoned,' and after an unavoidable interregnum re-adopted by the parish meeting of the larger area. This, it appears, is the view taken by the Local Government Board."

The Coal Conciliation Board.—Last Tuesday the joint conference of coalowners and miners in the federated mining districts, representing about 500,000 miners, met at the Westminster Palace Hotel to determine whether both sides should accept the provisional agreement come to a month ago—viz., that wages should be advanced 5 per cent. conditionally on the maintenance of the Coal Conciliation Board until January, 1904. This question was referred to the respective constituents of the coalowners and the miners; and it was reported to the Board that both sides had accepted the terms of the recommendation. Mr. A. Hewlett presided, and Mr. B. Pickard, M.P., occupied the vice-chair. The conference lasted about two hours, and at its conclusion the following report was issued by the Joint Secretaries—Messrs. T. Ratcliffe Ellis and Thomas Ashton: "The following resolutions were unanimously adopted: (1) That in consideration of the agreement for the continuance of the Conciliation Board from Jan. 1, 1901 (the date of the expiration of the present arrangement), for a further period of three years, with the present minimum and an increased maximum to 60 per cent. on the 1888 standard, the present rate of wages for underground labour be increased as from the first making-up day in January, 1900, by 5 per cent. on the standard, and that the advance as from that day shall be paid on the first pay-day after this date. (2) That for a further period of three years from Jan. 1, 1901 (the date of the present arrangement), the rate of wages shall not be below 30 per cent. above the standard rate of wages of 1888, the present minimum, nor more than 60 per cent. above the standard rate of wages of 1888. (3) That during that period the rate of wages for underground labour shall be determined by the Conciliation Board within the above-named limits. (4) That the Conciliation Board, as at present constituted and under its present rules of procedure, shall be continued for this purpose from Jan. 1, 1901, to Jan. 1, 1904. It was further unanimously resolved to recommend that the advance of 5 per cent. on the 1888 rates as from the first making-up day in January shall extend to the wages of surface labour engaged on the pit banks and screens in manipulating the coal, and be paid on the first pay-day after this date." Practically, the result will be that both the workmen above and below ground will get the advance of 5 per cent. until January, 1901, when either side can summon the Board for an alteration of wages. It is hoped that by this arrangement strikes in the federation area will be prevented.

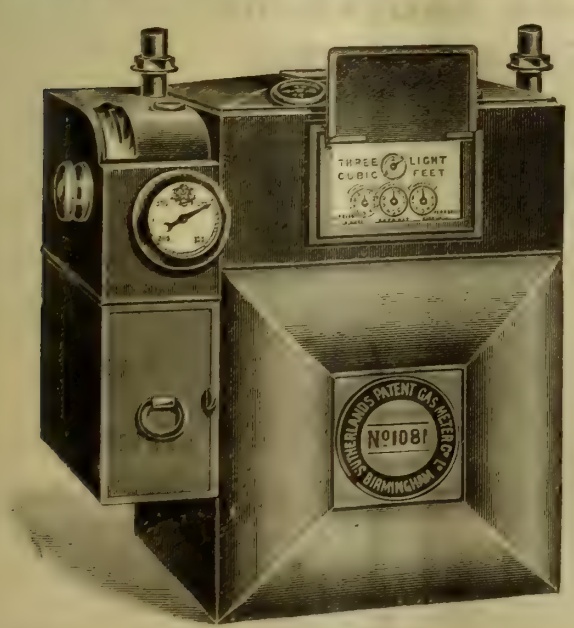
Extensions at the Leek Gas-Works.—Mr. W. A. Ducat recently held at Leek an inquiry on behalf of the Local Government Board with respect to an application of the Urban District Council for sanction to raise £21,000 for gas-works extensions. The Clerk (Mr. W. Allen) made a statement showing that the total indebtedness of the town was £46,561, and that there was still a margin of £90,755. The Gas Manager (Mr. W. H. T. Norfolk) stated that he would not guarantee a proper supply of gas to the town for another year unless the extensions were made. There was practically no opposition.

The Proposed Gas Company for Heswall.—At a recent special meeting of the Heswall Parish Council, the report of a Committee was read with reference to the proposed lighting of the town with ordinary and acetylene gas. After a long discussion, the following resolution was passed: "That this Council, having considered the application being made by the Heswall Gas Lighting Company, Limited, to the Board of Trade for a Provisional Order for powers to supply gas (including acetylene gas) in the parish of Heswall, cannot consent to the same, either in respect to coal gas or acetylene gas."

Carburetted Water-Gas Plant at Bournemouth.—An installation of carburetted water-gas plant will shortly be in operation at the Bournemouth Gas-Works. Messrs. Humphreys and Glasgow's system has been adopted, and the whole has been arranged and carried out under the Company's Consulting Engineer (Mr. F. S. Cripps). The work involved the erection of new buildings, iron roofs, boilers, exhausters, tanks, gasholder, &c., in addition to the water-gas apparatus. It is in two sections, and sufficient for the production of a million cubic feet of carburetted water gas per 24 hours; but ample space and provision has been made for another two sections in the present house. Everything possible to secure economy of production has been adopted in connection with the plant.

Shortage of Coal and Increased Gas Consumption at Hunstanton.—At the last meeting of the Hunstanton District Council, the Gas Manager (Mr. P. E. Hart) reported that the contractor had failed to keep up the supply of coal at the gas-works, and that he had, in the emergency, to obtain ten trucks locally, at an advance of about 5s. 6d. per ton, and with a result of some 2000 cubic feet of gas less per ton. Mr. Beeton said there was no such thing as the "coal famine," and the difference in the cost and the loss in gas should be charged to the contractor. The Chairman (Captain W. Pattrick) acquiesced; and the Manager was instructed to draw up an account showing the amount to be received. He produced a statement showing that there had been an increase of some 10·7 per cent. in the consumption of gas during the past year. The production was on the average 8884 cubic feet per ton of coal. Mr. Beeton said they ought to have 10,000 or 12,000 cubic feet. A report on the gas undertaking was also received from the Engineers. They said that when the new exhauster and scrubber were fixed, there would be hardly any further outlay needed until the consumption had so increased that entirely new works were required. They commented upon the increase in consumption, the present rate of which they thought could hardly be expected to continue. They considered that at least 10,000 cubic feet of gas should be obtained from a ton of coal; and, further, that the leakage should be reduced to 8 per cent.

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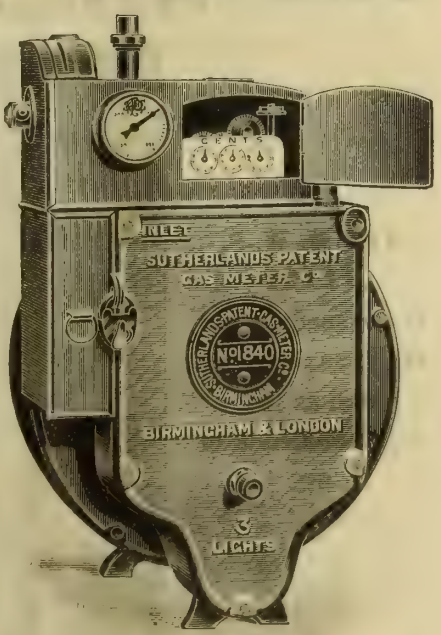
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Improved Position of Manchester's Stock of Water.—The recent heavy rainfall has considerably augmented the stock of water in the Manchester Corporation reservoirs; the quantity at present available being sufficient for 104 days' supply, as compared with 87 days rather more than a fortnight ago. Thirlmere is overflowing, and has been so for some days past. A curious fact is that there has been less rainfall at Woodhead than at Gorton; and there has consequently been a less increase in the quantity collected in the former reservoirs than in the latter. The total supply in hand is less than was the case at the corresponding period of last year.

Plymouth Water Supply.—At the last monthly meeting of the Plymouth Town Council, Alderman Bond, the Chairman of the Water Committee, reported that during the recent heavy rain the overflow from the storage reservoir at Burrator had been at the rate of 300 million gallons a day, which, if maintained for two days, would be sufficient to fill the reservoir. It may be added that nothing is now heard of the complaints made during the summer and early autumn of the discoloration of the water. Whether the effect of the rain has been to scour the reservoir or to cause a settlement of the matter in suspension, the result is that the water has resumed its former bright appearance.

Water Supply of Wallasey from the Liverpool System.—At a meeting of the Wallasey District Council held last Thursday, the minutes presented by the Special Water Committee contained the heads of the agreement to be entered into with the Liverpool Corporation for a minimum supply of 500,000 gallons per day of Vyrnwy water, at the rate of 6d. per 1000 gallons. The Chairman (Mr. J. Paxton) disagreed with the terms. He said the cost of construction had not yet been agreed upon; but, assuming it was £150,000, if the Corporation determined the agreement at the end of ten years, the Council, paying 6½ per cent. on the cost, would have paid £97,500. They would get back from the sinking fund £42,989; leaving £54,511, which they had paid to the Corporation as rent for the pipe-line for ten years. Was this a business-like arrangement? Further, he did not approve of the method of procedure. The Corporation were to be the contractors in laying the pipe, and yet the Council were not to be the owners of it. He did not think the Public Health Act gave the Council power to make such an arrangement as to engage the Corporation as contractors, and he would take no responsibility. The question was: Were they sufficiently protected under the heads of agreement? If not, ought the Committee not to go back and get clauses to give them that protection? Mr. Hughes moved that the matter be referred back to the Council in Committee. Mr. Scott seconded the amendment. Mr. Steel pointed out that they must ask the Corporation to lay the pipe, because the Local Government Board refused to allow the Council to borrow the money. The Corporation's Act of Parliament compelled them to insert the five years' agreement, and the terms were the best they could make. The Corporation would spend £150,000 on the pipe; and it was not probable that they would break the agreement during the thirty years, because they would have to repay the amount standing in the sinking fund. The amendment was lost by 11 votes to 4; and the Committee's proceedings were adopted.

Increase in the Price of Gas at Durham.—In consequence of the rise in the price of coal and other material, the Directors of the Durham Gas Company have increased the price of gas in the city by 3d. per 1000 cubic feet. The old price was 2s. 11d.

Cleveland Water Company.—The half-yearly report of the Directors of the Cleveland Water Company states that there is a profit balance of £4872, enabling a dividend to be declared at the rate of £9 10s. per cent. per annum on the original and "A" Shares, and £6 13s. on the "B" Shares. This will allow a balance of £1517 4s. 1d. to be carried forward.

Water-Supply Projects in Essex.—A public meeting has been held at Stanstead to protest against two schemes which are to be introduced into Parliament by the South Essex Water Company and the South Essex Water Board. Mr. Henry Baker, Clerk to the Stanstead Rural District Council, explained that it was proposed to erect pumping-stations at Heydon, Stanstead, and Henham, which would have the effect of draining all the existing wells. He urged the meeting to oppose the Bills. Mr. H. Green and Mr. H. Chester, J.P., were of opinion that, if this were done by the Council, the costs might be surcharged upon the members; but Mr. E. B. Barnard, J.P., and the Chairman (Mr. W. Fuller, J.P.) were of an opposite opinion. Colonel Byng, the owner of the land on which the Rivers Cam and Chelmer rise, strenuously opposed the Bills, and said he would not sell for the purpose required. On the main question of opposition, the meeting was unanimous, and passed resolutions (1) to oppose at every stage; (2) that a guarantee fund be raised among the landowners; (3) that copies of the resolutions be sent to the Essex County Council, Rural District Council, and Members of Parliament for the Saffron Waldon and Epping divisions; and (4) that petitions be sent from every parish affected.

A Large Leakage from the Thirlmere Water-Main.—At the meeting of the Manchester Corporation Water Committee last Thursday, some discussion took place relative to a leakage from the pipe-line from Thirlmere. The pipe is designed to pass 10 million gallons of water daily. It is proved beyond all question that this quantity is received therein every day through the tunnel under Dunmail Raise; but it is said to be ascertained with equal certainty that, within a comparatively short distance from the tunnel, before the aqueduct crosses the Lune, one-tenth of the volume is daily lost by leakage. There is a great fall in levels between the two points, which may account in itself for some slight proportion of the loss; but the full cause has not been explained. Over 8 million gallons find their way to Manchester; but there are several instances of tapping *en route* for legitimate use, and the loss otherwise on this part of the line is not troublesome. It is recognized as highly important that the reasons for the escape of a million gallons every 24 hours should be accurately established, more especially when remembering that before very long it will be imperative to add another pipe of like dimensions to the one now in use to meet the growing demand for water. Consequently the Committee resolved that a close examination of the aqueduct shall be made with this object, when a fitting opportunity presents itself for temporarily shutting off the supply from Thirlmere.

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

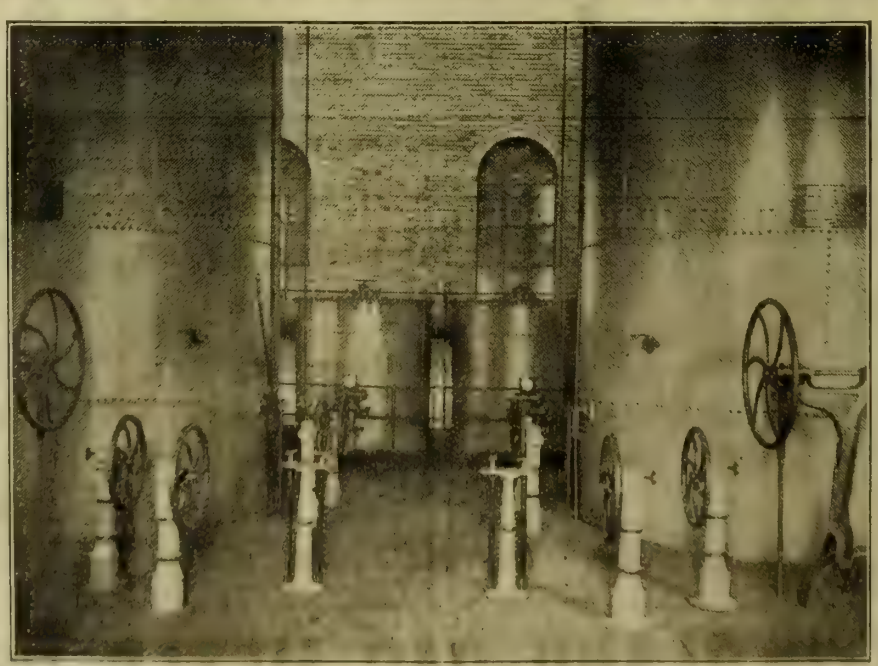
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While boring for water on Lord Bristol's Estate, in Old Sleaford, a splendid spring was tapped at a depth of 149 feet. The site was located, and depth specified, by Mr. Mullins, the "water diviner."

It is announced that the Blackpool, St. Annes, and Lytham Tramways Company are seeking authority to double their existing lines at a cost of £53,616 12s. 1d., and propose to work the whole system by electricity. Gas-motors are used at present on the line.

At a Trades and Domestic Exhibition now being held at St. Helens, Messrs. John Wright and Co., Limited, of Birmingham, have a very imposing display of their "Eureka" gas-cookers, gas-fires, and other appliances for domestic use with gas as the heating agent.

As from the 1st inst., a scheme of old-age pensions came into operation in Germany. All workpeople whose earnings do not exceed £100 a year will benefit; and the age at which the pension can be claimed is 70. Persons incapacitated through no fault of their own become entitled to relief much earlier.

Messrs. Abel and Imray have taken into partnership Mr. Arthur G. Bloxam, F.I.C., F.C.S., who has for some time been associated with them in business, especially in the chemical department. Mr. Bloxam has held appointments as lecturer in chemistry and practised as a consulting chemist. There will be no change in the style of the firm.

The Horseley Company, Limited, are distributing a very tastefully got-up description of their extensive works at Tipton, Staffordshire, with illustrations prepared from photographs showing views of various parts of the premises and some of the bridges constructed by the Company. The Company have carried out large contracts for roofs, piers, and gas holders.

There have been numerous complaints at Llandudno respecting the deposition of naphthalene in the gas service-pipes, and the consequent insufficiency and quality of the supply. To meet the difficulty, the Gas Manager (Mr. T. Davies) has recommended the Council to purchase a carburetter to enrich the gas as necessity arises. The proposal has been adopted,

At the meeting of the Huddersfield Town Council last Wednesday, the salary of the Gas Engineer and Manager (Mr. E. A. Harman) was raised by £100 for the current year, with a similar increase from Jan. 1, 1901. On the same occasion, the salary of the Assistant-Manager (Mr. Joe Sykes) was advanced from £185 to £200 per annum; and that of the Chief Clerk in the Gas Department from £100 to £110.

Those of our readers who visited the Gas Exhibition at the Royal Aquarium no doubt noticed the attractive display of gas and other fittings made by Messrs. Falk, Stadelmann, and Co., of Farringdon Road, at their stand in the East Section of the area. This branch of their business has attained such proportions as to necessitate the preparation of a catalogue of their fittings for ordinary, incandescent, and acetylene gas lighting, as well as electric accessories, apart from their lamp list; and it has just been issued. It makes quite a bulky book.

Last Wednesday the employees of the Seaham Gas Company, Limited, had their annual dinner in the large office at the works, which was tastefully decorated for the occasion. The Engineer, Mr. J. Whyte, presided, and afterwards addressed the men. He was followed by Mr. Hogg, who spoke very feelingly of the benefits and objects of such gatherings, and of the interest shown by the Directors in the welfare of the men. Mr. J. Thorman, one of the Directors, also addressed a few kind words to those assembled; and Mr. H. B. Wright, the Secretary, assured them of the kindly feeling of the Directors to all in their employment. A most enjoyable evening was spent in songs and games; and votes of thanks to Messsrs. Wright and Thorman, and to Mr. and Mrs. Whyte were passed.

The members of the Leeds Association of Engineers last Tuesday evening paid a visit to the Leeds Corporation Gas-Works, New Wortley. They were introduced by the President of the Association (Mr. J. A. Tempest) to the Manager (Mr. John Bond), who conducted them round the works. After passing through the retort-house, worked by hand, the visitors were shown two methods of stoking by machinery—viz., the West compressed-air and the Arrol-Foulis hydraulic systems, both of which afforded much interest. These machines draw and charge 450 through retorts five times every twenty-four hours, and are manipulated with ease by the machine men. The members also took the opportunity of inspecting several benches of regenerative retort-settings in course of construction.

The Austrian colliery strike movement, says the Vienna Correspondent of the "Daily Chronicle," is now extending over Bohemia, Silesia, and Moravia. Out of about 120,000 hands, a considerable number are already on strike, while the rest are preparing to come out. The movement is for an eight-hour day and an increase of wages. At Kladno (Bohemia), 12,000 hands went on strike on Monday last week. In the northern railway districts of Ostrau and Karwin, where about 40,000 hands are concerned, the employers conceded a part of the men's demands. On the advice of the leaders, therefore, work has been resumed, but only by a section of the men. The scarcity of coal is rapidly increasing, more particularly in Bohemia; and it is said that Prague will very soon be without a supply.

According to the Paris Correspondent of the "Financial News," the railway companies in Russia have been authorized to import up to about 40,000 tons of foreign coal, free of duty. This measure is owing to the growing scarcity of fuel throughout Russia. The Government are striving by every means to hasten the development of the coal deposits discovered in the countries traversed by the Trans-Siberian Railway. They are likewise doing all they can to encourage the utilization of peat as fuel, as considerable deposits of this product are found nearly everywhere throughout the Empire. Trials are being made with peat briquettes specially made for use in blast-furnaces. As to the supply for domestic purposes, the peat fuel prepared in a private factory situated in the neighbourhood of St. Petersburg has given such excellent results that it is proposed to further extend the industry in accordance with new processes now in use in Canada.

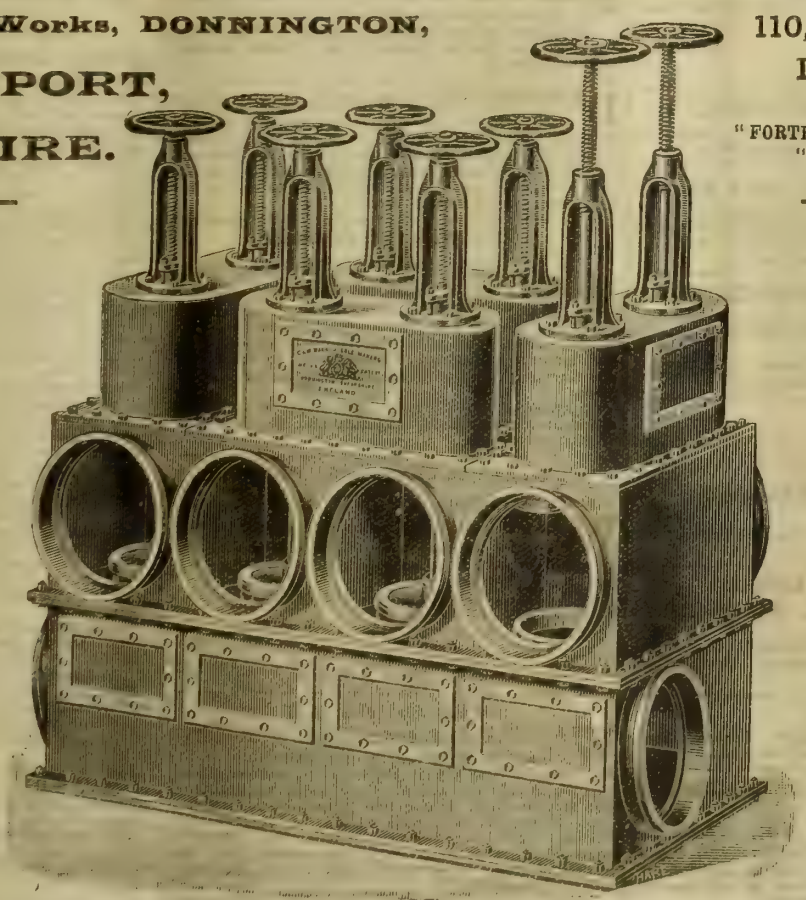
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All communications, remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

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COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

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GEO. T. LEWIS,
Clerk.
Town Hall, Clacton-on-Sea,
Jan. 20, 1900.

THE DERWENT VALLEY WATER BOARD.
APPOINTMENT OF ENGINEER.
BY the Derwent Valley Water Act, 1899, the Derwent Valley Water Board are authorized to construct six large Reservoirs in the Valleys of the Derwent and the Ashop in Derbyshire, together with important subsidiary Works in connection therewith to deal with an estimated flow of Fifty Million Gallons of Water per day. The Reservoirs will be constructed successively; and the execution of these and the other authorized Works is expected to occupy many Years.
Applications are now desired for the position of ENGINEER to the Board. The Engineer will be responsible for the Designing and Construction of the Works. He will be required to reside in the neighbourhood of the Works, and to devote the whole of his time to his duties under the Board, and to have daily personal charge of the work in hand. The staff of Assistants, Inspectors, Draughtsmen, Clerks, and others necessary in the carrying out of the work will be provided by the Board, and be under the direction of the Engineer.
The engagement will (subject to the services rendered being satisfactory) be certainly until the first two Reservoirs are completed (this work it is estimated will take some Ten Years to carry out), and may be a permanent one. The Engineer on his part will be required to enter into an agreement to remain in the exclusive service of the Board until the first two Reservoirs are completed. The Board reserve the power of determining the engagement with the Engineer on giving him Six Months' Notice, in case his services are not considered satisfactory.
It is indispensable that Candidates for the appointment should have had considerable experience in designing and constructing Reservoirs and Gravitation Water-Works.
The Board reserve the right (which they will probably exercise) to appoint, or take the opinion of, a Consulting Engineer or Consulting Engineers on the Works, when and as desired.
Each Applicant must furnish at least two References and *copies* of Testimonials (which cannot be returned, and which preferably should be printed); the Board having the right to call for the production of the originals.
Applicants must state Age, Experience, Present Position, Salary required, when at Liberty, and general state of Health. Personal Canvassing will be a disqualification.
Communications to be sent to me not later than the 10th day of March, 1900, marked on the outside "Derwent Valley Engineer."
JAMES BELL,
Clerk to the Board.
Bowlon Buildings, Bowling Green Street,
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St. Joseph, Mo.	750,000	Posen	450,000
Edinburgh	2,000,000	Dunedin (N.Z.)	150,000
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Brentford	1,200,000	Brighton (Second Contract)	1,750,000
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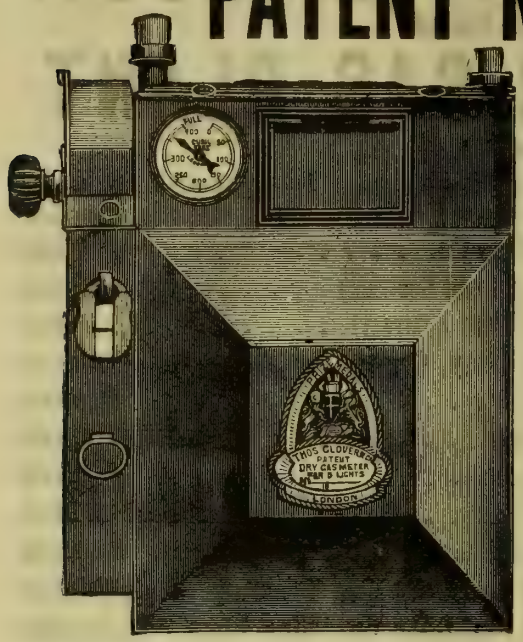
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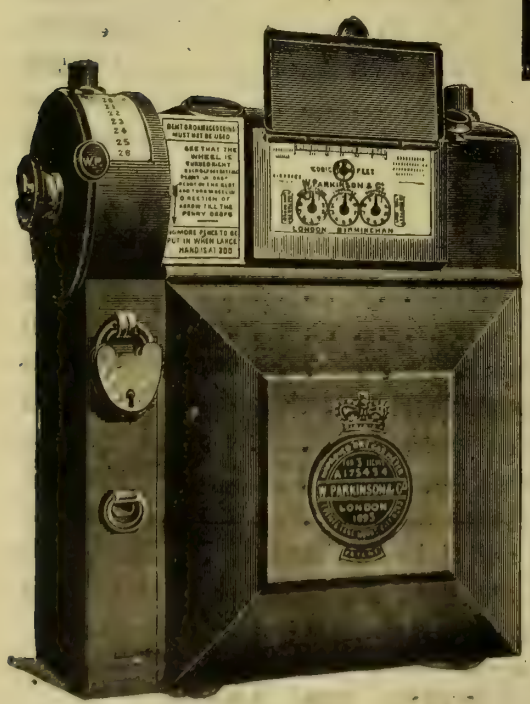
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CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE.
Prospects of Union in the Gas Industry . . . 255
The Report and Accounts of the Gaslight and Coke Company . . 256
The State of the Coal Market . . . 256
More About the Everett Coke-Gas Plant . . . 257
The Labour World in 1899 . . . 257
Defer to the London County Council . . . 258
WATER AND SANITARY AFFAIRS—
The Report of the Water Commission . . . 258
Water Affairs in Paris—A Divining-Rod Commission . . . 258
The Stevenson Memorial . . . 259
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market . . . 260
Electric Lighting Memoranda . . . 260
German Views of Gas Photometry . . . 261
Joint-Stock Enterprise in the Past Year . . . 261
Trade Disputes in 1899 . . . 262
Changes in Rates of Wages and Hours of Labour in 1899 . . . 262
COMMUNICATED ARTICLES:—
A Smoke-Preventer for Pipe-Jumpers. By J. O. V. Irminger, of Copenhagen . . . 263
The Temperature of Gas and Electric Light. By Charles F. Botley, Assoc.M.Inst.C.E. . . . 263
"Gas Fountains." By Just Alix, Chemist to the Lyons Gas Company . . . 264
TECHNICAL RECORD:—
The Illuminating Power and Colour of the "Kugel" High-Pressure Gaslight . . . 265
Ventilation without Draughts . . . 268
Parish Water Supply and Sewerage . . . 269
REGISTER OF PATENTS:—
Incandescent Gas-Burners—Clay, W. R. . . . 270
Incandescent Mantle Supports—Sugg, W. T. . . . 270
Coin-Freed Meters—Abel, C. D. (La Société Anonyme Continentale pour la Fabrication des Compteurs à Gaz et autres Appareils) . . . 270
Manufacture of Anthracene—Wilton, T. . . . 271
Washers or Scrubbers—Chandler, S. & J. . . . 271
Automatically Igniting Gas—Automatic Universal Gas Lighter . 272
Incandescence Bodies—Duncan, J. H. H. . . . 272
Self-Igniting Gas-Burner—Perlich, A. . . . 272
Fly-Wheels of Explosion Engines—Otto, M. . . . 272
Actuating Gas-Burners from a Distance—Weber-Marti, C. A. . . 272
Gas-Engines—Lake, H. H. (The Standard Automatic Gas-Engine Company) . . . 273
Manufacture and Purification of Alkaline Cyanides—Wilton, T. . 273
Patent Notices . . . 273
CORRESPONDENCE:—
The Projected Amalgamation of the Gas Institute and the Institution of Gas Engineers . . . 273
The Recovery of Cyanogen from Coal Gas . . . 273
The Boston Retort-Oven Gas Plant . . . 274
The Water-Gas Plant at Halifax . . . 274
Wet Lime Purifiers for Carburetted Water Gas . . . 275
PARLIAMENTARY INTELLIGENCE:—
Private Bills (Session 1900)—Opposition on Standing Orders . . 275
MISCELLANEOUS:—
The Gaslight and Coke Company—Report and Accounts . . . 275
Rates and Gas and Water Charges in Provincial Towns . . . 277
Large Gas-Works Extensions at Blackpool—Local Government Board Inquiry . . . 277
The Auxiliary Gas-Works for Coventry—Arbitration as to the Purchase of Land . . . 277
Hartlepool Gas and Water Company—Consolidation and Increase of Capital; Sale of Shares . . . 277
Gas Matters at Middlesbrough . . . 277
The Disaster at Stoke—Inquest on the Second Victim . . . 277
Explosion at the Newark (N.J.) Gas-Works—A Meter-House Wrecked . . . 278
Singular Gas Poisoning Case at Wednesbury—Two Ladies Suffocated; A Doctor's Testimony . . . 278
Electric Lighting Notes . . . 278
The Final Report of the Metropolitan Water Commission—Abstract of the Report; Press and other Opinions . . . 279
Gas and Water Companies' Stock and Share List . . . 283
Notes from Scotland . . . 284
Current Sales of Gas Products . . . 286
Coal Trade Reports . . . 286
PARAGRAPHS:—
PERSONAL: Mr. G. Elliott; Mr. J. Renfrew; Mr. Joseph Heaton; Mr. C. V. Bennett; Mr. John Duncan; Mr. Ernest Lomax Newbigging; Mr. Stephen Moore; Mr. A. T. Harris . . . 263
OBITUARY: Mr. H. Boulger; Mr. Thomas Hawley; Mr. Herbert Harry Hickmott; Sir George Henry Long . . . 263
Society of Engineers—Southern District Association of Gas Engineers and Managers—The Proposed International Gas Congress in Paris—Institution of Mechanical Engineers . . . 259
Dellwik's Water-Gas Process for Enriching Purposes . . . 260
German Protest against the Prohibition of the Exportation of Carbolic Acid from England . . . 263
Protected Lead Pipes—Rapid Methods for the Purification of Waters—Artificial Stone . . . 265
The Carburetted Water-Gas Plant at Lower Sydenham . . . 270
Faversham Town Council and the Water Company . . . 273
Shifnal Water Supply—The Spalding Water-Works Purchase Bill to be Proceeded With . . . 275
The Projected Purchase of the Newtown Gas-Works by the District Council—The Foulger-Glover Torch Syndicate, Limited—Pudsey Gas Company . . . 276
Sales of Shares—The Rugeley Gas Bill to be Opposed—The Borrowing Powers of the Birmingham Corporation Water Department—The New Gas-Works for Scunthorpe—House Wrecked by an Explosion at Beverley . . . 287
The Cambridge Municipalization Scheme—The Quality of the Gas at Maidstone—The Supply of Coal for the Ripon Gas-Works—The Profits of the Gas and Water Undertakings of the Hull Corporation—An Additional Water Supply for Nottingham—Scotch Water for London—The Maidenhead Town Council and the Water Company—Water for the Paris Exhibition—A Danger to the Cardiff Water Supply . . . 288
Weardale and Shildon Water Company—Cambridgeshire County Council and the South Essex Water Bill—Budleigh Salterton Water Supply—St. Agnes Water Supply—The Consumption of Water in Manchester . . . 289

EDITORIAL NOTES.

Prospects of Union in the Gas Industry.

It is not all war, and rumours of war, even in these days. In our "Correspondence" columns to-day will be found a pleasant communication exhibiting Mr. J. W. Helps and Mr. A. Dougall joining hands and waving an olive branch with grace and vigour. To be plain, these representatives of the Institution of Gas Engineers and the Gas Institute unite in reporting substantial progress for the movement in favour of bringing about a fusion of these organizations. Few readers of the "JOURNAL" who desire the good of the gas industry, and of those who live by it, will receive this intelligence otherwise than with favour, and even with gratitude. Those moving spirits on both sides who have been so far instrumental in carrying the matter to the promising stage of a Joint Committee deserve heartiest congratulations upon their tact and perseverance. It is unnecessary to recapitulate all the influences and circumstances which, taken altogether, went to show that there was no longer anything in the way of a reunion of the members of the professional side of the gas industry, and further indicated the desirability of such a consummation. Suffice it to acknowledge that the time had ripened for turning over a new leaf of the history of the technical associations connected with the British gas industry, and willing hands were found to assist in the operation.

Preliminaries having so far been arranged, we can perhaps encourage those who hesitate on the edge of the next stage by appealing to all who may be concerned to regard the turned leaf as closed for ever. Let bygones be bygones, for the sake of the future. The most hopeful spirit for the Joint Committee and their supporters to receive will be that of desiring to make a fresh start altogether, only remembering the past in order to avoid its errors. Since our correspondents mention the subject, there can be no harm in laying stress on the guiding principle that, in framing the constitution of the new Institution, it should be reserved, as far as possible, for those belonging to what we have already distinguished as "the professional side of "the gas industry." This leading rule should be sufficient. If it is kept in the forefront in the drafting of the Articles of Association, and acted upon in the spirit by successive Councils, the organization cannot go far wrong. For this reason, chiefly, it would seem preferable to retain the title of the Institution of Gas Engineers, as being in line with other modern technical organizations, such as the Institution of Electrical Engineers, which imply a professional, individual, or personal qualification in the members. The word "Institute," as in the example of the Iron and Steel Institute, appears to belong more appropriately to an organization possessing more of the attributes of a trade society. This was, indeed, the idea of those who gave the Gas Institute its name; but the plan has not worked well in this instance. If for no other reason, the profession and the trade of the gas industry are too large to be combined in one "show" for comfort, especially if it is to be a travelling one. Of course, there will be occasion for boundary disputes; it being difficult sometimes to draw the line between candidates for membership with diversified qualifications. But this difficulty, such as it is, is not peculiar to one kind of Society, and is rarely insuperable by goodwill and common sense. One has to keep one's mind clear from cant in this regard, as in many other practical problems of social life. Speaking in the broadest sense, all professional men are traders, inasmuch as they are in their callings for a living. Gas engineers are not as astronomers, or persons mildly interested in psychical research. It is not for them to sniff disdainfully at a "trader;" nor do they, to our knowledge. Those who object most strenuously to the participation of commercial men in their technical gatherings do so not for the reason that the latter are in any sense their inferiors, but only that their interests are different. Every gas engineer and gas manager, for example, is interested in the puzzle of naphthalene; but this cannot interest the gentleman who sells tubes. On the other hand, when it is a question of the best practice in gas distribution, the tube maker may be helpfully taken into counsel for the sake of the knowledge that he must have of the best value to be had for money spent upon his speciality.

After all, the issue lies in the hands of the individual followers of the profession. If they are truly persuaded

of the advantages of the periodical assembling of themselves together, for mutual assistance and support in plodding along the highway of life, they must agree that it is better to have one company than two. Men who are like-minded can find one another in any crowd, but not in two distinct collections separated by time and space. Every gas engineer and manager ought to belong, as of right, to his national technical society, which should be supported with discriminating liberality by the gas proprietary interest, and be the focus of technical instruction for those who are learning the business. In addition, every full member should acknowledge his obligation to do all in his power to raise the organization to the highest pitch of authority and credit possible for its nature and origin. This is to be done, not merely by contributing papers of real value, and discussing the papers of others with candour, fairness, and an honest desire to spread the truth—although this is the first essential to the success of a technical society—but also by setting and upholding a high standard of professional and social conduct. Those who go to a society meeting for the sake of advertisement, or as to a beanfeast, are much better away, whatever their nominal qualifications. Within the ranks of such a calling as that from which the membership of an Institution of Gas Engineers must be drawn, there will always be men of many minds and of various tastes; and a dead-level of professional demeanour is not to be desired, even if it were attainable. Most probably—be it said with bated breath—even the Association of Head Masters has moments of unbending! Enough on this head, however. We heartily wish all success to the Joint Committee; and have every confidence that, in the hands of such worthy and capable men of affairs as Mr. Dougall and Mr. Helps, the matters at issue will be guided to a happy solution.

The Report and Accounts of the Gaslight and Coke Company.

The report of the Directors and the statement of accounts relating to the working of the Gaslight and Coke Company for the past half year have been issued. The general meeting of the Company is convened for Friday next, the 2nd prox. The report states that the profit balance available for distribution amounts to £560,663, out of which the Directors recommend the payment of a dividend on the ordinary stock at the full statutory rate of £4 18s. per cent. per annum, which will leave the sum of £193,333 to be carried forward to the credit of the current six months. This remarkable improvement is due to several causes. Prominent among these is the material increase of gas consumption for the half year, which attained the rate of 4·92 per cent. Some observers would declare that this is a case of "one man's poison being another man's meat," and refer it to the shortcomings of the electricity supply undertakings in the Company's district. Nor should we say that this notorious defect of the rival illuminant was a negligible quantity in the influences bearing upon the Company's fortunes. Residuals have likewise helped the Company greatly; their income from this source having risen by £110,090. These are big figures, and they will be taken to amply justify the reduction in the price of gas by one penny per 1000 cubic feet, which came into force at the beginning of the year. For the immediate future, on the other hand, the condition of the coal market, both as regards supplies and prices, is justly mentioned as a cause of anxiety to the Directors. Happily there has been no actual shortage of coal at the Company's stations, although the stocks were seriously depleted; but higher prices are regarded as inevitable.

In regard to their parliamentary programme, the Directors content themselves with stating that the provisions of their Bill are in all respects identical with those of the measure which the House of Commons accepted last session. The negotiations between the Company and the Directors of the South Metropolitan Company relating to the possible transfer to the latter of the Surrey-side district of the Company are mentioned in a special paragraph of the report. It is admitted that there is at present an immovable difference between the two Boards in respect of the value of this property, "and there the matter "for the present rests." The circumstance of the Bill actually being promoted by the South Metropolitan Gas Company containing an application for permissive powers for making this purchase, is very properly described as providing further opportunities for discussing the whole subject. In another paragraph, this South Metropolitan Bill and the Bill of the London County Council for further regulating the testing of the gas supply of London are characterized as requiring very careful watching on the part of the Directors, "with a view to safeguarding "the interests of the Company." And there an end. Nothing is said concerning the recommendations of the Powers of Charge Committee, which were presented too late to be mentioned in the last report.

The accounts show that the net capital expenditure of the Company was £75,834 for the half year, mostly on distributing plant. The increase in gas-rental has already been noticed. It amounted to £62,869 in money. The rise in residuals was from £371,337 to £481,427. Altogether, the Company's revenue rose from £1,912,785 to £2,088,220. On the other side of the account, the expense of gas manufacture rose from £1,016,690 to £1,133,843. Repairs and maintenance are well kept up. The other entries do not call for particular remark. Economies have been effected in some departments; and in the matter of workmen's compensation, a change would appear to be in progress from a computed to the actual charge. The undertaking has had a prosperous and uneventful half year, which the able and conscientious officers have doubtless utilized to their best ability in improving the property committed to their care. The suspense account for automatic fittings begins to show a shrinkage. The report states that the opportunity for a change of Auditors has presented itself, in the ordinary course. It is possible that the same occasion may be taken for raising the question of professional auditors; but we have no specific information on this head. The address of the Governor (Colonel Makins) to the meeting is certain to be received with quite the usual meed of interest.

The State of the Coal Market.

Readers will not require any apology from us for reverting to the question of the dearth of coal. It is at present *the* topic of the hour, and is, moreover, a cause of constant anxiety in the gas world; while in the Press generally, in spite of the absorbing interest of the news—or, as often as not, the lack of news—from the seat of war, the scarcity and high price of coal are attracting attention, and are being made the subject of more or less instructed comment. In spite of the open weather that has prevailed for some time past, the situation, so far at any rate as the leading Gas Companies are concerned, shows no sign of appreciable improvement; and, in view of the depleted condition of the coal-stores at the end of the year, it is pretty certain that the Metropolitan gas managers are thanking Heaven for the absence of frost and fog as fervently as they are cursing (in parliamentary language) their contractors for the absence of coal. The situation in London at the end of December, and the possibilities of the situation in January had maximum gas consumption prevailed, can be gauged from the stock of coal on the last day of the year shown in the balance-sheet of the Gaslight and Coke Company—namely 161,120 tons, compared with 258,662 tons at the end of 1898. Assuming the Company's weekly consumption in mid-winter at 65,000 to 70,000 tons, they had on the average less than 2½ weeks' coal in stock at their various works at the end of last month, and that in spite of an increased manufacture of carburetted water-gas during the preceding half year. This fact supplies a conclusive answer to the question asked by a correspondent in our columns last week, as to whether buyers relying chiefly or entirely upon seaborne coal supplies were experiencing the same difficulty in obtaining delivery from their contractors as those whose coal should reach them by rail. The passing of the holiday season and the disappearance of fog, without the accompaniment of anything more than a very slight improvement in the matter of coal deliveries, tends to remove from the list of excuses relied upon by colliery owners for their non-fulfilment of contract obligations, that of congested railway traffic.

There are two further suggested explanations for the present state of the coal market which are frequently put forward. The one is that to which we referred last week—the supposed reduction of output due to idleness on the part of the miner. This excuse has been frequently advanced by defaulting contractors to explain their failure to deliver and now the public are being asked to accept it as accounting for the high and rising price of coal. The theory is expounded with considerable humour, but an entire absence of proof or logic, in a letter in "The Times" of Thursday

last, upon "Miners and the High Price of Coal," signed "C. K. F." The writer prefaces his letter by remarking that he has "never seen a collier" himself; but we are disposed to think that his interest in the question may be something more than academic, and his concern less for the general public than for the coal-owner. The "lazy "collier" theory is so very convenient to the over-sold colliery proprietor. The fondness of coal "winners" for a holiday is, of course, a matter of common knowledge, and not a matter of very great astonishment to anyone acquainted with the conditions under which much of the winning is, of necessity, effected. But when it is sought to suggest that the present scarcity, and consequent high price, of coal are due to a more than usually frequent indulgence in this habit of "playing," it is necessary to point out, as we did last week, that, unfortunately for the contractors, the facts do not tally with the theory.

The "Financial Times," in an article entitled "The "Monopoly in Coal," which appeared on the same day as the letter to which we have referred, showed the general public, from the statistics of the Board of Trade (quoted in these columns last week), as we have put it to our readers, that the "idling miner" argument "is ingenious, but that "it is not based on fact." The writer of the article then proceeds to set out his own view of the coal situation, and advances the other of the two explanations we wish to notice. That explanation consists in alleging "the exist-"ence of a powerful Trust in the coal trade," and suggesting that there is no real scarcity of coal. So far as the second point is concerned, if by saying that there is no scarcity of coal in this country, nothing more is meant than that the mines are far from being exhausted, no one will be found to contest the obvious truism; but if the suggestion is that coalowners have got large stocks somewhere concealed, we can only ask for some proof of their existence. In regard to the alleged Coal Trust which is supposed to be almost entirely responsible for the rise in price, we, recognizing the notorious difficulty of proving a negative, can do no more than point out reasons for holding that the balance of probability is against the existence of such Trust.

Foremost among such reasons is the enormous difficulty of creating a combination of the many interests concerned in so vast an industry as the coal trade, sufficiently effective to rule the market and force up prices to their present figures; and, further, could such a combination be successfully brought about, the extreme improbability of such a ring being called into existence, and effectively maintained for months, without the knowledge of the commercial world generally. Again, the fact that the scarcity and dearness of coal are not confined to our own country, but are in fact practically universal, is an argument which proves that, if a Coal Trust exist, the state of the market here is not mainly due to its influence. Germany, Italy, and Russia have been and are all suffering from the lack of coal; while trade in Austria, before the present strike of miners had created a real state of coal famine, was seriously hampered by want of fuel. Is it suggested that the "powerful Trust" embraces all collieries in all countries? Some people can never accept a simple explanation, such as that abnormally active trade for more than twelve months has been sufficient to harden the coal market very considerably; they must always conjure up visions, and seek for occult and sinister forces. We decidedly think the "Coal Trust" is a vision; its existence is certainly as yet "not proven."

More About the Everett Coke-Gas Plant.

The long and interesting letter of Dr. F. Schniewind concerning the Everett (Boston) Retort-Oven Gas Plant which appears in to-day's "Journal," taken in conjunction with the article we reproduced last week from "Progressive "Age," brings down to the latest date the available technical information relative to this highly interesting experiment in gas manufacture. Dr. Schniewind is quite justified in believing that our interest in this venture is both kindly and earnest. We have no prejudices whatever in regard to the manufacture of illuminating gas, and gladly welcome everything that has any respectable credentials as an improvement upon established practice. The gas industry of the United States has always been liable to revolutions, which have not always proved true reforms. The supersession of the coal-gas supply of the Eastern States, for instance, by carburetted water gas, was not due to technical considerations. The carburetted water-gas interest contrived to circumvent or to oust the old coal-gas interest; and there was the end of it—for the time being. As in the United Kingdom, so in America, carburetted water gas did not succeed on account of its greater cheapness as compared with coal gas. Bulk for bulk, there was little to choose between the cost of the two products as delivered into the holder; but the carburetted water gas was of very much higher candle power than the coal gas it supplanted. Twenty-four candle carburetted water gas cost no more than 16-candle coal gas; accordingly it "went" with the American public. It was as a carburettor that the same product first made its mark here. During the years of this progress, however, something else was going on which tended to redress the balance. American gas oils did not grow more plentiful, nor cheaper; and the incandescent gas-light knocked candle power into a myth. The Age of high-grade gas passed away. Boston, having been captured by the water-gas interest, had retaliated by enslaving the water-gas capitalists in turn. Having laid down their plant, they had to make the best of it, which meant that the price of gas must be kept up to accord with the high illuminating power. The one was the sole excuse for the other. On top of this artificial position of the Boston gas industry came the Everett enterprise, with an offer of coal gas at considerably less price than the water gas cost to make. Dr. Schniewind says the venture is justifying itself. We are glad to believe him. There is nothing in his letter to disturb our first impression that, as compared with gas *plus* coke making, coke *plus* gas making is merely change for a shilling. It is different when the competition is with carburetted water gas; and Mr. A. C. Humphreys has already admitted that the latter has been overdone in America. The chief question is, of course, what is the natural and economic system of gas manufacture for every locality. The water-gas speculators have declined to recognize the economic frontiers of their realm; and they are consequently threatened with the loss of the provinces they ought never to have occupied. Our readers must form their own opinion as to the financial dealings so lightly touched upon by Dr. Schniewind. Personally speaking, we should dearly like to take the trip to Boston and spend a few days in company with our respected correspondent and his financial chiefs, Mr. Whitney and Mr. Elkins. Such an experience would be a liberal education; but the "Journal" imposes ties which must not be broken, even on such a temptation. Meanwhile, we shall continue to follow the fortunes of the Everett undertaking with the liveliest interest, and the sincerest admiration for that individual enterprise which, as Dr. Schniewind well says, cannot flower freely in the stifling atmosphere of State Regulation and rampant Municipalism.

The Labour World in 1899.

We print elsewhere summaries of the preliminary statistics issued by the Board of Trade relating to industrial disputes last year and the changes in rates of wages and hours of labour reported during the same period. For the final and elaborated returns the world must wait the pleasure of the Department, which has an unlimited faith in the virtue of making haste slowly. It is, indeed, only a few weeks since we noticed the appearance of the annual report on trade disputes in 1898. In some respects the preliminary summary possesses an advantage over the final, inasmuch as we are told that one of the chief causes of the delay in publishing the latter is the length of time required to obtain all the particulars of the minor disagreements between employers and employed—disputes the facts of which, however interesting and important to those directly concerned, tend rather to confuse than to enhance the value of the statistics relating to those conflicts which afford a real indication of the relations existing between the bulk of employers and employed.

The past year was singularly and happily free from any serious disturbance of the peace in the industrial world. The number of days lost through strikes or lock-outs, as compared with those in 1893—the "black year" of modern times in this regard—was in the ratio of 1 to 12½, and less by 30 per cent. than in 1896, which was itself especially free from trouble. Of such disputes as did arise, the great majority were in respect of wages, while less than 3 per cent. arose over hours of labour—a pretty accurate indication of the preference of the working man for better earnings rather than more leisure. Only something under 6 per cent. of the hands involved struck work over the

"employment of particular classes of persons," which is a more euphonious description of the strike against non-union labour—a cause of trouble which it is to be hoped will continue to be, as it has been of late, less prevalent than formerly. We wish we could infer that the comparative freedom from serious disputes that the community has enjoyed since the trouble in the engineering world in 1898, was due to some more abiding cause than the flourishing condition of trade. We hope (though not too confident in our optimism) that the history of the engineers' dispute may have been an enduring lesson to employees generally, that extravagant unreasonableness may prove its own undoing, by calling into being the latent power of combination possessed by employers.

That the working classes have obtained a fair share of the advantage accrued to commerce by the revival of trade is evident from the report as to changes in wages last year; those changes being, with insignificant exceptions, in the nature of increments of a substantial character, affecting large numbers of hands, and obtained in 97 cases out of every 100 without any strike or stoppage of work. Wages have, in fact, been moving steadily upward now for several years; the turning-point being about the latter end of 1895. Last year and 1898, however, witnessed the most striking advance; the movement synchronizing with the steady improvement in trade. This rise in wages has been most marked in the coal and iron trades, which have been more especially flourishing, and in which rates of wages are made to depend, more or less exactly, upon current prices. Signs are not wanting, however, that coal miners are by no means satisfied with the advantage they are gaining from the present abnormally high prices of coal. As these prices cannot, in the nature of things, be long maintained, it is doubtful whether employers will willingly grant the rise in wages now being demanded. But it is earnestly to be hoped that the condition of the coal market will not be aggravated by labour disputes.

Defer to the London County Council.

It must be a blessed and a happy state to be a convinced and accepted "Progressive" in the minor political world of London. No more painful balancing of the rights and wrongs of things; nothing to disturb the equanimity of a mind firmly based on the immovable rock of faith in the London County Council! What are Parliaments, and Royal Commissions, and Government Departments in the balance with this repository of every civic virtue and all wisdom? We can see the operation of this municipal form of Mohammedanism in the reception accorded by that organ of the faithful, the "Daily News," to the report of the Royal Commission on the London Water Supply. It was graciously conceded that the Chairman of the Commission, Viscount Llandaff, "is an extremely "clever and accomplished man." But—it is an awful "but"—he lacks the "judicial mind," and entertains "a violent prejudice against the London County Council." Wherefore, away with him! It is the only possible way of municipal salvation to hold the most insensate of prejudices in favour of the body which Lord Rosebery once led—but to which he denied a palace in Westminster—and is now supposed to be illuminated chiefly by the ripe wisdom and experience of Messrs. John Burns, Sidney Webb, and Co. The Commission find that the other Authorities interested in Water London have no faith in the London County Council; and accordingly they propose a Water Board, such as many populous centres know already. But this "flimsy" excuse the "Daily News" brushes away as of no account. What are the County Councils of Hertfordshire, Middlesex, or Surrey that they should presume to object to the ineffable magnates of Spring Gardens? As in water, so, of course, in gas, tramways, everything—there must be no shadow of resistance to the London County Council, on pain of the greater damnation. Yet we remember that not so long ago there were people, not outcasts like Water and Gas Companies, who held the opinion that the Council was not wholly justified in its policy towards Sunday Concerts and Lord Rowton's Houses. Naturally, these were much more important questions than the water supply of the Metropolitan area, or the gas either. But oh! to be a "Progressive," with no obligation to have one's own opinion about any of these things! Blessed Authority, which is always ready to relieve the world of thought for itself. We have no Czar nor Pope in this Land of the Free; but we have more than one County Council.

WATER AND SANITARY AFFAIRS.

In another part of the "Journal" will be found the first instalment of our abstract of the final report of the Metropolitan Water Commission, a general outline of the contents of which, with the principal recommendation, was given last week. In view of the extent to which the questions referred to the Commission have been from time to time discussed in the Press, it has been thought to be of interest to reproduce some of the opinions which the publication early last week of the long-expected report called forth, and, in common fairness, to record, in connection with them, the views which have been orally expressed by members of the party known to be hostile to the Water Companies. We leave the abstract and the comments to the attention of the general reader. Those who are specially concerned with the subject-matter of the report will, of course, study the original document. The Commissioners, as is now pretty widely known, recommend the constitution of a representative Water Board to acquire and carry on the undertakings of the Companies; and it will be seen that the majority of the Press approve of the recommendation. There are necessarily some differences of opinion as to the proportion of the representation, and other matters; but, broadly, the proposal is accepted as the best solution of a difficult problem. And we may add that satisfaction is generally expressed that the London County Council are not to be entrusted with the control of the water supply. For ourselves, we have consistently expressed the opinion that if it is to be taken out of the hands of those who have been for so many years responsible for it—and we have never admitted any necessity for such a step—it should be handed over to a permanent body specially constituted for the purpose, and not to the County Council. Several reasons might be adduced here in support of this opinion; but we prefer to let those given by the Commissioners in their report speak for themselves. Just one, however, may be noticed. It is this—that the area of what has become known as "Water London" is larger than that which is under the jurisdiction of the Council. Unless the outer areas were lopped off, the powers of the Council would have to be extended; and such extension would meet with strenuous opposition from the Local Authorities concerned, who certainly have not manifested a desire to be under the supervision of Spring Gardens. When this question of the control of the Metropolitan Water Supply was taken up by the Government four years ago, we ventured to suggest that the only appropriate authority to be entrusted with it would be one representing the interests of the whole of the consumers who are dependent on the Water Companies; and that to such a body the undertakings might be transferred. We considered that little friction would be experienced in effecting the transfer, provided the terms of purchase were fair and equitable; but that the public and the general body of consumers would be any better off by it, we ventured to doubt. We will leave our readers to judge how far these views accord with those expressed by the Commissioners in their report.

It may very fairly be asked: Why, except as a concession to Municipalism, should the water undertakings be transferred to a public body? There are people—and they have their representatives on the County Council and their spokesmen on the Press—who will reply: Because the owners of those undertakings purvey an unwholesome commodity, are extortionate in their charges, and neglectful of their duties to the public. The injustice of such assertions is fully shown in the present report as well as in that of Lord Balfour's Commission of 1892-3. The latter body expressed the strong opinion that the water supplied to the consumers in London was of a "very high standard "of excellence and of purity," and "suitable in quality "for all household purposes." Viscount Llandaff's Commission say that "the Companies have, upon the whole, "performed their duties to the public satisfactorily and "well." There is no reason for supposing that they will not continue to do so if they are left in possession of their property. But if they are to be bought out, it must be at a fair price; the owners not being willing sellers. The views of the Commissioners on this point, as will be seen from our abstract of their report, are clearly expressed. They see nothing which would lead them to suppose that Parliament will sanction any exceptional provisions, or "depart from the terms of arbitration usual where the

"property of private persons is taken from them against "their will." Consequently, away go all the attempts to depreciate the property of the Companies with the view of getting it at some "old iron" price. Whatever the figure is to be—whether £30,000,000 or £45,000,000—it will have to be determined by an arbitration conducted on the lines of the Lands Clauses Act, but with possibly a different tribunal, in view of the magnitude of the undertakings. We agree with the "Pall Mall Gazette" that the constitution of this tribunal is the *crux* of the whole question. Its President will have to be a man who will command confidence; and he must have the assistance of legal assessors. But the right man will be found when the time comes for seeking him.

In less than ten years the London Water Companies have had to bear the expense, and their Directors and responsible officials the anxiety, of two long investigations into their affairs by Royal Commissions. They have passed through both ordeals with honour. Some of them have been before Parliamentary Committees, and one has been the subject of a special inquiry by the Local Government Board. In spite of persistent opposition, they have been able to hold their ground. But for this opposition, their works would to-day be in a better condition than they are for meeting the demands upon them. Where public companies are subject to continual attacks from without, the energies of their conductors are spent in repelling them, instead of being directed to the perfection of internal arrangements. It is to be hoped that the outcome of the protracted inquiry by Lord Llandaff and his colleagues will be a definite settlement of the Metropolitan Water Question. It has been objected that the Commissioners advise the addition of one more to the numerous controlling authorities now existing in the Metropolis, instead of handing over the water supply to the Local Government Board, or to a specially created Public Health Department or National Water Board. But it should be remembered that, under the Commissioners' scheme, the Water Board will be to a large extent subject to the supervision of the Local Government Board, and will be also responsible to Parliament. Should either or both of the other suggested bodies be created—and, in view of the present scramble for watershed areas, some such organization as that last named appears to be needed—there would not be much difficulty, we should think, in incorporating with it the Water Board which it is now proposed to constitute.

In view of the incursion of large numbers of visitors into Paris during the coming summer, attention is being given to the question of the supply of potable water by the Technical Commission who have been entrusted with this matter. Last year, notwithstanding the very hot, dry weather which prevailed, the normal supply of 48½ million gallons of spring water was found to be sufficient. During the present year, however, there will be an addition of some where about 17½ million gallons from new springs, and 4½ millions from the St. Maur filters. The daily supply will thus be raised to 70½ million gallons. Irrespective of this, there will be in store 22 million gallons at St. Cloud, and 88 millions in the other municipal reservoirs. These stores will, of course, not be drawn upon until necessity compels it; but when they are, there will be available 100 million gallons of water as an auxiliary supply. During the drought of last summer, some alarm was felt lest an inadequate supply of spring water should militate against the success of the Exhibition by deterring strangers from visiting the city, or hastening their departure from it. It would seem that the municipal authorities have taken steps in time to ensure the efficiency of this most important service; and it is to be hoped the provision they have made may prove ample. A dearth, or even a short supply, of water in a city like Paris, in the full tide of the Exhibition, would be really deplorable.

While referring to Paris, it will not be out of place to notice the appointment of a Commission to investigate the subject of the divining-rod as an aid to the discovery of sources of water. Their duty will be to ascertain, by studying both scientifically and technically, the methods now employed, apart from the application of geological and hydrological knowledge, their value for locating subterranean water. The President of the Commission is to be M. De Rollière, a Consulting Engineer residing at Neuilly, near Paris, who is already known, at all events in France, by his works on hydrology. On him will devolve the collection of materials and information, which will be dealt with at general sittings of the Commission. It is to be hoped that the outcome of their labours will be to throw light upon a system as to the merits of which opinions are by no means unanimous. If there is any scientific value in divination, it will stand the test of investigation; if, however, it is little more than a piece of jugglery, the sooner the trick is exposed by some authoritative pronouncement the better.

THE STEVENSON MEMORIAL.

Our readers will doubtless remember that, on the initiative of Mr. H. E. Jones, Engineer and Manager of the Commercial Gas Company, preliminary steps were taken last November to form a Committee to consider the advisability of the erection by the gas profession of some memorial to the late Mr. George Ernest Stevenson. It was felt, however, that it was hardly possible to get together anything like a representative gathering of gas engineers just as the very busiest time of the whole year for them was so nearly approaching. The matter has, however, not been allowed to lapse; and Mr. Jones has now issued a circular of invitation to all those who responded to his original suggestion, asking their attendance at a meeting to be held next Friday at the Westminster Palace Hotel, at 4 o'clock—"for the purpose of considering the form the memorial should take, what limit (if any) should be put on the subscriptions, the disposal of any possible surplus that may result, and further for the election of a Working Committee for carrying out the objects of the meeting." Mr. Jones trusts that all who sympathize with the movement and are able to attend the meeting will do so, without further personal invitation; but if unable to be present, that they will write before Friday stating their views on the points raised, and also what contribution to any fund they are disposed to give.

Society of Engineers.—The first ordinary meeting of this Society for the current year will be held at the Royal United Service Institution, Whitehall, next Monday, when the retiring President (Mr. J. Corry Fell) will present the premiums awarded for papers read during the session of 1899, and his successor—Mr. Henry O'Connor, of Messrs. James Milne and Son, Limited, of Edinburgh—will deliver his Inaugural Address.

Southern District Association of Gas Engineers and Managers.—The first meeting of this Association for the current year, which, under ordinary circumstances, would have been held on the 8th prox., has been postponed till the 1st of March; the Committee being of opinion that, as the second Thursday in February falls so early in the month, and as the present season is an exceptionally heavy one, it would be inconvenient for the members to attend on that day.

The Proposed International Gas Congress in Paris.—With reference to the particulars in regard to this matter which appeared in the "Journal" for the 16th inst. (p. 140), we may remind our readers that the Organizing Committee, of which M. Vautier is Chairman, will be glad to be advised by the 15th of February, if possible, of any intention entertained to present communications to the congress to be held from the 3rd to the 5th of September. M. Vautier's address is 65, Rue de Provence, Paris.

Institution of Mechanical Engineers.—The annual general meeting was held in the new Institution House, Storey's Gate, St. James's Park, last Friday. At the commencement of the proceedings, Sir Edward H. Carbutt (who presided in the absence of the President, Sir William H. White, K.C.B.) made the gratifying announcement that they had had a considerable accession of new members since the last meeting. The Secretary (Mr. Edgar Worthington) then read the annual report of the Council, which stated that, at the end of last year, the number of names in all classes on the roll was 2922—a net gain of 238 during the year. The total revenue for the year was £8777; while the expenditure was £9230—leaving an excess of expenditure over revenue of £453. The past year is the first in which the Institution have occupied their own house; and an increase in the expenditure was inevitable. Certain expenses of a special character had also to be incurred in connection with the opening of the house. Under these exceptional circumstances, the financial result of the year was considered satisfactory. The expenditure to Dec. 30 on the new building amounted to £59,214. The report was unanimously adopted; and the Chairman then announced that Sir William White had kindly consented to accept the position of President for the second year. The plaudits of those present demonstrated the popularity of Sir William. The Vice-Presidents and other office-bearers having been elected, Mr. William Schönheyder read a paper on "Water-Meters: With Special Reference to Small Flows and Waste in Dribbles." The principal portions of the paper, with a summary of the full discussion which followed, will be published in next week's issue.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 283.)

BUSINESS on the Stock Exchange cannot be reported to have improved last week, so far as any increase in volume is concerned. Rapid fluctuations were the rule. After a fairly firm opening, things turned rather shaky, and railways in particular lost some ground. Then there was a recovery, which became more pronounced when it was apparent generally that the fortnightly settlement was not likely to give rise to difficulties. On Thursday, everything jumped up at the receipt of good news from the seat of war; but the rise was tempered by a strong disposition to realize profits. The next day there was marked depression on the news of the abandonment of Spion Kop; and the week closed flat. Prices all round have suffered generally, although here and there special circumstances have operated the other way. The Money Market continued to become easier; and the further reduction, on Thursday, of the Bank of England rate to 4 per cent. from the 4½ per cent. (which had lasted a week) became inevitable. Business in Gas was on the whole decidedly quiet, beyond what was done in the issues of the leading Company. The general tendency was favourable; and a fair number of quotations made moderate advances, while the movements in the other direction were few and unimportant. In Gaslight issues, the ordinary opened rather too buoyant, jumping at once to 110—a price which had to be modified later on; and though 110½ was touched at one time, the closing mark was a point lower. The quotation, however, had gained a point-and-a-half. This was owing to the issue of the report and accounts, which certainly found favour. The secured shares were not much dealt in; but the maximum and the debenture improved. South Metropolitan was rather quiet, and not disposed to go any higher. Commercials gave no sign of movement. Transactions in the Suburban and Provincial group were rare, and movements were irregular, comprising an advance in Brightons, and a retrograde move in Crystal Palace. In the Continental Companies, transactions were much restricted; but there was a rather firmer feeling in Imperial Continental. Among the minor undertakings, Tuscan had a fall, but River Plate rose. Business in the Water Companies was not quite so near the stagnation point; and there were a few movements in quotations. But they were slight in degree, and variable in direction.

The daily operations were: Business opened quiet on Monday, but with a very good tendency. Gaslight ordinary rose 1. There was a shade more activity on Tuesday; quotations remaining unchanged. Wednesday's operations were slacker; but the general disposition was firm. Brighton original rose 2½, and the ordinary 2, and Imperial 1. In Water, Lambeth advanced 1; but New River fell 2. Thursday was a little busier, and showed renewed strength in Gaslight ordinary, which gained ½. River Plate debenture went up 1; but Crystal Palace fell 3, and Tuscan ½. Friday was active and buoyant. Gaslight maximum and debenture rose 1 each. In Water, East London moved up 1½. On Saturday all was quiet and unchanged.

ELECTRIC LIGHTING MEMORANDA.

Electric Traction on the Metropolitan Railways—The Difficulty—The Requirements—The Apparatus—Wanted, A General Manager of Town Lighting

SOME interesting information has at last leaked out respecting the progress of the preparations for the crucial trial of electric traction on their system which the Metropolitan and Metropolitan District Railway Companies are known to have in hand. There are two aspects of electric traction, as of electric lighting, which are respectively regarded by electricians and by mechanical engineers who have not been infected by the electricity microbe. The view of the professional electrician is that the time is past for questioning the applicability of electricity to any and every purpose, from propelling railway trains to heating shaving-water. The only question he permits is as to the interval that must be allowed to elapse while steam and gas-fittings are cleared away to make room for the electrical apparatus. As Mr. Hammond told the Dublin City Council the other day, the disappearance of gas from the streets of Dublin is only a matter of time; and Mr. Hammond is a typical prophet of electricity. Cold-blooded mechanics, on the other hand, who have been brought up to the trade, have a hard-headed way of treating electricity as a mere tool, with strict reference to its suitability for any particular work. Consequently, in the hands of English mechanical engineers electricity has to justify itself at every turn; and the ardent electrician chafes at this callous requirement. He wants to feel himself flying on the wings of progress, with his prophet's mantle streaming behind him; but the British mechanic has no faith in flying machines as a general thing.

We have lately had occasion to lay stress upon certain experiences of users of electric lighting which appear to indicate that, with all its charms, this method of illumination has not outgrown its constitutional weaknesses. In discussing electric tramways, we have also urged time and again that in this matter British highway authorities had better "make haste slowly;" and now it transpires that there is no immediate prospect of the abolition of the steam locomotive from those mephitic tunnels of the Metropolitan Railways whence its departure is most heartily desired by the travelling public. The conclusion of a "Times" article on this subject is that some time "in the course of next century it may become possible to travel round the Circle by electricity." This is remarkably cold comfort to those who "remember how often an electric locomotive was paraded in fancy by Sir Edward Watkin before the expectant eyes of the Metropolitan shareholders, and how regularly it failed to put in a concrete appearance upon the railway." The truth of the matter is that, notwithstanding the vapourings of the electrical prophets, those who are responsible for the working of a great railway know well the seriousness of the business, and how very doubtful it is that electrical engineering is as yet sufficiently advanced to cope with the requirements of full-sized railway service. A general manager of a railway has to think of everything necessary to the continued working of the line; and he has too much reason for knowing what infinite importance attaches to the multitudinous trifles that the would-be innovator from outside naturally overlooks.

It cannot be said that the joint railways interested in this experimental research fell into the error of entrusting the inquiry to unbelieving hands. The Companies employed Sir W. H. Preece to overlook the electrical part; and if anybody could make an electrical train go, one would think the late Chief Electrician to the Post Office is the man. Sir J. Wolfe Barry, representing strict engineering orthodoxy, was associated with the Electrical Knight in this inspiring enterprise. The result up to the present time is described in "The Times" for the 24th inst. Of course, the object of the experiments was not to ascertain whether railway trains could be propelled by electricity at a considerable rate of speed. No fresh proof of this was needed, after what is done every day in London and elsewhere. But what was required was trustworthy data as to the engineering and economical conversion of a steam to an electrical railway under the conditions prevailing in actual practice, having due regard to the keeping of the capital outlay within reasonable bounds and to the subsequent working. Nobody could say for certain how much power would have to be provided to work a section of full-sized railway on an electrical system. The wildest hypotheses prevailed upon this point, down to the opening of the Waterloo and City Railway, which is but a tramline. It is a *sine quâ non* that every railway train must be able to start and stop whenever and wherever required, and travel between its stops at any speed desired by the driver, up to the maximum. Upon this head alone, to say nothing of others, no certainty existed.

The line selected for the experiments is that which runs direct from Earl's Court to High Street, Kensington. The length is nearly a mile; and there is the steepest gradient in the whole system in one section of it. The continuous conductor is of bonded channel iron, fixed parallel to and outside the metals. The current is of 500 volts potential, according to a now pretty well-established rule for traction currents, provided by Belliss-Siemens generators. There would be no difficulty in obtaining any amount of motor electricity at this pressure, transformed from high-voltage main supplies generated at one or more river-side stations. The train picks up the current by means of sliding contacts, which need make a pretty good connection, as the experimental train weighs 200 tons. It must be rather severe work, transmitting the current for driving such a train through so temporary a contact. With regard to the results of the working, there is as yet nothing to be said. The train will run; and where one train runs others can follow. But this by no means proves that it will be worth while for the Metropolitan Railway Companies to scrap their steam locomotives and take to the "slippers." Some positive gain will have to be shown to warrant the change; and this is precisely where the shoe pinches the electrician. Mere improvement of the atmosphere of the Inner Circle Railway will not suffice to turn the scale. The possibility of an accelerated service, so as to make the trains almost continuous, would be a greater inducement than anything else that could be named. If the electrical trains could follow one another like omnibuses on the road, there would be much to be said for the principle.

Meanwhile, it may be remarked how salutary it would be if the supreme discretion of the general railway manager could be exercised by somebody acting, say, as chief of the lighting service of a town! This is a mere fancy, of course; but suppose such an official were authorized to decide whether such-and-such an applicant should have electricity or gas-lighting, having regard to the nature of his requirements. A good deal of disappointment would be spared to those who could fall in with such an arrangement. The officer would say, for instance, to the hospital director, "Electric light for your operating theatre? Nonsense, my dear sir—what you want there is a light you can depend upon. Take gas. Keep electricity for your wards." And so forth. Dreams, idle dreams, for there is nobody to tell us how to run our private trains on the "Railway of Life."

Dellwik's Water-Gas Process for Enriching Purposes.—A water-gas plant on the Dellwik-Fleischer system has been in use for some months at the town of Iserlohn, in Westphalia, for the production of water gas, which is subsequently carburetted with benzol, and used for supplementing the town supply of coal gas. In the daytime, about 30 per cent., and at night 25 per cent., of this carburetted water gas is added to the coal gas.

GERMAN VIEWS OF GAS PHOTOMETRY.

When the subject of gas-testing in Germany is approached, it immediately appears that there is much diversity of method in the photometrical practices of the great cities. In respect of the gas industry, Germany and Austria are one. There is no photometric frontier between Hamburg and Vienna. The first feature to be noticed in German gas-testing is the frequent adoption of the English system, which is the natural consequence of the undertakings in many of the large towns being now or at some period in the hands of English Companies. The Imperial Continental Gas Association has had a great deal to do with the physical enlightenment of Germany; and though the Association has scrupulously sought to adapt itself in all respects to local standards of every order, whenever it could safely do so, yet, in the absence of a settled German rule of gas photometry, it placed its German works under the *régime* of the English Gas-Works Clauses Act, 1871, in this regard. This description must not be taken too literally, of course; but it conveys the correct idea. The Act of 1871 provides for all that is necessary in regard to the testing of 14-candle gas, which is the grade of coal gas usually supplied throughout the European Continent. Accordingly we find the English parliamentary standard candle, Sugg's No. 1 London argand test-burner, and the Evans or Letheby photometer, in every part of Europe. The example of Vienna may be cited in illustration of this observation. The photometrical practice of the Kaiserstadt was, of course, originally established by the Imperial Continental Gas Association; but it has not been departed from since the Municipality set up in the gas business for themselves.

According to the regulations yet in force, the minimum illuminating power of Vienna gas is 14 English standard spermaceti candles for 141 litres (5 cubic feet) of gas per hour, burnt in a Sugg's No. 1 London argand. The pressure of the gas at the inlet of the photometer meter must be 1 inch of water. The candles must burn at the rate of 120 troy grains per hour. The average of six readings of the photometer, at 5-minute intervals, is taken as the illuminating power of the gas. Evans's modification of the Bunsen photometer is the legal pattern of the instrument. The examination must be started not earlier than one hour after the lighting of the public lamps, and not at any other time, and must be completed in half-an-hour. These tests are made once a week, at stations fixed by the Municipality, where the gas is delivered to the apparatus by a special service pipe (unmetered). There is no staff of gas examiners, the duty coming within the ordinary routine of the municipal administrative staff who look after the public lighting generally.

The Vienna gas is tested by acetate of lead paper for sulphuretted hydrogen. The results of the tests for illuminating power, purity, and pressure are published in the official notices. The testing offices actually in use are those at the Municipal Lighting Bureau, the Funfhaus Gas-Works, and the Erdberg Gas-Works. Usually the tests show an average illuminating power at these places of from 15 to 16 candles. It is obvious that the tests have reference to the gas actually being sent out at the moment for consumption in the city. The situation of the testing-stations, and the rigid prescription of the time for making the tests, are conclusive on this point. Nothing is said about correcting the photometer readings for temperature and barometric pressure; nor have we any information on the subject of penalties.

Harking back from the east of Europe to the centre, we find philosophic, scientific, and common-sense Germany in a stage of transition as regards gas photometry. At one time, the general standard of light for this purpose was either the English parliamentary standard spermaceti candle, or the so-called German normal paraffin candle. The introduction of the amyl-acetate unit of light at the instance of Von Hefner-Alteneck was loyally seconded by the leading gas authorities of the nation, including Dr. Bunte; and many of the gas undertakings accepted this feeble, delicate, and most troublesome standard of light for their photometrical purposes. The definitive adoption of this standard, however, coincided with the rise of the incandescent system of burning gas for all practical lighting purposes. The German mind saw in this radical change of the method of obtaining light from gas something incompatible with former ideas of photometry as a just means of ascertaining the illuminating value of town's gas. With that emancipation from prejudice—that readiness to drop any tradition, however respectable in its day, that no longer corresponds with the facts, which is so marked a characteristic of the educated German people—the municipalities and gas companies of the Fatherland are quietly letting the ancient photometry die a natural death. Many German cities, from Berlin downwards, now have their municipal gas-works; and the up-to-date gas committees of these corporations are not disposed to hamper their manufacturing resources, nor tax the public irrationally, for the sake of an exploded convention. They see no sense in careful photometry of the luminous argand or flat-flame gas-burner, which is hardly ever used by the public, while the gas is only wanted for its heating power on an Auer mantle. Consequently, and until a new and more rational system of testing the real value of lighting gas shall be evolved, the truly progressive German ceases pretending to care for the old-fashioned photometry.

Pressing circumstances contribute their influence to persuade the frugal, wide-awake Teuton to see the matter in this light. The market for good gas coal—good, that is, in the old-fashioned sense of yielding gas of statutable illuminating power—is as "tight" in Germany as it is in England. Quantities of English North-Country gas coals go to Germany; but most of it wants the assistance of a carburettor if the gas is to stand the strict tests formally enacted for some localities. Rich native gas coal is neither plentiful nor cheap; while there is an abundant supply of raw material out of which an excellent common run of gas can be made. "What *is* the good," says the German, "of going to the trouble and expense of carburetting gas, or of binding oneself hand and foot to suppliers of high-class gas coal, when the people only burn the gas after destroying all its native illuminating power in an atmospheric burner, to heat up an incandescent mantle?" He is not so foolish as to tie himself down to any such moss-grown convention. The portable photometer, costing the gas consumers of London an extra quarter-million pounds sterling a year for the "fancy," may be County Council "Progressivism;" but the wise German has other and better uses for his money.

This is how it works out in the concrete example of the gas supply of Magdeburg, as long ago set forth by Herr W. von Oechelhaeuser. It has been demonstrated to the satisfaction of the Municipality of the place, that conventional "candle power" has no meaning in regard to gas that is to be used in incandescent burners. The present standard of illuminating power for Magdeburg gas is 14 candles; and comparative experiments with this and so-called low-grade gas have demonstrated that, with a certain make of gas testing only to 2 candles by the photometer, the superiority for use with the incandescent burner lay with the latter. We have no information as to how this low-grade and presumably cheap gas was made, but assume that it was a true product of manufacture, not merely common coal gas "let down" by the addition of air. The latter, of course, would be illusory. It is reported, at any rate, that Magdeburg is going for cheap gas; and if this does not glorify the photometer, so much the worse for the photometer.

Other German towns are equally set upon the same course; being similarly able to discriminate between means and ends. For this reason, our inquiry into the ideals and methods of German legal gas photometry comes suddenly and unexpectedly to an end. The German view is that the photometer was a good servant in its day; but it would be a bad master now. Consequently, the instrument is being relegated to the technological museums, together with the various patterns of open-flame, luminous gas-burners that were its fellows. We doubt not that German science will eventually prove equal to the task of producing something capable of taking its place, and answering to its purpose of checking the operations of the gas manufacturer in the interest of the consumer. If this German science, which our own teachers so often tell us to admire and follow, does not do anything of the kind, it will probably be because nothing of the sort is felt to be wanted. After all, it is easy to tell whether an incandescent gas-light is up to the mark or not; and the gas-testing of the future will probably be a development of the chemical side, with the object of keeping down noxious impurities.

We feel that it is useless to carry this inquiry further. There is a world of difference between the classic photometry of France, which has known no change for forty years, and the keen actuality of Germany, where the nimble pfennig is chased through the gas-bill as everywhere else. The circumstance that the price of gas in Paris has remained as fixed as the photometry, should not be regarded as an accidental coincidence. Formalism in science is only a reflection of economic error in industry. From formalism to obscurantism is a mere step. But it is the one step which leads over the precipice. To ignore all the gains of mechanical progress in the name of a fetish is not creditable to the common sense of a nation. The legislative authorization of the portable photometer in England would be a calamity, not only for the immediate penalty it would entail upon the community implicated, but for its consequential injuriousness. Statutory gas photometry is to the gas industry of the United Kingdom what the Man with the Red Flag was to mechanical road traction; and it is not from Germany that countenance will be found for riveting the load of the one upon a generation that has already been delivered from the other.

JOINT-STOCK ENTERPRISE IN THE PAST YEAR.

The "Investors' Guardian" for the 20th inst. furnishes particulars relating to the joint-stock companies registered in the past year. We find therefrom that the number was 4529, with a total capital of £234,687,296, as compared with 4653 and £240,853,504 in 1898. Last year's figures are lower than those for its three predecessors, and our contemporary says the reason can only be conjectured. The war may have had some influence; but it is not thought that even this would have operated to stop the flow of new companies up to November—indeed, several important issues were made late in the year. It is true that the first six months of the year gave £148,855,281, while the July to December figures were only £85,832,015. But this is said to be the usual effect of the holiday vacation; 1898 showing £145,889,428 and £94,964,076 in the respective halves.

An analysis of the companies does not show unusual briskness in any department; and our contemporary finds few points to call for remark. The capital invited for purposes of gas supply amounted to £1,105,700, as compared with £1,107,100 in 1898—a drop of £1400 only; while for water supply, £231,000 was applied for, against £134,500, or a rise of £96,500. For electric purposes, a sum of £11,192,700 was asked for last year, as compared with £3,452,364 in the preceding twelve months. With regard to the supply of raw and other material, the capital required for getting coal was £8,666,500, against £4,473,500; for iron and steel production, £9,372,418, against £6,856,000; and for engineering, £9,037,160, against £12,846,580. For coal, therefore, twice the amount of capital was sought last year as compared with 1898; for iron and steel there was a good rise; but there was a decrease in engineering companies. As far as the public are concerned, the only significant feature of the year was, we are told, the issue of some big "combines" similar to American Trusts. These added some millions to the total. In Scotland, there was a heavier decline than in England; the companies registered last year numbering 333, with a total capital of £13,678,669, against 392, with £20,525,758 of capital, in 1898; while the Irish companies fell from 138, with £3,885,900 of capital, to 114, with £2,198,669. In both cases, the figures are below the average of the last five or six years. So far as the present year has gone, Somerset House has been quieter than usual. What it will be later in the year, our contemporary hesitates to prophesy. He is sanguine enough to think we may reasonably hope that the end of the war will soon be reached, and that it will be followed by healthy speculative activity. Peace would certainly be welcome, for other and far weightier reasons than this.

TRADE DISPUTES IN 1899.

A PRELIMINARY summary of the statistics of strikes and lock-outs in 1899 has been published by the Board of Trade. The figures now available, it is explained, are incomplete to some extent, because the annual reports of Trade Unions, Employers' Associations, and Wages, Conciliation and Arbitration Boards will not be available for some time yet. Moreover, a number of disputes begun in 1899 have not up to the present been settled, and consequently cannot be classified as to the basis of settlement—whether in favour of employers or employed, and so forth. For full details we are asked to wait for the annual report; but as that has a knack of appearing at so late a date as to be regarded as ancient history, we will take the preliminary figures of the Department as affording a fairly reliable indication of the nature and result of the trade disputes last year. In fact, the report now issued specifically states that the additional information required for the full record cannot affect the broad conclusion to be drawn from the preliminary statement—namely, that 1899 was freer from important disputes than any year in recent times.

Apart from the jute-workers' dispute in the Dundee district, which involved 35,000 hands, lasted several weeks, and ended in favour of the employers, there was no dispute involving so many as 10,000 workpeople. That which perhaps attracted most attention was the strike and lock-out of plasterers, which affected 4000 men, and caused an aggregate loss of 200,000 days' work. The total number of employees involved in the 721 new disputes recorded last year was 178,440 (considerably less than 2 per cent. of the industrial population of the kingdom); and the number of days lost thereby was 2,496,358. The lowest number of days' work lost through disputes in any of the six preceding years was 3,746,368 (in 1896), and the highest 31,205,062 (in 1893). Looking at the analysis of the disputes according to the trade or group of trades involved, it is seen that the building trades are an easy first (with more than one-third of the total days lost), the textile industries second, followed by the mining, and then the engineering and shipbuilding trades; while the iron and steel group has, in comparison, an almost clean sheet—a striking testimony to the combined effects of excellent automatic wage-adjusting arrangements, and of great prosperity in the trade. The number of workpeople indirectly affected—that is, thrown out of work at the establishments where the disputes occurred, but not themselves on strike or locked-out—represents no less than 23 per cent. of the total; the percentage being highest in the mining industries, where it amounts to 42, a strike of a small number of men or boys of one class of workers, such as the abortive strike of the enginemen and fitters in South Wales last autumn, being frequently sufficient to disorganize the working of a mine and throw idle the whole of the employees.

So far as the originating causes of the disputes are concerned, we find that, taking the number of hands involved, 68·5 per cent. were fighting on questions of wages (54 per cent. being engaged in a struggle for higher rates); less than 3 per cent. on questions of hours of labour; slightly under 6 per cent. over the "employment of particular classes or persons;" 13 per cent. in respect of working arrangements; and about 10 per cent. from sundry other causes. The disputes resulted favourably to the employers so far as 43 per cent. of the workpeople directly affected were concerned; in favour of the employed in respect of 26 per cent.; 28 per cent. of the hands came to a compromise with their masters; and 3 per cent. were engaged in disputes not yet settled. If the percentages of settlements ended in favour of the masters, the men, or neither party be calculated according to the number of disputes, they appear almost exactly equal—being 31·1, 32·6, and 31·6 respectively; but the correct basis is, obviously, the number of men involved. Otherwise one dispute between a builder and half-a-dozen bricklayers, ending in favour of the bricklayers, might be treated as counterbalancing a struggle like that of the Engineers' dispute in 1898, resulting in favour of the employers—a method which would render the statistics (as statistics are so easily rendered) entirely misleading as to the actual circumstances of the case.

England, and especially the South of England, was last year remarkably free from labour troubles. Of the 178,440 hands rendered idle by disputes, 60,165 were employed in Scotland, 36,552 in Wales and Monmouthshire, and 2878 in Ireland. The northern counties of England accounted for only some 70,000; while in all the southern and western counties, including London, only 6876 workpeople came to loggerheads with their employers. The foregoing are the most important of the particulars as yet obtainable. The chief additional statistics promised us in the annual report—when it may appear—will relate to the proceedings of the various Conciliation and Arbitration Boards last year.

CHANGES IN RATES OF WAGES AND HOURS OF LABOUR IN 1899.

THE following particulars relating to the changes recorded by the Board of Trade as having taken place during last year in rates of wages and hours of labour, are taken from the current number of the "Labour Gazette." They are subject to correction in the annual report, which will also include the wage statistics relating to railway servants, seamen, and agricultural labourers. Complete information as regards these three important employments will not be available until the annual returns relating to them have been compiled. It can, however, be stated generally that wages in these trades have shown an upward tendency, in sympathy with the general movement in wages throughout the country, the extent of which will be seen from the following statistics.

The upward movement in wages which commenced—to a small degree—in the latter part of 1895, and continued during the three following years, was fully maintained in 1899; the number of workpeople affected by increases in rates of wages being over 1,100,000—a larger number than in any previous year for which statistics are available; while only just over 1000 were affected by the decreases reported. The total effect of all the changes in 1899 was a net increase of £85,820 per week in total wages, equivalent to an average rise in weekly wages of 1s. 6½d. per individual affected. Of this total, £49,000, or 57 per cent., went to the coal miners, £13,000 (15 per cent.) to the iron and steel workers, and £6400 (7 per cent.) to building trade employees. The engineering and shipbuilding trades show an increase for 1899, but only a small one, both absolutely and relatively. The computed increase in wages last year was £2068 per week, as compared with £15,679, £9751, and £9904 in the three preceding years. The steady rise in wages throughout the four years, however, amounts, it will be seen, to a matter of £37,402 per week; so that the workers have every reason to be satisfied with having maintained and slightly increased their wages in 1899. Of the 1,112,000 workpeople whose rates of wages were changed last year, only 31,000, or 2·8 per cent., were affected by disputes causing a stoppage of work; while the remainder obtained their better rates of pay, half by means of negotiations (either direct or through representatives), one-third through the medium of Conciliation Boards or similar bodies, and one-sixth through the operation of sliding-scales.

The changes in the hours of labour recorded last year were inconsiderable, either in regard to the number of hands affected or the reduction in the weekly hours. Those hours were reduced in the case of some 29,100 workpeople, and increased in the case of 2600; the net result being an average decrease of about half-an-hour per day in the hours of labour of the 31,700 hands in question. Nearly one-third of the total number affected by the changes were workers in the building trades; in the coal-mining industry 3800 workmen had their hours reduced half-an-hour daily (a change scarcely sufficient to materially affect the total output for the kingdom); in the engineering and allied trades 6300 workpeople obtained a reduction of nearly an hour per day (the eight-hour day being adopted in one case involving 710 hands); while 4668 employees of public authorities obtained an average reduction of 9½ hours per week. This high figure is due to the reduction by 12 hours per week of the working time of 1000 tramwaymen in Liverpool, the adoption of the eight-hour day for 570 employees of the West Ham Corporation, and the change from seven to six days' labour per week affecting over 1900 tramway men in the employment of the London County Council. We do not view with too great favour the labour policy of the London County Council and many other public authorities—the workers' vote is given too great a prominence in the consideration of rates of wages and hours of labour; but we are not disposed to cavil at the recorded mitigation of the conditions of service for tramway employees, which are too often nothing less than scandalous.

PERSONAL.

Mr. G. Elliott has obtained the managership of the Ayton (Berwickshire) Gas-Works.

The management of the Lochgilphead Gas Works has been placed in the hands of Mr. J. Renfrew, foreman at the Kelso Gas-Works.

Mr. Joseph Heaton was appointed Assistant Gas Manager by the Brighouse Town Council, at their last meeting, in terms of the advertisement that recently appeared in our columns.

The vacancy in the managership of the Herne Bay Gas-Works caused by the death of Mr. H. Legg, has been filled by the appointment of Mr. C. V. Bennett, formerly of Wells (Somerset), and recently of Felixstowe.

Mr. John Duncan, who has been for a long time employed in the Broughty Ferry Corporation Gas-Works, has been appointed Manager of the Kirriemuir Gas Company, in succession to Mr. C. P. Myers, who has obtained the managership at Troon.

The Gas Committee of the Macclesfield Corporation have selected, from 22 candidates for the Gas Engineership, Mr. Ernest Lomax Newbigging. The office, it will be remembered, was rendered vacant by the appointment of Mr. J. G. Newbigging as Chief Gas Engineer to the Manchester Corporation. Mr. E. L. Newbigging is the youngest son of Mr. Thomas Newbigging; and he will take up his duties at Macclesfield with the best wishes of his father's numerous friends in the gas industry.

Mr. Stephen Moore, the General Manager of the water undertaking of the Nottingham Corporation, has just been presented with a very handsome silver cake-basket by the Staff of the Water Department, as a mark of esteem on his birthday. The Chief Clerk (Mr. Copley) made the presentation in a complimentary speech; and Mr. Moore, in returning thanks, said no official could be served with a better or more loyal staff. Mr. Moore was formerly in Messrs. Smith's bank; and in 1866 he was appointed Chief Accountant to the Nottingham Water Company. On the transfer of the undertaking to the Corporation in 1880, he became General Manager.

On leaving Droitwich to take up his duties as Manager of the Market Harborough Gas-Works, Mr. A. T. Harris was presented by the members of the Corporation and a few friends with a marble clock and a case of drawing instruments, in recognition of his sixteen years' faithful and valuable service. The presentation was made by Alderman Langford, who referred to the admirable manner in which Mr. Harris had performed his duties, and congratulated him on his new appointment. He said that during the time Mr. Harris had been Manager, the make of gas had augmented more than 300 per cent., the price had been reduced 50 per cent., and the public lamps increased 50 per cent., with improved lighting. Mr. Harris thanked the Chairman and all the subscribers for their very handsome gifts, and spoke of the cordial relations which always existed between the Corporation and himself. Mr. Harris, who was Quartermaster-Sergeant of Volunteers, was also presented with a pair of binocular glasses by Major Tombs and the sergeants of the company.

OBITUARY.

The recent death is announced of Mr. H. Boulger, who had been Manager of the Maryborough Gas Company for about 45 years.

The Directors of the Elland-cum-Greetland Gas Company have lost a colleague in the person of Mr. Thomas Hawley, whose death at the age of 71 took place on the 22nd inst.

We record with deep regret the death of Mr. Herbert Harry Hickmott, the Town Clerk of Rotherham, at the early age of 41 years. The loss to the borough is inestimable; and the event deserves mention in our columns owing to the conspicuous benefits which Mr. Hickmott's services conferred upon the water undertaking.

The death is announced of Sir George Henry Long, Chairman of the Windsor Gas Company. Deceased was a solicitor by profession, and for some years held the office of Town Clerk, and Clerk to the Windsor Magistrates, the Justices of the Berkshire Petty Sessional Division, and the Buckinghamshire Magistrates at Slough. He had also been Clerk to the Windsor Urban Sanitary Authority. He was Mayor of Windsor in 1897, the Diamond Jubilee year, when he was knighted.

German Protest against the Prohibition of the Exportation of Carbolic Acid from England.—From German chemical papers just to hand, we learn that the Order in Council prohibiting the exportation from the United Kingdom of carbolic acid and certain other coal-tar products, which was referred to in the "Journal" last week (p. 194), is deeply resented by many German chemical manufacturers. It is pointed out that about one-third of the whole of the carbolic acid produced in England ordinarily goes to Ludwigshafen, where it is worked up into various products. The idea that the Ordnance Department requires the whole of the carbolic acid produced in the United Kingdom for the manufacture of picric acid is scouted as absurd by the German technical papers. The chemical manufacturers affected by the promulgation of the Order are said to have lodged a protest with the Chancellor of the German Empire.

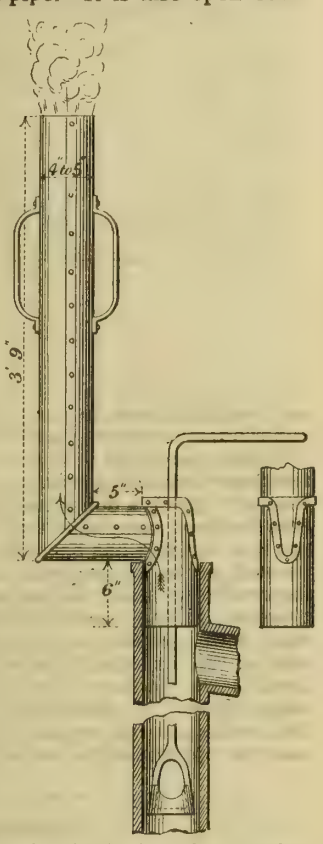
COMMUNICATED ARTICLES.

A SMOKE-PREVENTER FOR PIPE-JUMPERS.

By J. O. V. Irminger, of Copenhagen.

Every gas engineer, and especially every pipe-jumper, knows what a difficult and troublesome work it is to clean the ascension-pipes, owing to the intense smoke that injures the chest and lungs, and makes the work very disagreeable. I have now made an apparatus that facilitates this work, and as it has proved to be excellent, and has been received with unusual satisfaction, I want to describe it, so that it may be used in other gas-works. I am sure that when the pipe-jumpers have used it once, they will always use it.

The apparatus (as shown) is very simple and easily applied. It consists of a bent iron tube, open at both ends, and is put down the mouth of the ascension-pipe. It is also open over the ascension-pipe, so that the tools for cleaning the pipes may be used as usual. If it is wanted to use the rod without making it longer than is just necessary, there is a small cutting in one side of the tube. When the tube is placed in the ascension-pipe, the smoke immediately goes up through it, and the pipe-jumper is completely free from smoke during the whole work. When, at the commencement, the tube is cold, and will not act immediately, the only thing necessary is to cover the opening over the ascension-pipe for a moment. The smoke will then go the right way; and this will also continue when the tube is shifted to another ascension-pipe. The retort-lid must be shut during the work; otherwise the tube will not act.



The tube is made of thin riveted plates (No. 24 B.W.G.); and the weight is about 9 to 10 lbs. It is thus very easily managed. The diameter of the tube that is put into the ascension-pipe is ¼ inch less than the inside diameter of the ascension-pipe. On the tube are fixed two light handles.

Pipe-cleaning is such hard work, that everything that can make it easier will be for the benefit both of employers and workmen; and this tube affords a simple and secure relief. Some might think that the opening just over the ascension-pipe would prevent the smoke from going the right way; but, in effect, it acts thoroughly.

I should be very glad if the apparatus were tried at one or more foreign gas-works, and hope to see the results of the trials published in the "Journal," so that other colleagues may take advantage thereof.

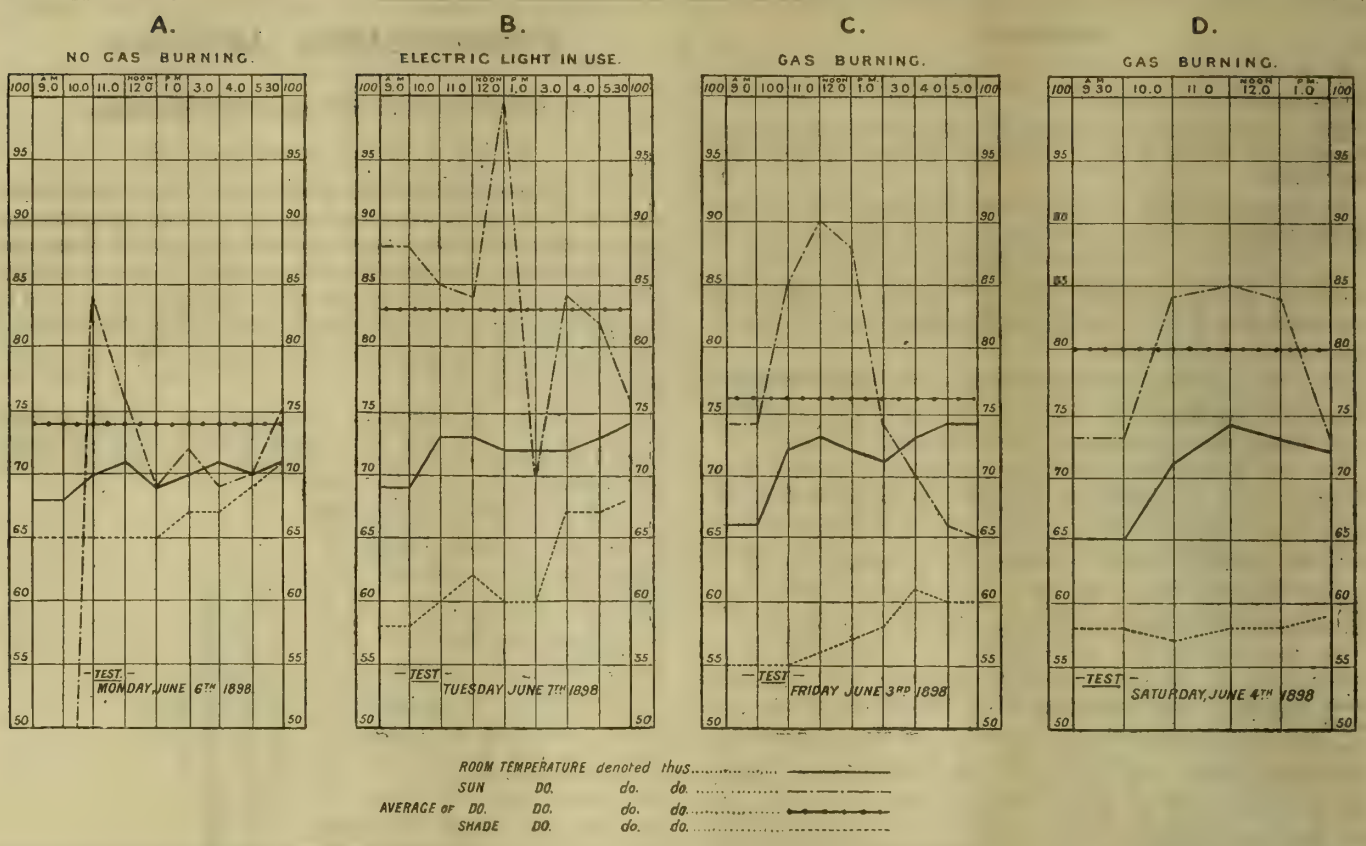
THE TEMPERATURE OF GAS AND ELECTRIC LIGHT.

By Charles F. Botley, Assoc.M.Inst.C.E.,

Gas and Electrical Engineer, of Hastings.

With reference to a "Note," in the issue of the "Journal" for the 16th inst., respecting the temperatures of various gas and electrical lamps, it has occurred to me that some experiments I made a short time since in regard to the heating effect of gas on the atmosphere of a room might be of interest to your readers. The tests were made under the ordinary conditions of use in our room, which is lighted by eleven electric glow lamps and ten "C" incandescent gas-burners; and I send herewith a diagram (p. 264) showing the results obtained, which may serve to induce others to make investigations on a similar line, since the question involved is an important one, and is made much use of by electrical canvassers.

The room was the one in which the members of the Institution of Gas Engineers had their luncheon on the occasion of their visit in 1896, and tests were made under ordinary conditions with the door and windows closed—indeed, in one of the experiments with the gas alight, my assistant went so far as to stop up the two fireplaces until I discovered it; so that we did not favour the gas. The candle power of the gas used was 500; and of the electric lamps, 224. The content of the room was 16,000 cubic feet. The temperature is given in degrees Fahrenheit; and it was taken at a height of 6 ft. 6 in. from the floor. The other data necessary to follow the experiments are given on the diagram; and I would suggest the importance of noticing the characteristics of the experiment when neither gas



nor electricity was in use. It will be observed that the atmospheric temperatures materially affect the question.

In the case of gas lighting and the heat produced, with distinct reference to modern practice, it has always appeared to me a case of "giving a dog a bad name;" and I have often noticed that the heat complained of as having arisen from the use of gas in a building has been due either to the number of people present or to atmospheric conditions, although it is next to impossible to make the ordinary public understand this. As, however, in the case of lighting a church, I had guaranteed that, with incandescent burners, the temperature and condition of the air should be as satisfactory as if electricity were used, I was induced to make the experiments in question to satisfy myself. I should like it to be clearly understood that the results are not regarded by me as conclusive; and I shall take the opportunity of repeating them as soon as I can.

"GAS FOUNTAINS."

By Just Alix, Chemist to the Lyons Gas Company.

Among the numerous satellites of the gas industry, there are several which have for some time become exceedingly interesting; for example, petroleum, now employed as an agent for producing incandescence, and acetylene, which is making good progress. Besides these, however, there are others which have not, up to now, been very successful, owing principally to the restrictions attending their practical application. I am referring to the various processes by which it has been sought to utilize the high photogenic properties of certain hydrocarbons to enrich gases having no light-giving power, one of the most attractive of which is air. The enrichment of air by illuminating hydrocarbons—the air acting as a carrier of the lighter gases—is, of course, not a new idea. Nearly seventy years ago, Mongruel, in Paris, brought out a process for carburetting air by means of light oils; and in 1847, Mansfield had a patent for using light hydrocarbons for a similar purpose.

The most recent process of this kind is that employed in connection with the so-called "gas fountains." A precursor of these appliances, however, was that of Mille, who invented a process which caused some stir about the year 1866. His lamp, which he called the "gazo-lamp," was so constructed that, "without any mechanism, it could furnish a supply of atmospheric air in the state of inflammable gas perfectly suited for heating and lighting." It was fed by "essences or ethers of petroleum." In the accompanying illustration, fig. 1, one will recognize the principle of the appliance patented last year by a Company whose headquarters are at Fontaines-sur-Saône, near Lyons. The "gazo-lamp" of Mille consists of a rectangular vessel A B, containing a basket A' B' of wire gauze filled with some absorbent material, such as coke, pumice stone, or sponge, capable of holding petroleum essence, but not in excess. Air entering by the opening O is charged with hydrocarbon vapours which make it heavier; it then descends, and issues from the pipe O' ready for consumption. It burns with a very brilliant and remarkably steady flame. Here, in embryo, is the "gas fountain" which is at present being exploited by the Company above referred to. The inventors have therefore gone a little too far in making out that their gas is produced upon "an entirely new principle." However, their appliances are very portable; and were it not for the price, the popularization of the gas should be encouraged.

The "fountain" is composed of a tin vessel, resembling in size and shape an ordinary domestic petroleum oil-can. At the upper part there are two tubes (see fig. 2), one of which dips to the bottom of the vessel, which is filled with a light permeable substance (the inventors prefer paper pulp) having great absorbing power for light hydrocarbons. This pulp is moulded into the form of small prisms placed one over the other in baffle-plate fashion, so that the air can circulate freely between them. The apparatus is charged with petroleum either, boiling at 122° to 158° Fahr., and of ·650 to ·720 specific gravity. Formerly these essences were but little employed. They are, in fact, so light that they had to be excluded from the category of lamp oils because their vapours caused explosions in petroleum lamps.

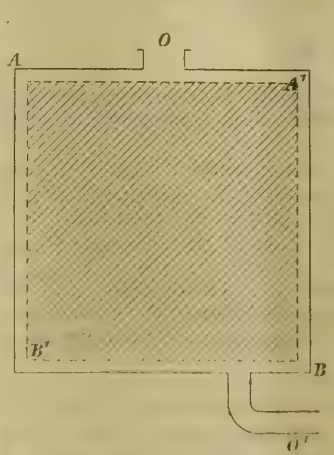


Fig. 1.

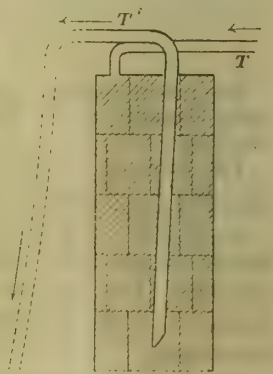


Fig. 2.

But now their price has gone up, in consequence of the great demand for them for use with petroleum motor cars. When the apparatus has been charged, it is absolutely harmless. A lighted match may be brought near it without causing an explosion, inasmuch as there is no current of gas. In order to produce one, there is attached to the tube which dips to the bottom of the vessel a second, and longer tube, which acts as a syphon. The air, as it becomes carburetted, increases in density, and descends into the outlet-pipe T', at the same time causing an inflow of air by the pipe T. This operation is continuous. It will be readily understood that under such conditions—the difference in the specific gravities of the carburetted and non-carburetted air being but slight—only a very low pressure is obtainable at the points of consumption, even though they may be located at a certain height. It is this that necessitates the employment of special burners with this aërogene gas. These have been devised by the inventors, and one was described in the "Journal" for Dec. 26, 1899 (p. 1553).

An obstacle which presented itself when the carburetting process was first used with the "gazo-lamp" was the necessity for having special service-pipes. In fact, as the gas has very little pressure beyond that which it acquires in its descent to the burner, it is necessary to carefully avoid everything likely to reduce it, such as elbows, contractions, friction, &c. It is for this reason that large service-pipes have to be employed. When from one to ten burners are used, the diameters of the pipes vary as follows :—

No. of Burners.	Diameter. Inch.	No. of Burners.	Diameter. Inch.
1	7-25ths	6	18-25ths
2	10-25ths	7	20-25ths
3	13-25ths	8	22-25ths
4	15-25ths	9	23-25ths
5	17-25ths	10	24-25ths

These diameters require increasing slightly in practice in order to compensate for the action of elbows and sharp angles.

With regard to coupling up the "fountains," two arrangements may be adopted: (1) To have installations of series of three burners, and adapt to each distributing system a "fountain" of corresponding section. (2) To have one distributing system to as many multiples of three burners as there are jets to supply. The vessels are then put in communication with each other. The second method is the best for ensuring the complete emptying of the "fountains."

I have personally visited the show-room of the Company in Lyons, in which the gas produced by these "fountains" is to be seen in use. The vessels are placed upon a shelf near the ceiling, at a height of 10 to 12 feet above the point of consumption. Under these conditions, the gas burns well, particularly in a Bengel burner specially adapted for the purpose. I remarked, however, that the flame had that slightly reddish appearance which to gas engineers is an indication of the presence of air during the combustion of hydrocarbons. At the time of my visit, the inventors were trying a new burner fitted with a Welsbach mantle; but I doubt if the results were satisfactory. It seems to me difficult to make the gas burn in the presence of an additional quantity of air, which, in view of the low pressure of the gas, would only decrease the rate of delivery, and, moreover, have a serious cooling effect. As the air contained in the gas serves only as a carrier, it will be readily understood that the combustion temperature of the hydrocarbons should be for the most part absorbed in heating it. This, as a matter of fact, really occurs with coal gas when an inert gas such as nitrogen is put into it. However, the inventors utilize their gas for heating and culinary purposes, in stoves specially constructed. They have also at work an engine operated by it. It drives a small dynamo supplying current to some incandescent electric lamps. But this utilization of the gas does not appear to have before it a very great future, as the "fountain" in this case plays the part of the air carburetter in auto-motors; and, under these conditions, I question whether this transformation of energy would be attended with benefit. Information is wanting as to the results obtained by these motors.

In conclusion, I may say that each "fountain" contains about a gallon of gasoline; and the inventors claim for their gas that, by supplying it to a 15 decimal candle burner, 70 hours' lighting can be obtained at the cost of rather less than ½d. per burner per hour.

Protected Lead Pipes.—At Seeforts, near Copenhagen, there is a water conduit, about 1200 yards in length, running through the sea. The diameter of the lead pipe is 2 inches; and it is protected by a coil of steel wire, over which is a jacket of jute. It was laid in the manner followed in putting down submarine cables.

Rapid Methods for the Purification of Waters.—In a recent number of the "Journal de Pharmacie et de Chimie" there is a paper by M. Malmejac upon the above subject. It deals, however, rather with mechanical than with chemical action in the purification of water. The author has experimented on four processes, two using alum, and two using perchloride of iron. The experiments show that the perchloride of iron processes give the best results, as they diminish the proportion of organic matter, either in an acid or alkaline medium, by 60 per cent.; while the alum processes only reduce it by 25 and 33 per cent. respectively. The two latter, however, have a stronger action—nearly three times as powerful—in destroying microbes.

Artificial Stone.—An artificial stone made in Belgium has been tested in the Malines Arsenal. It is said to have four times the resisting force of French freestone, is not sensitive to the action of cold, absorbs only 6 to 7 per cent. of water, even after a long dry spell, and cannot be crushed under a pressure of 40 kilos. to the square centimetre. The stone is manufactured in the following manner: Eighty parts of extremely clean and dry coarse sand are mixed with 20 parts of hydraulic lime reduced to a fine dry dust. The mixture is put into an iron box, which is plunged into a boiler of water, which is hermetically closed. During 72 hours the cooking goes on under a pressure of six atmospheres; the temperature being maintained at 165°. At the end of this time the iron box contains a perfect homogeneous mass of stone, which rapidly hardens upon exposure to the air.

TECHNICAL RECORD.

THE ILLUMINATING POWER AND COLOUR OF THE "KUGEL" HIGH-PRESSURE GASLIGHT.

Dr. H. Bunte and Dr. P. Eitner, of Carlsruhe, have recently published in the "Journal für Gasbeleuchtung" an account of an exhaustive investigation of the illuminating power and colour of one form of intensified gaslight. The work was undertaken at the desire of the "Kugel" Light Company, of Dresden, with the so-called "Kugel" or "Ball" light, invented by Herr Salzenberg, Manager of the Crefeld Gas-Works. This light is essentially a high-pressure gaslight, in which gas pressures of 1 atmosphere and upwards can be employed and specially good results secured. The report of the investigation is of general interest, as such researches hitherto have been of a disjointed character. The work was directed chiefly to the following points: (1) Ascertaining the illuminating power at various gas pressures, the rate of consumption, the composition of the gas, and of the mixture of gas and air in the burners. (2) Determining the illuminating power at different angles. (3) Comparing spectrophotometrically the Kugel light, high-pressure gaslight, ordinary incandescent gaslight, and the Hefner light.

The determination of illuminating power was made by direct comparison of the light of a Kugel burner with the light of a standardized Hefner amyl-acetate lamp, consuming amyl acetate of standard quality. A Kruss's Lummer-Brodhun sighting-box, the equality of the two sides of which had been proved, was used for making the comparisons; and the Hefner lamp was placed at a distance of 300 mm. (nearly 12 inches). The distance of the Kugel light was afterwards measured, and its illuminating power calculated therefrom. The pressure of the gas was ascertained by means of a mercury pressure-gauge, which was directly connected just below the nozzle of the burner. The Kugel burner had a double mantle made by Messrs. Feuer, of Berlin. Five observations were taken in each case; and each figure recorded below is the mean of the five results.

In order to determine the rate of consumption, the top of the burner and the mantle were removed; and the air-inlet holes of the bunsen were closed with putty, so that they were gas-tight. The top of the bunsen tube was then connected with the inlet of an experimental gas-meter; and the gas issuing from the outlet of the meter was led off into the open. The meter, &c., threw a back-pressure of at the most some 4 inches of water; and this would about compensate for the resistance ordinarily offered by the burner-top and the mantle. Two observations of the rate of consumption were made in each case; and the meter was verified before and after each observation. Each figure stated below is the mean of the two results.

The figures given in the original table have been converted into English terms on the assumption that 1 Hefner-unit equals 0·877 English sperm candle. The results of the observations then become as follows :—

Pressure of the Gas. Atmospheres.	Illuminating Power. English Candles.	Rate of Consumption. Cub. Ft. per Hour.	Efficiency. Candles per Cub.
0·2	290·7	15·70	18·5
0·4	465·9	24·01	19·4
0·6	649·2	29·67	21·9
0·8	818·3	34·80	23·5
1·0	904·5	39·20	23·1
1·1	1033·0	41·32	25·0
1·2	1080·1	43·53	24·8
1·4	1140·5	47·59	24·0

At the normal working pressure of 1·1 atmospheres, the Kugel light therefore gives an illuminating power of 1033 candles, which is higher than that hitherto afforded by single incandescent gaslights, and at the present time can be attained practically only by means of the electric arc lamp. The value 904·5 candles found for 1 atmosphere pressure, clearly was lower than it should be, though no reason could be given to account for the discrepancy. The efficiency is highest at a gas pressure of 1·1 atmospheres, and is then very high. For instance, good new [German] Welsbach burners show an efficiency of about 17 candles per cubic foot; while the Pintsch high-pressure gas-burner, working at 0·2 atmosphere pressure, yields about 220-candle power for a consumption of 9·36 cubic feet per hour, which indicates an efficiency of about 23·4 candles per cubic foot of gas. The results of the examination showed that the Kugel burner afforded a very economical utilization of the gas, with the production of a light of great intensity and of a yellowish tint.

For the sake of completeness, the composition of the gas used was determined; and the following shows the percentage by volume of the several constituents: Carbonic acid 2·2, heavy hydrocarbons 3·4, carbonic oxide 7·7, methane 32·3, hydrogen 52, and nitrogen (with traces of oxygen) 2·4. The gas under high pressure had the same composition, but constantly contained some air. Even after repeated exhaustion and refilling of the compressing cylinder, about 4·5 per cent. of air was discovered in the high-pressure gas. In order to find the composition of the mixture of gas and air in the burners, they were set up but not lighted; and samples of the gaseous mixture were withdrawn from the interior of the mantle by means of a capillary

tube, and subjected to analysis. The following percentages by volume of gas and air were found under the stated conditions :—

—	Kugel Burner.		Pintsch's High-Pressure Gas-Burner.	Welsbach Burner.
Pressure of gas,	0·2 atmosphere	1·1 atmosphere	0·2 atmosphere.	14-10th of water.
Gas	22·87	13·88	13·54	22·5
Air	77·13	86·12	86·46	77·5

The distribution of the light was observed by means of Kruss's radial photometer. For the sake of comparison, some observations were also made, with an Elster radial photometer, on the distribution of the light from the Welsbach burner. The results are shown in the appended table, in which 0° signifies vertically beneath the burner, 90° the horizontal plane, and 180° vertically above the burner. As the figures were required only for comparison with one another, the absorption factor of the mirror of the radial photometer was not ascertained.

Angle, degrees.	10	20	30	40	50	60	70	80
Illuminating power, English Candles—								
Kugel	66·9	126·3	185·2	251·4	294·8	316·6	358·0	356·7
Welsbach	..	8·5	15·8	23·3	30·3	36·0	..	..

Angle, degrees.	90	100	110	120	130	140	150	160
Illuminating power, English Candles—								
Kugel	388·0	386·7	363·8	333·5	306·7	257·5	215·3	158·3
Welsbach	46·5	..	..	..	..	..	..	..

These figures indicate, as may readily be seen diagramatically, that the Kugel burner affords a more uniform distribution of light than does the Welsbach burner. The reason for this difference may be traced in the longer mantle of the Kugel light, and the globular shape which it assumes on use, especially in its upper half. The radiation thus occurs from a globular surface. The bulging of the mantle is not due to the asbestos fibres by which it is supported, nor does it return to its original form when the pressure is discontinued.

With regard to the colour of the Kugel light, it has been noticed at the Crefeld Gas-Works—where it is used side by side with the ordinary Welsbach light—that it has an agreeably warm yellowish tint, while the latter is of the well-known peculiar greenish colour. The impression is not the result of an optical illusion due to the great difference in the intensities of the two lights, for the same variation in tint is observed when the lights are compared on the photometer and the disc is equally illuminated by them. The difference in this case resembles that which occurs when the Welsbach light is compared with the light of the Hefner lamp. The ordinary high-pressure (0·2 atmosphere) gaslight resembles the Welsbach light in colour; and it therefore becomes pertinent to ask if the special colour of the "Kugel" light is to be traced to the high gas pressure of 1·1 atmospheres. This question was first attacked by making spectrophotometric observations of the Kugel light, the high-pressure gaslight, and the Welsbach light, with mantles prepared in precisely the same manner and of the same composition, and using different gas pressures.

The high-pressure gaslight, with 0·2 atmosphere pressure of gas, was obtained by means of an incandescent burner the orifices of the nipple of which had been reduced in size, until, at the pressure named, the burner consumed about 7 cubic feet of gas per hour, and was adapted for the use of a simple mantle. In the tests, the actual rate of consumption was 7·14 cubic feet per hour. In order to obtain mantles of identical quality, the unprepared fabrics were impregnated carefully with a 30 per cent. solution of the nitrates of thorium and cerium, in such proportions as would (on incineration) yield a mantle consisting of 98·75 per cent. of thorium oxide and 1·25 per cent. of cerium oxide. A special spectrophotometer was devised for the work, in order that the intensity of the similar rays from different sources might be directly compared. The light of the source under investigation was broken up by a prism into its components, in such a manner that two coloured bands—one above the other—were obtained. The one band was the light of the standard lamp, the other the light of the source under comparison. Similar colours were precisely above one another. By means of an eye-slit, any portion of the spectrum could be examined, apart from the rest, at will. The position of the portion of the spectrum under examination could be determined by means of a scale. The measurements were made in each case in the red, yellow, green, blue, and violet portions; and the range over which they extended comprised the six divisions of Bunsen's spectroscope scale. The comparisons were made at first with a standardized Hefner lamp, burning amyl acetate which had on testing been found to be of normal quality. The pressure of the gas was observed on a mercury pressure-gauge. The results given in the subjoined table show the intensity of the source of light in each colour, when the intensity of the Hefner light in the same colour was taken as unity. Each figure given is the mean of two observations; and the sighting-box was reversed between the two readings.

Colour of the Light.	Position according to Bunsen's Spectroscope Scale.	Mean Wave Length of the Light.	Intensity (Hefner Lamp = 1). Welsbach Light, 2 inches of Water Pressure.	High-Pressure Gas, 0·2 Atmos. Pressure.	Kugel Light, with Double Mantle, at 1·1 Atmos. Pressure.	Kugel Light, with Double Mantle, at 0·2 Atmos. Pressure.	Kugel Light, with Simple Mantle, at 0·2 Atmos. Pressure.	Kugel Light, with Simple Mantle, at 1·1 Atmos. Pressure.
Red . .	32·0	670 $\mu\mu$	31·1	160·4	421·2	183·9	308·3	120·6
Yellow .	50·0	589 ,,	44·9	252·9	578·2	256·3	431·5	183·5
Green . .	65·5	540 ,,	59·5	319·7	710·5	304·3	544·0	229·1
Blue . .	95·5	477 ,,	73·9	484·3	986·6	376·8	823·6	321·5
Violet . .	126·0	434 ,,	64·1	529·0	1053·6	444·5	945·6	341·2

At the high gas pressure of 1·1 atmospheres, efficiency is lost when the simple mantle is used, as the flame passes completely through it; hence the figures are much lower than when the double mantle is used. The table indicates clearly that, with all the lights examined, the intensity, relative to that of the Hefner light, rises from the red to the blue end of the spectrum. The purport of these figures will be seen more clearly from the following table, which is deduced from the preceding one, and expresses the intensity for each source of light in terms of the intensity of the same source in the red. The Hefner light remains the unit of comparison in all colours.

Colour of the Light.	Position according to Bunsen's Scale.	Intensity, compared with that of the Hefner Light. Welsbach Light; 2 Inches of Water Pressure.	High Pressure Gas; 0·2 Atmos. Pressure.	Kugel Light. Double Mantle. 1·1 Atmos. Pressure.	Double Mantle. 0·2 Atmos. Pressure.	Simple Mantle. 0·2 Atmos. Pressure.	Simple Mantle. 1·1 Atmos. Pressure.
Red . . .	32·0	1·000	1·000	1·000	1·000	1·000	1·000
Yellow . .	50·0	1·144	1·571	1·373	1·394	1·400	1·522
Green . .	65·5	1·913	1·993	1·687	1·655	1·765	1·900
Blue . . .	95·5	2·376	3·019	2·342	2·049	2·672	2·666
Violet . .	126·0	2·061	3·298	2·501	2·417	3·067	2·829

There is a remarkable concordance between all these figures, with the single exception of those for the ordinary Welsbach light, which show a decreased intensity in the violet. The comparison indicates that the high pressure gaslight should appear bluish, the Welsbach light greenish, and the Kugel light with the double mantle reddish in tone. The Kugel light with simple mantle closely resembles the high-pressure gaslight. The difference towards the blue and violet is not, however, so great as it seems; for the Hefner light, which forms the basis of comparison, is very poor in blue and violet rays. In order to gain a proper impression of the relative colour of the high-pressure gaslight, the Kugel light, and the Welsbach light, the first two were compared spectrophotometrically with the last. In addition, from the figures already obtained in the comparisons with the Hefner lamp, the intensity of the first two in the different colours was calculated in terms of the intensity of the Welsbach light, regarded as unity for all colours. In the direct comparisons, six observations were made; and the means are—

Colour of the Light.	Position according to Bunsen's Scale.	Intensity (the Intensity of the Welsbach Light = 1). By Calculation from the Hefner Light Results. Kugel Light. Double Mantle. Pressures 0·2 Atmos.	1·1 Atmos.	Simple Mantle. 0·2 Atmos.	1·1 Atmos.	High-Pressure Gaslight. 0·2 Atmos.	By Direct Observation. Kugel Light, Double Mantle. 0·2 Atmos.	1·1 Atmos.
Red . .	32·0	5·913	13·513	9·913	3·878	5·158	3·781	17·832
Yellow .	50·0	5·703	12·866	9·662	4·083	5·628	3·803	15·414
Green .	65·5	5·114	11·911	9·113	3·881	5·373	3·853	17·043
Blue . .	95·5	5·090	13·351	11·145	4·331	6·393	4·179	18·533
Violet .	126·0	6·931	16·437	14·782	5·323	8·253	5·013	20·783

Here, however, as in the case of the Hefner lamp comparisons, the true relation between the colours is not readily seen until only such an amount of light is contemplated as gives equal intensity in one colour. If, therefore, the intensity of colour of the lights compared with the Welsbach light is expressed in terms of the intensity in the red, which is taken as unity, the following values are obtained :—

Colour of the Light.	Position According to Bunsen's Scale.	Intensity, Compared with that of the Welsbach Light.						
		By Calculation from the Hefner Light Results.					By Direct Observation.	
		Kugel Light.				High Pressure Gaslight.		Kugel Light, Double Mantle.
		Double Mantle.		Simple Mantle.				
		Pressures } 0·2 Atm.	1·1 Atm.	0·2 Atm.	1·1 Atm.	0·2 Atm.	0·2 Atm.	1·1 Atm.
Red .	32·0	1·000	1·000	1·000	1·000	1·000	1·000	1·000
Yellow .	50·0	0·965	0·950	0·969	1·053	1·091	1·014	0·862
Green .	65·5	0·865	0·882	0·922	0·993	1·042	1·027	0·953
Blue .	95·5	0·862	0·986	1·124	1·122	1·271	1·114	1·036
Violet .	126·0	1·173	1·214	1·488	1·373	1·600	1·336	1·161

These figures show a remarkable concordance. It is, however, again apparent that the Kugel light with a simple mantle closely resembles the high-pressure gaslight, and that they are both distinguished from the Kugel light with double mantle by the blueness of their tone.

The Kugel light was next compared spectrophotometrically with the high-pressure gaslight. Six observations were made in each case; and the mean results are recorded in the first of the two cross-page tables at foot, in which also values deduced from the preceding comparisons with the Hefner lamp and the Welsbach light are included. If, again, the quantity of light in the red in each case is taken as 1, the relations between the colours are shown more clearly, as in the second cross-page table. Finally, by deducing the mean values from the results of the different observations, the summary appended, showing the relations between the colour intensities of the lights, is obtained. The Kugel light is here taken only when working with a double mantle, and at its normal pressure of 1·1 atmospheres. The final figures of the summary show clearly that the high-pressure gaslight is bluish, and the Kugel light reddish, in tone compared with the Welsbach light; while the Kugel light also is reddish in comparison with the high-pressure gaslight. The investigation, however, has shown that the reddish colour of the Kugel light does not arise simply from the high gas pressure of 1·1 atmospheres which is employed. The figures show that the Kugel light with the double mantle, working at 0·2 atmosphere pressure, is even redder than when the same mantle is used at the higher pressure of 1·1 atmospheres; while, on the other hand, the Kugel light with the simple mantle is, either at 1·1 or 0·2 atmosphere pressure, very similar in tone to the high-pressure gaslight. The reddish colour of the Kugel light, therefore, arises chiefly from the mantle used. In the first place, the mantle is double; in the second place, it is of compact structure. The weight of the incinerated Kugel mantle is 3·838 grammes, which is about seven times the weight of an ordinary mantle. But though the reddish tone of the Kugel light cannot be directly ascribed to the high gas pressure of 1 to 1·1 atmospheres, yet it actually depends indirectly on the pressure. The mantle, in order that it may be durable under this high pressure, must be of so compact a structure that it necessarily radiates yellowish or reddish light. Such a mantle would be no novelty applied to the ordinary high-pressure gaslights and incandescent burners; and with it they would similarly yield a reddish light. But the use of this mantle at a low pressure would be highly irrational, for a far lower illuminating power would be obtained than with the ordinary mantle giving a greenish light. For instance, a simple Kugel light mantle, used on a high-pressure gas-burner at 0·2 atmosphere pressure, afforded a duty of only 10·05 candles per cubic foot of gas consumed; whereas the same mantle employed at 1·1 atmospheres pressure, as in the Kugel light, showed a duty of 25 candles per cubic foot.

Colour of the Light.	Position according to Bunsen's Scale.	Comparison with the Welsbach Light.		Comparison with the High-Pressure Gaslight.
		High-Pressure Gaslight.	Kugel Light.	Kugel Light.
Red . .	32·0	1·000	1·000	1·000
Yellow .	50·0	1·053	0·906	0·881
Green . .	65·5	1·035	0·918	0·901
Blue . .	95·5	1·193	1·011	0·874
Violet . .	126·0	1·468	1·188	0·829

The results of the investigations described in the foregoing report may be summed up as follows :—

(1.)—The application of 1 to 1·1 atmospheres gas pressure enables a very high duty to be economically obtained from the gas.

(2.)—The aforesaid high gas pressure gives a rather more uniform distribution of the light than is obtained with the Welsbach light. This difference is due to the high pressure and velocity of the effluent gas causing the greatest intensity of the flame to be transferred to a higher position, and to the bulging of the mantle which is effected thereby.

(3.)—The aforesaid high gas pressure makes it possible to obtain an agreeable yellowish light concurrently with a very high illuminating duty from the gas consumed.

Colour of the Light.	Position According to Bunsen's Scale.	Intensity (the Intensity of the High-Pressure Gaslight = 1).					
		By Direct Observation.	By Calculation from the Welsbach Light Comparisons.	By Calculation from the Hefner Lamp Comparisons.			
				Kugel Light, Double Mantle.		Kugel Light, Simple Mantle.	
		Pressures. } 1·1 Atm.	1·1 Atm.	0·2 Atm.	1·1 Atm.	0·2 Atm.	1·1 Atm.
Red	32·0	3·374	4·767	1·147	2·626	1·992	0·752
Yellow	50·0	3·106	4·053	1·013	2·286	1·706	0·726
Green	65·5	3·133	4·423	0·952	2·222	1·702	0·717
Blue	95·5	3·093	4·436	0·778	2·037	1·701	0·664
Violet	126·0	2·905	4·140	0·840	1·992	1·788	0·645

Colour of the Light.	Position According to Bunsen's Scale.	Intensity Compared with that of the High-Pressure Gaslight.					
		By Direct Observation.	By Calculation from the Welsbach Light Comparisons.	By Calculation from the Hefner Lamp Comparisons.			
				Kugel Light, Double Mantle.		Kugel Light, Simple Mantle.	
		Pressures. } 1·1 Atm.	1·1 Atm.	0·2 Atm.	1·1 Atm.	0·2 Atm.	1·1 Atm.
Red	32·0	1·000	1·000	1·000	1·000	1·000	1·000
Yellow	50·0	0·921	0·850	0·884	0·871	0·888	0·965
Green	65·5	0·929	0·928	0·830	0·840	0·885	0·953
Blue	95·5	0·917	0·930	0·679	0·770	0·885	0·883
Violet	126·0	0·861	0·869	0·733	0·758	0·930	0·858

VENTILATION WITHOUT DRAUGHTS.

The Ventilation of Gas-Lighted Rooms.

At a recent Meeting of the Society of Arts, a paper on the above subject was read by Mr. Arthur Rigg. In the course of it, he remarked that, as usually practiced, ventilation bears a far closer relationship to art than it does to science; for though many exhausters serve as ornamental finials to a roof, they produce draughts and other evils worse than those they are intended to cure. Ventilation, contemplated as a science, will include warming or cooling an ample supply of air, and the washing, diluting, or removal of deleterious ingredients contained in air which has been breathed. The ventilation of the Houses of Parliament has been a perennial cause of criticism; and, although Committees have reported, and celebrated names have been invoked, yet it remains to the present day a subject of controversy. The new Law Courts serve as a fine example of imperfect ventilation. It was originally supposed that cold air would be so accommodating as to enter only from below, while warm and supposed vitiated air would be equally complaisant and go out only by openings in the ceiling. But the air persisted in following its own natural laws, and not the architect's expectations.

The movements of large volumes of air for purposes of summer or winter ventilation may be carried out generally in three different ways: (1) By vacuum (drawing air out of a room). (2) By plenum (forcing air into a room). (3) By a combined plenum and vacuum system. Furthermore, admission of fresh air may take place—(*a*) At the floor of a room. (*b*) At or near the top of a room. (*c*) At intermediate levels. Where special exits for foul air are provided, these may be situated at the top of a room for ascending currents, or at the floor of a room for the descending current system of ventilation.

The vacuum is the commonest system of ventilation, but when applied to large halls it requires a powerful suction ventilator, generally fixed in the top of a room; and usually no provision whatever is made for an adequate supply of fresh air. Consequently cold air is sucked underneath doors, flooding the floor with a layer of low temperature. In ordinary dwelling-rooms, the fire acts like the ventilator in drawing air out of dwelling-rooms. As a rule, the first draught of importance is that under the doorway, while leaky windows contribute their quota; and an altogether surprising amount of air is drawn through the solid walls. In an ordinary living-room, with a fireplace, an almost ideally perfect system of ventilation can be carried out by admitting fresh air in divided streams into the upper parts of such rooms, where it may mix with the warmer strata it finds there, and gradually descend and pass away eventually up the chimney.

As regards Tobin tubes, the author stated that those fixed at the Royal Institution are of the most modern design and proportions. Their vertical flat inlet-tubes measure 12 in. by 3 in. The total height above the floor is 5 ft. 3 in. The outlet is 20 inches wide at the back, and 18 inches at the front, with a 7-inch wide opening at the top, provided with a thin wire netting as cover. The sectional area for the inlet is 36 square inches; and the sectional area for the outlet, 133 square inches. When a tube of this character is applied to a room filled with warm air, there would not be a sufficiently high velocity to cause it to rise among a volume of air possessing greater heat and less specific gravity. Consequently, cold douches would fall upon the heads of those who happened to be sitting underneath, or near to the inlet of fresh and cold air. The author said the intention in this apparatus seemed to be to destroy most of the velocity which the current would otherwise possess on entering the room; and it was not easy to see why such an object should have been put forward by the designer, unless, perhaps, it was from a desire to counteract some of the tendency of the ventilating arrangements in the roof to absorb all the cold air coming from the Tobin tube before it could serve the intended purpose.

Having described the ventilating arrangements at the Society of Arts, Mr. Rigg proceeded to consider other systems. By the plenum system pure and simple, fresh air is forced into the room at any convenient locality, so no stagnant places need occur; and foul air finds its way out by open doors, windows, or leakages—in fact, through the very openings which advocates of the vacuum system rely on for providing their supply of fresh air! The plenum system is independent of winds and weather, and, indeed, each system is essentially the opposite of the other. By the combined operation of the plenum and vacuum systems, considerable volumes of fresh air can be forced into a room, and a corresponding quantity can be extracted by a ventilator situated generally on the roof. But by whatever method a supply of fresh air enters a room, there are two grand divisions in which its disposal can be arranged: (1) As a general up-flow, from floor to ceiling or roof, and out at the top. (2) As a general down-flow, from floor to ceiling or roof to floor, and out at the floor.

In regard to the ventilation of buildings, the author remarked that it is too often assumed that there is no happy medium between that of breathing air utterly foul and a system so profoundly scientific that by no chance shall any part of the air that has been once breathed enter the lungs of another. The common-sense system mixes fresh air with that which has been breathed, or may be breathed again, and it does this without draughts or appreciable inconvenience; while the over-scientific system sends large volumes of cold or heated devitalized air into a room, and expects the forceful, irregular currents to travel in all sorts of ingenious ways that no independent currents would ever be likely to follow under any natural impulse.

The author next described a system of ventilation of which he highly approved. A suite of rooms, erected in 1898 in London, has been provided with a system of natural ventilation which he considered as nearly as possible perfection, subject, however, to the one defect of being interfered with by contrary winds. This building runs almost due north and south, and advantage has been taken of the prevailing winds (which are south-west and north-east) to apply the inlet arrangements to both sides of the building, so that one or other can be relied upon. The suite of rooms consists of—

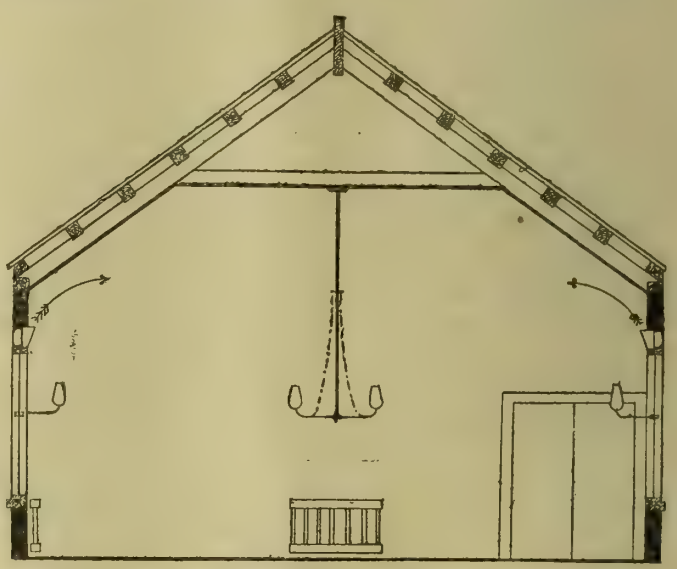
Entrance Hall.—21 ft. 6 in. by 17 ft., and 18 feet high (not specially ventilated). Heated by two radiators, each 21 inches diameter and 3 feet high. Lighted by three Welsbach incandescent gas-burners.

Drawing Room.—22 ft. 6 in. by 26 ft., and 18 feet high. Ventilated by three ventilators on the west side only. Heated by one radiator on the north side, 4 ft. by 3 ft., one on the east side 4 ft. by 3 ft., and one on the west side 4 ft. by 2 ft. 5 in. Lighted by seven Welsbach burners.

Library.—22 ft. 6 in. by 17 ft., and 18 feet high. Ventilated by two ventilators on the west side only. Heated by one radiator on the east side 4 ft. by 3 ft., and one on the west side 4 ft. by 2 ft. 5 in. Lighted by two Welsbach burners.

Dining or Ball Room.—30 ft. by 45 ft., and 18 feet high. Ventilated by ten ventilators, five in the east and five in the west sides. Heated by six radiators, each 4 ft. 7½ in. long and 2 ft. 5 in. wide. Lighted by twelve Welsbach burners.

Café.—30 ft. by 35 ft. and 18 feet high. Ventilated by four ventilators, two on the east and two on the west side. Heated by two radiators, each 4 ft. by 2 ft. 5 in. Lighted by six ordinary gas-burners.



The accompanying illustration is a section of the dining or ball room. It is 18 feet high from floor to ceiling, and the roof is hermetically sealed, having no openings whatever. No special provision is made for the exit of carbonic acid from below, as the doors and usual cracks and crannies are found to be sufficient. The room is lighted by twelve Welsbach incandescent burners; so that there is considerable heat to be disposed of. Fresh air is admitted by ten inlets, five being on each side. These are set at about equal intervals apart along the room, and 2 feet below the springing of the roof or ceiling. Each inlet grating is provided with a sliding shutter, whereby the area open can be regulated. Although the air-bricks measure 11 in. by 16 in. outside, the clear area is but 30 square inches for each ventilator. The inlets to the room measure 16 in. by 3 in. = 48 square inches, or 1 square foot, and when tested by an anemometer the current varies considerably—generally reaching a speed of 300 feet per minute. Sometimes, however, the current is reversed. The results of these arrangements have been quite satisfactory. There is a complete absence of draughts as well as of those cold douches of Arctic temperature which make many assembly-rooms in town or country models of discomfort and veritable death-traps. Most of such rooms are decorated with a lavish generosity; while no care whatever is given to ventilation, scientific or otherwise. Such rooms are contentedly supplied with a big hot-air extractor in the roof, which creates all the draughts below; and the whole barbarous arrangements takes a toll of human life which it is perfectly appalling to contemplate.

In conclusion, the author summed up his views as follows: (1) Ventilation should, as far as possible, be carried out by the plenum and not by the vacuum system. (2) Fresh air should be introduced as an upward current from openings above the heads of an audience, but not so high as the ceiling. It should be driven in divided streams into the upper part of the room, so as to mix with warm air already travelling there. (3) Exits for

carbonic acid, dust, and watery vapour should be provided at or near the floor-level, if required. (4) The roof or ceiling of a properly ventilated chamber should be hermetically closed. (5) Open windows should only be used during warm weather, never in winter. (6) As natural draughts cannot always be relied upon, fans or a furnace, or other means of producing artificial draughts, should be resorted to, when necessary.

PARISH WATER SUPPLY AND SEWERAGE.

At the Meeting of the Society of Arts last Wednesday, under the presidency of Sir Benjamin Baker, K.C.M.G., a paper on "Local Government and its Relation to Parish Water Supply and Sewerage" was read by Mr. W. O. E. MEADE-KING, M. Inst. C.E., one of the Inspectors of the Local Government Board. The following are some extracts from the paper.

It will doubtless be allowed without comment that two of the most important duties of a local authority are to provide for the inhabitants under their jurisdiction (1) a proper, wholesome, and adequate water supply, and (2) a proper and efficient means of disposing of the sewage of their district. The question then arises: Do these authorities in the rural districts of England carry out in a proper and efficient manner the duties for which they are responsible? Perhaps it would be putting it too strongly to say the answer must be in the negative, as due allowance must be made for the many difficulties that present themselves; but certainly the information gained as the result of much investigation seems to point in the direction of a negative answer.

Under the Public Health Act, 1875, anyone who thinks he has sufficient grounds to do so can complain to the Local Government Board that the authority responsible for such matters in the district in which he resides or has property have made default in providing that district with adequate sewers, or that the water supply is insufficient or unwholesome. Persons making complaint as to an alleged improper water supply have to produce evidence to show that works to remedy the evil can be carried out at a reasonable cost, which naturally opens a very wide question, for, so far as the author is aware, no one has ever yet laid down any rule or principle on which a reasonable cost could be based.

It has been argued that if it can be shown that a scheme can be carried out for a sum not exceeding one year's assessable value of the district, it should be looked upon as reasonable. The following figures concerning 20 places which have come under the writer's immediate observation may be worthy of note, and may be of some assistance in deciding this point. The places in question had an average population of 2460, and an average annual assessable value of £9320. The average estimated cost of the scheme per place came to £1917, or about 15s. 7d. per head of the average population. In only one instance did the estimated cost of the scheme exceed one year's assessable value; in only three instances did it come near it; and in all the other cases it was very considerably below, seldom reaching one-half.

Should the complaint be one concerning sewerage, or rather the want of it, the necessity to prove that a scheme can be carried out at a reasonable cost does not exist. Nevertheless, it is interesting to note to what sum the average estimated cost of sewage-disposal schemes works out; and the following figures show that, in most cases, such a scheme need not cost anything like one year's assessable value. Fifty places have been taken which have come under the writer's notice during the last three or four years. Of these places the population varies from over 27,000 in one case, to about 500 in another; the average being about 4300. The average annual assessable value of these places comes to £19,850; varying from about £81,000 in one case, to about £1500 in another. The total estimated cost of sewerage and sewage-disposal schemes came to £228,183, or an average estimated cost per place of £4551, or rather less than a quarter of the average annual assessable value. The actual average estimated cost of the schemes per head of the population works out to £1 1s. 10d.

There are, at the present time, 7936 parish councils in England, to say nothing of the numberless parishes not possessing that luxury; therefore it will be readily understood that, in making inquiries concerning water supply and sewerage, it was necessary to limit the field to some extent. Accordingly, 200 parishes were selected at random; the writer having no previous knowledge of them. No parish was chosen having a population of less than a 1000 or more than 1500; and, for the purpose of making the information general, a few were taken from every county in England, exclusive of the County of London. Of these 200 parishes, 76 show an increase in rateable value during the four years 1894-8, 109 show a decrease, and in 15 cases the returns could not be obtained. The total rateable value of these 185 parishes in 1894 was £1,450,848, and in 1898 £1,432,029; showing a decrease in the four years of £18,819. It is believed, from observations made while professionally engaged in every part of the country, that the results of inquiries instituted concerning the 200 parishes chosen will convey very fairly accurately the state of all parishes throughout the country. It now remains to be seen what are the sanitary conditions under which these 200 parishes exist. Out of the 76 that can show an increase in their rateable value during the four years 1894-8, 20 obtain their water entirely from water-works; while out of the 109 showing a decrease of wealth in the same period, only 12 so obtain their water. Of those furnishing no returns as to rateable value, five obtain their water in this way; thus showing that out of these 200 parishes 37 are dependent entirely on water-works for their water supply, and that a substantial majority of them can show an increase in their rateable value. Looked at in another light, the figures prove that 26 per cent. of the parishes obtaining their water from water-works can show an increase in their rateable value, while only 11 per cent. of the parishes on a similar footing show a decrease. The advantages of a good and plentiful water supply laid on in a district are so manifold and obvious, that it is not intended by the author to enter into the merits of such a supply. Some parishes combine water-works and wells for their water supply—that is to say, water is laid on to the main part of a village, while isolated houses and farms, &c., are dependent on their own private wells. This is doubtless the next best form of supply to that from water-works only, and out of the total number of 32 parishes so situated, no less than 23 show an increase in their rateable value out of the 76, or 30 per cent., and only 7 out of the 109 parishes, or about 6 per cent., show a decrease. In two cases the rateable values could not be obtained. It is gratifying in a way to find that of the parishes dependent entirely on wells, of which there are 101 out of 200, only 23 out of the 76, or 30 per cent., show an increase in rateable value; while out of the total number of 109 which show a decrease, 71 parishes, or 65 per cent., thus get their water. Seven parishes dependent on wells give no returns of rateable value. The day is bound to come when every shallow well will have to be closed. Out of the 200 parishes taken, 24 obtain their water from a combination of wells, rain-water collected, ponds, &c.; but out of the 76 showing an increase in their rateable value, only 3 parishes, or about 4 per cent., thus get their water, and 20 parishes, or about 18 per cent., out of the 109 showing a decrease are dependent on this as the source of their supply. One parish in this category does not give any returns as to rateable value. Before leaving the subject of water supply, taken independently of sewerage, there yet remains one other form of supply—viz., parishes dependent on rain-water, wells, and water-works. Of these, there are two showing an increase in rateable value (being equal to 2·6 per cent.) and one a decrease, being equal to 0·91 per cent.; the fact of water-works forming even a part of the supply appearing in this, as in other cases, to have something to do with, if not to actually ensure, an increase in the rateable value.

It now remains to be seen what effect, if any, sewerage and sewage disposal, irrespective of water supply, have on the rateable value of a parish. Of the 200 parishes previously alluded to, 37 are sewered, and treat their sewage at disposal works. Of these, 3 give no returns as to rateable value; leaving 34 parishes which can be considered. It is found that 21 of these, or about 27½ per cent., show an increase, and only 13, or nearly 12 per cent., a decrease in the rateable value. It is satisfactory to find that those parishes which have gone to the expense of sewering, but go no further, and are offenders under the Rivers Pollution Prevention and other Acts, on account of discharging their sewage direct into a stream, should apparently suffer. Only 31 out of the 200 parishes dealt with do so, and one of these does not give any returns as to rateable value. Of those left, 10 parishes, or about 13 per cent., show an increase, and 20, or 18 per cent., a decrease in their value.

It would probably astonish people, did they but know it, what a number of parishes there are scattered throughout the country that are without any system of sewerage. These can, for present purposes, be divided into three classes: (1) Parishes not sewered, but causing pollution of a stream or streams by private drains. (2) Parishes draining by private drains into cesspits, but not causing pollution of a stream. (3) Parishes draining into cesspits, and by these overflowing, or by other means, causing pollution of a stream. In the first mentioned class, 19 show an increase in rateable value out of the 76 so doing, being equivalent to 25 per cent.; and 21 show a decrease out of the 109 in that predicament, being equal to about 19 per cent. It would thus seem that people do not care what becomes of their sewage, provided it is got rid of. As to the second class, 27 parishes out of 76, or about 35 per cent., have increased, and 45 out of 109, or about 41 per cent., have decreased in value. There remains the third class. This is about the worst form of getting rid of the sewage of a parish, and it is disappointing to find the honours so nearly divided as regards the rateable value. Out of the 200 parishes, 48 appear to be content to exist in this state; and of these, 17, or about 22 per cent., increased, and 26 out of 109, or nearly 24 per cent., decreased in value between 1894 and 1898.

Having now dealt with water supply and sewerage independently, it still remains to be seen what effect the two combined have on parishes. Out of the 200 places selected, only 23 get their water from water-works and are sewered to disposal works. But of this number no less than 15 out of 76, or over 19 per cent., have increased in rateable value, while only 6 out of 109, or about 5½ per cent., have decreased. Of parishes which obtain their water from water-works, but which are not sewered and drained to cesspits or streams, there are 25 out of the 200; and of those in which it is possible to compare the rateable values, some 16 out of 76, or 21 per cent., have increased, and

6 out of 109, or about 5½ per cent., have decreased in value—showing once more that, given a good water supply, the public care little what becomes of the sewage, so long as it disappears. As is well known, and as has been shown in this paper, the majority of parishes are dependent on wells of greater or less depth for their water supply; but some which are dependent on this source are properly sewered, and the sewage treated at disposal works. In such cases, the source of the water supply may very possibly be all that can be desired—provided, of course, none of the wells are liable to contamination by the sewage-disposal area or other polluting source. Only 21 parishes out of the total 200 are in such a state. But 12 out of 76, or nearly 16 per cent., show an increase; while only 8 out of 109, or about 7 per cent., show a decrease in their value—a margin which, once more, is greatly in favour of good sanitary conditions. The parishes having the worst sanitary conditions, so far as water supply and sewerage are concerned, are those dependent on shallow wells for the former, and at the same time are polluting streams and ditches, and making use of cesspits. Unhappily, these form the great majority; no less than 135 parishes out of 200 being in this condition. But it is some consolation to find that only 39 out of 76, or 51 per cent., can show an increase in rateable value; while 88 out of 109, or 80 per cent., show a decrease. The remaining parishes furnish no returns as to rateable value. The danger of such a state of things is too obvious for comment.

Before leaving the subject of the analysis of parishes, as regards their sanitary state and rateable value, mention must be made of one county alone where information regarding the source of water supply and means of disposing of the sewage was obtained from no less than 67 parishes. The result of this information goes to prove, first of all, the serious state of things which prevails; and, secondly, that good sanitary conditions enrich rather than impoverish the community. Of these 67 parishes, it was found that 58 (including one dependent to some extent on rain-water) rely entirely on shallow wells for their water supply, and 53 of them have no proper system of drainage, but turn their sewage into ditches and streams—thereby offending under the various Acts passed for the suppression of this evil, to say nothing of endangering their water supply—and, in addition, 5 use cesspits. Seeing what is done with the sewage, it is small wonder to learn that in the majority of cases the wells, on analysis, are pronounced to be suspicious, and in many cases dangerous and unfit for use. Of the total number of 67 parishes referred to, 42 give the returns of population at the last census (which varies from about 2500 to 300), also the rateable value in 1894 and 1898. It has been found that 22 parishes out of the 42 increased in value during those years; while the remaining 20 decreased—the balance showing a total increase in value of £9071. It is interesting to note that out of the 22 parishes which can show an increase in their wealth, eight obtain their water from water-works, and seven are sewered and treat their sewage at disposal works. Out of these 15 parishes, four both get their water from water-works and are sewered, the sewage being dealt with at disposal works; while out of the 20 parishes which show a decrease in their value, only one gets its water from water-works, and none have sewage-disposal works. The one getting its water from water-works has only decreased to the extent of £4 in rateable value.

Such, then, is the general state of parishes throughout the country; and yet it is said that nothing is more characteristic of the close of the nineteenth century than the extent to which sanitary science has come to the fore. It may have been, and no doubt has been, said; but it cannot be correctly said, so far as country parishes are concerned, that the desire for good sanitary conditions is much greater now than it was before the days of any legislation on the subject. So long as agriculture remains the staple industry of the country, the future prosperity must in a large measure rest with the parishes, the general tendency of which is not to increase materially in population. There is an outcry throughout the country as to the scarcity of agricultural labour. By carrying out proper works of water supply and sewerage, not only would labour be employed in the parish for the time being, but the general health and contentedness of the parish would be increased; and the fact of the sanitary arrangements being good would be an inducement to people to live there rather than seek the close confines of a large business centre. If the parishes produce weakly children by reason of insanitary conditions, both the towns receiving the rising generation and the parishes themselves, and therefore the country at large, must necessarily suffer. It is hoped the information gathered in this paper will be sufficient to satisfy local authorities and the public generally that money laid out on works of water supply and sewerage not only ensures health, but wealth.

The Carburetted Water-Gas Plant at Lower Sydenham.—In the description of the new carburetted water-gas plant at the Crystal Palace Gas-Works which appeared last week, mention was made of the method of re-circulating the water, &c. We have since been informed that this, with the settling-tank for the tar, and with the addition of cooling arrangements for the water, has been in use at the Windsor Street Gas-Works, Birmingham, for a considerable time. Something very similar, we understand, had also been previously employed at the Brentford Gas-Works.

REGISTER OF PATENTS.

Incandescent Gas-Burners.—Clay, W. R., of Bolton. No. 27,416; Dec. 29, 1898.

This is a modification of one part of the inventor's patented arrangement of 1897 (No. 17,679), as he says he finds that a better bunsen flame may be obtained if the secondary air supply at the neck of the upper part of the heavy burner body be cut off. In order to do this without injuring the efficiency of the arrangement as an anti-vibrator, he proposes to carry that portion of the apparatus which holds the spring very freely through the neck, and on the upper face of the neck to place a metal ring or washer, which shall surround the part carrying the spring or resilient bearing, and fit as closely to it as shall enable the spring-holding device to work freely up and down through or within the ring, and thereby not hinder the heavy body from promptly responding to any vibrations coming in a vertical direction. In order not to interfere with the sideway movement of the heavy body, the ring (being of larger outside diameter than the hole in the neck through which the spring-carrying device passes) rests or slides on the upper side of the neck, and thus forms a joint or packing closing up the annular space which would otherwise exist between the sides of the hole in the neck and the spring-carrying device freely passing through it.

Fig. 1 illustrates the application of the invention to an anti-vibratory device carrying a conical burner-top; and fig. 2, when carrying a burner-

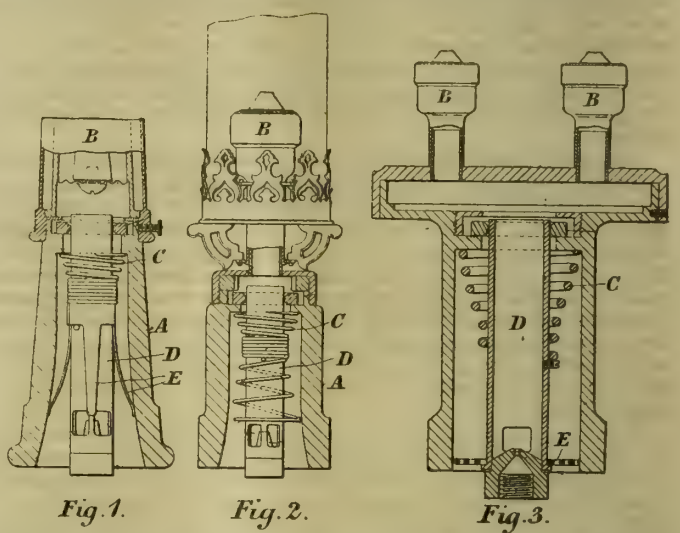


Fig. 1. *Fig. 2.* *Fig. 3.*

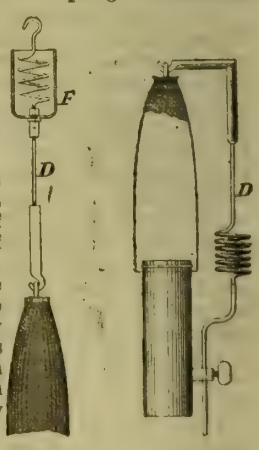
top of ordinary construction. Fig. 3 shows the application of the invention to a cluster of burner-tops.

A is the "heavy body" by which the burner-top B and mantle are supported, surrounding the bunsen tube. C is a spiral spring carried by the upper part of the bunsen tube D, and serving as a resilient bearing for the body. In fig. 1, there are radially-disposed spring-legs E placed below the spring, in order to check undue movement of the lower part of the body. In fig. 2 these spring-legs are replaced by a spiral spring. In fig. 3 is shown another alternative form of lower spring—a flat helical spring. The bunsen tube D here passes through the neck of the body A, so as to permit of free lateral play.

Incandescent Mantle-Supports.—Sugg, W. T., of Westminster. No. 2172; Jan. 31, 1899.

The patentee proposes to employ a pendent support for incandescent mantles, or a standard support; but in both cases it is of a flexible character—preferably consisting of a coil or coils of wire.

The part of the support from which the mantle is suspended is formed of steatite, to which the wire portion D is secured in any convenient manner. This wire portion is formed with coils to obviate vibration. In the pendent form, the coil is protected from the heat of the flame by a shield F, preferably of steatite.

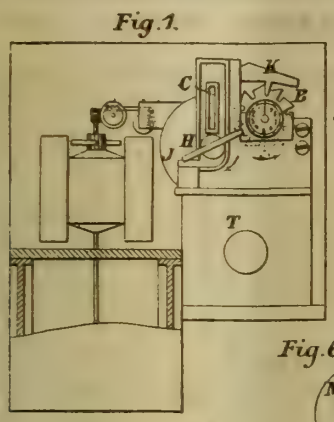


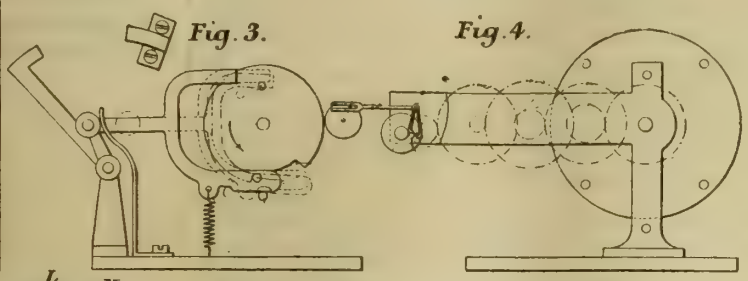
Coin-Freed Meters.—Abel, C. D.; a communication from the Société Anonyme Continentale pour la Fabrication des Compteurs à Gaz et Autres Appareils, of Paris. No. 27,390; Dec. 28, 1898.

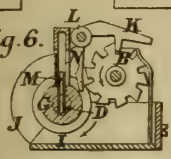
This invention relates to coin-freed apparatus for electricity and gas or other fluid meters, so arranged that, by inserting a coin and turning a handle, two operations are performed by the movement given to the coin—first, the circuit of an electric meter is closed, or the valve of a fluid meter is opened, and then clockwork is wound up, which, after moving for a time (determined by the value of the coin and the price of the energy or fluid), opens the circuit or closes the valve, and comes to rest.

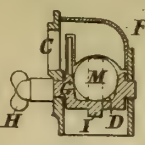
Fig. 1 (p. 471) is an elevation of the meter. Fig. 2 is a section of the clockwork; and figs. 3 and 4 are sections on the lines 3 and 4 of fig. 2 respectively. Fig. 5 is a plan; and figs. 6 and 7 are a longitudinal and transverse section of the parts immediately acted on by the coin.

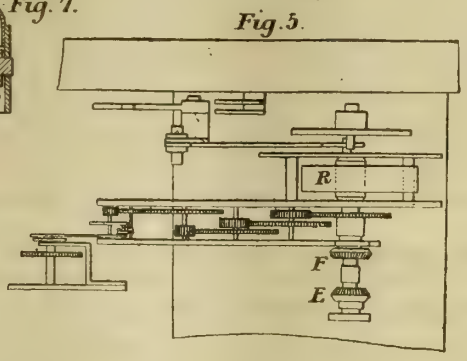
The coin M, when introduced through a slot C, enters a notch D in the collar I of a spindle G, which is turned partly round by an external handle H. By its revolution, a shutter J is moved across the slot, so as to prevent the introduction of another coin. The shutter, acting on a lever-arm N, withdraws a pawl K; and the coin thereupon becomes engaged with the teeth of a ratchet-wheel B (which it turns one tooth),

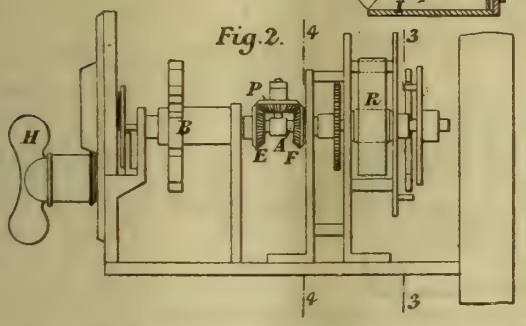










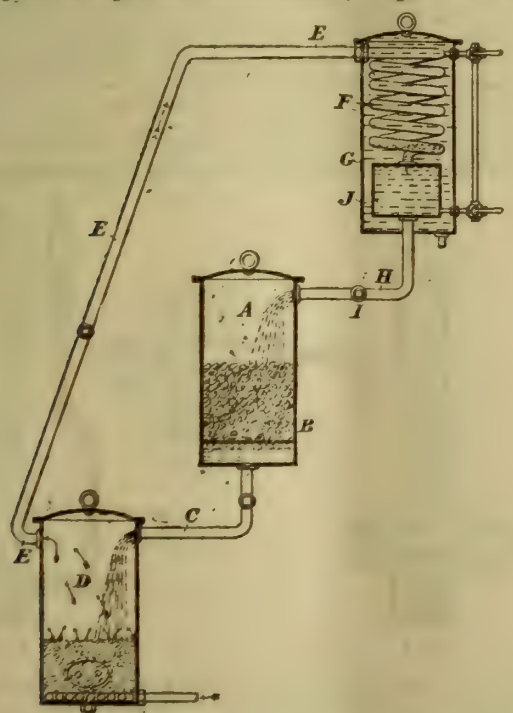


and then drops into a receptacle T below. The handle being then returned by hand or by a spring to its original position, a number of coins may be similarly introduced in succession, each turning the ratchet-wheel one tooth. The spindle on which the ratchet-wheel is fixed is connected through bevel-wheel differential gear to the spindle of a clock spring or weight.

The ratchet-wheel has on its spindle a bevel pinion E, gearing with a pinion P, which in its turn gears with another pinion F, and is pivoted at right angles on a separate axis A, to which one end of a spring R is attached—the other end being fixed to the framing. As the ratchet-wheel B turns while F is stationary, the spring is wound up by the axis A carried round by P. The pinion F is on a sleeve geared to a train of wheels and pinions governed by clockwork, which is moved by the spring, and which turns the axis A backwards, and also the pinion F, while the pinion E is stationary—the amount of movement backwards being equivalent to that forwards effected by the number of coins introduced. The clockwork is controlled by an escapement, which consists of an anchor acted on by a pin projecting from a disc driven by the clockwork. The anchor has a forked lever-arm engaging a stud on a disc on the axis of a wheel, which is moved by the counter of the meter. Each turn of the wheel causes a to-and-fro oscillation of the anchor, allowing the pin to escape; so that the wheel makes a revolution which permits the spring to unwind. When it is unwound as much as it had been wound by the act of introducing coins, the mechanism stops.

Manufacture of Anthracene.—Wilton, T., of Beckton. No. 27,559; Dec. 31, 1898.

This invention consists in a new or improved method of purifying or dissolving out the impurities from anthracene; the patentee finding that



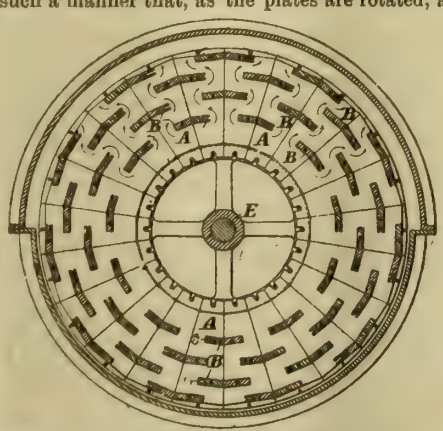
liquefied ammonia gas (NH_3) has the power of dissolving out most of the impurities in crude anthracene, while at the same time the anthracene itself is insoluble or practically so. By the use of liquefied ammonia gas, therefore, he claims to be able to obtain anthracene "of a higher commercial purity at little expense."

He describes one means of carrying his method into useful effect by such an arrangement of apparatus as that shown, which he has found to give good results, though he lays no claim to this particular apparatus, and any suitable means may be used. The apparatus consists of an air-tight receiver A, having a bottom strainer B. The lower part of the receiver (below the strainer) is connected by a pipe C to a lower vessel D. In order to render the process continuous, the lower vessel is connected by a pipe E to a coil-condenser F, situated within a vessel G, arranged at the upper part of the apparatus, and connected to the top receiver by the pipe H fitted with a stopcock at I.

In using this apparatus, the anthracene to be purified is pulverized and placed in the receiver A, and the whole apparatus made air-tight. The anthracene is then subjected to the action of the solvent ammonia by passing same through it in a liquid form, and under sufficient pressure to maintain liquefaction. During the process, the substance that is dissolved out of the anthracene under treatment by the selective action of the solvent runs in liquid form through the pipe C to the lower vessel D, from which it is subsequently removed. The anthracene which is not acted upon by the solvent remains in the vessel A, and may be removed therefrom. The ammonia, when in the lower vessel D, may be evaporated by heat or otherwise from the substances dissolved out; and the vapour of ammonia will then pass up the pipe E, and being re-condensed in the coil F will pass into the vessel J, and thence by the pipe H to the receiver A, when the cock I is opened. Thus the anthracene is left in an insoluble and highly purified state in the receiver A, and the ammonia solvent may be applied to the anthracene under treatment over and over again; the required pressure being maintained in the apparatus during the whole process.

Washers or Scrubbers.—Chandler, S. & J., of Kennington, S.E. No. 2832; Feb. 8, 1899.

This is a modification of the "Standard" washer-scrubber, the original patent for which was No. 2085 of 1881, wherein was described a series of plates, sheets, or boards (or of clusters of the same) arranged upon a rotating shaft or axle, and partially immersed in the washing liquid in such a manner that, as the plates are rotated, all parts of them will be



successively immersed in the washing liquid, and so maintained in a wet condition. The object of the present invention is "to provide improved means for maintaining the spaces or channels between the plates, sheets, or boards, and causing the gases which pass between to travel much further before leaving them than heretofore, whereby the gas is more effectually purified, and for providing carriers of any shape or number to distribute liquor over the surfaces employed."

The plates or boards are separated by distance-pieces of a breadth

corresponding with the space which is to be preserved between adjacent plates; the distance-pieces being either straight or curved or otherwise suitably shaped, and being preferably arranged in a series of concentric circles around the axis of the washer—spaces being left between the distance-pieces of each circle, while the distance-pieces of one circle are arranged opposite to the spaces between the distance-pieces of adjacent circles, so that the gas in passing from the centre of the drum to the exterior will have to flow in a zig-zag or circuitous passage. The distance-pieces are formed with hollows or recesses, which raise the liquid as the apparatus rotates, and allow it to drop again through, and in contact with, the gases flowing through the apparatus.

A are the plates, sheets, or boards; and B the distance-pieces arranged between them—a series of the plates and distance-pieces being secured between the side-plates C D, and fixed to a boss E mounted upon a shaft carried in suitable bearings in the ends of a casing which encloses the plates. The casing is divided by partitions into bays, in each of which a series of plates rotates, and which at the bottom is adapted to be provided with the washing liquid which, as the plates are rotated, keeps them constantly wet. The boss E has two flanges, to which the side-plates are respectively connected. One is provided with a series of openings, and has its face running in close proximity to the margin of an opening formed in the adjacent partition; while the other side-plate extends right down to the second flange. This arrangement is provided in order that the gas to be purified—as it flows from one bay to the next, through the opening—shall pass to the interior of the cluster of plates; thence between the same; and thence to the next bay, as indicated by the arrows.

Automatically Igniting Gas.—Automatic Universal Gas Lighter, Limited, of Copthall Avenue, E.C. No. 3555; Feb. 17, 1899.

The patentees point out that igniting-bodies heretofore employed in conjunction with fine wires or filaments of platinum for automatically igniting gas, and comprising porous material impregnated with finely-divided metal—such as platinum black—are found to rapidly lose their automatic igniting property; and one object of this invention is to increase the durability of such bodies.

For this purpose, infusorial or silicious earth—*i.e.*, kieselguhr, in a pure and finely levigated condition—is formed, as heretofore, into small blocks (preferably of rectangular cross section), which are impregnated with a solution of salts of platinum and thorium; the impregnated blocks being dried and afterwards heated to a high temperature in a stream of reducing gas, such as hydrogen, to form the improved igniting-bodies. The invention may conveniently be carried out by placing the raw blocks of porous material in a solution composed of about 1 part by weight of bichloride of platinum (deutochloride of platinum), 0·4 part by weight of nitrate of thorium (thorium nitricum), and 4 or 5 parts by weight of water; the quantity of the solution used being such that the weight of the bichloride of platinum and nitrate of thorium therein is about three times that of the raw blocks to be treated. The blocks are allowed to remain for one or two hours in the solution, which is then nearly evaporated to dryness in a stove, at a temperature of about 60° C. The blocks are then placed on a plate of glass or the like material, and completely dried at a temperature of about 100° to 110° C., after which they are placed in a tube of hard glass, and gradually heated up to a high temperature in a stream of pure and dry hydrogen simultaneously passed through the tube. By this means, the salts of platinum and thorium are reduced; the platinum and thorium being deposited in a very finely-divided condition in the porous body, and water, chlorine, and hydrochloric acid being eliminated. When the elimination of these substances has nearly ceased, the temperature of the tube is raised still higher—to a white heat or nearly so, which is maintained until the white sublimate evolved during the heating is completely volatilized and the interior of the tube left quite clean. The source of heat is then removed, and the impregnated blocks, which will then be quite black, are allowed to cool in the stream of hydrogen gas until they attain a temperature of about 70° C., whereupon they are caused, as by inclining the tube containing them, to fall into a glass bottle or other like receptacle. The finished igniting-blocks are then ready to be mounted, combined with fine platinum wires or filaments to produce an automatic igniting-device.

Incandescence Bodies.—Duncan, J. H. H., of Coleman Street, E.C. No. 4243; Feb. 25, 1899.

According to this invention, incandescence bodies suitable for use with gas-burners are made of thoria, alumina, and chromium oxide in the proportion of 50 per cent. of thoria, 40 per cent. of alumina, and 10 per cent. of chromium oxide.

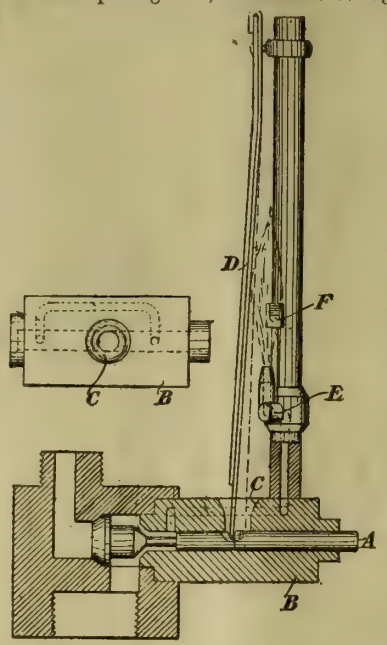
The incandescence bodies can be produced in various ways—for example, by impregnating suitable threads or fabrics with salts of the substances mentioned, and then converting the salts into their oxides by heating or otherwise treating the impregnated threads or fabrics in the usual way; by mixing the salts with collodion or other material that is afterwards converted into threads, which are suitably fixed and formed, by weaving or otherwise, into incandescence bodies of any suitable shape, and igniting them; or by any other process which results in the production of suitable filaments of oxides.

When the incandescence bodies are prepared by the impregnation process, the thorium, aluminium, and chromium, which are to be in the form of oxides in the finished body, may be added to the impregnating solution as thorium nitrate, aluminium nitrate, and chromic acid, in such proportions that the thoria, alumina, and chromium oxide present in the mixture will be in about the proportions mentioned. When the incandescence bodies are made from filaments or threads produced from a mixture containing collodion or some other solution of a combustible substance, the thorium nitrate, aluminium nitrate, and chromic acid may be dissolved in a solvent of the combustible substance, and in this form be added to the collodion or other solution of a combustible substance.

Although the proportions named of the various substances used, if strictly adhered to, will (says the patentee) give most satisfactory results with the methods of manufacture and burning off now in use, yet it is not intended to limit the scope of the invention rigidly thereto, as the proportion of thoria may be varied considerably so long as the alumina and chromium oxide are retained in the relative proportions mentioned, or "in variations of the same that will allow of, or at least will not prejudice, the chemical combination of these two substances."

Self-Igniting Gas-Burner.—Perlich, A., of Dresden. No. 13,556; June 30, 1899.

The patentee proposes to employ a block B, having a central horizontal circular opening in it, in which is a snugly-fitting valve-stem A, adapted to move backwards and forwards. On the forward end of the stem is a double valve—the former adapted to rest in a valve-seat provided in the forward end of the circular opening, and closing the same when the stem is in a backward position; while the latter valve engages a valve-seat formed in the passage of the head-piece, and closes it when the stem A is in a forward position. The block is also provided with a passage, which forms a continuous channel from the head-piece to the hollow tube supporting the self-igniting mass F. Adjacent to the latter is mounted an expanding and contracting plate D, the lower end of which, passing through the hole C, engages the lip formed in the stem A. Thus when the gas-cock (not shown) is opened, the gas entering through the head-piece travels to the self-igniter, which latter, acting in the usual manner, ignites the gas at the small burner E. The flame, acting on the plate D, causes a deformation of the plate, by which action the lower end engaging the lip drives the stem A backward, and closes and opens the respective valves; and the gas passes to the burner, and is ignited.



Fly-Wheels of Explosion Engines.—Otto, M., of Neuilly, France. No. 17,210; Aug. 24, 1899. Date claimed under International Convention, Feb. 24, 1899.

The patentee claims to have invented a means of turning to account the energy stored by the fly-wheel of (say) a gas-engine, not only to regulate the speed and work of the engine, but also to accumulate an additional energy, which remains constantly available for starting purposes. He proposes to substitute for the simple mass of metal now employed, a dynamo placed on the main driving-shaft of the engine, and the moveable parts of which are connected with a mass of metal forming a fly-wheel. This dynamo—which, moreover, may be of any type, and can be series shunt or compound—will not only act as fly-wheel, but will also feed, during the working of the engine, a battery of accumulators, and will be able, in addition, to supply the electric current requisite for an electric device of any kind for igniting the explosive mixture. When, after the stoppage of the engine, it is wished to set it working again, it will suffice to reverse the direction of the current by the aid of a reversing commutator; and the dynamo fly-wheel, receiving the current from the battery of accumulators, will immediately transform part of the electric energy accumulated into mechanical energy for starting the motor. When this last has acquired its normal speed, the commutator is replaced in its ordinary position.

Actuating Gas-Burners from a Distance.—Weber-Marti, C. A., of Zurich, Switzerland. No. 18,874; Sept. 19, 1899.

This invention is characterized by "the provision at a suitable point in the gas-conduit of a chamber connected both to the gas-conduit and the atmosphere by a particular duct and to the supply of the controlling air, and of a piston having a flow-through channel to communicate with the through-way of the conduit, and adapted to work hermetically in the chamber cross-wise of the conduit through-way, and to be moved with its flow-through channel into or out of communication with the conduit through-way by compression or exhaustion of the controlling air acting in the chamber, respectively by the action of the atmosphere."

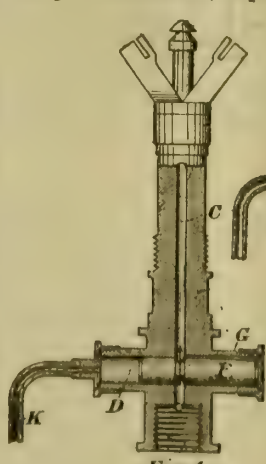


Fig. 1.

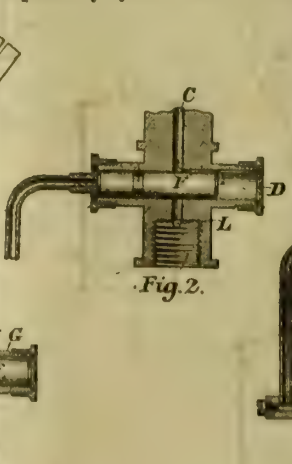


Fig. 2.

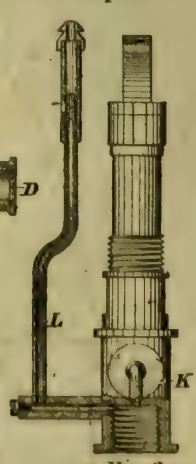


Fig. 3.

As applied to an acetylene gas-burner, fig. 1 represents the device in sectional elevation, showing it open for the through passage of the gas. Fig. 2 illustrates the device closed so as to prevent the passage of the gas; and fig. 3 represents a side elevation, partly in section.

The gas-conduit B is formed with two through-ways or passages C D, crossing each other at right angles. C serves for the passage of the

gas to the point of ignition, and D serves to receive a piston F, having a peripheral groove by means of which the gas passes through C as required. One end of the through-way D is closed by a coupling communicating with suitable air supply and exhaust apparatus (not shown) by a pipe K; while the other end (closed by a cap) communicates with the outlet-passages C and the atmosphere, by a duct G made in its upper wall.

When it is desired to permit of the passage of the gas through the channel C, air is forced through the pipe K into the adjacent end of the chamber D. This causes the piston F to assume the position indicated in fig 1, which allows the gas to pass the peripheral channel in this portion. When it is desired to prevent the passage of the gas, air is exhausted from the chamber D, through the pipe K, when the pressure on the other end of the piston causes the latter to assume the position in fig. 2, which prevents the gas passing the peripheral channel.

From the lower part of the through-way C, a conduit L leads to the igniting device, which consists of a gas-nozzle, above which is fitted an air and gas mixing-tube having an air-inlet, and fitted at its top with a removable burner (or there formed as a burner) having a less bore than that of the mixing-tube, so as to prevent the bunsen flame striking back.

Gas-Engines.—Lake, H. H.; a communication from the Standard Automatic Gas-Engine Company, of Oil City, Penn., U.S.A. No. 20,664; Oct. 14, 1899.

This invention—relating to a gas or explosion engine, and having for its objects to simplify the valve mechanism, to render the igniter more reliable, to improve the means for cooling the piston, and to provide simple and efficient means for starting the engine—is not described apart from a series of detail drawings accompanying the specification.

Manufacture and Purification of Alkaline Cyanides.—Wilton, T., of Beckton. No. 24,307; Dec. 6, 1899.

This invention relates to the manufacture and purification of alkaline cyanides—such, for example, as cyanide of potassium, sodium, and so forth—by a method whereby in the manufacture it is possible to separate or dissociate the alkaline cyanides from mixtures or compounds containing them, and so obtain cyanides of a higher commercial purity and at but little expense.

The patentee states that he has found that liquefied ammonia gas (NH_3) has the property, when properly applied to mixtures containing alkaline cyanides, of dissociating (by dissolving out therefrom) either the cyanides or the impurities present with them, according to which is the most soluble. Liquefied ammonia gas is a solvent which does not in any way injure the cyanide, and has a selective action in dissolving out certain salts; and it is this special property that he utilizes. In carrying out the invention, the mixture containing the cyanide or cyanides is subjected, when in a reduced or powdered condition, to the action of the liquefied ammonia gas under suitable pressure; and to render the process continuous, the ammonia is evaporated from the dissolved portion, whether it be the cyanide or the impurities, and then recondensed in a coil ready for re-use, while the separated cyanide is left in a highly purified state.

The form of apparatus employed, and its mode of operation, are exactly similar to that specified in patent No. 27,559 of 1898 (*ante*, p. 271). Substitute the word "cyanide" for "anthracene" in the above-named description of the illustration, and the patentee's meaning is clear. He concludes his specification by saying: "The process will, as above indicated, vary according to the particular cyanide under treatment. For instance, in the treatment of potassium cyanide, when it is less soluble than the impurities with which it happens to be mixed, the cyanide will remain in the first vessel, while the impurities will be deposited in the lower vessel D; and as the solubility of different cyanides varies, it will be obvious that the same method can be used for the purpose of dissociating or separating them from each other. For example, cyanide of potassium may be separated from cyanide of sodium by fractional solution; the latter being more soluble in liquefied ammonia gas. The process is applicable to all alkaline cyanides; the above instanced being examples of the process and the mode of application."

APPLICATIONS FOR LETTERS PATENT.

887.—Abel, C. D., "Gas-engines." A communication from the Gasmotoren Fabrik Deutz. Jan. 15.
905.—Graetz, A., "Burners for light carburetted hydrogen gas." Jan. 15.
910.—Knapp, W., and Steilberg, R., "Production of compressed gas." Jan. 15.
1049.—Vaillant, J., "Gas-regulator for water-heaters." Jan. 17.
1085.—Hagger, W. T., "Column or post lamps." Jan. 17.
1086.—Paterson, B., "Prepayment gas-meters." Jan. 17.
1093.—Abel, C. D., "Gas-engines." A communication from S. L. y Fernandez. Jan. 17.
1097.—West, J., "Charging machine for gas-retorts." Jan. 17.
1235.—Hautier, C., "Gas-engines." Jan. 19.
1241.—Clay, C., "Conveyors." Jan. 19.
1262.—Crowther, A., "Gas-burner." Jan. 20.
1292.—Jensen, P., "Gas-lamps." A communication from V. Margonari. Jan. 20.
1297.—Vickery, A., "Conduits for underground pipes." Jan. 20.
1311.—Sheftel, M., "Mantles for lighting by incandescence." Jan. 20.

Faversham Town Council and the Water Company.—A Committee appointed by the Faversham Town Council to consider the desirability of purchasing the Water Company's undertaking have received an intimation from the Local Government Board to the effect that they would not be prepared to sanction a loan for the purchase of the undertaking, as the Company are supplying Oare (an outlying parish) with water. The Company have just completed a reservoir capable of storing a million gallons of water, and are boring a well at a depth of 120 feet.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Projected Amalgamation of the Gas Institute and the Institution of Gas Engineers.

Sir,—It will be within the knowledge of many of your readers that certain steps have of late been taken towards bringing about the much to be desired reunion between the Gas Institute and the Institution of Gas Engineers; and some information as to the progress that has so far been made in this direction will doubtless be of interest.

The Councils of the two Institutions have, after careful consideration, arrived at the conclusion that, provided satisfactory rules can be formulated governing the qualifications of members, reunion is desirable. They have, therefore, each nominated five members to form a Joint Committee for the consideration of the whole matter, and for the drawing up of an amended set of rules.

This Committee has already held one meeting, at which it is pleasing to note great unanimity prevailed. It is proposed that the result of its deliberations, together with a copy of the proposed rules, shall be laid before the two Councils at an early date; and, if they are considered satisfactory, the whole matter will be brought forward at the annual meetings of the two Associations in May and June next, and propositions submitted for the dissolution of both Associations, and the formation of a new and combined society.

It was at first thought that the procedure in the case of those members of the Gas Institute who are engaged in trade would form the main difficulty; but, from information laid before the Committee, it appears that this is not likely to prove so formidable a stumbling-block as was anticipated, for it is understood that the majority of such members are so desirous of seeing the amalgamation effected that, rather than put any obstacle in the way of its accomplishment, they are willing to resign their membership forthwith.

Of course, no final steps will be taken until the whole question has been thoroughly discussed by both Institutions; and it is the intention of the respective Councils to send to each member prior to the general meeting, a copy of the suggested rules, and of the proposals dealing with the question of dissolution and re-formation.

J. W. Helps and A. Dougall,
for
Jan. 26, 1900. The Joint Committee.

The Recovery of Cyanogen from Coal Gas.

Sir,—In the "Journal," No. 1913, of Jan. 9, an article with the heading "Dr. Bueb's Cyanide Recovery Process" has appeared. In the article it is admitted that my process, in some essential points, differs from the Rowland process; but at the same time it is suggested that my process is identical with the one which for some time past has been in use at Beckton. As it is further said that, until my publication became known, the Beckton process has been kept secret, I can as regards publications on this process only refer to Mr. Methven's presidential address at the meeting of the Institution of Gas Engineers in 1893, which you also mention in your article.

On that occasion Mr. Methven verbally said: "Ammonium ferrocyanide is consequently produced in the washer; and the solution is then removed to the products works, where by a special process the prussian blue is obtained." Therefore, according to Mr. Methven's communication, a compound closely characterizing the ammonium ferrocyanide, and this in solution, is being recovered. By my process a double salt, of a molecular composition totally different from ammonium ferrocyanide, as precipitate in the form of a solid compound, is gained. Here is a contradiction which requires clearing up before it can be sustained that the process as worked at Beckton and mine are identical. If I am rightly informed, the several works of the Gaslight and Coke Company do not employ special apparatus for separating the tar (the Pélouze apparatus); and the separating of the tar is effected in tower scrubbers together with a partial separation of ammonia. Experience has shown that my process can only be carried out at works where the gas, after having been condensed, passes directly through a dry tar separator, and then immediately (with its full contents of ammonia) into a cyanide washer. The previous passing of the gas through a tower scrubber causes so much loss of ammonia, that it renders my process impracticable. It would be interesting to know whether at the different works of the Gaslight and Coke Company the tower scrubbers have now been removed, and, if this is the case, since when.

Your article concludes by saying that with the Beckton process a separation of liquid from the precipitate does not take place; and it is also presumed that the same applies to my process. I beg to state that this is not so. The Gaslight and Coke Company being, however, as shown in the present case, in the habit of concealing their methods of working, there is for the present no reason for my entering into further details as to my process.

If I consider the leading position which the Gaslight and Coke Company pretend to occupy in gas matters, I cannot understand how this Company could have foregone taking out a patent for their mysterious process of recovering cyanides. By doing this, the Company could have shown that they were actually working by a new process quite apart from securing thereby to themselves greater advantages than by wrapping themselves up in a mystery.

Dessau, Germany, Jan. 25, 1900. Dr. T. Bueb.

Sir,—As a contribution to current literature on the above subject, I have read with great interest the *résumé* which you recently published in the "Journal" on Dr. Bueb's cyanide recovery process. Up to the present time, the recovery of cyanogen products does not appear to be accompanied by any profitable return; but any fresh attempts in this direction must be welcomed as at least of scientific interest, if not of commercial value.

There is perhaps but little criticism to offer as to rival processes; but, with all deference to Dr. Scharrer, he seems to me to pose quite as much

as an advocate of the Bueb process, as an exponent of scientific facts. The most interesting fact to learn as to the practical working of cyanogen recovery, is that, by a comparatively simple process, the cyanogen in coal gas can be totally eliminated in the marketable form of potassium ferrocyanide. The method is clear up to the detail of the treatment of the sludge and liquor for the production of the finished product; but with regard to this no particulars are given. Dr. Scharrer is, however, very strong in his claims for eliminating cyanogen from coal gas, apart from the commercial value of the eventual product obtained; and it is in this that his statements are open to criticism. He is, of course, speaking all through upon Continental practices in purification, &c., and his experiences are evidently derived from this source.

Categorically the claims of the benefits derived from purifying gas from cyanogen are as follows, with special reference to the Bueb process:

1. That the free cyanogen which is inevitably present in gas made and purified in the ordinary way, is "taken up by the water in the gas-holder tank, which is thereby rendered poisonous, or it corrodes the plates of the holder and the meter drum, and may even be consumed with the gas."

2. That by the adoption of the special process, a portion of the ammonia is removed from the gas, which "relieves the ordinary scrubbing plant, and the yield of ammonia is increased."

3. Moreover, "the oxide may be far more completely exhausted than hitherto in the removal of sulphuretted hydrogen from the gas, as it has only this (its proper) function to perform, and is not partially utilized in absorbing cyanogen and ammonia."

4. At gas-works in which the process has been in use for a year, "the spent oxide has been found to contain over 50 per cent. of sulphur."

There are other minor details which need not be noticed; but it may be stated, with regard at least to current experience in English works, that as far as the knowledge of the writer extends no poisoning of the water of gasholder tanks or of corrosion of gasholder plates and meter-drums has ever been traced to the presence of cyanogen; and even if "consumed with the gas," there is no special harm in the combustion products (nitrogen and carbon dioxide).

Further, although the elimination of cyanogen is inevitably accompanied with the removal of a corresponding amount of ammonia, this cannot be claimed as a material advantage in relieving the ordinary scrubbing plant or in increasing the yield of ammonia. Efficient scrubbing plant is capable of removing the whole of the ammonia in a comparatively costless way, without employing such an expensive adjunct as sulphate of iron.

With regard to the duty of oxide on sulphuretted hydrogen, there cannot be much mischief from cyanogen and ammonia, considering that it is customary to work up the oxide before sale to from 50 to 60 per cent. of sulphur on the dry basis.

Taking into general consideration the whole question of the Bueb process, it appears to me that the value of the elimination of cyanogen by this method is solely dependent on the market value of the cyanides obtained.

H. Leicester Greville.

Jan. 23, 1900.

The Boston Retort-Oven Gas Plant.

Sir,—In your issues of Nov. 7 and 14, 1899, you published two articles based on my previous publications in "Progressive Age." It is with a great deal of pleasure that I notice that the "Journal" has taken a kind and earnest interest in our enterprise. I think, therefore, you may wish to look over the short article published in the issue of Jan. 1 of "Progressive Age," where a few data regarding the quality and quantity of the surplus gas are given.* It only remains to be added that up to the present time steady improvements have been made, even over the figures given in the article. The quantity of gas produced has been increased to almost 4000 cubic feet per gross ton of coal. The illuminating value remains between 18 and 19 candle power. It is expected to still further improve the quantity obtained per gross ton of coal. The amount of purified gas supplied to the gas-works is 3,500,000 cubic feet per day. The mains connecting the plant with two other Gas Companies are now being filled.

On p. 1176 of the "Journal" a few remarks are made regarding which I beg to offer some information. It is stated that the slack coal from Cape Breton enters the United States on the basis of 15 c. duty per gross ton. It was omitted to state accurately the amount of drawback allowed by the United States Government for export shipments of coke. You say: "The amount is not stated, so that we cannot say whether or not it is sufficient to be called a bounty." The amount of drawback, as fixed by the United States Custom-House, is arranged upon the basis that all the products obtained by the distillation of one gross ton of coal will share in the total drawback of 15 c. (less 1 per cent. for Custom-House expenses); so that the amount of drawback allowed on coke is fixed by the percentage obtained, and must be less than 15 c. I will not occupy any more of your space by figuring this in detail.

Furthermore, it should be mentioned that the price of gas as charged by the Massachusetts Pipe-Line Gas Company is 20 c. per 1000 cubic feet of 12-candle power gas. As the Pipe-Line Company are now furnishing a gas of very much higher candle power, they expect to receive a higher price, based upon a fixed valuation per 1000 candle feet.

The fact that the gas is not sold directly by the New England Gas and Coke Company to the consumers is cited as a "curious illustration of the complexity of the financial side of this enterprise." The gas situation in Boston—*i.e.*, the so-called "Gas War" between the several factions, to control the gas supply of the city of Boston and its suburbs—has truly been a perplexing one; but this has absolutely nothing to do with the operations of the New England Gas and Coke Company. The Company manufacture a gas of high candle power as a bye-product of its extensive coal carbonizing operations. They sell this gas to the Massachusetts Pipe-Line Gas Company, who in turn sell it to the local Gas Companies at a price lower than these Gas Companies can produce it by either the coal or water-gas processes. It is a matter of indifference to the New England Gas and Coke Company, who control the gas-works in and around Boston, because their market for this gas is assured as long as they are in a position to continue the manufacture of gas at a lower cost.

Mr. Whitney's motives in separating the Massachusetts Pipe-Line Gas Company (as the distributing agent) from the New England Gas and Coke Company (as the producing agent) can be easily understood. The Gas Companies in Massachusetts are under the control of the Board of Gas and Electric Light Commissioners of Massachusetts. If Mr. Whitney's entire scheme had depended upon the sanction of any State Board, it is certain it never would have been carried out. Such gigantic and novel departures can be called into existence only if private enterprise is unhampered by State Boards, whose conservatism would soon exhaust even the greatest amount of energy available in a single man.

The plan upon which the New England Gas and Coke Company were conceived and carried out, involved no risk whatever that their failure would result in any additional burden to the gas consumers. On the contrary, their failure would have resulted only in a great loss to Mr. Whitney and his associates. In case, however, the plant would be a success, great benefit to the community would be the immediate result. This has already been evidenced by the reduction in price of gas made by the Companies which purchase their gas from the Massachusetts Pipe-Line Gas Company. Herewith is their announcement in full—

"The undersigned hereby give notice that, having arranged with the Massachusetts Pipe-Line Gas Company for the purchase of coal gas at a lower price than that for which they have hitherto been able to manufacture it, they will supply coal gas in place of water gas whenever the said Massachusetts Pipe-Line Gas Company is ready to furnish it. From and after that time, the price of gas used for fuel, when supplied through a separate meter, will be 75 cents per 1000 cubic feet; when used in gas-engines, of a type to be approved by the Company furnishing the gas, 1½ cents per horse-power-hour, up to 100 horse-power; in engines from 100 to 200 horse-power, 1 1/10 cents per horse-power-hour; in engines of 200 horse-power and over, 1 cent per horse-power-hour; for gas supplied to gas furnaces, of a type to be approved by the Company furnishing the gas, 50 cents per 1000 cubic feet. All interested parties are requested to communicate with the undersigned at their several offices, who will be pleased to give information in regard to the kind of apparatus best adapted to accomplish a satisfactory result.

Brookline Gas Light Company, by E. G. Storey, Treasurer.
Dorchester Gas Light Company, by F. P. Addicks, Treasurer.

The Jamaica Plain Gas Light Company will join in the prices above named, and will reduce its price for illuminating gas from $1.25 to $1 per 1000 cubic feet whenever the Massachusetts Pipe-Line Gas Company is prepared to supply the gas for which the Company has already contracted.

Jamaica Plain Gas Light Company, by E. N. Foss, Treasurer."

This reduction has actually gone into effect on Jan. 1; and the Jamaica Plain Gas Light Company are now selling illuminating gas for $1 per 1000 cubic feet.

You also have some misgivings regarding the possibility of establishing a satisfactory market for the large quantity of coke produced by the New England Gas and Coke Company. The article in the issue of Jan. 1 of the "Progressive Age" states with what success the coke has met in New England. "*L'appetit vient en mangeant.*" The New England Gas and Coke Company cannot supply the demand for coke which they have created; and a large extension of the plant is under consideration.

There is a strange confusion of facts in the statement regarding the sale of the Everett works to the Dominion Iron and Steel Company of Nova Scotia. Neither Mr. Whitney nor Mr. Elkins is in any way discouraged regarding the result of the plant. On the contrary they are very enthusiastic over its present achievements and future prospects.

Mr. Whitney is also President of the Dominion Iron and Steel Company who are now building an enormous blast-furnace and steel plant at Sydney, Cape Breton. This Company will draw their coal supply from the same source—*i.e.*, the Dominion Coal Company—as the New England Gas and Coke Company.

Mr. Whitney has placed with the United Coke and Gas Company the contract for the erection of another plant of 400 Otto-Hoffmann ovens at Sydney, for the Dominion Iron and Steel Company, which plant is now in course of erection, and will be completed in the fall of this year. This has probably caused the confusion in your statements. The gas from these coke works will be consumed by the steel plant in its open-hearth furnaces.

There is also a remark on p. 1176 regarding the disposal of the tar produced by the New England Gas and Coke Company. The entire tar production is sold to the National Coal Tar Company for five years. This is not a "daughter concern" of the New England Gas and Coke Company. The parties interested in the New England Gas and Coke Company have absolutely no interest in the National Coal Tar Company. It is a *bonâ-fide* sale, based on current prices of tar in this country.

It is easily understood that tar distillers and roofing paper manufacturers were somewhat disturbed by the news of the impending production of tremendous quantities of tar at Everett. Consequently, the New England Gas and Coke Company asked the writer to prepare plans for their own tar distillation works, which were immediately commenced, when the offer from an independent tar concern was made which resulted in this sale at a figure satisfactory to the Coke Company.

You will excuse my being explicit on all these points, because a great deal of maligning has been done for the purpose of impeding the progress of the New England Gas and Coke Company. Ordinarily, no attention has been paid to any incorrect statements; but it is not our desire to see these enter the columns of your paper without correction on our part.

In conclusion, we want to state that many pages can be filled with descriptions and statements about the Everett works; but they will not convey a true conception of the magnitude of the enterprise. In case you or any of your readers will not shun a trip to Boston, they may be assured of a cordial welcome, and we will gladly permit an inspection of the plant.

The United Coke and Gas Company.
per Dr. F. Schniewind.

Everett, Mass., U.S.A.,
Jan. 9, 1900.

The Water-Gas Plant at Halifax.

Mr. T. Holgate, the Engineer and Manager of the Halifax Corporation Gas-Works, writes, in reference to the statement in the "Journal" for

* The article referred to by our correspondent was reproduced last week, p. 205.—Ed. J.G.L.

the 2nd inst. (p. 45) as to the non-completion of the carburetted water-gas plant there being due to the fact that "the contractors were behind with their work," that the mode of expression employed might possibly lead some of our readers to suppose that the Economical Gas Apparatus Construction Company, Limited, were the "contractors" referred to. This is not the case. The enlargement of the plant has involved the employment of many firms, who have had difficulty in obtaining material; and this consequently delayed the execution of the work. It was to this general fact that Mr. Holgate referred in the interview we reported.

Wet Lime Purifiers for Carburetted Water Gas.

Mr. G. W. Anderson, of Caterham, asks if any of our readers can inform him whether wet lime purifiers have been tried for carburetted water gas; and, if so, with what result?

PARLIAMENTARY INTELLIGENCE.

PRIVATE BILLS (SESSION 1900).

Opposition on Standing Orders.

On Tuesday last, the final day for depositing memorials complaining of non-compliance with Standing Orders in the case of the remaining Bills in the General List of Petitions, no memorials had been received in respect of those in which our readers are interested. The following Bills will not, therefore, be opposed on Standing Orders: Lymington Corporation Gas and Electric Supply Bill, British Gaslight Company (Staffordshire Potteries) Bill, Fishguard Water and Gas Bill, Mid-Kent Water Bill, Edinburgh District Lunacy Board Bill, Spalding Urban District Council (Water) Bill, Paignton Urban District Water Bill, Gaslight and Coke, Commercial Gas, and South Metropolitan Gas Companies Bill, Glyncorrwg Urban District Council Gas Bill, Lee Conservancy Bill, Otley Urban District Council Water Bill, Morley Corporation Bill, Newtown and Llanllwchaiarn Urban District Gas Bill, Hemel Hempstead Corporation (Water) Bill, Woodbridge District Water Bill, Salford Corporation Bill, South Metropolitan Gas Bill, Gwyrfai Rural District Council Water Bill, Rugeley Gas Bill.

The memorials complaining of non-compliance with Standing Orders in the case of the petitions for the South Essex Water Bill and the South Essex Water Board Bill have been considered by the Examiners, who decided that the allegations had not been sustained. Last Friday, the memorial of Mr. John Griffiths, complaining of non-compliance in the case of the petition for the London Water (Welsh Supply) Bill was considered. The alleged non-compliance consisted in the omission from the books of reference of properties of which the memorialist is owner, and affected by the scheme, and the absence of the necessary written application to him with respect to those properties; and, further, the failure to deposit plans, &c., with the Clerk of the Parish Council of Guarafog, in which the properties are situated. In the course of the inquiry, it transpired that notices had been served on Mr. John James Griffiths, of Highbury, the father of the memorialist, with regard to certain properties, including those in question. Mr. J. Griffiths said the property had been in his hands for seven years. Mr. Cripps, who appeared for the promoters (the London County Council), submitted that they had complied with the Standing Orders in naming the "owners or reputed owners." A referencing expert stated that the people in the neighbourhood told him that the ownership of the various properties was vested in "Mr. Griffiths down at the hotel." That was Mr. J. J. Griffiths. He had heard nothing of Mr. John Griffiths. The Examiner said he considered that, under all the circumstances, the promoters were quite justified in regarding Mr. John James Griffiths as the reputed owner of the properties. He declined to sustain this allegation of the memorial; and the others were not proceeded with.

Shifnal Water Supply.—At a recent special meeting of the Shifnal District Council, a report of the Joint Committee to consider the East Shropshire Water Company's Bill was presented. It stated that there were great differences of opinion on the subject in the several districts comprised in the proposed area; and it was resolved that the Special Committee be empowered to join with the other Committees of the Dawley and Oakengates District Councils in securing expert engineering and legal advice upon the Bill—the Clerk of each Council to submit a case to the Engineer and Counsel employed; it being provided that the Shifnal Council should pay one-third of the costs incurred.

The Spalding Water-Works Purchase Bill to be Proceeded With.—Last Tuesday, a town's meeting was held at Spalding, to consider the question of the purchase by the town of the undertaking of the Spalding Water-Works Company. The Chairman of the Urban District Council presided, and moved a resolution sanctioning the Council's Bill for the purchase of the undertaking. It transpired that a provisional agreement has been made with the Directors of the Company for the purchase of the undertaking, which is now awaiting confirmation by the shareholders. Until the matter had been before the shareholders, it was not thought desirable to state the amount of the purchase price, but it was calculated that not more than £26,000 or £27,000 would be required to cover the total expenses. The loan was proposed to be repayable over a period of fifty years, which would require an annual payment of £1150 to cover instalments of principal and interest. The income from the works had been about £1000 a year—leaving £150 a year to be raised by a rate of 1½d. in the pound. It was thought that a rate of a few pence for a few years might be necessary, but that afterwards the increased revenue would cover the expenditure. The resolution authorizing the Council to proceed with the Bill was unanimously adopted. It was mentioned that very considerable improvements were contemplated in connection with the water-works—both as to the quantity and the quality of the supply—if the undertaking were acquired by the town.

MISCELLANEOUS NEWS.

THE GASLIGHT AND COKE COMPANY.

The Half-Yearly Report and Accounts.

The following is the report of the Directors of the above-named Company for the six months ending Dec. 31, 1899, which, with the accounts for this period, will be presented to the proprietors at the half-yearly general meeting next Friday:—

The accounts for the past half year show that, after providing for the fixed charges, there remains a balance available for distribution of £560,663 15s. 1d., out of which the Directors recommend a dividend on the ordinary stock at the statutory rate of £4 18s. per cent. per annum, carrying forward the sum of £193,333 8s. 4d. to the credit of the current half year.

The Directors report with great satisfaction a material increase in the sale of gas during the half year. The quantity sold was 10,764,044,000 cubic feet, which compares with 10,259,258,000 cubic feet sold in the December half year, 1898; showing an increase at the rate of 4·92 per cent.

The improvement in the sale of gas has been accompanied by an equally satisfactory improvement in the revenue from residual products, with the result that, while the additional cost of coal, as compared with the figures of the corresponding half year, has been £92,154, the increase in the returns for residuals has been £110,091.

In consideration of the improved condition of the market for coke and other residuals, the Directors in October last resolved to reduce the price of gas to private consumers in their district north of the Thames by 1d. per 1000 cubic feet as from the 1st of January inst.

In common with all other large users of coal, the Company has experienced very great difficulty in obtaining the quantities of coal which had been purchased for delivery during the past half year, and this has resulted in a serious depletion of the stocks. Fortunately the quantity of coal purchased was in excess of the Company's immediate requirements; and it has not been necessary to restrict on any occasion the full supply of gas throughout the Company's district.

The present condition of the coal market is a cause of anxiety to the Directors, for, while they do not believe that the specially high prices which have been quoted during the past month or two fairly represent the market value, they cannot anticipate any extension of their existing contracts except at some advance on the current contract prices.

The Directors have deposited a Bill for raising, by 3 per cent. debenture stock, £2,500,000 additional capital to meet the expenditure necessary to provide for the extension of the Company's business. The provisions of the Bill are in all respects identical with those of the Bill which passed the House of Commons in May last. In compliance with Standing Orders, this Bill will be submitted to the proprietors, for their approval, at a special meeting to be held after the close of the ordinary meeting.

In August last, negotiations were commenced between the Directors of this Company and those of the South Metropolitan Gas Company for the sale to that Company of so much of this Company's undertaking as is comprised within its district south of the Thames. For the consideration of this question, a friendly conference between the Directors of the two Companies was subsequently held, and this was followed by correspondence; but up to the present time no agreement has been arrived at. The price offered on the part of the South Metropolitan Company was, in the opinion of the Directors and responsible officers of this Company, inadequate; while that asked on the part of this Company was held by the Directors of the South Metropolitan Company to be excessive. Under these circumstances, with a view to arriving at a settlement, the Directors of this Company proposed that the question of price should, within certain limits, be the subject of a reference to arbitration. But the Directors of the South Metropolitan Company have declined to entertain the idea of such a reference; and there the matter for the present rests. As, however, the South Metropolitan Company has deposited a Bill in which permissive powers are sought for the purchase of the southern portion of this Company's undertaking, there will doubtless be further opportunities for discussing the whole subject.

The Bill above referred to, and that deposited by the London County Council "for making further provision as to testing the illuminating power of gas" and for other purposes, will receive very careful watching on the part of the Directors, with a view to safeguarding the interests of the Company.

Mr. Chisholm and Mr. Stoneham, the Auditors of the Company, retire. Mr. Stoneham offers himself for re-election. Mr. Chisholm has notified that, on the ground of ill-health, he does not intend to seek re-election; and Mr. P. H. Ashworth and Mr. J. J. Walker, both being duly qualified for election, have respectively given notice of their intention to become candidates for the vacancy thus created.

The accounts accompanying the report consist of the usual statements. The total amount of capital authorized is: Share, £21,642,990; loan, £4,323,975—together, £25,966,965. Of this amount, £25,516,965 had been called up on the 31st of December, and the addition of £1,603,050 of premium capital made a total of £27,120,015. The expenditure on capital account in the past half year is shown in the following items:—

Expenditure to June 30, 1899			£12,749,020 14 11
Expenditure during the half year to Dec. 31, 1899, viz.:—			
Buildings and machinery in extension of works	£9865 14 1		
New and additional mains and service-pipes	22,877 5 0		
Do. do. meters	28,077 19 7		
Do. do. stoves	26,061 17 3		
	£86,882 15 11		
Cr. by sale of surplus land	11,048 7 1		
		75,834 8 10	
		£12,824,855 3 9	
Nominal amount added on conversion		13,656,465 0 0	
		£26,481,320 3 9	
Balance of capital account		638,694 16 3	
		£27,120,015 0 0	

The revenue and net revenue accounts are given below.

The balance applicable for division is £560,663 15s. 1d.; and the statement showing how the Directors propose to appropriate it is as follows:—

Dec., 1898.			
£51,855	..	Net balance brought from last account	£139,557 19 0
364,641	..	Net revenue for the half year	421,105 16 1
£416,496			£560,663 15 1
(12½ per cent.)		A dividend on the ordinary stock—	
£362,737	..	£4 18s. per cent. per annum on £14,993,075 . .	367,330 6 9
£53,759	..	Balance carried to next account	£193,333 8 4

The three statements relating to the reserve, insurance, and depreciation funds show that the balances on Dec. 31 were as follows: Reserve fund, £51,224; insurance fund, £83,492; depreciation fund, £53,895. The insurance fund had to bear during the past half year a payment of £59 16s. 8d., the value of plant destroyed by fires in the Company's district.

The statements furnishing particulars as to working are as follows:—

STATEMENT OF COALS USED, ETC.

Description of Coal.	In Store, 30th June, 1899.	Received during Half Year.	Carbonized during Half Year.	Used during Half Year.	In Store, 31st Dec., 1899.
	Tons.	Tons.	Tons.	Tons.	Tons.
Common . .	119,463	1,003,398	977,626	1,530	143,705
Cannel . .	18,686	4,844	*6,111	4	17,415
Total . .	138,149	1,008,242	983,737	1,534	161,120

* In addition to this quantity of cannel 4,498,100 gallons of oil and spirit have been used during the half year.

STATEMENT OF RESIDUAL PRODUCTS.

Description.	In Store, 30th June, 1899.	Made during Half Year.	Used during Half Year.	Sold during Half Year.	In Store, 31st Dec., 1899.
Coke—tons	25,191	612,760	138,942	463,478	35,531
Breeze—tons.	384	64,873	18,414	42,610	4,233
Tar—gallons	784,601	10,092,554	9,807,514	21,439	1,048,202
Ammoniacal liquor—butts	32,383	286,892	292,127	..	27,148

STATEMENT OF GAS MADE, SOLD, ETC.

Quantity Made.	Quantity Sold.		Total Quantity accounted for.	Number of Public Lamps.
	Public Lights and under Contracts (estimated).	Private Lights (per Meter).		
Thousands.	Thousands.	Thousands.	Thousands.	
*11,424,876	549,952	10,214,092	10,920,463	52,522
†10,928,545	542,772	9,716,486	10,403,251	52,345

* Including 1,438,592,000 cubic feet of "oil gas." † December half year, 1898.

The last statement is the general balance-sheet. It shows that the value of the stores on hand on Dec. 31 was as follows: Coals, £114,013; coke, £24,329; tar and ammoniacal liquor and products, £112,418; sundries, £254,596—total, £505,356. The figures at the corresponding period of 1898 were: Coals, £163,174; coke, £17,125; tar, &c., £91,625; sundries, £263,979—total, £535,903. The item "automatic meter supplies (fittings account)" amounts to £289,604, as compared with £299,902 in the six months ending Dec. 31, 1898.

DR. REVENUE ACCOUNT. CR.

Dec. Half Year, 1898.		£ s. d.	£ s. d.	Dec. Half Year, 1898.		£ s. d.	£ s. d.
	To Manufacture of Gas—				By Sale of Gas—		
£634,037	Coals, including oil, dues, carriage, unloading and trimming . . .	723,191 3 9		£1,439,043	Common gas, per meter, at 3s. and 2s. 1d. per 1000 cubic feet .	1,505,404 13 6	
14,411	Salaries of engineers and other officers at works	14,454 10 2		77,538	Public lighting and under contracts— Common gas	74,076 0 1	
160,274	Wages, carbonizing £161,684/15/5			£1,516,611			1,579,480 13 7
16,870	,, sundries . . £17,348/14/1	179,033 9 6		20,179	Rental of stoves	..	22,197 11 5
37,511	Purification, including £16,959/11/10 for labour.	35,183 19 10			Residual products—		
153,587	Repair and maintenance of works and plant, materials and labour, less received for old materials, £3536 12s. 6d.	178,975 17 5		£254,486	Coke, less £43,035 16s. 7d. for labour, &c.	321,181 14 2	
			1,133,843 0 8	6,200	Breeze, less £2,237 4s. 10d. for ditto	9,007 13 6	
	Distribution of gas—			43,151	Tar and tar products	68,885 5 1	
32,095	Salaries and wages of Officers (including Rental Clerks) . .	34,348 14 9		67,500	Ammoniacal liquor and sulphate of ammonia	82,353 1 9	
46,819	Repair and maintenance of mains and service-pipes	43,101 11 7		£371,337			481,427 14
25,505	Repair and renewals of meters .	22,038 19 3		£4,442	Rents receivable		4,635 4 8
28,685	Stove fixing, repairs, and renewals	30,525 18 9		216	Transfer fees		238 17 6
			130,015 4 4				
	Public lamps—						
17,348	Lighting and repairing	..	16,044 17 11				
	Rents, rates, and taxes—						
5,909	Rents payable	6,153 12 1					
110,397	Rates and taxes	118,229 13 11					
			124,383 6 0				
	Management—						
2,750	Directors' allowance	2,750 0 0					
200	Company's Auditors and Assistant	252 10 0					
10,945	Salaries of Secretary, Accountant, and Clerks	10,945 17 0					
19,741	Collectors' commission	20,425 8 11					
7,668	Stationery and printing	6,964 5 5					
3,635	General charges	3,487 5 4					
			44,825 6 8				
702	Parliamentary charges	..	..				
1,056	Law charges	..	633 10 7				
4,907	Bad debts	..	5,431 12 0				
500	Depreciation fund for works on lease-hold lands	..	500 0 0				
12,427	Annuities	..	12,933 0 11				
2,500	Workmen's Compensation Account .	..	2,045 12 4				
	Public Officers—						
1,254	Gas Referees and Official Auditor.	1,438 9 4					
856	Public testing-stations	1,241 13 5					
			2,680 2 9				
£1,952,589			1,473,334 14 2				
560,196	Balance carried to net revenue account		614,885 7 6				
£1,912,785			2,088,220 1 8	£1,912,785			2,088,220 1

DR. NET REVENUE ACCOUNT. CR.

Dec. Half Year, 1898.		£ s. d.	£ s. d.	Dec. Half Year, 1898.		£ s. d.	£ s. d.
	To Interest on debenture stock and						
£61,160	bonds, accrued to Dec. 31, 1899 . .	..	66,429 12 6	£414,592	By Balance from last account	506,888 5 9	
75,999	Dividend on the preference stocks. .	75,999 4 0			Less dividend on the ordinary capital		
45,500	Dividend on the 3½ per cent. maximum stock	45,500 0 0		362,737	for the half year to June 30, 1899 .	367,330 6 9	
			121,499 4 0				139,557 19 0
9,896	Interest on temporary loans & sundry funds		5,870 14 11	51,855			
416,496	Balance applicable to dividend on the ordinary stock.		660,663 15 1	590,196	Revenue account	..	614,885 7
£612,051			754,443 6 6	£612,051			£754,443 6 6

The Projected Purchase of the Newtown Gas-Works by the District Council.—Yesterday week a town's meeting was held at Newtown (Montgomeryshire), to consider a resolution approving of the propriety of the promotion of a Bill in Parliament to empower the Council to supply gas, and to purchase the undertaking of the Newtown and Llanllwchaiarn Gas and Coke Company, Limited, and for other purposes. One of the ratepayers moved that the Council take no action at present, and referred to the proceedings of the Council in relation to the purchase of the water-works. Since the purchase of the gas-works had been before the Council, matters had seriously changed for the worse in his opinion, and he doubted if the ratepayers generally were in favour of further proceeding with the Bill. Eventually, however, the resolution approving of the Bill was carried; three members only voting against it.

Pudsey Gas Company.—The Directors of this Company report the satisfactory increase of 8 per cent. in the consumption of gas during last year. An interim dividend was paid at the rate of 8¾ per cent. per annum on the new consolidated 7 per cent. stock; and a similar dividend for the past half year is recommended. During the twelve months, above 121 million cubic feet of gas was sold; and the income was £20,208.

The Foulger-Glover Torch Syndicate, Limited, has been formed with a capital of £5000, in £10 shares, to acquire certain inventions specified in an agreement made with Mr. G. F. L. Foulger and Mr. J. Glover relating to improvements connected with the lighting of incandescent and other lamps. The first Directors are Messrs. R. T. Glover, J. G. Glover, G. F. L. Foulger, and W. Sugg. Mr. Foulger and Mr. Glover are Managing Directors.

RATES AND GAS AND WATER CHARGES IN PROVINCIAL TOWNS.

Mr. James Carter, Borough Treasurer of Preston, and Hon. Secretary of the Association of Borough Accountants, has sent us a copy of his tabulated statistics of the rates levied and the charges made for gas and water in a number of provincial towns. There are 71 in all, the populations in which range from 668,645 (Liverpool) down to 21,937 (Stafford); the rateable values in these towns being the highest and the lowest—£3,910,369 and £73,007. The places with the highest rates are Dewsbury, 8s. 6d.; Middlesbrough and Norwich, 8s. 5d.; and West Ham, 8s. 2d. Belfast and Rotherham come next with 7s. 9d.; Sheffield with 7s. 8½d.; Wolverhampton with 7s. 8d.; Brighouse and Stockton-on-Tees with 7s. 5d.; East Ham and Preston with 7s. 4d.; Northampton with 7s. 3½d.; Leicester and Southampton with 7s. 3d.; Macclesfield with 7s. 2d.; Stafford with 7s. 1d.; Nottingham with 7s. 0½d.; and Coventry, Leeds, Oldham, and Plymouth with 7s. The rates in 22 places range between 6s. and 7s. in the pound; and in 26, between 4s. and 6s. The lowest-rated place is Lancaster, with 3s. 8d. in the pound. Out of the rents of property and profits transferred from municipal undertakings, Carlisle relieves the rates to the extent of 2s. in the pound; Wigan coming next with 1s. 10d.; Darlington with 1s. 7½d.; Stafford with 1s. 4½d.; Stockport with 1s. 3½d.; Blackpool with 1s. 1d.; and Lancaster with 1s. The following places receive the smallest relief per pound from the municipal profits: Accrington, 1·8d.; Dewsbury, 1·75d.; Eastbourne, 1·375d.; Blackburn, 1·25d.; West Hartlepool, 1·125d.; St. Helens, 1d.; Portsmouth, ½d.; and Sunderland, 0·4d. The highest net charge for gas is at Preston—3s. 1½d. per 1000 cubic feet—where the total rates amount to 7s. 4d. in the pound; and there is relief to the extent of 8d. The lowest is at Carlisle—1s. 3d per 1000 cubic feet—where the rates are 5s. in the pound; the relief from the municipal undertakings (including the gas and water works) being 2s. in the pound. Besides Carlisle, there are only six places in the list where the price of gas is below 2s.—viz., Sunderland and York, 1s. 11d.; Sheffield, 1s. 10d.; Newcastle and Gateshead, 1s. 9·6d.; and Plymouth, 1s. 9d. The supply in these cases is in the hands of Companies. The charge for water for domestic purposes, on a house of £15 rateable value, is highest at Rochdale—2s. in the pound, where the rates come to 6s. 8d. in the pound, and the relief is 8½d. Here there is a deficiency of 1½d. in the pound on the water-works. The price is lowest at Liverpool—7½d.; Leamington and Manchester following closely with 8d., Reading with 10·8d., Bootle with 10·5d., South Shields with 10·4d., and Birkenhead, Salford, and Southampton with 10d. Besides Rochdale, there are only five places where the charge is above 1s. 6d. in the pound—viz., at Ashton-under-Lyne, 1s. 11d.; Blackburn, 1s. 7·2d.; Chester, 1s. 8d.; Darwen, 1s. 7·2d.; and Huddersfield, 1s. 8d.

LARGE GAS-WORKS EXTENSIONS AT BLACKPOOL.

Local Government Board Inquiry.

Some considerable extensions at the Blackpool Gas-Works have been projected; and an application having been made to the Local Government Board for sanction to borrow £86,020 for the purpose, an inquiry into the matter was held last Wednesday. The Town Clerk (Mr. T. Loftus), in stating the case for the Corporation, mentioned that the proposal was to practically duplicate the present works. In 1894, the capital of the undertaking was £98,739; now it was £144,000. In 1894, 245,000,000 cubic feet of gas was made, and last year 427,000,000 cubic feet. In the first year the department handed over to the relief of the rates £5229, and last year £10,700. The rateable value had increased from £220,175 to £387,600. Mr. John Chew, the Gas Engineer, detailed the plans; the works being erected on the east side of the railway. It was proposed to spend £10,000 upon carburetted water-gas plant. Questioned by Mr. Tomlinson, a member of the Town Council, Mr. Chew said there was a great deal of difference of opinion as to the use of carburetted water gas. Addressing the Inspector, Mr. Tomlinson favoured the greater use of carburetted water gas. Though only 25 per cent. was about the proportion used in this country, 75 per cent. was allowed in America. Where the works were proposed to be built, there was a very large population, who were anxious as to any nuisance that might arise from the works. Some members of the Council, he said, were favourable to the gas-works being removed to an entirely new site. Mr. Chew said to do this would mean a loss of £100,000, and the raising of the price of gas 6d. per 1000 cubic feet. There was no opposition.

THE AUXILIARY GAS-WORKS FOR COVENTRY.

Arbitration as to the Purchase of Land.

Last Thursday, at St. Mary's Hall, Coventry, Sir John Rolleston, of Leicester, sat as Umpire in a dispute between the Corporation Gas Committee and the Coventry General Charities Trustees, as to the price to be paid for land at Foleshill, which, under statutory powers, the Corporation desire to acquire for the purposes of auxiliary gas-works. The area of the land is about 26 acres. Mr. H. Yorke Stanger, Q.C., and Mr. P. Atkin represented the Corporation, and Mr. Hammond Chambers, Q.C., the Trustees. Mr. Chambers contended that the land was especially valuable, as it had on one side the main road from Coventry to Nuneaton, was near the canal and railway, and was passed by an electric tram service. It was well adapted for the erection of artisans' dwellings, factories, and workshops, and was now let to a yearly tenant at £45—a rate which must very quickly increase. He placed the value at £5500. Mr. W. P. Evans, Agent to the Newdigate Estates, thought that, including the percentage added for compulsory purchase, and considering there was coal underneath the land, it was worth £5559. Mr. Stanger strove in cross-examination to prove that a previous offer of the Trustees was very much less than the value now placed by them on the land. Mr. Chambers remarked that the previous offer was made without prejudice, and had been withdrawn. Mr. Stanger urged that, according to the geological survey, no coal was under the land. Mr. Joseph Ashley, auctioneer, considered that, exclusive of 10 per cent. for compulsory purchase, the land was worth £5086. Mr. T. Clements, auctioneer, made his estimate £5525, and believed, if the Trustees waited their opportunity, they would obtain even more than that. Mr. Stanger held that the valuation put upon the land was a speculative and excessive one when the rental was but £40 or £45 per annum. From £1500 to £1700 was the value which his witnesses placed upon it. Mr. T. S. Fallows, auctioneer and valuer, Birmingham, estimated the value at about £1600. It was purely agricultural land, and not suitable for building purposes. He placed no value on the belief that there was coal under the land. Mr. W. F. Pudmore, estate agent, considered the value to be about £1685, and Mr. W. J. Watson, auctioneer, placed it at £1750. Addresses by Counsel concluded the inquiry.

HARTLEPOOL GAS AND WATER COMPANY.

Consolidation and Increase of the Capital—Sale of Shares.

A Special Meeting of the shareholders of the Hartlepool Gas and Water Company was held last Thursday, to consider the provisions of the proposed Bill for the consolidation and conversion of the existing capital, and for raising additional gas capital of £200,000. The Chairman (Mr. W. H. Fisher) said it was proposed that the various classes of shares should be consolidated and converted into uniform stock, bearing interest at the rate of 5 per cent., in such a way that the shareholders would remain in relatively the same position as before. Thus a total capital of £480,000 in four different classes of shares bearing interest at 5, 7, 7½, and 10 per cent. would become £699,000 of uniform 5 per cent. stock. The Directors also asked for power to raise additional gas capital because they had nearly exhausted the amount at present authorized. They had but 1000 shares unsold, and 500 of these had only just been disposed of by auction, and the other 500 would be offered shortly. The sum thus raised would just about pay for the works they had in hand at the present time for making carburetted water gas. But if the present rate of increase went on, they would have to tackle a much greater expenditure for a second coal-gas works on the new site. Last year there was an increase on the previous twelve months of 44 million cubic feet of gas consumed; and during the first half of the present financial year, there had been a further increase of 11 million cubic feet. The provisions of the Bill were then read and explained; and by a unanimous vote they were approved.

At the sale of the 500 £10 shares referred to by the Chairman, the prices realized varied between £17 17s. 6d. and £18 3s. 6d.

GAS MATTERS AT MIDDLESBROUGH.

It may be remembered that some months since, the Middlesbrough Corporation Gas Committee asked the Council to sanction an increase in the price of gas. The reason given was that the advance in the price of coal and other materials necessitated an increase in the price of gas, in order to make the income equal the expenditure. At the time several members of the Council thought it would be better to put on 6d. instead of 3d. per 1000 cubic feet; and (according to the "Northern Echo") at the meeting of the Gas Committee last Wednesday it is understood a report was submitted by Mr. Corbet Woodall, the Consulting Engineer for the extensions taking place at the gas-works, that suggests even 6d. increase would be inadequate. Mr. Woodall, it is said, practically condemns the large gasholder tank on the Marshes, concerning which so much discussion has raged for several years. Unfortunately the position is precarious, because of the deficiency of gasholder storage. The daily output is about 2½ million cubic feet; and the reliable holder can only contain 1 million cubic feet. Mr. Woodall therefore urges the Committee to proceed at once with the erection of another gasholder, incorporating a part of the present one. As an alternative, he suggests building a small one for safety; and then taking down the large tank and re-erecting it after consolidating the foundations. As it will take two years to erect a new tank, it seems obvious that no time should be wasted; and as a matter of fact, the Committee instructed the Manager (Mr. David Terrace) to report further on the matter. Mr. Woodall also describes the system of mains as defective, particularly with regard to the maintenance of an equal illuminating power; and he makes various suggestions, which he believes would have the effect of improving the supply along the riverside and in the busiest parts of the town. This, of course, means additional expense. The Committee, says our contemporary, ought to renew mains and service pipes perhaps more frequently than is done in other towns; for Middlesbrough lying so low and level there are many places where the soil being saturated renders the life of the pipes so much shorter. The Engineer also thinks the lighting of the streets compares unfavourably with other towns, and would like to suggest that the use of incandescent lights would prove successful, and not cost any more. The report, as a whole, seems to point to considerable further expenditure on the gas undertaking; and the impression is that the past has not altogether borne its fair share of the burden.

THE RETORT-HOUSE DISASTER AT STOKE.

Inquest on the Second Victim.

On Monday of last week, Mr. Hugh W. Adams, the Deputy-Coroner, held an inquiry, at the North Staffordshire Infirmary, into the circumstances attending the death of James Wheatley, a bricklayer, who had succumbed to the injuries received in the accident which occurred at the Stoke-on-Trent Corporation Gas-Works on the 10th inst. The evidence was practically the same as that given at the inquest on the body of Plumb, who it will be remembered was killed instantly, and in whose case the Jury returned a verdict of "Accidental death" (see *ante*, p. 156). In the course of the evidence last Monday, it was stated that the new retort-house was being erected under the direction of John A. Garside, a foreman in the employ of Messrs. R. Dempster and Sons, Limited, and a man of considerable experience. The walls were up, and

seven principals were in position. About noon on the 10th inst., a sudden gust of wind came; and the principals fell towards the south side of the building. By this collapse Plumb was killed, and the deceased and several other men sustained serious injuries; these proving fatal on the 18th inst. in the case of Wheatley. Ephraim Heath, foreman bricklayer, in the employ of Mr. Embrey, stated that the walls of the new retort-house had been up about two weeks before the principals were put on. He did not think the mortar had properly set, because the weather had been so bad. At the same time he did not think the walls had given way. He had had experience in this kind of work; and, in his opinion, the principals were not secured properly, or the accident would not have happened. He thought it was quite possible for the gust of wind to blow the principals over. There were no diagonal strappings fixed. In his evidence at the other inquest, and confirmed by him at this, Garside said that at the foot of each principal two holes were introduced for bolting; but he had not considered the bolts necessary in this case. The Jury came to the unanimous decision that the accident was brought about by negligence on the part of the erector in not properly fixing the girders. They thought that none of the girders should have been put up until properly bolted. The Coroner: There are different degrees of negligence. The Foreman: We think the foreman was to blame in putting up the girders without staying them. In further reply to the Coroner, he said the Jury did not think it was a case of gross negligence; and their verdict was one of "Accidental death." The Coroner intimated that he would add to this the Jury's expression of opinion.

In the minutes adopted at the meeting of the Stoke Town Council last Thursday was an expression of the sympathy of the Gas Committee with the widows and relatives of Peter Plumb and James Wheatley.

EXPLOSION AT THE NEWARK (N.J.) GAS-WORKS.

A Meter-House Wrecked.

A correspondent sends an account of a somewhat serious explosion that occurred during the evening of Tuesday, the 9th inst., at the gas-works at Newark (N.J.), U.S.A. The meter, purifying, and condensing house was torn to atoms; the windows in houses and stores for blocks were broken; and the alarm created spread to all parts of the city. What caused the explosion is not known, as there was no one in the building at the time. The structure was of brick, 100 feet long, 60 feet wide, and about 60 feet high, but had only one floor. It formed an L with the main building and ran along the Morris Canal from Congress Street. The building was visited about once an hour to inspect the working of the automatic machinery and appliances in it; but no one had been in it for upwards of three-quarters of an hour before the explosion took place. In the main building and retort-house adjoining many men were at work. The explosion threw the south wall of the building into the canal, filling it with brick rubbish. The roof flew upward and outward, and landed some distance from the site of the building. The explosion was followed by a flash of flame so brilliant that it was seen from every engine-house in the section; and before an alarm had been turned on the firemen were on their way to the scene, guided by the glare. The prompt arrival of the firemen kept the flames from spreading; but the burning gas gave the firemen much trouble, and they had an all-night job. A peculiar feature of the explosion was that while the walls and roof of the building were wrecked, the force does not appear to have worked inward; and although covered with *débris* most of the apparatus in the building continued to perform its duty, and only a few sections of the city were left without gas. This leads to the belief that one of the meters blew up and wrecked a few other pieces of machinery in the building, together with the structure itself, but left the rest of the machinery intact. The loss to the Company will be about $20,000; and the damage to buildings in the neighbourhood, $5000.

Our correspondent adds: How the escaping gas was ignited is a mystery, as there were no open lights in the room. The place was lighted from lanterns in the walls. It is thought, however, that the glass in one of the lanterns must have been cracked. Or the leak may have come from a broken gauge glass. In his own works the glasses occasionally break; and so, as a precaution, he has the cocks to the gauges always turned off at night.

SINGULAR GAS POISONING CASE AT WEDNESBURY.

Two Ladies Suffocated—A Doctor's Testimony.

News of a distressing case of gas poisoning comes from Wood Green, Wednesbury. In this instance, the lives of two ladies were lost—Isabella Francis (aged 82) and Monica Minnie Tuthill (aged 19), respectively mother-in-law and daughter of the Rev. R. G. Tuthill, Vicar of Wood Green. The two ladies resided at the vicarage, and occupied the same bedroom. They retired to rest about 10.30 on the night of Friday, the 19th inst.; and as they did not appear by breakfast time the following morning, a sister of the younger lady went to their room for the purpose of calling them. Receiving no response, she raised an alarm; and deceased were then discovered to be dead. The gas-jet in the room was found alight, and there was a strong smell of gas. At the inquest held by the District Coroner (Mr. H. A. Pearson) on Monday last week, Dr. Walter Garman (whose evidence was of an interesting character) stated that he was called to the vicarage before ten o'clock on Saturday morning, and found Mrs. Francis and Miss Tuthill both dead. The room smelt strongly of gas when he arrived, although he understood the door had been open about forty minutes. He was of opinion that Miss Tuthill had died quite recently; but Mrs. Francis appeared to have been dead longer. The peaceful expression and attitude of both the deceased were such as to show that they had died painlessly and in their sleep. In his opinion, death was due to asphyxia, slowly produced by prolonged breathing of gas-laden air. Deceased would be almost imperceptibly poisoned. In answer to the Jury, witness said death was due to ordinary coal gas. The carbon monoxide had displaced the oxygen, and had thus produced death. There was nothing improbable in gas being present while there was a faint glimmer of light in the room. He agreed that there might easily have been an explosion, but the explosive mixture of air and gas was a peculiar one, and required a definite proportion of coal gas before the explosion point was reached. The air might be highly charged with gas, and quite capable of destroying life, without reaching a point when it would ignite; and this had been the case here. Witness had followed this point up carefully, and found there would be some diffusion going on, as there was a passage up the chimney. The escape of gas might have been, and apparently was, slow; and the diffusion which went on was sufficient to prevent it ever reaching the explosion point. Another matter which had struck witness was that there was a thick carpet all over the bedroom floor except under the bed; and if the gas escaped underneath the boards and found itself shut in by a thick carpet, it would probably travel to the bed, where there was no carpet, and the occupants of the bed would have the gas thick about them, while it would diffuse into the air elsewhere. He thought this appeared to exactly account for the way in which death occurred in the present instance. He could not express an opinion as to whether, had the bedroom door been left open, the effect of the gas would have been nullified; but a very little more oxygen only was needed in the room to have warded off death sufficiently long to have enabled some means to be taken to restore animation. It was a rate of poisoning which required eleven hours to do its work. Witness understood there had been difficulties experienced with the gas; and it was possible that a syphon had been left turned on. Eliza Price, housekeeper at the vicarage, stated that on Friday night the gas-lights all suddenly went out; and witness attended to the meter by putting water in it. Miss Monica and a sister turned off all the jets, and afterwards relighted them. There was a gas-syphon underneath the boards in the room which deceased occupied; and she thought the younger woman might have been attending to this. A police-superintendent stated that he went to the vicarage about 10.30 on Saturday morning, and observed there was a strong, though not an overpowering, smell of gas in the bedroom in question. In a far corner of the room, he saw a loose board, underneath which was the syphon referred to. On kneeling down, he came to the conclusion that gas was oozing out from this loose board. The syphon was turned off; and, having satisfied himself that there was no volume of gas, he struck a light, with which he examined the joints, but could detect no leakage. James Tidey, gas-fitter, spoke to examining the gas-pipes, and to finding no leakage whatever. He tested the meter for two hours, and obtained conclusive proof that all joints and taps were sound. The Jury returned a verdict of "Accidentally suffocated." But the point from which the gas actually leaked remains a mystery.

ELECTRIC LIGHTING NOTES.

On Friday Mr. W. A. Ducat conducted a Local Government Board inquiry at Birkenhead into an application by the Corporation for power to borrow £3500 for the purpose of extending the electric light to various roads in Higher Tranmere. There was no opposition.

Under the heading of "The Spasmodic Illumination of the Streets," a letter appears in one of the Plymouth newspapers complaining of the eccentricities of the arc lamps. "The remedy is simple enough," says the writer; but this hardly seems to be the case, for the complaints have now continued for four months, and the town, according to the writer of the letter, is still in semi-darkness.

At a meeting of the Parliamentary and Bye-Laws Committee of the Newcastle Corporation last Tuesday, reference was made to an application to Parliament from an Electric Lighting Company for power to supply electric light at Whickham and other places in the district. As it was considered that the promoters would also seek powers to carry their lines through the streets of the city, it was decided to take steps to oppose the application. There was a feeling that the Corporation would, in time, be able to supply such places themselves.

The Electrical Engineer of Belfast (Mr. V. A. H. M'Cowen) has submitted to the Corporation Electric Lighting Committee his annual report It disclosed the interesting fact that the increase in the number of units sold during the past year was 76 per cent.; while the increase in revenue was only 1 per cent.—thus indicating a considerable reduction in the charge for current. The average price for current for lighting during the year was 4½d. per unit, and for power purposes 2¾d. per unit. The number of lamps applied for and connected up amounts to above 58,000.

"Industries and Iron," referring to the recent failures of the electric light in Marylebone and elsewhere in London, says: "The County Council has power to require that the Gas Companies shall maintain their light at a certain standard; and frequent official tests are made to secure that end. Something of the same kind is becoming necessary with regard to the Local Authorities and Companies now professing responsibility with regard to electric lighting. They should be required to bring their plant to such a point that it can deal with the maximum demand that is likely to occur."

The "Municipal Journal" considers that until the Electric Lighting Companies bring down their charges, they are not going to make much advance in public street lighting in those districts of London where they have already secured a foothold. In Kensington, the Vestry have been considering for some time whether to allow the two Companies within their area to light some of the main roads. Although the price to be charged for public lighting has been provisionally fixed by Parliament at not more than 2½d. per unit, the Vestry regard this figure as being still too high. Until more favourable terms can be obtained, the Vestry are being urged by their Works Committee "to look for the improvement of the street lighting in the parish to the increased adoption of incandescent gas lighting."

Under the heading of "The Light that Failed," the "Municipal Journal" has an article on the recent interruptions of the electric lighting in Marylebone and Paddington. It is only in these two parishes that the Metropolitan Electric Supply Company have an absolute monopoly; but our contemporary remarks that "there has been sufficient inconvenience in them to suffice for the whole of London." The following particulars are given of the failures last December in the drapery establishment of Messrs. Lewis and Co., in Oxford Street and Hollis Street: Dec. 6, 4.40 to 7.50 p.m.; Dec. 7, 4.45 to 5.15 p.m.; Dec. 8, 5.20 to 7.30 p.m.; Dec. 11-14, 4.0 to 8.0 p.m.; Dec. 15, 3.0 to 4.0 p.m. The

cause of the interruptions on the 6th and 7th is given as "main fuse;" "no current" being entered against the other dates.

Mr. J. H. Rider, the Engineer of the Plymouth Corporation electric lighting works, has been kind enough to warn the consumers that they will have to pay for the luxury in which some of them have been indulging freely during the last quarter. The accounts for this period are about to be sent out, and he is of opinion that they will frighten a good many people. But the fright will, he thinks, do them good. When they have had a heavy bill, they will learn to be economical in the use of the light, and will turn the current off when it is not required. To people who have been accustomed for years to the unstinted use of cheap gas, the turning of the lights on and off will be a new experience; while to tradesmen who have the electric light in their shops and windows, the lesson—sharp as Mr. Rider says it will prove—will be of no avail. They must keep the lights on during the lighting-up time in business hours.

For the purposes of the electric lighting undertaking, the St. Helens Town Council require an additional £20,000; and Mr. A. W. Ducat, of the Local Government Board, last Thursday inquired into an application for leave to borrow this sum. The Town Clerk (Mr. G. W. Bailey), in sketching the history of the concern, said the Council first undertook electric lighting in 1896; and on April 24 in that year obtained sanction to borrow £10,000 for putting down experimental plant on the alternating-current system at the gas-works in Warrington Old Road. On Oct. 16, 1897, a further £16,500 was sanctioned; but only about £4000 of that sum was expended at Warrington Road, when it was decided to change from the original scheme, and erect an electricity station at Cropper's Hill, in order to supply current on the continuous system for both lighting and traction purposes. In connection with this project, they had spent £2956 more than the sums borrowed; and they desired a further sum—£17,043—for extensions of the station and plant. Since the Corporation adopted electricity, the business had rapidly developed. In 1896 they started with 15 consumers and 1686 lamps; and in December last year they had 150 consumers and 10,612 lamps. Mr. J. S. Highfield, the Corporation Electrical Engineer, detailed the proposals as to extensions.

The administration of the Bath Corporation electric lighting works must be in a bad way if the severe criticism which Mr. W. F. Gould passed on it at the last meeting of the Town Council has a good foundation. He compared an analysis of their returns for the year 1898 with the returns of other corporations, showing that the cost and quantity of coal used was excessive; that in oil, waste, &c., the expenses were only exceeded in one other town (Coventry); that the works costs were higher than any in London, and were only exceeded by five other towns; that every unit burnt in the public lamps meant a loss; and that the item for management, salaries, legal expenses, and insurance was only exceeded in four other places. He thought careful inquiry should be made with a view to reducing the expenditure, and moved, as an amendment to the adoption of the Committee's minutes, that the Chairman be asked to appoint a small Committee to deal with this matter. The amendment, however, was ruled out of order by the Mayor. Alderman Taylor, replying, pointed out that in 1898 the electric light works were in a transitory state; and the expenses were necessarily heavy. The report for 1899 would be brought forward as soon as possible; and he asked the Council to wait for it before appointing a Committee of Inquiry.

The commotion of the past year or two at Walker over the electric lighting question has not been altogether calmed by the bestowal of powers of supply on the District Council in preference to the Gas Company; for now that the former are proposing to exercise their newly acquired authority, a formidable opposition has arisen against them doing so. This was made amply clear by the proceedings at an inquiry conducted by Lieut.-Col. A. C. Smith, on behalf of the Local Government Board, in respect to an application by the Council for permission to borrow £23,356 for an electric lighting and dust destruction scheme. The Clerk (Mr. T. M. Sturgess) laid before the Inspector an account of the contests which the Council have had during past years to keep in their own hands the right to furnish electricity in the town. He then pithily described the objects of the comprehensive scheme which the Council purpose undertaking as being (1) to efficiently deal with the refuse; (2) to supply electricity to private consumers; (3) to supply cheap power to various manufactories; and (4) to provide a complete system for the public lighting by means of electricity, at a cost no higher, and probably less, than that at present paid to the Gas Company. The proposals of the Council could not have been put more nicely; but, notwithstanding, when the Inspector asked if there was any opposition, quite a string of gentlemen representing important interests popped up. Mr. George Irving opposed on behalf of the North-Eastern Railway Company, who are large ratepayers. Mr. Samuel Alexander and Mr. Wigham Richardson appeared in opposition, as did also Mr. John Brown, who presented a petition, which he said had been got up hurriedly, from the ratepayers in the district. He had not had one refusal to sign it; and he was certain that 90 per cent. of the property owners were against the scheme. Mr. Henry White was present to oppose on behalf of the owners of the Walker Colliery, and Mr. R. S. White for Messrs. Sir W. G. Armstrong, Whitworth, and Co. They made out a substantial case in support of their opposition.

On Tuesday last, there was a conference at the Manchester Town Hall of representatives of the Municipal Corporations affected by the Lancashire Electric Power Bill. The Lord Mayor of Manchester (Mr. Thomas Briggs) presided; and nearly every corporate borough in the county south of the Ribble was represented, as well as Preston. The leading part in the speech-making was taken by Alderman Higginbottom, Chairman of the Electric Light Committee of the Manchester Corporation. He said the Bill had undergone some alteration since last year; but it was equally objectionable. As far as Manchester was concerned, the Corporation had instructed the Committee to oppose at every stage. Under clause 5, the promoters sought to put away what had been granted to corporations by Act of Parliament; and for this clause alone the Bill ought to be opposed. Under clauses 35 and 36, the promoters said that, with the exception of a main distributing-feeder which they wanted to carry through a borough, they did not propose to supply any consumer in such borough without the consent of the corporation. They held that they ought not to have a private Company running mains at a high voltage through their streets. In Manchester, claims were made against the Corporation in cases where they had any short circuits or explosions. Supposing a private Company had a main running through the streets with a pressure of 10,000 volts (from which the Corporation obtained no benefit whatever), if they had a short circuit or a blow-up, who was to decide whether it was in the Corporation's or the Company's main? Clauses 41 and 42 were alarming when looked into. It was quite plain from them that, if the Company's main ran down a street where there was a public building, and the "person or company" owning such building wished to be supplied from the main, the Company could take a supply into the building without cutting through the street. Corporations had been granted powers by Parliament; and had in many cases expended very large sums of money belonging to the citizens. Neither they who had exercised their powers, nor those who at present held those powers in abeyance, ought to be submitted to the opposition of private firms. The Bill said a corporation might supply in opposition to the Company; but what chance would a corporation have of so doing after the Company had become established? Parliament had hedged the powers of corporations round about with very stringent regulations; and they ought to be protected against interference from private companies. The Association of Municipal Corporations were going to fight three other Bills besides the Lancashire one—those affecting Tyneside, South Wales, and Dublin; and he hoped they would have the same success with regard to them as they had in their opposition to the Electrical Bills of last year. He moved—"That this conference of Municipal Corporations within the area comprised in the Lancashire Electric Power Bill, protests against the same as contravening the principle for which municipal corporations have in past years successfully contended, and which have been established by the Tramways Act, 1870, and the Electric Lighting Acts of 1882 and 1888, and determine to take united action in opposition to the Bill." The Mayor of Wigan (Mr. J. T. Gee) seconded the motion, which was carried unanimously. It was agreed that copies of the resolution be forwarded to the Prime Minister, the First Lord of the Treasury, the President and Secretary of the Board of Trade, to all the Lancashire members of Parliament, to all the Municipal Corporations of the United Kingdom, and to the Secretaries of the Associations of Municipal Corporations and of Urban District and Rural Councils. An Executive Committee were also appointed for the purpose of giving effect to the resolution, with power to apportion the expenses among the various Corporations comprised in the conference. The Executive Committee were also authorized to consider the provisions of similar Bills on this subject affecting other parts of the kingdom, and to take part in conferences which may be held in reference to any Electricity Bills promoted in Parliament in the present session. The Lord Mayor of Manchester was appointed Convener of the Committee.

THE FINAL REPORT OF THE METROPOLITAN WATER COMMISSION.

As recorded in the "JOURNAL" last week, the final report of the Royal Commission on "Water Supply within the Limits of the Metropolitan Water Companies" was published on the 22nd inst. We have already given an epitome of its contents, and the portion containing the principal recommendation of the Commissioners. In the present and succeeding issues we shall give a full abstract of the report.

The Commission was appointed by the Home Secretary (Sir Matthew White Ridley) on May 1, 1897; the Commissioners being Viscount Llandaff, the Right Hon. J. W. Mellor, Sir J. E. Dorington, Sir G. Barclay Bruce, Mr. A. de Bock Porter, C.B., Major-General A. de Courcy Scott, R.E., Mr. H. W. Cripps, Q.C., and Mr. R. Lewis. They were to inquire—

1.—Whether, having regard to financial considerations and to present and prospective requirements as regards water supply in the districts within the limits of supply of the Metropolitan Water Companies, it is desirable in the interests of the ratepayers and water consumers in those districts, that the undertakings of the Water Companies should be acquired and managed either (*a*) by one authority, or (*b*) by several authorities; and, if so, what should be such authority or authorities. To what extent physical severance of the works and other property and sources of supply of the several Companies, and the division thereof between different local authorities within the limits of supply, are practicable and desirable; and what are the legal powers necessary to give effect to any such arrangements.

2.—If the undertakings are not so acquired, whether additional powers of control should be exercised by local or other authorities; and, if so, what those powers should be.

3.—Whether it is practicable to connect any two or more of the different systems of supply now administered by the eight Metropolitan Companies; and, if so, by whom, and in what proportion, should the cost of connecting them be borne, and what are the legal powers necessary to give effect to any such arrangement.

Viscount Llandaff accepted the position of Chairman of the Commission; and the first meeting took place on May 29, 1897. The public sittings were held for the most part weekly, with intervals, until March 23, 1899, when the inquiry closed, and the Commission proceeded to consider their final report—they having, in compliance with a request from the President of the Local Government Board, issued on the 19th of January last year an interim report dealing with the third subject of the reference.

After the inquiry had closed, the Commissioners had the misfortune to lose two of their colleagues—Mr. H. W. Cripps and Major-General Scott—by death. The latter, however, was able to supply them with a full statement of his views on the subject of the inquiry; and they largely availed themselves of the valuable assistance thus afforded. The report, therefore, only bears the signatures of Viscount Llandaff, Mr. Mellor, Sir J. E. Dorington, Sir G. B. Bruce, Mr. A. de Bock Porter, and Mr. R. Lewis; but its recommendations may be taken as those of the entire Commission.

At their first meeting, the Commission considered the question of the manner in which their proceedings should be conducted. They decided that their sittings for the reception of evidence should be open to the public and to the Press, and that the parties concerned in the inquiry should not be represented by Counsel. Upon the latter decision becoming known, however, they received pressing applications, both from the

Metropolitan Water Companies and the London County Council, to reverse their ruling in this respect; and they modified their decision to the extent that Counsel were allowed to appear, on the understanding that they should only examine witnesses, or address the Commissioners on any points deemed desirable. The Commissioners immediately placed themselves in communication with, and invited evidence from, the Water Companies, the County Council, the Corporation of London, and the County Councils of Middlesex, Surrey, Kent, Essex, and Hertfordshire; these being the Authorities, within the area of Water London, primarily affected. They also afforded an opportunity to the Vestries and District Boards of Works within the County of London of either giving evidence orally, or of expressing their opinions in writing. Out of a total of 42 Authorities communicated with, 28 replied. The Commission first heard the views of the London County Council, then those of the City Corporation. Having completed the evidence of the Authorities within the County of London, the Commission proceeded to hear that of the five surrounding counties whose areas are partially within Water London. All the Urban and Rural District Councils whose areas were in any way affected were communicated with; but these Authorities, however, in the majority of cases, decided to leave their interests in the hands of their County Councils. The Commission next proceeded to hear the evidence called on behalf of the Water Companies. During the course of their inquiry, they found it necessary to make several applications to the Companies for information as to their supply and works. These requests, the Commissioners say, were "very readily complied with;" and they received from the Companies all the information they desired to obtain. They examined the Chairman and officials of each Company, with the exception of the Chairman of the Lambeth Company, and also (at great length) Mr. R. E. Middleton, one of the Engineers of the Staines Reservoirs Scheme, as well as the following Engineers: Mr. Walter Hunter, Sir Frederick Bramwell, Mr. Charles Hawksley, and Mr. E. M. Eaton. Sir William Crookes and Professor Dewar, who daily analyze and bacterially test the water supplied by the Companies, likewise gave evidence. The late Sir Edward Frankland, Mr. Allen Stoneham (the Government Auditor), the Chairman and Engineer of the Thames Conservancy, and the Clerk to the Lea Conservancy Board, were also called.

The Commissioners met on 84 days, 64 of which were occupied in hearing evidence; the number of witnesses examined being 79.

After these explanatory statements, the Commissioners offer some preliminary observations on certain considerations of great weight on the subject of the purchase of the London water undertakings, which appeared to them to be excluded from their inquiry. They point out that the Duke of Richmond's Commission in 1869 expressed the opinion that the control of the water supply of London and the expenditure of rates should not be in the hands of a trading company, but that, on various grounds of public policy, the supply should be under public control, and entrusted to a responsible public body. It was urged upon the Commission that Parliament had made a clear pronouncement in favour of the policy of purchase by the decisions of various Committees, by the numerous cases in which corporations had been empowered to purchase local water undertakings, and by legislation—such as the Chamberlain's sinking-fund clauses, which expressly contemplate purchase of the London Companies' undertakings. It was said that there was a popular demand and sentiment for the control of the water supply by the consumers, or by a representative body, which could only be satisfied by purchase; that the close connection between public health and the water supply strengthened the feeling in favour of the municipalization of the water supply; that purchase would put an end to the continual and costly inquiries into the water question which had been going on for so many years; and that the argument in favour of purchase was especially cogent in London, because the Water Companies had evaded the system of competition which Parliament intended, and because the London system of re-valuation had unduly swollen water charges based on rateable value. On the other hand, it was argued that it was preferable, especially in London, to rely upon the interested energy of private enterprise, rather than upon any municipal or statutory body, for dealing with the water supply; and that it was inexpedient that any representative body, largely elected by the working classes, should, by taking over the water supply, become large employers of labour. Other similar views were expressed. The Commissioners conceived that they had not to decide between, or indeed to consider, these views of public policy, except in so far as they might have any bearing upon the questions referred to them. They were appointed, they say, to determine, as accurately as possible, "the expediency of purchase in the interests of ratepayers and water consumers, on financial grounds, and with regard to the future as well as the present requirements of Water London."

At an early period of the inquiry, it became necessary for the Commissioners to consider whether it was their duty to re-open any of the questions dealt with by Lord Balfour's Commission of 1892-3; and they came to the conclusion that it was not. At their sitting on Dec. 6, 1897, they announced that, speaking generally, they accepted the findings of that Commission. This decision had the effect of excluding a good deal of evidence which the county of Hertford and the London County Council were desirous of adducing to controvert the conclusions come to by Lord Balfour and his colleagues. But while that Commission reported, in effect, that the sources available within the watersheds of the Thames and the Lea were adequate in quantity and quality for a period of forty years from the date of their appointment, they had not to consider, and did not consider, the cost of providing from those sources the requisite additional supplies. Since 1891, two or three periods of prolonged and unprecedented drought have occurred, which, no doubt, showed that in such years it would be much more costly and more difficult than had previously been supposed to procure from the Thames and the Lea the necessary supplies; and the County Council contended that, on financial as well as on general grounds, it was better to go at once to certain sources in Wales which their Engineer had examined. The Commissioners felt bound, therefore, to embark on the inquiry whether the method of meeting the prospective requirements of Water London proposed by the Council or that advocated by the Companies was, on financial grounds, most worthy of adoption. The evidence bearing on this inquiry was voluminous and conflicting, and occupied much time. The estimates laid before the Commission differed so widely, and were of so technical a character, that they appointed, with the sanction of the Treasury, Colonel W. H. Rathborne, R.E., an Assistant-Commissioner to investigate and report upon them. His services were of great value in assisting the Commissioners to form an opinion on the cost of the competitive schemes. It was necessary to arrive at some approximate opinion on the absolute as well as the comparative cost, in order to form a judgment as to whether private companies would be capable of dealing with the financial problems of the future, or whether ownership and management by some public authority would be necessary or expedient; and also in order to estimate the financial position and the liabilities of those who would have the task of supplying the area of Water London during forty years from the date of the inquiry.

The Commissioners then deal with the financial position of the Water Companies, and the extent of their operations. They show that the ordinary stock of the Companies in 1897 was of the nominal value of £10,228,548, the market value of which, at the prices ruling at the close of the year, was £32,645,189. In June, 1898, the Companies had, besides the ordinary stock, preference stock to the amount of £801,676, bearing interest at the rate of 5 and 4½ per cent.; making a total annual interest of £39,271. They had irredeemable debenture stock amounting to £4,250,110, with an annual charge for interest, at 5, 4½, and 4 per cent., amounting to £175,557. They had debenture stock amounting to £1,109,950, redeemable at par at various dates between 1919 and 1922, the annual interest on which, at 3 and 2¾ per cent., amounted to £33,174; and the Kent Company had a mortgage of £42,000, with an annual charge, at 3½ per cent., of £1470. The preference and debenture stock and the mortgage amount together to £6,203,736, with an annual charge of £249,472; and the value of such stock on the basis of 2¾ per cent. interest, with the addition of the £42,000 mortgage, is £9,060,254. Adding the share and loan capital together, a total of £16,432,284 nominal, and £41,705,443 market value is reached. The net profits in 1897 amounted to £1,032,728; and the dividends on the shares were £973,741. The figures for net profits and dividends in 1879 were £717,470 and £733,850. The average annual dividend for the five years 1893-7 was £943,806. The amounts of back dividends claimable in March, 1897, on six of the Companies, reached a total of £5,732,856, on a share capital of £7,053,524, or more than 81 per cent.; and the Commissioners point out that it is only when these arrears have been paid, and a reserve fund built up, that any surplus profits beyond the maximum dividend in any year are directed to go in reduction of the rates charged for water. There is a sum of £5,024,500 of capital authorized, including £1,250,000 for the Staines Reservoirs Committee, but not yet issued, except as to some of the Committee's debentures.

The Commissioners experienced much difficulty in ascertaining the population served with water by the Companies in any year but that of the general census. From figures given in the report of the Local Government Board for 1898-9, it is estimated that during the year ended Dec. 31, 1898, 5,814,219 persons were supplied. According to the Companies' returns for 1898, the estimated number was 5,819,583, of which 4,478,396 were within, and 1,341,187 beyond the County of London. The area supplied is 120 square miles within, and 230 square miles outside the county. They supplied the above population with an average daily quantity of 204,053,955 gallons of water from all sources. In 1895, it was 211,986,498 gallons; in 1896, 197,988,052 gallons; and in 1897, 202,102,544 gallons. During the past 17 years, the daily average quantity supplied per head per day has varied from 30·32 gallons in 1883, to 35·43 gallons in 1897, and has shown a gradual increase.

In considering the question of purchase, the Commissioners deal first with the debenture and preference stocks and the mortgage debt of the Companies; and they express the opinion that there is no way of dealing with them except by the purchaser taking them over from the Companies. They point out that in the provincial transfers, the purchasing authority, as a rule, took over the debenture stock of the company purchased, without any provision for redeeming it. They think that irredeemable debenture stock should not be converted into redeemable stock, even if secured upon rates, without the consent of the stockholders. The redeemable stock and the mortgage should be taken over, with the same power of redemption optional on the part of the purchasing authority. The preference stock does not stand in quite as secure a position as debenture stock. It was suggested on behalf of the County Council that it would be sufficient to pay off those preference shareholders at the market price of their stock at the date of purchase. The Commissioners think it would not be unreasonable to value the stock, as a trustee stock, on the basis of 2¾ per cent. On this basis, it would be worth £1,428,036. The Commissioners say it is impossible for them to foresee how Parliament, in the event of purchase being determined upon, would deal with these different classes of stock. For the purpose of their further inquiry, they assume that they are taken over by the purchasing authority as they are, and that the total interest charge—amounting, as already stated, to £249,472, including the interest on the outstanding mortgage—has to be deducted from the gross profits available for the purchaser.

In the next section of the report, the Commissioners deal with the important question of the method of fixing the price of the undertakings; this being, they say, a necessary preliminary to determining whether or not purchase is likely to be financially advantageous to the consumers. They think it is scarcely possible, in view of what has already taken place in this direction, to expect that the price can be settled by agreement; and therefore the only other method of doing it is by arbitration. They record at length the proceedings of the London County Council in this matter, from the time of Sir Matthew White Ridley's Committee in 1891 down to last session. In order to ascertain exactly what were the views of the Council on the question of arbitration, their representative was asked, in the course of the inquiry, whether their contention was that the purchase of the water undertakings would be expedient on any, or only on certain special terms of arbitration. The answer, which was given in writing, under the authority of the Water Committee of the Council, concluded as follows: "The Council's view has been that the position of the Metropolitan Water Companies differs in many respects from that of similar undertakings with which Parliament has hitherto dealt; and its contention is that the fair value of the Companies' undertakings should be ascertained by a court of arbitration of the highest standing, with the fullest powers to inquire into all the circumstances of each individual case." The Commissioners remark that the history of

the special arbitration clauses proposed by the Council shows that they "think it necessary, in the interests of the ratepayers and consumers of water, to guard themselves against an arbitration conducted on ordinary terms under the Lands Clauses Act."

In order to appreciate more clearly the object of these special arbitration clauses, the Commissioners proceed to examine the contentions put forward to show why the purchase value of the water undertakings ought not to be ascertained by the ordinary method. They refer to the fact that much stress is laid on the point that the London Water Companies have no monopoly, but are liable to competition. The history of this matter is somewhat involved; and the Commissioners deem it advisable to review the position of the Companies from the year 1806 down to 1821, when the arrangements and agreements existing between them were all brought before a Select Committee of the House of Commons, appointed to inquire into "the past and present state of the supply of water to the Metropolis." The Committee, in their report, recognized that several of the Companies were instituted by Parliament on the principle of encouraging competition, and that none of them had any claim to exclusive privilege of any sort. But they expressed the opinion that, from the peculiar nature of these undertakings, the principle of competition required to be guarded, in its application to them, by particular checks and limits, in order to avoid ruin to the Companies, and ultimately serious injury to the public; and that the agreements and arrangements by which they had partitioned the supply of the town among themselves, "although they bore the appearance of a combination against the public, were nevertheless measures of self-preservation, without which all but one or two of the wealthiest Companies would have been extinct." At that time, the Companies were not limited in the amount they could charge for water. The Commissioners point out that the Water-Works Clauses Act, 1847, embodies an attempt to carry out the suggestions of the Committee of 1821 as to competition guarded by checks and limits; and by section 35 it creates a right in owners and occupiers of houses within the area of a company to compel the company to furnish a supply, provided their number was such that their water-rates should amount to one-tenth of the expense of laying down pipes for the required supply, and provided they severally bound themselves to take the supply for three years at least. Parliament did not, however, think fit to apply even this guarded form of competition to all the Water Companies.

Other contentions put forward by the County Council were that some of the agreements by which the Companies bound themselves not to compete were illegal, and ought not to increase the value of the undertakings; that the rates charged for water were maximum ones, and that the Companies had, in 1852, given a pledge to Parliament that these should not be charged in all cases, or even in the majority of them; and that their capital ought to be revised, on the ground that in the case of three Companies it included items which were not sanctioned by Parliament, and that in the case of all of them "it included sums which had been expended many years ago on works or plant which had been abandoned or had become obsolete, and which no longer corresponded to effective works capable of producing income." These contentions are all carefully examined, and their value appraised, by the Commissioners. With respect to the last, which is dealt with at the greatest length, they say the Council claimed that the revision should go back to the commencement of each Company, and that the capital should be cut down by eliminating all that is obsolete, and reduced to an amount represented by actual works in use at the present moment. If this contention were sound, it seemed logically to follow that the revision must take place periodically—not, perhaps, annually, but whenever there was a change of intake, or some large change with regard to a company. It was also contended that the Companies—at any rate, in the period before 1871, when the Government audit was introduced—devoted too much of their annual revenue to dividends and interest, and too little to maintenance; and that they did not charge to revenue items which ought to have been so charged. The Commissioners remark that the contentions concerning the revision of capital and income were put forward as having more relation to the question of control than to that of purchase; but "it was insisted that the arbitrator who had to determine the value of the undertakings should take into consideration, as an element, the relationship of capital to actual works, that he should have some powers of estimating the value of the undertakings upon a valuation of the works, and that he should bear in mind the circumstance that there are obsolete works, in assessing the number of years' purchase he will award." Another matter of contention on the part of the County Council was the question of back dividends and the method of raising capital by a company before the auction clauses were introduced. In regard to this, the Commissioners say the legal right of the Companies to pay back dividends to their shareholders, and to give them the benefit of the premium obtained on shares issued at par, appear to them to be incontestable.

A further matter affecting the value of the Companies' undertakings, and therefore proper to be considered in an arbitration to determine that value, was, in the view of the County Council, the method of charging for water by a percentage on the rateable value of the property supplied. The Commissioners deal with this subject at considerable length; making frequent reference to the evidence submitted to them on the point. They freely acknowledge that the rating powers of the Companies are various, and sometimes ambiguous, and that the charges they are authorized to make grow with the rateable value, although the premises remain the same. But they express the opinion that "these variations in the charges allowed by statute to the different Companies, and the supposed automatic and unwarranted rise in their profits from increases in the rateable value of Metropolitan premises, hardly supply valid grounds for attacking their revenues as inequitable." They add that "this contention could not be advanced in any arbitration without setting aside and disregarding the statutory rights of the Water Companies." The views of the Commissioners on this matter, which has been the subject of much dispute, are so definitely expressed, that we reproduce this paragraph of the report. It runs as follows:—

> Parliament, in 1847, deliberately adopted for all water undertakings the principle of paying for water "according to the annual value" of the tenement supplied; such annual value to be ascertained, in case of dispute, by two Justices. After the decision of Dobbs' case in 1883, the Act commonly called Torrens' Act was passed in 1885, declaring that the "annual value" mentioned in the Water-Works Clauses Act, 1847, should, in the unions and parishes subject to the Metropolitan Valuation Act, 1869, mean "the rateable value as settled from time to time by the local authority." This enactment was passed with full knowledge of the fact that the effect of the Metropolitan Valuation Act was to raise the rateable values of many premises. Large sums of money have from time to time been advanced on the faith of these enactments and of the Special Acts of the Metropolitan Water Companies, by which they were enabled to charge a certain percentage on the annual value of the premises supplied. It is true that the percentage has been reduced for some of the Companies; whereas in the case of the Lambeth Company, although they have been before Parliament many times since their scale of charges was fixed, Parliament has not thought fit to reduce such charges. It appears to us that any arbitration to ascertain the value of these Companies must proceed upon the basis of these statutory rights; and that the arbitrator should not take upon himself to consider whether Parliament would or might curtail them, and, therefore, to assign to the Companies a lower compensation, on the ground of the probability of such interference with existing statutory rights. And it is precisely in order to enable the arbitrator to take that course that the special arbitration clauses we are considering have been framed.

In closing their remarks on this subject, the Commissioners say they have thought it worth while to consider at some length the contentions put before them by the County Council, because they illustrate and explain the special terms of arbitration they demanded. The Commissioners are disposed to agree with the opinion expressed in the House of Commons by Mr. Chamberlain on March 24, 1896, that these terms are "so exorbitant and unreasonable that they could not be conceded by the Government or the other interests concerned," and with the opinion expressed by Sir W. Harcourt in August, 1893, in reply to a deputation, when he said: "I cannot myself accept the proposition that you could deal with the Water Companies, or any other person, by simply repealing their rights, and making their rights what you choose them to be." The Commissioners call special attention to the fact that the City of London, speaking through their Remembrancer, informed them that they had always held that they could not hope for these special arbitration terms. The Commissioners admit that there have been cases where Parliament has sanctioned such terms. For instance, under the Housing of the Working Classes Act, 1890, and under the Local Government Act, 1894, the Arbitrator is directed not to give any compensation for compulsory purchase; and in the arbitration to settle the affairs of the Chatham and Dover Railway Company, the Arbitrators were empowered to deal with contending interests as fully and effectually as could be done by Act of Parliament. The case of the Metropolitan Water Companies and their compulsory purchase does not appear to the Commissioners to be analogous to these instances. They say: "The Companies have, upon the whole, performed their duties to the public satisfactorily and well. Most of them have gone through periods of struggle and difficulty, during which the shareholders ran considerable risks, and received inadequate returns for their money. Some have now reached, and others are approaching, a more prosperous condition, by the help, no doubt, of great privileges which Parliament has given them. We see nothing which leads us to suppose that, if these undertakings are compulsorily purchased for the public advantage, Parliament will sanction any exceptional provisions, or depart from the terms of arbitration usual where the property of private persons is taken from them against their will. We shall therefore assume that, if the policy of purchase is adopted, the price of the undertakings will be determined by an arbitration conducted on the lines of the Lands Clauses Act; although, possibly in view of the magnitude of the undertakings, a different constitution of the tribunal may be adopted."

The next point considered by the Commissioners is what the financial results of such an arbitration are likely to be. They review the proceedings of the County Council in opposition to the various proposals brought forward since 1891. In a memorandum presented to the Water Committee of the Council in February, 1894, the Chairman (Mr. W. H. Dickinson), discussing the question of purchasing the undertakings of the Water Companies on arbitration terms, said he thought it must be taken for granted that the figure an arbitrator would name would not be less than £30,000,000. He said he did not see how any arbitrator could, under the present law, "do otherwise than assess the value on the basis of present income. Parliament could adopt another plan; but no other authority could do so." The Commissioners agree with Mr. Dickinson that the arbitrator "would, and should, base his estimate, in the first place, upon the existing net income of the Companies, so far as it is legally raised, and as it has been allowed by the Government Auditor from time to time." They say he ought next to consider whether that income is stable or unstable, with a view to determine the number of years' purchase which will represent its true value to the shareholder. In considering this point, any capital expenditure necessary to maintain the income would properly be taken into account; while it must be borne in mind that the Companies are under an obligation to maintain a proper supply of water for the whole of their respective districts. The shareholders ought to receive such a sum as would purchase an equally good security producing the same income. If this calculation were accurately and fairly made, it would seem that there would be neither loss nor gain to the purchaser. He would receive the equivalent, and no more than the equivalent, of what he paid. If, however, the purchaser were in a position to borrow on the security of rates as well as of water charges, and if he had the option, as he ought to have, of paying in cash the amount of compensation awarded, it might well happen that he would derive an advantage from the fact that he would be able to borrow the necessary amount at a lower rate of interest than the water shares were taken as earning.

Dealing further with this branch of the subject, the Commissioners say the purchase of the share capital of the Water Companies is not likely to be attended, under a just award, by much profit or loss. There is no doubt a chance of profit, by reason of the purchasing authority being able to borrow at a lower rate of interest than that rate at which the water income is taken by the arbitrator. Against this, however, must be set the items for prospective income and for compulsory sale; and it is not certain which way the balance would lie. But in the event of a purchase by a public authority, it has been the practice of Parliament to require that a sinking fund shall be set aside to repay the sum borrowed within a period of 60 years. Considering the magnitude of the operation and its permanent results, the Commissioners think it would not be unreasonable to allow a term of 80 to 100 years; but even if that concession were made, the financial results, they say, are serious. It

would not be prudent to calculate the accumulations of a sinking fund on the basis of more than 2 per cent. interest. On that basis, the annual sum required to redeem £1,000,000 in 60 years would be £8767 19s.; in 80 years, £5160 14s.; in 100 years, £3202 15s. These amounts, multiplied by the number of million pounds required for the purchase, represent an annual charge over and above the interest on the borrowed purchase-money. The Commissioners next inquired how far the added expense of a sinking fund would be counterbalanced by economies which could be secured by a public authority purchasing the eight undertakings. These economies were estimated by Mr. Haward, the Comptroller of the London County Council, at £50,000 a year, made up of several items. This witness put before the Commissioners a calculation intended to show how many millions the Council could afford to give, without loss, for the water undertakings. He reckoned an amount of £980,000 available for interest and sinking fund, apart from any economies the purchasing authority might be able to effect. These, as already stated, he estimated at £50,000. Adding this sum to the £980,000, he brought out an income of £1,030,000 available for interest and sinking fund. He assumed that the Council would borrow at £2 12s. per cent., and he calculated the sinking fund on the 2½ per cent. table. On this basis, the charge for interest and sinking fund on £1,000,000 would be £33,353 if repayment was to be in 60 years, £30,026 if it was spread over 80 years, and £28,312 if 100 years were allowed. The available income of £1,030,000 would therefore suffice to pay interest and sinking fund on 30·88 millions for a 60 years' term, on 34·03 millions for an 80 years' term, and on 36·38 millions for a 100 years' term. The Commissioners say Mr. Haward's figures need correction, as he has estimated his interest and sinking fund in "too sanguine a spirit." They consider that if the Council had to borrow 30 or 40 millions, the interest they would have to pay would be nearer £3 than £2 12s. per cent.; and it would not be prudent to assume that a sinking fund could be accumulated at a higher rate of interest than 2 per cent. If, therefore, interest is taken at 3 per cent., and the sinking fund calculated on the basis of 2 per cent., the annual payments per million for interest and sinking fund would be £38,768 on 60 years for repayment, £35,161 on 80 years, and £33,203 on 100 years. The income of £980,000 would thus be sufficient to pay the interest and sinking fund on 25·27 millions, 27·87 millions, or 29·51 millions, according as the term of repayment was 60, 80, or 100 years.

Another point raised by Mr. Haward to establish the financial advantage of purchase was that the income available for the purchasing authority would be the full net income of the Companies; but that, inasmuch as they had to pay considerable sums to the Chamberlain's sinking fund—sums estimated at £56,000 a year in 1901—the income which they had to sell, and on which an arbitrator ought to assess their value, would be their net income *minus* the sum payable to the Chamberlain. In Mr. Haward's view, the purchasing authority, not having to make payments to the Chamberlain's fund, would enjoy the full net income without deduction, but would pay for only the net income *minus* the deduction. The Commissioners remark that the practical effect of the sinking-fund clauses has hitherto been small, because the dates when payments to the Chamberlain become due have not arrived. They recognize that, in any Act of Parliament authorizing purchase, these clauses would have to be considered and dealt with. If the Act left them unrepealed, the purchaser, who must take over the obligations as well as the rights of the Companies, would have to continue the payments to the Chamberlain in the same way as the Companies would have done. The income to be purchased would, in that case, be smaller; but it would be the same income as that sold. The Commissioners think it is not improbable that Parliament would direct the amount accumulated in the hands of the Chamberlain, up to the date of purchase, to be employed in aid of the purchase-money; but this amount will be insignificant, if purchase takes place at an early date.

We shall deal further with the report next week.

Press Opinions on the Report.

"The Times," in the course of a leading article on the report last Tuesday, said: "What the Commission recommends is purchase by an independent and permanent authority to be created by Parliament, which should hold the whole water supply in trust for the whole population of Water London, and which should be strong enough and impartial enough to administer the whole for the benefit of all. It admits, however—and this is very interesting—that such a body, purchasing on equitable terms, and required to provide a sinking fund to repay capital and interest in 60 or even in 80 years, would encounter a deficit in the income produced by the existing rates. In other words, it would have to increase the charges to the consumer. Were it to embark upon the undertaking of bringing water from Wales, its deficit would be yet greater. But, on the other hand, were Parliament to dispense with a sinking fund, the Commission thinks that by maintaining the existing charges a purchaser would pay his way, and might effect some reduction of charge at an earlier date than that at which the Water Companies will reach their maximum dividends. The Commission sees no need for going to Wales; believing, after re-examination of this question, that Lord Balfour's Commission was right in holding the supply from the Thames fully adequate, with proper storage, for all the needs of Water London up to 1941, even supposing (what is by no means certain) that the population goes on increasing at its present rate."

The "Standard" thinks it would be too much to assume that the report represents the last word in the protracted controversy to which it is the latest contribution. But it acknowledges that it is, at all events, what it purports to be, the "final" judgment of the body appointed to investigate the question. The effect of the various recommendations is, our contemporary says, "dead against the scheme to which Spring Gardens has committed itself. The Royal Commission is in favour of expropriating the existing Companies, and of entrusting the duty of effecting the purchase, and leaving the subsequent management of the water supply, not to the London County Council, but to a permanent Water Board. . . . A more careful and practical report could not have been desired."

The "Morning Post," which, as already mentioned in the "Journal," a few months ago devoted a series of articles to the London Water Question, says: "It has long been conceded by most people that the water supply of London would have to be taken up as a public question which concerned more than the inhabitants of London; and three years ago the Government gave its pledge that it would be so taken in hand and treated. Next session we may see the findings of the Royal Commission bearing fruit. On the main question whether the existing Water Companies should continue their separate work or whether they should be bought out, the Commission pronounces for purchase and ultimate management by a single public authority. There are sufficient reasons for that decision; but one of them is not the ineptitude of the Companies, who have, on the whole, done their work well, and without question until the London County Council began ten years back to abuse them. It is further found (it might have been almost taken for granted) that the Council would not be a fit 'public authority' to take charge of the water supply—for this reason, among others, that the jurisdiction of the Council is not commensurate with the areas of the Water Companies. The reason is good enough, though some of the 'others' would be better. At any rate, it is satisfactory that the exclusion of the Council is unequivocal. The suggestion of the Royal Commission accords with our own—that there should be a Water Board in touch with the Government, if not exactly a new Government Department, on which should be conferred powers of purchase and supply."

The "Daily News" regards the report as a "very disappointing document." While acknowledging that Viscount Llandaff is "an extremely clever and accomplished man," it is said that he "lacks a judicial mind, and from the first showed a violent prejudice against the London County Council." Our contemporary says: "The County Council are the only body which has offered to purchase the property of the Companies; their credit enables them to do so; and they are, by all analogy, the right people to undertake the business. But the Commissioners decide against them, on the flimsy and inadequate ground that the area now supplied by the Companies includes Hertfordshire and parts of other Home Counties not under the jurisdiction of the Council. This is a mere question of apportionment, which could easily be settled by practical men. It is absurd that four millions of Londoners should be deprived of their rights, lest a few hundred thousand residents outside the Metropolis should have their water from a Metropolitan source. The Commissioners actually recommend the revival of a Water Board, such as Lord James's Bill provided in 1896, with the result of pleasing neither the Companies nor the public. This means doing nothing; for such a Bill would have no chance of becoming law."

The "Daily Chronicle" gladly recognizes in the Commission's report "an absence of any tone of hostility towards the London County Council." This, the "Chronicle" says, "is not, perhaps, so strange as may at first appear, seeing that the Commission appointed to curse has been constrained to bless the main proposal of London's County Council—namely, purchase for the public of London's water supply. But when we have paid this tribute to a Water Commission's chastened mood, there is little that we can add in the way of compliment to the outcome of the Commission's labours. The practical conclusion of the report is that the Companies must be bought out by the public—*i.e.*, the ratepayers—at a figure which will involve a heavy annual loss. In spite of obsolete plant; in spite of notorious deficiencies in the past; in spite of the fact that the Companies' undertakings are even now under the necessity of incurring heavy additional liabilities in order to perform their statutory obligations; in spite, finally, of the fact that the public can borrow more cheaply than a private company—the conditions of purchase are to be such that there shall not only be no question of public profit, but the certainty of increased water charges to the consumers or increased rates to the ratepayers. We have no hesitation in saying that by such a conclusion the Commission has largely discounted the value of its long, and in many respects able, report; for this proposition, to which it has given the weight of its authority, is, and must always be, absurd."

The "Financial News" thinks the report has really "solved satisfactorily a problem whose urgency was only exceeded by its perplexity." It says: "The most conservative among us had become convinced of the need for public control of the Metropolitan Water Supply; but the most moderate and progressive of Londoners (we are not using these words in their technical party sense) shrank from the only alternative to the existing system hitherto put before the public—the acquisition and control of the supply by the London County Council. So strong and widely spread is the dislike with which this alternative has been viewed, that it is likely that reform would never have come had not some other way been found. Englishmen do not like to have their important public services run by a political caucus. And that is the function to which the active Progressive spirits of the London County Council have effectually reduced that body. There is inherently no reason why the water supply of a municipality should not be entrusted to the ordinary municipal authority; but there are in everyone's mind (outside the Fabian Society and the Socialistic Radical Clubs) numerous reasons why the water supply of London should not be entrusted to the municipal authority of London. Apart from the circumstance that Water London is larger than the County of London, it is not deemed desirable to give the London County Council more powers to abuse. This is the view which has been consistently advocated in these columns for years past; and we are glad to find the Water Commission endorse it."

The "Globe" last Tuesday contained the following remarks upon the report: "The report of the Royal Commission on the present and future water supply of the Metropolis presents such a wide variety of highly important questions as to necessitate mature consideration before final judgment is delivered. The Commissioners' scheme is the outcome of much painstaking care. But the labour bestowed on its evolution will not commend it in the slightest degree to the approval of the Progressives. Their pet project—the bringing of water from South Wales—is summarily rejected, for several good and sufficient reasons. It would enormously increase the expenditure, while this outlay would be wholly unproductive during the period of construction—from ten to fifteen years. Moreover, during last year's prolonged drought, the very rivers from which the supply would have to be taken fell so low that a genuine water famine prevailed for a time in the adjacent country. As regards the financial aspects of the scheme, it is most right that a municipal body with such a monumental capacity for mismanagement and extravagance as the London County Council should only share the control to a limited extent."

In an article entitled "Purchase with Payment" which appeared last Tuesday, the "Pall Mall Gazette" said: "The report of Lord Llandaff's

Water Commission has taken some time to compound; but the most critical of its examiners will admit that the Commissioners have deliberated to good purpose. Their report is a masterly and a comprehensive review of this most important question. It deals with every possible point of controversy; examines every contested figure; and, after combing out every shred of expert testimony from both extremes, it puts forward a scheme that is tangible and fair to every interest concerned—and to that of the consumers not the least. It did not take the Commissioners long, apparently, to decide that it is desirable that the undertakings of the Water Companies supplying the vast Metropolitan and extra-Metropolitan area known as Water London should be acquired and administered by a single central authority. Following quickly upon that decision came the conclusion that the Water Authority for this great area should not be the London County Council. These two conclusions, bracketed, will square admirably with the views of the 'man in the omnibus.' The authority recommended is a Water Board on somewhat the same lines as that proposed by Lord James in his Bill of 1896. . . . We see no reason why the Government should not at once place the matter before Parliament, and invite the co-operation of moderate men on both sides of the House to settle this important question on the principle outlined in the report of Lord Llandaff's Commission."

The "Westminster Gazette" considers the report as "not very comforting"—admitting present defects, but providing no practical remedy for the future. Our contemporary says: "It did not require the collective wisdom of Lord Llandaff and his colleagues on the Commission to prove to London householders that the present system of water supply is dangerously unsatisfactory. What we wanted was some feasible scheme for ensuring safety and plenty in the future; and it is giving a stone instead of bread to suggest, as the Commission does, a revival of the Water Board idea—a Board on which the London County Council is to have one-third of the representation. The Thames and the Lea are still to be the sources of our supply, and the compensation to the existing Companies, unlike the probable water supply, is to be ample. We do not think that the public will accept these conclusions as by any means final."

The "Spectator" says: "Either the London County Council must control and administer the water supply of London, or a Water Board for the purpose must be constructed. We agree with the report that a special Board would prove to be the best solution of the problem."

The "Saturday Review" says the report may be regarded as "a satisfactory document," though it will be disliked by the London County Council, "whose policy it condemns in most particulars." Our contemporary says the Government were justified in appointing the Commission, and they must now complete their work by the translation of the report of that Commission into law. It may not be possible to do this in the present session, but it is thought that "the following year should close this long controversy by fact." The hope is expressed that the Directors and shareholders of the Water Companies will "bow to the clear and unanimous verdict of an impartial tribunal, and will not offer opposition to what is found to be in the public interest."

"Engineering" says that "if anything is capable of bringing the Metropolitan Water Question to an issue, it should be the report of Lord Llandaff's Commission." Our contemporary thinks "it will be agreed by most persons who read the report that the conclusions arrived at are framed generally on common-sense principles, though there may be differences of opinion in regard to the distribution of patronage in the nomination of members of the Board." On the whole, "Engineering" regards the suggestions set forth in the report as "the most promising basis for legislation yet brought forward."

The "Engineer" gives the salient features of the report, in which it has failed to find "any proper case made out against the Water Companies;" nor can it see any clear proof therein "that the consumers are going to benefit to any appreciable extent." Our contemporary holds the very strong opinion that, on the contrary, they might suffer. The Editor would not be at all surprised to find, if the entire proposals of the Commission should be carried into effect, "that the water-rates would go up instead of down," and that we should be "in a much worse condition than we are now."

The "Lancet" is by no means inclined to agree with the report in its entirety. But with regard to the London County Council not being recommended as the authority to have charge of the water undertakings, it says: "There are many ways in which the Council can be useful to the water consumers of London without straining for the absolute control which the Commissioners advise Parliament not to confer upon them. They have not always used the powers which are already in their possession for the protection of the consumers. We trust they may now find time to attend to this work."

The "Municipal Journal" knows why the Royal Commissioners have taken so long to produce their report. It is because they have been engaged in "building up an elaborate apology for the water monopolists, and in preparing a detailed criticism of all the evidence lodged against them, more particularly when the testimony emanated from the London County Council." The organ of that body considers that "the Commission has proved itself to be one of the most useless which ever met. There is nothing new in its report. It has learned nothing, and has forgotten everything—except all that went to favour the interests of the Water Companies." The Editor comes to the conclusion that all the Commission has done is to "block the way of reform in another useless Blue-book."

The "Local Government Journal" characterizes the report as "one of the vaguest documents ever issued to a long-suffering public." It is said to bear on the face of it "the stamp of insincerity," and to be "not worth discussing in a serious vein."

What Progressive County Councillors Think of the Report.

On the resumption of the sittings of the London County Council last Tuesday, a representative of the "Daily Chronicle" had a chat, in the lobby at Spring Gardens, with several members of that body on the subject of the report. He recorded their expressed opinions next day as follows:—

Dr. Collins was very emphatic. "A body which is responsible to nobody ought not to be trusted by anybody," he said. "That was the criticism I passed on the Water Board proposed by Lord James, and it applies equally to the present scheme. Under it, every interest concerned

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 260.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 13	10½	Alliance & Dublin 10 p. c.	20¼—21¼	..	4 17 8
186,666	10	,,	7½	Do. 7 p. c.	14½—15½	..	4 16 9
800,000	100	Jan. 2	5	Australian 5 p. c. Deb. .	100—102	..	4 18 0
200,000	5	Nov. 15	6	Bombay, Ltd.	5¾—6¼	..	4 8 11
40,000	5	,,	6	Do. New, £4 paid .	4—4½	..	5 6 8
880,000	Stk.	Aug. 16	11	Brentford Consolidated	275—280	..	4 5 9
270,000	,,	,,	9	Do. New . . .	210—215	..	4 3 9
50,000	,,	,,	5	Do. 5 p. c. Pref. .	140—145	..	3 9 0
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb. .	124—128	..	3 2 6
220,000	Stk.	Sept. 15	11½	Brighton & Hove Orig. .	255—260	+2½	4 8 6
226,320	,,	,,	8½	Do. A. Ord. Stk. .	185—190	+2	4 9 6
973,500	Stk.	Aug. 16	5	Bristol, 5 p. c. max. .	125—130	..	3 16 11
420,000	20	Sept. 29	10	British	43½—44½	..	4 9 10
50,000	10	Aug. 31	12	Bromley, Ord. 10 p. c. .	25—27	..	4 8 11
75,000	10	,,	9	Do. 7 p. c. . . .	19—21	..	4 5 8
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd.	9¾—10¼	..	5 17 1
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb. .	98—100	..	4 0 0
150,000	20	July 13	8¼	Cagliari, Ltd. . . .	28—29	..	5 13 10
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	13½—14½	..	5 10 4
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	56—58	..	5 3 5
550,000	Stk.	Oct. 13	13½	Commercial Old Stock .	805—810	..	4 7 1
200,750	,,	,,	10½	Do. New do. .	240—245	..	4 5 9
200,750	,,	Dec. 14	4½	Do. 4½ p. c. Deb. .	140—145	..	3 2 1
800,000	Stk.	Dec. 14	9	Continental Union, Ltd.	177—181	..	4 19 5
200,000	,,	,,	7	Do. 7 p. c. Pref. .	178—183	..	3 16 6
51,000	Stk	Aug. 31	14	Croydon A 10 p. c. . .	335—340	..	4 2 4
168,400	,,	,,	11	Do. B 7 p. c. . .	265—270	..	4 1 5
555,000	Stk.	Aug. 16	5½	Crystal Palace Ord. 5 p. c.	125—130	−3	4 0 9
60,000	,,	,,	5	Do. 5 p. c. Pref. .	140—145	..	3 9 0
486,090	10	Jan. 26	11	European, Ltd. . . .	20½—21½*	..	5 2 4
554,650	10	,,	11	Do. £7 10s. paid .	15—16*	..	5 3 2
14,993,075	Stk.	Aug. 16	4⅞	Gas- 4 p. c. Ord. . .	108—110	+1½	4 9 1
2,600,000	,,	,,	3½	light 3½ p. c. max. .	98—100	+1	3 10 0
3,799,735	,,	,,	4	and 4 p. c. Con. Pref.	119—122	..	3 5 7
3,993,375	,,	Dec. 14	3	Coke 3 p. c. Con. Deb.	97—99	+1	3 0 7
70,000	10	Nov. 15	8	Hongkong & China, Ltd.	13½—14½	..	5 10 4
1,000,000	Stk.	Nov. 15	10	Imperial Continental .	213—218	+1	4 11 9
473,600	Stk.	Aug. 16	3½	Do. 3½ p. c. Deb. Red.	101—104	..	3 7 4
75,000	5	Dec. 14	6	Malta & Medn., Ltd. .	5—5½	..	5 9 1
500,000	100	Oct. 2	5	Met. of 5 p. c. Deb.	110—114	..	4 7 9
350,000	100	,,	4½	Melbourne 4½ p. c. Deb.	107—109	..	4 2 7
541,920	20	Nov. 15	3	Monte Video, Ltd. . .	11—12	..	5 0 0
617,946	Stk.	Aug. 31	9½	Newc'tle & Gatesh'd Con.	220—225	..	4 2 3
264,555	Stk.	Dec. 29	8½	Do. 8½ p. c. Deb. .	104—107	..	3 5 5
60,000	5	Sept. 29	7	Ottoman, Ltd. . . .	5¾—5¾	..	6 1 9
					* Ex div		

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
150,000	5	Nov. 30	8	Oriental, Ltd. . . .	7—7½	..	5 6 8
185,000	5	,,	8	Do. New, £4 10s. pd.	6½—6¾	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.	1¼—1½	..	4 11 5
500,000	100	Dec. 1	6	People's Gas 2nd Mtg. of Chicago Bonds .	102—106	..	5 13 2
851,070	10	Oct. 13	7	River Plate Ord. . . .	10¾—11¼	..	6 4 5
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb. .	99—101	+1	3 19 3
250,000	10	Sept. 15	10	San Paulo, Ltd. . . .	12—13	..	7 13 10
135,000	Stk.	Sept. 15	10	Sheffield A.	249—251	..	3 19 8
209,053	,,	,,	10	Do. B.	249—251	..	3 19 8
447,427	,,	,,	10	Do. C.	249—251	..	3 19 8
5,600,000	Stk.	Aug. 16	5½	South Metrop., 4 p. c. Cri.	133—136	..	3 18 5
1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb. . .	100—102	..	2 18 10
120,000	Stk.	Aug. 31	6	Tottenham A. 5 p.c.	141—143	..	4 3 11
250,520	,,	,,	4½	and B. 3½ p.c.	102—104	..	4 6 6
55,100	,,	Dec. 14	4	Edmonton 4 p. c. Deb..	113—117	..	3 8 5
182,380	10	Jan. 12	5	Tuscan, Ltd.	8½—9½	−½	5 5 3
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.	101—104	..	4 16 2
				WATER COMPANIES.			
780,399	Stk.	Dec. 29	11	Chelsea, Ord.	307—312	..	3 10 6
150,000	,,	,,	5	Do. 5 p. c. Pref. .	157—162	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	145—150	..	3 0 0
175,785	,,	Sept. 29	4½	Do. 4½ p. c. Deb. .	148—153	..	2 18 10
1,720,560	Stk.	Oct. 18	7	East London, Ord. . .	202—206	+1½	3 8 0
654,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb. .	145—150	..	3 0 0
890,000	,,	,,	3	Do. 3 p. c. Deb. .	98—100	..	3 0 0
700,000	50	Dec. 14	7½	Grand 10 p. c. max. .	107—109	..	3 8 10
810,000	Stk.	Sept. 29	4	Junction 4 p. c. Deb. .	131—136	..	2 18 10
708,000	Stk.	Aug. 16	14	Kent	348—353	..	3 19 4
160,000	,,	,,	7	Do. New, 7 p. c. max. .	200—210	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max. .	293—298	+1	3 10 6
406,200	100	,,	8	Do. 7½ p. c. max. .	215—220	..	3 12 9
350,000	Stk.	Sept. 29	4	Do. 4 p. c. Deb. .	135—138	..	2 18 0
500,000	100	Aug. 16	13½	New River, New Shares	423—428	−2	3 3 0
1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb. .	130—135*	..	2 19 3
902,300	Stk.	Dec. 14	7½	South- Ord. . . .	202—207	..	3 12 6
126,500	100	,,	7½	wark 7½ p. c. max..	190—195	..	3 16 11
489,200	Stk.	,,	5	and 5 p. c. Pref.	160—165	..	3 0 7
1,019,585	,,	Oct. 13	4	Vauxhall 4 p. c. A Deb.	131—136	..	2 18 10
1,155,066	Stk.	Dec. 14	10	West Middlesex . . .	288—293	..	3 8 3
400,000	,,	,,	4½	Do. 4½ p. c. Deb. .	147—152	..	2 19 3
200,000	,,	Sept. 15	8	Do. 8 p. c. Deb. .	100—102	..	2 18 10
					*Ex div.		

including that of the London County Council, will be in a permanent minority. The terms of purchase propounded appear to me quite unsound. I am also astonished at the Commissioners' views in regard to the use of flood water. I do not anticipate any better success for this Commission's report than that which befell Lord James's ill-fated Bill. No solution of the London Water Question will, in my opinion, be satisfactory until the London County Council is created the water authority for the whole area within the county."

Mr. John Burns had nothing good to say of the report. "It is nothing more or less," he said, "than another Jameson raid on London. Raids are popular just now, and this is one made in the interests of the water lords against the people of London."

Lord Carrington objected to the insignificant position allotted to the County Council on the Board. "I have always been a Council man," was his way of putting it, "and I hope always to remain one; and so any water scheme for London which places the County Council in a minority is to me unsatisfactory. On the other hand, there is ground for encouragement in the fact that the Commission recommends purchase. That is an advance, and the day may yet come when a Royal Commission may go the full length and give London what it wants."

Mr. W. Crooks, Chairman of the Council's Bridges Committee, declared that the creation of another indirectly-elected body in London would be a fatal mistake. "It will be another Thames Conservancy Board," he said, "and we know what little interest the people of London take in that body, and also the difficulty of keeping it up to a high standard of duty, simply because it is not directly responsible to the ratepayers."

Mr. Sidney Webb said: "I don't think London will put up with a Board dominated by two Government officers appointed by the Local Government Board; and I am not prepared to trust to such a body the negotiations for the purchase of so large a property as that owned by the Water Companies, when the ratepayers will be saddled with the cost."

Lord Tweedmouth thought the proposal in favour of purchase was one which fully justified the County Council's policy. As to the constitution of the Board, he would prefer not to express an opinion until he had more fully studied the report.

Mr. E. Cornwall said: "This proposed Board is utterly impossible. Why should the London Water Supply be treated differently from that of Glasgow, Liverpool, or Manchester, where the representatives of the ratepayers manage the undertakings themselves. The proposal that the Local Government Board should nominate the Chairman and Vice-Chairman of the proposed water authority would never do; it would simply mean another Thames Conservancy."

A Trades Exhibition is being held at Bishop Auckland; and prominent among the exhibitors are Messrs. John Wright and Co., Limited, of Birmingham, acting in conjunction with the local Gas Company. They make a good display of the "Eureka" gas-cookers, with all the latest improvements. Consumers are able to obtain these stoves from the Gas Company on a seven years' hire purchase system.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Mr. W. Stevenson, the Sub-Convener of the Gas Committee of the Glasgow Corporation, was prompt in his action on Monday, at a meeting of the Corporation, in detecting a matter which, though in appearance small, might have had far-reaching consequences. In the minutes of the Cleansing Committee, it was stated that "a petition by the Secretary of the National Union of Gas Workers, &c., had been received for consideration." Mr. Stevenson pointed out that the Corporation General Department had already refused to acknowledge a petition coming from such a source; and he thought it should not be received there—that is, in the Police Commission. He moved that the matter be sent back to the Committee. Mr. Battersby, who is one of the supporters of the Union, explained that the petition was only received for consideration as to competence. An expression to this effect having been added to the minutes, Mr. Stevenson allowed them to pass. It is easy to perceive how, if the minute had not been challenged, it might have been used to show that the Committee had "recognized" the Union.

The troubles over the working of the steamship carrying coal for the Aberdeen Gas-Works have, according to latest information, been got over. So much was said in these "Notes" last week; but full information had not then been received. On the arrival of the vessel at Aberdeen last Saturday, the Captain reported to the Convener of the Gas and Electric Light Committee that, while the men were at dinner on the previous day in Leith Docks, a Trade Unionist representative—from Glasgow, he said, but that is immaterial—appeared among the labourers, and began to address them. He urged the labourers to cease work, and, it was reported, went so far as to offer them a monetary consideration if they did so. The men did not comply. Instead, their foreman informed the police; and, it is added, "the Trade Unionist deputy was at once arrested and removed from the vicinity of ths docks." I do not believe that he was arrested; he would be simply told to desist, and would, of course, comply, for those gentlemen know well where to draw the line. At all events, the vessel was loaded in Leith without further trouble. She was also discharged in Aberdeen without a hitch, sailed for Bo'ness on Wednesday, was loaded there without difficulty, arrived in Aberdeen on Thursday night, and was again promptly discharged. The working of the vessel would thus appear to be back to its normal.

The views of the Union on the subject are given in a resolution adopted by the Executive Committee of the Dock Labourers' Union (Aberdeen Branch), at a meeting on Monday night. The resolution is too long to be set out here; and, indeed, it is unnecessary to give the whole of it, because it deals in detail with a statement which has been made on behalf of the Gas and Electric Light Committee, some of the particulars of which it admits, and some of which it denies. The only denial of consequence—and it is made emphatically—is that the Union went to the men who discharge the ship. The men, it is said, went voluntarily to the Union and gave them the information; and the

Season 1899-1900.



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Union officials then, believing that a breach of contract had taken place, drew up a complaint on the men's behalf. This is not quite a likely step on the part of the men, because, if they were dissatisfied with their pay, and wanted Union rates, they had only to give up their work and join the Union. There are other vessels to discharge in Aberdeen besides this one. The fact that this did not take place, would seem to show that the non-Union men who work for this contractor know better than the Union men the possible conditions of labour at the port. Why, in the Aberdeen district, after raising two regiments of Gordons for service in South Africa, and a third for garrison duty in Edinburgh, there is a superabundance of free, unskilled labour, anxious to get away from the land to the better paid work to be had in the towns; and the cost of living in Aberdeen is considerably less than at any port to the south of it. The Union rate of wage is, therefore, more than is necessary, and more than can be enforced. In this resolution, complaint is made that the contractor for the discharge of the gas coal has, by offering lower rates, monopolized the work of the discharge of Scotch coal in Aberdeen. (It is mostly coal from the Tyne which is used there.) Probably he has acquired a monopoly. But it is enterprise; and that it is not an enterprise oppressive to the workmen can be affirmed, for they earn from 39s. to 40s. per week of 27 hours. One of the complaints of the Union is that the contractor himself pockets £4 per week from this ship alone; and another is that he employs three men in the canting department, instead of four, thereby depriving one man of the opportunity of earning a livelihood, and endangering the lives of the three men employed. This new version of three men in a boat is the only part of the complaint which could, by any possibility, make it relevant. The Gas Committee are doubtless fully aware of the circumstance. It is given, as a reason for the interference of the Union in the matter, that the rate of wages paid, being below the Union scale, is a violation of a resolution of the Town Council to the effect that all contractors be required to pay Union rates. This will, no doubt, be pleaded when the subject comes before the Town Council. The reply will probably be that the wages paid are in accordance with the practice of the port. In that case it will, in all likelihood, come to this—that in the end both parties will hold to their own opinions. But then, the Gas Committee will have got their coal, and effected the saving which they entered into the business with the view of securing.

The Water and Gas Committee of the Dundee Town Council have unanimously resolved to adopt hydraulic power, in preference to compressed air, for driving the stoking machinery in their new works. According to a report by their Engineer (Mr. W. M'Crae), the first cost of hydraulic machinery will be £6837, and the annual charge for maintenance £341 17s.; while the first charge for compressed-air machinery would be £8548, and the annual charge £427 8s. The Committee gave instructions for the machinery to be procured, as also four locomotive engines, a station-meter, two Babcock and Wilcox boilers, and retorts and bricks. The erection of the new works is thus now fairly under way.

A Committee of the Dundee Town Council have also resolved upon a bolder step than any I have yet heard of, in connection with the introduction of the trolley-wire system of car traction into the city. The standards which are to carry the cables for the driving of the cars are also to be utilized as lamp-posts. There may probably be little difficulty in working two such systems of public service upon one set of standards. The one current will be overhead, and the other underground, so that the maintenance of insulation may be quite easy. But that it is not usual seems to point to some practical difficulty.

A conference was held in Leith yesterday between representatives of Leith and of the Edinburgh and Leith Gas Commissioners and the Edinburgh and District Water Trust, upon the subject of the formation of subways for the carriage of gas, water, and sewage pipes. An official statement of what took place is given. It appears that the proceedings were begun with a luncheon, at which there was much profession of good-will between the parties. This is certainly a new feature, and a hopeful one. At the conference, the scheme of subways which was suggested was explained by Mr. Baxter, of Leith. Thereafter comments were made upon it by Mr. Kinloch Anderson, as representing the Gas Commission, and by Mr. Archibald as representing the Water Trust. It is stated that "the result of a most pleasant and social conference was that all parties agreed to take the matter into consideration, and that, if necessary, further meetings would be held to discuss this and other mutual subjects." These meetings, I anticipate, will be few and far between, unless the practice of treating each other to luncheon should become the rage. If so, be sure that a fresh proposal for amalgamation of the two Municipalities is not far off.

On account of the increasing demand for gas at Johnstone, the Gas Commissioners there have had plans prepared for extension of the works, including the formation of a siding from the Glasgow and South-Western Railway Company's lines. The total cost is to be about £8000.

The "North British Daily Mail" of last Wednesday contained the following: "Up till now it has been within the power of the Board of Trade to grant licences to communities to municipalize the electric lighting of their towns. The power has not in any way been withdrawn by Parliament; but the Board of Trade have apparently made up their mind to grant no more licences. The matter is one of great importance to town councils and other local authorities concerned with the lighting of towns; and it ought to have their special attention forthwith, if they are not to be compelled to promote Provisional Orders in Parliament, or else fall into the hands of one of those private companies concerned for burghal enlightenment and dividends. Oban resolved not long ago, through its Town Council, to lighten up with electricity; and the Town Clerk wrote to the Board of Trade asking if it had any 'rules on the subject.' The reply of the Board of Trade was an eye-opener. 'They are not now disposed,' the Secretary was directed to say, 'to entertain applications for licences.' The Board consider 'that the power of granting licences was entrusted to them by Parliament, in order that statutory powers of lighting by electricity might be exercised by way of experiment.' Apparently, therefore, the days of 'experiment' have ended. At all events, in the opinion of the Board, 'the time has come when the longer tenure which can be given by Provisional Order alone may be adopted under conditions receiving parliamentary and not merely departmental approval.'"

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CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan.* 27.

Sulphate of Ammonia.—The market has been active during the week; but towards the close it has become quieter—the quotations being £11 12s. 6d. to £11 15s. per ton f.o.b. at the ports. The bulk of the demand has been for prompt and near delivery, and mostly for "covering" purposes; but prompt prices have also been paid for February delivery. Production has been disposed of as it has become available; there being nowhere any disposition to stock. There has been less doing in the forward position; but this has been mainly owing to the firm attitude of producers. For delivery up to June f.o.b. Leith, £11 17s. 6d. per ton, ordinary terms, is required; while for London £11 16s. 3d., Beckton terms, is the quotation, February-April delivery.

Nitrate of Soda is firm at 8s. per cwt. for fine quality on spot.

LONDON, *Jan.* 27.

Tar Products.—The week has been marked by a good deal of excitement in consequence of the Government ban preventing the exportation of several important products. The restriction will seriously prejudice the position of many manufacturers; and it is felt that, if the Government pursues this policy in the interests of the general community, the serious loss which it entails should not fall upon the industry affected. Either the Government should purchase up the production at the price obtaining at the time of the proclamation, or compensate for loss in value which has since taken place. Ninety per cent. benzol is very flat; and, although for gas enrichment purposes 8d. per gallon has been realized, for ordinary manufacturing uses 7d. at country ports is not procurable. A more favourable freight, however, is obtainable in the Thames; and perhaps 7½d. to 8½d. for odd lots might be realized. Fifties benzol keep fairly steady; toluol is neglected; solvent naphtha is not quite so strong; crude and heavy naphthas show no change; creosote is perhaps weaker; carbolic acid, according to locality, exhibits remarkable differences in market price; pitch is dearer, and stronger for forward delivery; and anthracene remains unchanged and neglected.

General values may be taken at: Tar, 17s. to 26s. Pitch, east coast, 35s.; west coast, 32s. to 33s. Benzol, 90's, 7d.; 50's, 10d. Toluol, 90's, 1s. 2d.; pure, 2s. Solvent naphtha, 1s. 3d. Crude, 30 per cent., naphtha, 4½d. Heavy naphtha, 1s. 2d. Creosote, 3¼d. Heavy oils, 3¾d. Carbolic acid, 50's, 2s. 3d.; 60's, 2s. 8d. Crude naphthalene, 52s. 6d. Anthracene, nominal, "A," 4d.; "B," 2½d.

Sulphate of Ammonia has continued a steady market. There are urgent buyers; but makers, in most cases being very free of stock, want more money than is now quoted. To-day's average value may be taken at £11 12s. 6d. per ton, less 3½ per cent.

The coal output on Vancouver Island for the past year exceeds that of all previous years in the history of coal mining there by nearly 50,000 tons, and for the fourth time passes the million-ton mark. In 1891, the output was 1,029,098 tons; in 1894, it was 1,012,953 tons; in 1898, 1,117.915 tons; and last year's record was 1,166,251 tons.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—An exceedingly strong position is maintained throughout the coal trade of this district; and the advance in prices on the part of the Lancashire coalowners reported last week has been followed in surrounding coalmining centres. The result is that the upward movement has been established without difficulty; buyers having no option but to pay the full prices—the question being more one of obtaining the requisite quantities. If anything, supplies are perhaps coming rather better to hand; and there is not quite so much complaint generally with regard to the restriction of the output by the colliers, who seem, now that the wages question has been finally decided, to be settling down somewhat more regularly to their work. The railway companies are also now dealing with the traffic in a fairly satisfactory manner. Notwithstanding all this, however, every description of fuel, except perhaps some of the very best qualities of house coal, continues exceedingly short; and collieries are still not able to do more than keep the works and mills of their regular customers supplied from hand to mouth. Where extra quantities have to be bought in the open market, these are only obtainable at special prices. The general pit quotations remain exceedingly firm at the advanced rates, averaging 14s. 6d. to 15s. per ton for best Wigan Arley, 13s. up to 14s. for Pemberton four-feet and seconds Arley, 12s. to 12s. 6d. for common round coal, with engine fuel 10s. for ordinary sorts and 10s. 6d. to 11s. for best slack. The opinion is freely expressed in some quarters that there is a danger of prices being pushed upwards to an excess; but no doubt one object in getting up list rates to the highest possible point is that this may be taken as a basis when the railway and gas-coal contracts come upon the market, and upon which it is becoming practically certain, as previously anticipated, there will be an advance of fully 2s. 6d. to 3s. per ton over last year's prices. The shipping demand continues exceptionally brisk; and as there are only limited quantities offering at the ports on the Mersey, higher prices have to be paid—16s. being obtained readily, with 6d. to 1s. above this in some instances stated as having been secured for special deliveries at the ports. There is a further upward movement going on in the coke trade. As manufacturers are all pressed for quantities in excess of what they are producing, they have recently been readily getting above their list rates.

Northern Coal Trade.—There is now a decidedly easier tone, the supplies of coal being normal, and the consumption in one or two branches showing a slight falling off. In the steam coal trade, though the demand is full for this season of the year, the price is easier than it was a week ago, and from 19s. to 19s. 6d. per ton f.o.b. represents the current quotations for best Northumbrian steam coals for early delivery. Steam smalls are 11s. to 11s. 6d. The demand for gas coal is still very full; but with a better output, heavy deliveries are now being made on contracts that were behindhand, and there is still only a moderate quantity for sale to occasional customers. For best Durham gas coal, the quotation for cargoes now varies from 17s. to 18s. per ton f.o.b.—which is considerably below the quotations that have been made since the beginning of this year. The coke trade is in undiminished activity; prices being firm, with higher

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OTTAWA	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
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BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
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WILKESBARRE, PA.	750,000
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BUFFALO, N.Y.	2,000,000
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.,	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
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BURNLEY	1,500,000

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quotations forward. Gas coke is steady. There is no change in the range of prices to notice this week.

Scotch Coal Trade.—The market has still an upward tendency, due to a continued home demand of great volume, and an increasing foreign business—chiefly the former. During the past week, the Conciliation Board have advanced the miners' wages by 9d. per day; but experience shows that high wages mean decreased outputs, and the prospect thus is that for some time high prices will rule. It has been pointed out that while miners' wages have been raised by some 3½d. per ton, the price of coal has been advanced by about 9s. per ton. It has to be taken into account, however, that the enhanced price is only upon new contracts, and that coalowners are not reaping so large a harvest as the market would lead one to suppose. The other side of the matter is that with current rates so high, coalowners who have contracted for a period are inclined to favour current buyers, and to give as little as they can to customers who hold contracts at lower rates. The market is complicated by foreign considerations; and the future depends upon them more than upon home demands. The quotations are: Main 13s. 6d. to 14s. per ton f.o.b. Glasgow, ell 16s. to 17s., and splint 15s. to 15s. 6d. The shipments for the week amounted to 201,314 tons—an increase of 67,823 tons upon the preceding week, and of 39,877 tons upon the corresponding week of last year. For the year to date, the total shipments have amounted to 400,312 tons—an increase of 58,470 tons on the same period of last year.

Sales of Shares.—Last Tuesday evening Messrs. Kidwell and Son disposed of 500 £5 shares in the Chatham, &c., Water Company for £10 per share. They were part of the new capital authorized by the Company's Act of 1898. On Wednesday, Messrs. Spelman sold ten lots of £10 shares in the City of Norwich Water Company for £18 10s. per share. Other lots fetched £18 2s. 6d. and £18 per share. On Thursday, Messrs. Kidwell disposed of nine £3 6s. 8d. shares (7 per cent.) in the Rochester, Chatham, and Strood Gas Company, at £6 12s. 6d. each. On the same evening, Mr. G. Turner disposed of £280 of "A" stock of the Ipswich Gas Company (with accruing dividend) at £29 15s. per £10 lot; eight lots of "B" stock, at £23 per lot; and six similar lots at £23 2s. 6d. each.

The Rugeley Gas Bill to be Opposed.—A special meeting of the Rugeley Urban Council was held last Wednesday to consider the report of a Special Committee with respect to the Bill of the Rugeley Gas Company being promoted in Parliament this year. The Company, it seems, have been approached to make certain alterations in the Bill, especially with respect to the raising of the price of gas to 4s. 6d., and to providing proof of the Company having expended £4000 out of income for improvements. They also asked that the price of gas should be 3s. 6d.; that the Council should have a deduction of 20 per cent. for gas used for public lamps; and that the Council should have power to purchase the undertaking within a reasonable time, if they thought proper. The Company declined to accede to the main points. The Chairman said he did not think the Company had met the Council in the manner they should have done; and he should strongly advise the Council to oppose the Bill. A resolution to this effect was carried.

The Borrowing Powers of the Birmingham Corporation Water Department.—The Birmingham City Council last Tuesday approved of the proposal of the Finance Committee to borrow, from the Prudential Assurance Company, £500,000, at 3¼ per cent. interest, for the purpose of the Corporation Water Act of 1892. Alderman Clayton mentioned that the interest which would be saved by the arrangement would be something like £70 a week, that the total sum raised under the Act was now £2,153,200, and that there was still a large margin of borrowing power.

The New Gas-Works for Scunthorpe.—Tenders for the construction of their new gas-works were considered by the Scunthorpe District Council yesterday week. Contract No. 1 included the retort-house, coal-store, exhauster, boiler, and purifier houses, men's room, smithy, stores, foreman's residence, governor-room, office, gasholder tank, tar and liquor tank, underground water-tank, surface-water drains, and other works. Only one tender was received for this work—viz., that of Messrs. W. Wright and Son, of Lincoln, whose price was £6919. This was accepted. There were four tenders for Contract No. 2, which was for the erection of a retort-bench, condenser, boiler, exhauster, scrubbers, purifiers, meter, gasholder, governor, and other apparatus, and for supplying and laying the main pipes and appendages. The tender of the Leeds Fire-Clay Company, Limited, of Leeds—£7468—was accepted. The highest tender was £1233 more than this. The total of the successful tenders is £14,387, which is £423 above the estimate of the Engineers (Messrs. Stevenson and Burstal). The contracts are to be completed by July 31. It was also decided by the Council to apply to the Public Works Loan Commissioners for a loan of £21,500, repayable in forty years, as provided in the Act. This amount includes the £5500 to be paid to Messrs. Cliff for the old plant.

House Wrecked by an Explosion at Beverley.—A startling explosion took place in Keldgate, Beverley, about ten o'clock on Sunday morning last week. It occurred at the house of a Mrs. Horsley. The premises and household goods were completely demolished; but, strange to say, the inmates—Mrs. Horsley and her sons and daughter—all escaped serious injury. It is stated by a local paper that "gas had been known to be escaping from somewhere in large quantities for several days. All the neighbourhood had complained loudly; and the Gas Office had been appealed to to remedy the matter." The gas must have percolated through the ground into the house, as it is not laid on to the building, and the main is on the other side of the street. It is, however, supposed that the explosion was caused by one of the sons (who was afterwards found buried among the débris) lighting a cigarette in a bedroom. This, as a local contemporary points out, raises the question as to how the whole family escaped suffocation by gas during the night, because if there was sufficient gas in the room to cause an explosion, it would seem that there must have been some very narrow escapes from suffocation while the family were asleep. The force of the explosion is shown by the fact that a door was hurled across the street, and through the window of a house opposite. The property in the neighbourhood is very old; and the houses on either side of the wrecked premises have received a severe shaking, which has made them almost untenantable.

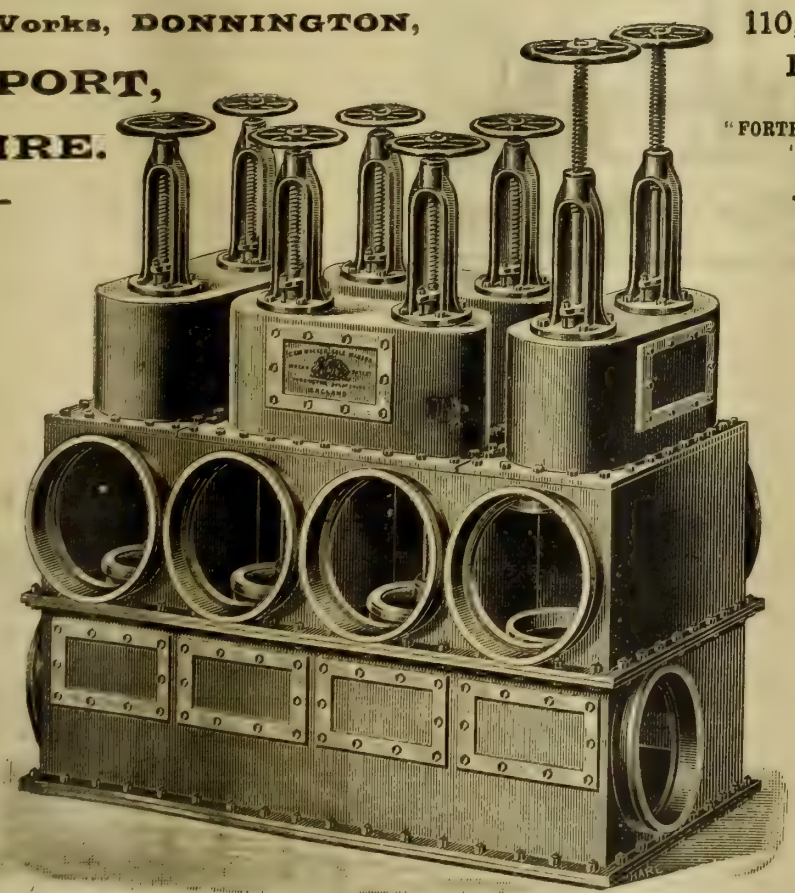
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Weck's Patent Centre-Valve for Four Purifiers.

The Cambridge Municipalization Scheme.—The demand which was made at the recent meeting of ratepayers for a poll on the municipalization scheme (which included the acquisition of the Water Company's property) has been withdrawn, so that the Bill will not now be proceeded with.

The Quality of the Gas at Maidstone.—The Maidstone Gas Company must be wicked to the extreme. It is the belief of Mr. G. King, a member of the District Council, that they supply, in the course of a day, two qualities of gas—the superior in the morning, and the poorer in the evening. So convinced are Mr. King and some of his colleagues that this is so, that, at the last meeting of the Council, they passed a resolution instructing the Gas Examiner to make his tests in the evening instead of the morning. A little enlightenment on the subject of the manufacture and distribution of gas is badly wanted in the governing circle of Maidstone.

The Supply of Coal for the Ripon Gas-Works.—At the quarterly meeting of the Ripon City Council last Thursday, Mr. Walker asked if any satisfactory arrangements had been made in regard to the supply of coal to the gas-works. The Manager (Mr. E. E. J. Anderson) stated that, in consequence of the difficulty of obtaining coal, the Committee had authorized him to reduce the candle power of the gas. Alderman Lee observed that the Committee ordered the quality of the gas to be reduced because the price of coal had gone up 25 per cent. The Manager stated that more room was required at the gas-works for the storage of coal. Of late the candle power of the gas varied from 16 to 18 according to the quality of the coal. Subsequently it was resolved to increase the Manager's salary by £25 per annum, and to give him a gratuity of £50 for engineering work done in connection with the recent extensions.

The Profits of the Gas and Water Undertakings of the Hull Corporation.—The Engineer of the Hull Corporation Gas and Water Departments (Mr. F. J. Bancroft) has submitted an estimate of receipts and expenditure to his Committee for the year ending March 31, 1901; and the statement no doubt afforded very pleasant reading to the Committee. The receipts from the gas undertaking are expected to be £13,903, and the expenditure £9975; leaving a gross profit of £3928. Of this amount, however, interest and sinking fund will claim £3887; so that the net profit will be but £41. These figures are arrived at on the supposition that by the end of March next the Broadley Street gas-works will be dismantled, and the Committee would purchase 100 million cubic feet of gas from the British Gaslight Company at 1s. 6d. per 1000 cubic feet, and dispose of it at 2s. 10d. per 1000 feet. The cost of manufacturing gas at the Broadley Street works is 1s. 7d. per 1000 feet, or 1d. more than the Committee will purchase it for; but they will not have any residuals for sale, which will make all the difference. The estimates for the Water Department predict a net profit on the year's working of £9858, after paying £13,628 sinking fund and interest, and contributing £2600 to the city fund. In other words, the receipts will be £52,832, the expenditure £26,746, and the gross profits £26,086, or more than 50 per cent. Considerable reductions in charges were recently authorized; and consequently these figures are very gratifying.

An Additional Water Supply for Nottingham.—Pumping at the new water borings at Boughton belonging to the Nottingham Corporation has been going on for some time now, with the result that no appreciable impression has been made upon the supply; and the putting down of permanent works at the earliest opportunity is fully justified.

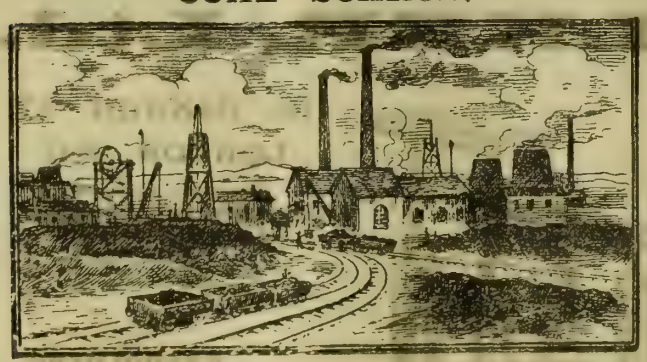
Scotch Water for London.—Wales and even the Lakes have been considered from time to time as possible sources of additional water for the Metropolis; but the opinion has lately been put forward that London will ultimately—the time will doubtless be very distant—have to go to the Highlands of Scotland for an adequate water supply, the northern part of the kingdom being in the fortunate position of having a store sufficient for the needs of even a larger population than that of the Metropolis.

The Maidenhead Town Council and the Water Company.—At a recent meeting of the Maidenhead Town Council, the Water Committee reported that they had had under consideration the draft Provisional Order promoted by the Maidenhead Water Company for obtaining power to raise additional capital, and they were of opinion that it was highly desirable that the application should be opposed by the Council. The Committee therefore recommended that a representation be made to the Board of Trade embodying objections to the Order. The Committee submitted that the supply of water to the borough should be in the hands of the Corporation. The document embodying the objections was brought up, and ordered to be sealed.

Water for the Paris Exhibition.—The quantity of water required for the machinery at the Paris Exhibition is estimated to be 1760 million gallons, the length of pipe at about 17½ miles, and the weight of iron at 380 metric tons. A main conduit for Seine water, 24 inches in diameter, will be laid along the entire length of the Champ de Mars, and will feed the generators. Smaller pipes will branch off this, and serve the various buildings, round which a conduit for spring water will run. The water for the gardens will be taken from the Ourcq, and will be supplied gratuitously by the Municipality, as well as about 1½ million gallons daily from the Seine. The spring water laid on for the visitors will be paid for at the rate of 1½d. for 220 gallons.

A Danger to the Cardiff Water Supply.—At a recent meeting of the Water Committee of the Cardiff Corporation, Mr. Allen directed attention to the effect produced on iron pipes by the water supplied to the borough. He said experience in his trade had shown him that the soft water now supplied in Cardiff was forming a deposit of oxide of iron in the pipes, and this fact was an ever-present source of grave danger to the inhabitants, besides shortening the life and diminishing the service of the large mains. Comparative tables were produced by the Engineer, who endorsed Mr. Allen's remarks, but showed that softer water was supplied to many large towns in the country. This statement suggested that there was a constituent in the Cardiff water which affected the pipes, and that mere hardening would not remove the oxidation. It was agreed that samples of water should be submitted for chemical analysis.

COAL SCARCE.



There is a tide in the affairs of men (and Gas Departments), which, taken at the flood, leads on to fortune.

Julius Cæsar IV., 3.

STOVES PLENTIFUL.



N.B.—Perhaps the Reader will supply the Advertisers' Name.

CONTENTS.

EDITORIAL NOTES:—

GAS, LIGHTING, &c.— PAGE.

The Meetings of the Gaslight and Coke Company 317
South Metropolitan Affairs—The Problem of Coal 318
The Queen's Speech 318
Electricity-in-Bulk Schemes 319
Straight is the Line of Duty! 319

WATER AND SANITARY AFFAIRS—

The Report of the Water Commission 320
The Government and the Water Question 320

ESSAYS, COMMENTARIES, AND REVIEWS:—

Gas and Water Companies in the Stock Market 321
Electric Lighting Memoranda 321
The Remuneration of Labour—Another View 322
Water and "Omnibus" Corporation Bills for 1900 323
The Gas Undertakings Returns 323

NOTES:—

The Thickness of Earth-Retaining Walls 325
Sampling Cement for Testing 325
Water Circulation in Boilers 325
Coke Fuel for Road Motor Vehicles 325
The Valuation of Water-Power Privileges 325

TECHNICAL RECORD:—

Institution of Gas Engineers—Annual (Formal) Meeting . . . 326
Society of Engineers—Inaugural Address of Mr. Henry O'Connor 326
Society of Chemical Industry—
Dr. H. G. Colman and Mr. J. F. Smith on the Estimation of Naphthalene in Coal Gas 330
The Recovery of Nitrogen in Coal Distillation 330
Testing Gas Liquor for Ammonia 334
Action of Acetylene on Copper—An Explosion 335
Institution of Mechanical Engineers—Mr. W. Schönheyder on "Water-Meters: With Special Reference to Small Flows and Waste in Dribbles" 335

REGISTER OF PATENTS:—

Controlling the Flow of, and Igniting Gas—Serin, A. 338
Lighting and Extinguishing Lamps—Simmance, J. F. 338
Coin-Freed Meters—Glover, R. T. & J. G. 339
Water-Meters—Reisert, H. 339
Production of Acetylene—Higgins, W., and Sandilands, H. . . 340
Controlling Gas-Cocks and Lighting Gas-Burners—Haddan, R. (La Société Anonyme "Lux Nova") 340
Gas-Engines—Williams, J. 340
Incandescent Gas-Lamp—Beese, R. 340
Automatic Acting Cut-Off Stopcocks for Gas-Pipes—Murphy, J., and Arnold, H. L. 340
Automatic Gas-Igniter—Schultze, K. 341
Patent Notices 341

CORRESPONDENCE:—

The Projected Amalgamation of the Gas Institute and the Institution of Gas Engineers 341

PARLIAMENTARY INTELLIGENCE:—

Opening of the Session—Government and Private Members' Bills 341

LEGAL INTELLIGENCE:—

Supreme Court of Judicature—Court of Appeal—
Welsbach Incandescent Gas-Light Company, Limited, *v.* The New Sunlight Incandescent Gas Company, Limited 341
Welsbach Incandescent Gas-Light Company, Limited, *v.* Sluice—Same *v.* Riemer 342
Robbery from a Prepayment Meter 342

MISCELLANEOUS:—

Meeting of the Gaslight and Coke Company 342
Brentford Gas Company—The Half-Yearly Report and Accounts . 345
The London County Council and the Testing of Gas 345
South Metropolitan Gas Company—The Half-Yearly Report and Accounts 345
Provincial Gas and Water Companies 347
Leicester Corporation Gas and Electricity Supply—Additional Capital Required 347
Additional Stoking Machinery at the East Greenwich Gas-Works 348
Carburetted Water-Gas Plant for Longton 348
The Gas Workers' Union at Llanelly 348
Electric Lighting Notes 348
Opposition to the Welsh Water Scheme of the London County Council 349
The Final Report of the Metropolitan Water Commission—Abstract of the Report 350
Gas and Water Companies' Stock and Share List 352
Notes from Scotland 355
Current Sales of Gas Products 357
Coal Trade Reports 357

PARAGRAPHS:—

PERSONAL: Mr. J. G. Newbigging; Mr. John Francis Taylor; Mr. W. V. Watson; Mr. Hill; Mr. R. Philipson; Mr. Hereward Sadler 325
Sulphate of Ammonia as Manure 324
Wood Casing and Tubes for Electric Wires 330
The Gas and Water Undertakings of Local Authorities—The Official Report on the Acetylene Exhibition at Buda-Pesth . . 334
Lymington Town Council and the Gas Company's Order—The Hanley Corporation and the Gas-Works 341
The Abstraction of Water from One District for the Benefit of Another—Proposed Incandescent Gas Lighting in Marylebone . 342
Fire at a Railway Gas-Works—The Assessment of the Stoke Gas-Works 344
The Southport Water Company's Bill to be Opposed 345
Water Supply in Sydney 356
New Loan for Gas-Works Purposes at Stockport—The Price of Gas in Provincial Towns—The Ilfracombe Water Bill—Gas-Works Affairs at Cowes—The Public Lighting of Plymouth—Narrow Escape from Gas Poisoning at Govan—Prepayment Meter Collections in Manchester—Sales of Shares 358
Chicago Water Supply—Checking Waste of Water at Guildford—Quality of the Bolton Water Supply—Holywood Water Supply . 359

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication but as a proof of good faith.

EDITORIAL NOTES.

The Meetings of the Gaslight and Coke Company.

THE ordinary meeting of the proprietors of the Gaslight and Coke Company on Friday was quiet, not to say dull. The Governor (Colonel Makins) presided, and the attendance was not large. The usual address from the Chair was pitched in a studiously non-provocative key throughout, with one exception, of which no notice was taken at the time. The first point made by the Governor was that of the happy increase of gas consumption, which has been so much larger than anything of the kind it has fallen to his duty to remark of late years. Next it had to be explained that the prices of coal and oil had risen considerably; while, with certain named exceptions, the Company's coal contractors had failed of their covenanted deliveries. The result was a serious depletion of the coal stocks, almost approaching the danger-point. The Governor uttered, rather superfluously, a complaint that the Company had not received from some of their coal contractors the amount of consideration they had a right to expect. There are two sides to all such questions; and we do not recall any published evidence going to show that the Horseferry Road has ever been remarkable for the degree of consideration extended to those who have had to do business there. It was admitted that the advance in the value of residuals has more than compensated hitherto for the increased cost of coal. This was ever the case in the experience of the gas industry, when an advance in the price of coal was not due to a temporary or artificial cause. So true is it, that the wise coal-gas manufacturer is but little disturbed about the price of coal while he can see that other buyers of different descriptions of coal are in the same box with him. It is otherwise with gas manufacturers largely dependent upon oil, which leaves no residuals, and takes away a very valuable bye-product—coke—whether it can be spared or not. Those gas makers who have so far fought shy of the carburetted water-gas attraction, are beginning to flatter themselves on having the best of it just now.

Among the more interesting things of minor importance touched upon by Colonel Makins, was the disclosure that the slight increase of the Company's bad debts was due to the depressed condition of the publicans' trade. This is, surely, not all loss. Rates, as might be expected, are still running up, and are likely to do so while Londoners remain so heedless of the affairs of local self-government. It was a singular complaint for the Governor to make, after all that has been said about the high capital expenditure of the Company during recent years, that the undertaking is very much behindhand in regard to the provision of labour-saving machinery. Nothing, or hardly anything, can be provided in this line unless the Company obtain more money. This is the chief need put forward in justification of the Company's Bill; but, naturally, people will ask what the Board have to show for all the money they have spent these ten years past in excess of the expenditure of other Companies who now have complete modern equipments. This consideration leads directly to the only controversial subject of the whole address—the proposed cession to the South Metropolitan Company of the Nine Elms works and the Surrey-side district, late the property of the London Company. The Governor said a good deal that was quite unexceptionable on the subject of the proposed cession. He observed, and very justly, that the suggestion was really more a matter of sentiment than of anything else as between the actual and prospective owners of the property; and he also admitted that, in the circumstances, a difference of opinion as to the value of the property was not to be wondered at. More—he went on to lay down the entirely reasonable propositions that, whereas the Chartered Board were resolved not to sacrifice the property at a loss, the South Metropolitan Board were equally justified in offering for it only what they considered to be its worth to them. So far good; but at this point the reserve of the Governor left him, for he could not finish his story without giving a dig at the other side which might well have brought Mr. Livesey to his feet in indignant expostulation. There being a difference between the parties to the proposed transaction as to price, why not arbitrate? asked the Governor, innocently. He answered his own artless query by offering the explanation that doubtless the other side were so weak in their figures that they dared not submit them to an independent

arbitrator! This is not exactly the soft answer that turneth away wrath. It would have been more politic, as well as more correct, to admit that from the first, before ever the two Boards came together, Mr. Livesey had carefully put it upon record that there could be no arbitration over what was essentially a question for agreement, and could never be done on compulsion. Why go out of one's way to say such things of people who have a perfect right to their own opinion of the desirability of a bargain?

Everybody, as Colonel Makins said, knows what gas making is; and there is no mystery about Nine Elms as a gas factory. Nor is it any secret that this establishment has been the Cinderella of the Chartered family of gas-works. It has a carburetted water-gas plant, it is true; but how much has been done to improve, develop, or modernize the works and coal-carbonizing plant since the Gaslight and Coke Company took possession of it, and Mr. Robert Morton turned his back upon the yard gates for the last time as master? We have often thought the valuation of this property for severance would be a curious exercise. The present owners would doubtless demand the book-value of the works; but, on the other hand, it is by no means obvious that purchasers should be compelled to pay an undepreciated price for old works, while new ones can be built, replete with all modern improvements, for less money. It is pleasanter to turn from this subject to Colonel Makins's treatment of the topic of the portable photometer, which was thoroughly sensible and well informed. The Wharncliffe meeting of shareholders duly followed the ordinary general meeting; but the proceedings do not call for special comment.

South Metropolitan Affairs—The Problem of Coal.

The report and accounts of the South Metropolitan Gas Company will be found in another part of the "Journal;" the general meeting being fixed for the 14th inst. The Directors' statement plunges at once into the story of how the price of gas has been brought down to 2s. 1d. per 1000 cubic feet, and shows clearly how the demand for gas "in "all its varied uses" is continually growing. The financial narrative is broken momentarily for the purpose of interjecting a remark concerning the difficulty experienced by the Company in obtaining coal—a trouble which brought into active play the energy and devotion of the Company's officers, and evoked the hearty co-operation of the workmen in the paramount task of maintaining the gas supply at ample pressure without any interruption all through the trying winter. Then the report returns to the subject of profits and the dividend. It has been the policy of the Board to keep a little of the divisible profit in hand for building up a cash reserve, which now stands at the comfortable figure of £130,000. In view of this fact, and of the last reduction in price, it has been considered whether the shareholders might not have a little more of the dividend to which they are lawfully entitled. The dividend has been kept practically stationary for many years. It now stands at 5⅓ per cent.; and the legal rate is £5 14s. per cent. The Directors have pondered the question of rewarding the patience of the proprietors by recommending the declaration of a dividend after the nominal rate of 5½ per cent. per annum, at which new level it might, in ordinary circumstances, be maintained. But they have been persuaded by regard for certain signs of the times to hold their hand. These warning indications are of two kinds. The first, and probably the most serious one, is the present state of the coal market; and the second is the fussing of the London County Council over the testing of gas. The Directors are quite candid regarding both these causes of disquietude, and probably feel it to be the wisest course to "play their cards" openly. If the price of coal is kept up to its present figure over the period at which the new contracts must be made, it is clear that there will be a heavily-increased expenditure on this score. Moreover, although it is certain that dear coal all round means good business in residuals, if this inflated price of coal is unnatural, it will fall sooner or later—perhaps soon after the contracts are concluded. Then what will become of the residuals?

Gas undertakings everywhere may well hope for a warm and early spring. The coal trade is in a thoroughly artificial condition. The colliery proprietors are very popularly supposed to be having a rosy time at present, and to be selling to their great advantage the coal which ought to have been delivered to their regular customers the Gas Companies. This is so short and easy an explanation of the position—it argues such an artlessness in guile—that men of the world who know what kind of people the large colliery proprietors are will promptly reject it. The right explanation probably is that the colliery proprietors cannot help themselves. They would very much like, of course, to make all the hay they could while the sun is shining; but they are not their own masters in all respects. There are the men to be considered; and they, in the old established coalfields, hold the key of the position. They can earn such good wages at ruling rates that they decline to work more than four days a week, which provides them with as much money as they need. This consideration, and its consequences, should be commended to the very earnest attention of professed economists and the newspaper expounders of the science. The colliery proprietors are prevented from reaping all the benefit they might otherwise derive from the high market prices of coal, simply because they have no coal to sell—not even enough, in numerous instances, to fulfil their contract obligations. For them, to this extent, the high prices are meaningless. Not so to the colliers. Market prices, not quantities sold, are their guide. It may, and does, seem incredible to class-room economists that working men will not earn all the money they might. Not very long ago, the statement that a particular kind of labour was so highly paid that the men could not be got to do enough of it, was received in the London newspapers with derision. Yet it is perfectly intelligible to those who know the British workman at first-hand.

The only hope is that, as the pressure of the winter demand slackens, even the short time that the colliers will condescend to work will enable their employers to satisfy the market. Then gas coal would return to the normal value, which will be affected also by the degree of success that may attend the enterprise of sinking new pits and re-opening old ones. Meanwhile, the South Metropolitan Board have a margin of 4d. per 1000 cubic feet wherewith to protect their present dividend from encroachments due to dear coal or the vagaries of the London County Council. The Directors are meeting the latter with a strong declaration of the costliness of endowing the portable photometer with any legal status, in which they are in line with the Directors of the Gaslight and Coke Company. With the report is sent out a printed statement giving the history and the results of the profit-sharing movement; and another circular has been issued explaining the objects of the Company's Bill. We have dealt at such length with the important questions raised by the report, that there is no space left this week for an examination of the accounts; but this is of comparatively small moment, as the figures do not call for criticism. A paragraph of the report, setting out the points in which the position of the Company has been strengthened during the last ten years, possesses supreme interest at the present crisis in the Metropolitan Gas Settlement.

The Queen's Speech.

The speech delivered in the Queen's name at the opening of Parliament this day week was not expected to, and did not in fact, contain promise of any heroic measures or proposals of a contentious character. The Government have their hands too full of military and foreign affairs to be able to devote much time to domestic questions. Were it otherwise, it would not lie within our province to discuss subjects definitely within the arena of party politics, unless they should happen to directly affect the interests of the industries we represent. There is, however, in the legislative programme for the session a more than usually large proportion of measures foreshadowed that are not, or should not be, the subject of party contention. Some of these will, if they eventually find places on the statute-book, more or less directly affect the interests of "Journal" readers.

It is a pleasure to observe that Company Law Reform is placed in the forefront of the legislative programme. If this should prove to be indicative of the intention to give the question the first place in the Lower House, there should be small doubt of the measure becoming law; for the Bill will in all probability be practically identical with that which has already passed the Upper House more than once. The need for very considerable amendments in the laws which govern Limited Liability Companies is beyond discussion; the one difficulty will be to so frame those amendments as to materially reduce the opportunity for fraud without

placing any vexatious checks upon commercial enterprise. An ample margin, however, exists between the restrictions on company-mongering imposed by the existing law, and such as would prove harassing to the honest trader wishing the assistance of the investing world to enable him to develop a really genuine business. The measure which has already received the approval of the House of Lords cannot be said to pass beyond that margin.

A second subject upon which legislation is promised, and in which all engaged in occupations where skilled labour is required are closely interested, is that of Secondary and Technical Education. It is intended to enable Local Authorities to render greater aid to institutions designed to provide such training. Proposals will also be made for the amendment of the Factory Acts, and also of the Housing of the Working Classes Act. We firmly believe that the housing question is ripe for legislation; but it is so large and so difficult a problem that there is room seriously to doubt whether a Government with its hands so full as those of the present Administration will be for the next few months, will find it possible to devote the time adequate to its solution. One would, therefore, rather see the subject left standing over until less strenuous times, than that it should be dealt with in an inadequate and ill-considered manner at the fag-end of a session. Nothing is more difficult in this country than to reopen a question within measurable time after it has been (however partially or unsatisfactorily) settled by Parliament. The party that then took it in hand does not care to admit that its settlement was in any way faulty; the other prefers to criticize their opponents' want of success, to attempting to improve upon it.

There is another paragraph in the Speech from the Throne which—while not directly concerning the gas industry—is calculated to indirectly affect its interests by its influence upon the coal outlook. We allude to the exhortation to the Commons not to relax their solicitude for the efficiency of the Navy, "at a time when several "other nations are perfecting their naval preparations." Without going further than the one country of whose naval programme we have recently heard most, it appears extremely probable that Germany will carry out the Emperor's proposal of spending about 15 millions sterling during each of the next seventeen years upon additions to its navy. If this country proceeds (as we have no doubt it will proceed) to proportionately increase its sea-power, the activity in the iron and steel trades will continue for some years to come. This means, first, high-priced materials for erecting and repairing plant; and, secondly, a maintenance of an enhanced price for coal. Every ton of manufactured iron, it must be remembered, means from 6 to 7 tons of coal used. The present prices of coal are, doubtless, only temporary; but we see little prospect of a return for some considerable while to the rates of (say) two years ago. For the compensations of the present situation, gas managers must look to the residuals market, and to the stimulation of the use of gas for cooking and heating purposes due to the dearness of coal fuel.

Electricity-in-Bulk Schemes.

THERE will probably be a renewal during the present session of Parliament of those municipal pretensions to the monopoly of electric power generation and distribution which were so well advertised last year. Again several Bills are being promoted for authorizing electricity generation and transmission "in bulk," in relation to various centres of manufacturing industry; and again the fuglemen of Municipalism are busy raising the alarm against these asserted poachers on the municipal preserve. The Electrical Press naturally complains of the municipal attitude, and asks why the United Kingdom should be deprived of the advantages enjoyed by other countries from large electrical power schemes, simply because the Municipal Corporations do not want to be undersold in their newly-found speciality of electric-power vendors. All last year's Bills of the kind were thrown out; and the Electrical Press professes inability to say why, unless it was because of pressure brought to bear on borough members by the Local Authorities. This is not quite the whole truth. Parliament has registered the opinion that there is no general objection to the legalizing of electricity supply in bulk; and we do not believe that even the Manchester Corporation could prevent the passing of a thoroughly sound measure for the provision of cheap electricity throughout South Lancashire. Liverpool could not stop the construction of the Manchester Ship Canal when it had been proved to be expedient. But the weakness of all these British electricity-in-bulk schemes is this very question of expediency. The electricians should not delude themselves. If such a scheme will but "hold water," the Local Authorities will only get protective clauses in the Act. Not one of the schemes of last year was worthy the sanction of Parliament on its merits; and it has yet to appear that the new ones are any better. We are mildly interested in the question, so far as it involves the possible distribution of cheap power. The domain of lighting will hardly be touched by the new movement. But power—well, if there is anything in the experience of Niagara and Switzerland, electricity in bulk is an addition to the world's workshop conveniences. It remains to be proved that electrical power distribution on the same principle is feasible and expedient for the districts scheduled by the Bills now in Parliament. Until this has been established, it is beside the mark to complain of municipal narrowness and selfishness. Naturally, the Municipalities have a right to protect themselves; and it is only common prudence on the part of a parliamentary opposition to make use of every means of upsetting the other side. When it comes to the last struggle, however, everything is for the side that can prove its case on the merits; and so far the electricians have failed to do this for the cause of electricity generation in bulk, in this country. Vaguely, there is something to be said for the idea—just as much as for the old idea of making gas at the pit mouth, or even down in the coal mine itself. But this is not sufficient for Parliament, which has, besides, to be particularly careful to prevent the public being victimized by company promoters on the supposed faith of a statutory endorsement of their designs.

Straight is the Line of Duty!

ONE of the most incisive criticisms of the London County Council that has yet appeared in the newspapers was innocently perpetrated by the "Daily News" of Thursday last—the next day but one after the ordinary weekly meeting of the Council. The circumstance of the report of the meeting being "held over" was not complimentary to the so-called "London's Parliament;" for day-before-yesterday's news is not, as a rule, regarded as first-class matter. The belated report began with the inquiry, "When Press "and public are preoccupied with a depressing war and "an exciting Parliament, what is a poor County Council "to do?" The obvious reply is that the best thing a poor County Council can do at any time—even so poor a one as that which sits at Spring Gardens every Tuesday—is to attend to its own proper business, regardless of what is going on outside. The admiring reporter in this instance hastens to record the praiseworthy fact that the London County Council rose to the occasion. "Knowing that "there would be few to watch the flames, it abstained "from setting the Thames on fire. Or rather, to pipe "in a lower key, it conducted unostentatious business "unostentatiously." What a blessing! The very remarkableness of this conduct, however, goes to strengthen the suspicion that the County Council much prefers to act differently. Its best performers, in the histrionic sense, like a good audience. All the mountebanks and mummers, all the public entertainers and showmen of every degree, find these times very cold and the world cruelly unsympathetic. The small politician finds himself distinctly "out of it," now that all English-speaking people are thinking mostly of how the great Empire whose strength we have all been accustomed to take as a matter of course is being tried as by fire. Will the noble Figure prove to have feet of clay, after all? That is the query to which we all greatly wish to thunder back an "Everlasting No," as Carlyle would have said. Meanwhile, there is perhaps just a little danger lest those of us who, while not lamenting the inattention of the world to ourselves, still feel that our part in the British world is a small one, may be tempted to "hold our manhoods cheap" on this account. This is not right. Like the London County Council, we have our work to do, although the newspaper reporters may be sharpening their pencils without a thought of us. Let the cankers of a calm world and a long peace be swept away and utterly forgotten; but the man who works, and feels he works, is never out of place in the great scheme of things. Whoever is doing the nearest duty as it should be done, is at the Front.

WATER AND SANITARY AFFAIRS.

When giving, in the "Journal" for the 16th ult., a forecast of the principal recommendation of the Royal Commission on the Metropolitan Water Supply, whose report was not published till the following Monday, we ventured to express a doubt as to the water question being taken up by the Government this session, in view of the disturbed condition of the political atmosphere. We were not, therefore, surprised to find no reference to this matter in the Queen's Speech on the opening of Parliament last Tuesday; nor were we greatly astonished to be told by her responsible Ministers that "the time is not propitious "for any domestic reforms which involve a large expen- "diture." The attention of the Government will be too much engrossed by existing complications, to say nothing of others to which they may give rise, to devote serious thought to what, after all, is only a local question, though admittedly a very large one. Moreover, the water supply of London is not in so deplorable a condition as to call for immediate intervention by the Government. The Water Companies are quite equal, under present arrangements, to meeting the demands made upon them; and if they are permitted to carry out the projects which they will within the next few days lay before Parliament, they will be in a still better position for doing so. In the matter of water supply, therefore, London will not suffer by awaiting the advent of more peaceful times before looking for any action by the Government in the direction of giving effect to the recommendations of Lord Llandaff's Commission. In the course of their long investigation, his Lordship, it may be remembered, hinted at the possibility of nothing being done as the result of their labours. We did not then, and do not now, share this view. We still hold the opinion already expressed that the outcome of their inquiry will be the placing of the water supply of the Metropolis upon a much firmer basis than that on which it now rests; and we think it is quite justified by the general tenor of the Commission's report.

In another part of the "Journal" to-day we continue our abstract of the report. Having disposed of the question of arbitration, the Commissioners proceeded to analyze the evidence submitted to them by the representatives of the various Local Authorities on the subject of purchase. The general feeling was antagonistic, and to a large extent on the ground that it would lead to increased water charges. Even Sir Alexander Binnie could only say that the charge would be about the same as now. In several cases, however, the Authorities were favourable to purchase, provided they could obtain control of the portion of the undertakings serving their districts. As a matter of fact, this evidence did not help the Commissioners much in the solution of the difficult question as to what the financial results of purchase on arbitration terms would prove to be. They then turned their attention to the cases of Provincial Corporations, in the hope of deriving some material assistance. Mr. Gomme, the Statistical Officer of the London County Council, submitted to them an analysis of the water accounts of the county boroughs of England, as well as of Dundee, Edinburgh, and Glasgow, for the year 1896-7. But, unfortunately, they did not furnish any information either as to the method or the financial results of purchase; nor did they enlighten the Commissioners on one very important point—viz., as to whether or not the transfer had resulted in a change in the charge for water. The only conclusion they were able to draw from these statistics was that in some 28 boroughs there were surpluses, and in 19 boroughs deficits in the water account, after paying expenses and loan charges. Out of the surpluses, amounting in the aggregate to £141,898, only £1846 was applied in reduction of the charges for water, while £61,115 went to the relief of the borough funds, and £51,967 to the reserve fund. The rest went to the capital account, or was held as a balance. The deficits amounted to £237,298, of which £164,126 was made good out of a special water-rate, £77,101 out of borough rates, and the remainder from the balances of the water accounts. Glasgow was the most favourable example of corporation management brought forward. The conclusion arrived at by the Commissioners from a study of these statistics was that they did not establish any superior economy in corporation over company management, or prove that the charge for water is lessened when the works are managed by the Local Authority. Even in Paris, where they are supposed to do a good many things so much better than we do here, there is an annual deficiency in the water revenue which has to be made up out of the general taxation of the city.

The Commissioners leave this subject to consider the present and prospective requirements of Water London, and their bearing on the expediency of purchase. Everyone will, we think, agree with their formulation of these requirements: A supply of pure and wholesome water, constantly laid on at such a pressure as will make the water reach the top storey of the highest houses, and in quantity sufficient to meet the needs of an increasing population. In the matter of purification, the Commissioners think there might be improvement upon the existing system; and this, they believe, would be best secured by placing the works under a public authority which would ensure the "unity of management and the uniformity of "arrangements" now absent. As to the next point, the present enactments in regard to constant supply and pressure are various; and the Commissioners come to the conclusion that in each of these respects the consumers would benefit by some public authority having control of the service. Finally, as to the quantity of water which should be furnished—one of the most important of the requirements specified—the Commissioners refer to the advantages which have been secured by the intercommunication system already adopted by the Water Companies, and express the opinion that the unification of the undertakings by purchase would increase these advantages, and tend to secure the sufficiency of the supply by a more rational and economical method of distribution. This, however, is an engineering detail. The far more important questions are: How much water is needed per head of the population, and whence is it to be obtained? The Commissioners answer them both very explicitly. They adopt the 35 gallons per head which Lord Balfour's Commission considered erred, if at all, "on the side of "lavishness;" and they rely upon the present sources—the Thames and Lea, and springs and wells in the Lea Valley and in Kent—to furnish it. They think it reasonable to expect that an additional quantity of water may be obtained from the chalk in Kent as well as in the Thames Valley to supplement the supply of 300 million gallons per day which they consider may be safely drawn from the river. The water coming from these various sources will, in their opinion, suffice for the needs of Water London, with a population of 12 millions, up to 1941. This being their definitely expressed opinion, they, of course, do not see any necessity for incurring now the cost of carrying out the Welsh scheme of the London County Council. Should, however, the population continue to increase at the rate they have assumed in their calculations, the resources of the Thames will be more severely tried after 1941; and the question of seeking some other source of supply will then "assume a different degree of importance." Thus is the Welsh scheme disposed of.

The next question considered by the Commissioners is whether the water undertakings should be acquired and managed "by one or by several authorities," and to what extent severance of the works and the sources of supply would be "practicable and desirable." The conclusions come to are that the concentration of the undertakings in the hands of one authority is desirable, and that they should be acquired and managed by a public authority. These conclusions dispose of the question of severance of the works and sources. Although this would not be actually impracticable, the Commissioners say it would be very difficult and highly undesirable, and would involve "needless waste and expense." Yet this is precisely what the London County Council proposed to do. They first clamoured for authority to purchase the undertakings on the ground that concentration of management would be secured thereby, and then pledged themselves to transfer portions of them, if acquired, to the Metropolitan counties. Yet their own Engineer declined to advocate severance from the point of view of economy of administration and construction of works! "*Divide et impera*" seems to have been their motto; but the Commissioners were not captivated by it. They considered the proposed severance to be open to so much objection as to be practically inadmissible. On this ground, "among others"—and for the "others" we must refer the reader to our abstract—they came to the conclusion that the Council should not be the purchaser, but that a permanent Water Board should be specially

constituted to acquire and carry on the water undertakings. The nature and powers of this Board have already been fully indicated in the "JOURNAL," and therefore it is unnecessary to allude further to the matter. Here we will leave the report till next week.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 352.)

THE Stock Exchange opened with a gloomy appearance last week; and prices declined on the unsatisfactory news from the seat of war. The actual dealings, however, continued on a very limited scale; and business was much restricted, both on speculative and investment account. A better tone subsequently prevailed. The references to the war in the Queen's Speech were well received on the whole; but what favourably affected markets most was Continental buying orders, coupled with various favourable rumours indicating a possible termination of the war at an earlier period than was thought probable after the recent repulses. Money and discount rates, which were harder, show an easier tendency; while Consols and other investment stocks are tending upwards. The public, however, are not doing much; and business in Gas securities share in the general stagnation. Hardly any changes have taken place since our last issue. The most activity has been in Gaslight ordinary. The recent advance brought in sellers; and the price has receded 1, though no transactions have been recorded below 108. Maximum 3½ per cent. changed hands at 98½; but the price is quotably unaltered. The debenture stock is marked higher at 98-100. The stocks of the other Metropolitan Companies remain steady. As regards the Suburban and Provincial group, there were no movements whatever, except a decline of ½ in Alliance and Dublin 7 per cent. In the Foreign Gas Companies, some business has been done in Imperial Continental, European, and San Paulo; but the dealings were few and far between. Business in the Water Companies was also very slack; but prices were well maintained, with the exception of Southwark and Vauxhall ordinary, which fell 2. There were also some dealings in the "A" debenture; but the market value of the stock was unaltered. Altogether the week has been inactive for both Gas and Water stocks.

The daily operations were: Business was extremely quiet on Monday; the only dealings being in Gaslight ordinary, which marked 109¼. Water stocks were also featureless; but business was done in Southwark and Vauxhall "A" debenture at 132½. Tuesday was also a slack day; the only feature being a fall of 1 in Gaslight ordinary to 107-109—business being recorded at 108. Dealings were transacted in maximum 3½ per cent. at 98½ and 99. New River "B" changed hands at 132. On Wednesday, considerable transactions were recorded in Gaslight ordinary between 108 and 109; but there was no change in the quotation. Some business was also recorded in Imperial Continental and British Gas. Thursday saw very little doing in Gas; but there was a little more business in Water. Friday and Saturday were quiet days, especially the latter. On Friday, Dublin Alliance 7 per cent. fell ½.

ELECTRIC LIGHTING MEMORANDA.

Dr. J. Fletcher Little on the Electricity Supply of Marylebone—Pernicious Mis-statements—A Mistaken Plan—The "Journal" a Source of Merriment.

THE discussion of the shortcomings of the Metropolitan Electric Supply Company in respect of the duty of the Company to their Marylebone customers is still dragging on in the columns of "The Times." It does not tend to any definite good, and might be stopped without injury to anybody. Indeed, it may be said to have wrought positive harm, inasmuch as most of the contributaries have manifested more of that lack of knowledge which darkens counsel than of the possession of helpful information on the subject. One of the influential persons whom the opposition to the Company have gathered to their side is Dr. J. Fletcher Little, who unfortunately betrays the superficiality of his acquaintance with the electric lighting business in a letter dated the 17th ult. Not even an eminent Consulting Physician can be supposed to know everything; but when such a personage undertakes to lay down the law on a matter outside his own speciality, it behoves him to test his facts before making use of them. This elementary precaution Dr. Little neglected. For example, he compared the price of current, 6d. per unit, which the Marylebone people pay the Company, with 3d. per unit charged by the Shoreditch Vestry. If Dr. Little had looked a very little way beneath the surface of this comparison—the materials for which were doubtless supplied to him by some interested prompter—he would have learnt that, whereas the Metropolitan Company are a business firm, earning and paying reasonable dividends to their shareholders, the Shoreditch Vestry are carrying on their electric lighting venture at a loss, which is charged upon the rates. Why did not Dr. Little inquire into the genuineness of the Shoreditch figures? He would have found out immediately that the Electrical Press has registered disbelief in the ability of the Shoreditch Vestry to profitably carry on their electrical business at the quoted price of current.

Again, Dr. Little, while objecting to competition between two Companies in his parish, cites as one reason for his objection that "the ratepayers would lose the profit that is enjoyed by those Municipalities in London and all over the country that own the electric supply and, by means of its profits, carry out public improvements and reduce the rates." This statement is more baseless and misleading than the comparison with Shoreditch. Where did Dr. Little get such an erroneous idea of the financial results of electricity supply by Local Authorities? What can be more pernicious than the spreading of error like this, when it could so easily be avoided by the smallest intelligent inquiry beforehand? We challenge Dr. Little and his prompters to name as many truly solvent municipal electric lighting undertakings as could be told on the fingers of both hands—to say nothing of such as help to pay for municipal improvements and reduce the rates. Marylebone can set up its own electric lighting in the manner mentioned fairly enough by Dr. Little. The new Municipality can buy out the local portion of the undertaking of the Metropolitan Company; but this will have to be paid for at what the arbitrators, not the would-be purchasers, consider a fair and reasonable price. At present, the Company have named a price which Dr. Little calls "so exorbitant that it does not even form a basis for negotiations." That is nonsense. The basis of negotiations exists by law independently of whatever price the owners choose to put upon their property—which is their own, it must be remembered, until they part with it. But this influential resident in Marylebone has another plan, which he imagines will serve to light London properly and uniformly with electricity at a cheaper rate than gas.

This notable scheme is for the London County Council to buy the whole undertaking of the Company in Marylebone, Paddington, Holborn, and the Strand, with the new generating station at Willesden, and supply the electricity in bulk to the several parishes. He imagines that "we should then only pay 3d. per unit, instead of 6d." Why? Supposing for a moment that this desire were gratified, so far as regards the purchase of the whole undertaking by the County Council—would the wealthiest of all London districts receive the benefit of the transaction? It argues a childlike faith in the vote-hunters of Spring Gardens to assume that they would not much rather "equalize" matters as between aristocratic Marylebone and, say, democratic Battersea to the advantage of the latter. At any rate, it remains to be proved that electricity, sold in bulk to the Vestry or Municipality of Marylebone at 3d. per unit, would be retailed at a price to compare favourably with gas for lighting. Something would need to be added to the wholesale cost to pay the expenses of distribution and local management; and there would not be a vast difference between the ultimate retail price and the present charge of the Metropolitan Company. Where would be the profit to go in aid of the rates? Practically, if Dr. Little's idea were carried out, the supply of electricity to Marylebone would not be cheapened one iota, and the difference between its cost and that of gas would remain as great as ever.

It is very gratifying to have been able to contribute to the gaiety of nations, and we are therefore greatly obliged to the "Electrician" for assuring us that the "JOURNAL" article of the 23rd ult. entitled "The Breakdown of the Electric Lighting Acts," will "afford merriment" to its readers. In order to make sure of so desirable a result, on the part of those who have for some time past been laughing out of the other side of their mouths, our contemporary reproduces the article in full. We are quite content with this delicate compliment, and only regret that there is so little about the gas industry that is amusing, not to say comical, that the electricians never entertain our readers in a similar way. Let those laugh who win. There is nothing essentially funny about a reasoned indictment of a scheme of legislation. Certainly, the article in question was not meant to be comical; and even now, after glancing through it again with the imaginary spectacle of a hilarious electrician throwing fresh light upon the page, we see nothing humorous about it. It is not true, as the "Electrician" asserts, that we hold the Electric Lighting Acts to have failed "all because of that little local pother about the Metropolitan Electric Supply Company's shortcomings in Marylebone." If it were, these are nothing to laugh at. On the contrary, we took the part of the Company in all seriousness against its local detractors. Since when, moreover, have the Electric Lighting Acts been the admiration of the electric lighting interest? Who has said the bitterest and hardest things about them? What the "JOURNAL" has done has simply been to point the moral that the Acts have failed to subserve that major public interest for the sake of which they were made oppressive upon the electric lighting undertaker. Electric lighting on a 42 years' lease has been found to be unreliable and dear. Either this is the fact, or it is not. If it is true, then the scheme of legislation based upon the principles actually underlying the Acts is defective to this extent. If there is "merriment" here, then the deadest witticism from the Bench that ever provoked an explosion of "laughter" in the tense atmosphere of a Court of Law, is too wildly comical for human consumption. Judged by this standard, it should be easy to be as funny as "Punch" is not.

THE REMUNERATION OF LABOUR—ANOTHER VIEW.

In the "Journal" for Aug. 1 last, under the title "The Remuneration of Labour," there appeared an account of a novel system of paying men employed on engineering work, which was claimed to be a real improvement upon previous experiments in the same important business. This plan was styled the "premium system;" and it consisted in immediately and directly remunerating the workman for all the time he could save upon his particular job. In this way it was believed to escape the defects of remoteness, and dependence on influences beyond the workman's control, which are alleged against profit-sharing systems; while it was not open to the objection applicable to piecework, of tending to depress the ordinary rate of payment for the same kind of work. This and other considerations applying to different ways of remunerating labour were so plainly, if briefly, discussed in the article referred to, that the same ground need not be gone over again now. It was remarked in conclusion upon the matter that the Trade Unions of this country would certainly object to it, as they do to anything and everything that appeals to the self-interest of the workman as an incentive to him to earn more than the Society rate of wage. This appears to be the guiding principle of Trade Union standard rates of wages, which certain local authorities, following the lead of the London County Council, have endorsed under the impression that by so doing they attain the eminence of ranking as "model employers." As we observed in the article in question, Trade Unions do not object to payment for some kinds of labour by the piece; this being the rule of many of the most highly "organized" trades. What they do hold by is the principle of cash payment, on the nail, for work done at such rates as will enable an ordinary—very ordinary—workman to earn, without at all over-exerting himself, the competent income appropriate to his calling and grade.

The Trade Unions do this for the very strong reasons that "the duffers must live as well as the rest;" and also that they do not believe in a man working too hard, and so taking the bread out of the mouth of another man. The one is a practical objection, based upon the natural disinclination of the Union to have upon its funds a number of those "duffers" for whom, by a little management on the part of the branch secretary, the employer might be made to keep room in his shop. The other is a bit of the plausible theorizing which Trade Union leaders learn at Trade Union congresses, and go home to practice whenever they get the chance. Both reasons negative the idea that the workman has the smallest interest in increasing the volume or quality of his output, or in increasing his own earnings thereby. So long as the Trade Unions are inspired by such motives for maintaining the "Union stroke," so long will these organizations remain opposed to the development of production, and the improvements of the condition of the individual workman, by the way of appeal to his self-interest.

The premium plan of remunerating labour resembles piecework in respect of its enlisting the workman's interest to save time, which is money, for his employer. It was invented fifteen years ago by Mr. F. A. Halsey; and is reported to have worked well in many leading establishments in the United States, whose encroachment upon English trade supremacy has been erected of late into a bogey. We have been told that the Americans were bound to beat us in the long run, because American artisans are not infected by the Socialistic dry-rot, and are emancipated from the "Union stroke." With the way thus clear, it might have been expected that the American workman everywhere would take to the premium plan with reasonable appreciation of what was so good for himself. It is, therefore, intensely interesting to learn, by an account of actual experience of the plan given in the "Engineering Magazine" for last month, by Mr. H. M. Norris, that the innovation failed last year in the case of the works of the Bickford Drill and Tool Company, of Cincinnati. The failure, moreover, was due to the same cause that we distinguished as certain to prevent its general success where it might be most needed here—the hostility of the mens' Trade Union.

It is that "touch of Nature" which "makes the whole world kin" that Mr. Bickford discloses, when he begins his story, by stating how the workmen in this shop were "almost all Union men, opposed to piece work." We may suppose that the management had reasons for desiring to get more work out of the shops, or it would never have been thought expedient to attempt the always hazardous expedient of introducing a new method of paying the men. However this may have been, Mr. Bickford deemed it was worth while to try a change. With a familiar caution, he distrusted posted notices as being liable to misunderstanding, and made a start with a personal talk with a leading hand. Having succeeded in making it clear that the proposed alteration was not piecework, Mr. Bickford found the men willing to try it; and for a time everything went well. Then the trouble began. The men commenced "soldiering;" the time spent on different jobs rising instead of falling as it did at first. Something had to be done to stop the rot; and the greatest offender was discharged after repeated vain warnings. This action precipitated matters; there were symptoms of a strike "in sympathy;" and it was discovered that the Union was at the bottom of the revolt. The demand was preferred for the instant reinstatement of the discharged hand, and the withdrawal of the premium plan, on peril of a general turn-out. What was to be done? Of several expedients short of unconditional surrender to the demands of the Union, which would mean the end of all discipline, it was decided to adopt that of reminding the men that the premium plan was not compulsory; but that those men who did not want to take their premiums might leave them. This strikingly recalls Mr. Livesey's experience with his original profit-sharing scheme.

The immediate result, also, was the same. A Union official appeared on the scene, claiming to represent the injured men generally, and the "victimized" man in particular. In the true Society style, he pleaded the cause of the sufferer on universal grounds, carefully ignoring the circumstance of his having been put up by order of the Union to test their power. The employer saw through the subterfuge, and declined to argue further with the Union official, who had tacitly admitted that the man was more under his control than under the lawful orders of his employer. The immediate result was the triumph of the employer. The man was shown up as a shirker; and the Union was left to take care of him as best it could. The other men returned to their work; but at the next pay day they all refused to lift their premiums. The management was thus checkmated. No legitimate fault could be found with the men for denying themselves the extra payments they had truly earned; but meanwhile, what was to become of the "plan"?

The management endeavoured to probe to the bottom this mystery of men turning away from proffered dollars, and discovered the hand of the Union in it. The firm were told that, unless they could convince the Society officials of its merits, the system would never go with the men. Mr. Norris chose what appeared to be the less of two evils, and sent for the "business agent" of the Union, to whom he laboriously explained the impugned plan. Mr. Halsey's arguments were gone over; and all the incidental considerations dealt with in our previous article were expounded. In vain. From the Society point of view, all methods were equally bad if they tended towards increasing a workman's output. They were lumped together in the wholesale condemnation of all schemes of the employer to augment his bank account at the ultimate expense of the working man. Another official of the Trade Union enforced this contention by declaring it to be his conviction, formed after years of study of the problem, that the payment of day-work rates is the best for the men, in the long run.

The conversation between this official and Mr. Norris is instructive reading for all who desire to see the subject from more than one point of view. It transpired that the chief source of disagreement lay in the mens' lack of confidence in the *bona fides* of their employer. They could not overcome the suspicion that behind and above all temporary encouragements to extra diligence there was the intention to take advantage of the improvements, to the detriment of the employee—if not immediately, then at the first slack time, or when any man began to fall behind his prime best. In the event, it was agreed between Mr. Norris and the head of the Trade Union that the matter should be held over until after the Convention of the Society, in the city of Buffalo, at which this and other questions of pressing importance were to be disposed of in the usual way. Here, for the moment, our information stops. The story will be resumed in this month's issue of the "Engineering Magazine;" but enough has been said to exhibit the attitude of the American mechanic to industrial progress. As our contemporary the "Engineer" remarks, this is an attitude that will surprise not a few people in this country. It means that there is no geographical limitation to the theory of Labour that increased output means diminished occupation; and that to work at one's very utmost capacity is a blunder of the first magnitude. This latter reflection appears to sum up the whole difference between the mental prepossession of the wage earner and that of the professional and commercial classes. Of all workers, the so-called working man is the only one who fears to hurt himself by doing too much. This is the badge of servitude, which Trade Unionism helps to rivet more firmly on the neck of him who bears it. Where is the trader who fears to increase his business, although he may foresee that he may have to do more work every year to reap the same net profit? In the Bankruptcy Court. Where is the professional man who weighed his effort and labour by the amount of his fee, or the consideration of the worldly eminence of his client? One would rather not say. Of course, there are at least two sides to every question; and this of the identification, or severance, of the interest of the employer and of his workpeople may be viewed from several standpoints. For the present, it would seem that all the popularity, in the bad sense, is on one side; and all the reason on the other. It does not do to dogmatize, however; and what is needed more than anything else is the calm treatment of the claims of labour from a higher standpoint than that of the moralist of the Industrious and Idle Apprentices. The good workman cannot always marry his master's daughter and succeed to the business; but what is to be his substituted recompense for doing his best?

A proposition is to be submitted to the Leeds City Council, that the salary of Mr. R. H. Townsley, the General Manager of the Gas Department, be increased by £200 per annum.

WATER AND "OMNIBUS" CORPORATION BILLS FOR 1900.

The following Bills of Local Authorities already owning water-works contain provisions for the extension and improvement of these undertakings.

The Hastings Corporation Bill has a part relating to water. It proposes to give the Corporation the usual rights of reservation of water privileges on the sale of surplus lands. The application of the water revenue is prescribed, the surplus profits being appropriated to the district fund. A clause proposes that, notwithstanding the provisions of the Water-Works Clauses Act, 1847, the Corporation may make the communication between their water pipe or main and the water service-pipe of any house not connected, or not properly connected, therewith, and recover all costs from the owner or occupier. Power is sought to make bye-laws for preventing waste and contamination.

The Ilfracombe Improvement Bill defines the water limits. Additional works are proposed, including an intake in Weirs Combe Brook, in the parish of Challacombe, and other similar works on tributary streams in the same locality, to be completed within seven years. The rates for domestic supplies are not to exceed 10 per cent. maximum. Water for other purposes is to be sold by measure at the maximum price of 2s. per 1000 gallons. The supply to any premises unoccupied for 48 hours may be cut off. It is desired to supply water in bulk to outside local authorities. The additional sum of £6000 is required for water-works purposes, repayable in sixty years.

The Margate Corporation Bill contains a part relating to the water supply of the borough. The limits of the Corporation supply are defined. New water-works are contemplated, comprising a pumping-station with wells and adits to be situated at Wade, in the parish of St. Nicholas. The maximum rate for domestic supplies is to be 7 per cent. Water-rates are to be made preferential charges. Certain classes of consumers may be supplied by measure, at the option of the Corporation, at the maximum price of 1s. 6d. per 1000 gallons, but so as the total charge is not less than the ordinary domestic rate. There is to be the right of supply in bulk. The powers of water supply under the Public Health Acts are to be adopted, but not the financial provisions of the Public Health Act, 1875. Previous statutes are to be repealed. The sum of £56,000 is required for the purchase of lands and water-works purposes generally, repayable in sixty years. Surplus water profits are to go to the district fund. Power is sought to appoint professional auditors of the borough accounts. Bills of sale are not to protect chattels against rates. A superannuation scheme for officials is proposed.

The Morley Corporation Bill proposes to enable the Corporation to exercise the water powers of the Public Health Acts, but not the financial powers. The other water clauses are not exceptional. Their water loans are to be excluded from the calculation of the indebtedness of the borough under the Public Health Act, 1875.

The Motherwell Water Bill is to enable the Burgh Commissioners to carry out additional water-works and improve the administration of the undertaking. A new reservoir is to be made on the stream known as the Culter Water, in the parish of the same name, Lanarkshire, discharging therefrom compensation water at the rate of 850,000 gallons per day. Ten acres of land are required to be taken for auxiliary water-works purposes. The powers of land purchase are to be exercised within five years, and the works completed within ten years. Provision is to be made for the laying of pipes in roads within or outside the limits of supply. The mains are to be laid through all inhabited streets. Terms are proposed for metered supplies not domestic, and also to outlying consumers. Water for sanitary purposes is to be supplied gratis. Interference with the Commissioners' valves, &c., is to be punishable with a fine of £5. All supplies may be by meter on agreement. Annual estimates of the expenses of the undertaking are to be framed by the Commissioners, and the domestic water-rate fixed accordingly. Shops are to be charged one-fourth, as also canals, gas and water pipes, and agricultural land. Unoccupied premises are to be exempt. The undertaking is to be self-supporting, but not to return a surplus profit. The sum of £200,000 additional water capital is required.

The Mountain Ash Water Bill is to authorize the District Council to enlarge their water-works by the construction of an impounding reservoir (the Perth-Gelyn Reservoir) in the parish of Llanwonno, Glamorganshire, for collecting the waters of the River Clydach. The works are to be completed within seven years. The rates for domestic supplies are to range from 8 to 7 per cent. An excess payment by the District Council of £3281 over their statutory powers is to be confirmed. The additional sum of £60,000 is to be borrowed for water-works purposes, repayable in sixty years. Surplus profits are to be carried to the district fund.

The Paignton Urban District Water Bill is to enable the District Council to make new water-works, including a storage reservoir to be formed by means of a masonry dam across the Venford Brook, in the parish of Holne. The waters to be taken are tributary to the River Dart; and compensation water is to be provided. The Venford reservoir is to be completed within twenty years, and other works within five years. The maximum domestic water-rate is to be 12 per cent.; and the price of water sold by meter 1s. 6d. per 1000 gallons. Surplus profits are to go to the district fund.

The Otley Urban District Water Bill is to authorize the construction of a reservoir wholly in the parish of Middleton, on the stream called the March Gill, subject to the obligation to discharge compensation water at the rate of 140,000 gallons per day. These works are to be completed in seven years. The water supply is to be treated for the prevention of plumbism. The rates for domestic supplies are to range from 7 to 5 per cent. The District Council require to borrow £55,000 for water-works purposes. A clause is inserted for the protection of the Leeds Corporation.

The Ramsgate Corporation Improvements Bill proposes, among other things, some extensions of the borough, with corresponding enlargement of all Local Acts, and a rearrangement of the Corporation finances.

The Rotherham Corporation Bill has a part relating to water. It is proposed to annul the statutory obligation on the Corporation to supply water to the Rawmarsh District Council from works authorized in 1863, and to enable the Corporation to make fresh agreements with the District Council. It is also proposed to sanction agreements with the Sheffield Corporation. [The Bill also contains clauses authorizing gas-works extensions, and to forbid the laying of gas-pipes in streets without the consent of the Corporation.]

The Southport Extension and Tramways Bill contains a section laying upon the Urban District Council of Birkdale the responsibility for providing and maintaining distributing plant adequate for enabling the Corporation to supply gas within their district at a reasonable initial pressure.

The Salford Corporation Bill chiefly relates to street and sewer improvements; but it also includes clauses proposing to increase the gas capital by £200,000, repayable in forty years, and copying the Bristol provisions as to control of the position of meters and the laying of pipes. Lands are also to be acquired for gas-residuals works. A novel set of proposals deals with the assessment of "land values" as a basis of rating. These clauses do not touch gas or water property.

The Taunton Corporation Bill defines the limits of supply, and reorganizes the finances of the undertaking. The maximum rate for domestic supplies is to be 7 per cent. The Taunton Water-Works Act of 1858 is to be repealed. The surplus water profits are to go to the district fund.

The Walsall Corporation Bill proposes a gas-works loan of £120,000, and the appropriation of additional lands for gas-works purposes.

The West Bromwich Corporation Bill has a part proposing the formation of a thrift fund for Corporation employees, to which such persons are to contribute not exceeding 3¾ per cent. of their salaries or wages; the Corporation contribution to be one-third of this amount.

[Note: Several of the preceding Corporation Bills contain provisions relating to the supply of electrical power for the working of tramways and for lighting purposes; but these clauses do not contain matter of special moment as schemes of novel legislation, being merely of an enabling character.]

THE GAS UNDERTAKINGS RETURNS.

The returns relating to the gas undertakings of the United Kingdom for the year ending Dec. 31, 1898, in the case of the Companies, and March 25, 1899, for the Local Authorities, were issued last Wednesday, pursuant to an order of the House of Commons dated the 7th of August, 1899. The returns for 1897-8, which were ordered on Aug. 8, 1898, were published on the 20th of December; so that the present returns are six weeks late. Our readers are aware that the value of these statistics has been enhanced of late years by the inclusion of additional information and the provision of an index. A further improvement has been made by printing the returns on larger paper. We shall not attempt any analysis of the mass of figures presented in them, but simply indicate, as on previous occasions, the nature of the changes made, and give the principal totals. There has been an amalgamation of the information contained in columns 19 and 20 of the old returns relating to Companies—the former showing whether the sliding-scale clauses are authorized, and the latter giving the initial price for the sliding-scale—and a new column (No. 16) has been introduced, bearing the heading "Standard Price if Sliding-Scale Clauses are Authorized." The number of columns is now 27, instead of 28. The Local Authoritiesr eturns are unaltered in arrangement.

The returns furnish particulars in reference to 439 authorized gas undertakings in the hands of Companies—being three more than in the preceding returns. Three of the new Companies are in Scotland, and nine in Ireland. The Arundel, Budleigh Salterton, Cannock and District, Colwall, Crossgates, Great Marlow, and Whitwick Gas Companies are new comers; whereas the Clacton and Laindon Gas Companies drop out, and Ystrad and Filey appear among the Local Authorities. In Scotland, the Fort William Company has gone; but the Stirling Company has come in. From Local Authorities there are 222 returns, as compared with 212 for the year ending March 25, 1898. The fresh entries are from Bakewell, Filey, Great Driffield, Kingston-upon-Hull, Morley, Rhondda Valley, Swadlincote, Darvel (Ayrshire), Peebles, and Portsoy, N.B. Of the total, 41 undertakings

are in Scotland and 7 in Ireland. The amount of capital authorized by the 661 gas undertakings is £96,209,668, of which £82,109,752 has been paid up and borrowed. The previous amounts were £92,111,252 and £78,636,518. The receipts on revenue account are £21,270,795, compared with £20,207,453; and the expenditure is £15,675,943, against £14,981,527. The amount of capital authorized for gas undertakings in the hands of both Companies and Local Authorities includes, in some cases, other purposes. Turning to the statistics of working, the quantity of coal and cannel carbonized in the period covered by the returns was 12,841,817 tons; the bulk of gas produced being 138,146,994,782 cubic feet, of which 127,365,376,845 cubic feet were sold. An interesting foot-note to the latter figures sets forth that they include 7,404,193,550 cubic feet of water gas, and 82,550 cubic feet of acetylene gas. The previous totals of working results were: Coals, 12,616,153 tons; gas made, 132,692,734,427 cubic feet; gas sold, 122,219,679,208 cubic feet. At the dates to which the last returns were made up, there were 25,481 miles of mains in use for the supply of 3,249,138 consumers and 566,864 public lamps. The previous figures were: Miles of mains, 25,157; gas consumers, 3,025,376; public lamps, 553,803.

As in the returns for the year 1897-8, particulars are furnished as to the nature and quantity of materials other than coal used for the manufacture of gas, the supply of water gas, and the maximum proportion of its admixture with coal gas. The extent to which oil, petroleum spirit, carburine, or "other material," is now utilized for the production of gas will be seen from the following list of Companies and Local Authorities who make returns in regard thereto:—

Companies.

Bath.	Exeter.	Preston.
Bournemouth.	Folkestone.	Richmond.
Brentford.	Gaslight and Coke.	Rochester.
Bridlington.	Godalming.	Snodland.
Brighton.	Gravesend.	Southend.
Bristol.	Guildford.	South Metropolitan.
Broadstairs.	Hastings.	Staines and Egham.
Bromley.	Hornsey.	Swansea.
Canterbury.	Hoylake.	Swindon (New).
Colchester.	Huyton and Roby.	Taunton.
Commercial.	Isle of Thanet.	Tonbridge.
Croydon.	Lea Bridge.	Tottenham.
Crystal Palace.	Liverpool.	Tunbridge Wells.
Derby.	Longwood.	Waltham Abbey.
Dover.	Maidstone.	Watford.
Dublin.	Mitcham.	West Ham.
Dundalk.	Musselburgh.	Winchester.
Eastbourne.	Newport (I.W.).	Windsor (also Eton).
Ely.	Norwich (British Co.).	Yarmouth.

Local Authorities.

Alloa.	Coventry.	Padiham.
Alva.	Darlington.	Paisley.
Ardrossan.	Dumfries.	Peebles.
Ashford.	Edinburgh.	Perth.
Belfast.	Glasgow.	Portsoy.
Birkenhead.	Greenock.	Rochdale.
Birmingham.	Hereford.	Rotherham.
Blackburn.	Huddersfield.	Smethwick.
Broughty Ferry.	Ilkeston.	Southport.
Bury.	Keighley.	St. Helens.
Chorley.	Manchester.	Stockport.
Colne.	Middlesbrough.	Stockton-on-Tees.

There are a few additions to last year's list; but Falkirk and Salford drop out as users of oil in the production of gas. At Portsoy (the return for which is for the year ending July 31, 1898), carbide of calcium and oil are the "other materials" used. The quantities employed cannot be given, nor the number of cubic feet of gas made; but 73,400 cubic feet of coal gas, and 61,500 cubic feet of acetylene gas were supplied to private consumers, and 21,050 cubic feet of the latter gas for public lighting —making the 82,550 cubic feet of this gas above referred to.

With regard to carburetted water gas, the returns show that when they were made up it was supplied by the following Companies and Local Authorities:—

Companies.		*Local Authorities.*
Bath.	Hornsey.	Belfast.
Brentford.	Liverpool.	Birkenhead.
Brighton.	Lea Bridge.	Birmingham.
Bridlington.	Maidenhead.	Blackburn.
Colchester.	North Middlesex.	Coventry.
Commercial.	Norwich (British Co.).	Edinburgh.
Croydon.	Plymouth.	Manchester.
Dorking.	Preston.	Middlesbrough.
Durham.	Southend.	Southport.
Falmouth.	Swansea.	Stockport.
Gaslight and Coke.	Swindon (New).	Stockton-on-Tees.
Guildford.	Tottenham.	
Hastings.	Winchester.	

Since the previous returns, the manufacture of water gas has been taken up by the Durham, Falmouth, Croydon, Dorking, Guildford, Maidenhead, North Middlesex, and Plymouth Gas Companies. The Hoylake and Taunton Gas Companies, who appeared in last year's list, do not furnish any figures to the present returns. The proportion in which water gas is supplied varies considerably; but it is generally 25 or 30 per cent. In Norwich, the maximum is 63·4; at Tottenham, 52·54; in Belfast, from 50 to 55; at Dorking, Liverpool, Preston, and Southend, 50—Coventry coming close with 47·56, Bath and Plymouth with 40, and Maidenhead with 38. In Edinburgh, the percentage is only 9·27; the North Middlesex Company and the Stockton Corporation sending out 15 per cent. In the case of the Gaslight and Coke Company, it is stated that, of the total quantity of gas sent out, 26 per cent. was unmixed with water gas. As to the remainder, the maximum proportions were as follows: 73 per cent. contained 18 per cent.; 12 per cent. contained 26 per cent.; 4 per cent. contained 28 per cent.; and 11 per cent. contained 37 per cent. The Commercial Company's proportion of water gas is 22 per cent.

Comparing the figures furnished by the present returns with those contained in similar returns for the previous nine years, it will be seen that the capital obligations of the Gas Companies are as follows:—

Year.	Share and Premium Capital Paid up.	Loan Capital Issued.	Capital Sold under Auction Clauses.	Premiums Realized.
1889.	£32,117,202	£6,090,546	£3,641,730	£1,563,595
1890.	32,884,026	6,568,676	4,008,465	1,765,557
1891.	34,282,164½	6,862,117	4,300,266	1,823,068
1892.	35,266,898½	7,149,367	4,755,597	2,144,619
1893.	36,491,562½	7,544,563	5,417,667	2,432,970
1894.	37,059,199½	7,739,678	5,715,024	2,637,019
1895.	37,307,330½	7,888,086	5,974,455	2,779,604
1896.	41,433,325	8,185,710	6,783,468	3,512,818
1897.	42,368,976	8,891,218	7,248,545	3,405,345
1898.	44,134,488	9,360,293	7,786,216	3,995,781

Some of the other comparative details in the Companies' returns are—

Year.	Tons of Coal Carbonized.	Cubic Feet of Gas Made.	Number of Consumers.	Public Lamps Lighted.
1889.	6,309,495	64,627,914,489	1,128,838	268,013
1890.	6,618,460	67,214,546,500	1,153,989	275,611
1891.	7,071,161	70,953,927,023	1,180,333	282,761
1892.	7,119,189	72,178,028,396	1,213,322	288,021
1893.	6,995,125	71,050,955,154	1,225,253	296,910
1894.	7,128,126	72,610,842,498	1,266,943	295,787
1895.	7,531,131	77,245,618,489	1,339,712	302,015
1896.	7,681,770	80,015,323,004	1,439,272	308,180
1897.	7,963,465	84,040,175,901	1,549,627	314,451
1898.	7,958,669	86,705,722,752	1,670,847	319,007

The somewhat similar figures for the Local Authorities are—

Year.	Amount Borrowed, including Annuities (not deducting Repayments).	Receipts.	Expenditure (exclusive of Amount in the next Column).	Interest, &c., Paid.*	Net Profit after Payment of Items in preceding Column.
1889-90.	£21,669,789	£5,067,843	£3,627,578	£971,755	£486,483
1890-91.	21,891,655	5,628,212	4,231,643	956,183	460,608
1891-92.	22,476,180	5,906,319	4,589,109	965,533	397,947
1892-93.	22,734,556	5,983,359	4,702,179	994,517	305,040
1893-94.	23,619,082	6,219,460	4,866,486	1,038,462	341,470
1894-95.	24,624,554	6,402,046	4,681,035	1,114,014	622,366
1895-96.	25,624,326	6,478,191	4,881,944	1,126,170	493,886
1896-97.	26,561,689	6,639,342	4,989,283	1,136,789	534,390
1897-98.	27,376,324	6,759,883	5,058,705	1,161,171	554,014
1898-99.	28,614,971	7,177,670	5,365,995	1,219,771	625,780

* These figures include: (1) Interest paid on loans; (2) amount paid for annuities; (3) amount of loans repaid; (4) amount paid for redemption of annuities; (5) amount placed to sinking fund.

Year.	Tons of Coal Carbonized.	Cubic Feet of Gas Made.	Number of Consumers.	Public Lamps Lighted.
1889-90.	3,353,516	33,453,368,830	1,115,267	178,867
1890-91.	3,623,967	35,796,491,799	1,143,289	184,773
1891-92.	4,148,131	37,740,332,448	1,172,704	192,323
1892-93.	3,977,291	39,303,250,095	1,203,574	201,484
1893-94.	4,025,167	39,730,833,247	1,226,332	210,316
1894-95.	4,191,175	41,684,838,142	1,257,274	217,069
1895-96.	4,406,315	44,170,134,202	1,320,059	224,873
1896-97.	4,614,969	47,026,280,408	1,406,456	232,464
1897-98.	4,652,688	48,652,558,526	1,475,749	239,352
1898-99.	4,883,148	51,441,272,030	1,578,291	247,857

Sulphate of Ammonia as Manure.—Professor W. J. Malden, of the Agricultural College, Uckfield, has been investigating, at the expense of the East Sussex County Council, the subject of the quality of the herbage produced on pasture land under different systems of manuring. The land selected for the experiments was representative of a very considerable portion of the pasture lying on the Sussex Weald, where dairying and stock-raising have been more frequently resorted to than has the fattening of cattle. Eighteen plots were laid out, each occupying 1-20th of an acre. A middle plot was left unmanured as a check; and the other plots were all manured differently. The weight of the herbage and its botanical constituents were ascertained for each plot in the two seasons of 1898 and 1899. The soil being deficient in phosphates, nitrate of soda used alone was wasted. Wherever it was applied, the increase in the weight of herbage was largely due to the undesirable weed grass, Yorkshire fog; but where the application of nitrogen took the form of sulphate of ammonia, perennial rye-grass came into prominence, and the Yorkshire fog declined in quantity.

PERSONAL.

Mr. J. G. Newbigging commenced his duties as Gas Engineer to the Manchester Corporation on the 1st inst.

Owing to advancing years, Mr. John Francis Taylor, who has been on the Board of the York Water-Works Company since 1862, and was Chairman for upwards of 26 years, has been compelled to resign his seat.

Mr. W. V. Watson, who was formerly in the service of the Imperial Continental Gas Association in Amsterdam, will succeed Mr. C. V. Bennett as Engineer and Secretary of the Felixstowe Gas Company.

Mr. Hill, the Assistant-Manager at Rochdale Road, who, it will probably be remembered, was badly injured by the explosion there last October, is, we understand, still too unwell to do more than put in an occasional appearance at the works.

Mr. R. Philipson, Assistant-Secretary to the Tyne Improvement Commissioners, has been appointed Secretary to the Thames Conservancy Board, in succession to Mr. J. H. Gough, whose retirement was noticed in the "Journal" for Nov. 7 last.

Mr. Hereward Sadler, son of Colonel Sadler, of Preston-on-Tees, left for the seat of war last Saturday week. Notwithstanding that his intended departure had been kept very quiet, a considerable crowd assembled at the railway station to wish him good luck and a safe return.

NOTES.

The Thickness of Earth-Retaining Walls.

Mr. Ira O. Baker, Professor of Civil Engineering to the University of Illinois, has discussed, in a "Treatise on Masonry Construction," the formulæ for designing retaining walls. Mr. Baker finds fault with all the best-known theories and formulæ relating to the stability of retaining walls, as to which he remarks that theoretical investigations are of little value; the problem being one that does not admit of exact mathematical solution, because the conditions cannot be expressed algebraically. Mr. Baker gives empirical rules which he says will suffice to determine for all practical purposes the great desideratum—that is, the thickness of the wall. These rules, laid down more than half-a-century ago, in accordance with which hundreds of retaining walls have been successfully built and maintained, have been endorsed by Sir Benjamin Baker. The general rule is that a wall sustaining earth having a level surface, whose thickness is one-fourth of its height, and which batters one or two inches per foot on the face, possesses sufficient stability when the backing and foundation are both favourable. As a summary, the common rule of making the thickness of the wall equal to one-third of the height from the top of the footings, is declared to be deserving of general acceptance. The next consideration is to connect this rule with the economical practice of counterforting, and bracing or anchoring retaining walls of considerable dimensions.

Sampling Cement for Testing.

The testing of portland cement is a subject of enduring interest for constructors, few of whom care to bind themselves to specify the use of cements of a particular make, and wash their hands of the consequences. The question of testing is comparatively simple when the job for which the material is required is a large one, permitting of the establishment of a special testing installation. It is otherwise in regard to small jobs, for which good materials are equally desirable. This is a case for a central testing-laboratory; and in England, at any rate, there is no lack of reliable assistance in this respect for municipal and private builders. It appears from a statement in the "Engineering Record," that the Bureau of the State Engineer of New York, at Albany, has been the first to lay itself open to do this service for municipal officers who have not the necessary facilities for making their own cement tests. The directions published for the taking of samples of consignments of cement for testing are worth noting. It is ordered that the samples be taken from every tenth barrel or bag, by means of a sampling-iron reaching to the middle of the parcel. The quantity so taken must be at least 8 ounces, or sufficient to fill a 3-inch cubical tin box, tightly closed. An interval of 14 days is allowed between the despatch of the samples by post and the receipt of the report, which is on the points of fineness, tensile strength, time of setting, and the hot-water test if desired. Where cement is bought in the open market, something of this kind is obviously expedient.

Water Circulation in Boilers.

Mr. George Halliday has submitted to the Institute of Marine Engineers the results of some experiments conducted by himself with a view to ascertain the influence on the rate of evaporation, of the rate of circulation of water through boiler-tubes. It is not so long ago that the effective circulation of water through the tubes of a boiler exposed to the furnace was supposed to be a useful element in the steaming capabilities of the boiler. The faster the water ran through the tubes, the quicker the evolution of steam. This was the popular view. The contrary view has recently been promulgated, chiefly by the "Engineer," that so long as the heating surface is wetted, all the essentials of the best steaming exist, and that all circulation of the water beyond what is necessary to satisfy this requirement is injurious. Mr. Halliday set himself the problem of experimentally testing this contention, with an atmospheric gas-burner and a tank of water through which circulation could be effected by the heated water flowing through tubes. By varying the rate of circulation, and also the heat supplied, it was found that it is necessary to provide sufficient water in the pipe to take up the heat of the furnace; otherwise the effect is simply to heat the pipe. When all the water supplied is evaporated, the maximum effect is produced. Where the flow of water was excessive, the rate of evaporation fell. It was therefore shown by these experiments that the quantity of steam made depended on the quantity of heat supplied to the outside of the tube; and also on the speed at which the water flows through the tube. The greater the speed of the water through the tubes of a water-tube boiler, the less the evaporation.

Coke Fuel for Road Motor Vehicles.

The contemporary progress of the engineering of self-propelled road vehicles is interesting to all manufacturers who are much concerned with haulage. The Liverpool Self-Propelled Traffic Association are doing useful work in the way of testing the running performances of heavy vehicles, such as would be used to carry coals and other bulky articles over common roads. From the latest report of the Association, it would appear that the initial difficulty with these vehicles lies in keeping the tare weight below the legal maximum of 3 tons and yet giving the carriages a desirable degree of strength and carrying capacity. Last year, some hill-climbing tests were carried out by the Association, for which the city of Liverpool affords good facilities. The test-ground was a length of Everton Brow, Browside, and Rupert Street, which included macadam, boulders, Lancashire grit setts, and smooth granite sett pavements, with gradients varying from 1 in 17 to 1 in 9½. The cars had to run up and down these pavements, making an emergency stop on the 1 in 9½ smooth granite sett pavement. The roads were all too steep for loaded horse traffic. The weather was fine. It is rightly observed that to be quite conclusive, such trials ought to be carried out under the worst possible conditions, on the greasiest roads, and during muggy days. An interesting result that came out from these trials was the superior cheapness of coke-fired motors over petroleum-fired cars. In their tender to the Chelsea Vestry for motor dust-carts, the Leyland Company advocated the use of coke fuel. The "Engineer" notices in this connection the performance of a De Dion boiler in a Bayley vehicle. Using gas coke, this van only consumed 1·84 lbs. per ton-mile, as against 2·38 lbs. of coal (best Welsh) in the Thorneycroft machine in the same class. Actually, the Bayley van ran with a coke consumption of 6·76 lbs. per vehicle-mile.

The Valuation of Water-Power Privileges.

The question as to the value of horse-power, as the unit of mechanical force, is likely to increase rather than diminish in practical moment as time goes on and machines are more and more relied on for doing the work of the world. For a variety of reasons, the task of putting a price upon mechanical power has become better known in American than in British engineering practice. This is due chiefly to the circumstance that British water-power privileges are small, and amenable to treatment by the method of compensation water discharge on agreed data. In the United States, these things are not done by halves; and when a water privilege is taken for the purpose of supplying a town with drinking water, it has more than once happened that the whole flow has been appropriated. This proceeding has involved compensating the millowners, not by giving them sufficient water for their needs, but by allowing them the money value of the water power taken away. The case of the City of Worcester is in point, and has been explained by Mr. George I. Rockwood to the American Society of Mechanical Engineers. The city, in 1895, appropriated the waters of a certain brook, with an average flow of 5½ million gallons in 24 hours, passing the premises of 67 owners of 80 developed water privileges, and a few not developed. About 1000-horse power, for eleven months in the year, was the total quantity of power thus diverted from its original applications. Three arbitrators sat to adjudicate on the questions raised. One was a lawyer experienced in water cases, another a manufacturer and large user of water power, the third a hydraulic engineer. The hearing lasted fifty days; and the result of the award was a settlement by the city for $500,000, with interest for four years at 6 per cent. per annum. The exact sum paid was $615,259. The chief purpose of the paper was to explain and contrast the different theories of the parties as to the correct way of estimating the value of the power lost by the millowners. The petitioners, the millowners, claimed that a horse-power is a commodity having a definite market value, of which they had been deprived, and for which, therefore, they deserved financial recoupment. On the other side, the theory was advanced that water power is not a property, but an easement with no market value, inasmuch as it did not exist away from the locality. The basis of valuation, on this theory, was the cost of substituting the net available privilege throughout the year by something else. It was on the measurement of this net amount of power that the greatest disagreement arose. In the event, the Court seemed to take the view that water power is an easement.

TECHNICAL RECORD.

INSTITUTION OF GAS ENGINEERS.

The proceedings of the Annual General Meeting of the Institution were commenced on Saturday last, at the Offices, No. 11, Victoria Street, S.W. In the absence of the President (Mr. Frederick D. Marshall, of Copenhagen), the chair was taken by the VICE-PRESIDENT (Mr. James W. Helps, of Croydon). Nearly all the members of the Council were present. As usual on this occasion, only routine business engaged attention; and consequently a quarter of an hour sufficed to dispose of it.

MINUTES OF LAST YEAR'S MEETINGS.

The SECRETARY (Mr. Thomas Cole) first read the minutes of the annual general meeting held on Feb. 4 and May 2 and 3 last year. These were confirmed; but it was remarked by Mr. C. C. CARPENTER that it was rather a pity no record of the autumn meeting was kept in the minute-book.

OFFICIAL APPOINTMENTS AND NEW MEMBERS.

The SCRUTINEER (Mr. H. Iago) was next requested to examine the ballot-lists for the election of officers and members. At the conclusion of his scrutiny, he announced that the following gentlemen had been elected to take office:—

President—Mr. James W. Helps, of Croydon.

Vice-President—Mr. Fletcher W. Stevenson, of London.

*New Members of Council**—Mr. W. Doig Gibb, of Newcastle-on-Tyne; Mr. Charles Meiklejohn, of Rugby; and Mr. Henry Morley, of Cardiff.

Auditors—Mr. Magnus Ohren and Mr. Alfred Lass.

* The other Members of Council are: Mr. C. C. Carpenter, of London; Mr. W. R. Herring, of Edinburgh; Mr. T. Holgate, of Halifax; Mr. T. S. Lacey, of Pimlico; Mr. J. Tysoe, of East Greenwich; and Mr. G. Winstanley, of Coventry. The retiring members were: Mr. C. E. Botley of Hastings; Mr. T. May, of Richmond; and Mr. F. W. Stevenson (the new Vice-President).

The following names were added to the roll of the Institution:—

Members.—Mr. A. E. Edwards, of Copenhagen; Mr. John W. Morrison, of Sheffield; Mr. Thomas Price, of Walton-on-Thames and Weybridge; Mr. Robert J. Skinner, of Londonderry.

Associates.—Mr. Harry Ashton, of Barnstaple; Mr. W. D. Hunter, of Rotherhithe; and Mr. John H. Methven, of Bow Common.

On the motion of the CHAIRMAN, seconded by Mr. C. E. BOTLEY (Hastings), the report of the Scrutineer was adopted.

The CHAIRMAN then declared the meeting adjourned until the 1st of May and two following days. The Institution of Civil Engineers will then be the place of meeting.

SOCIETY OF ENGINEERS.

Inaugural Address of Mr. Henry O'Connor.

The First Ordinary Meeting of the above-named Society for the present year was held last night at the Royal United Service Institution, Whitehall. At the opening of the proceedings, the chair was occupied by the retiring President (Mr. J. Corry Fell), who presented the premiums awarded for papers read during the past year; the recipient of one being Mr. Gordon Harris, whose paper on "Water Supply to Country Mansions and Estates" was noticed in the "JOURNAL" for Dec. 12 last (p. 1436). He then introduced the new President—Mr. HENRY O'CONNOR, of Edinburgh—who proceeded to deliver his Inaugural Address. He began by thanking the members for his election, and offered some remarks on the prosperity and work of the Society. He said the papers read last year had come well abreast of those given in previous sessions; and the vacation visits had been to works of varied description and of great interest. After these preliminary observations, he continued as follows:—

And now, gentlemen, I venture to crave your indulgence while I direct your attention to one or two matters of a technical nature. In seeking to find a subject for some brief observations in this direction, I have felt that I could not do better than follow the unwritten law on such occasions, and confine myself almost entirely to that branch of our common profession with which I am most familiarly acquainted. The business of gas engineering is one in which, as in most similar directions, great developments have been made in recent years.

Looking back over our records, I was somewhat astonished to find that, although the proportion of our members specially interested in gas engineering matters is at present about 10 per cent., and was, I believe, even greater in the past, yet during 46 years we have only had seventeen papers, bearing on such subjects. The following list will show that while in these papers many important points were discussed, there are other interesting topics which have never before been brought forward.

The first paper was on "Gas-Meters and Pressure-Gauges," by Mr. J. Willcock, in 1860; followed by "The Manufacture of Coal Gas," by Mr. A. F. Wilson, in 1864; "Modern Gas-Works at Home and Abroad," by Mr. H. Gow, in 1868; "The Prevention of Leakage in Gas and Water Mains," by Mr. C. M. Barker, 1869; "The Methods Employed in the Determination of the Commercial Value and Purity of Coal Gas," by Mr. F. W. Hartley, 1869; "Apparatus Employed for Illumination with Coal Gas," by Mr. W. Sugg, in 1869; three papers on Charging and Drawing Machinery for Coal Gas by Mr. J. Somerville in 1873, Mr. F. W. Hartley in 1875, and by myself in 1891; two papers on Gas-Engines, by Mr. C. Gandon in 1881, and by Mr. S. Griffin in 1889; "Illumination by means of Compressed Gas," by Mr. Perry F. Nursey, 1881; "Modern Improvements in the Manufacture of Coal Gas," by Mr. R. P. Spice, 1886; "Gas Substitutes," by Professor Vivian B. Lewes, 1893; "Gasholder Construction," by Mr. E. Lloyd Pease, 1894; "Automatic Gas Station Governors," by myself, in 1897; and "Gas-Works Machinery," by Mr. E. A. Harman, in 1898.

Several gentlemen intimately connected with the gas interest have occupied the chair of the Society, but the unwritten law already mentioned not having by that time come into use, Mr. C. Gandon did not confine himself to the review of his own side of the profession, but noted the general achievements of engineering during the year preceding his election. Mr. William A. Valon confined his remarks to another branch of his work—viz., water and sanitary engineering. Another Gas Engineer, Mr. C. C. Carpenter, who would in the ordinary course have been our President a few years back, found his increasing duties so onerous that he could not afford the time necessary for the presidential work of the Society. Under these circumstances, I feel that a review of the improvements in the methods of manufacture, and in the various engineering work carried out in this branch of our profession, will not be out of place. That a vast amount of work has been done in this way is beyond question. The greatly increasing size of the gas-works necessary to supply our cities with gas has demanded considerable engineering ability on the part of those engaged in their erection and superintendence—a demand which has resulted in the growth of a distinctly new class of engineers with specialist qualifications in this branch of the profession.

The staple raw material in gas making is coal; and one naturally begins with the reception and housing of that article. The mechanical unloading of coals from ships and barges has recently engaged the attention of many engineers; and one of the systems which has now been largely adopted is the use of Hone's patent grabs, which work with a single chain. These are lowered into the hold on to the coals, and then, on the hauling in of the chain to which they are hung, the grabs gradually close, filling themselves with coal as they do so. The rate at which these automatic grabs can unload a ship, when used with hydraulic derricking cranes, has been proved at Beckton to be a little over 50 tons per hour. This speaks exceedingly well for the arrangement, as it clearly shows that, while with the grabs the number of men required is considerably less, the speed is maintained.

About a hundred of these grabs are now in use at various gas-works in London alone. At several of the works of the Gas-light and Coke Company there are pillars of brick and iron-work round which the coal is deposited from the trucks as received, and afterwards lifted by the hydraulic cranes on the tops of the pillars, by means of these grabs, and placed in the smaller trucks running into the retort-houses, as the coal may be required. Mr. George Livesey was undoubtedly the first to adopt continuous conveyors on a scale of any magnitude, at the Old Kent Road works, where he installed plant capable of dealing with the coke from eight ranges of through retorts to the coke breaker, yard, or store; and since then (1890) many others have adopted the system, both for carrying away the coke and for bringing the coal to the stores or retort-houses. Where sufficient coal is required, perhaps the simplest and most efficient plan is to provide overhead railways into the coal stores and retort-houses, with self-emptying trucks drawn by locomotives. Where smaller quantities, however, have to be dealt with, the continuous conveyor has many advantages.

After the storing of the coals, we come naturally to the heating of the retorts. The principles of regenerative firing are becoming every year better understood; and the very elaborate arrangements which Siemens, Klonné, and others introduced some years back are giving place to more simple methods, which appear to give equal, if not greater, satisfaction. The intricate channels for the heating of the air supplies have been found unnecessary, and simple settings built with ordinary tiles and fire bricks are now being used in most of the larger works; though in moderate-sized works some of the patented systems, notably Mr. Hislop's, have been largely adopted, and with considerable advantage. With the exercise of a little care, a large saving will be effected in the fuel necessary for carbonization; but to get the best results, those in charge should be thoroughly acquainted with the underlying principles of the process. A knowledge also of the methods of testing the gases in the furnace or producer, the combustion chamber, and the flues, will enable the engineer to accurately adjust the quantities of air both for the primary and secondary supplies.

The system of sloping retorts was re-introduced in 1880 by M. Coze, of Rheims; and these have been very considerably adopted in this country. M. Coze, although not the original inventor of sloping retorts, was the first to make their use practical, and he deserves every credit for his labours. The varying

nature, however, of the coals to be dealt with in British gas-works has prevented the more general adoption of retort-benches on this system. The differences in the angle of repose of the various classes of coal is the great trouble, causing as it does much difficulty in getting an even layer and in effecting the easy removal of the coke, especially when the retorts are cracked and uneven. However, there are a large number of works where the charging and drawing of such retorts goes on daily with much success; and a large new works in the North is to be fitted with them. One suggestion, which I feel never received a sufficient trial, was that proposed by Mr. G. C. Trewby, by which a plate was inserted over the coals while they were being put into the retorts, and prevented their sliding down when the retort was set at as high an angle as 35°; this high angle rendering the removal of the coke an easy matter.

Stoking machinery has been increasingly employed during recent years in order to do away with much of the more arduous labour in the retort-house; and at present there are two firms who stand pre-eminent for their apparatus—Messrs. Arrol, who manufacture the Arrol-Foulis hydraulic machinery, and West's Gas Improvement Company, who make Mr. West's machines, which can be driven either by rope gearing, compressed air, or manual labour. Both these systems give admirable results, and considerably reduce the amount of labour required in the filling and emptying of the retorts. In each case the designer of the plant is a gas engineer of considerable experience, who has brought that experience to bear in producing a machine which requires very particular care in its arrangement, as it is subjected to the cutting influence of the coal and coke dust, which has such a very deteriorating effect on all machinery.

For many years past, considerable expense has been incurred in providing baths, &c., with hot and cold water supplies, for the use of the stokers; but it has been found that they are not used to that extent it was hoped might have been the case, and they speedily get dirty and uncared for. A recent application of a simple shower or shower-and-spray fitting for this purpose seems likely to meet a better fate, as there is a constantly descending stream of clean water, which, as it fulfils its purpose, goes at once to the drains instead of forming an accumulation of dirty water around the bather.

Coke, the bye-product of the retort, is now largely used for heating, both for commercial and domestic purposes. The public are beginning to find out what scientific men have known for a long time—that its heating power is very nearly as great as that of coal, being, when properly used, in the proportion of about 13,500 to 14,700; these figures representing the number of heat units evolved by a pound of each substance. Coke breeze, which at one time was almost a drug in the market, is now used in so many ways that its price is well upheld. With forced draught it can be easily employed for steam raising, and mixed with sand and cement forms admirable concrete. The mechanical breaking of coke has largely developed its use for domestic purposes, the loss of weight in the coke being not more than 5 per cent. with the best breakers; and, as I have already said, the residue (breeze) finds a ready sale.

Although not strictly bearing upon engineering, the question of the recovery of the cyanogen, which is always made in a gas-works, could hardly be left out of a list of the improvements made in the methods of manufacture of gas. The cyanogen, which is a gaseous compound of nitrogen and carbon, is produced at the later periods of the carbonization of the charge of coal, and is now principally valuable for export purposes in connection with the recovery of gold from its ores, when it is employed as cyanide of potassium. The amount recoverable from a ton of coal varies from 5000 grains at low heats to 10,000 grains at high heats.

The methods generally adopted for its removal from gas are:

1.—By treatment of the gas as it leaves the scrubbers when all the ammonia has been removed, the gas is then passed through soda or potash in solution in the presence of an excess of iron salt, when from 4 to 4½ lbs. of crystallized ferrocyanide of soda or potash is recoverable from 1 ton of coal carbonized. The great thing to be noted for the complete recovery is that a prolonged and intimate contact between the gas and the alkaline iron solution is necessary. At one time, the formation of sulphocyanide was considered undesirable, but means have now been devised for rendering this equally useful.

2.—By the treatment of the gas liquor with iron salts, when the cyanogen is precipitated as prussian blue.

3.—By the use of oxide of iron in the first purifier for its removal. This plan has been considerably adopted on the Continent, but has the disadvantage of not recovering so much cyanogen as by the washing process, the latter exceeding the former by nearly 50 per cent. Where the recovery takes place in the purifiers, all ammonia must first be removed and a long contact secured with the oxide in a moist state and at a low temperature. A further trouble is that the continuous revivification of the oxide reduces the quantity of cyanogen that it will remove.

Weldon Mud is the name of a bye-product from the manufacture of bleaching powder, and consists principally of hydrated oxides of manganese (M_nO_2 and MnO) and of calcium. The advantages of this material for removing sulphuretted hydrogen are considerable. Instead of charging purifiers frequently, as is the case with oxide of iron, a small quantity of air is admitted into the vessels, which oxidizes the material and renders charging much less frequent. The Weldon Mud is used until it contains from 50 to 60 per cent. of free sulphur, and might even be used still further; but this extent is generally considered to be the highest that is profitable. The *crux* of the question, as between Weldon Mud and oxide of iron, is purely a matter of the price at which the two materials can be obtained.

While upon the question of the use of bye-products of other manufactures for the purification of gas, a precipitated oxide of iron may be mentioned which has been introduced of late years. It contains 95 per cent. of pure hydrated oxide of iron, and can either be used to assist spent oxide, or mixed with sawdust, coke, or any other inert and porous material. As sent out it is in a very fine powder, and can be worked up in the usual way to from 60 to 70 per cent. of sulphur. When such material has to be sent abroad, the saving in freight, as compared with bog ore, must be considerable.

The use of oxygen for the revivification of the oxide or Weldon Mud in the purifiers was, perhaps, rendered commercially possible by the introduction of the Brin process of extracting the oxygen from the air. Our esteemed Past-President, Mr. William A. Valon, was early in the field; and to him is largely due the rendering useful of this plan. He it was who carried out the earliest experiments at the Ramsgate works; and there he proved its utility. He has recently informed me that he is still using this process, and is still as much in favour of it as ever. There is no doubt that the use of pure oxygen has many advantages over the employment of atmospheric air, containing as the latter does such a large proportion of nitrogen, which is only a diluent, and serves no useful purpose when mixed with the gas.

One of the greatest helps to a scientific knowledge of the strains, &c., governing the design of gasholders, was the publication in the "JOURNAL OF GAS LIGHTING," and afterwards in book form, by Mr. F. Southwell Cripps, of his "Notes on the Guide-Framing of Gasholders." This book has done more for the engineering of these structures than perhaps anything else, and has led many to take an intelligent interest in the principles of gasholder construction who would otherwise have been content to plod on in the old rule-of-thumb style which generally prevailed before this book appeared.

The gigantic gasholders on the cantilever system which Mr. George Livesey was, perhaps, the first to undertake, have necessitated a much more thorough knowledge of the stresses involved; and to him and Mr. Cripps no little thanks are due from the gas engineering profession for their aids to this knowledge. The articles by the latter gentleman were originally intended as a criticism on the proposal for the abolition of guide-framing first suggested by Mr. Webber. It is probably this fact which has prevented many from following as closely as they might the admirable chapters on the designing of the more ordinary types of gasholders with cast-iron columns and wrought-iron or steel standards. If Mr. Cripps could be induced to publish a small pamphlet giving merely the details of his investigations into these more every-day strains, I feel sure he would not only earn the gratitude of his professional brethren, but would reap the reward in other and perhaps more solid ways. In the year 1889, which seems to have been very fruitful of new ideas and processes, columnless gasholders were first suggested in a practical form, either with spiral guides, or with wire ropes to keep the floating bell horizontal. Both these systems have been adopted in a considerable number of works, and appear to have given every satisfaction. They have certainly shown that the heavy and costly guide-framing, which was in past years considered necessary, can be largely done away with, and that without endangering the safety of the structure. Although personally interested in the rope system of guiding, having taken out a patent for this method some three months only after Mr. Pease, I am fain to confess that for large holders I do not care to advocate the abolition of all guide-framing, but much prefer Mr. Livesey's plan of retaining the framing to a certain height, leaving only the upper portion free or guided by wire ropes. That this is quite feasible has been proved by Mr. Livesey's gigantic example at East Greenwich.

Gasholder tanks have, of course, like the gasholders, assumed much larger dimensions, and in connection with their size, considerable changes have been made in the material of which they are made. The old-time brick tank with puddled backing has now largely given place to the concrete tank, either with puddled backing, or, what is more common, the face rendered with nearly neat cement. The saving in cost is very considerable, and the tightness and durability are not in any way impaired. One of our Past-Presidents, Mr. C. Gandon, in making a concrete tank somewhat recently, conceived the idea of casting blocks of concrete from time to time. Whenever he removed any old retort work, and had sufficient broken fire-brick, &c., he cast blocks of the right shape to form part of the wall of a proposed tank; so that when the tank was started, a number of these blocks were ready to be merely jointed together in position. This plan has many advantages, as it saves ground space which would otherwise have to be provided for the storage of the broken bricks, and it certainly helps largely to keep the works tidy. It, however, necessitates the providing of plans of

the extensions long before these are absolutely required. I am wondering in how many works this has been done, and a clear and distinct plan of extensions provided, to which the works may be converted as the output increases. I fear in but few except the larger works. Effort in this direction should form an interesting and instructive work for any gas manager, and might well become a source of no little profitable discussion whenever several congregated together.

To return, however, to the use of concrete in gasholder tank construction, I can recommend to anyone about to undertake such work the plan adopted by myself in the construction of a 10-feet tank somewhat recently. The concrete was mixed dry on the ground level with only one turning, and then shovelled into the hopper of a shoot leading to the stage at the level where the concrete was to be used. It was then watered and turned over, and was found to be most thoroughly mixed—in fact, I have never seen better mixed concrete than in this instance. The method occasionally adopted of wetting the concrete before it is put into the shoot is one which I cannot recommend, as it has a tendency to coat the sides of the shoot with cement, and leaves the ballast or other aggregate to pass down without the proper amount of cement.

It is unfortunate that little new data or little information of a scientific nature have been forthcoming as to the strength of tank walls, as the old methods of calculation are distinctly unsatisfactory; and until someone with time and inclination to experiment takes the matter in hand, mere rule-of-thumb must continue to largely prevail in these matters.

The recent expiry of the Otto patent for the 4-cycle gas-engine, which was first introduced in 1876, has led to a number of makers of such plant including these engines in their manufactures; and there is little doubt that the use of gas-engines will increase in consequence. But gas engineers do not sufficiently push their use, nor do they use them sufficiently in their works. In my opinion, all motive power in a gas-works, except that for the exhausters, which is so very variable in its load, should be furnished by gas-engines. Scrubbers, pumps, coke-breakers, elevators, stoking machinery, could all be driven by this means; but how often is it so done? Let the public see that we practice what we preach, and they will the more easily believe us.

Mr. Denny Lane's suggestion was a distinctly good one—viz., to supply current for electric light by means of gas-engines; but this has not been sufficiently encouraged. Nor have gas engineers taken this matter in hand, or they could have kept much of the electric lighting within their own power, and with little if any decrease in their gas consumption.

Gas-engines are now made on the Continent up to 1000 and even 1500 horse power, if desired, and to be used with coal gas, Dowson gas, or high furnace gases; the use of these latter effecting a considerable saving in fuel as compared with their use for heating boilers for steam-engines.

While upon the subject of internal combustion engines, I might mention a coal-dust burning internal combustion engine of a very novel description, which has been invented by Mr. P. F. Maccallum, of Helensburgh, Dumbartonshire, and experimentally tried on a small scale at Edinburgh. The construction of the engine is such that no lubrication of the combustion cylinder is necessary; while at the same time the rubbing surfaces of the piston and working cylinder are thoroughly protected from heat and dirt by an ingenious method of interior water circulation. In working the experimental engine, a volume of air is compressed by the up-stroke of the piston into the upper part of the combustion cylinder. The proper quantity of coal dust is then injected by a jet of high pressure air on to a wrought-iron plate attached by a stud to the piston, and maintained at a high temperature by the successive combustions. Immediately the first portion of the coal dust strikes the plate, ignition takes place, and a working down-stroke is made. When the piston reaches the bottom of its stroke, the exhaust-valve opens, allowing the combustion products and suspended ash to escape. A fresh charge of air then ascends through automatic valves from the crank chamber, and is compressed into the upper part of the cylinder in readiness for another combustion stroke, and so on. As the fuel never comes into contact with any but dry surfaces, and is always kept in a state of suspension and motion, no accumulation of ash or dirt takes place within the engine; the force of the exhaust being amply sufficient to sweep out any solid matter which can possibly enter the engine through the fuel feeder. The engine is equally satisfactory when employed with oil.

The engine working with coal dust gives diagrams of good and regular form, showing about 15-horse power at a speed of 150 revolutions per minute, with a fuel consumption of about 1½ lbs. of coal dust per horse power per hour. The consumption of fuel would be much less but for several defects in the design of the experimental motor—in fact, from one cause and another nearly one-half of the fuel injected at each stroke is exhausted without having done any useful work. Notwithstanding the defects alluded to, inseparable perhaps from a first motor presenting so many points of absolute departure from previous practice, the engine has been pronounced a practical success by many well-known experts who have examined it in operation. Professor Stanfield predicts that a larger engine of improved design will give a horse power for a consumption of about ½ lb. of coal per hour. Almost any kind of coal can be used; and the cost of pulverizing is stated to be from 6d. to 9d. per ton. The inventor is now engaged in forming a Company to fully demonstrate his system by building a larger engine on improved lines.

The troubles with the labourers engaged in gas-works in 1889—first at Beckton, then at Manchester, and finally at the South Metropolitan Gas Company's works—will be in the memory of most of us, more especially on account of the success of the latter Company, who were afterwards able to announce that they would receive no Union workmen. The strike cost them a considerable sum of money, and was perhaps the direct cause of their profit-sharing scheme, which provides a bonus of 1 per cent. on the year's wages of any workmen for every 1d. reduction below 2s. 8d. per 1000 cubic feet. This was a successful attempt to identify the workmen with the interests of the Company. At Beckton, however, the Directors of the Gaslight and Coke Company erected, and have kept in order since that time, complete barracks, with officers' quarters, bakeries, &c., in accordance with an arrangement with the War Office that in the event of the stokers leaving, soldiers from the Royal Artillery shall be quartered in the barracks on the gas-works, and accompanied by their own officers. Beds, blankets, &c., are kept dried and aired continually.

Probably the strikes were the cause of one of the most conspicuous instances of evolution in the manufacture of gas—namely, the introduction into this country of the system of carburetted water gas, which had been considerably used in the United States. Originally patented in the year 1824, by Mr. J. H. Ibbetson, it never proved a commercial success until, in 1873, Professor T. S. C. Lowe introduced what is now termed the "Lowe apparatus," which is really the foundation of all the carburetted water-gas plants in use in this country. All these plants make use of the well-known fact that superheated steam passed through incandescent fuel becomes separated into its component parts, hydrogen and oxygen; the latter combining with the carbon of the fuel to form carbon monoxide, the former passing off by itself. These gases are then enriched by being mixed with oils vaporized by heat, and are further fixed, or rendered permanent, by prolonged contact with heated surfaces.

The fact that the name "carburetted water gas" contains the term "water gas" is unfortunate, as many would-be clever people who have that "little knowledge" which is "a dangerous thing," have been raising considerable agitation in many towns in which this plant is being placed. The one fact which they have failed to grasp is that, while water gas, *per se*, has no smell, carburetted water gas has, if possible, a stronger and more penetrating smell than coal gas; and yet, day after day, we see the statement advanced in the Press that the danger of the adoption of this system of gas supply is the fact of its possessing no smell, while it is of a much more toxic character than ordinary coal gas. The pronouncements of scientific men seem to have no effect on these statements, and one finds them repeated time and again.

That carburetted water gas does contain more carbon monoxide than coal gas is not to be denied; but that the extra quantity which will be delivered through the mains to the consumers will cause any greater number of accidents through escapes, I do not think at all likely. As one eminent scientific gentleman remarked, "gas is not made for breathing." At the present time, plant to the extent of 97,795,000 cubic feet per day has been erected by Messrs. Humphreys and Glasgow, by the Economical Gas Apparatus Construction Company, and by Messrs. Samuel Cutler and Sons in different gas-works in this country. That such a number of those responsible for our gas supply should have favoured this system clearly indicates that there must be in it several points of advantage to the gas maker. First and foremost the small area required is, in some works, the most important consideration; and nearly four times the quantity can be made of carburetted water gas as could be made of coal gas in the same area. The initial cost is comparatively low; while the number of men employed is much less. But what perhaps interests the gas engineer more is that it uses up his stocks of coke, and enables him to ask for, and obtain, a much higher price for what he has to spare. Then, again, the rapidity with which a set can be put into complete action is, in our foggy and changeable climate, a great advantage. A completely cold setting can in four hours' time be in full work, as against some forty-eight hours with coal-gas retorts. The simplicity also of the regulation of the candle power of the gas by the control of the quantity of oil used in carburetting, is distinctly in favour of this process; while the fact that troubles with naphthalene in the district are much reduced, if not entirely removed, forms yet another reason for its popularity.

The contractors for this apparatus are generally prepared to guarantee that the plant shall produce 1000 cubic feet of 22-candle gas, with not more than 50 lbs. of coke nor more than 4 gallons of oil—and this under very stringent conditions. That the contractors have almost invariably improved considerably upon their guarantee is a clear proof of the satisfactory nature of the various designs for the apparatus. An average of some twenty-four tests in the same number of works gives a candle power of 22·56, with a quantity of oil of 2·99 gallons per 1000 cubic feet.

The Peebles process of making permanent high-quality gas for enriching ordinary coal gas has been considerably adopted throughout the country. Using, as it does, almost any class of oil, it has, with the water-gas plants, distinctly governed the price

of cannel coal, and prevented that commodity rising to the high figure it seemed destined to reach. The plant is very simple, and consists mainly of a retort set at a slight angle and heated to from 900° to 950° C., or about black red. The oil is run into the retort and gasified, passing away to condensers filled with the oil making its way to the retort. This washing with oil removes all the non-permanent gas, so that only the gas which will remain as such passes away to the mains, while that which has been condensed out by the oil is returned to the retort with the fresh oil, and is there either gasified into permanent gas or else left in the retort in the form of a dense coke, consisting of nearly 96 per cent. pure carbon. It has been found with the gas made by this plant, as well as with that made in the carburetted water-gas plants, that the enriching value of the gas is considerably greater than its direct illuminating value would lead one to believe, and this to an extent of from nearly 25 to 30 per cent.

The Clark-Maxim carburetters, and also that of Mr. Cripps, are now largely used in gas-works for enriching the gas as it leaves the works; and in them a highly volatile liquid carburine is generally used, although naphtha or benzene are also frequently employed. These systems are said to reduce the number of naphthalene troubles.

A few years back, the discovery of the possibility of manufacturing acetylene gas—which Professor Vivian B. Lewes had been endeavouring to show was the principal cause of the illuminating power of coal gas—from carbide of calcium, led to innumerable patents and reports that a further rival to coal gas had arisen, which would entirely supersede it in a very short while. This, however, it has not done, although it has been considerably introduced for the lighting of private houses in country districts which the ordinary towns' gas-mains do not reach. The necessarily high price of carbide of calcium, which requires a fairly strong electric current for its manufacture, has done much to restrict the use of this acetylene gas; while numerous accidents with it, both at home and on the Continent, have made people chary of adopting it. One of the unfortunate circumstances connected with this gas is that it does not hold its high illuminating effect when used as an enricher of lower candle power gases. When it is employed in this way, its enriching value is considerably reduced—far beyond what would generally be the case with other rich gases. It is, therefore, very different in this respect from either carburetted water gas or the gas made by the Peebles process of direct oil-gas enrichment. The great simplicity of the making of acetylene gas from calcium carbide will no doubt assist in its adoption; but that many have been grievously disappointed over it can be easily seen by an examination of the Patent Office records.

For some years past, I have devoted a large amount of time to photometrical matters, more especially with the aim of devising a photometer which shall require no calculations of any sort; so that it may be placed in the hands of anyone of ordinary visual activity, but who may not have that acquaintance with decimal arithmetic which is necessary with present methods. A few years ago I read a paper on the subject before the North British Association of Gas Managers, dealing with the progress I had then made in this direction. I have since then had the matter simplified through the introduction by the Metropolitan Gas Referees of their new form of photoped testing apparatus. They have gone largely on the same lines as I was working on, in that they bring the beams of light from the two sources—namely, the standard and the light to be tested—upon one translucent screen. The principle of measuring the time which it takes to consume the one-sixth part of a cubic foot of gas when the two beams of light are equal, has enabled me to arrange for the complete elimination of all calculations. I attach the clock to the meter, and have a connecting-rod by which the clock may be started and stopped, when desired, by the meter; and upon the face of the clock I have a second circle divided into candle powers and tenths about the ordinary circle showing the seconds. In making a test with this instrument, the procedure is exactly similar to the Gas Referees' new Instructions, in so far as regards the comparing of the beams of light and the settling of the proper rate of travel of the meter; but the latter, having the attachment for correcting for the variations of temperature and barometrical pressure, removes the necessity of calculations for this correction. As soon as the rate of travel is found, the clock is started by depressing the lever in the ordinary way. This not only starts the clock, but puts into gear a wheel which will have the effect of stopping the clock when the meter has made two revolutions. The position of the hand indicates on the outer circle of the clock the exact candle power of the light being tested. This system could also be applied to the ordinary bar-photometer. Any engineer can readily set out such a circle for his clock after an examination of the table provided by the Gas Referees.

With regard to the more chemical part of gas testing, the principles remain much the same—namely, the absorption by different reagents of the several constituent gases, and noting the diminution of the volume of gas after absorption. The Cooper tube or eudiometer has been almost entirely superseded, on account of the great trouble involved in getting perfectly accurate results; and a host of other apparatus have come into use—principally the Bunte burette, the Frankland and Ward, and the Orsat-Muencke apparatus. In the latter arrangement, separate chambers are provided for the absorption by each of the reagents; and the gas is forced into each in turn, the diminution in each case being noted. This is very useful and convenient for the partial analysis of gases, more especially furnace, producer, and flue gases; while the Frankland and Ward apparatus, which is somewhat elaborate, is more suitable for thorough analysis, but is only to be found in very complete gas-works laboratories.

Having only recently dealt with the subject of governors in my paper before the Society, I need not enter into great detail regarding the improvements in them. At present, it would hardly be possible to find a governor made without compensation of some kind for the variation in inlet pressures. The principle of working a governor at some distance from the works by means of an air-tube and separate loading bell, first proposed by Mr. Foulis, has been adopted in a number of works; and the saving in main-laying thereby has been great. Several arrangements have been tried, with success, for the purpose of varying automatically the weighting of the bell according to the quantity of gas passing through the governor. The greatest trouble, however, which makers of these pieces of apparatus have to contend with is the desire on the part of most engineers for a governor of much larger capacity than is at all necessary. The area of the cone of the governor need never be greater than two-thirds of the area of the mains in connection with it; and where only a very small day consumption is found, a smaller bye-pass governor may be fixed with advantage.

One of the greatest advances in gas matters has been the introduction of the Welsbach incandescent light. The early attempts were unsuccessful, owing to the tender nature of the mantles; and it was not until the use of collodion was introduced that it became possible to send the mantles from manufacturer to user. The patent for the use of the rare earths employed in the preparation of the mantles was perhaps more carefully drawn up than many others, as, despite most costly litigation, the original patent has been upheld throughout. The first patent has now expired; but there is still another in the hands of the Welsbach Company which has some years to run, and which contains protection for a very essential element in the making of the mantle. Into the details of the manufacture I need not enter; but a remark may well be made on the enormous increase of light obtainable by the incandescent system over the ordinary flat-flame or any other form of burner—it giving as much as from 25 to 30 candles per cubic foot of gas as compared with some 3 to 4 candles per foot with argands or flat-flame burners. In other words, a Welsbach burner will give a light of 20-candle power for 1000 hours for 2s. 3d., while a flat-flame burner, for a light of only 16-candle power for 1000 hours, will cost 15s.

That this burner has done more for the extension and retention of gas lighting than any other invention of the last twenty years, cannot be denied; as not only is the light much cheaper, but a reduced quantity of gas required means a smaller quantity of oxygen consumed and air vitiated—an important point in small rooms. There is, no doubt, still further improvement necessary, and that is in the direction of strengthening the mantle. Wherever vibration exists, the mantles speedily go to pieces; and hence, despite elaborate mechanism to preserve the mantles, they are still absent from many of our street-lamps, where they would be most admirably placed. This is owing to the large number of mantles completely spoilt in a very short time; and when a stronger mantle can be supplied, there is little doubt that our streets will speedily be better lighted.

The knowledge of the ordinary gas-fitter of the elementary principles which govern the distribution of gas is very limited. He seldom knows anything of the difference in pressure due to the varying levels, the difference in quality of the gases in different towns, or the difference in the respective quantities that can be passed through a pipe of a given size and of a certain length according to the variations in the specific gravity of the gas. When called upon to lay pipes and light rooms, he goes by any old rule-of-thumb method which his father or grandfather practised. How many could set out a diagram showing, say, the amount of light thrown upon the floor by the lights they suggest for a certain room? How many know even the most ordinary details of gas manufacture? Surely here is a field for those who have the necessary knowledge to begin by enlightening the gas-fitter, and so save trouble later on. Every gas manager in the three kingdoms should give lectures periodically to those in his town interested upon these points; and if he cannot do it himself, someone who has perhaps the time or requisite knowledge should be engaged to give such lectures in as popular a manner as possible. The addition of a small model gas-works, or even the simple old experiment of the clay pipe, will help many to better understand the method of the manufacture. For my own part, I have always found these lectures listened to with interest by all classes of the community.

And now, gentlemen, I think I have said enough to show that a gas engineer at the present day has to be educated in most of the branches of the profession of a civil and mechanical engineer; and to aid him in this direction, much good has been done by courses of lectures in most of the large centres. The admirable reports of the various meetings and the careful selection of interesting matter in our technical journals, the "JOURNAL OF GAS LIGHTING" and the "Gas World," have also helped considerably; but in addition to these means, the gas engineer must apply himself to the acquirement of knowledge from every possible source. He should make it a rule to note down every item coming to his notice which may at any future time be likely

to be of use to him. He must study every detail of the apparatus under his control. He should be able to take to pieces and re-make any portion of the works, however unimportant; it is not sufficient merely to know their use and purpose. He should be able at any point in the process of gas making to make a test both of the gas itself and of the material used in its purification. He should study not only the stresses in the various structures, but should also note the effect of wind, weather, and oxidation upon them. If he be sufficiently inventive, he can make for himself, very cheaply, almost all the testing apparatus he may require, provided he understands correctly the principles upon which the tests are made. The examinations annually held by the City and Guilds of London all over the country are most admirably conducted, and of a thoroughly practical character. A glance over the questions of the past few years will satisfy anyone that they are not set by mere theorists, but by men with a thoroughly practical every-day experience of the needs of a gas engineer. I would strongly advise all young men connected in any way with gas-works to study and to strive to pass these examinations, as they will find that to hold the certificate of the City and Guilds is to have a guarantee of their practical acquaintance with the working of a gas-works plant. General knowledge of all branches of engineering may be obtained in few better ways than by attendance at such meetings as ours. For my own part, I cannot recollect the occasion when I have been present at the reading of a paper, and the subsequent discussion, when I have not gone away with some information likely to be of benefit to me; and I hope to see a full attendance each evening during my year of office.

ESTIMATION OF NAPHTHALENE IN COAL GAS.

At the Fourth Meeting for the present session of the Nottingham Section of the Society of Chemical Industry, held last Wednesday, at Burton-on-Trent, a paper on the above subject, prepared by Dr. Harold G. Colman (Chemist at the Saltley Gas-Works, Birmingham) and Mr. J. F. Smith, was presented. The method devised by the authors depends on the well-known fact that naphthalene combines with picric acid to form a fairly stable crystalline compound—$C_{10}H_8$, $C_6H_3N_3O_7$—which is scarcely soluble in aqueous picric acid. In carrying out the test, gas is passed through a series of bottles containing picric acid solution of known strength and volume, at the rate of 0·5 to 1 cubic foot per hour, until from 10 to 15 cubic feet have passed. The naphthalene separates almost entirely in the first bottle, in partial or complete combination with picric acid, as a yellow precipitate. The combined liquid and precipitate is then heated in a closed bottle for some time. After cooling, the whole of the naphthalene separates out in needles of the above compound. These are filtered off, and the amount of picric acid in the filtrate estimated by alpalimetry. The difference between this quantity and that originally taken gives the amount of picric acid which has combined with naphthalene. As naphthalene picrate contains 229 parts of picric acid to 128 parts of naphthalene, the quantity of picric acid found in this manner multiplied by $\frac{128}{229}$ gives the amount of napthalene in the volume of gas passed. A series of tests made with gas containing known quantities of naphthalene shows that the method is accurate to about 1 part in 30 parts, when proper precautions are taken.

Wood Casing and Tubes for Electric Wires.—In view of the recent correspondence in "The Times" on the subject of the protection of electric light wires, to which reference has been made in our "Electric Lighting Notes," it may be of interest to reproduce from the "Electrical Review" the wiring rules prepared by Professor Kennedy in connection with the three-wire system of supply by the Battersea Vestry. They are as follows: "All conductors must be protected either by incombustible tubes or by hardened casing. If tubes are used, no elbows may be employed, but corners must be turned either by bends or by the use of a suitable box. Details of all such arrangements should be submitted to the Engineer for his approval before they are carried out, in order that there may be no difficulty in approving the installation afterwards. Where wood casing is employed, the conductors must be separated by a continuous fillet of wood which must not be less than ¾ inch wide, except with the very smallest branches, and must be increased up to 1½ inches wide for main conductors. The capping must in all cases be secured by screws and not by nails, and the screws must be fixed in the outer edges of the casing, unless the middle fillet is at least 1¼ inches wide. If conductors have to be carried along damp walls, they must either be run in iron or metal pipes, or if in wood casing they must be lead covered, and the casing itself blocked out from the wall at least ¾ inch. In the latter case, and whatever wood casing is to be embedded in plaster, it must be covered inside and outside with at least two coats of waterproof varnish. On no account must staples be used to fasten a conductor to any wall or ceiling. Wherever conductors are connected to switches, fuses, or other appliances, great care should be taken that the whole of the wires forming the conductor are neatly twisted and clamped into the terminal, so that no loose wire or strand can project."

THE RECOVERY OF NITROGEN IN COAL DISTILLATION.

By W. Carrick Anderson, M.A., D.Sc., and J. Roberts, F.C.S.

In the "Journal" for Nov. 28 last, a brief abstract appeared of the communication made by the above-named authors to the Scottish Section of the Society of Chemical Industry. The publication of the full text of the paper in the "Journal" of the Society places further particulars at our disposal.

The authors commenced by referring to a paper they read about a twelvemonth before, in which they drew attention to the large amount of combined nitrogen which is annually being used up in the combustion of coal without being turned to profitable account. Certain figures they then put forward as indicating the possibilities in the way of ammonia recovery that lay before the industries engaged in the destructive distillation of coal, were based upon the expectation of advance along two different lines. The first of these was an extension of the present processes of separating coal into gaseous and fixed constituents (to be subsequently burned apart), with simultaneous recovery of the resulting ammonia and tar. The application of this mode of procedure to even a fraction of the coal at present consumed in the raw state for industrial and domestic purposes would result in a very considerable augmentation of the present supplies of combined nitrogen available for industrial use. The second depended on the possibility of a substantial improvement in the present methods of ammonia production from raw coal in the industries of gas lighting, coke production, and iron smelting, which would render available for the market a larger percentage of the nitrogen which is combined in every ton that is daily consumed in these several connections.

Since then, they continue, the practicability of extensive development along the former of these lines has been amply discussed, and we might almost say fully demonstrated, by Mr. Beilby in his Presidential Address to the Society at its last annual meeting in Newcastle (see "Journal," July 18, Sept. 5 and 12, 1899). The installation of central stations from which fuels, solid, liquid, and gaseous, would be distributed according to the requirements of the consumer, would open up the prospect of largely increased supplies of marketable nitrogenous products, and especially of sulphate of ammonia. But while, not only as chemists but as citizens, we must wish God-speed to any such proposal, the time seemed opportune to further inaugurate a discussion which might tend to promote a better understanding of the conditions of ammonia production in the destructive distillation of coal, and so render it, perhaps, possible to obtain larger yields per ton than are now the rule.

At present, the commercial supply of sulphate of ammonia is drawn from four sources, but to a very different extent. The latest report of the Chief Inspector of Alkali Works shows that during last year the output of sulphate of ammonia in this country was made up as follows:—

(1)	From gas-works	129,590 tons.
(2)	„ shale-oil works	37,264 „
(3)	„ blast furnaces	18,000 „
(4)	„ recovery coke-ovens	11,568 „
	Total production	196,422 tons.

Of the four sources indicated, Nos. 2 and 3 are probably scarcely to be looked to for any very remarkable increase. At present, the production of sulphate at gas-works enormously preponderates over the other three. Mr. Beilby's calculations show that, were beehive ovens to be entirely replaced by plant of the recovery type, it would probably result in an addition to the fourth item of 110,000 tons per annum, which would bring the aggregate from this source to practically the same figure as the first. Now, without asserting that the complete replacement of beehive ovens by recovery types is an event of the very near future, we are not over-sanguine in saying that a comparatively short term of years will see this large tonnage very nearly approached, while, at the same time, should the desirable consummation be reached to which Mr. Beilby pointed—namely, the manufacture of solid, liquid, and gaseous fuel in large central establishments—we might well see the aggregate from items Nos. 1 and 4 grow into a total that at the present moment it would appear fanciful even to mention.

The importance of a thorough understanding of the conditions under which ammonia is obtained from coal is thus apparent. It is an importance which is not to be measured by present-day results, successful in a way, and profitable as these undoubtedly are, but by the enormous future which lies before these industries when the doctrine of economic waste has been brought home as a vital truth to a larger section of the community than at present.

The points we propose specially to consider are: (I.) The way in which the nitrogen of coal distributes itself on heating; and the conditions under which ammonia is obtained in retorts and ovens. (II.) The limits of ammonia production; and the obstacles in the way of reaching these limits.

It is difficult to say exactly what the average nitrogen content of coal is. Samples differ so much within the narrow limits of, say, 1 to 2·5 per cent., that it is hardly possible to set down a single figure as the ascertained average.* Excluding anthracites,

* With reference to determinations of nitrogen in coal and coke, there is little reason to doubt that many of the figures given by the earlier writers are too low.

however, from consideration, analyses we have made of specimens drawn from very various quarters, seem to indicate 1·4 per cent. as not far removed from the average figure:—

One ton of coal assaying 1·4 per cent. of nitrogen contains 31·36 lbs. of nitrogen, equivalent to 147·8 lbs. of sulphate of ammonia.

From figures quoted by Mr. Beilby, it appears that the average yield of sulphate of ammonia per ton of coal is—

From coke-ovens. . 19·7 lbs. = 13·3 per cent. of available (calculated on above basis).
„ blast furnaces. 20·2 „ = 13 7 „ „ „
„ gas-works . . 22·4 „ = 15·1 „ „ „

Overhead, the average weight of sulphate recovered per ton of coal is rather under 22 lbs.; or about 14½ per cent. of the available nitrogen is obtained in this form. The quantities of nitrogen recovered and recoverable as cyanogen compounds, while forming a fairly large aggregate, work out to such a small figure per ton that for the moment we leave them out of account.

It is further to be noticed that, in the three principal industries referred to, the quantities of sulphate made per ton of coal treated are by no means the same—

Coke-ovens. . . . . 19·7 lbs.
Blast furnaces. . . . . 20·2 „
Gas-works . . . . . 22·4 „

Moreover, it is hardly to be doubted that, if the yields obtained in various coke, iron, and gas works were set forth for comparison, still more striking differences would be noted.

Coals are mixtures of more or less complex bodies, produced from the degradation of the original constituents of the vegetable substances that went to form them; and one of these bodies at least in every coal is nitrogenous, derived from the primitive albuminous or protoplasmic substances of the plants and their spores. It is this body, or series of bodies, whose behaviour on distillation we have to consider; and the first difficulty that meets us is our entire ignorance of its character and constitution. Tervet, however, has shown (see "JOURNAL," Vol. XLIII., p. 403) that when hydrogen is brought in contact with nitrogenous bodies at a high temperature, the latter part with their nitrogen more or less freely in the form of ammonia, and in the generality of cases the ultimate result is a complete, or almost complete, conversion of it into this form. The ease with which the separation is effected, however, varies in different compounds. Pyrrol and alkaloids do not appear so susceptible to the action of hydrogen as other substances; paracyanogen, on the other hand, which initially contained no hydrogen, gives ammonia at once.

When coals are subjected to a gradually increasing temperature in a closed vessel, a considerable loss in weight is experienced before the thermometer reaches 300° C.; but in no case have we found any loss of nitrogen to take place under 333° C. Above that limit, coals differ very widely as regards the temperature at which ammonia or other basic substances begin to be evolved. The exact determination of these minima directly in the case of different coals is rendered somewhat difficult by the varying duration of the acid reaction, which in most cases is noticeable in the distillation process at temperatures between 315° and 400° C. In every coal we have tried, however, the alkaline reaction may be said to start below 480° C. The splint and gas coals of Mid-Lanarkshire begin to yield alkali at what is, comparatively speaking, a low temperature, a fact which has undoubtedly been of great value in relation to the development of ammonia recovery in the blast-furnaces of the West of Scotland. In the case of strongly caking coals, the minimum temperature of ammonia formation is higher than in the Lanarkshire splint and gas; but in all instances of which we have experience it lies below 470° to 480° C. The evolution of ammonia, when started, continues for a considerable length of time, during which the temperature of the charge is steadily rising; and even when a quantity of material has been at a red heat for some time, it is possible to detect an alkaline reaction in the gases.

The varying temperature at which the evolution of ammonia begins in the case of different samples of coal, would suggest at once that the nitrogenous bodies present in them were different. This conclusion is supported by other evidence as well. For example, the derivatives we have obtained by oxidation of the coals are apparently different, and, as we shall see hereafter, in other ways the nitrogenous constituents in different coals behave differently.

While this is so, it is an interesting fact that the fixed residues of coals which differ widely in character, and which come from distant localities, contain a very constant proportion of nitrogen, when the residues are prepared in the same way, under identical conditions. In a series of experiments we conducted with reference to this point, 2 grammes of the finely powdered coal was heated in a covered platinum crucible for exactly two minutes, over a strong bunsen burner, and then, without cooling, for exactly three minutes over the foot-blowpipe. The cooled residues were weighed, and, after being finely ground, the nitrogen was determined in 1 gramme of the powder.

The analyses of these samples of coal were given in our previous paper mentioned above. Nos. 1, 2, and 3 are non-caking bituminous coals; Nos. 4 and 5 are well-known caking varieties; while No. 6 is from a seam which has been partly "burnt" by intrusive volcanic rock, converting it into a high-class steam coal. The numbers given in our third column of figures are strikingly large as compared with those that are recorded for certain samples of coke made on a manufacturing scale by Foster and Watson Smith. An explanation of the difference at once suggests itself as likely to be found in the fact that very much more rapid heating has taken place in the case of the small sample treated in a platinum crucible than is possible with a charge of 4½ to 5 tons in a coke-oven, or even with one of 3 cwt. in a gas-retort.

From the experiments of Tervet, quoted above, the nitrogen of coal is capable of being eliminated completely, or almost so, by the action of hydrogen at a red heat. Time, however, is a necessary factor in the reaction; and in the experiments detailed above the influence of the hydrogen ceased completely in less than five minutes, whereas, even in the comparatively rapid process of heating employed for making illuminating gas, a hydrogen atmosphere surrounds and permeates the coal before it is thoroughly coked, for a much longer period. Much more is this the case in the coke-oven, and especially in wide ovens of the beehive type, where a temperature of 350° C. and upwards —sufficient to cause formation and evolution of ammonia—may, and even must, exist for a very long time, especially in the central region, before the heat required for complete coking has penetrated from the top or sides.

TABLE I.

Name of Coal.	Nitrogen in Coal.	Weight of Fixed Residue (Coke).	Nitrogen in Fixed Residue (Coke).	Nitrogen Expelled from 100 grms. Coal.	Nitrogen left in Coke from 100 grms. Coal.	Per Cent. of Original Nitrogen left in Coke.
	Per Cent.	Per Cent.	Per Cent.	Grms.	Grms.	Per Cent.
1. Ell coal	1·53	55·37	1·83	0·517	1·013	66·2
2. Splint coal . , .	1·50	55·14	1·73	0·527	0·973	64·9
3. Kiltongue coal. .	1·65	55·84	1·77	0·661	0·989	59·9
4. Bannockburn main coal	1·89	69·93	1·80	0·631	1·259	66·6
5. Kilsyth coking coal	2·04	66·59	1·79	0·849	1·191	58·4
6. Lower Drumgray (Slamannan) .	2·12	79·14	1·79	0·693	1·427	67·3

The figures given in the third column of Table I. show a very striking agreement among the percentages of nitrogen left behind in the fixed residues got on ignition. Yet it would not be safe to lay too much stress upon such apparent identities. Although the figures representing nitrogen expelled show a little more variation, they are really of greater practical and even theoretical importance.

Since the nitrogen is expelled through the agency of hydrogen, it might be hastily assumed that the absolute amount thus volatilized ought to bear some approximately constant ratio to the total hydrogen or to the amount of (so called) available or disposable hydrogen in the coal, or even to the amount of volatile matter obtained on ignition. In point of fact, it shows no such relation. And on further consideration, it is obvious that we have no real ground for any such expectation. To begin with, even if the composition of the gases from two coals were absolutely identical, the temperature of decomposition in the one case may be very much higher than in the other; and the influence of equal weights of hydrogen on the contained nitrogen will therefore not be the same. Moreover, a "coal" is a complex mixture; and the total hydrogen in one may be made up from sources whose relative values are different from what they are in another sample. The "disposable" hydrogen, and even the so-called "combined" hydrogen, may be disposed differently, and the volatile matter may be of very different composition in different cases. Take what is known as "isomerism" in coals. Here are two samples, the analyses of which we quote from our previous paper—

TABLE II.

——	Gas Coal (Hamilton District).	Upper Drumgray Coal, Sample (1) (Airdrie District).
	Per Cent.	Per Cent.
Hydrogen	6·11	6·16
Carbon	83·92	83·69
Oxygen + Sulphur. .	8·29	8·36
Nitrogen	1·68	1·79
	100·00	100·00

The figures for the ultimate analysis are practically identical; but in every other respect the coals are different. The one is the Hamilton gas coal—a non-caking, shaly-looking mineral, with a marked conchoidal fracture, giving on distillation a large yield of gas. The other is a bright, lustrous substance, with irregular fracture, and of fair caking power. It is from the Upper Drumgray seam in the Airdrie district. But, when ignited, the one gives 2 per cent. more volatile matter than the other; and we can safely affirm that the temperatures at which decomposition will begin, and the form in which the volatile matter will appear under similar conditions of distillation, will not be the same. Hence the action of the hydrogen on the nitrogen contained in the two bodies must necessarily be different, to some extent, in degree; and, indeed, the gases evolved in the one

instance begin to give an alkaline reaction at a temperature 40° lower than in the other. Our former investigations on the derivatives of the nitrogenous constituents of coals seemed to indicate that in different coals we had to deal with bodies which, although similar, were not absolutely identical in composition; and the position and arrangement of the nitrogen atoms in the original bodies may therefore be assumed to be different.

One other observation we have made in this connection is important. The samples of coal in which the above determinations of nitrogen, fixed and volatilized on ignition, had been made were left in a finely powdered condition in bottles for a period of ten months; and similar determinations were then made upon them. As the result presumably of an alteration in the composition of the coals consequent on atmospheric oxidation, the distribution of the nitrogen on ignition had changed. In both the samples of caking coal, it was found that a much larger percentage of nitrogen remained fixed in the coke; in splint coal the amount was the same; while in the Kiltongue it was less than at first.

TABLE III.

—	Nitrogen (at first).	Nitrogen (after Coal had lain powdered for Ten Months).
	Per Cent.	Per Cent.
Coke from splint coal contained	1·73	1·720
Coke from Kiltongue coal contained	1·77	1·575
Coke from Bannockburn Main coal contained	1·80	2·100
Coke from Kilsyth Coking coal contained.	1·79	2·244

A 5 gramme sample of the splint coal, which was found to show the least amount of change in these experiments, was boiled for 60 hours with 300 c.c. of a 5 per cent. solution of sulphuric acid. The residue was thoroughly washed till free from acid (an operation that required a very long time), then dried at 100° C., and examined. The composition of the sample, as indicated by proximate analysis, remained practically unchanged. When, however, the fixed residue got on ignition of this sample was assayed for nitrogen, it was found to contain 2 per cent., as compared with 1·73 per cent. in the original coal.

The conclusion we arrive at is that, in ordinary practice of ammonia recovery in distillation, the first factor to be considered is the character of the coal itself; and that, even when distilled under identical conditions, different coals will give off variable amounts of nitrogen, and that this is not dependent altogether on the quantities of nitrogen and hydrogen, or of both, which the coals contain.

TABLE IV.

—	Original Coal.	Treated Coal (Dried at 100° C.).	= Calculated on basis of 7·27 per Cent. Moisture.
	Per Cent.	Per Cent.	Per Cent.
Moisture	7·27	0·60	7·27
Ash	2·20	1·42	1·32
Volatile matter	36·22	39·94	37·26
Fixed carbon	54·31	58·04	54·15
	100·00	100·00	100·00

The portion of the original nitrogen of the coal which becomes fixed in the carbonaceous residue (amounting in our experiments —Table I.—to 53 to 63 per cent. of the total) is at the present time unrecovered in any of the industries which deal with the manufacture of nitrogenous compounds from coal. Its presence in the coke, moreover, necessarily lowers the heating power of the latter, and in the blast-furnace diminishes the efficiency of the active gases generated in its combustion by diluting them with a more or less considerable proportion of free nitrogen. In these circumstances, it seemed worth while to try the effect of certain reagents in eliminating this nitrogen; and the results are interesting, even if they do not offer very much encouragement. The splint and ell coals were selected as examples of the non-caking class, and Bannockburn Main and Kilsyth coking as typical caking coals.

(*a*) One grm. of the sample, in powder, was thoroughly mixed with 5 c.c. of a 10 per cent. solution of caustic soda (= 0·5 grm. NaOh) in a platinum crucible. The mixture was then evaporated to complete dryness, and the residue ignited under exactly the same conditions as described above. A determination of the total nitrogen in the residue was then made. (*b*) One grm. of the sample was mixed with 10 c.c. of milk of lime, containing 0·5 grm. CaO, and the mixture evaporated to dryness and coked as before. (*c*) 0·66 grm. Na_2CO_3 (= 0·5 grm. NaOH) was substituted for the caustic soda in the first set of experiments. The results obtained are shown in Table V.

TABLE V.

Name of Coal.	Nitrogen in Coal used.	Nitrogen in Coke from untreated Coal.	Percentage of original Nitrogen in Coke.	Nitrogen in NaOH Coke.	Percentage of original Nitrogen in NaOH Coke.	Nitrogen in $Ca(OH)_2$ Coke.	Percentage of original Nitrogen in $Ca(OH)_2$ Coke.	Nitrogen in Na_2CO_3 Residue.	Percentage of original Nitrogen in Na_2CO_3 Coke.
	Grms.	Grms.	Per Cent.	Grms.	Per Cent.	Grms.	Per Cent.	Grms.	Per Cent.
Splint coal	0·0150	0·0095	63·3	0·0018	12·3	0·0097	64·7	0·0148	98·7
" "	..	..	..	..	..	0·0097*	64·7	..	..
Ell coal	0·0153	0·0101	66·0	0·0036	23·5	0·0116	75·8	0·0140	91·5
Bannockburn Main coal	0·0189	0·0125	66·1	0·0140	74·0	0·0126	66·7	0·0158	83·6
Kilsyth coking coal	0·0204	0·0119	58·3	0·0174	85·3	0·0144	70·6	0·0156	76·5

* Lime water was used instead of milk of lime.

The residue from 1 grm. splint, which had been treated with a mixture of 0·5 grm. Na_2CO_3 in solution and 0·5 grm. $Ca(OH)_2$, contained 0·0115 grm. nitrogen = 76·7 per cent. of the original nitrogen in the coal.

These figures present two very remarkable features: (1) a fairly complete elimination of the fixed nitrogen is effected by caustic soda in the case of the non-caking coals, but none at all in the caking varieties; (2) carbonate of soda causes in every case a further fixation of nitrogen, and in the non-caking coals this is equal to over 90 per cent. of the total nitrogen content of the coal; (3) slaked lime produced in all cases very little result, but invariably showed a tendency towards fixing additional nitrogen in the coke. Blank experiments had proved the absence of any estimable quantities of nitrogen in the reagents used.

Whatever amount of stress we are to lay upon these results, they establish at least a distinct difference between the nitrogenous bodies in the caking and non-caking coals in one particular—namely, their behaviour towards caustic soda at a red heat. But to what is the marked difference of action of sodium hydrate and sodium carbonate to be ascribed, and at what stage in the heating process does the liberation of the nitrogen by the former reagent take place? To throw some light on this point, 1 gramme of splint was fused for 45 minutes with 10 grammes of caustic potash in a silver basin at a temperature just sufficient to keep the mixture liquid. After cooling the mass, it was found to contain 0·0148 gramme of nitrogen (N in original coal = 0·0150 gramme). So that at that temperature, even prolonged contact with fused alkali had failed to convert any appreciable part of the nitrogen into volatile compounds.

Ignition with excess of sodium carbonate had shown in every case a fixation of the nitrogen which would have been set at liberty under ordinary conditions. In the case of the caking coals, caustic soda produced a like result. The question suggested itself, Is the extra nitrogen thus fixed in the form of soluble or insoluble compounds? To ascertain this, 1 gramme of splint was treated as before with soda carbonate and ignited. The residue was then completely extracted with hot water, washed, and dried. The dry extracted residue still contained 0·0095 gramme of nitrogen—*i.e.*, the same quantity as it was found to hold when ignited in the ordinary way. The filtrate from the insoluble residue contained sodium cyanide equivalent to 0·0022 gramme of nitrogen, and a small quantity of sulphocyanide which was not determined.

In 1883, attention was called by Mr. J. Alfred Wanklyn (see "JOURNAL," Vol. XLI.), to a process patented by Mr. W. J. Cooper, for increasing the yields of tar and ammonia in the distillation of coal by "liming" the coal. "Limed coal is made by taking quicklime, slaking it, and thereby getting it into a state of fine division, and mixing the finely divided slaked lime with the coal." The proportions recommended were slaked lime equivalent to 2½ parts quicklime to 100 parts of coal. Regarding the utility of the liming process, the evidence of gas engineers was of the most contradictory character. At Beckton Gas-Works the increase in ammonia recovery was reported to be 36 per cent.; at the Commercial Gas-Works 27 to 28 per cent.; at Cheltenham 20 per cent. Mr. Cooper himself stated that experiment had proved the gain in ammonia to vary from 20 to 100 per cent. On the other hand, the old Bankside works of the South Metropolitan Company reported no gain of ammonia while using the process; and this result was confirmed at the Vauxhall works of the same Company, where no improvement was noted although 30,000 tons of coal were treated by the process.

Now, in the face of positive statements by well-known engineers that in the works under their control an increased quantity of ammonia was recovered while the process was in operation, it would be idle to deny that, in the case of certain coals at least, an admixture of slaked lime produces an effect in the distillation. But our experiments detailed above show that, in the case of these typical Scotch coals at least, the nitrogen, which under ordinary conditions of distillation remains fixed in the coke, is not liberated in any form by distillation with lime, even when the latter is employed in a much greater proportion than could be suggested for use in any commercial process.

The augmentation of ammonia, when it occurs, is therefore apparently to be ascribed to an effect produced on that part which is set free even under ordinary conditions of distillation, and which may ultimately appear either in the form of ammonia or of free nitrogen. In this case the action of the lime would consist in altering the rate of conductivity of the charge, and also, it may be, in setting free the elements of water above a certain limit of temperature, which, diffused through the gases, might aid in maintaining the stability of the alkali.

Apart altogether from the results of our experiments, it is impossible to conceive that the lime, mixed as it was in the original process with the coal by hand or mechanical means, could exercise any great influence on the fixed nitrogen of the coal. Unless the two were ground together to the state of an impalpable powder, the non-volatile and infusible earth must necessarily have failed to reach anything more than a fraction of the nitrogenous molecules present in the charge.

A like objection applies to every attempt (and how numerous have been the suggestions!) to remove this residual nitrogen from coke by steaming or the application of external reagents after the coke is made. Metallurgical coke, as Thörner's microscopical researches have shown, is a mass of cells, the walls of which are thoroughly vitrified and gas-tight. Steam, except in so far as it burns away the carbon of the coke, scarcely comes in contact with the nitrogenous constituents of the latter, protected as they are by this impervious coating.

From the experiments described above, it appears that when small quantities of coal are distilled, a fairly constant percentage of the total nitrogen remains behind in the fixed residue, averaging about 64 per cent. The balance of about 36 per cent. is set free in three forms—alkaloidal and other nitrogenous bodies in the tar, ammonia in the liquor, and free nitrogen in the gas.

The quantity of nitrogen in the tar is affected greatly by the temperature of distillation. Watson Smith gives 1·667 per cent. as the quantity found in a sample of (high temperature ?) tar. A sample of Scotch splint, distilled at a fairly low temperature, we found to yield a tar containing 1·11 per cent. of nitrogen. If we take the yield of tar as being about 10 per cent. of the weight of the coal, and regard it as containing on an average 1·4 per cent. of nitrogen, this would represent 0·14 per cent. of nitrogen calculated on the weight of the coal itself. Assuming, again, that this latter contains 1·4 per cent. nitrogen altogether, the amount found in the tar is equal to 10 per cent. of the total.

Watson Smith's calculation of Foster's results shows 48·68 per cent. of the nitrogen in the coke. Knublauch gives the average figure for Westphalian coal as 50 per cent. in the coke; and these, for reasons we shall afterwards give, we regard as nearer the average figure, under practical working conditions, than the 64 per cent. which we found in coke got by rapidly igniting small quantities of coal in a platinum crucible.

These two items then, taken together, account for 60, or at the most 65 per cent. of the total nitrogen. The balance of 35 to 40 per cent. comes off as ammonia and free nitrogen in the gases. Regarding the quantity ordinarily making its appearance as ammonia, there is a remarkable unanimity in the evidence from all sources. The average yield of sulphate per ton of coal distilled in this country we have stated to be about 22 lbs.—equivalent to 4·67 lbs. of nitrogen; or, in other words, 0·21 per cent. of the coal is represented by nitrogen, which is evolved and collected as ammonia. If we regard 1·4 per cent. as the average nitrogen content of the coal distilled, this result would be equivalent to 15 per cent. of the total nitrogen present.* Carefully conducted distillations of specimens of Scotch and English splints gave us in the laboratory 19·6 per cent. and 18 per cent. respectively. For Westphalian coals, Knublauch (*supra*) quotes 12 to 14 per cent., and Foster's results for English coals show 14·5 per cent.; Schilling gives 15·1 per cent., while Tichauer says the figure varies from 13 to 24 per cent. Therefore 15 per cent. may fairly be regarded as a close approximation to the actual practical yield of ammoniacal nitrogen. The balance unaccounted for is about 25 per cent.; and with the exception of a very small quantity, which appears as cyanogen compounds, this large proportion exists as free nitrogen in the gaseous products of distillation. It is present in estimable quantity in all coal gas; and Lewis T. Wright has shown that Newcastle gas contains 2·8 to 3·4 per cent. of nitrogen, when every precaution has been taken to exclude air.

To account for the presence of this free nitrogen among the gaseous products of distillation, it is necessary to recall the fact, to which we have already alluded, that the decomposition of the nitrogenous part of coal, with formation of ammonia, begins in the different specimens only when they are heated to over 375° C., and in many cases not till a very much higher temperature is reached. But it has been shown by Ramsay and Young that, under favourable conditions, ammonia begins to dissociate at a temperature slightly under 500° C., and that the decomposition is complete at 780° C. Since, therefore, under the ordinary conditions of destructive distillation, the temperature of the charge is continually rising, it is inevitable that a considerable part of the decomposition of the coal must take place at a temperature sufficiently high to admit of more or less of the resulting ammonia being dissociated in contact with heated surfaces.

* Taking the different sources separately, it would work out: Coke-ovens 13·3 per cent.; blast furnaces 13·7 per cent.; gas-works 15·1 per cent.

No doubt this decomposition will be retarded to some extent by the presence of a protecting atmosphere of hydrogen and hydrogen containing gases; but at higher temperatures it will not be altogether prevented. On the other hand, carefully conducted experiments have shown us that, so long as the distillation is carried on at temperatures below 500° C., no part of the nitrogen contained in the coal makes its appearance in the free state. For example, when 3 grammes of Scotch splint coal was distilled for three hours at a temperature varying from 440° to 470° C., the nitrogen of the coal (1·50 per cent.) distributed itself in the manner shown in Table VI.

TABLE VI.

	Nitrogen.	Percentage
	Grm.	
In the coke (= 1·93 grms.)	0·03540	78·67
In the aqueous distillate as ammonia	0·00476	10·58
In the tar (= 0·41 grm. containing 1·11 per cent.)	0·00455	10·11
Total nitrogen found	0·04471	99·36
Total nitrogen in coal used	0·04500	100·00
Balance unaccounted for	0·00029	0·64

If a small sample of coal which has been ignited for five minutes over the blowpipe in a closed vessel so as to expel its volatile matter be tested for nitrogen, it will be found that, even although kept at a bright red heat for five or six hours, no further portion of the nitrogen remaining is expelled, thus:—

TABLE VII.

	Sample "A."	Sample "B."
	Per Cent.	Per Cent.
Nitrogen in coke (5 min.)	2·19	2·10
Nitrogen in coke after 6½ hours at red heat	2·14	2·18

On the other hand, when a quantity of coke from sample "B," which had already been heated for 5¼ hours, was subsequently heated to redness in a stream of hydrogen gas for six hours, it parted with 17·27 per cent. of its nitrogen as ammonia.

TABLE VIII.

		Grm.
Nitrogen in 0·7 grm. of coke from Sample "B"	..	0·01526
Nitrogen collected as ammonia on passing hydrogen over this for six hours at red heat	Grm. 0·00266	
Nitrogen found in the residue	0·01274	
		0·01540
Experimental error		0·00014
		= 0·9 per cent.

From the results of these experiments, it seems exceedingly improbable that any part of the nitrogen of coal is liberated in the distillation process as free nitrogen, and its invariable presence in the gaseous product may therefore be set down to a more or less extensive dissociation of the previously formed ammonia in contact with heated surfaces. It was pointed out by Ramsay and Young that the rate of such dissociation was influenced both by the extent and the character of the heated surface, as well as by the time of exposure to its action. In general, a rough surface may be said to facilitate the decomposition. There can be little doubt that these causes operate to some extent in gas-retorts, and very powerfully in coke-ovens. In the latter, the ammoniacal gases being evolved from the central portions of the charge, have to make their way to the exit-tube through a layer of partially coked material, which is already at a fairly high temperature. The conditions, so far as the roughness of the solid surface and the rate of passage of the gas are concerned, are almost ideal for bringing about dissociation to the utmost extent, and go a long way to explain the fact that, while for the whole country the average yield of sulphate from gas-works is 22·4 lbs. per ton, that from coke-ovens is only 19·7 lbs.

The recovery of ammonia from the gases of the blast furnace presents itself as a special case of what is carried on in the gas-works. Apart from the engineering difficulty of dealing with the 130,000 cubic feet, or thereby, of gas per ton, as against some 10,000 cubic feet in the gas-works, the process would present no extra difficulty, were it not for one factor which has hitherto been most remarkably ignored. So far as avoiding the danger arising from simple dissociation of the alkali is concerned, the gradual descent of the charge in the furnace admits of distillation being carried on for a fairly lengthy period at a low temperature, as compared with that obtaining in the gas-retort, while, since the gas in rising is continually passing into zones of diminishing temperatures, the alkali does not here incur the risk of dissociation to the same extent as in making its escape from the coke-oven. Yet we find that the average yield from blast furnaces is only 20·2 lbs., as against 22·4 lbs. from gas-works. What is the reason?

A long-continued series of experimental trials established conclusively that the presence of iron ore in the distillation charge was responsible for a very serious falling off in the yield of sulphate of ammonia, and that this was brought about by oxidation of the ammonia by the oxide of iron—a reaction which begins at a fairly low temperature.

A sample of splint, which gave, when distilled, about 31·65 lbs. of sulphate of ammonia, yielded, when treated as nearly as possible under the same conditions of temperature, but in the presence of calcined clayband ore in the proportions of an ordinary blast furnace charge, only 23 lbs. of sulphate. Another coal, similarly treated, gave—

When distilled alone . . .	30·73	lbs.	of Am. Sulph.	per ton.
When distilled with ore "A" .	17·11	„	„	„ „
When distilled with ore "B" .	17·97	„	„	„ „

In order to determine the rate at which this destruction of ammonia proceeded at different temperatures, an independent investigation was set on foot, which showed that the action begins at a fairly low heat, and rapidly increases as the temperature rises. The complete figures will be communicated to the Society at an early date.

From these experiments, it is obvious that the presence of the ore in the upper part of the blast furnace cannot be regarded as a negligible quantity in weighing the different factors that contribute to the result. Too much stress may, of course, be placed upon the figures representing the destruction of ammonia in passing it alone over heated iron ore. The conditions in such an experiment are not identical with those obtaining in a blast furnace where the alkali is protected by an atmosphere of hydrogen and hydrogen compounds. Still, the distillation experiments described above, which were made under conditions somewhat resembling those obtaining in practice, show that a serious falling off in the yield of sulphate of ammonia may result from the operation of this cause.

Summary.

We may now gather up the conclusions which we are inclined to regard as the result of these experiments—

1. When coal is heated, part of the nitrogen contained in the nitrogenous constituent comes off as ammonia in the gases, part goes to form nitrogenous compounds in the tar, the rest remains fixed in the solid residue or coke.

2. The percentage which is thus evolved as ammonia is dependent partly on the structure of the nitrogenous constituent of the coal, as well as on two other factors—the amount of hydrogen available to combine with, and carry off, the nitrogen, and the period during which the nitrogenous body is exposed to the influence of the hydrogen above a certain limit of temperature attained in the operation.

3. Heating the nitrogen-containing body has no effect alone in dislodging the nitrogen; there must be a simultaneous action of hydrogen or certain hydrogenized compounds.

4. The presence of free nitrogen in the gases got from distillation of coal, amounting frequently to 25 per cent. of the total nitrogen of the coal, is due to dissociation of the ammonia at temperatures over 500° C.

5. The amount of this dissociation is increased by rise in temperature and by increase in the time during which the gas is exposed to the heat. For this reason, although in a coke-oven the charge is subjected to a more gradual heating than in a gas-retort, the quantity of ammonia recovered may be actually much less than in the latter case, because in the coke-oven the ammonia liberated in the lower part of the charge is subjected to dissociation conditions for a longer time in passing upwards through a thick crust of strongly heated coke.

6. In blast furnaces, the oxide of iron exercises a destructive effect on the ammonia at comparatively low temperatures, and while, owing to the very gradual descent of the raw coal towards the hotter region of the furnace, a considerable part of the ammonia will be formed and escape before the limit of dissociation is attained, yet the influence of the oxide of iron in the ore, which is active at very much lower temperatures, may be such as to more than counterbalance the benefit derived from these favourable conditions, and bring out the average yield of sulphate at a lower figure.

The Gas and Water Undertakings of Local Authorities.—According to the Local Taxation Returns for 1897-8, recently issued, the income, expenditure, and profit of gas and water undertakings in the hands of Local Authorities in the period named were as follows: Gas-works, £5,091,000, £3,957,000, and £1,134,000; water-works, £3,292,000, £1,284,000, and £2,008,000.

The Official Report on the Acetylene Exhibition at Buda-Pesth.—We have received, by the courtesy of the Executive Committee, the official report on the Congress and Exhibition held last year at Buda-Pesth for the furtherance of the carbide and acetylene industries. An account of the more important of the papers presented at the Congress has already been given (see "JOURNAL," Vol. LXXIV., pp. 939, 997). The official report now before us points out that there were ten papers contributed by seven French authors, seven papers by German, and three by Hungarian authors. The report reproduces the text of these papers in either French or German. The remainder of the volume is devoted to a full account of the proceedings at the Congress and Exhibition. This is given in French, German, and Hungarian. The report, which is on sale by L'Association Nationale des Industriels Hongrois, at Uj-utcza, 4, Buda-Pesth, should be of great value to all interested in the carbide and acetylene industries.

TESTING GAS LIQUOR FOR AMMONIA.

Herr O. Herting, of Cainsdorf, in Saxony, gave in a recent number of the "Journal für Gasbeleuchtung" an account of some researches which he has carried out with the object of evolving a rapid method for the estimation of ammonia in gas liquor, and in the effluent from liquor works. The coal from which the gas liquor tested was derived was from the local Zwickau field. The method recommended by Dr. Lubberger (see "JOURNAL," Vol. LXXIII., p. 1039) was first tried on the effluent or spent liquor from liquor works. This method consists in adding lime to the hot spent liquor, and, after shaking, cooling, and filtering, titrating an aliquot part of the filtrate with semi-normal acid. From the acid required, the amount of acid which would neutralize the lime present is deducted; and from the result, the amount of ammonia present in the quantity of liquor titrated is calculated. Herr Herting found, however, that the amount of lime which dissolved in a given quantity of spent liquor was not constant, as Dr. Lubberger had supposed. Twenty trials indicated that the amount of semi-normal acid required to saturate the lime dissolved in 50 c.c. of spent liquor varied from 8 to 18 c.c. On this account, therefore, Herr Herting desisted from using Dr. Lubberger's system; and, pending the discovery of a simple empirical method, he continued to use the tedious distillation process. This system is described by Lunge in his treatise on "Coal Tar and Ammonia." Lunge, however, states that the distillation should be continued for one hour, or, even better, for three hours. Herr Herting has found it is quite unnecessary to distil for so long a time. Distillation with caustic lime for 30 minutes liberates all the ammonia from liquor, and the estimation may therefore be completely made in from 35 to 38 minutes. Seminormal sulphuric acid, seminormal solution of caustic soda, and methyl orange are used in the estimation.

Herr Herting has, however, found that the ammonia in spent gas liquor may be empirically estimated with tolerable exactness by the aid of the sense of smell, and test papers. He puts two small lumps of caustic lime in an Erlenmeyer beaker, and pours on them 100 c.c. of the hot spent liquor. He then heats the beaker on a hot plate; and from the strength of the odour which emanates from the beaker, he is able, by practice, to draw reliable conclusions as to the amount of ammonia in the liquor. For instance, a powerful pungent odour arises when the liquor contains 0·134 per cent. of ammonia (*i.e.*, is of 0·6 oz. strength). Spent liquor of this strength indicates defective working of the liquor plant. Even when the liquor contained only 0·04 per cent. of ammonia (*i.e.*, was of 0·2 oz. strength), the odour at the mouth of the beaker was distinct; and a strip of moist turmeric paper held there was rapidly turned brown. Spent liquor containing 0·016 per cent. of ammonia gave a feeble but recognizable odour, while turmeric paper was slowly changed to a weak brown colour. The odour was no longer perceptible, nor was turmeric paper affected, with liquor containing 0·009 per cent. of ammonia; but Nessler's papers showed the presence of ammonia.

With regard to Dr. Lubberger's method of estimating the total ammonia in gas liquor by adding a constant amount to the quantity of free ammonia found by direct titration, Herr Herting finds that it is not accurate when applied to gas liquor derived from Zwickau coal. Dr. Lubberger believed that the fixed ammonia in gas liquor did not vary greatly in amount, and that for each gas-works a constant might be found empirically which would represent fairly accurately the fixed ammonia in all liquor produced at the works. Given such a constant, the determination of the total ammonia in the liquor resolved itself into a simple titration to find the amount of free ammonia present; and the tedious distillation method no longer had to be applied in estimating the total ammonia. Herr Herting, however, finds that the amount of fixed ammonia in liquor from Zwickau coal is high and variable, and hence Dr. Lubberger's constant cannot be found for such liquor. On the other hand, Herr Herting thinks that the following results indicate that, with this liquor, readings of the hydrometer are useful.

No. of Sample.	Degrees Beaumé.	Sp. Gr.	Percentage of total ammonia.	Percentage of fixed ammonia.	Proportion of fixed to total ammonia, per cent.
1 . .	1·4 ..	1·0100 ..	0·500 ..	0·400 ..	80·0
2 . .	1·8 ..	1·0125 ..	1·215 ..	1·105 ..	91·0
3 . .	2·0 ..	1·0140 ..	1·275 ..	0·975 ..	76·5
4 . .	2·4 ..	1·0170 ..	1·530 ..	1·310 ..	85·6
5 . .	2·6 ..	1·0180 ..	1·700 ..	1·340 ..	79·0

The fixed ammonia was chiefly in the form of chloride, in which the liquor from Zwickau coal is especially rich. For instance, in sample No. 5 the chlorine present was equivalent to 1·21 per cent. of ammonia. For the determination of the chlorine in gas liquor, Herr Herting recommends the following plan in preference to Dyson's classical method, which he finds gives too low results. First of all, 10 c.c. of liquor are diluted to 250 c.c., and one-fifth (2 c.c. of liquor) is mixed with a few cubic centimetres of nitric acid, and heated to boiling, in order to decompose sulphide and carbonate. An excess of silver nitrate is next added. The precipitate of silver chloride is allowed to settle, and is then collected on a filter and washed with warm water. The precipitate is next dissolved from the filter in ammonia, which leaves tarry matter undissolved on the filter; the solution is acidified with nitric acid, and raised to boiling.

After settling, the precipitate of pure silver chloride is filtered off, ignited with the usual precautions, and weighed. From the weight of silver chloride obtained, the amount of ammonium chloride in the liquor is calculated. Titration of the chlorine in the diluted liquor, after acidifying with nitric acid, with standard solution of silver nitrate, is not feasible, as the potassium chromate, which is used as an indicator of the completion of the reaction, does not answer under these conditions.

With regard to Herr Herting's strictures on Dr. Lubberger's method of computing the total ammonia in gas liquor from the percentage of free ammonia and a constant, it should be pointed out that the liquor examined by Herr Herting appears to have been of an extraordinary nature. It was recognized in most gas-works laboratories in this country, before Dr. Lubberger called attention to the matter, that the proportion of fixed ammonia in the strong liquor despatched to the sulphate plant was almost always the same. In some works, for instance, the liquor thus despatched contains almost invariably fixed ammonia equivalent to about 1·2 oz. strength, even though the total strength of the liquor ranges from 6 to 10 oz. This 1·2 oz. in such cases represents Dr. Lubberger's constant, and if added to the ounce strength found by direct titration, the result will indicate fairly closely the total strength of the liquor as shown by the distillation test. The constant will, however, vary at different works according to the description of coal carbonized and the methods of working; and in some cases it may not be possible to find such a constant.

ACTION OF ACETYLENE ON COPPER—AN EXPLOSION.

Signor T. Gigli, of Pavia, gives in the "Chemiker *Zeitung*" an account of an explosion in an experimental gasholder, apparently arising from the action of acetylene on copper. It has generally been supposed that the explosive compound of copper and acetylene was formed from acetylene only in the presence of cuprous oxide and ammonia. Bullier's researches indicated that metallic copper was not attacked by acetylene; and therefore many practical men considered that it was unnecessary to nickel plate inside the walls of copper gasholders, and that they might be used for acetylene without danger.

Last May, a copper gasholder of rather over 1 cubic foot capacity was filled with acetylene. Nearly half its contents was used within a few days; but the remainder stood untouched until Nov. 8. On that day, the acetylene was completely expelled by water, and the holder was subsequently filled with oxygen. Nearly a third of the oxygen was used almost immediately, and the holder was then stood aside. On Nov. 15, upon being simply touched, it blew up with violence and powerful detonation. The ends were torn out, and the upper one hurled upwards; while the cylindrical part was rent from top to bottom. The interior of the gasholder was coated with an almost black, and apparently crystalline, layer, which, when it had become dry, ignited on being rubbed with the finger, or even with a feather, and burnt with beautiful scintillations. Unfortunately, Signor Gigli could not collect any of this incrustation for further examination; but he concludes, from its mode of occurrence and behaviour, that it must have consisted of the compound of copper and acetylene. He thinks this compound is formed more readily than is commonly supposed. Assuming that the interior of the holder was previously covered with a thin layer of oxide such as ordinarily coats old copper, he nevertheless considers that the acetylene must have also attacked the underlying metallic copper in order to produce so thick an incrustation as was observed when the wrecked gasholder was examined. Notwithstanding that the lower half of the holder was in contact with acetylene for only a few days, the whole of its interior was equally covered with the explosive incrustation. Hence it appears that its formation occupied only a very short time. The subsequent introduction of oxygen to the holder made explosion possible. As the whole of the acetylene had been previously expelled by water, the explosion could not be attributed to the presence of a small quantity of phosphuretted hydrogen with which the acetylene had been contaminated. Even if the proffered explanation is not satisfactory, the accident should, in Signor Gigli's opinion, serve to emphasize the great danger of employing copper gasholders for acetylene.

WATER-METERS: WITH SPECIAL REFERENCE TO SMALL FLOWS AND WASTE IN DRIBBLES.

At the Annual General Meeting of the Institution of Mechanical Engineers last Friday week, Mr. W. Schönheyder submitted a paper on the above subject. The following is a *résumé* of the contribution.

Water-meters, the author pointed out in his introduction, are divided into six classes: (1) Low-pressure meters; (2) inferential meters; (3) volume or capacity meters, without device for rendering them tight; (4) those of the Venturi class, which have a special function; (5) waste-detection meters, of the Deacon class; (6) positive meters, or meters which provide a space to be filled with and emptied of water, and which have some contrivance for rendering them tight at varying pressures, and under diverse conditions of service. Generally it may be observed that these classes have all a useful purpose which they are capable of answering with more or less advantage according to their individual merits. The mistake most commonly made, in the author's opinion, is that they are indiscriminately used, and frequently selected on account of first cost, without due consideration of the duty they have to perform.

The question next presenting itself is, What is the small flow to which this paper has reference, and of what importance is the measurement of waste in dribbles? That all water supplied by private companies, intent on earning dividends, should be paid for, goes without saying, provided the cost of measurement does not exceed that of allowing pumped, impounded, filtered, and delivered water to run to waste. In tabular form, the author illustrated the large flows of water represented by leakages through comparatively small holes, when under a pressure of 100 feet head; the quantities being estimated, but confirmed by experiment at Liverpool.

Table I.—*Flows of Water Represented by Leakages.*

Size of Hole.	Gallons.		Number of Persons that can be supplied at 15 Gals. per Head per Day.
Inch.	Per Hour.	Per 24 Hours.	
¼	381	9144	610
7/32	214	5136	342
⅛	95	2280	152
1/16	24	576	38
1/32	6	144	10

But, continued Mr. Schönheyder, a wider and more important question arises when the needs of our increasing population and the necessity of larger supplies come forward for consideration. Ten gallons per head per day of the London water supply admittedly represents waste. This quantity, based on a population of 5 millions, is 50 million gallons per day, or sufficient to supply 25 gallons per head per day to an increased population of 2 millions; or, in other words, is more than sufficient for the needs of the City of Berlin. To put the matter (if possible) still more plainly, if this waste is permitted to continue, £8,000,000 of capital, or one-fourth of the total approximate cost of the proposed Welsh scheme of water supply (of 200 million gallons per day) to London will be spent in order to make up the deficiency caused by preventable waste. Here is a great problem; and the author believes the solution of it lies in the sale of water either by meter only (at very low prices, it may be), or by meter with a fixed charge for a minimum supply at present rates, in order to ensure health and cleanliness.

Proceeding to deal with the different kinds of meter in the order in which he classified them at the outset, the author referred first to the low-pressure instruments. The great objection to them is that the whole of the pressure from the main is lost in passing through them. Therefore, they require to be placed at the highest elevation at, or from which, a supply is to be taken. He described the "Parkinson" as the oldest and probably best-known meter of this type; and then the "Bascule."

Inferential meters next came in for notice. As the name implies, the water is not actually measured in this type of meter; but the quantity passed through it is "inferred" from the number of revolutions made by the fan or turbine, which is the only moving part. These meters are exceedingly convenient and useful, as they are comparatively small, light, and cheap; and they are fairly accurate when the water passes through at a good speed. Illustrations of this form were the Siemens's "Turbine" and "Fan" meters, and the "Tylor Inferential."

The third class—volume or capacity meters—are, it was remarked, almost exclusively made in the United States; and their use is chiefly confined to America. They seldom possess any provision for taking up wear; and the parts are therefore difficult and expensive to repair. Hence as they are not tight even when new, they cannot measure small flows; and their leaky condition is necessarily augmented by wear. Their merits appear to be simplicity, small size, lightness, and cheapness; and for large flows they are said to be very accurate. The "Hersey," the "Crown," the "Bee" or "Thomson," the Kent "Uniform," the "Nash," and some others belong to this class.

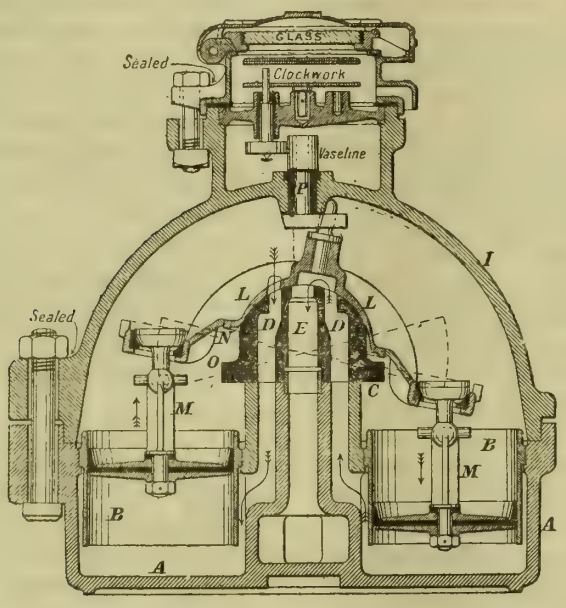
In referring to the Venturi meter (fourth class), the author said it is cheap considering the large volume of water it deals with, and for ordinary rates of flow in water-mains it is said to be very accurate. But, of course, it must not be used below its rated capacity.

Waste-detection meters—the fifth class—were lightly dealt with; the author characterizing the "Deacon" meter as "very simple and effective." He described its action, and then passed on to the sixth class—positive meters. The "Kennedy" meter, brought out about 47 years ago, still retains its high reputation. The author believes this is the only single-cylinder positive meter now in use. The number of parts and the special tools required for their repair, as well as the numerous directions for attending to the meter, indicate some of the disadvantages attendant upon the general use of it. Nearly all the other types of positive meter have two measuring cylinders with their pistons and valves, and are of the duplex class, in which the piston of one actuates the valve of the other. The best known are: The "Frost," the "Tylor Positive," the "Worthington," the

"Frager," the "Schreiber," the Kent "Absolute," the "Goodwin," and the "Schmid." Meters of this class can only be repaired by skilled workmen, and must in all cases be removed to the workshop for the purpose. Several of this type of meter are also crowded with small screws, pins, and springs, which often give trouble by breakage.

Early in 1884, the author's attention was directed by one of the largest London Water Companies to the great want of a good water-meter, which should be free from the defects of those already in use, and which should above all be simple, and be able to register the smallest dribbles for long periods without liability to derangement. After considerable study and not a few experiments, he brought out his first meter in 1888. It was of the three-cylinder horizontal type, having a single flat valve with a double movement, which caused it to remain always tight; and the three-cylinder arrangement produced a steady flow, as well as a quiet working. These meters were before the public for about seven years, and most of those made are still doing good service; but they were composed of too many working parts for thorough efficiency.

Further study, a few experiments, and assistance from the manufacturers, Messrs. Beck and Co., of Southwark, produced the present type, now called the "Imperial," shown quarter full size in the illustration (a section of the meter). In it the single-acting three-cylinder arrangement is retained, as is also the double movement of the valve, now made with a semi-spherical face; and there is the same absence of small screws and springs, while the dismounting and remounting are even simpler and easier than in the first type. It has in its composition ten fewer moving parts; and therefore the force required to drive it and the wear and tear are much reduced.



The meter consists of the following parts—namely: The lower portion or body A containing the three cylinders B, and the valve-seating C, with its three ports and passages D, communicating with the bottom of the cylinders; and there is a discharge port and passage E. Inlet and outlet connections and strainer are also attached to the body portion. I is the cover, with a rib for holding down the strainer; and it has a prolongation at the top for receiving the counter gear. The unequal division of the bolt-holes prevents the cover from being wrongly fixed to the body. Though the counter gear contains a few novelties, such as the entire absence of brackets, screws, springs, and small pins, and has a conveniently hinged glass cover, still essentially it does not differ very much from the counters of other meters. L is the valve with its three arms, in the ends of which are cup-shaped bushes, for receiving the spherically shaped heads of the piston-rods M, and to these are secured the pistons, composed of upper and lower piston-plates, nuts, and flexible piston packings. The water enters the meter, as shown by the arrows, passes up through the strainer into the upper portion of the casing, and presses equally downwards on all the three pistons, and also on the valve. According to the position of this valve, the lower end of each cylinder in succession is communicating with the outlet-passage, and its piston is therefore forced down by the superior pressure above, and thus discharges the contents of the cylinder. At the same time one or both of the other cylinders is having its piston raised, whereby water is drawn in through the passages, and the lower part is filled. Thus each lower end of the three cylinders B is in due course filled and emptied; one or two pistons always supplying the active force, so that there is no dead-point. The length of the stroke is regulated by the flanged projection N, on the valve L, coming into rolling contact with a similar flange O on the valve-seating C; a slight skew of the ports causing the pistons to endeavour to take a longer stroke than they should, and the roller-paths restricting this tendency. The teeth in the valve and the notches in the valve-seating prevent the valve from turning round on its own axis. A pin in the upper part of the valve engages with the crank of the crank-spindle P, which communicates motion to the clockwork in the usual manner. The pins through the upper ends of the piston-rods prevent the pistons from falling out of the cylinders should the meter be turned upside down.

It will be seen from the above description that the meter is positive in its action, that the lengths of stroke are definite, that the speed of water through it is practically uniform (as in a three-throw pump), so that there is no concussion or water-hammer, that there is no backlash between any of the working parts, and that the meter can therefore be run at any convenient speed without noise. It has few working parts, not a stuffing-box nor a spring among its details, and is self-lubricating. It contains no small parts, neither pins nor screws; the three studs and nuts (permanently securing the valve-seating), the cover-bolts, and the piston nuts are the only appliances of the sort. As soon as the cover has been removed, the whole of the working parts can be taken out, examined, cleaned, new piston-cups fitted, and other ordinary repairs effected, if necessary, even without removing the meter from its position in the pipe-line. The only joint which has to be made is that between the body and the cover; and any leakage here is at once detected, as it is outwards. As to durability, the author has frequently been informed by users, who take out meters for repair every two years, that it has been a common occurrence to find that they only require cleaning, painting, and re-testing, to be again fit for service. Even the piston-cups often serve two terms (of two years each). The valve-faces never require any attention, as they soon polish themselves bright like mirrors, and remain quite tight.

In order to test for himself the practical working of this meter, the author had one of ¾-inch size affixed to the service-pipe of his private house in February, 1896, and tested it for accuracy at various times with satisfactory results. In May, 1897, an American type "Volume" meter of ½-inch size (being the smallest he could obtain) was fixed tandem with the "Imperial," which was first cleaned and furnished with new piston-cups, so as to put both on the same footing. Both meters were tested before fixing, at various speeds, and were found to be practically correct, though the "Volume" meter was disinclined to register flows below about 2 gallons per hour. The service is partly direct through draw-off taps on the ground floor and basement, and partly through a ball-valve in the main cistern, for supplying a bath, lavatory, and hot-water cistern. From May 21, 1897, to May 20, 1899, the "Imperial" had registered 100,248 gallons, and the "Volume" meter 81,772 gallons, or more than 18 per cent. less than the "Imperial" for the two years. As the inhabitants of the house do not allow dribbling wastes by leaky or half-closed taps to continue, the author feels certain that for an average house the readings of the two meters would have shown much greater difference. Weekly readings showed the "Volume" meter to be from 10 to 50 per cent. slower than the "Imperial;" and in one night of twelve hours, in April, 1898, when a leaky fitting had been discovered, the "Volume" registered only 5 gallons, while the "Imperial" registered 29 gallons. On another occasion the figures were 9 gallons and 29 gallons respectively, also for twelve hours. The meters were tested from time to time in the two years, and both were found to be correct, excepting the "Volume's" objections to small flows. When the meters were tested in May of this year, the "Imperial" was practically correct at all speeds, down to 2 gallons per hour (below which it was not tried), while the "Volume" would not register 4 gallons per hour; and at 5 gallons per hour, it was 10 per cent. slow, while at 48 gallons per hour it was practically correct. The rate of working in this house, according to a large number of observations, varies from a mere dribble up to 100 gallons per hour, which has been found sufficient for all purposes. The author submitted that these experiments proved the "Imperial" meter to be in every way fitted for measuring supplies to private houses (in addition to suitability for general use), and that a meter which will not measure the smallest dribble is misleading and costly for such service.

As comparative tests of different types of meters are but seldom recorded, the author thinks that the following results of tests of four meters, coupled in line on the supply to a country waterworks, would be of interest. The supply was varied from time to time by hand, and each meter was tested for accuracy before fixing, with the results given.

TABLE II.—*Tests of Four Water-Meters.*

Meters.	"Positive."	"Inferential."	"Volume."	"Positive."
Initial Errors.	− 3 per cent.	+ 7 per cent.	+ 2 per cent.	+ 1½ per cent.
1889				
Feb. 4	2,780	1,990	2,346	2,898
" 13	2,800	3,200	2,454	2,958
" 18	1,310	880	850	1,378
" 25	1,960	1,410	1,344	2,040
Mar. 4	2,000	1,310	578	2,040
" 11	1,880	1,200	2,358	1,980
" 18	2,060	1,325	1,465	2,150
" 25	2,080	1,115	1,465	2,300
Apr. 1	2,320	1,080	1,802	2,316
" 8	2,250	1,850	2,040	2,304
Totals registered	21,440	16,250	16,642	22,496

Here certainly there seemed little to choose between an "Inferential" and a "Volume" meter. Both were practically 25 per cent. slow on the average of the ten weeks' test.

Discussion.

Mr. SCHÖNHEYDER (whose paper had been read by the Secretary, Mr. Edgar Worthington) referred to the difficulties he had experienced in perfecting his meter. But they had, he said, been overcome by changing the material of which certain parts were made, and not by altering the construction. He also drew attention to a variety of meters on view. Samples of his own instruments which had been in use for two and four years, and which were open for inspection, had, he pointed out, practically nothing amiss with them, and were only dirty. One of them—a ½-inch meter from the Southwark and Vauxhall Water Company—he had tested down to 5 gallons per hour; and at that slow speed, it showed a leakage of ½ gallon per hour. At 20 gallons per hour, it was quite correct.

Mr. CHARLES HAWKSLEY said, speaking generally, each class of meter had its own defects—such, for instance, as in the case of inferential meters very small quantities of water could not be registered; and it was these small quantities which were of great importance to people who had to sell water. Unless a meter would measure small quantities, it was not very useful, especially in those many cases in which waste went on by dribbles. With regard to low-pressure meters, the Parkinson had been found to give very good results during the many years it had been in existence; but it had this great defect, that it would not transmit pressure. Many meters would register accurately when new; but they soon ceased to do so on account of the wear on the various working parts, particularly the valves. Then, again, a meter might work very well with one kind of water; but if taken into another district, it would perhaps be a complete failure. Hard water would probably ruin the meter very rapidly, by wearing away the faces of the valves; whereas in a soft-water district, it would work admirably. Again, the reverse might be the case. A meter might be put out of action by the rust from the pipes in a soft-water district, and which was unknown in a hard-water district.

Professor W. C. UNWIN complimented the author on the design of his meter. Speaking of the Venturi meter, the author said it must, of course, not be used below its rated capacity. He was perfectly right, but, on the face, the statement conveyed a wrong impression. Every meter would cease to register at some discharge or other—it might be very low or very high. In the Venturi meter, the registration went on all right until the flow became too small to be measurable by it—in other words, the meter would not register quite so low a discharge as some other meters. But there was practically no limit to its registration of large flows; and it formed a wonderfully correct gauging instrument in dealing with large mains. Concluding, the speaker suggested the use of lignum-vitæ for the rubbing surfaces of meters.

Mr. PHILIP BRIGHT (of Messrs. Tylor and Co.) pointed out that two of the meters referred to by the author had not been made by his firm for eleven and sixteen years. Lignum-vitæ was used by them for large meters; and as regards absence of friction, they found nothing to compare with it. If inferential meters were constructed small enough for the work, they could be made to register down to small dribbles—indeed, meters were at work which would register 2 or 2½ gallons per hour with perfect accuracy. The author had made some tests of a positive and volume meter; but he did not tell them the respective costs of the two meters. He (Mr. Bright) found that one brought in, at the rate of 1s. per 1000 gallons, about 3d. per week more than the other. In this connection the question of the original cost and the cost of maintenance would be valuable; so that they might estimate whether the 3d. per week was worth saving. As to meters in general, they had not been adopted in England to the great extent that they had been abroad; and he thought the question of waste had a great deal to do with this. If only Mr. Schönheyder could bring out a meter which would register all the waste which existed in the water companies' own mains, he (the speaker) believed it would be universally adopted. (Laughter.)

Mr. W. B. BRYAN (East London Water-Works Company) said he was responsible for a revenue of £150,000 a year from meter supplies; and naturally such a large revenue required a very great deal of care and study of the different types of meters. There was room for several types of meters in large water-works—for instance, positive meters could not be used for large supplies like those to railway companies and large manufacturers. Some of his Company's supplies went as high as 300,000 gallons per day; and it was necessary to use an inferential meter. In such cases an inferential meter registered with considerable accuracy. For small supplies, however, such a meter was perhaps not quite so good as a positive meter. Sometimes a positive meter would stop, and then a very extraordinary letter would be received from the occupier of the premises asking why the supply had been arbitrarily cut off by the Company. On the other hand, if an inferential meter stopped registering, it did not stop the supply to the house. This was an advantage to the consumer, but certainly not to the Company. In speaking of the waste of water, the author inferred that the sale of water by meter universally would be a great advantage. In the volume of water used, no doubt it would be; but, on the other hand, the cost of the meter and maintenance would in some cases be prohibitive. His Company alone supplied over 80,000 houses at rentals of less than 3d. per week for water, and perhaps 20,000 for 2d. per week. With such rentals, there was not much margin to pay for positive meters like Mr. Schönheyder's, keep them in repair, and so on. With 210,000 houses under supply, the cost of applying a positive meter to all of these would be considerably over a million of money; and the annual cost of keeping them in repair would also be large. On the other side, it would save capital in some ways—such as in going further afield for water as the district increased. Regarding the supply by meter to houses abroad, it should be remembered that in places like Berlin the number of inhabitants per house was about 60, and in Vienna, he believed, 69. Consequently they could put in an inferential meter to such houses with 60 or 70 inhabitants; but this could not be done in London where the houses only contained six or seven people, or in the Provinces where the number per house would only be (say) five. It would therefore be seen that there was considerable room for inferential meters for manufacturing supplies, and positive meters for small supplies. He believed the Kennedy meter had many advantages over every other type; but, of course, it had the disadvantage of bulk, especially for use in London. Mr. Schönheyder's meter was a distinct departure from every other type of positive meter; and he must congratulate him on the ingenuity he had displayed in making such a meter. As to the Deacon meter, his Company passed the whole of their supply throughout their huge district—sometimes 50 million gallons a day—through Deacon meters. They were really most wonderful pieces of machinery for enabling water-works engineers to detect and localize waste. As regards the Venturi meter, that, of course, had great advantages in aiding them in measuring pretty accurately the flow through large mains. His Company had one on a 48-inch main. It was checked by cubing the water from a large reservoir which passed through it; and its registration was very accurate indeed. The disadvantage was that, if the clockwork stopped, the registration stopped; and this would not suit his Company.

Mr. ISAAC SMITH (Nottingham) described the meter of which he is the inventor. It was, he said, based on the principle of spiral channels or canals. The channels were gradually tapered from the inlet to the outlet port, and struck according to a formula of mathematical calculation. These spirals were either cast or stamped by a die; and the sleeve of the drum was mounted on two bearings—an upper bearing and a lower one. The two bearings rode upon a port box, which had four port-holes. The entrances to the channels or walls of the channels were so enlarged that only one port-hole was able to supply one channel at the same time. Thus what was called congestion was effectually prevented. The port-box was terminal, so that, while the pressures that came into the pipes were resisted by the buffer, no rotation of water took place in the drum. Another thing was there was no thrust either up or down. He ventured to think the principle on which this meter was constructed was the right one. Where they wanted perfection in a meter was in the wheel-work; the least little friction or looseness in a wheel would soon give incorrect indications on the dial.

Mr. E. B. ELLINGTON pointed out that Parkinson's low-pressure meter was the one most largely used for hydraulic power supply in London. This was because it was only the pressure, and not the water, that was used; and it was the exhaust that was registered. For this purpose, the Parkinson meter was admirably adapted. Its great drawback was that, while it would register perfectly correctly when the water was pure, as the water had to be registered after it had passed through the machines, and was contaminated with grease and bits of packing, trouble arose through the filling up of the drums. For general use, the Parkinson meter was very large for the work required of it. With regard to power supplies, there was often a great deal of difficulty in registering the water. The meter which was usually employed for this purpose was the Kent; and it had proved to be very satisfactory. It would not, however, save for a short time after being put to work, register very small flows; and therefore it was necessary to frequently change the working parts. As to ordinary water supply, the cost of meters in relation to dribbles was a very important point. He congratulated the author upon the results he had obtained with the "Imperial" meter.

Mr. COCHRANE said he believed in Manchester they used entirely high-pressure meters of the Kent "Uniform" type, and that the registration there was very good indeed—as much as 98 per cent. in a twelvemonth. He understood that, even over a period of four years, it was the same. They could not claim as much as this in London.

Mr. WHEATLEY (who is connected with a firm of meter makers), alluded to some of the difficulties that had prevented the more general adoption of positive meters. The chief one was the question of price. When they considered the onerous duty the meter had to perform, and the amount of care and money that had been expended in order to reduce the cost so as to produce a larger demand, he thought it would be agreed there was not a very great prospect of much further improvement in this respect. What they, as meter makers, asked water engineers to consider was the earning capacity of the instruments they supplied to them. They maintained that they could produce dividends, if this was what was wanted; and they also claimed that the meters could do more to check waste than any

other known means. He appealed for fair play for meters, and for a little more attention on the part of water engineers to the question of their fixing and location. Another point was that meters were still called by the size of the pipes to which they were to be fixed; but he hoped that in future, in deciding upon sizes, some consideration would be given to the quantity of water the meters would have to deal with per 24 hours, and the highest rate of speed at which they were likely to have to pass the water.

Mr. W. Morris (Kent Water-Works Company) was in hopes the author's meter would prove the best positive one they had. He (Mr. Morris) was employing some of them; but, of course, he could not fairly say what the result was until he had had them in use some time. Whether it would be worth while paying a higher price for them than for inferential meters (with which they worked very well as a general rule) he could not yet tell. In the case of his Company, they did not furnish domestic supplies by measure; but they had a good many meters attached to private houses where, in addition to domestic use, water was taken for irrigating gardens. It seemed to his Company very important to impose some sort of check on the quantity of water used for gardens, because it was taken at the hottest part of the year, when, of course, there was the greatest draft. They had therefore established a system by which, if a person wanted water for his garden, they gave him a meter, and charged the ordinary rate and something as meter-rent. Supposing the ordinary rate for the house was £4, they added, as a minimum charge, £1 a year; making the total payment £1 5s. per quarter. Consequently, they were not very much concerned about precise accuracy in the registration of dribbles. The meter was a check upon undue consumption; and, in the majority of cases, the garden supplies did not go beyond the minimum rate. Of course, there were men with large gardens who used the water lavishly, and who went over the minimum supply. For such purposes as this, the Siemens meter seemed very satisfactory. Some time ago he visited Berlin to investigate the system of meter supply; and he found there the Siemens meters were very satisfactory. The reason they were so there was, in the first place, because there were no cisterns, and the supplies were taken direct from the mains; and, therefore, the water was drawn at considerable speed. Then the houses were built for 70 to 100, and even more, inhabitants; and the landlords paid for the whole of the water for the premises, which passed through one meter. In this way, it did not matter what the individual consumer used; he merely paid a regular charge. In every case, too, under the police regulations, the landlord had to have a representative on the premises; and the man could read the meter, and see that there was not an excessive consumption. At the time of his (Mr. Morris's) visit, the consumption in Berlin was about 12 gallons per head per day; but he fancied it was rather more now. He believed 1-inch meters were the smallest used, and that the difference in the quantity of water pumped by the engines and that registered by the meters was only about 15 per cent.

The Chairman (Sir E. Carbutt) remarked that the Government were putting up a Physical Laboratory, for which they had agreed to grant £12,000, and to spend £4000 a year in its management. In addition to experimental work, a large amount of testing would be done; and he believed the question of the testing of meters would be taken up. In making some experiments recently, he wanted a meter tested; and he found there was nobody in the country to do it. All he could do was to get another meter from the same manufacturers, and try the two. This, he did not think, was at all satisfactory.

Mr. Schönheyder, in reply, thanked the speakers for their appreciatory remarks. He acknowledged, and further illustrated, Professor Unwin's explanation of his observation as to the capacity of the Venturi meter. He had tried many experiments with lignum-vitæ; and in several meters he had fitted the bushes of the valves with it. But he found, on taking the meters to pieces, that the lignum-vitæ had dried and split; otherwise the wear on it was good. As to Mr. Bright's remarks, he apologized for having illustrated old types of meters; but pointed out that he had not gone into details. Regarding the use of small meters, only small deliveries could be obtained by them; so that such meters would be of no value for measuring (say) dribbles and garden supplies. Respecting his tests with a volume and positive meter, the former was now so slow that it would hardly register 5 gallons per hour; and how to repair it he did not know. It only cost £2; but 18 per cent. of revenue would be lost by its use. The ¼ inch "Imperial" which he had in tandem with it was only listed at £3 7s. 6d.; and after four years' working (during which time it had only had a new set of cups), it would register down to 2 gallons per hour, and perhaps much less. As to the high cost of measuring water by positive meters, there were a great many at work where only 4d. per 1000 gallons was charged; and it was found an advantage to use them. In the case of small houses, there was no reason why one meter should not deal with the supply to two or three. He knew a town where the whole supply was metered, and one meter was fixed to every four cottages. This was found to work capitally. He thought if Mr. Morris put a positive meter tandem with one of the inferential meters he had spoken of, he would learn something which would be beneficial. He agreed with the Chairman that an official testing-place for water-meters would be a decided advantage.

REGISTER OF PATENTS.

Controlling the Flow of, and Igniting Gas.—Serin, A., of Brussels. No. 3201; Feb. 13, 1899.

This invention is chiefly designed to provide means for obviating the continued exposure of the catalytic material employed to light the gas to the action of the flame proper after ignition.

For this purpose, the supply of gas to a bye-pass jet is controlled by the same cock as is employed for controlling the supply of gas to the main burner; and the bye-pass jet is provided with a catalytic igniter arranged so that, when the gas is ignited, it will be in a position to ignite the gas issuing from the main burner, while the igniter will be out of contact with the flame from the main burner.

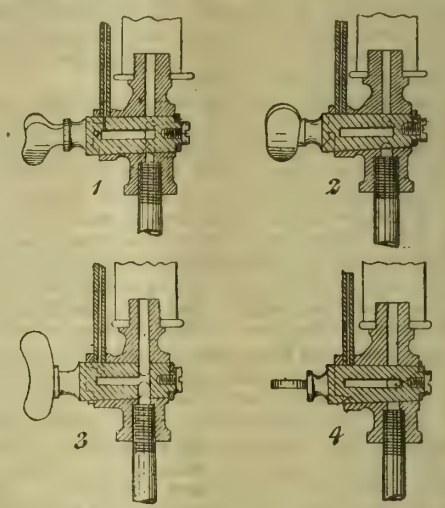
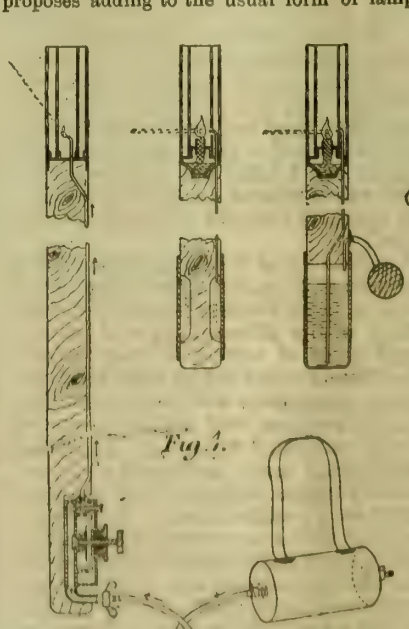


Fig. 1 shows the cock in the position in which the gas-supply pipe is connected with the bye-pass supplying the pilot-light, which is ignited by the catalytic material fitted at its exit end. Fig. 2 shows the cock in the position when ignition takes place at the main burner. Fig. 3 shows the position of the cock after having been partially turned out of the position shown in fig. 1. In this position, the pilot or lighting-flame is extinguished. On the other hand, the gas flows to the burner at full pressure. Fig. 4 shows the cock in the position at which the bye-pass for the igniting, as well as the passage leading to the burner, are closed. This position corresponds to a rotation of the plug through an angle of 180° from its initial position shown in fig. 1. By these means, when the cock is turned from the "off" position, fig. 4, to the other extreme position, fig. 1, the jet at the bye-pass will be ignited by the catalytic igniter; and when the cock is turned into intermediate positions, figs. 2 and 3, the flame at the main burner will be ignited by the bye-pass flame, and the bye-pass flame will be extinguished—thus preventing deterioration of the catalytic igniter. The bye-pass is preferably provided at its end with a tubular cap, having a suitable jet or nozzle for projecting the bye-pass flame into the path of the gases issuing from the main burner; and to this cap is secured the catalytic material in the form of a pastille, wire, or the like, in such a position that it will lie in the bye-pass jet, but not in the flame from the main burner.

Lighting and Extinguishing Lamps.—Simmance, J. F., of Hammersmith, W. No. 3683; Feb. 20, 1899.

To obviate the necessity for approaching the lighting-torch sufficiently near to (say) the incandescent mantle of a public-lamp burner to risk damage to the burner or its fittings by a blow from the torch, the patentee proposes adding to the usual form of lamplighter's torch a small tube



fixed along the pole. The upper end of the tube is fitted with a jet; and this jet is directed at such an angle in relation to the flame of the wick that anything ejected from the jet will impinge upon part of the flame. The lower end of the tube terminates in a small reservoir, capable of

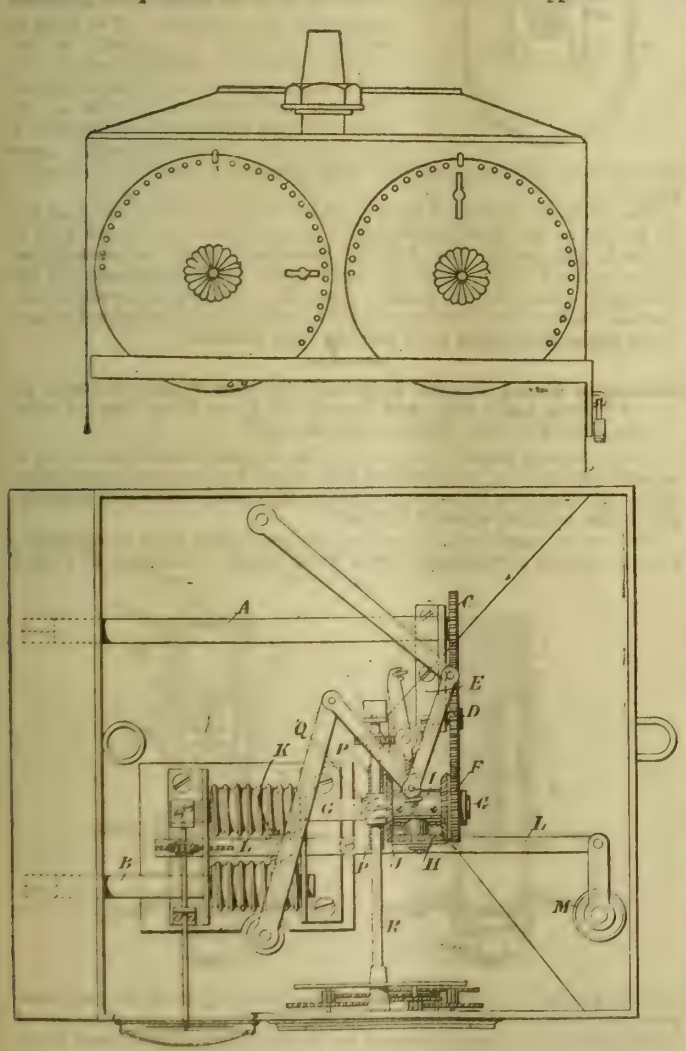
being compressed, or so acted upon as to force a small portion of its contents in a stream through the torch-flame; and, a suitable aperture being provided, a jet of flame can be spurted from the torch which will reach the gas-burner at a distance of several inches. The reservoir may simply contain air, which, injected into the torch-flame at a proper angle, will deflect it from its normal position, or may contain spirit or light oil, the spray of which, passing through the torch-flame, is ignited, and lights the gas without the nearer approach of the torch. A guard is provided, to prevent the torch coming in contact with the burner. Or there may be attached to the torch a reservoir of compressed coal or other gas, of which a small quantity can be liberated instantaneously by a valve at such pressure as to direct the jet as desired. In this case, the torch need not have a wick; the gas from the reservoir being allowed to burn in its place in a small flame, which can be momentarily enlarged and projected upon the gas-burner to be lighted. These several arrangements are shown in fig. 1.

For burners fitted too high in the lantern for convenient torch-lighting, the patentee proposes arranging a tubular poised arm, fitted with a jet at its upper end, and attached by a swivel joint to a convenient part of the gas-supply pipe—see fig. 2. The plug of the swivel is so pierced that, when the arm is swung out at one side of the burner, gas passes to the jet, and can in that position be lighted by the torch. Then, by thrusting the torch against the poised arm, the jet of lighted gas is caused to swing over the burner at a convenient height for igniting the gas. By further pushing with the torch, the arm swings past the burner, and shuts off at the swivel the gas to itself. In extinguishing the light, the operator first brings the poised arm into its original position, and then turns off the main cock—leaving all ready for the next time of lighting.

Coin-Freed Meters.—Glover, R. T. & J. G., of St. John Street, Clerkenwell. No. 4341; Feb. 27, 1899.

This invention has for its object to utilize intercepting mechanism in coin-freed gas-meters in such manner that coins of (say) two different values may be inserted in their respective receivers, and the original mechanism be actuated thereby to effect the movement of the gas-inlet valve proportionately to the value of the coins so inserted.

When giving an example of their invention, the patentees refer to their previous patent No. 22,830 of 1894, in which two parallel screw-threaded rods have a pinion in gear with each, so that one is turned after the receipt of a coin to open the gas-valve, and the other is turned by the meter-mechanism to close the valve. In connection with such mechanism, they propose to mount on one of the rods an extra pinion, to which, through an intermediate or idle gear, motion can be given from the second or independent shaft of the second coin-receiver apparatus—the



extra pinion having in conjunction a bevel gear for operating a circular travelling idle bevel-wheel, which is also in gear with a second bevel-wheel, forming part of the pinion of the meter-operating shaft which closes the valve. The circular travelling bevel-wheel is idle in either direction—*i.e.*, it walks over or around the teeth of the stationary pinion bevel; and through it, by the operation of the coin-receiver, the valve can be opened further to a distance corresponding to the quantity of gas to be delivered. Thus (say) a penny and a halfpenny can be placed in the respective slots; and on the handle being operated, the one valve of the meter can be opened to the allotted extent according to the value of the coin so inserted.

The illustrations show a plan of the meter with the top or cover removed, and a front view of the upper part of the meter with two price-changer face-plates in position for (say) a penny and a halfpenny respectively.

These price-changer front-plates and the rear appliances connected with them for the reception and utilization of either coin are the same as those described in patent No. 25,272 of 1894. The two parallel screw-threaded rods with the pinion in gear are also protected—by patent No. 22,830 of 1894. The modification needed consists in providing a half or any value coin-receiver and actuating shaft A, about horizontal and parallel in position to that of the full-value coin-receiving or actuating shaft B. The shaft A has on its inner end a toothed wheel C, in gear with an idle wheel D; both being carried by the same bracket or bearing E. This idle or intermediate wheel is also in gear with the toothed wheel F, mounted loosely upon the shaft G for rotating it in conjunction with a bevel-wheel as part of it. This bevel-wheel, by its action on the traveller pinion gear H, causes the wheel to rotate, and by its being carried by a sleeve I fixed on the shaft G, so that it not only has a rotation but a travel around the shaft's axis, and in such motions ensures the rotation of its screw-threaded portion in the same direction as would happen to its screw-threaded portion if the shaft B had been acted upon after the receipt of the full-value coin—the bevel-wheel J remaining stationary, so that the wheel H simply walks around the wheel J without affecting it in any way.

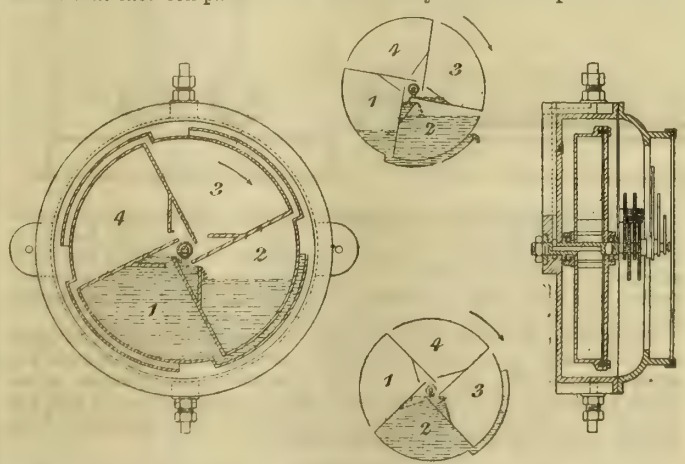
The movement just described causes the pinion K to rotate, and move by its bar L the gas-valve M to open it to a greater distance—proportionate to the value of the inserted coin. The bevel-wheel J, also mounted loosely on the shaft G, is in a piece with the toothed wheel P, which receives its motion from the worm Q; this being fixed on the index-spindle R for transmitting the motion of the bellows mechanism in the usual manner during the consumption of gas. The toothed wheel P and bevel-wheel J are then rotated, and act upon the sleeve-pinion H to cause the sleeve I, and consequently the shaft G, to reverse their direction of travel, and the valve M to be gradually moved to close the passage for gas by the back-travel of the pinion K; the bevel-wheel and the pinion F being then stationary, so that the wheel H simply walks around without affecting the bevel-wheel in any way.

Supposing the meter be prepared for a penny and a halfpenny respectively, a penny could be inserted through one slot in the front-plate of the meter, and a halfpenny through the other one. Then the handles are turned until each coin is forced against a fixed stop for its arrest and automatic discharge. There is a locked bar placed across the face-plates of the price-changers, to check the removal of the plates except by a responsible official.

Water-Meters.—Reisert, H., of Cologne. No. 5929; March 18, 1899.

This invention relates to apparatus, in shape of a drum, by means of which the quantity of water passing from any reservoir or other source may be measured.

The water to be measured flows into a drum divided into several chambers or compartments, in such a way that each chamber is filled to a certain point, and afterwards emptied again by the rotation of the drum caused by the overweight on one side of the drum. As such meters must revolve very easily, in order to prevent the streaming through of unmeasured water, former constructions never worked precisely (according to the patentee) on account of the chambers often not being entirely filled at the moment when, by the rotation of the drum, the water has already begun to flow out. In this new invention, means are provided to prevent the underfilling of the compartments, and to ensure that each compartment is filled exactly to a certain point.



The drum—as shown—is divided into four compartments 1, 2, 3, and 4, which are connected through tubes with the atmosphere. The water to be measured flows through the hollow shaft steadily and freely into the drum. At the partitions of the different compartments, plates are fixed, which form pockets; and, in order to ensure that an overweight on one side of the drum and therewith a rotation of the same takes place, the partitions are not arranged radially but diverge somewhat from the radius drawn from the centre to the point where they are fixed to the circumference of the drum in the direction of the arrow.

In the position shown in the main drawing, the compartment 1 is filled in the right way—that is to say, it contains the quantity of water that each compartment should contain when it begins to empty. In this position, the end of the partition is on the same level with the free end of the tube. If now the drum begins to rotate, on account of the overweight on the right-hand side, the water of the compartment 1 flows out through the tube. During this time, the water to be measured passes through the hollow shaft into the corresponding pocket, and from there into compartment 2.

When now, by rotation, the partition sinks under the horizontal radius

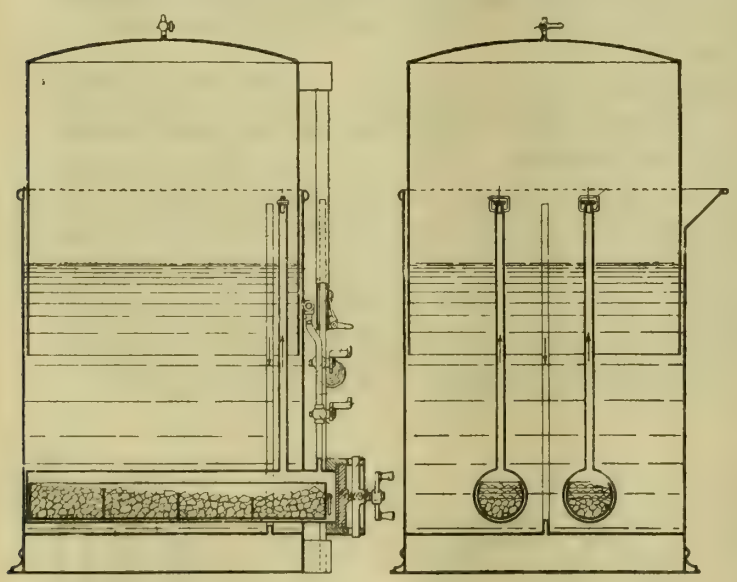
of the drum, the streaming-in water would flow not only into compartment 2 but also into compartment 3, so that compartment 2 could not be filled sufficiently if the plate had not been arranged. By this plate, the water is caused to flow into the next pocket, and from there back into compartment 2. This lasts until the end of the plate is on the same level with the end of the partition ; and as soon as this position is passed, no more water can flow into compartment 2, which is now completely filled.

When the drum T^1 rotates farther, some water will flow over the end of the partition into compartment 3, until the end of the partition is on the same level with the end of the tube. The compartment is now in the same position as compartment 1 was in, and is filled exactly with the same quantity of water, as the surplus of water has been delivered to compartment 3.

In this way, in order to obtain always exactly the same quantity of water, the compartments are at first overfilled and afterwards the surplus of water flows into the next compartment; and thus the highest accuracy in measuring is said to be attained.

Production of Acetylene.—Higgins, W., of Putney, and Sandilands, H., of Whitehall Place, S.W. No. 15,977; Aug. 4, 1899.

This generator comprises an ordinary bell gasholder, with which is combined a series of what the patentees term "retorts" for the production of acetylene—consisting of horizontal chambers (preferably cylindrical) formed in the lower part of the wall of the gasholder, and opening outwardly through the walls of the latter so as to permit of the introduction into each chamber of a perforated vessel containing a charge of carbide, and making, when so introduced, a gas-tight joint with the mouth of the retort. From an aperture in the side of the well in which the gas-bell floats, a small pipe leads to a perforated pipe or sprinkler fixed within the upper part of each retort; the handle of the stopcock on the pipe being formed by a lever, one arm of which is weighted so as to normally hold the cock closed, and thus prevent access of water from the well to the charge of carbide in the retort. The other arm of the lever is engaged (when the gas-bell sinks below a certain level) by a tappet fixed to the bell; the descent of the bell thus causing the stopcock to be opened, and water to be admitted through the sprinkler to the carbide—thus generating acetylene. The gas produced is conveyed into a pipe leading upwards through the water in the well to the space within the bell where it is stored; the production of gas being automatically controlled by the bell, as it rises and falls, actuating the handle of the stopcock. An outside view of the apparatus, and cross sections (at right angles to each other), are given.



The stopcocks controlling the supply of water to the retorts are not all simultaneously opened by the bell in its descent; the tappets being arranged at different levels. Water being admitted to (say) only one retort at a time, any excessive production of acetylene at a given moment is prevented, and opportunity is afforded for recharging those retorts wherein the carbide has been first exhausted, while the others are in use.

The pipe by which the acetylene passes from each retort to the space within the bell is provided with a stopcock accessible from outside the apparatus; and the upper end of the pipe has a spring-loaded valve, which permits the discharge of gas from the retorts into the bell, but prevents its return—as, for instance, when gas is being generated from carbide in the holders within the bell itself.

Controlling Gas-Cocks and Lighting Gas-Burners.—Haddan, R.; a communication from La Société Anonyme "Lux Nova," of Ghent, Belgium. No. 20,124 ; Oct. 6, 1899.

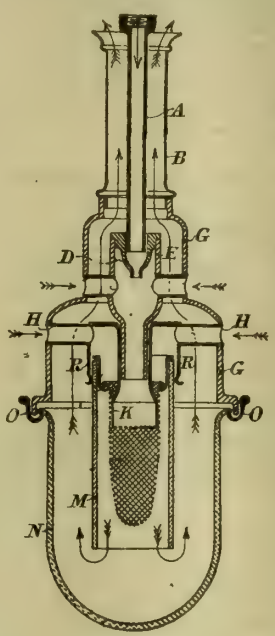
In this arrangement for electrically controlling gas-cocks, having two distinct electric circuits, there is a conical cock pressed by a spring to its seat, in order to avoid escape of gas; the cock being provided on its outer extension with a small lever capable of being moved in one or other direction by the armature of one or other of the electro-magnets, in order to open or close the cock and the passage for the gas, and to allow the lighting or extinguishing of the burner. The absolute tightness of the apparatus is obtained by the use of a cock (of conical form) for opening and closing the passage of the gas, the circumferential face of which is maintained in contact with the inner wall of its shell by the action of a spring pressing against the greatest base of the conical cock. On the other hand, the direct lighting of the burner by the electric spark is obtained by causing the opening of the cock and the electric spark to be simultaneous—the latter being large "in consequence of the disposition adapted for producing the interruption of the current."

Gas Motor Engines.—Williams, J., of Pittsburg, U.S.A. No. 22,215; Nov. 7, 1899.

This invention in explosive engines is designed for the purpose of obtaining a motor capable of receiving an impulse at each stroke, and for the purpose of applying the resultant force to a common main shaft through the medium of a plurality of pistons (centrally arranged in tandem) mounted in a series of similarly arranged cylinder chambers, wherein is produced a cycle of explosions. The operations of explosion, discharge, suction, and compression are performed successively. The engine is designed to transmit the power generated in the explosion chambers in a constant succession of strokes—thereby obviating the usual delays incident to the performance of the functions when obtained in engines of single or double cylinder construction—and the transmission of the forces is maintained in a common central line; thus avoiding unequal strain on the working parts of the engine and main shaft. It also consists in certain details of construction not described apart from a series of drawings.

Incandescent Gas-Lamp.—Beese, R., of Dresden. No. 23,619; Nov. 27, 1899.

In this incandescent gas-lamp, the flame burns from underneath; so that the shadows cast by the frames of the lamps when the flame burns from above are eliminated.



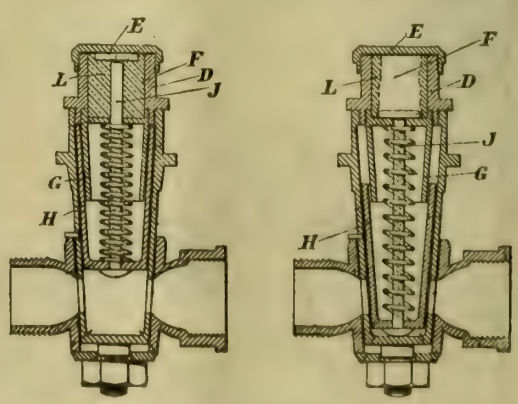
At the end of the gas-pipe A is a nozzle D; and the gas passing through the pipe and nozzle enters a bunsen tube E, into which air is lead by the cross-tube F. Hermetically secured to the tube E is the burner K, which has integrally formed with it a cylindrical depending closed collar R provided with a fluted end, which grips the end of a glass chimney or cylinder M. The collar is also provided with cross-tubes H, similar to those in the bunsen tube E, and through which air is directly conducted to the flame. The cylinder M carries a socket (which has one end bent upwardly and outwardly) adapted to rest upon, and grip, the upper edge of the cylinder; while its lower end is perforated to allow the passage of air to the flame, and bent inwardly so as to form a groove adapted to receive a ring to which is secured the upper end of the mantle. The lamp is surrounded, from the nozzle to the burner, with a concentric body G, in which the mouths of the cross-tubes are fastened, and which is secured at its lower end by a hermetical coupler O to a lower glass N. The combustion gases pass upwards into a waste-pipe B concentrically surrounding the supply-pipe A.

The patentee remarks: "By this construction, it will be seen that the air passing to the flame, as also that air lead into the bunsen tube is heated by the outward flow of the hot burnt gases, while the incoming gas is also warmed by the same through the concentric arrangement of the waste-pipe about the gas leading pipe—thus giving great essential advantages in the effectiveness, as well as substantially reducing the cost of the flame, in addition to its freedom from shadows."

Automatic Acting Cut-Off Stopcocks for Gas-Pipes.—Murphy, J., of Suffolk Lane, E.C., and Arnold, H. L., of King Street, Covent Garden, W.C. No. 23,732; Nov. 28, 1899.

This invention relates to a gas-valve or stopcock constructed to act as an ordinary stopcock, but provided with means for automatically cutting-off the gas supply in the event of a fire or other abnormal rise of temperature in the building where it is fitted.

The valve is made hollow; and on its upper end is fitted an extension-piece D, having a removable cover E, a cavity or chamber F, a rod J



passing through a central aperture in the bottom plate of the extension-piece, and a conical tubular prolongation G. H is the automatic cut-off or secondary valve, made (conical) in the form of a thimble, and fitting the hollow interior of the main valve—its base fitting a corresponding seating in the bottom. The rod J is secured (preferably in a detachable manner) to the base of the secondary valve; and a spring is arranged to bear against the base and under side of the top plate—the tension of the spring being such as to press the thimble down into its lowest position with the base on the seating, as shown in the right-hand figure.

The secondary valve or thimble H is held up against the pressure of the spring in the position shown in the other figure, by means of a fusible plug L made of such material or alloy as to become fluid at an

abnormal rise in temperature, but preferably to become fluid at a considerably lower temperature than that required to melt the lead or composition pipes carrying the gas supply or other usual metal gas-fittings. Should a fire occur, or should the temperature rise beyond a predetermined limit, the plug L fuses, and offering no further support to the head of the rod J, the spring comes into action and shuts down the secondary valve or thimble H tightly against its seating, and cuts off the supply through the main valve.

Automatic Gas-Igniters.—Schultze, K., of Berlin. No. 24,043; Dec. 2, 1899.

This automatic gas-igniting device consists of a tube of thin porous platinum-foil, to which is connected a pill-like bulb or body of spongy platinum, adapted to become ignited when exposed to a current of carburetted hydrogen or other illuminating gas; the advantages said to be gained by the employment of the tube of porous platinum over the platinum wire hitherto employed for this purpose being that the tube, "when heated, quickly and readily distributes the glow over the whole

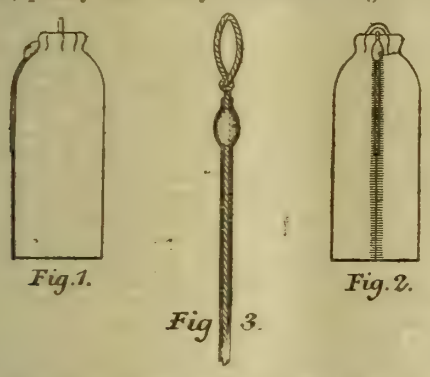


Fig. 1. *Fig. 3.* *Fig. 2.*

of its surface, which permits that the exciting or igniting pill or bulb may be at the top of the flame of the burner, instead of being at the lower end thereof, and exposed to the greatest heat, as hitherto—thus by my invention prolonging the life of such igniting-devices." Fig. 1 is a side elevation of an incandescent mantle to which the device has been connected. Fig. 2 is a view of fig. 1 as seen from left to right. Fig. 3 is an enlarged view of the middle portion and upper end of the device, in which is illustrated the employment of an asbestos thread passing through and supporting the exciter or igniter of the gas.

APPLICATIONS FOR LETTERS PATENT.

1334.—Mallol, J., "Incandescent gas-burners." Jan. 22.
1336.—Chicken, B. R., Smith, A. G., and the Bon-Accord Acetylene Gas Company, "Purifying acetylene gas." Jan. 22.
1354.—Stotschek, J., "Acetylene generator." Jan. 22.
1358.—Melhuish, A. G., "Gas or oil engine." Jan. 22.
1418.—Bradshaw, T. P. R., and Legge, J. St. C., "Artificial lighting." Jan. 23.
1425.—Wood, C., "Gas and oil engine." Jan 23.
1481.—Ransford, R. B., "Fluid-meters." A communication from L. Burrell. Jan. 23.
1488.—Tatham, J. E., "Gas-burners." Jan. 23.
1491.—Smith, G. A., "Lamps." Jan. 23.
1495.—Allen, S. W., and Davies, L. J., "Acetylene generators." Jan. 23.
1538.—Fassett, H. H., "Gas-cocks." Jan. 24.
1540.—Davis, L. S., "Generating gas from oil." Jan. 24.
1551.—Row, S. J. H., "Steadying the flame produced by the combustion of gas or gases." Jan. 24.
1586.—Verity, B. S., and Mitchell, S. W., "Pressure-reducing and automatic-closing valves." Jan. 25.
1594.—Rutnagur, S. M., "Water-waste preventer and recorder." Jan. 25.
1644.—Stattler, C., "Production of acetylene." Jan. 25.
1651.—Downing, H., "Pressure-reducing and self-closing valves." Jan. 25.
1657.—Nicholson, R. T., "Generation of acetylene." Jan. 26.
1663.—Downie, T., "Conveying and charging material." Jan. 26.

Lymington Town Council and the Gas Company's Order.—At a recent special meeting of the Lymington Town Council, a resolution was submitted approving of the draft of the Provisional Order for which the Gas Company are applying. A good many objections were raised; and Alderman Lewis promised that the illuminating power should be increased to 15 candles, and the maximum price reduced to 4s. 6d. per 1000 cubic feet. The putting of the subscribed capital at £8000, instead of £4000 (the actual amount) was also objected to; but Alderman Lewis said £8000 was the present value of the works. The Town Clerk was instructed to consult the Corporation's Parliamentary Agents, in the interests of the ratepayers, if necessary.

The Hanley Corporation and the Gas-Works.—A special meeting of the Hanley Town Council was held last Tuesday to consider the steps to be taken with reference to the Bill to be promoted in Parliament to empower the British Gaslight Company, Limited, to erect works and to expend further capital at their Staffordshire Potteries station. A resolution was proposed to the effect that the Bill be opposed. The Town Clerk explained that the object of passing the resolution was to obtain *locus standi* for the Corporation before the Parliamentary Committee. In reply to questions, he further stated that it would be necessary to promote a fresh Bill if the Corporation wished to make their own gas; they had no power to purchase the gas undertaking from the Company. Mr. Foster wanted it to be clearly understood that the Corporation wished to obtain power to purchase the undertaking if they desired to do so. Alderman Cooke remarked that they were all agreed on this point. The resolution was unanimously adopted.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Projected Amalgamation of the Gas Institute and the Institution of Gas Engineers.

Sir,—I read with amazement the communication from the Joint Secretaries on the above subject in your issue of the 30th ult.; for I cannot help thinking that the Council have gone outside their functions in doing as they have without first getting some resolution passed expressive of the opinion of the members, or in some way authorizing them to take such steps as they have done.

Much as I desire union or fusion (for I cannot understand the use of the word "reunion" in reference to this matter), I cannot subscribe to any proposition which involves the dissolution of the Gas Institute; nor do I think the members generally will care for it. Indeed, to those members who fought so strenuously for the continued existence of the Gas Institute eleven years ago, the action of the Council at the present time will seem like a great betrayal. Then what of the vast number of members who have joined the Gas Institute since the period of secession—a number, I believe, which exceeds that of the whole membership-roll of the Institution. Surely they will have something to say against the dissolving of a Society which they have joined in good faith.

The Institution may dissolve, and arrangements may be made by which its members may be taken over *en bloc*, without loss of dignity to them; but I trust the Gas Institute will go on. Its name may be altered, and its rules may be altered, as they both have been in the past; but its continuity should not be interfered with. The Council of the Gas Institute would do well to reconsider this, if they do not wish to spend time and trouble to no purpose.

Stalybridge, Feb. 3, 1900. Wm. Carr.

PARLIAMENTARY INTELLIGENCE.

OPENING OF THE SESSION.

Government and Private Members' Bills.

The seventh session of the present Parliament was opened last Tuesday by Royal Commission. The Speech from the Throne did not contain any matter of special importance to our readers; no intimation being given of any intention on the part of the Government to give effect to the recommendations of the Royal Commission on the Metropolitan Water Supply. It was announced, however, that amendments are required on the laws governing limited liability companies, and that attention will be invited to proposals for, among other things, enabling local authorities to aid secondary and technical education in England and Wales, and for amending the factory law. Notice was subsequently given by the Home Secretary (Sir Matthew White Ridley) and the President of the Board of Trade (Mr. Ritchie) of their intention to introduce, on the following Monday, Bills to amend the Factory and Workshop Acts and the Companies Acts. On Friday, a number of Bills were brought in by private members, as usual at the commencement of the session, dealing with the following subjects: Boiler Registration and Inspection, Borough Funds, the Companies' Acts, Labour in Mines, Local Government in Scotland and Ireland, Old Age Pensions, Public Health, Workmen's Compensation, and Water Supply by Companies and others (Mr. Cornwallis's Bill of last session). Mr. Knowles, the member for West Salford, has put upon the paper a notice that he will call attention (he has wisely not specified the day) to the subject of the registration of plumbers, and move—"That it is desirable that the Government should introduce legislation dealing with the subject, and create a scheme for the national registration of plumbers."

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Wednesday, Jan. 31.

(*Before* The Master of the Rolls *and Lords Justices* Collins *and* Romer.)

Welsbach Incandescent Gas-Light Company, Limited, v. The New Sunlight Incandescent Company, Limited.

This was an appeal by the plaintiffs from the order of Mr. Justice Byrne of Jan. 22 directing that letters of request should issue to the Austrian Courts for the examination of certain witnesses.

Mr. Fletcher Moulton, Q.C., Mr. Terrell, Q.C., and Mr. Walter appeared for the plaintiffs; Mr. Bousfield, Q.C., and Mr. Neill represented the defendants.

Mr. Terrell said this was an appeal by the plaintiffs from an order made by Mr. Justice Byrne in chambers, directing letters of request to issue to the Austrian Courts for the examination in Austria of certain witnesses—among others, Dr. Welsbach. The action was brought to restrain infringement of the patent of 1893, for making mantles out of thorium and cerium. One of the allegations in the particulars of objections was that the alleged invention was not novel, "having been made, used, exhibited, and sold in this realm prior to the date of the said patent." "The defendants will rely on the manufacture, exhibit, use, and sale of mantles made according to the alleged invention by the plaintiff's predecessors in business, the Incandescent Gas-Light Company, Limited, from time to time during the years 1891 and 1892"—the patent in question being dated in 1893. He submitted that the letters of request ought not to be granted, as defendants were out of time. The action was set down for hearing in September; and an application was recently made to postpone the trial, on the ground of the absence of a material witness. An adjournment was granted for three weeks;

and advantage had been taken of this to apply for the letters of request, the result of which would be to postpone the trial indefinitely.

Mr. NEILL pointed out that plaintiffs did not put in their affidavit of documents till Dec. 13; so that defendants could not be charged with delay, as they at once made the application.

Mr. TERRELL argued at some length that the appeal should be allowed.

Mr. WALTER followed on the same side.

Without calling on Counsel for the respondents,

Their LORDSHIPS dismissed the appeal with costs; stating that it was impossible to differ from the view taken by Mr. Justice Byrne. The evidence which the defendants sought to obtain went to the very root of the case.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Tuesday, Jan. 30.

(*Before Lords Justices* SMITH *and* COLLINS.)

Welsbach Incandescent Gas-Light Company, Limited, v. Sluice—Same v. Riemer.

This was an appeal by Mr. Major Sluice from the order of Mr. Justice Day dated Dec. 19, committing him to prison for breach of an injunction restraining Riemer, Thomas Sluice, and Sluice and Co. from infringing the plaintiffs' patents. Major Sluice was brother to Thomas Sluice; but it was stated that he was not connected in any way with him in business matters, and, further, that notice of the injunction having been granted had never been personally served on him. Plaintiffs contended that the committal order had been properly made, as, since the injunction was granted against Riemer, Major Sluice had been carrying on business with him at 18, Mincing Lane and 832, Old Kent Road, either as partner or servant, or had aided and abetted Riemer. It was further alleged that Major Sluice was really Thomas Sluice who carried on the business of manufacturer of incandescent mantles at Foster Lane, and against whom an injunction had been granted.

Mr. DODD appeared for the appellant; Mr. TERRELL, Q.C., and Mr. WALTER represented the respondents.

Lord Justice SMITH said it must be clearly proved by the applicant for a committal order that the person against whom the application was made had, in fact, been guilty of a breach of the injunction. In this case, the plaintiffs had apparently obtained an injunction in February, 1898, against Thomas Sluice and Sluice and Co., to restrain them infringing their patent. In November, 1897, an injunction was obtained against Riemer enjoining him from making mantles. It might be that there was great difficulty in stopping infringers after injunctions were obtained; but that did not justify a person being put into gaol unless he had been guilty of committing a breach of the order. The injunction restrained Thomas Sluice and Sluice and Co.; and it had not been proved that Major Sluice was either Thomas Sluice or Sluice and Co. Further, it had not been proved that he was a servant or agent, or an aider and abettor, of Thomas Sluice or Sluice and Co. in the breaches which had been committed by these parties. Even if this had been proved, there was nothing to show that the order had been personally served on the appellant. The evidence failed to establish that appellant had been aiding and abetting Riemer; and therefore the order for committal would be discharged.

Lord Justice COLLINS concurred.

The appeal was therefore allowed, with costs.

Robbery From a Prepayment Gas-Meter.

Thomas Dickenson was recently charged at the Manchester City Police Court, before Mr. Armitage and other Magistrates, with breaking open and stealing 3s. 9d. from a prepayment meter at No. 4, Steele Street, Queen's Road, Manchester. In reply to the charge, he said: "Yes, I took it for safety. I thought the lodger might take it." Elizabeth Duckworth, a lodger in the house, proved seeing the prisoner wrench the lock off the meter with a pair of pincers, and take out the money. An inspector proved finding the meter broken open, damaged, and the above-named amount short. The prisoner was sentenced to two calendar months' hard labour.

The Abstraction of Water from One District for the Benefit of Another.—The Warwickshire County Council last Tuesday adopted the following note presented to them by the Sanitary Committee: "There are already several instances in the county where water is abstracted from one locality and conveyed considerable distances for the purpose of being sold for profit. In our opinion, legislation is required to restrict or regulate any such proceedings; and we recommend that a communication be sent to the County Councils Association to the effect that, in the opinion of the Council, such legislation is required as will make it illegal to construct any new water-works for the purpose of conveying water for sale from one parish to another without the consent of the council of the county in which the well or principal source of water supply, or proposed water supply, is situate, except by the authority of a Special Act of Parliament."

Proposed Incandescent Gas Lighting in Marylebone.—Undeterred by the fact that the Marylebone Vestry have before them proposals for the establishment of a municipal electricity undertaking, one of the members is anxious to introduce incandescent gas lighting; and he has put a notice on the *agenda* as follows: "That, in the opinion of this Vestry, it is desirable that immediate steps should be taken to improve the imperfect lighting of the public streets, and that a similar arrangement to that already in successful operation in Westminster, whereby the Gaslight and Coke Company contract (*a*) to install the incandescent system at the rate of £2 per lamp, spreading the cost over a period of five years, (*b*) to waive all claim for repairs of such lamps for three years, (*c*) to light, extinguish, and clean the same for the sum of 21s. per lamp per annum, (*d*) to provide necessary mantles, with a maximum charge for eight mantles per lamp per annum, and (*e*) to charge for the actual gas consumed at the rate of 2s. 1d. per 1000 cubic feet, be at once entered into with the Company by the Vestry."

MISCELLANEOUS NEWS.

THE GASLIGHT AND COKE COMPANY.

The Half-Yearly Ordinary General Meeting of this Company was held last Friday, at the Offices, Horseferry Road, Westminster—Colonel W. T. MAKINS (the Governor) in the chair.

The SECRETARY and GENERAL MANAGER (Mr. John W. Field) having read the notice convening the meeting, the seal of the Company was affixed to the register of shareholders, and the report of the Directors (given in the "JOURNAL" last week) was taken as read.

The GOVERNOR: Ladies and Gentlemen,—At the last meeting, I was compelled to take up a good deal of your time; but I hope on the present occasion the proceedings may be much shorter. The satisfactory feature of the accounts before us this half year is an increase of 4·92 per cent. in our sales of gas. The restricted sales in the December half years of 1897 and 1898 were attributed by us to the weather conditions of those periods; and, *per contra*, on this occasion we attribute to the cold and foggy weather which prevailed during the last three months the exceptional increase in the quantity of gas sold in the latter half of 1899. The actual figures approach 500 million cubic feet. The increase in the use of gas-stoves, both for heating and cooking, shows no signs of abatement. The number of additional stoves let out on hire and sold to consumers, other than automatic consumers, by the Company during the past half year has been 7460, which is equivalent to an increase of 7 per cent. The additional number of automatic meter consumers has also been very satisfactory; 7356 new supplies having been furnished, and with them 5666 stoves. Meanwhile, the ordinary consumers of the Company have augmented in number by 2314. Altogether, we have now in our district 329,417 consumers, 351,314 meters, and 208,049 stoves. I should add that the number of stoves I have just quoted is exclusive of those which the consumers have provided for themselves, without the intervention of the Company. Equally satisfactory has been the improvement in the revenue for residuals. Coke has yielded 13s. 6½d. a ton, as compared with 10s. 11½d in December, 1898; tar, 1·6d. per gallon, as compared with 1d.; and ammoniacal liquor, 6s. 5d. per butt, as compared with 5s. 3d. These improved figures represent the larger proportion of the addition to our half-year's residuals revenue, which amounts to £110,091; and there is no reason to suppose that in the near future there will be any material reduction in the market value of these products. Turning to the expenditure of the half year, we find only four items which call for special attention. These are "coal," "wear and tear," "rates," and "bad debts." The increase in the cost of coal is the result of what we must now look upon as a small advance in the contract price as compared with the prices of oil used in the manufacture of carburetted water gas. In 1898, we had a low-priced contract for American oil; but both this description and the Russian "Solar" distillate which we also used have considerably advanced, and, owing to the buyers not having been provided in time with a sufficient quantity of coal and oil to meet their current consumption, the market price for coal and oil has been in a very inflated position for some months past. Our experience leads us to think that the state of the coal market is absolutely unreal at the present time. No one with any experience of the trade considers the price immediately quoted for supplies of small lots is any true indication of the market value. We are told by the coalowner that the miner is responsible for this state of things, inasmuch as he only works for a limited number of days in each week. I am afraid we cannot accept this as the whole explanation. Certainly, the coalowners have been reaping a rich harvest during the past six months, and possibly in some instances at the expense of our stocks; and I think it would be giving them credit for a very remarkable freedom from the usual instinct of the trader if we were to suppose they viewed with distinct dissatisfaction the idleness of the miner. Fortunately, in our case, we purchased in the spring sufficiently large quantities of coal and oil to carry us through the winter and up to the end of next June. With three or four notable exceptions (I may name Sir James Joicey, Messrs. John Bowes and Co., the Stella Coal Company, and Messrs. Newton, Chambers, and Co.), our contractors have lately failed to maintain the full deliveries; and we have only been able to get sufficient coal to carry on our manufacture. The drain upon our stocks has been very serious; and we are to-day, with regard to the maintenance of our supply, in a condition which no gas company can look upon without some anxiety. I am happy to say that there is a slight improvement since I prepared this note; but still our stocks are lamentably low. We have shown our contractors all round the greatest possible indulgence; but I am compelled to tell the meeting quite plainly that the Directors have felt for some time past that the requirements and claims of the Company have not received from the majority of the coalowners the consideration to which they were entitled. I think it is very possible that the period of such an inflated price for coal will not be of very long duration. These abnormal rises in the price of such a commodity as coal have a tendency to provide for their own reduction. On the one hand, they stimulate the opening up of new sources of supply; and, on the other, they tend to restrict the demand, by putting it out of the power of the smaller manufacturers to continue to use it for fuel when its cost is so greatly enhanced. In fact, the goose that lays the golden eggs comes to an untimely end. A very striking instance of this came before me only a day or two ago with regard to a trade just outside London with which I am connected—namely, the building trade. The price of bricks, cement, sand, and all materials used in building, has gone up to such an extent that it has produced a very serious check in the building trade in Essex; and until there is some diminution in these inflated prices, I am inclined to think that trade will remain in a much quieter condition than it has been for some time past. As regards the future of coals, I think we should be acting judiciously if we were to allow the present excitement in the coal market to expend itself before we talk about next season's prices. We have been informally approached from one quarter; but we have not given any encouragement to proposals to enter on immediate engagements. In order to afford the shareholders some idea of what effect the

present quoted price of coals would have upon the gas industry, I may say that the Metropolitan Gas Companies would have to pay something like a million a year more for their coal, which is equivalent to an increase of upwards of 6d. per 1000 cubic feet in the price of gas. This illustrates the effect of the extreme prices which have been talked about lately. Before leaving the item of coal, I am able to congratulate the shareholders upon the fact that, owing to the exceptionally favourable conditions of the market for residuals, the extra cost of coal has been more than met by the additional revenue from residuals; the net cost of coals to December last, having been only 4s. 8d. per ton, against 5s. 1d. per ton in 1898, which is equivalent to a saving of £25,000 for the half year. The second item I mentioned as calling for remark is "wear and tear." As you know, we have been working with a very small margin of surplus for some time past, and have very properly postponed until better times some of the reconstruction work which it was not absolutely necessary to undertake. Having last year an ample balance over the statutory dividend, we have been enabled to meet the reconstruction of the last of our original purifiers at Beckton; and we have now under consideration other work of a similar character which, when carried out, will result in some reduction in working expenses. But, in view of the certainty of a higher coal bill next year, it will be necessary to exercise special care in the preparation of this year's budget. I should like to guard against being misunderstood. I think you know your Directors well enough to be sure that we should not starve the works for the sake of saving the cost of necessary repairs and maintenance. Our figures of expenditure show that, taking one year with another, we spend quite as much on wear and tear per 1000 cubic feet as the other Metropolitan Gas Companies and other well-managed Companies in other parts of the country. Again, the quantity of gas sold per ton of coal and the very low percentage of unaccounted-for gas affords, to our mind, ample evidence that the manufacturing and distributing plant is maintained in thoroughly good working order. What we do want is an addition to our mechanical labour-saving appliances. To the extent that these involve capital outlay charges, we must be content to wait until Parliament gives us the necessary power for raising the money; and so far as they involve charges against revenue, they must stand over until we can fairly calculate upon having a surplus beyond our statutory dividend, unless indeed we are to adopt the very objectionable course of raising the price of gas in order to meet such extraordinary expenditure. The third item I mentioned was that of "rates." Our property is assessed at a rateable value of £730,000 a year; and the rates have gone up from 6s. 2½d. in December, 1898, to 6s. 5¼d. in December last. We must be prepared, I fear, for a slightly increased assessment upon the approaching quinquennial revaluation. Whether the amount of rate in the pound will fall, I cannot say; but as long as the ratepayers of London continue to be so indifferent to the subject of local expenditure, I am afraid we cannot hope for any great reduction in these charges. The last item was "bad debts." They are slightly higher than last year; and I am told that our experience on this point is not exceptional, and that one trade, a large user of gas, has been passing through similarly bad times—namely, the public-house trade, which is a very important one. Before dealing with the appropriation of profits, I will give you as usual a short analysis of the capital expenditure for the half year. We have spent on buildings at Fulham £9865, on new and additional mains and service-pipes £22,877, on meters £28,078, and on stoves £26,062. That makes a total expenditure of £86,882. Then we have a credit for the sale of surplus land of £11,048, which brings down our capital expenditure to £75,834 for the six months. This, added to the amount brought from last year's account, will give a total expenditure of £12,824,855. That leaves us a floating capital of some £638,694. This amount, together with the aid of our undivided profit, which we shall be able to use for a time for this purpose in our business, will carry us on to the close of the year, we believe, without the issue of further capital. It may be necessary at the end of the year to issue some further capital in the shape of both ordinary and debenture stock; but we can say nothing definite until we know what Parliament is going to do with our Bill. The net result of our operations for the half year has been a profit of £614,885. This is compared with £560,196 in December, 1898. The fixed capital charges amount to £193,800, against £195,500 in the corresponding half of 1898. This leaves a net profit on the half-year's working of £421,105 If we deduct from this the statutory dividend of £4 18s. per cent.—which the shareholders will see is the equivalent of the old 12¼ per cent. which attached to the capital before it was converted—there will be a surplus for the half year of £53,775. Adding this to the surplus brought forward on July 1, the total to be carried forward to the credit of 1900 is £193,333 8s. 4d. I am glad to be able to state that this balance will render it unnecessary to make any addition to the price of gas during the present year; but beyond this I cannot say anything, in the absence of any reliable information as to the future of the coal market. You are aware, of course, that we made on Jan. 1 a reduction of 1d. per 1000 cubic feet in the price of gas in the northern district; and this will involve a reduction in our income for the current year of about £82,000. This reduction of price was determined on after making our contracts for the sale of Beckton coke at prices materially above those of last year; so that we give our consumers a full share of this improvement. Any abnormal advance of coal may render it necessary next year to reconsider the question of the price of gas. I will now, if you will allow me, refer to the paragraph of the report which deals with the suggested cession of our southern district to the South Metropolitan Company. As the facts alluded to therein have been stated very fully, I have but little more to add. The question of this cession of the southern district is wholly sentimental. The consumers of gas in London will not gain a penny piece by it; neither will the shareholders of this or of the South Metropolitan Company obtain the slightest advantage from it. For these reasons, whichever Company has the district will, directly or indirectly, have to pay for the works, and the dividend will have to be paid on the amount of money which is invested in the works. Secondly, there is no mystery in the manufacture of gas. The cost of it is principally governed by the position of the works—I am not speaking of material—so that whether we retain, or the South Metropolitan Company obtain, the Nine Elms station, the cost per 1000 cubic feet of the gas made there is not likely to vary (if at all) to any appreciable extent. But there is no doubt public sentiment which has to be taken into account. I can also quite understand, on sentimental grounds, that the South Metropolitan Company would like to have the river for their northern boundary. If, therefore, we are asked to consider the sentiments of the public, and of that Company, I think we are fairly entitled to claim that the cession shall not entail any loss to this Company; and that is our view of the case. Now, I will give you briefly the history of our negotiations. In August last, very shortly after our general meeting, I received a letter from Mr. Livesey asking me unofficially to consider the expediency of selling to his Company our southern undertaking and our district of supply and manufacturing station on that side of the river. I gave him my own personal views in answer to his letter, which may be shortly stated thus: "Given full value, I should be willing to sell." But I added that it was a matter which the Court of the Company had not then discussed. Two or three more letters passed; and then, as a result, a conference was held here (of the most amicable nature), when the outline of the scheme for sale and purchase was considered. But, as we anticipated might be the case, although all the other matters seemed capable of adjustment, the question of price was found to be the difficulty. A prolonged correspondence has followed that meeting; and I wish I could say that the difficulty as to the price was in the way of being solved. This, however, I cannot say; for while we on this side of the table are of one mind that no cession of the portion of our undertaking in question shall take place at less than its proper value, the Directors of the South Metropolitan Company—quite within their rights—appear to be equally unanimous that they will give no more than the business appears to be worth to them. I think it would occur to the man in the street that reference to arbitration was the obvious solution of the difficulty; but the South Metropolitan Company—doubtless for reasons which appear to them convincing—will have nothing to do with any such method of arriving at the price. Of course, we assume, rightly or wrongly, that in their opinion their case is hardly strong enough to place before an independent tribunal. Be that as it may, the negotiations are just now in a state of "suspended animation;" and we must wait and watch the outcome of the discussion before the Parliamentary Committee upon the Bill which the South Metropolitan Company have deposited, which includes provisions—permissive provisions only—for dealing with this question of our southern district. I need only add that, while we are quite willing to submit to arbitration the question of the sum to be paid, and to abide by the result, your Directors will never voluntarily part with a most valuable portion of your property at a "knock-out" price. The London County Council have also deposited a Bill—they are always depositing Bills—which would seriously affect the two Metropolitan Companies. The principal object of this measure is to legalize what are called travelling or portable photometers. If this is passed, the official gas tester will be able to go into any back street or slum where there may be a dead-end of a main, and where there is little draught upon the gas, and test it as a sample of the article supplied by the Company to customers generally in the district. Anything more misleading or oppressive, could not possibly be enacted. But who would be the greatest sufferers? Not you, the shareholders, but the public; because if gas tested under such conditions as those is to be of 16-candle power, it follows that that supplied in other parts of the district to give that result must be of 17, 18, or 19 candle power. Such a high quality of gas can only be secured by enrichment at very great cost; and even if it were secured, the gas would not be appreciated by the users of it, whether for lighting or heating purposes. Naturally, also, the price would have to be advanced to meet the extra cost. Therefore I cannot help thinking that the consumer, when he considers this, will pray to be saved from his friends who sit on the County Council. But the initial objection which we have to this proposition is that it is an attempt to disturb indirectly the settlement of 1876; and the Directors of this Company have always resolutely set their face against any tampering with that parliamentary bargain. There is no necessity for any such legislation. No allegation has been made that we are defrauding, or seeking to defraud, our customers. The preamble of the Bill only states that it is "desirable to make additional tests of the gas;" but what we object to is not so much the additional test proposed, as the introduction of tests of a very much more stringent character than those prescribed under existing legislation. It is really to be regretted that any attempt should be made to upset or disturb a bargain which has admittedly worked for the last 25 years so much to the advantage both of the consumers and of the Company. There are other minor questions raised by the London County Council Bill, to which this Company will offer objection; so I think we may look forward to the coming session of Parliament as one that will require considerable attention on our part. I will deal with our Capital Bill at the Wharncliffe meeting which follows this. There is only one other matter to which I need refer—and that is the retirement of our old friend Mr. Chisholm, after 36 years as one of our Auditors. I am sorry to say that ill-health, and the fact of his having attained to a patriarchal age, have compelled him to give up work. Until quite recently, he has devoted his attention to the service of the Company; and as he held no other office, he was just the kind of Auditor we required. He was a gentleman on whom we could call to attend day after day, and who would do a real day's work. He was not only willing and able to devote himself to the duty, but he brought to the work a ripe and trained experience of figures. I congratulate ourselves and the proprietors upon the fact that we still have the services of another ex-official of the Board of Trade—Mr. Stoneham—who can safely be relied upon to carry on the audit on the same lines as heretofore. The selection of Mr. Chisholm's successor rests with you. From what I have said, the meeting will see the importance of their action; and the gentleman who may be selected will, I am sure, realize that the office of Auditor to this Company is no sinecure. I have nothing more at this meeting to trouble you with. I believe that the uncertainty with regard to the price of coal, and the anxiety attendant upon that, which we are sharing with almost every other industry in the kingdom, is the only dark spot on our horizon. Everything else is healthy and in good condition. With that one exception, I may congratulate the proprietors upon the working of the past half year. I now beg to move the adoption of the report and accounts.

The Deputy-Governor (Mr. H. C. Ward) seconded the motion.

Dr. Wild, after congratulating the shareholders upon the satisfactory report, said it was upwards of twenty years since he made a speech of some importance at that meeting, which had directly or

indirectly led to an increase of revenue of about £500,000; and the remarks he intended now to offer would be in the same direction. Some years ago, there was what might be termed an electrical scare. After the Electrical Exhibitions in Paris and at the Crystal Palace, shareholders in gas companies began to tremble in their shoes, the consequence of which was that their shares dropped from £250 to £150. Taking advantage of that fact, he bought as many shares as he possibly could, with the result that he netted a profit of £100 per share. He was still impressed with the idea that, notwithstanding that electricity was not the light of the present day, it might be the light of the future. Recently he spent a week in Tunbridge Wells, and was surprised to find that even small lodging-houses were fitted with electric light, and that the tenants were charged simply the same price as they would be for gas. He asked the landlady whether electricity was not dearer than gas, and was told it was just about the same price. This surprised him very much until he came to consider that in Tunbridge Wells the houses were in juxtaposition, and the cost of supply was consequently less than it would be in London. If electricity became general in London, the price would be greater, owing to the houses being farther apart.

The Governor said the price of electricity would depend upon the price of coal.

Dr. Wild said this matter would affect gas companies as well as electric light companies. Twenty years ago, he warned the shareholders that they would have to face the question of electricity, and direct their attention to coal gas as a heating and cooking agent; and that, in order to encourage the extensive use of gas in this way, they must lend out heaters and cookers on hire. The Board adopted his suggestion, with the result that the revenue was increased by £500,000. He now begged to offer the further suggestion that fires should be lighted by means of gas instead of wood. This would be not only a great economy to the public, but would produce enormous interest on the outlay in a very short time. He had had a gas-lighter fixed in his drawing-room, and had found it a great success; the cost being about one-fifth of a penny. Formerly, the bill for wood was 2s. a week; so that he saved 1s. 5d. a week. In addition to this, the convenience of lighting the fire by means of gas was very great. If each house spent no more than 1d. a day on lighting fires and boiling kettles, the revenue would come to some £500,000 a year. The use of a gas-lighter would suggest the use of a gas-fire; and supposing 100,000 houses took advantage of the suggestion, and had gas-fires, it would produce further revenue of £600,000 a year, more or less. Another suggestion which he wished to offer was that the Company should have a laboratory in connection with the office, when, no doubt, some process might be discovered for economizing the waste of heat. At present 70 per cent. of the heat went up the chimney; but, by a proper application of science, this might be reduced to 30 per cent.

Mr. Douglas Walker congratulated the Company on the improved state of affairs, and upon the very accurate diagnosis made by the Governor at the last meeting as to the result of the half-year's working. He should like to know whether the Governor could give them any further details as to the improvements made in the labour-saving appliances of the Company. On reading over the evidence given before the Committee of the House of Commons, he came to the conclusion that undoubtedly in some points their competitors on the south side of the river were much in advance of themselves.

The Governor, in reply to Dr. Wild, said he was sure both the gas companies and the community at large must be very much indebted to a gentleman who had devoted so much time to problems the solution of which would be for the public benefit. He could assure Dr. Wild that the Directors always listened with attention to what he put before them; but he might say they had experimented with the apparatus, with every desire to find that it was as advantageous as stated, and the result had not been satisfactory. There was nothing to prevent any consumer who wished to have such an appliance put into his house from having one; but he thought it would be much better for them to have a gas-fire fixed at once. He thought that when coke became disintegrated, it would choke up the burner—at least, this was his experience. At any rate, it was not a thing for gas companies to exploit. They must be very careful not to recommend consumers, on the ground of economy, to adopt any system of lighting fires which would throw upon them the responsibility of failure. The convenience of gas-stoves had been proved up to the hilt; and the increase in the number was a testimony that the public appreciated them. He believed Dr. Wild had a second object in view, and that was the abatement of smoke in the Metropolis, which was a very desirable thing. He very much doubted whether Dr. Wild had not over-estimated the value of the means he recommended for this purpose. In reply to Mr. Walker, he might state that they were behind with labour-saving appliances, and the reason for it was that their capital outlay was very heavy. If they could get money at a reasonable rate, as they would do if their present Bill was passed for borrowing at 3 per cent., they would spend a considerable portion of the money on labour-saving machinery. The Deputy-Governor, who was at Beckton on the previous day, informed him that he saw the operation of one of West's automatic stokers worked by compressed air, and that it appeared to him to be very satisfactory. Both the Engineer and the foreman in charge were satisfied with it. They had great hopes that the Bill would receive the sanction of Parliament; and then they would be in a position to expend money on machinery.

The motion was then put, and carried unanimously.

The Governor next moved the declaration of dividends at the rates of 4, 5, and 3½ per cent. per annum on the consolidated, preference, and 3½ per cent. maximum stocks, and at the rate of £4 18s. per cent. per annum on the ordinary stock, subject to deduction for income-tax.

The Deputy-Governor seconded the motion, and it was carried unanimously.

On the motion of Mr. Ulick J. Burke, Mr. Howard Charles Ward, and Mr. Corbet Woodall were re-elected Directors of the Company. Mr. Allen Stoneham was also re-elected as one of the Auditors.

The Governor stated that Mr. Chisholm retired in consequence of ill-health, and that there were two candidates who had complied with the Act and sent in their names—viz., Mr. Percy Howard Ashworth and Mr. John James Walker. The matter of election rested entirely with the shareholders.

Mr. Ashworth said he wished to thank the gentlemen who had kindly offered him their support; but, on the present occasion, he asked to be allowed to stand aside in favour of Mr. Walker, who was a much senior man to himself, and was connected with the Imperial Continental Gas Association. At some future date he hoped to come forward as a candidate for the post of Auditor.

Mr. Galbraith proposed that Mr. John James Walker be elected an Auditor of the Company.

Mr. Ashworth seconded the motion, and it was passed unanimously.

A resolution was then carried authorizing the Directors to dispose of certain portions of the Company's property as were not now required for the purposes of the undertaking.

An Extraordinary General Meeting was then held, to obtain the shareholders' approval of the Company's Bill.

The Secretary and General Manager having read the notice convening the meeting,

The Governor said: Ladies and Gentlemen,—I now declare the meeting special for the purpose of considering a Bill which has been deposited in Parliament. I do not think it is necessary to read the heads of the Bill, because it is the same as that which was read to you last year, and which you approved; but, if you desire it, the Solicitor will read it. If not, I will propose that the Bill be approved, subject to such amendments and alterations as may be made therein by Parliament, and assented to by the Directors. It is the same as before, except that the capital is 2½ instead of 3½ millions. The reduction in the amount of capital is made in deference to the decision of the House of Commons, who thought that 3½ millions was more than was necessary; and reduced the amount to 2½ millions. Unfortunately, the Bill was rejected in the House of Lords, although no evidence was given against it. We can only conjecture what was the reason for the Lords' decision. The necessity for the additional capital has increased; and has now become more urgent; and we have no alternative but to renew the application. The loss of the Bill compelled us to husband our resources, at the cost of the non-extension of our labour-saving appliances, which had to be postponed, and which, with a view to cheaper labour, we should be only too glad to install. As the increased consumption of gas makes it clear that we must look forward to the extension of our works, the necessity for the Bill cannot be gainsaid. On the 15th of December—just a week before the heaviest period—we had a record day of 132 million cubic feet of gas, as against a maximum output for the year before of 120 millions. At the present time, the output is very satisfactory—an increase of about 7¼ per cent. up to now. Apart from the special expenditure for the extension of works and labour-saving appliances, the sum we have in hand would only last less than two years. In order to place the Company in a satisfactory position to meet the demands of the public, and to bring our working into line with that of other companies, we ought at once to increase our capital expenditure. The capital of the Company has been raised by 3½ millions since 1876; but the business has progressed *pari passu*. I now beg to move—"That a Bill to enable the Gaslight and Coke Company to raise additional moneys, and to purchase, take, and hold lands, and for other purposes, be, and the same is, hereby approved, subject to such amendments or alterations as may be made by Parliament and assented to by the Directors."

The Deputy-Governor seconded the motion.

A Shareholder asked whether the debentures would be redeemable.

The Governor replied that they would be irredeemable, and would be issued at the best price that could be obtained—he hoped it would be at a premium.

The resolution was carried unanimously.

Mr. Walker proposed a cordial vote of thanks to the Directors for their able management of the Company's affairs, and to the Governor for presiding.

Mr. Snowdon seconded the motion, which was carried unanimously.

The Governor: On behalf of my colleagues and myself—and I hope you will allow me to include the staff (hear, hear)—I beg to thank you for this continued expression of your confidence, and for the thanks which you have just accorded to us.

The proceedings then closed.

Fire at a Railway Gas-Works.—A fire broke out on Saturday morning, the 27th ult., at the gas-works of the Lancashire and Yorkshire Railway Company, in Smedley Road, Collyhurst, Manchester. The gas in one of the retorts was ignited by a quantity of hot tar, and the flames travelled through a main to some adjoining tar-tanks, the contents of which caught fire. The Fire Brigade, under Mr. Parker, were quickly on the spot, and the flames were subdued before serious damage was done.

The Assessment of the Stoke Gas-Works.—Some time ago, the assessment of the Stoke Gas-Works was raised from £1900 to £3380. The Corporation appealed, with the result that the amount was reduced to £2090. The reduction was announced at the last monthly meeting of the Corporation, when Mr. Holtom said the thanks of the Council were due to the gentlemen who had had the matter in hand. It only showed what a most extraordinary method there must be in assessing when it was possible to value a property at almost double its original amount, and then, when an appeal was made, to reduce the figure to one which was an almost infinitesimal increase on the original. Alderman Kirkham stated that he was rather surprised at the assessment against which the Council had appealed. When the report of Mr. Marshall on the re-assessment came down, they found the amount was an extraordinarily large one; but, to his (Alderman Kirkham's) great surprise, Mr. Marshall stated that he had written to the various gas-works—Longton, Fenton, and Stoke—for particulars of their make, profits, and so forth; but that Stoke had refused to supply him with any, and therefore he had to settle the assessment rather in the dark. Then the Stoke Gas Committee supplied the particulars; and thereupon Mr. Marshall found there had been a very large over-assessment. Primarily it was the Gas Committee who were to blame for not supplying the facts. If they had done so, no doubt this extreme assessment would never have been made.

BRENTFORD GAS COMPANY.

The Half-Yearly Report and Accounts.

The report of the Directors of the above-named Company for the six months ending the 31st of December last has been issued, in view of the meeting of shareholders next Friday. They record a continued satisfactory increase in the sale of gas, amounting for the half year to 8 per cent. over the corresponding period of 1898. The consumers by the automatic meter system now number 18,433, against 15,233 at the close of December, 1898, or equal to an increase of 21 per cent. The additional manufacturing plant at Southall is now complete, and is brought into use when required. Reference is made to the retirement, owing to severe illness, "after 46 years' continuous and valuable work in the Company's service," of Mr. W. Croxford, the Secretary, as already announced in the "JOURNAL;" and the Directors announce that they have awarded him a life pension of two-thirds of his salary.

The accounts accompanying the report show that the gas-rental in the six months covered by them amounted to £126,869, as compared with £117,497 in the corresponding period of 1898; the rental of meters and stoves produced £10,372, against £9209; the sale of residuals returned £31,882, against £25,703; and the total revenue was £169,163, against £152,453. In the manufacture of gas a sum of £84,374 was expended, as compared with £77,550 in the corresponding half of 1898; coal and oil costing £60,270, instead of £53,673. The total expenses came to £117,953, against £109,032; the amount carried to the profit and loss account being £51,209, as compared with £43,421. The balance available for distribution is £75,409; and, as announced last week, the Directors will recommend dividends at the rates of 5, 12, and 9 per cent. per annum. Under the supervision of Mr. J. Husband, the Company's Engineer and Manager, 67,179 tons of coal, and oil equivalent to 19,653 tons, were used in the production of gas, of which 927,274,000 cubic feet were made and 858,912,000 cubic feet sold. In the corresponding half of 1898, the raw material used was equal to 71,972 tons; the make and sale of gas being 851,501,000 and 795,214,000 cubic feet respectively. The Company were in the fortunate position of having more coal in store at the close of last year than they had at the end of 1898. The estimated quantities of residuals produced in the past six months were: Coke, 44,794 tons; breeze, 5585 tons; tar, 787,647 gallons; and ammoniacal liquor, 17,685 butts of 108 gallons, or 1,909,980 gallons.

THE LONDON COUNTY COUNCIL AND THE TESTING OF GAS.

The following are extracts from a report of the Public Control Committee of the London County Council which appears on the *agenda* for the meeting of the Council to-day:—

"For some time past we have had under consideration the question of the desirableness of seeking power from Parliament to test the gas supplied by the Companies who do not come under the Gaslight and Coke and other Gas Companies Acts Amendment Act, 1880. There are four large Companies who supply gas in the County of London who are not included in this Act—viz., the Brentford, Crystal Palace, Mitcham, and Wandsworth and Putney Gas Companies. The Solicitor has reported that the best means to obtain the power mentioned would be for the Council to oppose any Bill promoted by any of the Companies referred to, and endeavour to obtain the insertion of clauses giving the Council power to test the gas similar to that which the Council now possesses with regard to the gas supplied by the Commercial, the Gaslight and Coke, and the South Metropolitan Companies. With this view, we recommend—'That in the event of either the Brentford, Crystal Palace, Mitcham, or Wandsworth and Putney Gas Companies applying to Parliament for increased powers, the Parliamentary Committee be instructed to oppose the Bill, and to endeavour to obtain the insertion of clauses giving the Council similar power to test the gas supplied by the Company to that in force with regard to the gas supplied by the Commercial, Gaslight and Coke, and South Metropolitan Gas Companies.'

"In consequence of a communication which was received from the Limehouse District Board, complaining of the quality of the gas supplied in the district by the Commercial Gas Company, the Chemist arranged for one of the Council's Gas Examiners to make a series of tests of the illuminating power of the gas with the portable photometer. The standard fixed by Act of Parliament is 16 candle illuminating power; and the results of the tests made in the neighbourhood were all below the standard—one being between 12 and 13, seven between 13 and 14, and four between 15 and 16 candles. Although the tests made have no legal value at present, we are of opinion that the results are quite as accurate as those carried out at the prescribed testing-places. We have forwarded a copy of this report to the Parliamentary Committee for their information in connection with the application the Council is making to Parliament to legalize the testings of the portable photometer."

The Southport Water Company's Bill to be Opposed.—Last Tuesday, a public meeting was held at Southport to consider the advisability of passing a resolution in support of the decision of the Corporation to oppose the Water Company's Bill. The Mayor (Alderman Griffiths), who presided, stated that the Bill was not so innocent as it looked. It proposed to practically increase the present borrowing powers of the Company by 25 per cent. One clause, relating to the question of interest, was, considering the way the Company had lavishly expended their capital, a very serious matter for Southport, if the shareholders were going to get the same rate of interest on the new capital as on the old. He hoped Parliament would not sanction the rate of interest they had been allowed to have in the past. He believed 99 out of every 100 of the inhabitants felt acutely that it was desirable the water-works should be in the possession of the ratepayers. But then they had a capital of £371,000, and were trying to get something like another £100,000; and he had to tell the ratepayers that the question of purchasing the works was a most serious one, and would require the careful and grave consideration of the Council and of the inhabitants. He hoped that Parliament would at all events give them some stricter clauses with regard to the water-works; and he should be very glad if they would grant the Corporation purchase powers. A resolution to oppose the Bill was carried unanimously.

SOUTH METROPOLITAN GAS COMPANY.

The Half-Yearly Report and Accounts.

The following is the report of the Directors of the above-named Company for the six months ending Dec. 31, which, with the accounts for this period, will be presented at the half-yearly general meeting:—

The price of gas was reduced to 2s. 2d. per 1000 cubic feet from Christmas, 1898, and to 2s. 1d. from Midsummer, 1899. The charge to the ordinary consumers was 2d., and to the slot-meter consumers 3d., per 1000 cubic feet below that of the corresponding period; benefiting them to the extent of £45,000 in the last half year.

There has been an increase of 8¼ per cent. in the quantity of gas sold; the demand for cooking-stoves does not slacken; the number of customers by the slot meters has grown by 7989, to a total of 95,068; and 2293 additional ordinary consumers have been obtained in the half year. These facts show that the demand for gas in all its varied uses is fully maintained.

The Company, like most gas undertakings, has lately had difficulties in obtaining coal, although the precaution was taken of largely increasing the stock in the summer. The supply of gas to the consumers, however, was fully maintained at ample pressure, without any interruption, all through the winter. It affords the Directors pleasure to state that this satisfactory result was largely due to the energy and devotion of their officers, and the hearty co-operation of their workmen.

The policy of the last few years, of carrying a portion of divisible profits and the accumulated interest to the reserve fund, has, with the additions proposed to be made this half year, increased the fund from £37,000 in 1892 to close upon £130,000. The dividend, however, has been practically stationary. It was £5 4s. per cent. in 1886, and since then has ranged between that and its present figure of £5 6s. 8d. per cent. on the nominal capital. The actual dividend to the investor under the auction clauses is, however, only about 3¾ per cent. The present price of 2s. 1d. entitles the shareholders to a dividend of £5 14s. per cent. Two possibilities in the early future may, however, considerably increase the cost of gas making; otherwise the Directors think the patience of the shareholders might have been rewarded by increasing the dividend to 5½ per cent.

The rocks ahead are the present very high price of coal, which may not come down to a reasonable figure before the new contracts are made, and the Bill of the London County Council for increasing the standard of illuminating power by two or three candles. If the price of coal seriously exceeds that of last year's contracts, the price of gas must be raised, because the Directors consider the reserve fund too small to be of any use for this purpose, and should be kept intact to meet other possible contingencies.

The Bill promoted by the London County Council does not directly alter the illuminating power; but, by seeking to impose a new method of testing, the effect, if adopted, would be to compel the London Companies to raise their 16-candle gas to 18 or 19 candles. If this were done, it would be only fair to increase the initial price to a corresponding extent; but this the Council do not propose. Probably they had no idea of the effect of their proposal when they resolved to promote their Bill. When that effect is made clear, possibly they may not persist; and it is hardly likely that they will succeed. However, in the highly improbable event of their Bill becoming law, this Company will be obliged to add at least 2d. per 1000 cubic feet to the price of gas, and at the same time the reason must be given to the consumers why they are called upon to pay an extra £84,000 a year for an inappreciable alteration of quality, which they have not asked for, and which they do not want. This is going quite in the wrong direction. The consumers want cheap gas; and one way to cheapen it is to reduce the illuminating power, as proposed by the Company's Bill.

Under these circumstances, the Directors think it would be a mistake to increase the dividend at present, with the possibility of having to reduce it in the near future. The Company is now in the safe and satisfactory position of having 4d. per 1000 cubic feet in hand; that is, they can add 4d. to the price of gas, which will bring in £170,000 a year, without appreciably reducing the dividend. An increase of 4d. would reduce the dividend from £5 6s. 8d. to £5 6s., or only 8d. per cent.

The following comparisons show the strengthening of the position of the Company in the last ten years:—

- The gas sold last year was more than 4000 millions, or 72 per cent., in excess of 1889.
- The capital has increased £1,166,468, or 40 per cent., or at the rate of £280 per million sold.
- The dividend and debenture interest has increased only 20 per cent.
- The dividend and debenture interest amounted in 1889 to 12d. per 1000 cubic feet sold, and in 1899 to only 8·4d.—a reduction of 3·6d., or 30 per cent.
- The price of gas has been reduced from 2s. 3d. to 2s. 1d. per 1000 cubic feet.

The profit-sharing system adopted in 1889, which developed into shareholding in 1894, now represents a large item in the accounts. The shareholders are entitled to full information on this matter. A printed statement is therefore sent with this report, giving the history and results of the movement.

The old South Metropolitan Company founded a superannuation fund for their workmen in 1855, on the principle of joint contributions, which has proved very beneficial. The Company, although practically responsible for the stability of the fund, never formally guaranteed it. The rules are now being revised, and the Directors feel that the Company should definitely declare its responsibility by the addition to one of the rules of the words "the Company guarantees the stability of the fund."

A circular has been sent explaining the objects of the Bill the Directors are promoting in the present session of Parliament, and for which they need the sanction of the shareholders. A resolution for that purpose will be submitted at the Wharncliffe meeting which will immediately follow the ordinary general meeting.

The Directors recommend the payment of a dividend at the rate of 5½ per cent., as before, and that a further addition be made to the reserve fund.

Two Directors (Mr. George Livesey and Mr. Robert Morton) and one

Auditor (Mr. Charles Mortimer) go out of office by rotation. They are all eligible for re-election, and offer themselves accordingly.

The report is accompanied by the usual statements of account. The first two show the positions of the stock and loan capital at the close of the past year; and the third is the capital account. This, with the revenue and profit and loss accounts, is given below. Following these are the statements relating to the reserve, renewal, and insurance funds. They show that the balances on Dec. 31 were as follows: Reserve fund, £117,423; renewal fund, £19,103; insurance fund, £52,958. The statements dealing with the manufacturing operations of the Company furnish the following particulars:—

STATEMENT OF COAL.

Description of Coal.	In Store, June 30, 1899.	Received during the Half Year.	Carbonized during the Half Year.	Used during the Half Year.	In Store, Dec. 31, 1899.
	Tons.	Tons.	Tons.	Tons.	Tons.
Newcastle coal . .	52,427	533,555	515,423	513	40,046
Cannel coal. . . .	1,207	—	204*	—	1,003
	53,631	533,555	515,627	513	41,049

* 233,523 gallons of petroleum spirit used as a substitute for cannel.

STATEMENT OF RESIDUAL PRODUCTS.

	In Store, June 30, 1899.	Made during Half Year	Used in the Half Year.	Sold in the Half Year.	In Store, Dec. 31, 1899.
Coke—cwts.	84,698	6,738,845	1,484,158	4,894,031	445,354
Breeze—yards	1,247	112,300	22,698	83,186	7,663
Tar—gallons	443,898	5,110,549	277,571	4,802,170	474,706
Ammoniacal liquor—butts . .	14,512	165,657	98,180	43,837	38,152

STATEMENT OF GAS MADE, SOLD, ETC.

Description of Gas.	Quantity made.	Quantity Sold.		Total Quantity accounted for.	Number of Public Lamps.
		Public Lights (estimated).	Private Lights (per Meter).		
	Thousands.	Thousands.	Thousands.	Thousands.	
Common .	5,424,995	229,346	4,835,309	5,137,485	21,063

The remaining statement is the balance-sheet, which gives the value of the stores in hand at the close of the year as follows: Coals and enriching materials, £26,811; coke and breeze, £11,517; tar, sulphate, and liquor, £12,750; sundries, £162,392. The figures this time last

CAPITAL ACCOUNT.

	£ s. d.	£ s. d.
Capital account to June 30, 1899	..	3,826,269 5 1
Expenditure during half year to Dec. 31, 1899—		
New buildings and machinery in extension of works	5,476 5 7	
New and additional mains and services . .	20,933 8 7	
New and additional meters	20,781 1 6	
New and additional stoves.	25,865 13 6	
		73,056 9 2
Total expenditure		3,899,325 14 3
Balance		117,138 12 5
		4,016,464 6 8
Nominal amount added by conversion		3,851,666 13 4
Total.		7,868,131 0 0

Description of Capital.	Certified to June 30, 1899.	Received since that date.	Total.
	£ s. d.	£ s. d.	£ s. d.
Ordinary stock	2,315,000 0 0	41,885 0 0	2,356,885 0 0
Premium thereon.	414,332 0 0	16,754 0 0	431,086 0 0
Debenture stock	953,333 6 8	..	953,333 6 8
Premium thereon.	275,160 0 0	..	275,160 0 0
Total	3,957,825 6 8	58,639 0 0	4,016,464 6 8
Nominal amount added by conversion—			
Ordinary stock		£3,285,000 0 0	
Debenture stock.		566,666 13 4	
			3,851,666 13 4
Total.			7,868,131 0 0

REVENUE ACCOUNT.

To Manufacture of gas—			
Coal into store, including cost of petroleum spirit for enriching and including £23,136 15s. 9d. for labour.	£343,869 7 9		
Purification, including £6057 3s. 4d. for labour	17,840 16 6		
Salaries of Engineer and Officers at works .	6,942 5 2		
Wages (carbonizing)	59,781 11 0		
Repairs and maintenance of works and plant, including £13,013 5s. 8d. for labour, less £2493 4s. 6d. received for old materials .	83,814 15 0		
		£512,248 15 5	
Profit sharing		11,000 0 0	
Distribution of gas—			
Repair, maintenance, and renewal of mains and service-pipes, including £14,562 2s. 2d. for labour	21,637 8 0		
Salaries, &c., Officers and Rental Clerks . .	10,933 18 10		
Repairs, &c., of meters (£2144 8s. 10d. for labour)	12,705 6 2		
Repairs, &c., of stoves (£5864 17s. 11d. for labour)	11,510 17 8		
Gas-fittings (labour)	4,850 10 11		
		61,638 1 7	
Public lamps—Lighting and repairing (including £6772 13s. 2d. for labour)		11,921 1 11	
Rents, rates, and taxes—			
Rents payable	£1,336 13 2		
Rates and Taxes.	29,571 12 1		
		30,908 5 3	
Management—			
Directors' allowance	£1,792 6 2		
Salaries of Secretary, Accountant, and Clerks	2,533 19 0		
Collectors	8,380 13 3		
Stationery and printing	2,320 17 5		
General charges	3,423 10 1		
Company's Auditors	112 10 0		
		18,563 15 11	
Law charges	271 1 2		
Parliamentary charges	93 14 2		
		364 15 4	
Bad debts		1,672 13 10	
Pensions and officers' and men's superannuation and sick funds		3,376 9 0	
Gas Referees and Official Auditor		221 17 7	
Total expenditure		£651,915 15 10	
Balance carried to net revenue account		161,007 6 6	
		£812,923 2 4	

By Sale of gas—			
Michaelmas, at 2s. 1d. per 1000 feet . . .	£180,221 10 10		
Christmas, at 2s. 1d. per 1000 feet	319,118 9 8		
	£499,340 0 6		
Public Lighting and under contracts, including lighting, repairing, &c., £11,921 1s. 11d.	30,077 8 7		
		£529,417 9 1	
Meters in use—			
Company's Meters at rent: Ordinary, 94,588; automatic, 95,068	£19,578 4 5		
Company's stoves at rent: Ordinary, 45,834; automatic, 74,599; fires, 10,399	14,935 16 11		
		34,514 1 4	
Residual products—			
Coke, less £1640 5s. 7d. for cartage; £13,220 15s. 3d. for labour, &c.	178,870 15 3		
Breeze, less £211 4s. 9d. for cartage; £2684 14s. 4d. for labour, &c.	7,703 8 9		
Tar, less £139 16s. for cartage; £540 9s. 2d. for labour, &c.	22,554 0 1		
Ammoniacal liquor, less £1561 2s. 9d. for labour, &c.	9,988 2 11		
Sulphate of ammonia, less £4962 15s. 4d. for acid, &c.; £2768 11s. 3d. for labour, &c. .	27,997 1 3		
		247,113 8 3	
Rents receivable		1,816 3 8	
Transfer fees.		62 0 0	
Total Receipts		£812,92 2 4	

PROFIT AND LOSS (NET REVENUE) ACCOUNT.

Interest on temporary loan and deposits		£2,968 0 1	
Interest on debenture stock		22,800 0 0	
Balance applicable to dividend on the ordinary stock		165,676 7 10	
		£191,444 7 11	
Balance from last account			£186,655 17 0
Less dividend for the half year ended June 30, 1899 £149,333 6 8			
Divisible profit carried to reserve fund	7,466 13 4		156,800 0 0
			£29,855 17 0
Amount from revenue account			161,007 6 6
Interest on banker's balances.			681 4 5
			£191,444 7 11

year were: Coals, &c., £16,914; coke and breeze, £9778; tar, &c., £6867; and sundries, £133,793. A sum of £33,025, workmen's bonuses and savings, has been deposited with the Company; and the total of the officers' superannuation and guarantee funds is £39,008. The figures this time last year were £16,865 and £35,842.

At their meeting on Friday, the Gas Committee of the Manchester Corporation decided to request the Finance Committee to borrow £25,000, on the most favourable terms, for the erection of plant for the manufacture of sulphate of ammonia at the Bradford Road station. The work is to be proceeded with during the approaching summer.

PROVINCIAL GAS AND WATER COMPANIES.

We commence to-day our usual notes on the progress made by Gas and Water Companies in various parts of the kingdom whose reports and accounts come to hand about this time.

Gas Companies.

The total revenue of the Aldershot Gas and Water Company in the six months ending Dec. 31 last was £17,100, and the expenditure £12,465; leaving a balance of £4635. The sum available for distribution is £8184. The Directors recommend a dividend at the rate of £12 2s. per cent. per annum on the "A" shares, of £9 2s. per cent. per annum on the "B" shares, and of £7 per cent. per annum on the ordinary "E" shares; also a dividend at the rate of 9s. per cent. per annum on the "A" and "B" shares for the half year ended June 30, 1899—all less income-tax. There were increases in the consumption of gas by private consumers in Aldershot and Farnborough, and also in the revenue from residuals and fittings. There was a slight reduction in the consumption of gas, and a considerable falling off in the consumption of water by special contract. Owing to the great increase in the price of coal, the Directors considered it necessary to raise the price of gas to ordinary consumers in Aldershot by 3d. per 1000 cubic feet from the 1st of January.

The Chairman of the Cambridge Gas Company (Mr. E. H. Parker) had to tell the shareholders last Wednesday a tale of trouble and anxiety respecting the coal supply, which will probably be repeated by other gentlemen occupying a similar position. The Company's coal bill came to £12,142 in the six months ending Dec. 31, against £9509 in the corresponding period of 1898. There had, however, he said, been a large increase in the quantity of gas consumed, as well as in meter-rents. The result of the working was a sum of £4748 to go to the profit and loss account. This was not sufficient to pay the dividends at the rates of 10 and 7 per cent. per annum which the Directors recommended, and the loan and bankers' interest; yet, as they had made £11,008 in the two half years, and only £10,662 was required for the payment of the dividend and the fixed charges, they thought they were justified in suggesting the maximum, as usual. An unsatisfactory item was that of the unaccounted-for gas. As soon as they had the sewerage, the Chairman said, the Company began to lose gas wholesale. Unfortunately, he was afraid they had no remedy; but there was little doubt that the leakage was costing them a considerable amount per annum. Loss of gas to the extent of 1 per cent. represented £150; and it had certainly increased 4 per cent. since the town had been sewered, which meant £600 a year to the Company. The Directors' report, recommending the declaration of maximum dividends, was adopted.

At their half-yearly general meeting to-morrow, the Directors of the Chester United Gas Company will have a satisfactory report to present; the quantity of gas supplied in the past twelve months being greater than in any year of the Company's trading. A larger number of gas cookers, fires, and prepayment meters were fixed in 1899 than in any previous year. The revenue for the six months ending Dec. 31 was £17,350, and the expenditure £12,501; leaving a balance of £4849. The amount of net profit stands at £3555, and out of it the Directors recommend the payment of the full statutory dividends on the ordinary shares. An increase in the manufacturing plant having become necessary, the Directors, in conjunction with the Engineer and Manager (Mr. J. C. Belton), are considering the advisability of enlarging and improving the retort-house and its equipment.

At the meeting of the Coatbridge Gas Company to-day, the Directors will report that the demand for gas is still on the increase; the aggregate consumption in the six months ending Dec. 31 last being 57,786,500 cubic feet, or 15·47 per cent. more than in the corresponding period of 1898. The automatic supply system accounts for upwards of 2 millions of this, and the rest is due to new consumers. The gross revenue is £9804; the net profit being £2309. Owing to the abnormally high price of coal, and the increased cost of labour, the Directors have been compelled to raise the price of gas as from the 1st ult. from 2s. 6d. to 2s. 8½d. per 1000 cubic feet to ordinary consumers, and from 1d. per 28 cubic feet to 1d. per 25 cubic feet to those on the prepayment system. Under Mr. T. Wilson, the Secretary and Manager, the works have been well maintained; but, owing to the continued increase in the demand for gas, a considerable outlay on plant is in contemplation. The Directors recommend dividends at the rates of 10 and 7 per cent. per annum.

The annual report of the Walker and Wallsend Union Gas Company shows that the revenue for the year was £23,473, and the expenditure £17,839; leaving £5634 in hand. A half-year's dividend of £4 12s. 6d. per cent. was paid in August last; and the second dividend of like amount will shortly be paid.

The York United Gas Company had a balance of £6580 on revenue account at the close of the half year ending Dec. 31. The addition thereto of the interest on the reserve fund (£243) made a total of £6823. Of this sum, £235 was paid for the half-year's interest upon money raised on mortgage; leaving £6588 available for dividends, amounting to £7400. The Directors recommended that the usual rates should be declared of 5s. per share on the original shares and those created in 1878, and of 4s. per share on the 1898 issue, free of income-tax.

Water Companies.

The balance of the year's income of the Boston Water Company is £3301. Of this £500 is to be carried to the reserve fund, and £2700 used in paying a 9 per cent. dividend, which is an increase on former payments. Owing to the greatly enhanced price of iron, the Directors have felt it inadvisable to proceed at present with the reinstatement of the Company's mains.

At the meeting of the Cambridge Water Company last Tuesday, the report presented by the Directors showed that they, as well as their colleagues on the Board of the Gas Company, have to complain of the sewerage scheme of the city. At an inquiry held by General Crozier, one of the Inspectors of the Local Government Board, they opposed the scheme for the sewerage of part of the village of Cherryhinton, as they were advised that the proposed works would endanger the purity of their supply of water, and the Board have expressed themselves as not satisfied that this apprehension was groundless, and have refused their sanction to the scheme. The report also referred to the Bill promoted by the Corporation to obtain power to purchase the Company's undertaking; but, in the course of his remarks when moving the adoption of the report, the Chairman (the Rev. Dr. Perowne) said he was not in a position to state definitely whether or not the Bill would go forward. The Engineer and Manager (Mr. W. W. Gray) reported that during the past half year 239 premises had been furnished with a supply of water; bringing up the total to 15,548. Dividends at the rates of 10 and 7 per cent. per annum were declared.

A dividend of 7½ per cent. for the past year is to be paid by the Carnforth Water Company, which is an improvement of ½ per cent. The profit is £1159, and the small balance of £65 was brought forward. Although a higher dividend is to be paid, the balance in hand on this occasion will be £102.

The dividends of the Cleveland Water Company are at the rate of £9 10s. and £6 13s. per cent. per annum on the different classes of shares. The contingency fund has been added to; and an increased balance of £1517 is carried forward.

At the meeting of the Colne Valley Water Company next Tuesday, the accounts for the past half year will show a profit of £7349; and the amount available for distribution will be £6220. Out of this it is proposed to pay a dividend at the rate of 6 per cent. per annum, and carry forward £1000. The dividend for the corresponding half of 1898 was at the rate of 5 per cent., and only £390 was carried forward. The capital expenditure in the past six months amounted to £9190, including nearly £6000 in respect of the new service reservoir, to hold nearly 7 million gallons, at Bushey Heath, which will shortly be completed.

The report of the Consett Water Company for the past year states that the income shows an increase of £2112. The Directors recommend a dividend of 6½ per cent. on the ordinary shares; carrying forward £3370. The works of the Chester-le-Street Water Company have been acquired.

The annual report of the Weardale and Shildon Water Company shows an increased revenue and a fractionally larger dividend. For the past year it is at the rate of 5¼ per cent.; but the amount carried forward is raised to £11,194.

The profits of the Yeadon Water-Works Company for the half year ended Dec. 31 amount to £1205. The addition of the £229 brought forward makes a balance of £1435 available for dividend. This will pay 6 per cent. per annum on the original capital, and £4 4s. per cent. on the "B" stock; and leave a balance of £334 to be carried forward. The capital expenditure up to date is £55,509.

The half-yearly meeting of the York Water-Works Company was held last Thursday, when the accounts presented showed that the revenue in the six months ending Dec. 31 last, was £10,682, of which £10,618 was for water sold and the rental of meters. The expenditure being £3462, there was a balance of £7220. The balance of net profit was £7651; and out of this dividends at the rates of 10 and 7 per cent. per annum were declared.

LEICESTER CORPORATION GAS AND ELECTRICITY SUPPLY.

Additional Capital Required.

At a Special Meeting of the Leicester Town Council last Tuesday evening—the Mayor (Mr. Alderman Windley) in the chair—the requirements of the gas and electric light undertakings were under consideration.

Alderman Lennard, in moving the adoption of the report of the Gas and Electric Lighting Committee, reminded the Council that some time ago it was deemed advisable that an interim report should be presented between the two half-yearly financial statements from the department. Hence the Committee submitted figures at this time as to the progress made during the half year. With regard to the quantity of gas produced, the increase was 12·34 per cent. During the whole of the year 1899, there was not a month in which there was not a substantial rise; the lowest being 3·96 per cent. in March, and the highest 18·77 per cent. in December. They could not go on having such large increases as these without spending a good deal of capital. It was only two years since they went to Parliament for authority to raise £250,000, which they thought would last them for five years; but only £73,000 of this amount remained unborrowed. The Committee now asked permission for the Finance Committee to get them—he hoped at an easy rate—the sum of £40,000, for carrying out the work of the department. There was this to be said about it, that it was not dead outlay; they did begin to get a return for their money as soon as they spent it. They would not lay out a great deal on the ordinary gas plant during the next two years, because the water-gas plant was approaching completion, and the money for this—some £40,000—had already been borrowed from the Public Works Loan Commissioners. About a month ago, they sent out 8,600,000 cubic feet of gas in one day. Their storage capacity was only 7,000,000 cubic feet, and next winter they would be called upon to deliver 9,000,000 cubic feet a day. The £40,000 for which the Committee asked would only carry them on with respect to current expenditure. The electric lighting output continued to augment very satisfactorily; the 437,943 units sent out for the half year ending Dec. 31 being a 40 per cent. increase over the corresponding period of 1898. Of course, all this prosperity—this growth in the business—would mean increased prosperity in the income, but for certain ugly features; one being the extraordinary cost of coal. He concluded by saying he thought the Council would agree with him that the Committee were only just in time in resorting to water-gas plant, which would come in handy next winter.

The motion having been seconded,

Alderman Wood, though admitting that the works must be made sufficiently large to meet the demands of the town, said he wished to urge upon the Committee that it was very difficult at the present time for a corporation to borrow money. They could not get it at 3 per cent. or 3½ per cent., and in all probability they would have dear money the whole of the year. In consequence of this, they would be very wise if they spent as little as they possibly could. It was not at all likely that the Corporation would be able to borrow money at less than 3½ or 4 per cent.; and this would be a serious thing for the ratepayers. He was quite sure the Corporation would do well to follow what he saw the Birmingham Corporation had already done. They had resolved to defer some of their works for another year, on account of the dearness of money; and Leicester would have to take this matter into consideration.

Alderman Vincent, Chairman of the Finance Committee, emphasized

these remarks. He said that the Corporation were already committed to very large expenditure, which could not be put off. It was therefore of the highest importance that the Council should, as far as possible, minimize their outlay on capital account at present. If the money had to be provided, there was no help for it—they must pay the market rate; and he was very apprehensive that the time had gone by, he feared for some years, when the Corporation could borrow money at 2¾ per cent., as they had done during the past twelve months. He was not suggesting for a moment the desirability of not raising this money for the gas undertaking. It was a source of income in itself, and it would be unwise to cripple it for want of funds. He thought the Birmingham system was a good one.

Alderman LENNARD, in reply, stated that all that had just been said had been discussed by the Gas Committee, not recently, but during the past year. When they came before the Council with the water-gas plant, they had in mind the fact that they were going to produce the same quantity of gas at one-third the amount it would have cost under the old system. They were rather in the position of the Israelites under Pharaoh, who were required to make bricks without straw—they had no working capital in the gas undertaking. When they balanced up the accounts, every penny which the assets showed over and above liabilities had to be handed over to their Chancellor of the Exchequer as profit. They had to borrow largely, for they must pay cash for wages, and for coal, while giving credit for the gas. Next week they would start to collect £60,000, for which they had to give practically four months' credit. They owed their bankers £45,000, and were paying 5 per cent. interest—they could not get it for less.

Mr. BANTON asked if this increase in the rate of interest was one of the indirect ways in which the war had to be paid for.

Alderman VINCENT replied in the negative; saying that the reason money was so dear was the great briskness of trade.

The MAYOR said he took it that the excellent report presented was largely owing to the increase in consumption of gas, which was again due to a cause which he thought none but the Gas Engineer (Mr. Alfred Colson) rejoiced at—the dark, dismal weather lately experienced.

The motion was then put and agreed to.

ADDITIONAL STOKING MACHINERY AT THE EAST GREENWICH GAS-WORKS.

Our readers are doubtless aware that for some time past West's stoking machinery has been in use on a large number of retorts in No. 2 house at the East Greenwich station of the South Metropolitan Gas Company. We learn that the system is to be extended to Nos. 3 and 4 retort-houses—the installation to include all the necessary coal breakers, elevators, hoppers, &c., and the order has been placed with West's Gas Improvement Company, Limited, of Manchester. The existing retorts are set ten in a bed, and two pairs of drawing and charging machines have been working upon from 30 to 35 through beds, or from 600 to 700 mouthpieces; each machine drawing and charging from 1200 to 1400 mouthpieces during the 24 hours. The total cost of labour in the retort-house for all men above and below the stage—including machine men and assistants, cokemen, engine-drivers, firemen, &c.—is less than 1s. per ton of coal carbonized. This amount of work, it is claimed, is considerably in excess of that done by other classes of similar machinery; and it is partly, we believe, due to the retort-house, the mouthpieces, and the size of the retorts being specially adapted for machine stoking.

CARBURETTED WATER-GAS PLANT FOR LONGTON.

At the Meeting of the Longton Town Council last Thursday, it was reported by the Gas and Electricity Committee that their attention had been called to the great increase in the consumption of gas during the winter, amounting to 25 per cent. for the half year, compared with the corresponding period of last year. To provide for next winter's consumption, an extension of the gas plant should be taken in hand at once; and in view of increasing difficulties in obtaining satisfactory supplies of coal, it was thought that the best method would be to erect a carburetted water-gas plant. A Sub-Committee were appointed to inquire into the matter; and they advised the erection of a double set of apparatus capable of producing 600,000 cubic feet a day. The cost of the double set would be about £8000; and the Committee recommended that application should be made at once to the Local Government Board for their sanction to a loan for that amount. Alderman Bakewell, in moving the adoption of the report, said the Committee did not wish to disguise that they would have liked if possible to defer the erection of this new plant; but it was forced upon them by the large increase in the consumption of gas. Unless something were done immediately, there was danger that the town would be in darkness next winter. It had been said that perhaps the installation of electric light might relieve them. Unfortunately they would not be able to get the electric light installed before next winter; and even if the electric light were installed, he did not think it would relieve the gas-works. On the contrary, it had always been found that an installation of electric light never diminished, but rather tended to increase, the consumption of gas. With regard to carburetted water gas, he had every reason to believe it was quite as good as coal gas; and the cost of production was practically the same. Much depended upon the price of coal and the price of oil. In nine months out of the year, they would not require to use both coal gas and carburetted water gas; and they could therefore make whichever was the cheaper. The report was adopted.

Mr. John Aird, who has recently returned from Egypt, states that great progress is being made with the Nile dams. At Assiout, the works are so advanced that it is hoped this dam will be completed a year earlier than the contract time. About 15,000 men are now engaged; but more will be required as the season advances thus giving employment to many natives who would otherwise greatly suffer in consequence of the lowness of the Nile causing so much land to be out of cultivation.

THE GAS WORKERS' UNION AT LLANELLY.

The "Glasgow Herald" last Tuesday contained a letter, dated the 19th ult., from Mr. Albert R. Cawley, the Manager of the Llanelly Gas-Works, in which he replies to the statements in the letter of Mr. W. Thorne, the General Secretary of the Gas Workers' Union, given in "Notes from Scotland" in the "JOURNAL" for the 16th ult. He first of all denies that the man Davis was summarily discharged; 14 days' notice having, he says, been duly served upon him. Mr. Thorne mentioned a number of occasions on which applications had been made for advance of stokers' wages, and refused; and he went on to state how patient the stokers had been for a long time. He failed, however, to acknowledge that on every occasion except the last the notices for increased wages had been tendered only as a means to counteract notices of dismissal given to one or more employees. Particularly was this the case in November, 1898, when the local Union Secretary openly stated (and has recently confirmed it) to the Chairman and Mr. Cawley that the notices then tendered for increase of wages had only been given because two workmen had received from the Company 14 days' notice of dismissal—the other workmen declining to allow them to be dismissed. The local Secretary also stated that the men considered at the time they were adequately paid. The notices of dismissal were withdrawn; and no more was heard of any application for increased wages. Regarding Mr. Thorne's statement that the management at Llanelly tried to take advantage of the men by not allowing them to commence work in the same rotation as previous years, Mr. Cawley gives Mr. Thorne's own opinion, expressed at the time the strike in question occurred, to the effect that he did not think "the men were justified in pressing for the employment of Jenkins after the Manager had consented to place Richards as chief stoker." On a subsequent occasion, Mr. Cawley asked Mr. Thorne why, the foregoing being his opinion, he, as General Secretary to the Union Executive, did not order the men back to work. His reply was that the men would take no notice of him; thus showing, Mr. Cawley contends, a clear case in favour of "employers dealing directly with their employees." He says the Executive are of little use; they are, in fact, "only a post-box with Mr. Will Thorne as the postman." He closes his letter by informing Mr. Thorne that in every case, without exception, every workman who had to be discharged from the Llanelly Gas-Works had many times asked for re-employment, and had stated that he would not have acted as he did when employed by the Gas Company "if he had not thought that the Union were masters of the situation." Mr. Cawley thinks he has clearly shown that the workmen themselves are the proper persons for the Glasgow Corporation to deal with. He asks if it is not very funny that the Gas Workers' Union is generally most prominent when the darkest portion of the year is approaching, and when people are most dependent on the supply of gas.

ELECTRIC LIGHTING NOTES.

The Shipley District Council have instructed Mr. R. Quin, of Blackpool, to prepare plans and estimates for the purpose of making application to the Local Government Board for sanction to the borrowing of £22,000 for electricity works.

The Local Government Board have decided to comply with the application of the Warrington Corporation for sanction to borrow £44,966 for the purpose of electric lighting, and £9336 for the provision of a central depôt. It is proposed to erect refuse destructors in connection with the scheme.

Referring to the application of the Bolton Corporation for sanction to borrow £100,000 for the purpose of electric lighting, a letter was read from the Local Government Board at a meeting of the Electricity Committee last Thursday, intimating that the Department were willing to comply with the application so far as it related to the borrowing of £79,750. It is explained that the other sums are left over until the work is ready to be undertaken.

Street lighting by electricity engaged the attention of the Darlington Town Council last Thursday. It was recommended by the Streets Committee that 33 arc lamps should be erected, the charge for each of which would be £23 per annum, or, if half were extinguished at midnight, the price would be £20 per lamp. Even under the latter arrangement, the total charge would be £660, as against £351 paid for the gas-lamps which would be displaced. A suggestion was made that incandescent gas-lamps would be as effective and much cheaper; and before any decision is arrived at, the Committee are to report further.

There has lately been a curious dispute between a resident at Skipton—a Mr. Fattorini—and the Urban District Council. The gentleman in question sought permission from the Council to carry a wire from the shop of another resident, where electricity is produced, to his own shop. The Council objected to this, inasmuch as it would, they said, be countenancing and inviting competition with them in supplying electric illumination within their own area. At last Thursday's meeting they pledged themselves to obtain an Electric Lighting Order, which will give them the sole right to supply electric light in the town.

Speaking at a dinner of the Liverpool Conservative Club last Thursday, Alderman Charles Petrie referred to the success of electric lighting in the city. He said that, in four years, the number of 16-candle power lamps had risen from 35,000 to 130,000, while at the same time they had reduced the price for lighting from 7d. per unit to 4d. Even with this great reduction, some £30,000 had been placed to reserve fund. Owing, however, to the rapid development of the works, and to the fact that a large portion of capital would be unproductive for some time, he did not anticipate any great surplus from the electrical department during the next twelve months.

Attention has recently been drawn to one or two instances of wide tendering in connection with the supply of gas-works requirements; and gas-plant manufacturers will perhaps rejoice to learn that their compeers in the electrical industry are not free from the same fault. The Electric Lighting Committee of the Hull Corporation recently invited tenders for new dynamos of 2000 volts. In response, they received four offers, the highest of which was £6313 and the lowest £3725—a difference of no less than £2588! The two middle tenders were £5035 and £5275 respectively; so that even between the third and the highest tender there

is a solid sum. The lowest tender (which has been accepted) was sent in by Earle's Shipbuilding Company, Limited; while Messrs. Crompton and Co., Limited, of Chelmsford, had the honour of submitting the highest.

Mr. Robert Hammond has advised the Malvern District Council to spend £30,000 in commencing an electric lighting scheme. There is a strong feeling against so large an expenditure on so small an area; and the outside districts object to paying part of the cost. On Monday last week, Mr. Hammond lectured on the subject at the Assembly Rooms, for the purpose of converting the recalcitrant ratepayers. Speaking from 20 years' experience, he advised the ratepayers not to let a company step in. So far as his knowledge went, in every instance the light had paid a profit after three years' working. The probability of a company taking up the lighting owing to the opposition to the Council's scheme was, he thought, a bad thing for Malvern, especially as the ratepayers had £100,000 invested in the gas-works. He, of course, regarded the Council's Provisional Order as a valuable asset; and they ought not, in his opinion, to lose it. Mr. Hammond's efforts in instructing the ratepayers proved unavailing; for, at a large public meeting on Thursday, a resolution was passed declaring it undesirable, under present circumstances, that the Council should proceed with the electric lighting scheme.

Vexatious incidents continue to disturb the peace of the officials of the Manchester Corporation Electrical Department. Local papers report that Market Street, on Monday evening last week, was "the scene of another of the alarming explosions caused by faults in the electric cables, which have occurred with unpleasant frequency in Manchester during the past few months." It was about ten minutes past ten, when there were many people passing along the thoroughfare, that there was a loud report, and persons who were in the neighbourhood saw several large paving-stones lifted 5 or 6 feet into the air. The seat of the explosion was an underground chamber; and those who witnessed the accident state that for several seconds smoke poured out of the hole, the iron-bound concrete cover of which was completely shattered. The disturbance of the flags of the pavement around bore witness to the force of the explosion. Several people who were close by sustained a shaking, although, fortunately, no one was severely hurt. A crowd gathered round the spot; but their inquisitiveness was not sufficient to induce them to remain when, ten minutes later, a second explosion, though of a much milder character, occurred at the same place.

The ratepayers of Bridgwater do not seem disposed to incur any financial responsibility over electric lighting—at all events for the present. Their feeling on the matter was expressed in the passing, at a public meeting, of a resolution to the effect that it was inexpedient for the Corporation to proceed further with the scheme. It was thought that the cost might be very largely in excess of the estimate of the Consulting Engineer (Mr. Trentham), particularly as the prices of material had risen considerably; that it was very uncertain whether the undertaking would be a profitable one; and that it had already been ascertained that the rates of the borough would be about 1s. 8d. in the pound in excess of last year. The advocates of the scheme contended that it would effect a great town improvement; that it would prove profitable; that between £300 and £400 having already been expended in obtaining a Provisional Order, this must soon be carried into effect, or the expense incurred would be thrown away; and that in such case it was probable the electric light would be installed by a private company. These specious arguments had little effect; for, we are told, the resolution was carried by "an overwhelming majority."

The waywardness of the electric light at Chelmsford, both in the street and private lamps, continues to cause much annoyance, although strong representations on the subject have been made to the Company. Very uncomplimentary reference to the unsatisfactory service was made at the meeting of the Town Council last Wednesday. On the same occasion, the Company submitted an offer to enter into a fresh contract for the public lighting from March next. The Company were, the communication stated, prepared to do the lighting as near as possible at cost price—viz., arc lamps at £25 10s. each per annum, and £3 7s. 6d. for incandescent lamps. Under the present contract, the charges are respectively £22 10s. and £2 6s. 10d. Therefore the Company must have been supplying the Town Council at a loss; and the additional charge will add about £300 a year to the lighting bill. The inefficiency of the lighting in the past will, we should think, cause the Corporation to carefully consider whether they will be justified in continuing the present system at an increased cost. However, figures for electric lighting which are "as near as possible at cost price" will be interesting to other authorities who are contemplating adopting electricity for street illumination, and whose towns are similarly circumstanced to Chelmsford.

In the "Electric Lighting Notes" in the "JOURNAL" for the 11th of July last, reference was made to electric lighting in South Australia, and we gave the figures contained in the first balance-sheet of the South Australian Electric Light and Motive Power Company, who, it may be remembered, had agreed to supply to the Adelaide Corporation 30 arc lamps of 2000 (nominal) candle power at 1s. per lamp per annum. The profit and loss account for the six months ending the 30th of April was not credited with any income, except £1 2s. 5d. for interest. At the close of our observations on this account, we said it would be interesting to see how the next stood. We are able to gratify our desire for further information in regard to this flourishing undertaking (which has now been sold to the Brush Company), from a copy of the second balance-sheet of the Company, concerning the period from the 30th of April to the 30th of October, which has reached us. We give the figures from the profit and loss account, and let them tell their own tale: Balance from last account, £884; charges, £502; advertising, &c., £7; legal expenses, £100; working expenses, £1152—total, £2645. On the other side of the account are the following items: Electric current, £492; interest, £57; balance, £2096—total, £2645. The liabilities of the Company are put at £22,932; and against them stand the assets, as follows: Undertaking and goodwill, £4334; plant and land, £4652; deposits with Adelaide and Port Adelaide Corporations and interest, £2565; Port Adelaide station, £7725; ditto suspense account, £727; cash in bank, £420; meters, lamps, &c., £269; sundry debtors, £144; balance of profit and loss account, £2096—total, £22,932.

The development of the electric lighting question at Sudbury (Suffolk) has been followed up in these "Notes" because the town is typical of that class of place to which electricians will turn their eyes now that the best and largest of the plums have been picked, and because it is such towns as Sudbury that are, it seems to us, outside the boundary line of any possible chance of making profit out of electric lighting—even with a dust destructor thrown in. The report of Mr. W. C. C. Hawtayne to the Corporation, which we recently noticed, has been printed in pamphlet form and distributed for the purpose of ascertaining the "general" feeling of the ratepayers as to desirability of works being carried out. Now we maintain that the fairest way of submitting the question to the ratepayers would be by public meeting, at which the arguments for and against might be heard and discussed; for it is not only the section of ratepayers who may become consumers who should have a voice in the matter, but the entire body upon whom the burden will fall if the scheme proves a financial failure. Here is a proposal to put upon the shoulders of the ratepayers of a poor town a load equal to what we understand is its rateable value—about £20,000; and yet the councillors (some of whom appear to possess quite a feverish desire to push the scheme through with as little trouble as possible) have not sufficient courage to face a town's meeting. Why? We do not know whether the pamphlet has been issued broadcast to all the ratepayers, or only distributed among the possible users of electricity on the route of the cables. We have an idea the latter is the case; and if it is so, the recipients of the pamphlet will answer the first question put to them "Are you in favour of electric lighting being introduced into this town?" to suit their own convenience or pleasure, while the other ratepayers, who will have to bear their share of the responsibility, are simply ignored. The broad question which the Council should submit to the ratepayers at large is, "Are you prepared to authorize the expenditure of a sum of about £20,000 on a venture which, *if* the visionary success predicted by the electrical expert is realized, will return us the handsome net profit of something like £300 (!) a year?" We think, if this question was put fairly and squarely to the whole of the ratepayers, all save a few shopkeepers and publicans in two or three of the principal thoroughfares would say, "We are not." There is, according to the scheme, to be a long length of cable (in the compulsory area) running from the Station Road, down Friars Street, Church Street, and Ballington Street. Now how many consumers are likely to use the electric light in those thoroughfares excepting Mr. Alderman Mauldon, who is a member of the Corporation Electric Lighting Committee, and whose premises are, we believe, situated towards the farther end of that stretch of cable? As a little inducement to ratepayers on the line of cable to support the scheme, the circular intimates that those persons who announce, before the work is commenced, their intention to use the electric current will have their premises connected *free of charge*. The sop is a bit too thin. If the Corporation undertake this work, they will be very glad later on to connect more consumers on the same terms. There is one thing missing from the report which we had hoped to find in the copies distributed to the ratepayers. That is an amplification of the statement of Mr. Hawtayne that "the town is far superior to many where the establishment of similar works has proved remunerative." Three weeks ago we expressed a desire to know the towns comprised in the word "many," and the extent of their success. The information would still be interesting. The report is a feeble case for electric lighting in Sudbury; and the attitude of the Council in shunning a public meeting betrays a want of strength that a municipal body worthy of the name would be ashamed of.

OPPOSITION TO THE WELSH WATER SCHEME OF THE LONDON COUNTY COUNCIL.

At the last Meeting of the Gloucester Chamber of Commerce, Mr. P. Cooke referred to the Bill promoted by the London County Council to obtain parliamentary sanction for carrying out a portion of their Welsh water scheme, and read extracts from a report recently made thereon by Mr. E. D. Marten, M.Inst.C.E., Engineer to the Severn Commissioners. He also read a letter which he (Mr. Cooke) had written to the Board of Trade, on behalf of the Gloucester Harbour Board, pointing out that, in the opinion of the Severn Commissioners, the proposal of the London County Council was likely to most seriously prejudice and affect the navigation of the estuary of the Severn, within the jurisdiction of the Board. He remarked that the Birmingham Corporation were at present engaged in the construction of works to take 75 million gallons of water from the Wye; and it was now proposed to further abstract from the same source somewhere about 150 million gallons. Consequently, if powers such as were asked for by the London County Council were granted, the time was not far distant when the total abstraction from the watershed of the Wye would not be less than 225 million gallons a day; being about one-sixth of the whole water which entered the Severn estuary from the Wye basin, and about one-fifteenth of the total quantity of fresh water entering the estuary from the Severn and Wye combined. Although it was claimed by the promoters of these schemes that they proposed to impound flood waters, which would otherwise do great damage, and give out compensation water in dry times so as to increase the dry-weather flow, it could be shown that such claims had no foundation in fact, but that if powers were granted such as were sought in the Bill, it would not only be a most serious thing for the Wye, but more especially for the estuary of the Severn, and consequently for the navigation thereon. The Harbour Board, not having any resources out of which they could incur the expense of employing engineers, or of further protecting the interests of the navigation of the Severn, claimed the assistance of the Board of Trade, and asked that an inquiry should be made and an engineer employed to report whether the carrying out of the scheme would be likely to be prejudicial to the navigation of so important a river, as well as to the port of Gloucester. The President (Alderman J. A. Matthews) remarked that Mr. Foster, the Chairman of the Harbour Board, felt very strongly on the matter, and was of opinion that the taking of so much fresh water would very much affect the port of Gloucester. Mr. Phillips proposed—"That this Chamber cordially supports the action of the Harbour Board in their appeal to the Board of Trade." The motion was carried unanimously.

On Sunday evening, the 28th ult., the lighting of Sturry Church was greatly improved by the substitution of gas for the oil-lamps previously in use. Much satisfaction was expressed at the change.

THE FINAL REPORT OF THE METROPOLITAN WATER COMMISSION.

Continuing our abstract, commenced last week, of the above report, we have to deal first with the portion in which the Commissioners discuss the opinions of various Local Authorities on the subject of the purchase of the water undertakings. Having already gone through the several suggestions by which the expediency of purchase was sought to be established, the Commissioners reiterate their opinion that if the purchase of the Water Companies' property takes place under the ordinary arbitration terms, and with the usual requirement of a sinking fund when a public authority is the purchaser, the result of a just and fair arbitration will be that the water charges must be raised for the period during which the proceeds of the fund in the hands of the Chamberlain of London fails to cover the sinking fund required from the purchaser, or that rates-in-aid must be levied to make up the deficiency of the existing water charges. Sir Alexander Binnie and Mr. Dickinson, representing the London County Council, apparently anticipated an increase in the water-rates owing to the large extension of works which they thought would be necessary. Sir John Lubbock put the loss by purchase, on the basis of an 80 years' sinking fund, at £40,000 a year. The City Remembrancer (Mr. Goldney) told the Commissioners that the City did not hope that the special arbitration terms suggested by the County Council would be obtained; and that, in their opinion, at the present moment, and on the basis of the existing figures, any price that an arbitrator would be likely to give would be financially disadvantageous to the City. The Commissioners do not think it necessary to quote witnesses called by the Water Companies. They were uniformly of opinion that purchase would be financially disadvantageous to the buyer. They, however, briefly summarize the opinions expressed by various public authorities who gave evidence, but confess that they obtained very little or no help in the solution of the difficult question as to what the financial results of purchase of the undertakings on arbitration terms would prove to be. On the whole, such consideration as some of the Local Authorities had given to the subject did not lead the Commissioners to a different conclusion from that to which they had arrived.

It was hoped that some assistance would be derived from the cases of purchase of water undertakings by Provincial Corporations; and the Commissioners endeavoured to procure information concerning them. The only case of arbitration of which they were able to get particulars was that of the Stockton and Middlesbrough Corporations, who in 1878 acquired the undertaking of the Water Company supplying their district. After the purchase, the charges for water for domestic purposes were increased; and in 1897 the Water Board had a deficit which was met out of the rates of the three purchasing boroughs—the necessary rate being 11·6d. in the pound. Mr. Gomme, the Statistical Officer of the London County Council, furnished the Commissioners with an analysis of the water accounts of the county boroughs of England and of three Scottish towns—Dundee, Edinburgh, and Glasgow—for the year 1896-7. These tables gave no information as to the method of purchase, whether by agreement or arbitration, nor as to the financial result of purchase by arbitration, nor as to the changes, if any, in the amount of water charges before and after purchase. The only conclusion the Commissioners were able to draw from them was that in 28 boroughs there were surpluses on the water accounts, after paying expenses and loan charges, amounting in the aggregate to £141,898, and that in 19 boroughs there were deficits amounting to £237,298. Of the surpluses, only £1846 was applied in reduction of water charges, £61,115 went in relief of the borough funds, £51,967 to the reserve funds, and the rest was applied to capital account or held in balance of the water account. Glasgow was the most favourable example of corporation management brought forward. As the result of the examination of all the tabulated statistics submitted to them, the Commissioners do not think they establish any superior economy in corporation over company management, or prove that the charge for water on the community as a whole is lessened by the former management; although corporations have the advantage of being able to distribute the burden of the water supply between the consumers and the ratepayers, and of charging higher rates in districts outside the borough area, where they have to supply any such districts.

Another line of evidence consisted in a comparison of provincial rates of charge with those of the London Water Companies. Mr. Cripps, on behalf of the London County Council, put in tables comparing the charges of the West Middlesex, East London, and Lambeth Companies with those of Glasgow, Croydon, Liverpool, and Birmingham, and showing that, for houses of the rateable value of £37 10s., £192, and £209, the estimated charges of the East London and Lambeth Companies were higher than those of the Provincial Corporations selected. On the other hand, Mr. Hawksley put in a more extended table showing the charges, on houses of various rentals from £10 up to £360, made in all the provincial towns (except Stockton and Middlesbrough, the information from which was insufficient) with more than 100,000 inhabitants; and also a table showing the charges made by the London Companies on houses of the same rentals. The Commissioners say these tables, so far as they go, certainly lead to the inference that the poorer class of houses throughout the London water area, and houses of every class except in the East London, Lambeth, and Southwark and Vauxhall districts of supply, pay less for water than the average charge of the large Provincial Corporations for houses of the same rateable value. But this inference must not, they add, be stretched so far as to imply that occupiers in similar circumstances of life and fortune pay less for water in London than in the provincial towns. The Commissioners had some interesting evidence from M. Cadoux as to the water supply of Paris. They found that the annual deficiency in the water revenue which has to be made up out of the general taxation of the city is about 1,500,000 frs. (£60,000); but this amount is yearly diminishing.

The Commissioners next proceed to deal with the present and prospective requirements of Water London. Stated generally, the requirements of the population are these: A supply of pure and wholesome water, constantly laid on, at such a pressure as will make the water reach the top story of the highest houses, and in quantity sufficient from time to time to meet the needs of the growing number of inhabitants. The Commissioners point out that the purity of London water is a matter of vital importance; and owing to the fact that the Metropolis is supplied mainly from the Thames and Lea, which are liable to pollution from many causes, they say it is a matter calling for vigilance and careful treatment. Two Royal Commissions sitting at an interval of 25 years—viz., the Duke of Richmond's Commission in 1869, and Lord Balfour's Commission in 1893—both advocated the continued use of Thames water, but recommended improved conservancy of the river and efficient filtration as essential to preserve the wholesomeness of the water. The increased powers given to the Conservators of the Thames have done much to improve the condition of that river; and similar powers belong to the Lea Conservancy Board.

The treatment and filtration of the water taken from the rivers are entrusted to the Water Companies. Section 4 of the Metropolis Water Act, 1852, places them under the obligation to "effectually filter" all such water before it is distributed for domestic use. The test of efficient filtration was for many years considered to be the clearness and limpidity of the filtered effluent; but the discovery some years ago by Dr. Koch, of Berlin, of a method of cultivating bacteria, by means of which it became possible to ascertain the number of bacteria in any given sample of water, and the further discovery that filtration through sand, under favourable conditions, greatly reduced the numbers of bacteria contained in water so filtered, introduced the bacteriological test. The Commissioners acknowledge that the Water Companies have not been wanting in their endeavours to comply with this new test of purity. Under the conditions prevailing in Berlin, it is considered that efficient filtration has been secured if the effluent water does not show more than 100 microbes per cubic centimetre, after a period of incubation of 48 hours; but it is recognized that this standard will vary in different localities. The late Sir Edward Frankland adopted this German standard of efficient filtration; but he stated that it was a purely arbitrary one, sufficient, but not unduly severe, when applied to the river-derived supplies of the London Water Companies. He added, however, that he desired it to be understood "that the infraction of this standard does not throw suspicion on the wholesomeness of the water."

The Commissioners had before them Sir Edward Frankland, Sir William Crookes, and Professor Dewar; and their evidence is analyzed in the report. Those eminent experts suggested that experimental stations for filtration should be established; that laboratories should be opened in proximity to the principal works whence water is distributed to the consumers, and that systematic and frequent examinations of samples of water should be made. The Commissioners say it is no doubt possible, by legislation, to throw on the Companies the task of carrying out these suggestions, and of constructing the works and conducting the experiments necessary to arrive at a bacterial standard of quality which should be practical, safe, and satisfactory. They are, however, disposed to adopt the view that the important work of rendering potable, by scientific treatment, the river-derived water supply of London should not be entrusted to private enterprise, but should be in the hands of a public authority. They think "it would be an advantage to obtain that unity of management and uniformity of arrangements which are now absent."

Dealing with the next requirement of the population—a constant supply of water under sufficient pressure to reach the highest inhabited part of all houses—the Commissioners say this is not yet fully met in Water London. About 72,000 houses are intermittently supplied; the water being turned on during a portion only of the 24 hours, and the consumers having to depend on water stored in their cisterns for the rest of the day. The maximum height at which water constantly laid on under pressure has to be delivered varies with the different Companies; but there are reasons why the enactments regulating this matter, which have been in force for many years, should be revised. A change in the vertical limits of supply could not be effected without legislation, nor could additional obligations be imposed on the Companies against their consent or without compensation. But the Commissioners say that if some public authority became the purchaser of the undertakings, water would doubtless be supplied at constant pressure to the highest houses, to the great convenience of the public. Moreover, they think the unification of the undertakings by purchase would increase the advantages of intercommunication emphasized in their first report, and tend to "secure the sufficiency of the water supply by a more rational and economical system of distribution."

Another matter closely connected with the sufficiency of the water supply, now and hereafter, is the prevention of waste. The Commissioners have dealt with the evidence on this point in the latter part of their report. Here they only estimate the bearing of this detail of management on the expediency of purchase. They think the prevention of waste is much more likely to be realized if the undertakings are acquired and managed by a public authority, than if they are left in the hands of the Water Companies. They point out that companies supplying water for profit, and paid by water-rentals, are working at a disadvantage, compared with public authorities, in endeavouring to enforce such powers as they may possess for preventing even gross and wilful waste. The fact that their efforts in this direction result in profit to the shareholders prevents them, as a rule, from receiving sympathy or assistance from either the consumers or the local authorities. Yet such sympathy and assistance would be of the greatest value, because, under a system of constant supply, the consumption of water is practically in the hands of the consumers. The Commissioners think it is reasonable to hope that if the undertakings were purchased with the money of the community, and managed for the community, there would be "a general assent to the view that wilful waste of water, provided at great cost from sources not unlimited, was reprehensible;" and they express the opinion that "an authority properly constituted would receive general assistance in the performance of this duty."

The Commissioners next proceed to deal more fully with the future requirements of Water London as regard quantity of supply, and the bearing they have on the expediency of purchase. For the purpose of their inquiry, they think it is sufficient to look forward to the needs of the population in the year 1941. Lord Balfour's Commission, contemplating the requirements of London ten years earlier than that date—viz., in 1931—estimated that the rate of increase in the population in Greater London would be 18·2 per cent. decennially, and in the outlying parts of Water London 19·7 per cent. Lord Llandaff and his colleagues endeavoured to ascertain whether the increase from 1891 to 1897 bore out this estimate. They were not able, however, to obtain any reliable information on the subject. They have therefore thought it best to abide

by Lord Balfour's estimate, which, they say, errs, if at all, on the safe side. Taking, then, the decennial rates of increase above mentioned, the population of Water London will be something over 12 millions in 1941. The quantity of water required per head was estimated by Lord Balfour's Commission at 35 gallons a day—an amount which, in their opinion, erred, if at all, "on the side of lavishness." A good deal of contradictory evidence was given by expert witnesses before that Commission; but Lord Llandaff and his colleagues do not think it worth while to examine the discrepancies very minutely, believing that they are on safe ground in adhering to the estimate of 35 gallons per head per day. Applying this figure to the estimated population of Water London in 1941, given above, the daily supply required will be about 423 million gallons. The practical question before the Commission was how such a quantity could be provided, and how this large demand bore upon the question of purchase. The consideration of this is the next matter undertaken.

Lord Balfour's Commission came to the conclusion that the supplies available from the Lea and from wells in the Lea Valley and in the Kent Company's district amounted to 120 million gallons a day; and from the Thames, to at least 300 million gallons—making altogether 420 million gallons. Lord Llandaff's Commission adopt these figures, which show that in 1941 303 million gallons a day may have to be supplied from the Thames or from some other source for the requirements of Water London. They say the cost of obtaining this supply, and the possibility of getting it from the Thames without injury to the river, depend on various conditions, some of which have been presented in a new light by the experience of three years of unusual drought since Lord Balfour's Commission reported—viz., the years 1893, 1898, and 1899. The present Commission deal first with the question whether any, and what amount of, flow in the river should be at all times maintained; and whether the Companies or their successors should be prohibited from reducing the flow below that amount. The Commission of 1892-3 did not make any absolute recommendation on this subject; but their approval of Messrs. Hunter and Fraser's scheme of storage reservoirs at Staines, which included as one of its features a flow of 200 million gallons a day over Teddington Weir, may perhaps be taken as an indication of their opinion.

This question was hotly contested before Lord Llandaff's Commission; and it will be of interest to epitomize the opinions expressed by the various witnesses. Sir Alexander Binnie, for the London County Council, contended that at no times and under no circumstances must the flow over Teddington Weir be less than 250 million gallons a day, and that the Thames would silt up below Richmond if the flow were reduced materially below this figure. Mr. Deacon appeared to be content with a flow of 200 million gallons a day. Mr. Middleton, the principal witness for the Water Companies, thought the limit of 200 million gallons a day was too high, and preferred 150 million gallons; but he adopted the higher number in his estimates, and only illustrated the effect of the lower limit as a means of comparison. Other witnesses for the Companies went further. Mr. Hunter told the Commission that he adopted the minimum flow of 200 million gallons a day in deference to the views of the Thames Conservancy; but that, in his opinion, 100 million gallons was sufficient, and that this limit should ultimately, when the storage at Staines was completed, "be made to apply to the present rights of the Companies." Sir Frederick Bramwell preferred the limit of 100 millions to 200 millions, and thought even the smaller quantity might be reduced in an exceptional year. He said the difference was not appreciable for any practical purpose. Mr. Hawksley agreed with this view, and relied on floods to prevent silting up of the Thames. Mr. Eaton also thought 100 million gallons a day ample, and stated that the new half-tide weir at Richmond had considerably improved the condition of the river, and enabled the Conservators to clear out any silt that might be deposited below the weir. Mr. More, the Engineer to the Thames Conservancy, thought that to reduce the discharge at Teddington Weir from 200 to 100 million gallons a day would stop the pleasure navigation on the river below Richmond, where it would make a difference of about 7 inches in the absolute level of low water, decreasing to 4½ inches at Kew, and diminishing gradually farther down the river. This difference in level would, he said, be of importance in the narrow channel in the middle of the stream, in which, in places, the depth is only 2 ft. 6 in. at dead low water, and which is used by steamers drawing 2 ft. or 2 ft. 3 in. The reduction from 200 to 100 million gallons discharge would also leave something like 17 feet more of the muddy foreshore exposed on each side in the flattest places. He was of opinion that, if the 200 million gallons discharge was maintained as a minimum, the river would remain in good condition, even though that minimum flow continued for a long time. Sir F. Dixon-Hartland, the Chairman of the Thames Conservancy, also objected to the flow over Teddington Weir being reduced below 200 million gallons.

Upon the whole of this evidence, the Commissioners express the opinion that the minimum flow of the Thames over Teddington Weir should be fixed at 200 million gallons a day, and that the Water Companies should not be allowed to deplete the river so as to reduce the flow below this amount, except under special safeguards and restrictions. The gaugings of the river which they had before them showed that this limit will not operate harshly upon the Companies, except in years of unusual drought, such as 1893 or 1898. The difficulties arising in such years as these must, they say, be met partly by increased storage. They think they may also be met to a certain extent by vesting in the Local Government Board the power of allowing the Companies, on application, "to increase their take of water to an extent to be specified from time to time, even though the consequence is that the flow over Teddington Weir is reduced below 200 million gallons." This power should only extend to waiving the 200 million gallons rule for such number of days as the Board might deem expedient, and not to enlarging the total statutory rights of the different Companies to draw water.

Another material circumstance, in estimating both the cost and the possibility of a supply from the Thames being sufficient up to 1941, is the question whether flood water may be drawn into the reservoirs or the filters of the Companies, or whether any and what number of days after a flood should be allowed to elapse before any water is taken from the river. This is a question which also largely concerns the quality of the Thames water, and the Commissioners deal more fully with it in a subsequent portion of the report. They content themselves with saying in this place that they think it may be left to the discretion of the Engineers of the Companies how soon after a flood water shall be taken from the river into their works, and that it is unnecessary to prohibit the taking of flood water for any number of days. They consider it may be assumed that the convenience of the Companies, to whom turbid water is a trouble and an expense, will lead them, when practicable, to let flood water go down the river for a few days before they draw.

The Commissioners recognize that the maintenance of a minimum flow of water over Teddington Weir would only be possible, in a year of drought, by greatly increasing the quantity of storage provided; and this matter next engages their attention. They say it is obvious that, according as the minimum flow is fixed higher or lower, there will be fewer or more days on which a surplus of water is available for storage or supply, and more or fewer days on which supply will have to be kept up out of previous storage. Taking the figures for the years 1893 and 1898—two of the driest years known—they show how the increase in the limit of flow over the weir and the different conditions of the two years affect the amount of storage required, and, as a necessary consequence, the cost of providing it. After considering rainfall and other statistics, the Commissioners do not see any reason to suppose that any permanent change in the English climate has taken place, and they do not think it is necessary or reasonable to require that the full amount of storage needed to furnish a daily supply of 300 million gallons from the Thames, without ever reducing the flow at Teddington below 200 million gallons, in such exceptional years as 1898 and 1899, should be provided. They point out that, in ordinary years, a large part of this storage, with the accompanying pumping power and the wages of men to work the pumps, would be unused and unnecessary. If a year of drought occurred, the wants of the consumers might be met, as already suggested, by enabling the Local Government Board to dispense with the 200 million gallons minimum, and allow the river to be reduced below this limit during such number of days as might be needful. For their present purpose, which is to arrive at a safe approximate estimate of the cost of a daily supply from the Thames of 300 million gallons, the Commissioners think it might be sufficient to take the average conditions of the last thirty or forty years, and calculate the necessary storage on this. In order to be on the safe side, their estimates are based on the conditions of 1893, and on the storage necessary to meet the requirements of London if a series of equally dry years were to recur, without reducing the flow of the Thames at Teddington below 200 million gallons a day.

A great many conflicting estimates in regard to this matter were laid before the Commissioners by Sir Alexander Binnie, Messrs. Middleton, Hunter, and Hawksley, and other witnesses. They were carefully considered, with the assistance of Colonel Rathborne, and the conclusion come to was that the cost of providing sufficient storage to supply Water London from the Thames with 114½ million gallons a day, in addition to the 185½ million gallons a day which the Companies and the Staines Reservoirs Committee are now authorized to supply, in a year as dry as 1893, would be between £9,000,000 and £10,000,000. This sum includes all the charges for pumping to store and supply, capitalized and reduced to present value, the charges for connecting the mains with the service reservoirs of the Companies, and those for accumulated interest on the capital expended during the execution of the works. The amount of storage covered by this estimate will be 17,500 million gallons, and is sufficient to give the additional supply of 114½ million gallons, without drawing anything from the river when the flow over Teddington Weir is 200 million gallons or less. When the reservoirs necessary for this supply are all completed, they will cover an area of no less than 6000 acres, or about 10 square miles. The Commissioners remark, however, that these reservoirs need not be all concentrated at or near Staines. There are other sites, such as Walton and Hampton, where they might be placed.

The foregoing estimate does not cover the cost that must be incurred if the existing authorized take of the Companies and the Staines Reservoirs Committee—viz., 185½ million gallons a day—is made subject to the condition that water shall not be drawn from the Thames so as to reduce the flow at Teddington below 200 million gallons a day. This condition would involve an alteration of the existing statutory rights of the Companies; but assuming that the alteration is assented to, the cost of providing sufficient storage and pumping power both for storage and supply would be about £2,800,000, and a further expenditure for connections with the systems of the different Companies, amounting to about £2,000,000 more, would have to be incurred. This expenditure in respect of the existing authorized supply is calculated, as in the former case, upon the requirements of such a year as 1893; and it would have to be incurred whether the Companies remain as they are or are purchased by a public authority, and whether the further supplies of London are obtained from the Thames and Lea Valleys or from some more distant source. The Commissioners are careful to point out that the expenditure for drawing more water from the Thames, without depleting the river, by means of large storage works, would be gradually incurred. The reservoirs would be constructed successively as the need for them arose. If the population did not increase at the rate anticipated, the works could be reduced or delayed; and those works would become immediately remunerative and productive of income as soon as they were finished.

In considering this question of providing for the future needs of London, the Commissioners recall to mind the fact that, as shown by the report of Lord Balfour's Commission, there are in the Thames and Lea Valleys other less costly sources of water supply. It was estimated by that Commission that 27½ million gallons a day could safely be taken from wells in the Kent Company's district; and they thought there was a possibility of water being obtained from wells in the chalk area of the Thames basin, both above and below the Companies' intakes, although they believed there would be strong local opposition to increasing the supply of water to London by sinking additional wells in that area. With regard to wells in the Lea Valley, the estimate they formed was that, under the worst conditions of drought, the Companies could reckon on obtaining 40 million gallons a day; while in wet years, 56 million gallons or more would be available. The New River share of this total seems to have been 30 million gallons from wells, and 4 million gallons from the Chadwell spring; the East London Company's share being some 10 or 11 million gallons. It was suggested to the later Commission that their predecessors had been misled by the Companies. They say, however, that, on a review of the whole of the evidence, although legitimate suspicion is aroused by the contradictory statements put forward at different times, and the misleading sense in which an apparently plain expression,

such as "available supply," is used, they have come to the conclusion that the estimate of Lord Balfour's Commission is not too high, and that 40 million gallons a day are obtainable from existing wells in the Lea Valley even in so dry a year as 1898, although they are not satisfied that the machinery necessary to raise this quantity is yet in position. From the Lea itself, the supply contemplated by that Commission, of 52½ million gallons a day, is, they think, as much as can be expected. Indeed, the experience of 1898 shows that to obtain this quantity considerable storage will be necessary in exceptional years, as was clearly foreseen in 1893.

Recapitulating their remarks on this subject, the Commissioners' conclusion is that the estimate of a supply of 120 million gallons a day from the Lea and from springs and wells in the Lea Valley and in Kent is one that may be relied upon, when the necessary works are completed; and that it is reasonable to expect that an additional supply from the chalk in Kent and in the Thames Valley may be obtained to supplement the supply of 300 million gallons a day from the Thames, and to suffice for the needs of Water London up to 1941.

Much of the Commissioners' time was occupied in considering an alternative scheme of obtaining from Wales whatever water may be necessary in the future, over and above the 185½ million gallons a day now authorized to be drawn from the Thames. For the immediate future—that is, for the next ten or fifteen years, Sir Alexander Binnie thought the Companies had made sufficient provision by various Acts obtained between 1891 and 1897. These Acts did not give them power to obtain an increased supply, but enabled them to secure and improve their existing supply by extra reservoir capacity, better mains, pumping, and filtration plant, and generally improved means of carrying on their undertakings. For the more distant future, he recommended that recourse should be had to the head waters of the Usk, the Wye and its tributaries, and the Towy, at altitudes above the sea-level of from 600 to 2800 feet, from areas composed of the primary rocks of the old red sandstone and silurian systems, which are noted for the purity of the water flowing over their slopes. His advice to the London County Council, if they became the purchasers of the water undertakings, would be to commence at once an instalment of this Welsh scheme—viz., the construction of a storage reservoir by building a dam across the River Yrfon, a tributary of the Wye. This would form a lake 3000 acres in extent, having a gross capacity of 39,000 million gallons, and an available capacity of 35,700 million gallons, allowing for bottom settlement. The water would be brought to London, partly by an aqueduct or conduit 117 miles long, made capable of conveying 200 million gallons a day, so as to meet subsequent demands, and partly by 45 miles of pipes. The terminal works would be at Elstree, and would, in the first instance, be made capable of dealing with 147 million gallons a day. Sir Alexander Binnie estimated at £14,112,000 the cost of this first instalment, which would, in his opinion, be sufficient up to the year 1931. If it was limited to the supply available from the Yrfon, the estimate would be reduced to £10,032,250, exclusive of filters, of mains for connecting the Elstree reservoir with the service reservoirs of the Companies, and of all pumping charges. The possible supply would be 121 million gallons a day. In neither of these estimates is anything allowed for accumulated interest on capital expended during the execution of the works. The next instalment of the scheme—sufficient to provide for the wants of London up to 1948—was first estimated by Sir Alexander Binnie at an additional sum of £12,000,000, to be expended between 1931 and 1948. He subsequently modified this statement, and put in reduced estimates of the cost of bringing from Wales 147 and 208 million gallons of water a day. Other and very different estimates were put in by Mr. Middleton, Mr. Hunter, and Mr. Hawksley. These were based on the analogy of the cost of works undertaken by Manchester, Liverpool, and Birmingham to bring water to those towns from Lake Thirlmere, from the Vyrnwy, and from the Elan Valley. These works are similar in character to the proposed works on the Yrfon, and include the construction of dams and aqueducts of smaller dimensions and intended to convey smaller quantities of water.

The divergence of these estimates was so great as to make the Commissioners' task of deciding between them difficult and hazardous. As against Sir Alexander Binnie's estimate for the Yrfon supply of £10,032,250 for the cost of works, they had Mr. Middleton's estimate for the same works of £20,839,243, and Mr. Hunter's of £20,600,551; this being the lowest estimate of the opponents of the Welsh scheme. Colonel Rathborne accepted Sir Alexander Binnie's estimate for works, with an addition for law expenses bringing it up to £10,629,500. To each of these estimates for works an addition must be made, as in the case of the Thames expenditure, for accumulated interest during the construction of the works, and for pumping charges, capitalized. This addition brings Colonel Rathborne's total to £15,406,781, Mr. Hunter's to £23,878,448, and Mr. Middleton's to £33,843,174. The Commissioners do not think it necessary to discuss these estimates more fully, because even the lowest largely exceeds the cost of obtaining an equivalent supply from the Thames with sufficient storage. They say there is, no doubt, something attractive in the scheme of bringing water from the Welsh mountains for the supply of London, and one would be glad, if it were possible, now to secure a watershed to be used hereafter, if London should require it. No tests, either chemical or bacteriological, were in evidence as to the quality of this water. But, assuming that it would prove sufficient both in quality and quantity, there remains the fact that "it is much more costly than the supply from the Thames, and that it is unnecessary to incur this extra cost now, as the supply from the Thames will be adequate in quantity and quality up to 1941."

Summing up their figures, the Commissioners come to the conclusion that if the Thames and Lea basins remain the sources of supply, the capital expenditure required up to 1941 will be £4,800,000 to bring the daily supply of 185½ million gallons, the present authorized draught from the Thames, up to the conditions of storage and river flow they have recommended; £9,000,000 or £10,000,000 will be needed to provide adequate storage for a further daily supply of 114½ million gallons from the Thames; and £18,100,000 for works of distribution to the growing population. For storage works on the Lea, a further item must be added to the total of £32,000,000 or £33,000,000 thus made up. If the further supplies of London are obtained from Wales, this outlay would be considerably increased.

Large as these sums are, the Commissioners do not wish to imply that the Companies are incapable of raising them. If, however, they are left undisturbed to provide for the future, Parliament would possibly find it

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 321.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 13	10½	Alliance & Dublin 10 p. c.	20½—21½	..	4 17 8
100,000	10	,,	7½	Do. 7 p. c.	14—15	−½	5 0 0
800,000	100	Jan. 2	5	Australian 5 p. c. Deb.	100—102	..	4 18 0
500,000	5	Nov. 15	6	Bombay, Ltd.	5¾—6¼	..	4 8 11
40,000	5	,,	6	Do. New, £4 paid	4—4½	..	5 6 8
880,000	Stk.	Aug. 16	12	Brentford Consolidated	275—280	..	4 5 9
270,000	,,	,,	9	Do. New	210—215	..	4 3 9
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb.	124—128	..	3 2 6
220,000	Stk.	Sept. 15	11½	Brighton & Hove Orig.	255—260	..	4 8 6
226,320	,,	,,	8½	Do. A. Ord. Stk.	185—190	..	4 9 6
973,500	Stk.	Aug. 16	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Sept. 29	10	British	43½—44½	..	4 9 10
50,000	10	Aug. 31	12	Bromley, Ord. 10 p. c.	25—27	..	4 8 11
75,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd.	9¾—10¼	..	5 17 1
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	98—100	..	4 0 0
150,000	20	July 13	8½	Cagliari, Ltd.	28—29	..	5 13 10
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	13½—14½	..	5 10 4
50,000	50	Nov. 2	6	Do. 6 p. c. 1st Mort.	56—58	..	5 3 5
550,000	Stk.	Oct. 13	13½	Commercial Old Stock	805—810	..	4 7 1
200,750	,,	,,	10½	Do. New do.	240—245	..	4 5 9
200,750	,,	Dec. 14	4½	Do. 4½ p. c. Deb.	140—145	..	3 2 1
800,000	Stk.	Dec. 14	9	Continental Union, Ltd.	177—181	..	4 19 5
200,000	,,	,,	7	Do. 7 p. c. Pref.	178—183	..	3 16 6
51,600	Stk.	Aug. 31	14	Croydon A 10 p. c.	335—340	..	4 2 4
168,400	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
555,000	Stk.	Aug. 16	5½	Crystal Palace Ord. 5 p. c.	125—130	..	4 0 9
60,000	,,	,,	5	Do. 6 p. c. Pref.	140—145	..	3 9 0
486,000	10	Jan. 26	11	European, Ltd.	20¾—21¾	..	5 2 4
354,000	10	,,	11	Do. £7 10s. paid	15—16	..	5 8 2
11,993,975	Stk.	Aug. 16	4%	Gas-light	4 p. c. Ord.	107—109	−1	4 1 9 9
2,600,000	,,	,,	3½		3½ p. c. max.	98—100	..	3 10 0
3,799,795	,,	,,	4	and Coke	4 p. c. Con. Pref.	119—122	..	3 5 7
3,993,975	,,	Dec. 14	3		3 p. c. Con. Deb.	98—100	1	3 0 0
70,000	10	Nov. 15	8	Hongkong & China, Ltd.		13¼—14¼	..	5 10 4
3,800,000	Stk.	Nov. 15	10	Imperial Continental		213—218	..	4 11 9
473,000	Stk.	Aug. 16	3½	Do. 3½ p. c. Deb. Red.		101—104	..	3 7 4
75,000	5	Dec. 14	6	Malta & Medn., Ltd.		5—5½	..	5 9 1
560,000	100	Oct. 2	5	Met. of	5 p. c. Deb.	110—114	..	4 7 9
250,000	100	,,	4½	Melbourne	4½ p. c. Deb.	107—109	..	4 2 7
541,920	20	Nov. 15	3	Monte Video, Ltd.		11—12	..	5 0 0
617,046	Stk.	Aug. 31	9½	Newc'tle & Gateshd Con.		220—225	..	4 2 3
264,855	Stk.	Dec. 29	8½	Do. 8½ p. c. Deb.		104—107	..	8 5 5
60,000	5	Sept. 29	7	Ottoman, Ltd.		6¼—6¾	..	6 1 9

* Ex div.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
150,000	5	Nov. 30	8	Oriental, Ltd.	7—7½	..	5 6 8
135,000	5	,,	8	Do. New, £4 10s. pd.	6½—6¾	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.	1¼—1½	..	4 11 5
500,000	100	Dec. 1	6	People's Gas of Chicago 2nd Mtg. Bonds	102—106	..	5 13 2
851,070	10	Oct. 13	7	River Plate Ord.	10¾—11¼	..	6 4 5
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	99—101	..	3 19 3
250,000	10	Sept. 15	10	San Paulo, Ltd.	12—13	..	7 18 10
135,000	Stk.	Sept. 15	10	Sheffield A.	249—251	..	3 19 8
209,053	,,	,,	10	Do. B.	249—251	..	3 19 8
447,427	,,	,,	10	Do. C.	249—251	..	3 19 8
5,600,000	Stk.	Aug. 16	5½	South Metrop., 4 p. c. Cri.	133—136	..	3 18 6
1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb.	100—102	..	2 18 10
120,000	Stk.	Aug. 31	6	Tottenham A. 5 p. c. and B. 3½ p. c.	141—143	..	4 3 11
250,520	,,	,,	4½		102—104	..	4 6 6
55,100	,,	Dec. 14	4	Edmonton 4 p. c. Deb.	113—117	..	3 8 5
182,380	10	Jan. 12	5	Tuscan, Ltd.	8½—9½	..	5 5 3
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.	101—104	..	4 16 2
				WATER COMPANIES.			
780,399	Stk.	Dec. 29	11	Chelsea, Ord.	307—312	..	3 10 6
150,000	,,	,,	5	Do. 5 p. c. Pref.	157—162	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	145—150	..	3 0 0
175,785	,,	Sept. 29	4½	Do. 4½ p. c. Deb.	148—153	..	2 18 10
1,720,560	Stk.	Oct. 18	7	East London, Ord.	202—206	..	3 8 0
654,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb.	145—150	..	3 0 0
890,000	,,	,,	8	Do. 8 p. c. Deb.	98—100	..	3 0 0
700,000	50	Dec. 14	7½	Grand Junction 10 p. c. max.	107—109	..	3 8 10
310,000	Stk.	Sept. 29	4	4 p. c. Deb.	131—136	..	2 18 10
708,000	Stk.	Aug. 16	14	Kent	348—353	..	3 19 4
160,000	,,	,,	7	Do. New, 7 p. c. max.	200—210	..	3 6 8
1,048,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.	298—308	..	3 10
406,200	100	,,	8	Do. 7½ p. c. max.	215—220	..	3 12 9
850,000	Stk.	Sept. 29	4	Do. 4 p. c. Deb.	135—138	..	2 18 0
500,000	100	Aug. 16	13½	New River, New Shares	423—428	..	3 3 0
1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb.	130—135*	..	2 19 3
902,800	Stk.	Dec. 14	7½	Southwark Ord.	203—205	−2	3 13 2
126,500	100	,,	7½	7½ p. c. max.	190—195	..	3 16 11
489,200	Stk.	,,	5	and 5 p. c. Pref.	160—165	..	3 0 7
1,019,585	,,	Oct. 13	4	Vauxhall 4 p. c. A Deb.	131—136	..	2 18 10
1,155,086	Stk.	Dec. 14	10	West Middlesex	288—293	..	3 8 3
200,000	,,	,,	4½	Do. 4½ p. c. Deb.	147—152	..	2 19 3
200,000	,,	Sept. 15	8	Do. 8 p. c. Deb.	100—102	..	2 18 10

* Ex div.

necessary to allow them to raise the capital required partly by shares and partly by debentures; and the Chamberlain's fund would have to be abandoned. In the Commissioners' opinion, however, "the magnitude of the future requirements of London in regard to water supply leads to the conclusion that the concentration of the water undertakings into the hands of one authority is desirable." Such an authority would, they point out, be able to raise the large sums necessary for the future supply of London at a cheaper rate than the Companies; but they add that if the authority were required to provide a sinking fund to redeem in 60, or even in 80, years the money borrowed to furnish the purchase-money and to increase the water supplies, the administrative advantages they have enumerated would be accompanied by a deficit in the income, which could only be met by increasing the water charges or coming upon the ratepayers. If the purchasing authority provided for future requirements by bringing water from Wales, there would be a further deficit, due to the fact that expenditure on the Welsh scheme must be wholly unproductive for 10 or 15 years. If, however, Parliament thought fit to dispense with a sinking fund, they think that a purchaser would be able, by maintaining the present water charges, to pay his way; and that the growth of the water revenue would render it possible to reduce the charges for water sooner than such reduction could take place under the management of the Companies, through the attainment of their maximum dividend and the payment in full of their back dividends.

If a central authority were created which purchased and managed the Metropolitan water undertakings, it might very possibly be called upon to take over the water supply of some, if not all, of the outlying districts. But by what authority should purchase be effected? This is the question next dealt with by the Commissioners; and in conjunction with it they consider the allied subject of the reference—"to what extent physical severance of the works and other property and sources of supply of the several Companies, and the division thereof between different Local Authorities within the limits of supply, are practicable and desirable." They take up this matter first. They show that the limits of supply of the Companies include the Administrative County of London and parts of the counties of Middlesex, Surrey, Essex, Hertford, and Kent. In Middlesex there are 21 Urban and Rural District Councils, in Surrey 3 boroughs and 9 Urban and Rural District Councils, in Essex one borough and 13 Urban and Rural District Councils, in Hertford 5 Urban and Rural District Councils, and in Kent 8 Urban and Rural District Councils, whose districts are wholly or partly included within the area of Water London. No one suggested before that it would be desirable, or even possible, to divide the sources of supply and the works of distribution between these 60 Local Authorities; and they dismiss this alternative from further consideration. It was, however, suggested that severance and division might be effected between the six counties comprised in the water area.

The only witness who attempted to formulate any scheme for dividing the sources of supply and works of distribution between the Metropolitan counties was Sir Alexander Binnie. His suggestions, however, negatived the desirability, and even the practicability, of severance in the case of all those counties. Moreover, he stated that, as a Water Engineer, "he would not advocate such a severance from the point of view of economy in the administration and construction of the works;" and that, in his opinion, "the objections to severance, and its cost, would lead the outside counties to take water in bulk from the County of London—contenting themselves with taking over the distribution of that water in their own districts." Furthermore, he made no estimate of the cost of the schemes of partition he put forward. The details involved in this matter were too intricate and technical for the Commissioners to deal with in their report. The conclusion they arrived at is thus stated: "Although severance of the works and sources of supply of the several Companies, and the division thereof between the Councils of the six counties within the limits of supply, are not actually impracticable, they would be very difficult and highly undesirable. They will involve needless waste and expense, and can only be carried out with constant friction in working details, and at a greatly increased cost of management. All the advantages and economies of concentration and amalgamation will be sacrificed; it will become increasingly difficult to deal with future wants; and no compensating advantage will be secured. Moreover, it must be borne in mind that county boundaries are not stereotyped. Revision of areas has taken place; and the county of London might extend."

This conclusion has a decisive bearing on the question as to what authority should acquire and manage the undertakings of the Water Companies. At present, only one authority has proposed to acquire them—viz., the London County Council; and the Council are pledged to effect a severance of the undertakings, after purchase, between themselves and the five Metropolitan counties, whose representatives appeared determined to insist on being cut off altogether, for both the supply and the distribution of water, if the undertakings were acquired for London. The Commissioners attached great weight to the objections of these authorities to being placed under the control of the London County Council, in consequence of the large proportion of the water-consuming population which is under their jurisdiction, and not under that of the Council. At the present time, it is between one-fifth and one-fourth of the whole population supplied by the Companies. It is increasing at a very much more rapid rate than that of the population of London proper; and when the population of Water London reaches the large figure of 12 millions already mentioned, the Commissioners think it is very possible that the population of this Outer Ring for which the additional quantities of water are wanted, may fully equal that of the Administrative County of London. Inasmuch, therefore, as all the Metropolitan counties, except Hertfordshire, are bent on demanding what the London County Council are pledged to concede, they consider that a purchase by the Council of the water undertakings must necessarily be followed by severance and division of the works of supply and distribution into five distinct portions, which appears to them to be open to so much objection as to be practically inadmissible. On this ground, among others, they have come to the conclusion that the Council should not be the purchaser.

The Commissioners next deal with some of the "other reasons" which led them to their conclusion. In the first place, the Council, or their

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responsible advisers, are opposed to the use of Thames water for the future supply and the increased needs of London. The opinion of Sir Alexander Binnie in 1892 was that the open River Thames, as well as the Lea, should be entirely discarded as sources of supply for drinking water, and that the whole of the water to be used in London should be derived from some other source. In his evidence before the Commission, he modified this expression of opinion to some extent. He stated that, Parliament having sanctioned the taking of 185½ million gallons a day from the Thames, and such supply being for the next 10 or 15 years an absolute necessity, although it was not the mode in which he should advise the water supply of London to be derived, he must accept it; and that, if the County Council purchased the water undertakings, they would be obliged not to abandon that source of supply. At the same time, he thought that, as the Thames received what he called the clarified sewage of a million of people, water supplied from this source was always liable to be the cause of disease, and might produce an epidemic. He should therefore advise that no more water be derived from the Thames, as the risk was too great, and that the existing supplies should be supplemented by obtaining water from Wales. The Water Committee of the Council, in 1896, condemned the Staines reservoirs scheme, which they said would not be further proceeded with if they purchased the water undertakings. The subsequent actions of the Council in introducing their Purchase and Welsh Supply Bills show that their policy is unaltered.

The Commissioners remark that there is, no doubt, much to be said in favour of procuring, for the use of London, a supplementary source of pure water, drawn either from Wales or from some other quarter; but they reiterate their previously expressed opinion that the supplies to be obtained within the watersheds of the Thames and Lea are sufficient in quantity for many years to come, and that, given effective conservancy of the rivers, and adequate treatment of the raw water, the wholesomeness of the supply can be maintained. They think that to cast aside this source of supply for the future, and to incur at once the far larger expenditure involved by the Welsh scheme, is "needlessly to aggravate the financial difficulties which must attend the purchase of the water undertakings, and to throw an unnecessary burden on the present and next generation of water consumers and ratepayers, and their immediate successors." They lay special stress upon the fact that the policy of the Council includes severance of the water undertakings between themselves and the Metropolitan counties; so that the expenditure involved in the Welsh scheme would apparently have to be borne by the County of London alone, and would be incurred in order to provide water, not for the whole population of Water London or Greater London, but solely for the population of the county.

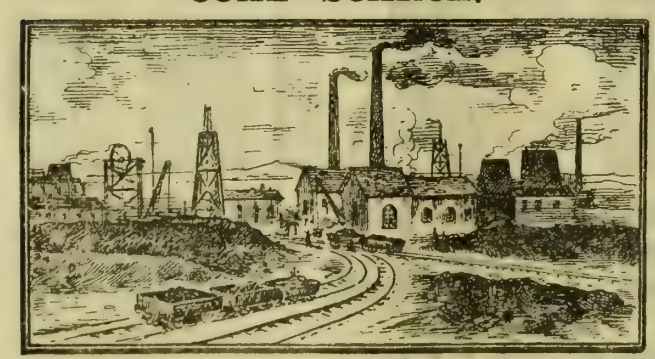
The Commissioners are of opinion that the Council "will probably have to face the expenditure they contemplate with a diminished water income." They point out that one of the grievances which to the water consumer is probably the most acute, arises from the varying rates which the Companies are entitled to charge; and they say it will be difficult, if not impossible, to maintain these rates "if the purchaser is an elected body equally representing all the districts of London, which will have equal claims to consideration." They think, therefore, the Council would very speedily find themselves driven to reduce the charges to the lowest level. It was estimated before the Commission that to bring down the rates of the different Companies to the level of the West Middlesex Company's statutory charges, which are 10 per cent. above those at present in force, would mean a loss of water income amounting to £161,155 per annum in the Administrative County of London; and if the same levelling down took place throughout Water London, the loss of income would be approximately £250,000 per annum. In a previous portion of their report, the Commissioners pointed out that, in their judgment, even the existing rates will be probably insufficient to meet the interest and sinking fund charges involved in purchase; and the further deficiency above alluded to would have to be met out of the general rates, which would be increased by something more than 1d. in the pound in the County of London alone. If London is isolated from the adjoining counties by the suggested severance, it will only have to meet the deficiency of £161,155; but, on the other hand, it will lose the advantage of charging outside districts more for their water than is paid in London itself—an advantage of which many provincial corporations supplying outside districts have availed themselves to eke out their water revenue. In any case, the period at which the purchase could become remunerative would be postponed.

Having set forth their reasons for coming to the conclusion that the London County Council should not be the purchaser of the water undertakings, the Commissioners approach the more difficult task of reporting what authority or authorities should, if the policy of purchase were adopted at all, acquire and manage them. The portion of the report in which this task is accomplished has already been given in full (*ante*, p. 216); and the remainder will be dealt with next week.

The Lancaster Town Council last Wednesday authorized the appointment, by the Gas Committee, of an Assistant Gas Manager; and the advertisement for the position appears elsewhere to-day.

The correspondent at Athens of "Sell's Commercial Intelligence" says the two great needs of the city are better paving and water supply. During the summer months, there is a great deal of dust which could be diminished if there were enough water for sprinkling the streets. But there is such a lack of it from April to October, that the people are obliged to get a small supply from distances, at great cost. So much has been said about it in Parliament and the Press that the Government sent for one of the Professors at the Polytechnic School in Paris, who went to Athens about two months ago and studied the place to see if it was possible for the town to be supplied with the waters of the Stymphalia and another lake. He is now preparing his report on the subject. The correspondent says bringing the water of any one of these lakes, which are many miles distant from the city, is a very important undertaking, the execution of which is estimated to cost about a million pounds. He calls the attention of those engaged in this line of business to the present opportunity, which he thinks should not be neglected.

COAL SCARCE.



There is a tide in the affairs of men (and Gas Departments), which, taken at the flood, leads on to fortune.
Julius Cæsar IV., 3.

STOVES PLENTIFUL.



NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The thanks of gas managers are due to Mr. A. R. Cawley, of Llanelly, for the courageous way in which he has come forward to assist in thwarting the attempts of the Gas Workers' Union to gain the ascendancy in the management of the Glasgow Gas-Works. The community of Glasgow have a big stake in their gas-works, and the management of them is a matter which they ought to guard jealously. I write as a Communist in this matter. The population of Glasgow is over 700,000; and the gas workers are only a few thousands. Therefore, in the interests of the community, it is necessary that the wages paid in the gas-works should not be above the standard which can be commanded by men in the same grade of life in other industrial works in the city. This is not the tenet of the Gas Workers' Union. Their object is rather, by raising the pay of Corporation employees, to obtain a lever by which to secure better wages for workmen outside. On paper, this is quite a laudable policy; but its weakness is manifest when Communism is brought into consideration. Wages may be raised, but they cannot be kept up, artificially; and if ten, or a hundred, labourers are to be taxed, or in the case of gas supply charged more than is meet, in order that one labourer may live in greater comfort than themselves, the proposition is practically reduced to an absurdity. I know that no amount of theorizing, such as my views are, will have effect with those who have positions to maintain (Unionist leaders) or votes to capture (municipal "magnates"); but the truth remains on my side. The contest for supremacy between those who advocate the claims of the Union and those who say that the citizens' interests should be first, may be a long, even an interminable one, so long as human impressionability exists; but it is clearly the duty of all who have the welfare of the general body of citizens at heart to resist attempts at sectional aggrandizement. It is in this connection that the value of Mr. Cawley's intervention is manifest. There was no call upon him to get into the breach at Glasgow; but he has been actively engaged at Llanelly in quelling the forces of financial disorder, and he has valorously come forward to assist in a case where the same people are directing their energies against another body. Mr. Cawley's letter, the principal portions of which are published in another column, lets daylight into some of the methods of procedure of the Union in a way which could not be done by reasoning, because he cites facts in support of his attitude. The letter speaks for itself. In place of further comment upon it, I would suggest that, seeing he has "come to Scotland" in this matter, he might be invited to more literally come down next July to the meeting of the North British Association of Gas Managers, and there, even if he should not contribute a paper on the relations of employees and employers, receive the thanks in person of his brother managers in the North for his fearless resistance to Trade Union tyranny.

The concluding sentence of the last paragraph leads me to the remark that I observe that you have issued the annual volume of "Reports of Proceedings of Associations of Gas Engineers and Managers during 1899," but that, so far as I am aware, the "Report of Proceedings of the North British Association of Gas Managers" is not yet out. If it has been issued, I have not seen it, nor heard of it; and as the meeting took place at the end of July last, it surely should before now have been in the hands of those who are interested in it. I should mention, however, that the Association appoint a Committee of Revisal, who determine what is to be published; and it may have been found to be difficult to get them together.

The Edinburgh and Leith Gas Commission held their monthly meeting on Monday. The Commissioners made a very fine bargain in coal for the year which is current; but they cannot get delivery of it. What may come afterwards is for the future to divulge. In the meantime, the supply of gas must be kept up; and the Commissioners, yielding to that necessity which knows no law, have issued an advertisement to the effect that they are prepared to receive tenders for splint to the amount of from 6000 to 8000 tons. It is not a great quantity—being only about one-twentieth of the whole year's consumption; but it is evident either that the Commissioners have run down their stocks to a level which it is not desirable to reach, or that they wish to lay in a store, for the delivery is to be within the succeeding four weeks. It is a sort of flag of distress hung out. The Commissioners have been "had" in the matter of coal this year, through circumstances which they could not have foreseen. Their ability to get out of the difficulty will now be seen. They do not give much time to offer; for the tenders must be in by Thursday of next week. Into the merits of the matter, I do not enter. There may be a rush to tender, or there may not. If there is, the conclusion to be come to is that the present period of inflated prices is about to come to an end, which is what I expect. If there is not, the converse is not necessarily to be accepted, because there are other elements to be taken into account. But the Edinburgh trouble, to those who may be favoured to know how it works out, will be a most opportune touchstone in the matter of coal contracting for the financial year which will begin in May.

One of the ordinary items before the Commission was the report of the Engineer (Mr. W. R. Herring). From this, it appeared that during December last the amount of gas made at the Edinburgh works was 188,414,000 cubic feet, as compared with 169,086,000 cubic feet in the corresponding month of the previous year; that at the Leith works the amount made was 82,037,000 cubic feet, as compared with 80,374,000 cubic feet in December, 1898; and that at the Portobello works there was 7,301,100 cubic feet made, as compared with 6,788,000 cubic feet in the corresponding month of the previous year. Another fact brought out in the report was that at the Edinburgh and Leith works, though not at Portobello, the average price of coal per ton was considerably higher than it was in December, 1898. As a result, the cost of coal per 1000 cubic feet of gas made was: At the Edinburgh works, 14·84d., as against 12d.; at the Leith works, 14·57d., as against 12·31d.; and at the Portobello works, 14·25d., as against 14·26d. Mr. Kinloch Anderson, in submitting the report, laid emphasis on the fact which it brought out—that during last December the amount of gas made showed an increase of 21½ million cubic feet, or equal, over the several works, to an increase of 8·39 per cent. At the Edinburgh works alone the increase was 11·43 per cent., at Leith it was 2·07 per cent., and at Portobello it was 7·56 per

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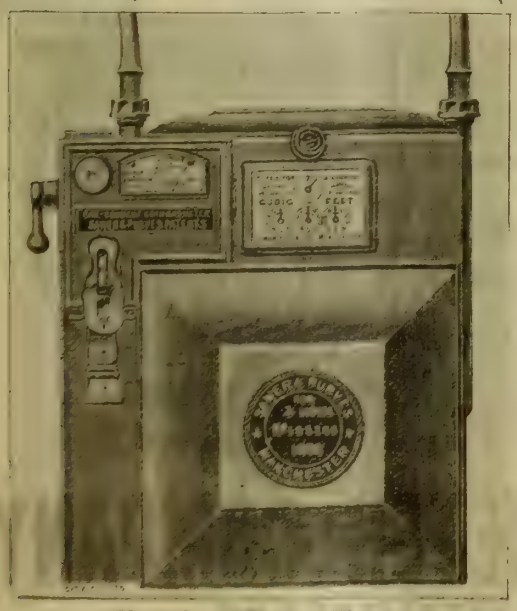
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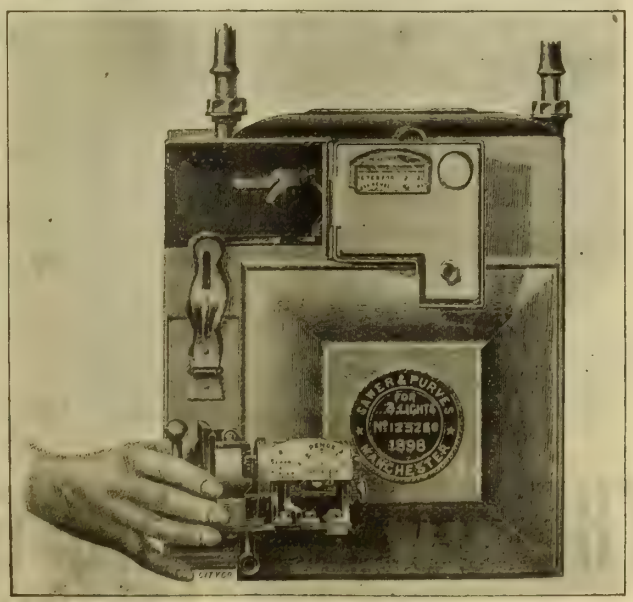
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cent. Since the 16th of May, the beginning of their financial year, the increase had been 65,550,000 cubic feet; being an increase on the average of that period of 6·38 per cent. This, he thought, was a marvellous increase.

The second of the large gasholders at Maryhill which have been erected by the Corporation of Glasgow is nearing completion, and will be in use at an early date. The Contractors for the excavation of the tank (Messrs. John Paterson and Son, Limited, of Glasgow) have made a claim upon the Corporation for £10,000 or £12,000 in connection with their work. The claim is the subject of litigation in the Glasgow Sheriff Court. The same Company were the Contractors for the excavation of the tank for the large gasholder at the Tradeston works of the Corporation; and there, also, they made a claim for payments over and above the contract price, which went to arbitration. The Company are at present, in the Court of Session, endeavouring to have reduced the award given in an arbitration which they had with the Corporation with reference to sewage works they executed for them.

The gentlemen who supply gas to the community of Glasgow have got a certificate of character from Mr. R. R. Tatlock, the Public Analyst for the city. Complaints have been made of late regarding the gas; and the Magistrates have called upon the Gas Committee for an explanation as to why the minimum illuminating power has been so low. Mr. Tatlock's report for the year shows that at the three stations of Dawsholm, Dalmarnock, and Tradeston, the average illuminating power was, respectively, 21·19, 20·92, and 21·23 candles. The maximum tests were 22·58, 22·84, and 25·13 candles; and the minimum, 18·63, 17·61, and 19·37 candles. The standard illuminating power is 20 candles; but the endeavour is to supply gas of at least 1-candle power above that. It will be seen that the average at all the works is above the standard, but that at each there were occasions when the standard was not reached. These, according to Mr. Tatlock, were very few. They were due, most probably, to the great run upon gas during foggy or dull weather, of which there has been a great deal of late. In Mr. Tatlock's opinion, very little can be said against the gas officials, seeing that only two or three slight defects had been recorded against them out of about 450 tests. The percentage, he considers, is very small indeed. It will be observed that the lowest readings were at Tradeston, and the highest at Dalmarnock. Some may be inclined to seek for a reason for this. There may be reasons—such as the supply of particular coal, and the like—which are only known to those inside; but beyond that there is this to be said, that the three works differ in important respects, each from the other. There is oil enrichment at Dawsholm; and there is mechanical stoking both there and at Tradeston. Tradeston and Dalmarnock are coal supplies; but at the latter the stoking is done by hand. I think it is in accordance with experience everywhere that while machinery increases production, and cheapens it, it also deteriorates the quality of the product. Hand-set type produces better printing than can be got from type set by any of the machines on the market. Hand-made paper fetches a higher price than does machine made. Even in agriculture, a better crop is got after tillage by the spade than by the plough. Yet there is little prospect that machine-setting of type will be abandoned, or that paper makers will return to the hand machine, or farmers to the spade. Mechanical stoking is a rougher method of laying coal than is hand stoking; and I take it for granted that it will not yield such good results. But the advantages of mechanical stoking are so great, in other respects, that no one would seriously consider a proposal to go back to hand stoking. After all, suppose my assumption to be correct, the difference in illuminating power shown here is not much; and I should say that any loss on this score is more than counterbalanced by savings affected otherwise.

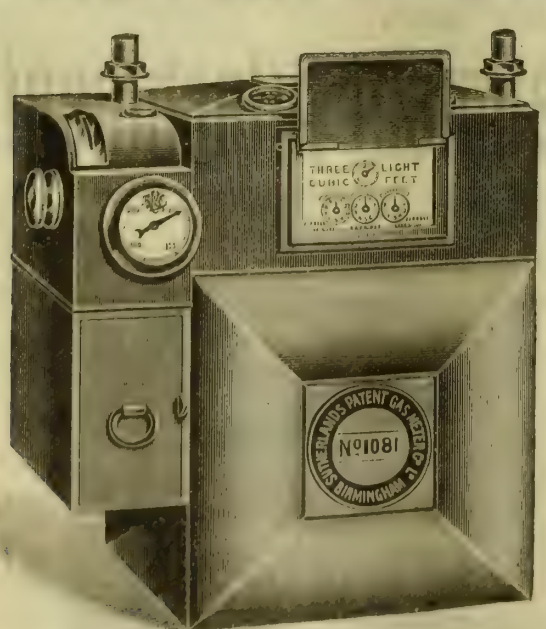
A peculiar water question has arisen at Campbeltown, in Argyllshire. The whole district is owned by the Duke of Argyll. There are numerous distilleries in it; and to these the Duke has given a supply of water. He has done the same for the town; but the town water supply does not rise to the higher levels. The Burgh Commissioners accordingly approached the Duke with a request to be allowed to make a temporary connection with the main which supplies the distilleries, until a reference which is pending should be decided. The Duke of Argyll has refused the request, and has given it to be understood that he will not break the engagement which has existed from the beginning, by which the distillers' supply is separate from the domestic supply. This reply has given great offence to the Commissioners, who, at a recent meeting, freely vented their indignation. When it is stated that the scarcity of water in the town arises from the mains being incrusted, and of there being a leak which cannot be located, and when account is taken of the fact that the distilleries hold their properties on very strict conditions as to water supply, it cannot be said that the Duke of Argyll is unreasonable in the matter. He has provided, he says, a supply of water per head of the population equal to that of any town in Scotland; and he holds it to be the duty of the Commissioners to see to its distribution. Besides, it is easy to understand that, if he were to interfere with the supply to the distilleries, his revenue from them would be affected. The question is whether it is the Duke or the community who are to lose money over the remedying of the town water supply. It has been left to the Water Commissioners to take such action as they may think necessary.

Water Supply in Sydney.—According to the "Builder," the works in connection with the Camden water supply, carried out by contract at a cost of about £8000, under the supervision of the engineering branch of the Water and Sewerage Board, are now completed. A circular concrete tank, having a holding capacity of 100,000 gallons, has been built on the banks of the Sydney water-supply channel at Kenny Hill. This is connected with the tank by a 15-inch pipe. The top water-level of the tank is about 140 feet above Camden; giving a pressure of 60 lbs. to the square inch. From the tank an 8-inch main, some 5¼ miles in length, has been laid, and it crosses the Nepean River into Camden. Here it is reduced to 6 inches in diameter; and branch mains therefrom, 4 inches in diameter, are laid along all the streets of the town where the estimated revenue warranted the expenditure. Altogether about 6½ miles have been laid, and fire hydrants have been fixed throughout the towns of Camden and Narellan.

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LIVERPOOL, *Feb.* 3.

Sulphate of Ammonia.—The market has been quiet throughout the week; and the closing quotations are £11 12s. 6d. to £11 15s. per ton, delivered f.o.b. at the ports. January contracts being covered, buyers seem disposed to wait in regard to February. On the other hand, the large makes are being delivered against contracts previously entered into; while the smaller producers, having only current production to deal with, have been under no pressure to sell. Everything offered, however, has found a market at slightly declining values. There has been but little doing in the forward position; consumers not being much interested. Makers' quotations remain at £11 16s. 3d. per ton London, Beckton terms, delivery over the spring months, and £11 17s. 6d. per ton, ordinary terms, f.o.b. Leith; but there are second-hand sellers at less money.

Nitrate of Soda has advanced in all positions, and the closing spot quotations are 8s. 6d. per cwt. for ordinary, and 8s. 9d. for refined, quality.

LONDON, *Feb.* 3.

Tar Products.—There is a better inquiry for pitch; and it looks as if this product may improve in value. There is no change of moment in benzol; but 90's, perhaps, are a shade better in request. For naphthas a fair demand exists; and prices are maintained. Tar oils are steady. Carbolic acid is much stronger, notwithstanding the prohibition as to exportation. Anthracene continues weak. There is some inquiry for pressed naphthalene, which is somewhat scarce.

The week's prices are: Tar, 17s. to 26s. Pitch, east coast, 35s.; west coast, 33s. Benzol, 90's, ordinary, 7d.; special qualities for gas, 8½d.; 50's, 10d. Toluol, 90's, 1s. 2d.; pure, 2s. Solvent naphtha, 1s. 3d. Crude, 30 per cent., naphtha, 4½d. Heavy naphtha, 1s. 2d. Creosote, 3¾d. Heavy oils, 3¾d. Carbolic acid, 50's, 2s. 6d.; 60's, 3s. Crude naphthalene, 52s. 6d. Anthracene, nominal, "A," 4d.; "B," 2½d.

Sulphate of Ammonia.—The effort to depress this market has not succeeded; but there has been a wide difference in the offers put forward by buyers during the past few days. The market closes to-day strong, and value may be taken at £11 15s. to £11 17s. 6d., less 3½ per cent.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—No change in the position of the coal trade of this district can be reported so far as prices are concerned; these continuing quite as strong as ever, with special rates ruling in the open market for outside supplies. There is perhaps, however, not quite the same scarcity either of round coals or engine fuel that has been so noticeable a feature since the commencement of the year; but collieries have still quite as much as they can do to keep up deliveries of the requisite quantities to their regular customers, and there is very little offering in the open market, with this only obtainable where buyers are prepared to pay above the basis of list rates. The better qualities of round coal are only in moderate request for house-fire purposes, and collieries are now generally getting straight with their order books. But where they have any surplus quantity which is not going away for house-fire purposes, this is readily disposable as steam coal at the full house-coal prices—many works, in fact, having only been prevented stopping by purchasing house coal for boiler purposes. Supplies of ordinary steam and forge coals continue very short; and the same also applies to engine fuel so far as Lancashire collieries are concerned. But from some of the outside districts the lower qualities of slack have been coming in more plentifully during the past week. Prices remain strong, at the full quotations of 14s. 6d. to 15s. per ton at the pit for best Wigan Arley, 13s. to 13s. 6d. for Pemberton four-feet and seconds Arley, 12s. to 12s. 6d. for common round coal, 10s. 6d. to 11s. for best engine fuel, 9s. 6d. to 10s. for medium sorts, and 9s. for common slack. The pressure of demand for shipment reported last week is quite as great as ever; and considerable quantities of house coal have been sent away to the ports as steam coal—fetching from 16s. 6d. to 17s. per ton delivered at the ports. Ordinary steam coals average about 16s. per ton. The Lancashire Coke Makers' Association have not definitely advanced their list rates; but there is a very heavy demand for all descriptions, and they are able to get above nominal basis quotations. Ordinary furnace cokes range from 23s. to 23s. 6d., and foundry cokes about 30s. per ton at the ovens.

Northern Coal Trade.—There is a rather better tone in the coal trade; but prices are down on the comparison with a week ago. Best Northumbrian steam coals are 18s. to 19s. per ton f.o.b., with a fair demand—indeed, a very full one for this season of the year. Steam smalls are about 10s. 6d. to 11s. per ton. Prices of gas coal vary greatly now—as much as from 16s. to 17s. 6d. per ton f.o.b. being paid for best Durham qualities; but little is sold at these figures. There are, however, contracts in course of arrangement, for which it is said that about 15s. per ton f.o.b. is likely to be the price fixed. The manufacturing coal trade is very steady, and deliveries are now being freely made. Coke is firm, and the tendency of prices is upwards. The gas coke trade is steady; and the current quotation for export is about 16s. per ton f.o.b. There is, however, considerable fluctuation in the actual prices paid.

Scotch Coal Trade.—The coal trade still remains as it was. There is a great home demand; and the foreign business is growing, for reasons which need not be specified. There seems, however, to be a check upon the upward advance of rates; and the probability is that the high-water mark in this respect has been reached. The prices quoted are: Main 14s. to 14s. 6d. per ton f.o.b. Glasgow, ell 15s. 6d. to 16s. 6d., splint 15s. to 15s. 6d. The shipments for the week amounted to 190,256 tons—a decrease of 11,061 tons upon the previous week, but an increase of 36,038 tons upon the corresponding week of last year. For the year to date, the shipments have been 595,367 tons—an increase of 9417 tons on the same period of last year.

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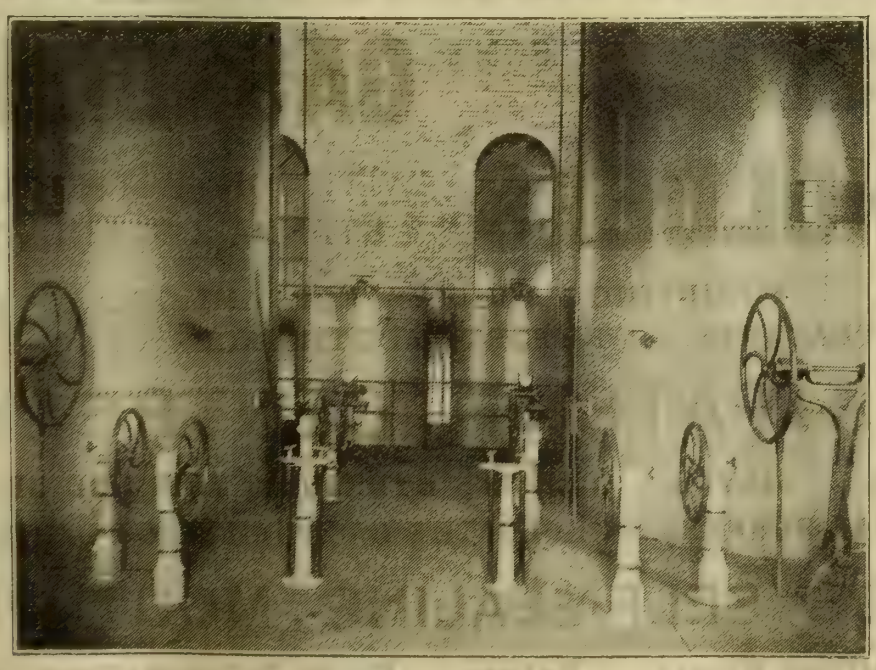
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New Loan for Gas-Works Purposes at Stockport.—Last Tuesday, Colonel A. J. Hepper, of the Local Government Board, held an inquiry into an application by the Stockport Corporation for sanction to borrow £10,000 for the purpose of extending the gas-mains, purchasing meters and stoves, erecting a stove-repairing shop, and making other gas-works improvements. The proposals and estimates were fully explained by the Engineer (Mr. S. Meunier).

The Price of Gas in Provincial Towns.—In the statistics tabulated by Mr. James Carter, the Borough Treasurer of Preston, relating to the rates and gas and water charges in various provincial towns, from which some particulars were given in the "JOURNAL" last week, he credits Carlisle with selling gas at the lowest price—viz., 1s. 3d. per 1000 cubic feet. This is obviously a misprint for 2s. 3d.; the figure attributed to Carlisle really, as our pages have recorded, having reference to Widnes, which, curiously enough, does not appear in Mr. Carter's list of towns.

The Ilfracombe Water Bill.—A poll of the owners and ratepayers of Ilfracombe was taken last week with reference to the Bill which the District Council are promoting for the extension of the water supply. The result was that 1485 votes were given for the Bill, and only 155 against it. Some feeling was created by the action of certain of the promoters in sending out with the voting-papers circulars in favour of the Bill. The Chairman of the District Council (Mr. W. Walters) called a meeting at which he disclaimed any knowledge of this proceeding. A question has been addressed to the Local Government Board as to the legality of the vote under the circumstances.

Gas-Works Affairs at Cowes.—The Cowes District Council last Tuesday received from the Special Gas Committee a report in which it was stated that, as the result of two years' working of the gas undertaking, a net profit of £146 had been realized. Last year, after six months' working, there was a net loss of £160 on the works. For principal and interest, £5068 had been paid. Mr. Baring said he was sure the financial statement must be very gratifying to the members. He thought the Committee might say they had seen the worst of their difficulties, and that there was a period of prosperity before them. The satisfactory result was an answer to those people who said the gas-works would be a source of loss to the Council. Mr. Snellgrove thought some of the shareholders in the late Gas Company would think they had not been paid enough for the works. One thing the Chairman of the Committee had forgotten to mention was that the farther they looked into the works, the more dilapidated they found the plant. Mr. Brown also congratulated the Committee on successful management, and was glad to know they proposed further expenditure on purifiers. His own opinion was that the increased consumption would pay for the increased outlay. Mr. Fellows, senior, said it was very satisfactory to hear the congratulations of the members; while 16 million cubic feet of gas per year were made by the old Company, 31 million cubic feet had been manufactured during the past year under the management of the Council. The report was adopted. The Clerk read a letter from the Local Government Board, sanctioning the payments made during the year by the Gas Committee. This has reference to the paragraph on the subject which appeared in the "JOURNAL" for Jan. 2 (p. 45).

The Public Lighting of Plymouth.—Incandescent gas lighting is being gradually extended in Plymouth, and the local papers are discovering that the streets to which it is applied are the best-lighted thoroughfares in the town, and that the system is less expensive than any other. The wonder is, says one of the papers, that incandescent gas lighting is not more generally employed in the streets, now badly and expensively lit with burners of the ordinary type.

Narrow Escape from Gas Poisoning at Govan.—A narrow escape from poisoning by coal gas occurred at a house in Blackburn Street, Govan, last week. A labourer named King found his wife and a lodger, in separate rooms, lying in a state of unconsciousness, from having inhaled coal gas. They were attended to by a doctor, and both recovered. It is stated that the gas-pipes in the rooms below those in which they lived had been gnawed through by rats.

Prepayment Meter Collections in Manchester.—At the meeting of the Gas Committee of the Manchester Corporation last Friday, the Superintendent of the Gas Department (Mr. Charles Nickson) submitted particulars respecting the amount in pence collected during the preceding week from the prepayment meters of the Corporation. They showed that £958 11s. 5d. was taken from 5846 meters, or an average amount of 3s. 3d. from each; the last-named amount representing 1170 cubic feet of gas at 30 feet for 1d. The sum of £958 11s. 5d. would be represented by 230,057 pennies, weighing 4601 lbs. avoirdupois, or 2 tons 1 cwt. 9 lbs.; and it was collected by 32 inspectors—144 lbs. weight by each man. On the same occasion, the following general information was afforded: That 50 pennies weigh one pound avoirdupois; in £5 sterling there are 1200 pennies, weighing 24 lbs.; and in £100 sterling there are 24,000 pennies, weighing 480 lbs., or 4 cwt. 1 qr. 4 lbs. A ton of copper contains 112,000 coins, worth £466 13s. 4d.

Sales of Shares.—At the Mart, Tokenhouse Yard, E.C., last Tuesday, Mr. Alfred Richards sold, by order of the Directors, £2968 of new ordinary 7 per cent. stock of the Wandsworth and Putney Gas Company. The last dividend on similar stock was at the rate of 12½ per cent. per annum; and the new issue fetched from £255 to £260 per £100 of stock. Some "A" stock of the Ilford Gas Company, bearing 6 per cent. dividend, was sold at £139 per £100; a parcel of "B" stock (last dividend 4½ per cent.) fetching £109. A new issue of 4 per cent. debenture stock and 500 additional £10 shares (5½ per cent. dividend) in the Lowestoft Water and Gas Company were also sold—the stock at £114 to £119 per £100, and the shares at prices ranging from £12 10s. to £12 17s. 6d. each. At Eastbourne, on the same day, Mr. J. E. Towner sold eight original £10 shares in the Eastbourne Gas Company (last dividend 14½ per cent.) at £32 12s. 6d. each; 25 similar shares fetching £32 10s. apiece. Six "B" £10 shares (last dividend £11 10s. per cent.) were sold at £24 7s. 6d. each; and four similar shares at £24 10s. An additional ten "B" £10 shares fetched £24 15s. each. At a sale at Southsea yesterday week, £10 shares in the Portsmouth Water-Works Company realized £28 10s. each; £5 10s. per cent. 1861 and 1868 issue shares, £13 10s. each; £5 7s. per cent. shares, 1879 and 1883 issues, from £8 10s. to £8 17s. 6d. each. Last Thursday, Messrs. Waterman and Sons disposed of five original £10 shares in the Maidstone Water Company, at £19 10s. each.

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Chicago Water Supply.—We learn from the "Engineer" that the new tunnel for the water supply system of Chicago has been completed. The tunnel includes one length under Lake Michigan and two lengths under the city. The whole system includes about 12½ miles of tunnel, a new intake shaft, and two new pumping-stations. It has been under construction for five years, and has cost about £800,000.

Checking Waste of Water at Guildford.—At the meeting of the Guildford Town Council last Tuesday, the Water Committee reported that, with a view to placing a check upon the excessive use of water, they had directed that in some instances where water had hitherto been supplied at a special charge, it should in future be supplied by meter; and that they had in other cases, where water was taken by meter, increased the minimum sum to be paid in future by the consumers.

The Quality of the Bolton Water Supply.—In consequence of the receipt of a communication from the Local Government Board, in which serious allegations were made against the purity of the water obtained from portions of the Bolton watershed area, the Water Committee of the Corporation have retained Professors Dixon and Delepine to make monthly analyses, both chemical and bacteriological, of the supply, while rigorous measures are also being adopted to prevent pollution.

Holywood Water Supply.—Mr. P. C. Cowan, one of the Inspectors of the Local Government Board, recently held an inquiry at Holywood relative to an application of the District Council for a loan of £2000 to enlarge and extend their present water-works. Mr. A. J. M'Kisack attended on behalf of the Council. There was no opposition. Mr. M'Kisack briefly explained the proposed scheme, after which he examined Mr. L. L. Macassey, Engineer to the Council, who produced the plans and specifications, and showed that by excavating the sides and bottom of the existing reservoir, about forty days' extra supply of water would be added to its present storage capacity. He believed a sum of £2000 would cover the cost. The Town Clerk (Mr. J. H. Barrett) was then examined, and proved the amount of loans at present outstanding against the Council, which came to £7594. The borrowing power of the Council was, he said, upwards of £23,000. He also gave details of the rates levied during the past year, and other statistics connected with the town, showing the necessity for the extension of the water-works. The Inspector expressed himself as satisfied with the evidence tendered, and said he would report favourably on the scheme. He subsequently visited the works, where he made a personal inspection of the proposed extension.

The Monaghan District Council have applied to the Local Government Board (Ireland) for a loan of £8000 required to carry out a proposed water-supply scheme.

Messrs. Jonas Drake and Son have lately secured the contract for sixteen through beds of nine retorts, with constructional ironwork, &c., at the Middlesbrough Gas-Works.

Messrs. Meldrum Bros., of Manchester, have secured an order for the erection of a destructor and other appliances for the Lancaster Corporation. The amount of the contract is £5025.

At the Hôtel Métropole, Leeds, on Saturday, the 27th ult., the whole of the staff of Messrs. Graham, Morton, and Co. held their annual dinner and smoking concert, which was a great success.

Among the offers which have been accepted for the alterations at the Inverness Gas-Works are, for the retort-bench, Mr. R. F. Hislop, of Paisley, £2035; and for condensers, Messrs. W. C. Holmes and Co., of Huddersfield, £550.

The new works of Messrs. Thomas Glover and Co., at Edmonton, are fast approaching completion; and by an arrangement with the Middlesex County Council the firm, as already recorded, erected a testing-station, with apparatus, and are to pay a fee for each meter tested by the officers, who are to be appointed by the Council. As the buildings will be ready by the end of March, the Council are advertising for an inspector, four assistants, and a labourer.

The annual dinner of the employees in the Meter, Stove, and Stores Department of the Leeds Corporation was held at the Grand Restaurant, Leeds, on the 27th ult. After a substantial repast, the evening was spent in a most enjoyable manner, with songs, recitations, and musical entertainments. During the evening, the men were addressed by Mr. Ratcliffe, Chairman of the Workshops Committee of the Corporation. In response to a recitation of "The Absent-Minded Beggar," by Mr. James Seymour, a collection was made on behalf of the Lord Mayor's Fund for the widows and orphans of the forces in South Africa. A most enjoyable evening ended by the singing of the National Anthem.

At the meeting of the Blackburn Town Council last Thursday, a long discussion ensued upon a recommendation of the Gas Committee, approved by the General Purposes Committee, that the salary of the Gas Engineer (Mr. S. R. Ogden) be advanced by £100 per annum. The proposal was contested by the Labour and Socialist members, who contended that, though the subject had had the advantage of a discussion in Committee, no adequate reason had been advanced for granting the increase, which, they further submitted, was not warranted by the efficient or profitable working of the gas undertaking. The Chairman of the Committee (Alderman Thompson) having replied to the criticisms of the proposal, the recommendation was carried with only seven dissentients.

The Board of Conciliation and Arbitration in the North of England iron and steel trade held their annual meeting last Tuesday, in Newcastle-on-Tyne—Alderman William Whitwell presiding. The annual report showed that there were 13 works in membership, owned by nine firms. The number of subscribing operatives was 5076, being an increase of 410 in the half year. The receipts during the year were £991, and the balance in hand was £355, or £36 less than at the beginning. Several claims and disputes were settled by the Board during the year. Three ascertainments of the average net selling price of finished iron had been made since the half-yearly meeting of the Board in July, each one giving an advance of wages under the sliding-scale arrangement. There was an advance of 2½ per cent. on Aug. 31, of 2½ per cent. in October, and of 5 per cent. in December; making 10 per cent. in all. The steel workers' wages advanced 2½ per cent. in October, and 5 per cent. later on.

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Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

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[For Illustrated Advertisement, See p. 366.]

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Applications, stating Age, Experience, and when Applicant could take up duties, together with *copies* of not more than three Testimonials of recent date, and endorsed "Gas-Works Foreman," addressed to the Chairman of the Gas and Water Committee, to be delivered to me at my Office not later than the first post of the 12th of February, 1900.

W. W. SHIRLEY,
Clerk to the Council

Town Hall, Earlestown,
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BY the Derwent Valley Water Act, 1899, the Derwent Valley Water Board are authorized to construct six large Reservoirs in the Valleys of the Derwent and the Ashop in Derbyshire, together with important subsidiary Works in connection therewith to deal with an estimated flow of Fifty Million Gallons of Water per day. The Reservoirs will be constructed successively; and the execution of these and the other authorized Works is expected to occupy many Years.

Applications are now desired for the position of ENGINEER to the Board. The Engineer will be responsible for the Designing and Construction of the Works. He will be required to reside in the neighbourhood of the Works, and to devote the whole of his time to his duties under the Board, and to have daily personal charge of the work in hand. The staff of Assistants, Inspectors, Draughtsmen, Clerks, and others necessary in the carrying out of the work will be provided by the Board, and be under the direction of the Engineer.

The engagement will (subject to the services rendered being satisfactory) be certainly until the first two Reservoirs are completed (this work it is estimated will take some Ten Years to carry out), and may be a permanent one. The Engineer on his part will be required to enter into an agreement to remain in the exclusive service of the Board until the first two Reservoirs are completed. The Board reserve the power of determining the engagement with the Engineer on giving him Six Months' Notice, in case his services are not considered satisfactory.

It is indispensable that Candidates for the appointment should have had considerable experience in designing and constructing Reservoirs and Gravitation Water-Works.

The Board reserve the right (which they will probably exercise) to appoint, or take the opinion of, a Consulting Engineer or Consulting Engineers on the Works, when and as desired.

Each Applicant must furnish at least two References and *copies* of Testimonials (which cannot be returned, and which preferably should be printed); the Board having the right to call for the production of the originals.

Applicants must state Age, Experience, Present Position, Salary required, when at Liberty, and general state of Health. Personal Canvassing will be a disqualification.

Communications to be sent to me not later than the 10th day of March, 1900, marked on the outside "Derwent Valley Engineer."

JAMES BELL,
Clerk to the Board.

Bowton Buildings, Bowling Green Street,
Leicester, Jan. 17 1900.

CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE.
The Coal Difficulty . . . 391
Coal Miners and the High Price of Coal . . . 392
The Legal Protection of Street-Lamps . . . 392
Concerning the Municipal Civil Service . . . 392
A Plea for Light-Reflecting Street Frontages . . . 393
Another Light that Failed . . . 393
Gas Supply Regulation in Massachusetts . . . 394
Mr. Ritchie on the Housing Problem . . . 394
WATER AND SANITARY AFFAIRS—
The Report of the Water Commission . . . 394
Water Meters for Small Consumptions . . . 395
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market . . . 396
Electric Lighting Memoranda . . . 396
The Press and the Scarcity of Coal . . . 397
A Good Beginning for the Year's Trade . . . 397
A Royal Commission on Municipalism . . . 397
The Ventilation of Tar and Liquor Storage Tanks . . . 398
Various Special Bills for 1900 . . . 399
Recent Publications—"The Local Government Annual and Official Directory;" "The Wonders of Modern Mechanism" . . . 400
Rural Sanitation . . . 400
NOTES:—
The Pneumatic Pyrometer . . . 401
Expanded Metal and Concrete Construction . . . 401
Steam Packings . . . 402
TECHNICAL RECORD:—
The White Deposit on Ceiling-Protectors and on the Chimneys of Incandescent Gas-Burners . . . 402
The Value of Producer Gas as a Fuel . . . 403
REGISTER OF PATENTS:—
Gas Heating-Burners—Mills, B. J. B. (La Société Anonyme des Fontaines à Gaz) . . . 405
Treating Coal and other Illuminating Gases—Colman, H. G. . . . 405
Obtaining Cyanogen Compounds—Mactear, J. . . . 406
Acetylene Burners—Dolan, E. J. . . . 406
Detachable Valve for Gas-Meters—Seymour, J., and Clark, W. J. . . 406
Gas-Engine Exhaust-Silencers—Evans, A. F. . . . 406
Explosion Engines—Smith, H. . . . 407
Patent Notices . . . 407
CORRESPONDENCE:—
The Little Ways of the Officials of the Gas-Workers' Union; Gas Fountains; The Registration of Gas Liquor Works; The Treatment of Spent Acid from the Washing of Crude Benzol; Gas-Stoves and Coal Prices . . . 408
PARLIAMENTARY INTELLIGENCE:—
Private Bills (Session 1900)—Allocation of Bills . . . 409
LEGAL INTELLIGENCE:—
High Court of Justice—Chancery Division—
The Welsbach Incandescent Gas-Light Company *v.* The New Sunlight Incandescent Company . . . 409
High Court of Justice—Queen's Bench Division—
Dewsbury and Heckmondwike Water Board *v.* The Assessment Committee of the Penistone Union . . . 411
Crystal Palace District Gas Company *v.* Idris and Co. . . . 412
The Willenhall Gas Company Fined for Deficient Lighting Power 412
The Incandescent Mantle Remover . . . 412
MISCELLANEOUS:—
Meeting of the Brentford Gas Company . . . 413
Crystal Palace District Gas Company . . . 413
Croydon Commercial Gas Company; Bromley Gas Company . . 414
Provincial Gas and Water Companies . . . 414
Manchester Corporation Gas and Water Supply—The New Gas Engineer; Electrolysis and Its Effects on the Water-Mains . . 416
The Powers of the Massachusetts Gas Commissioners—A Gas Company Ordered to Reduce their Price . . . 417
A Meter-Rent Question at Meltham . . . 417
Leeds Corporation Gas Undertaking—Increase in the Salary of the General Manager . . . 417
Comparison of the Cost of Incandescent Gas and Electric Lighting 418
Electric Lighting Notes . . . 418
The Final Report of the Metropolitan Water Commission . . . 419
Meetings of the West Middlesex, Southwark and Vauxhall, Grand Junction, and East London Water Companies . . . 422
Meeting of the Chelsea Water-Works Company . . . 423
Gas and Water Companies' Stock and Share List . . . 423
Notes from Scotland . . . 424
Current Sales of Gas Products; Coal Trade Reports . . . 426
PARAGRAPHS:—
PERSONAL: Mr. Alfred Lass; Mr. F. Trethewy; Mr. James Lord; Mr. G. H. Stewart: Mr. Matt. Dunn; Mr. John Pickup; Alderman John Lanham Hollis, J.P.; Mr. Joseph W. Buckley; Mr. H. Grundy; Mr. H. Pickford; Mr. E. H. Swaine; Mr. J. Phinn 401
The Action of Acetylene on Copper—Expenditure by Local Authorities on Technical Education—The Retort-House Machinery of the South Metropolitan Gas Company . . . 395
The Society of Chemical Industry and the Metric System . . . 401
The Midland Association of Gas Managers—The Prepayment Meter Collections of the Gaslight and Coke Company—The Export of Carbolic Acid—The Will of Mr. Horatio Brothers—British Association of Water-Works Engineers . . . 402
New Gas-Works at Zurich—The Higham Ferrers Water Bill—Water Supply and Storage at Morley—Gijon Gas Supply . . . 407
Gainsborough Water Supply . . . 408
Henley-on-Thames Gas Supply—Sales of Shares—West Bromwich Gas Supply—Hastings Water Supply—Wages and Holidays at the Newcastle and Gateshead Gas-Works . . . 412
Ottoman Gas Company, Limited—Gas-Meter Testing and Public Lighting at Bristol . . . 416
The St. Albans Corporation and the Water-Works—The Cost of the Stockport Water Purchase Bill—New Issue of Debenture Stock by the Brentford Gas Company—Trial of Sunlight Incandescent Gas-Burners at Oldham—Liverpool and the Water Supply of Wallasey—Opening of Water-Works for Avening—The Welsh Water Bill of the London County Council—Social Gathering of Employees of the Glasgow Corporation . . . 427
Explosion at the South Shields Gas-Works—Lighting of Boyle (Co. Roscommon) by Acetylene—The London County Council and Gas Testing—Gas-Works in Illinois—Increase in Price—Opposition to the British Gaslight Company's Bill—Advance of Halifax Gas Workers' Wages—Acetylene an Explosive—Bordeaux Gas Company—Bristol Water Company's Bill . . . 428

EDITORIAL NOTES.

The Coal Difficulty.

"We are to-day, with regard to the maintenance of our "supply, in a condition upon which no Gas Company can "look without some anxiety." In such terms did Colonel Makins sum up the position of his Company, in regard to their coal stocks, some ten days ago; and the sharp snap of wintry weather that was then just beginning to make itself felt, and has since become more severe, has not tended to lighten "the only dark spot" on the horizon of the majority of gas undertakings. "General January" fortunately did not prove himself a very terrible antagonist—much of the weather being of that open character that appears to be so favourable to the development of influenza—and yet we learn that the deliveries of gas throughout the Metropolis during that month were considerably in advance of those recorded during the same period last year. This is a clear proof of the stimulus afforded to the use of gas for other than illuminating purposes by the present high price of coal. Should February continue as it has begun, and the history of 1895 repeat itself, the consumption will, in spite of lengthening days, undoubtedly maintain its high level—if the Companies have the coal wherefrom to make it! To pray for sun, and to long for summer, is indeed an unaccustomed attitude for the gas manager. Not only, however, is the Ice King an unwelcome visitor (under existing circumstances) on account of the consequent increased consumption of gas, but, so far as the Metropolitan Companies are concerned, because of the possibility of added difficulties in getting coal to their in-town works, dependent therefor to a large extent upon canal-borne supplies.

The immediate situation may, in fact, without exaggeration be described as critical; and the next week or two may prove the closest pinch of all. Contractors, we learn, are doing nothing, or next to nothing, to make good the long overdue deliveries; and in many cases they are scarcely sending in the equivalent of current consumption. Even, however, were the immediate cause of anxiety removed by the arrival of sufficient of the purchased supplies, Directors have before them, in the more or less near future, the serious problem of negotiating fresh contracts. To buy, or not to buy; that is the question. What is to be the price? For what period the contract? To buy, and find the price fall heavily in a few weeks; but, then, not to buy and the price to go up—ay, there's the rub. The present is surely a time when the value of consultation between the chiefs of the great Metropolitan undertakings, and of, perhaps, concerted action in a matter of such vital importance, would have been fully demonstrated. Is it yet an impossibility? As to whether the present state of the market is or is not "absolutely unreal," one fact recently published is instructive as showing that the high prices quoted are being obtained for more than small lots of coal. The Swedish State Railways buy their fuel in the North of England; and they recently invited tenders for the supply of 420,000 tons during the ensuing twelve months—an increase, be it noted, of 100,000 tons over the previous year's purchases. They have, up to the present, closed with offers (from the Northern Counties and Scotland) of 270,000 tons of West Hartley Main, Lambton, and Cowdenbeath coal, at prices equal to about 17s. 6d. f.o.b. in the Tyne, or an advance of some 7s. over the recently expired contracts. The quantity purchased, it will be seen, is no matter of an odd cargo or so, but represents nearly a winter quarter's supply for the South Metropolitan Gas Company.

The large increase in the quantity of coal exported to foreign countries is, indeed, a factor by no means to be lost sight of in forecasting the future of the market. The exports for January show an increase of 55,000 tons over the same month last year, and of 178,000 tons over January, 1898—the bulk of the excess going to France, though some has gone to Natal; while much interest has been excited (leading to questions in both Houses of Parliament) by the reported purchase of 400,000 tons of Welsh coal for shipment abroad. The coal exports have, in fact, risen during the past 25 years from 10 per cent. to close upon 20 per cent. of the total output of the kingdom. Bearing these facts, and the prospects of the iron and steel trades, in mind, we are unable to see any hope of anything but a

considerable advance over current contract prices being paid for the supplies needed for 1900-1. Neither, however, do we see any obvious reason why coke should not realize a high, if not a proportionately high, figure.

Coal Miners and the High Price of Coal.

It is not often that we find ourselves in agreement with a Trade Union leader; but in Mr. Benjamin Pickard's letter to "The Times" of Saturday—refuting the suggestion that the present high price of coal is due, in any considerable degree, to an advance in miners' wages—we find little to dispute. The President of the Miners' Federation points out that during the past two years the members of that Association have obtained an increase only equal to about 3d. per ton; and that, under the terms of their existing arrangements with the coalowners, they cannot ask for any further advance this year—the current rates being the maximum obtainable under such agreement. We wonder whether the members of the Federation, at the present time, feel any weakening whatever in their antipathy to the sliding-scale method of adjusting wages! If they adhere loyally to the terms upon which they can now negotiate such adjustments, it must be imputed to them for a virtue that will tend to a most desirable increase of confidence on the part of the masters in the reliance to be placed on a voluntary bargain. Mr. Pickard also touches upon the question of the effect upon the output due to the industry or idleness of the miner. He declares that "the "men work as hard now as ever they did." We may take the opportunity, in mentioning this declaration of the head of the Federation, to explain what some of our readers, we believe, have mistakenly considered to be a discrepancy between remarks made in these columns last week, bearing upon the restriction of output owing to the habitual refusal of coal miners to work full time, and our earlier references to the point. That there is no real inconsistency in the several expressions of our views thereon will be seen on a careful consideration of what has been written. We have pointed out (what is perfectly true) that the scarcity of coal is due to increased demand, and not to any reduction in the total output last year as compared with preceding years, and that the miners have been working quite as well as formerly, and in some cases even a shade better. The "idling miner" theory is therefore, we have said, not the original cause of the failure of contractors to supply. They must, earlier in the contract year, have sold elsewhere—as witness the increase of exports of coal which practically accounted for the excess output in 1899—trusting to force their output later in the season. The shortening of the labour supply owing to the war then helped to frustrate that intention; but what finally upset their calculations was the fact that the miner was content to do just about as much work as, or but little more than, he had formerly got through. The colliery proprietors are, therefore, unable to do what the owners of any other commodity for which the demand greatly exceeds the supply would at once do—namely, greatly increase the output, and reap the harvest. The men are certainly not responsible for the increased demand; in some degree, however, they are responsible for the failure to increase the supply.

The Legal Protection of Street-Lamps.

In the "Journal" for Sept. 26 last year, we recorded and commented upon a noteworthy little case of damage by a mineral-water van to a lamp-post in the Crystal Palace district, in which the Company failed to obtain redress by Police Court proceedings against the owners of the van. The reason for the failure was that section 20 of the Gas-Works Clauses Act, 1847, under which the proceedings were taken, bears reference only to the person who actually does the act complained of—in this case, the driver of the van—and not against his master. It was a remarkable instance of exception from the general rule of law that a master is liable for the acts of his servants, for which the Court had to seek guidance from a decided case under a parallel enactment. Not that the master escaped liability, but only that he did not come under the personal liability created by the statutes in question. Consequently, nothing daunted by their trip in procedure, the Company sought their remedy in an action at common law for damages, and recovered. The defendants appealed, somewhat litigiously, on the ground that this common-law remedy was barred to the plaintiffs by the specific remedy given them in the Act of 1847, which they could use against the servant. Having shot their statutory bolt, and missed, it was argued that they could not try again. The obvious answer is that the special remedy was an addition to, not a supersession of, the common-law remedy. Wherever a new offence is created by statute, the special remedy enacted in regard to it by the same statute is the only one that can be properly taken. The special remedy provided by section 20 of the Act of 1847 is to protect the new objects of the highway—public lamps—which are allowed to be put there under section 6 of the same Act. Otherwise, a wayfarer might affect to regard the lamps as a nuisance and an encroachment, and consider himself free from any obligation to exercise care in respect of them. It would be easy to suggest cases in point. In the present instance, the Gas Company took the proper course of suing the master for damage committed by his servant in the ordinary way of his employment; and they have prevailed. It would have been just the same if the van had smashed somebody's shop window in turning a corner. The appeal seems to be mere litigiousness, which has been rightly punished.

Concerning the Municipal Civil Service.

Rather less than a hundred years ago, and in a city not wholly unlike London in some respects, although possessing some marked characteristics of its own, a discussion arose on a certain occasion in the Town Council over the amount of salary that should be attached to a particular appointment in the Corporation service. There is nothing remarkable or extraordinary in the fact of such a discussion taking place. On the contrary, it is one of the commonest incidents in the working of Local Government institutions. Something very suggestive did, however, come out in the course of this debate; and we desire to extract it from its commonplace surroundings in order that those worthy servants of their generation who give their time and talents to the work of local administration may ponder its bearings. It was this: A complaint was made that a late holder of the appointment in question had not been adequately paid. The reply of the immediate head of the department was: "He would have had more "if he had gone the right way about it." A perfectly natural observation, perhaps, and offered, we may be sure, without the faintest shadow of an intention to wound, or the smallest suspicion that it contained an explanation and the condemnation of a system. Yet we make bold to declare that whoever ponders these homely words well and in the proper spirit, will end by profoundly regretting that such a confession could ever be truly made as regards the inner administration of an English municipal department. A notorious municipalizer, speaking recently in public, very properly drew his hearers' attention to the magnitude and importance of the municipal civil service of this country. He pointed out that, regarded as a career open to smart young fellows leaving school or college, this kind of civil service offers higher remuneration and better prospects than the Government civil service to which those young people who can floor an examination paper with accuracy and despatch have for so long been encouraged to look for a livelihood. This is perfectly true, although there is another side to the picture; and no true patriot would in reality rejoice over the increase of the spirit of "functionaryism" in this country beyond the point to which competitive examinations for Government posts, and the Board School system of exalting clerical employment to the injury of handicrafts, have already carried it.

What we wish to show now is that the candid confession we have quoted, if it does not exactly imply that in the municipal civil service "kissing goes by favour," only too surely corroborates the suspicion that in this employment those officials who have an aptitude for "taking the "length of the Chairman's foot" do better for themselves than men who only know their duty, and do it. Of course, tactfulness, and that invaluable *savoir faire* which enables a man to get on satisfactorily with those above as with those beneath him, must always count for much in the success of every man holding a public office; but that it should be possible to say of an official that he might have had more money if he had known how to go about getting it, damns the service at the same time that it accuses the officer of awkwardness, or want of tact, or whatever else was his drawback. Whatever may be the shortcomings of the Government civil service, at least the pay and promotion of the members, from the highest to the lowest, are fixed and known. When once a man is accepted and assigned his

work, he has not to be everlastingly thinking and scheming for his own advancement in grade or emolument. This is a lesson which is not yet fully learnt by those who direct the municipal civil service of some cities—perhaps of the largest, least. The London County Council, for instance, have notoriously failed to understand this part of the science of municipal administration. For, undoubtedly, if the service of local authorities is a branch of the civil service of the nation, and as such is to be regarded as an eligible career for aspiring youth, the management and direction of this civil army is as much a science or art as the successful conduct of any other business or undertaking. Yet, by our democratic system, all sorts of people get into positions where they are able to influence the prospects of other men who have given their lives to municipal service; and woe be to the latter if they do not know how to "go the "right away about" everybody on the Council. Remember West Ham and its Surveyor!

If the Association of Municipal Corporations were of any sort of real use, they might be asked to appoint a small Committee to inquire into this subject, and frame general rules for the organization of the municipal civil service upon principles similar to those which have given this nation the purest, the most efficient, and the cheapest civil administration in the world. We all grumble at our Government offices occasionally; and people who have to support, or do business with, municipal officials will sometimes gird at the way they do their work. But those whose Progressive views incline them to favourably entertain the large extension of municipal employment of all sorts and conditions of men and women, should first see to it that the foundation of an honest, capable, and self-respecting municipal service is laid in an impartial, impersonal system of pay, promotion, and encouragement. It is monstrous that men who are presumably good enough for their work—or they would not be kept on—should depend for their bread on their powers of "carneying" to a Chairman of Committee, and judiciously keeping on the "blind side" of some mountebank of a Town Councillor. Yet this is a feature of municipal service which prevails to a greater or less degree in too many corporations, while the danger of it exists in all.

A Plea for Light-Reflecting Street Frontages.

Not a great while since, we had occasion to notice in this column the remarks of a travelled Englishman on the dinginess of the frontages of British towns, which is so greatly answerable for the gloominess of our streets by night, notwithstanding the higher standard now observed in regard to the provision of public lighting. We return to the subject for the purpose of suggesting that this is a matter to which, when fitting opportunity offers, the attention of the leaders of fashion in architecture, and the authorities who have a voice in the ordering of the styles of street front elevations, might be directed with advantage. Since architects have become a race apart, it has often been a cause of marvel with people who merely have to use buildings for business or residential purposes whether these artists in brick and stone are ordinary mortals. Elevations and sky-lines, mouldings and styles, seem to occupy the professional architect, to the more or less complete eclipsing of considerations of air, light, comfort, or suitability. One very often hears the wretched occupant of a monumental public building—be it Law Court, Government Office, or even showy shop—wish the eminent architect who designed the structure had to live in it. For the present, we will confine ourselves to the criticism of the material of street frontages, from the point of view of the sanitarian and public lighting engineer. British streets being frequently sloppy and dirty to a degree unknown in countries with a dry Continental climate, and the amount of wheeled traffic being enormous, common sense would suggest that the possibility of washing down the lower frontages with a hose and a powerful stream of water would be kept in mind by the architects. Is it? How many of the very newest street buildings, not only of London, but also of Manchester, Liverpool, Birmingham, and other cities throughout the land, have frontages cut and fretted until it is hopeless to think of keeping them clean!

Then, as to the lighting. Reflection being of the first importance as an aid to the cheerfulness of street fronts, all our architects go in for dark terra cotta, portland stone, or pressed brick, which can be warranted to become a gloomy no-colour in a year or two, and make the thoroughfare look like a vault when the sun does not happen to be shining brilliantly. Good old-fashioned stucco, kept clean and painted white, or very nearly so, is the real source of much of the brilliancy of the night scenes of Continental capitals. There is, of course, no necessity for sticking to stucco. Effective use has been made, in spots, in London and elsewhere, of highly-glazed light-tinted bricks and tiles. Much more of this needs to be done. Let anybody take up a post of observation on some dirty night at a part of a street where the public and other lights have a chance of being reflected from a painted or glazed white frontage, and let him compare the effect with that of the same number and powers of lighting in front of plain terra cotta, portland stone, or even stock brickwork. By day, the difference is scarcely noticeable. In sunlight, portland stone is almost light itself; but by night, in the rain, a stone-fronted street looks like a crypt. The London County Council are going to build a great new thoroughfare in Central London; and they have reserved to themselves powers for controlling the architecture of the frontages. To those who know what sort of standard of taste in architecture is likely to rule a British County Council, the circumstance does not offer an excessive guarantee that the new street will be as worthy of its position as would be the case (say) in Brussels. If, however, the County Council will but insist on one essential for the architecture of the street, and of all other streets similarly situated as regards atmosphere and light—that the materials of which the frontages are to be built shall be cleanly and capable of reflecting light in a high degree—the result will be that the new thoroughfare will possess beauty and brilliancy of its own that people will journey miles to see. Of course, the architects will protest that such a rule would be an outrage on Art—meaning that it would give them more trouble, and make them think a little more than a mere stylist has to do. It would do the architects good to compel them to have more regard to the conditions of common town life in, and usage of, buildings. Mr. W. Emerson, the President of the Royal Institute of British Architects, had a glimmering of what most architects need in this regard, when, in his address to students the other day, he reminded them that buildings should be "not only artistic, "but also scientific." That is the point. Beautiful stupidity, whether in a building or a person, is bad to live with.

Another Light that Failed.

An amusing example of litigation, smelling slightly of gas, but not sufficiently so for inclusion in our reports of law cases, recently occupied the attention of the Deputy-Judge in the City of London Court. Last year—so lately!—the defendant "had a patent for making gas from petroleum "for lighting and domestic purposes, and it was proposed "to use it for manufacturing purposes. It consisted of "driving air into petroleum in a generator so as to manu-"facture gas." Our readers may have heard of something like this before. The British Patent Office, with its usual impartiality, gave the inventive genius his patent; and on the strength of it he proceeded to get the necessary gas-works apparatus and put a fitter on to set it up in his (the fitter's) own little workshop at Wood Green. The "invention" took a deal of "developing;" and in the meantime the sanguine patentee used to bring "counts" and "honourables" to see it, with the ultimate view of bringing out a Company. Again, the story seems to be only too familiar. So, also, was the end. "Nothing came of "the matter." Now and then the inventor was able to get a light from his own apparatus; but when he could not do so, he had to fall back on the shop gas. After seven months' struggling against the inevitable, the inventor ceased to frequent the premises where his hopes lay shattered; and the proprietor sent in his little account for material supplied and work done. This charge differed from the amount which the disappointed patentee considered reasonable, and the parties went to law about it. Thus there was nothing in the action that could be regarded as a point of gas law; but the whole affair is worth passing notice as furnishing one more proof of the infatuation of ignorant "inventors" for "greased air" gas processes. This ignorance seems like something tangible. It appears to exist in the air, like a contagion, and to leave one set of victims ruined and discredited only to reappear in others. It is a real plague, which has to wear itself out wherever it shows itself. We purposely confuse the ignorance of technical matters with the illusory invention

which feeds upon it, because of the close connection between them. It is the "invention" which betrays the ignorance. Unhappily, most of these "greased air" gas processes never get very far before they need something more than simple ignorance to sustain their feeble life. When and where will the next "invention" of the kind be materialized? For the delusion is as everlasting as the confidence trick. "Truth crushed to earth shall rise again." Yes; but unfortunately this resiliency is a quality which truth shares with its opposite.

Gas-Supply Regulation in Massachusetts.

The particulars of an instance of the exercise of their plenary powers by the Massachusetts Gas Commissioners are given in another column. It is always interesting to see how differently in various countries the economic problem of gas supply is dealt with; and in the case of Massachusetts we have the spectacle of gas supply subjected to the control of an Authority which is our Quarter Sessions, Board of Trade, and Parliamentary Committee rolled into one. The Massachusetts Gas Commissioners had a splendid opportunity for the display of their wisdom and authority in the example of the Haverhill Gaslight Company. This undertaking started in 1853 with a share capital of $45,000, which was increased in 1871 to $75,000. The Company paid a regular dividend of 8 per cent.; and meanwhile spent their surplus profits to the amount of $275,000 in extensions. Everything went on very comfortably with this prosperous concern; and the local public seemed to think that the price they had always paid for gas was simply part of the scheme of the universe. A day of reckoning was coming, however, and, as not infrequently happens, it was hurried on by the action of the victims themselves. A Company was formed ostensibly for the purpose of doing a financing business; but really the first and only transaction it did was to buy up the Haverhill Gas Company's stock by exchanging for it its own nominal capital of $500,000 in 5 per cent. debentures. This was a little too barefaced, and the consumers petitioned the State Gas Commission to interfere. The Gas Company were actually making a 50 per cent. dividend, and extending their works to boot. After this, who shall say that gas supply is a moribund industry? The Gas Commissioners do not appear to have been able to stop this monstrous transfer performance; but they have declared that the consumers ought not to be required to bear the additional burden of the watered capital, and have summarily ordered a reduction in price to such a figure as will checkmate the financiers. Just like an English Quarter Sessions, only more so!

Mr. Ritchie on the Housing Problem.

The coming into force of the London Government Act of last year is being attended by various premonitory signs and portents. Mr. C. T. Ritchie, the President of the Board of Trade, has been expounding to the members of the local governing bodies of the East-end of London his views of the way by which the tremendous problem of the better housing of the working-class population may be most hopefully attacked. He pronounces in favour of the policy of going outside the towns and making working-class settlements. Risky as this expedient is, it seems the only economical alternative to that costly rehousing of the population on cleared intramural sites which is much too expensive to be carried far. It has been shown that in London the expense of acquiring the ground and clearing an insanitary area alone amounts to £500 per family—that is to say, to more than the average cost of freehold land and dwellings in an open locality. There are, of course, many risks to be run in letting local authorities go outside their own limits to make industrial settlements; but what of the risk of letting existing conditions go from bad to worse? The jerry builder, friend of the human race that he is—for he works while the philanthropists and politicians are talking—has no prejudices as to the site of his "eligible cottages." Who has built West Ham, and Stratford, and Ilford, and all that marvellous hive of humanity whose life-blood ebbs and flows through that immense Liverpool Street Railway Station every day? Whoever they may be, these are they whom the Authorities should consult as to the making of new settlements outside the radius. Unless the Authorities are wisely advised, they will get themselves involved before very long with all sorts of fads and fancies—of the electric-light-for-workhouses order—which will bring undeserved discredit upon their operations.

WATER AND SANITARY AFFAIRS.

We conclude to-day our abstract of the final report of the Royal Commission on Metropolitan Water Supply; the portion dealt with being that in which the Commissioners offer suggestions in reply to the inquiry addressed to them as to whether, in the event of the Companies' undertakings not being acquired by a public body, additional powers of control should be exercised by local or other authorities, and, if so, what those further powers should be. The first difficulty encountered by the Commissioners was about the definition of the word "control," as to the meaning of which a wide divergence of opinion had been made apparent in the course of their inquiry. The London County Council submitted a formidable set of "conditions "of control" which they thought worthy of consideration, though they were careful to point out that they were not suggestions as to the nature of the control the Council would recommend. Their position was that no control could be a settlement of the question—that, in fact, the formulation of a scheme would be impossible. The Commissioners thereupon attempted the "impossible;" starting with the declaration that by "control" they understood measures by which the due performance of the existing statutory obligations of the Water Companies could be "efficiently and conveniently secured and enforced." The Commissioners first of all review the various enactments affecting the Companies, and come to the conclusion that some remedy is provided therein for every breach of a statutory duty. But the very parties who should have taken steps to put these enactments in force have been too apathetic to do so. Control, in a certain measure, was in their hands, yet they would not exercise it. The Commissioners pass from this matter to consider the more urgent one of the draught made by the Companies upon the Thames and Lea, and the storage and filtration of the water thus obtained. As the result of all the evidence submitted to them, they come to the conclusion that no restriction should be placed on the taking of flood water from the first-named river. With regard to filtration, they are willing to leave all details to the Companies; but they think that the Official Water Examiner should have jurisdiction over them. It is freely acknowledged that no impediment has ever been thrown in his way; but we nevertheless agree with the Commissioners that he should have the right to enter and inspect the works at any time, and we are at one with them in refusing this right to Local Authorities. No Company, we believe, will object to the recommendation that returns should be furnished to the Water Examiner as to the pressure in the mains at certain hours, and the minimum depth of water in their reservoirs, leaving the Local Authorities to take such action as they please. As to controlling the pumping operations of the Companies, this is a matter which the Balfour Commission investigated very carefully; and so Lord Llandaff and his colleagues did not feel called upon to reopen the question. At the same time they concur in their predecessors' recommendation that the Companies should observe the effect of these operations, and furnish the results to the Water Examiner.

The next really important matter taken up by the Commissioners is the checking of waste; and the whole of the portion of the report in which they deal with it is interesting reading. Some months ago it was pointed out in "The Times" that twice as much water is lost in London as would suffice for the supply of the whole of Birmingham; and it is grievous to be compelled to add that it is lost through sheer carelessness. The Commissioners show how this waste can be reduced by the use of meters; and their remarks may be profitably studied in connection with the interesting paper by Mr. Schönheyder given in the "Journal" last week (p. 335), and dealt with below. They tell us that the New River Company brought their supply down to 30·5 gallons in 1896 and to 31·5 gallons in 1898; and they point out that the difference of 5 gallons in the consumption per head per day, when the population of London reaches the estimated 12 millions in 1941, will represent an addition of 60 million gallons to the daily supply. Waste of water, which, as they say, "benefits nobody and is wholly indefensible," proceeds from wilfulness or neglect. Of course, imperfect fittings are in many cases the cause; and the recommendation of the Commissioners on this matter is a very proper one.

They consider that the Companies should be empowered to require that all fittings should be tested and approved by them, and made to conform to properly framed regulations. They are quite conscious of the existence of jealousy on the part of some Local Authorities in regard to giving such powers as these to a trading Company; but they see no ground for it. Cisterns, again, afford another illustration of the need for intelligent revision of the present regulations, and even of the legislation, on the subject of fittings; and the Commissioners think that whoever supplies the water should have some kind of supervision over the vessel for storing it. But the difficulty here is to make the householder keep it clean. The Commissioners would put upon the Local Authorities, as the guardians of the public health, the responsibility for looking after this matter. They think the measures of control they suggest should be "kept alive" even in the event of purchase, though they do not for a moment distrust any representative or other public authority.

Before closing their report, the Commissioners throw out a suggestion which must not be left unnoticed. They express the opinion that the jurisdiction of the Local Government Board, or that of the Railway Commissioners (whose connection with the water supply of the Metropolis was established by the Act of 1897), might be usefully extended in another direction. They consider a company should exercise prudent forethought, and set about such works as increased reservoirs, enlarged filter-beds, and additional pumping power, "in advance of the "time when they will actually be required," if the supply is to remain constant and efficient. We are pleased to find that the Commissioners lay special stress upon the fact that the failure of the East London Company to maintain a constant supply in 1898 might have been prevented or mitigated, "if Parliament had not, in 1893, rejected the "Bill by which they asked for powers to construct addi-"tional reservoirs"—a proceeding which they repeated last session. The Commissioners unhesitatingly place in the right quarter the blame for these reverses; and they evidently think there should not be a chance of their repetition. They suggest, therefore, that it would be useful to extend the powers conferred upon the Local Government Board by the Metropolis Water Act, 1871, so as to include inquiry into the provisions made by a Company for meeting the present and future wants of consumers in their area of supply. Such an inquiry should, they think, be made only upon the initiative and under the responsibility of the Board. On this matter only one remark is necessary, and that is that the suggestion made by the Commissioners has been anticipated by the Bill which the associated Water Companies are promoting this session, and which received the approval of the shareholders last week. The scope of this measure, which is to carry out the recommendation of Lord Balfour's Commission, has already been fully explained in our columns.

Matters of current moment monopolized our attention in this column last week, and excluded comment on the paper (then published) on the subject of water supply by meter which Mr. William Schönheyder brought before the Institution of Mechanical Engineers at their annual general meeting. The presence of several eminent Water-Works Engineers—some of whom took part in the discussion—and others who have the management of towns' supplies attested the common interest in, and importance of, the question. The purpose of the paper was to demonstrate, first, the value to water suppliers of saving waste even down to dribbles, the multiplicity of which in a district forms a serious whole; second, that those persons who permit this waste should pay for it; third, that the best way of curtailing waste, or securing payment for it, is by measuring the water delivered; and, fourth, that the positive meter invented by the author is, in point of accuracy, the best yet devised for general application to residential supplies. In his modesty, the author did not say this with such pointedness; but his audience could not infer otherwise than that this was his opinion upon hearing his criticisms of other types of meters and his statements (drawn from experiment) as to the exactitude in performance of his own invention. In what he said, however, Mr. Schönheyder was well within his right. He has spent years in the study of water measurement and in the perfecting of his meter. For his labours, all praise is due to him; and if the product of those labours proves—as it bids fair to do—worthy of it, a more tangible recompense will surely follow. He has been complimented by capable critics, who will no doubt prove their first favourable impressions of the meter by a trial of its efficiency.

But to turn now to the general question as to the feasibility of employing the meter system for preventing waste. The discussion did not support *in toto* the author's views. No one denies that the universal measurement of water would be the best preventive; but that it is a practicable system, under the conditions ruling in this country, is contested by some of the highest authorities. This is an instance where the means would not be justified by the end in a district abounding in cottages and small houses. In such places, the cost of the meters alone would be prohibitive; but the first cost is not all. Besides the interest on the heavy capital outlay, there would be the expenses of maintenance (which is a more frequently recurring charge than in the case of gas-meters) and of inspection. Against all this, what has the water supplier to set out of the moderate rate charged for water in the case of small property? Obviously, if he is to derive a return from the service rendered, the meter system would entail an increased charge on the occupiers; and this would not be tolerated—at any rate, it would raise an outcry against which water-supplying authorities (especially the companies) could not stand. It would be said, and rightly, that the well-being of the community demands the continuance of the present cheap and abundant supply of water; but that well-being does not demand a waste of water. There comes the real difficulty. All householders do not regard it as any part of their duty to guard against the abuse of this necessity of life; and wilfulness and carelessness being, apparently, inherent qualities of some natures, it is essential for the suppliers of water, in their own defence and that of their conscientious customers, to stay its misuse. Therefore some preventive system is indispensable. Mr. Schönheyder says the best is to be found in the meter system; but, after carefully reading his paper and the discussion, we are driven to the conclusion that, from a monetary point of view, a good system of inspection has yet to be superseded in an ordinary residential district. The views expressed in the discussion by Mr. W. B. Bryan, the Engineer of the East London Water-Works Company, and by Mr. William Morris, the Engineer of the Kent Water Company, were particularly noteworthy.

The Action of Acetylene on Copper.—At a recent meeting of the Paris Academy of Sciences, MM. Sabatier and Senderens submitted a communication on the above subject. They showed that acetylene, when passed over copper heated to 200° C., undergoes a complicated transformation, giving a liquid hydrocarbon and a mixture of ethylene, propylene, butylene, ethane, and hydrogen. At the same time the copper becomes coated with a solid deposit, of the composition $(C_7H_6)_n$, to which the name of "cuprene" is given.

Expenditure by Local Authorities on Technical Education.—Last Friday a return was issued giving the amount spent on technical education by Local Authorities in England, Wales, and Ireland (with the exception of six who did not make any return), during the year 1897-8, with the estimated expenditure during 1898-9. It shows that in the former period the expenditure was £860,105; and that the estimate for the latter was £874,612. These amounts are exclusive of the sums allocated to intermediate and technical education under the Welsh Intermediate Education Act, 1889. The amounts raised by loan on the security of the local rates under the Technical Instruction Acts totalled in 1897-8 to £69,333; in 1898-9, to £133,583. The above-named total expenditure was divided thus: England (excepting Monmouthshire), £826,450; Wales and Monmouthshire, £28,006; Ireland, £5649. The estimated expenditure in England was £834,909; in Wales and Monmouthshire, £35,179; in Ireland, £4524.

The Retort-House Machinery of the South Metropolitan Gas Company.—We are asked by Mr. Livesey to correct two statements relative to the above which appeared in the last number of the "JOURNAL." Mr. Henry O'Connor, in the course of his Inaugural Address to the Society of Engineers, stated that "Mr. George Livesey was undoubtedly the first to adopt continuous coke conveyors, on a scale of any magnitude, at the Old Kent Road works." Mr. Livesey disclaims the honour thus accorded to him in connection with this innovation; his late brother (Mr. Frank Livesey) and Mr. Charles Tanner, the chief foreman, who has now retired, having, he says, done it all, "and must have the credit between them up to the system now in use—continuous wire-rope drawing trucks which can be attached and detached anywhere." With regard to the order for West's stoking machinery at East Greenwich, referred to on p. 348, Mr. Livesey says it is the wire-rope system which is found to be capable of doing more work than any other.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 423.)

A MUCH more cheerful feeling prevailed on the Stock Exchange during the early part of last week; and markets showed considerable firmness. But owing to subsequent disquieting news from South Africa, the full extent of the rise was not maintained. The settlement revealed a favourable position—there being apparently but a small account open for the rise; and stock in several markets proved scarce, while money was cheap. Investment securities were well maintained; their firmness being assisted by a rise of ⅛ in Consols, which were supported by the belief that the Government have no intention of making a fresh issue to defray the expenses of the war. The public are still acting with extreme caution, and fresh business is checked; but they are little disposed to change their investments. Dealings in Gas stocks have again been very quiet, beyond what was done in Gaslight ordinary, which has shown firmness during the week —the stock advancing 1, to 108-10; while dealings were recorded at 109¾. The dividend was taken off the price on Friday; and at the lower quotation business was done at 107. The secured issues were not much dealt in; but they maintain previous values. South Metropolitan and Commercial ordinary were also inquired for; but there was no change in prices. Transactions in the Suburban and Provincial group were rare, though a few dealings were recorded in Brentford, Crystal Palace, and Tottenham and Edmonton; but there were no quotable changes. Among the Continental Companies, the feature was the firmness of Imperial ordinary, which has advanced two points to 215-20. Respecting minor Companies, some inquiry prevailed for European, Malta, Monte Video, Bombay, and River Plate; but Ottoman receded slightly. As to Water stock, the past week has been very quiet; the only movements being a rise of two points in Lambeth 10 per cent. maximum and in New River shares.

In regard to the daily operations: They were fairly numerous on Monday; the dealings in Gaslight ordinary being most active between 108 and 109, while in South Metropolitan business was recorded at 134 and 134⅝. Brentford changed hands at 278½; and a special bargain was done in Commercial at 240. Transactions were recorded in Imperial Continental at 216½, European at 21, and River Plate at 10¾. Tuesday was very quiet; but a fair amount of business was done in Gaslight ordinary between 108 and 109, while Imperial Continental changed hands at 216¼, Malta at 5⅜, and Monte Video at 11. In Water stocks, West Middlesex were done at 290. Wednesday saw a rise of 1 in Gaslight ordinary, to 108-10. Business was done for the new account at 109½; while the 4 per cent. preference marked 121¾, and the 3 per cent. debentures 100. South Metropolitans were done at 136 for cash, and 134½ for the new account. British Gaslight changed hands at 43¾; and Bombay new at 4⅜. As regards Water, New River new rose 2, to 425-30; but there was no business recorded. Apart from Gaslight ordinary, which was dealt in between 108⅜ and 109⅜, Thursday was a very quiet day; but a little business was done in Commercial new stock at 242, Brentford at 279, ditto new at 214, Buenos Ayres at 9⅛, and Imperial Continental at 216½. There was not much doing on Friday; the only feature being a rise of 2 in Imperial Continental, which was dealt in at 216½. A fair amount of business was also done in Gaslight ordinary between 108 and 109; and a few dealings were recorded in South Metropolitan at 134 and 134⅝, Commercial new stock at 240, Brentford at 278½, and Buenos Ayres at 9⅜. On Saturday, the market was quite featureless; but a little business took place in Gaslight ordinary between 106 and 107 *ex* div., and in the 3 per cent. debentures at 100. Crystal Palace ordinary changed hands at 125, River Plate 11, Commercial 309½, South Metropolitan ordinary 134¼, and Tottenham and Edmonton "A" 141, and ditto "B" 102.

ELECTRIC LIGHTING MEMORANDA.

Electricity Generation in Bulk—Various Bills in Parliament—South Wales, Tyneside, Lancashire, Durham, Jarrow, and Hebburn.

A GOOD deal of prejudice hovers over and against the electricity generation in bulk schemes which this year as last propose to take advantage of the general welcome already extended by Parliament to the idea. There is no reason to doubt that Parliament will consider all these new Bills and the opposition to them strictly on the merits, without being scared or influenced from doing what appears to be the right thing by the bogey of Municipalism or the underhand workings of any other vested interest. The very fact that powerful municipal corporations should stand in the way of any project for providing the public with something it had not before, is a striking indication of what the community lost when the local authorities forsook their original purpose of government and took to trade. At the same time, it must be allowed that a municipality is fully justified in opposing all mere company mongering schemes for doing unnecessary things. If strange turns are given in our time to Municipalism, quite as remarkable things are done, or attempted, in the hackneyed name of electrical enterprise. Hence it behoves local authorities to be on their guard against electric wire-pulling, which is the only kind of imposition that remains to trouble town life nowadays. Not so long ago, town councils knew what it was to be badgered about sewage-treatment schemes by rival conjurers with incompatible claims to sole possession of the secret of turning sludge into sovereigns. These are all dead now. But the electrician is still with us; and his powers of prophesying and promising are artful enough to seduce many who know more about electricity than the average town councillor.

Electricity generation in bulk will have to make its way through Parliament on its particular merits. There are four Bills, for sanctioning as many schemes; the districts concerned being South Wales, Tyneside, Lancashire, and Durham. The first is apparently a respectable project, enjoying the support of Sir W. T. Lewis, Mr. John Cory, and other leading men of the district. It is proposed to acquire about 33 acres of land, in three lots, for generating stations in the counties of Glamorgan and Monmouth. The capital of the Company is mentioned as £750,000, with power to borrow one-third of the amount of share capital issued. The sum of £100,000 is to be subscribed before the compulsory powers of land purchase are exercised; and if this amount is not so raised, and £50,000 spent upon the undertaking before five years have expired, the Act is to lapse. The area of supply is to be the whole of the county of Glamorgan and part of Monmouthshire, including the county boroughs of Cardiff, Swansea, and Newport. The Company will not supply electricity except to wholesale consumers within the electricity supply limits of any local authority, unless with consent. The Company disavow any desire for monopoly. The Bill explains how the Company propose to deal with local authorities. Wholesale consumers, with whom the Company propose to deal directly, are such as will engage to use not less than 20,000 units per annum. The Company are willing to take a sliding scale with a standard price of 2½d. per unit, and a standard 10 per cent. dividend, rising ¼ per cent. for each one-twentieth of a penny by which the actual average price for the year shall have fallen below the standard price. Back dividends are expressly provided for. A 10 per cent. reserve fund is to be formed out of surplus profits over the statutory dividend, after which all excess profit is to be carried forward to the credit of the divisible profits of the following year. Quarter Sessions are to be empowered to see to the carrying out of these provisions, on the petition of two consumers, who are to be made liable for costs if their action is groundless.

The Tyneside Company is another venture which puts forward some very well known local names for its sponsors, to whom is added Mr. C. A. Parsons, of steam-turbine fame, and Mr. A. A. Campbell Swinton, the electrician. It is proposed to take sites for stations at Wallsend, Hebburn, and Whickham. The capital is £500,000 with one-third borrowing powers; and £100,000 is to be subscribed before the compulsory powers are put in force. The proposed area of supply includes the city of Newcastle-upon-Tyne, the boroughs of Gateshead, South Shields, and Tynemouth, and a large outlying district. The Company will not supply electricity generally within the city of Newcastle; nor do they claim a monopoly. The arrangements proposed to be made with local authorities differ considerably from those of the previous Bill. This Company also suggest a sliding scale working one way, under which they undertake to pay 10 per cent. dividends out of electricity sold at or within 5 per cent. of scheduled rates. For every 5 per cent. of average reduction of price, the dividend is to be increased by 1 per cent.

The Lancashire Electric Power Bill is to incorporate a Company in which Mr. R. P. Sellon, of accumulator fame, is the representative electrician, with a share capital of £3,000,000, and power to borrow one-third. This capital is to be at the disposal of Directors with a £500 qualification. The compulsory powers subscription is £100,000. The generating stations are to be at Aspull, St. Helens, Little Lever, and Davyhulme. The area of supply is to be all of Lancashire south of the Ribble, without monopoly. Generally the Bill resembles the previous measure, the Parliamentary Agents being the same. The last of the group of Bills relates to the county of Durham; and the first Directors include the electricians Garcke, Raworth, and Sellon. The scheme is the most modest of all; the capital being only £270,000. The area of supply is to be co-extensive with the districts of the Poor Law Unions of Gateshead, South Shields, Chester-le-Street, Sunderland, Houghton-le-Spring, Durham, Easington, and Hartlepool. For safety, the Company's system of supply is to be passed by the Board of Trade. There is no guaranteed subscription of capital before the exercise of the compulsory powers to purchase land. The generating stations are to be located at Gateshead and Harraton. It is not difficult to perceive that these different measures have unequal prospects of becoming law. The Walker and Wallsend Union Gas Company are in the field with a scheme of their own for the general supply of electricity to Jarrow and Hebburn, with a special capital of £250,000. Altogether, the parliamentary situation created by these various schemes is a very interesting one, and can hardly be cleared off without adding considerably to the available stock of knowledge respecting electricity generation in bulk.

In our "Register of Patents" to-day (p. 405), there appears a full abstract of a patent taken out last year by Dr. H. G. Colman, the Chemist at the Saltley Gas-Works of the Birmingham Corporation, relating to the treatment of coal and other illuminating gas during condensation, with the object of obtaining increased illuminating power and a more complete removal of naphthalene.

THE PRESS AND THE SCARCITY OF COAL.

We are daily receiving fresh evidences of the fact—upon which we have often found occasion to comment—that, if one chances to possess an intimate acquaintance with any event or topic of the day, the discrepancies on points of fact, and ignorance of elementary truths to be observed in the reports and comments of all but the very best of the general Press, creates a wholesome incredulity as to the accuracy of their accounts of occurrences of which one has no first-hand knowledge. We do not refer to the newspaper comments on the war—though no better instance could be quoted—but to the references, daily becoming more frequent, to the scarcity and high price of coal.

Some of the most brilliant specimens of careless reading and loose thinking were enshrined in an article published in the "Financial Times" last Thursday, entitled "Gas *versus* Coal." The article was based upon the half-yearly reports of the two great London Gas Companies; and attention was naturally called to the increase in the quantity of gas sold last half year by both undertakings. The consumers supplied by the Chartered Company will, however, be surprised to learn, on the authority of our contemporary, what is the reason for that increase. "In view of the fact," we read, "that substantial reductions were effected by each of the Companies in the charge for gas, although the price of coal increased to an abnormal extent, it was only to be expected that a number of people would alter their domestic arrangements accordingly." Even were the adjective "substantial" one that could fitly be applied to a reduction of 3 per cent. in the price per thousand feet, the fact that such reduction (the first made by the Gaslight Company since they raised the price in 1898) only came into force on the first day of the New Year, and will not be noticeable by the bulk of their consumers until they receive their accounts next April, completely destroys our contemporary's argument. It was rather the increased cost of coal, not the decreased charge made for gas, that brought about the altered domestic arrangements of the Gaslight and Coke Company's consumers.

If, however, the public were surprised to hear of the "substantial reduction" in the price of gas north of the Thames, how much greater must have been the astonishment and amusement of the Horseferry Road authorities to read that "Colonel Makins, at the meeting of the Gaslight and Coke Company, held last week, stated that that concern had sufficient coal in hand to last until next June." The South Metropolitan Company, however, we learn, are not so fortunate. "Their supplies in hand are much smaller than those of the other corporation." They, we suppose, have only a couple of months' consumption in stock. And this is the sort of stuff upon which the general public have to base their opinions! As Colonel Makins, in his recent speech, declared that the stocks of his Company were "lamentably low," we wonder how many million tons our contemporary imagines that the Company would have in hand if their stocks were normal.

A further contribution to the discussion of the coal difficulty is that provided by the "Westminster Gazette," who ask: "Why is it that we do not make more use of anthracite coal? It is claimed for it that it is very smokeless, and that its heating power is one-third more than the ordinary Welsh coal. It is true we should have to alter our grates and fire-bars to burn it; but, since things have got to the present pass, maybe we shall have to do even that." It is news to us, at any rate, that "ordinary Welsh coal," by which is understood steam or anthracitic coal, and the supply of which is at present insufficient to meet the demands of the industries which consume it, is commonly used in grates instead of "household. It is sometimes contended that gas-fires are not "home-like;" but fancy making merry round an anthracite fire!

Another daily paper—one rapidly achieving a reputation for short-sighted views and day-to-day opinions—announces, with its characteristic air of settling everything out of hand, that "for thirty years scientists have foretold a coming coal famine. To-day the famine has arrived." Writing a fortnight ago, we said that "if, by saying that there is no scarcity of coal in this country, nothing more is meant than that the mines are far from being exhausted, no one will be found to contest the obvious truism." But we reckoned without the "Daily Mail." The predictions of an approaching coal famine by scientists thirty-five years ago—not "for thirty years," the Coal Commissioners changed all that—were based solely upon a belief that the coal resources of the country were rapidly ebbing away. That the present scarcity is not due to any such cause, anyone could discover by reference to those predictions, to the report of the Coal Commission, and to the statistics of the output of the coal mines during the past thirty-five years. In order, however, to save our readers a somewhat laborious task, we have in type for early publication the first instalment of an article supplying a digest of that information. In commenting upon the "profusion of hypothetical and often of contradictory explanations" of the present shortage of coal, "The Times" recalls the story that during the Crimean War an old lady who was sorely puzzled by the enhanced price of candles inquired at the village shop if the battles were fought by the aid of candle light. Some of that old lady's daughters must, we are very much inclined to think, have taken to journalism.

A GOOD BEGINNING FOR THE YEAR'S TRADE.

The Board of Trade returns for the month of January show plainly that the end of the trade revival is not yet. Indeed, they rather indicate that we have not even reached dead-high water; for—although we are, of course, now comparing with 1899, which was throughout a year of advancing prosperity—the value of the imports and exports for the first month of the year was very considerably higher than for the corresponding period twelve months ago. The imports, exports, and re-exports during January reached a total of 73½ millions sterling, as compared with 66½ millions in 1899—an increase of no less than 10 per cent. Such an increase, after taking into account that there was one Sunday less in the month this year than last, can only be regarded as a remarkable proof of the buoyancy of trade, and as a cause for much congratulation on the part of the country as a whole, coming as it does at a time of such unusual and heavy drains upon her material resources.

It is impossible to keep references to coal out of any article discussing the condition of trade; and the following figures, being the exports of coal, coke, and fuel in the month of January for this and the two preceding years, are well worth recording and considering:—

	1898.	1899.	1900.
Quantity	2,909,807 tons	3,032,343 tons	3,087,532 tons
Value	£1,320,767	£1,527,195	£2,238,332

The statistics for the metal and engineering trades are also striking. The total value of all metals and articles manufactured therefrom (including machinery) in the past month was £5,268,095, as compared with £4,166,917 in 1899, and £3,844,372 in 1898. England, as a trading nation, is certainly not yet effete.

A ROYAL COMMISSION ON MUNICIPALISM.

The report of the Royal Commission on Water Supply within the limits of the Metropolitan Companies, of which a very full abstract has been given in the "Journal," possesses, of course, supreme authority as an answer to the particular questions referred to the Commissioners. As such, it must be allowed to speak for itself; and everybody interested in the subject of the reference will naturally procure a copy of the Blue-Book for his own study. Here, however, we propose to discuss the report in its more general character of a criticism of the popular doctrine of the saving virtue of Municipalism as a principle of administration of public supply undertakings. It is one of the signs of the times in which we live that the cry for municipalization of all such undertakings is the rallying call for many British citizens who rightly take an interest in the work of local self-government. It is rather beside the immediate question to touch upon all the aspects and consequences of municipal trading, as a branch of municipal business distinct from, and even antagonistic to, the original purpose of local self-government for which municipal bodies were created. Suffice it to concentrate attention for the present to the clearly-defined and popularly-held view that the municipalization, by purchase, of local supply undertakings actually carried on at a profit by private enterprise, is always and everywhere expedient and desirable. This is the point: The popular cry for Municipalism, raised as a test of Progressivism in municipal politics, is based on the principle; and this, of course, is regarded as of universal validity. Those who uphold it do not entertain the possibility of there being any doubt as to the merits of particular cases. If they did, there would be no principle to contend for, much less erect into a touchstone of politics. Everybody, whatever his political views or prejudices, agrees that there may be cases for government action in providing services for which private enterprise is inadequate or unavailable. But to admit this is not Progressivism, which is nothing if not superior to considerations of mere expediency on merits. The question of expediency as regards municipalization is settled in advance, in Progressive municipal politics, by *à priori* consideration. This is no fancy sketch. It is the popular opinion, and it is acted upon sometimes to the extreme of municipalizing something which is acknowledged to be a burden on the ratepayers, rather than permit private enterprise to try the venture on a commercial basis; the magic circle of municipal trading undertakings must not be broken, even though its completeness and its enlargement may not be economically justifiable.

As yet, it is safe to say, this extreme devotion to the principle of Municipalism is confined to the official and journalistic Progressive mind. It is not shared by the general public, even of those ratepayers who are disposed to side with the "advanced" party in local politics. What makes the unofficial public municipalizers is the delusion, industriously spread by the party leaders, that this principle always pays, and pays well. They are assured that the way to get cheap gas, cheap water, cheap electricity, cheap telephones, is by municipalization; and the enthusiasm of the heedless ratepayer is further excited by the assurance that by municipalization not only will the particular service be cheapened, but also, in addition, there will be a handsome surplus profit made which will be available to substantially reduce the rates and help materially to improve the locality. The most highly educated, as well as the most stupid, of owners and ratepayers are caught by this bait. It was trailed very

successfully lately through the Metropolitan Parish of St. Marylebone, in connection with local electric lighting affairs, and hooked some very warrantable fish.

Now, the only way by which the British public can be restored to the ordinary common-sense position in regard to Municipalism is to nail the principle to the facts of every suggested application. To attempt to fight the principle, would be beating the air. Its upholders will always be able to point to many brilliant examples of Municipalism *in excelsis* in actual operation in the United Kingdom. Granted; but these illustrations, where they are supposed to justify the principle, really exemplify the necessity of basing every instance upon actual expediency in fact. Those who have the true interest of the ratepayers at heart, will refuse to accept the sentimental plea of the principle, without inquiring how the circumstances and conditions of the case work out. This is a duty for the public and for intelligent public men, and is no concern of the "interests" which are sometimes alleged to be always opposed to Municipalism. Quite the contrary, most "interests" have no rooted objection to being bought up at what they consider a fair price. How the bargain turns out afterwards for the ratepayers, is no concern of theirs. The electric light companies, for example, all over the country have been municipalized by Progressive local politicians, who were at first very proud of their part in these performances. This satisfaction has not in every case proved of an enduring quality.

The proprietors of statutory supply undertakings of the more permanent order—as gas and water undertakings, which are freehold property—have frequent reason to complain of the conduct of the baser sort of would-be municipalizers. These ardent gentlemen, while professing to act "on principle," have a way of showing their knowledge of the grounds upon which the question of the expediency of municipalization is determined by doing all they can think of to depreciate and damage the property they covet. Thus the gas supply that is to be municipalized is commonly impeached as bad, inadequate, and dear; while the water undertaking approached in the same spirit is always condemned in advance. The most advanced of "Forwards" in a municipal corporation is rarely superior to this infantile strategy. Where, however, the question of municipalization is put into respectable hands, as was the case not long ago with the gas supply of Liverpool, the much-lauded "principle" is liable to be stripped very naked and bare. So naked, indeed, that its most devoted sponsors are ashamed of it.

Assuming that this unworthy trick of besmirching the object of municipal longing is not perpetrated, how is the question of expediency to be tested? The final report of the Royal Water Commission shows how; and it is for this that we cite it here. The Commissioners started from the datum of the report of the Duke of Richmond's Commission, 1869, which expressed the opinion that the water supply of London should be under public control, and entrusted to a responsible public body. Other potent considerations to the same effect were laid before the Commissioners, as well as opposite views as to the principle The Commissioners forthwith declared that it was no business of theirs to decide between these "views of public policy," but only to determine the expediency of purchasing the undertakings in the interest of ratepayers and water consumers, on financial grounds, and with regard to the future as well as the present requirements of the district. This means that the principle of municipalization was made to wait upon the demonstration of the expediency of the operation, on the merits. Then we get a heavy tussle with facts and figures which need not be followed here, except for the net result. The first consideration to be established was that the debenture and mortgage debts of the undertakings would have to be taken over as they stand, in accordance with precedent. The preference stock, although not quite so well secured as the debenture stock, was ranked immediately after, and with the latter as an initial charge upon the property. All these interests had to be deducted from the revenue before the amount of gross profits available for the purchase could be arrived at. The next question is that of how the price of the undertakings is likely to be fixed. This is a difficulty. In the particular case in point, the Commissioners found that the London County Council were not prepared to go into an arbitration with the Companies on ordinary terms under the Lands Clauses Act, for reasons which the report gives at length. Much interesting matter comes out in the course of the explanation; but this is not to the present purpose. The report concludes this part of the inquiry with the weighty declaration that there is nothing in the circumstances to warrant departure from the usual course of arbitration under the Lands Clauses Act. Consideration number two!

How is such an arbitration likely to result? The London County Council have been afraid to look the matter in the face. The two parties, naturally, would not commit themselves by naming their figure; so that the Commissioners had to make the best guess they could at the probable price—going to work in the way of an arbitrator guided by actual law and practice. This is a highly informing exercise, and incidentally demolishes several of the pet fancies of municipalizers "on principle." Mr. Dickinson, the Chairman of the Water Committee of the London County Council, has named 30 millions sterling as the minimum value at which any arbitrator might be expected to assess the Companies' property (this was in 1894); and although he subsequently tried to run away from his own figure, the Commissioners found this was only possible by virtue of taking certain impossible things for granted. So far as the purchase of the share capital is concerned, however, the Commissioners do not see much in it, either way. Doubtless, there would be the traditional advantage of the purchasing authority being able to raise the money at a lower rate of interest than the rate taken by the arbitrator for the water-income; but this might easily be wiped off if anything were allowed for prospective income and compulsory purchase. After this comes the very serious question of the sinking-fund, which would be a heavy additional burden, even if Parliament spread the period of repayment over a hundred years. It is argued, for the purchaser, that this charge would be recouped by the economies of public management. These are the familiar savings (in prospective) of directors fees and staff and office expenses. As the Commissioners acutely observe, these economies are not so often realized as expected. Municipal management costs more than company management, and is apt to be less efficient. This part of the report is extremely suggestive reading. The following is the conclusion respecting the prospect of economies; "Taking maintenance and management together, we have come to the conclusion that the saving by a purchasing authority will not be large, and that this set-off to the cost of a sinking fund may be almost entirely disregarded." There goes one plank of the municipalizers' platform!

There remained a gross water-income estimated at £1,300,000 a year to be purchased, as from 1901. The net revenue after paying loan and preference interests would not exceed £980,000, which would suffice to pay interest and sinking fund on 25·27 millions, or 27·87 millions, or 29·51 millions, according as the term of repayment was 60, 80, or 100 years. Would this capital satisfy the present owners? Plainly not. All the competent authorities consulted agreed that purchase of the property on fair terms would be financially disadvantageous to the ratepayers and the consumers. Other advantages were scarcely even claimed. The opinion formed by the Commissioners was strengthened by what they were able to learn of the recent results of water supply municipalization in a number of provincial centres. Upon these returns, the Commissioners conclude that there was no evidence of superior economy of corporation management over company management, or that the charge for water on the community, as a whole, is lessened by corporation management; "although corporations have the advantage of being able to distribute the burden of the water supply between the consumers and the ratepayers, and of charging higher rates on districts outside the borough area, where they have to supply any such districts." Here it seems the municipalizers' platform collapses altogether. Municipal water supply has always been held up as the first stage of progress in local government beyond mere executive and sanitary duties; and it is not justified in comparison with the working of the London Water Companies! The quality of expediency, at any rate, disappears from the agitation kept up by the London County Council for the purchase of the Companies' undertakings.

THE VENTILATION OF TAR AND LIQUOR STORAGE TANKS.

From time to time, reports appear in our columns of explosions of a minor or more serious nature in connection with tar and liquor storage tanks; and, apart from the reports of such matters, it is well known that mysterious occurrences do take place in connection with these tanks without any information being forthcoming. Manhole-lids have been blown off, and even the tops of the tanks considerably shaken, together with other damages, without the cause being accurately ascertained. The liability of accidents from these tanks is well known, and does not need emphasis; but some allusion to the general question may be permitted—following up the letter by Mr. E. A. Harman, of Huddersfield, appearing in the "Journal" for the 23rd ult.

Generally speaking, such accidents have taken place during either the repair of the tank, or of some apparatus in connection therewith. It will be recognized that, when the tanks are full of liquor, there is no danger; it is when they are nearly empty of liquor, and the upper portion full of gas, that the maximum danger exists. The explosive nature of the gases, under certain conditions, has been chemically and practically proved. It is a common practice to have a manho e-lid partially open, through which samples of liquid are taken from time to time for testing. The dividing-line between the tar and liquor is also ascertained through the manhole. This line is variously obtained. In some works, a piece of gaskin is fastened to a measured gauge-rod, which is dipped to the bottom of the tank. When withdrawn, the tar adhering to the gaskin indicates appproximately its depth; and this being deducted from the total depth of liquor in the tank, leaves the quantity of ammoniacal liquor remaining.

Some engineers prefer to have a series of small cups fastened on the gauge-rod; an examination of the contents of the cups revealing the dividing-line. Others prefer a single cup fastened to a gauge-rod, and let down tentatively until the cup contains a small quantity of tar—the measurement upon the gauge-rod enabling the subsequent calculations to be made. But, whatever method is adopted, the manhole must be open for a short time for the purpose. Sometimes a china float is fixed in connection with a measuring rod; so that the total contents of the tank can be seen at a glance. The necessary opening through the

top of the tank for the gear-work or rod as the case may be, is generally a little larger than the parts working through it; and hence a little ammonia gas is lost in this way.

The fundamental question which is of importance to all gas-works undertakings, is whether the ventilation of such tanks is desirable or detrimental. Ventilation necessarily involves a considerable loss of ammonia. It might justly be argued that if ventilation providing for evaporation is desirable, wherein lies the use of building expensive arches and providing girders for the covering of the tank? The idea of ventilation is suggestive of a pressure of gas accumulating in the tank; but this, it is well known, does not exist. If pressure or vacuum be a cause for anxiety, this can be easily overcome by providing a water-gauge in proximity to the tanks, where a casual observation would give the conditions obtaining in the tank. During pumping operations, it is desirable to have the man-lid open a little way, in order to provide for the displacement of the liquor by air; although the man-lid, not being a gas-tight one, generally provides an ample inlet.

The dissemination of such gas about a gas-works or district is eminently undesirable. Ammonia gas is well known to leave a bluish tint upon everything it comes in contact with, to the disfigurement of buildings and plant. And, however beneficial infinitesimal doses of ammonia may be, it has not yet been claimed that a large quantity freely distributed is conducive to health. Indeed, the ammoniacal odour about a well-conducted gas-works is generally the signal for an examination of the plant and apparatus concerned, with a view to the arresting of the loss taking place.

The subject of ventilation is one upon which even eminent gas engineers are divided. Some affirm with considerable emphasis that ventilation is desirable; while others denounce it as being too ridiculous to consider. All tar and storage tanks should be enclosed by a handrail preventing the storage of any material thereon, or indeed the passage of carts, vehicles, or pedestrians over them. Further than this, a clearly defined "Caution" should be placed on the tank, to the effect that under no circumstances whatever must a naked light be taken across the same or used in connection therewith. Any desired restrictions may be added to suit the ideas of different engineers.

In the case of anyone wanting to ascertain the quantity of liquid in a tank after daylight, a safety-lamp should be used for the purpose. Electric lamps, too, are now being used about some gas-works where there is any liability of danger. Indeed, as these articles get cheapened, they will probably be of great use where explosive gases are concerned. An open grating on the top of a tar and liquor storage tank is sometimes used; and ventilating shafts have also been provided, carried some little height above the tank.

The object of ventilation has, however, not yet been made apparent; and the subject is one which might worthily form a topic of discussion at one of the meetings of the Institution of Gas Engineers, the Gas Institute, or one of the District Associations—apart from a paper being read thereon.

VARIOUS SPECIAL BILLS FOR 1900.

THERE remain for notice, as forming part of the parliamentary programme of the session with which the gas or water interests are directly or consequentially concerned, certain Bills which do not come into any ordinary classification.

The City of London (Various Powers) Bill aims, with other objects, at the making of further and better accommodation for the laying of pipes, wires, and other apparatus in, over, or under streets, and the conferring of further powers upon the Corporation with respect to the control of streets and structures across streets, and the fixing of apparatus for public lighting in streets. The preamble refers to the prospective operations of the National Telephone Company and the Charing Cross and Strand Electricity Supply Corporation in breaking open all the main thoroughfares of the City, and declares that, owing to numerous other statutory powers enjoyed and exercised by other undertakers for doing the same thing, it is difficult to find room in some streets for all the pipes and wires. Therefore the Corporation desire power to provide and maintain proper and sufficient accommodation (called public service works) for this class of property. Part 6 of the Bill accordingly proposes that, with the consent and approval of the Board of Trade, the Corporation may make such public service works as may be necessary and expedient. These works may be carried through and across all underground cellars and vaults that may be found in the way; as little damage as possible being caused, and any damage wilfully or negligently done being fully compensated. All such public service works are to vest in the Corporation. Provision is made for the removal of pipes and wires into the public service works when made—new ones as and when required to be laid, existing ones to order of the Corporation and at their expense. There is to be a charge for the use of the public service works; but in the case of gas and water pipes in the streets by statutory right, the charge is to be based only on the saving (if any) resulting to the Company by reason of the pipes being laid and accessible in public service works, instead of being buried. Where public service works exist, the powers of Companies to break up streets are to cease. All pipes in these works are to be kept in proper order by their owners, under the supervision of an officer of the Corporation, who are to be responsible for the ventilation and drainage of the works. The administration of the public service works is to be in accordance with bye-laws to be approved by the Board of Trade. Provision is made for fixing the liability for accidents. A clause proposes to give the Corporation power to affix apparatus for public lighting to the external walls of any building in the City. The expenses of carrying out the provisions of the Bill are to be raised by a loan on the security of the consolidated rate or the sewer rate.

The London Water (Purchase of Companies) Bill is to empower the London County Council to acquire the undertakings of the London Water Companies. It is stated in the preamble that some of the Companies were established by Parliament in consequence of popular dissatisfaction with the quality of water supplied and the prices charged by the older Companies (the New River, Chelsea, and Lambeth Companies), with the object of making the supply competitive. The East London Company were also empowered to supply in part of the New River district. The Companies, however, subsequently entered into mutual arrangements, and refrained from competing among themselves. It is declared that, as a result of these combinations, the ordinary domestic consumer is generally charged the full maximum rate, which varies in different districts, but is always levied on the rateable value of the houses supplied. The rest of the preamble refers to proceedings taken since 1892 to deal with the water supply of London, and declares that the London County Council have come to the conclusion that, for financial and other reasons, it is desirable to adopt the policy of acquiring the undertakings of the Companies. Wherefore, the preamble states that, "in order to avoid further delay in finally settling the question of Metropolitan Water Supply, it is expedient that provision should be made for forthwith placing the undertakings of the Companies in the hands of the Council." Clauses of the Bill provide for the transfer of the undertakings by agreement; or, in default of agreement, by arbitration in accordance with special provisions. The purchase price is to include the cost of reinvestment. Otherwise the arbitrators are to exercise their absolute and unfettered discretion in arriving at the fair and reasonable value of the property, after considering all the circumstances and contentions of the parties. The Council and the Companies are to be empowered to enter into, and carry into effect, any agreement for the issue and acceptance of stock annuities in discharge of the consideration for transfer. Retiring officers are to be compensated. The Staines Reservoirs Joint Committee are to be dissolved, and the property vested in the Council. All the Companies' systems are to be combined for equalizing the supply over the Metropolitan water area. The Council propose to take powers to appoint a Committee of Management, which may include non-members of the Council. Extra-Metropolitan Councils are to have powers to acquire their portions of the undertakings, and to act as water authorities. The schedules of the Bill give the parliamentary status of the several Companies.

The London Water (Welsh Supply) Bill declares that the works of the eight Water Companies are inadequate to provide for the prospective requirements of the population within the Metropolitan water area, and that it is expedient that the scheme described in the Bill should be sanctioned. This comprises the construction of reservoirs for collecting the waters of the Rivers Irthon, Towy, Doethie, and Wye; a service reservoir at Borehamwood, in Hertfordshire; and the main and distributing aqueducts. It is desired to acquire the necessary protection lands. The lands are to be acquired within seven years, and the works completed within twenty years. Compensation water is to be provided as regards four streams. The capital expenditure contemplated is £18,100,000, repayable in sixty years.

The Metropolitan Water Companies Bill is to confer further powers upon the Local Government Board, and to impose further obligations upon the Metropolitan Water Companies with a view to providing for the future needs of London in regard to the supply of water. The object of the Bill is to enable the Local Government Board to arrange for the construction of additional storage reservoirs in the Thames Valley, as these may from time to time be required to enable the Water Companies to fulfil their engagements. It proposes, in effect, to develop without limit the scheme of storing and husbanding the flow of the River Thames, of which the Staines reservoirs are the first instalment. The cost of the works is to be provided by issues of unredeemable debenture stock. All schemes under the Bill are to be submitted by the Water Companies interested, to the order of the Local Government Board.

The Chelsea Water-Works Bill is to empower the Company for the general purposes of their undertaking to purchase by agreement and hold 100 acres of land. A certain creation and issue of shares to the nominal amount of £34,215, converted into stock (as to the legality of which doubts have been expressed by the Official Auditor), is to be made valid. A further sum of £20,000 of redeemable debenture stock is to be issued. Special clauses are inserted for dealing with the situation created by the Official Auditors' delay in passing the accounts.

The East London Water Bill is to authorize the Company to construct additional works, including two storage reservoirs at Waltham Abbey and Chingford, Essex, for collecting the waters of the River Lea. The works are to be completed in

seven years, subject to clauses protecting the Lea Valley Drainage Commissioners and others. Arrangements are proposed for enabling the Company to temporarily increase their powers of taking water from the River Thames, with the sanction of the Conservators, and without detriment to the interests of the other Companies enjoying equal privileges in this respect. Molesey Weir is to be adapted to the measurement of the flow of water over it. Mutual arrangements for assistance are to be made between the Company and the other Metropolitan Water Companies, under the direct sanction of the Local Government Board. Additional debenture capital to the amount of £1,800,000 is required, redeemable in the customary manner for London Water Companies.

The Lambeth Water Bill is to enable the Company to construct an additional reservoir at Molesey, with the necessary subsidiary works, within fifteen years. More Thames and gravel water is to be taken for the purposes of the Company's undertaking, under particular conditions applying to the flow of water over Molesey Weir, and subject to certain payments to the Thames Conservators. The Company desired to raise additional debenture stock, redeemable at par in 25 years, to the amount of £750,000.

The London Sea Water Supply Bill is to enable the Company to increase their share capital by £400,000, and to borrow £100,000, for the purpose of reviving and extending the undertaking authorized in 1896, but not apparently carried out.

RECENT PUBLICATIONS.

The Local Government Annual and Official Directory. Edited by S. E. Rogers. ("The Local Government Journal.")

The ninth issue of the above-named publication contains many new features, including the charges made for gas and water by the London Companies and by those supplying gas in the suburbs, and also the names of the officials. It is to be regretted that the information given on these matter is not quite so up to date as we trust is that furnished in regard to other subjects. For example, the price charged by the Gaslight and Coke Company is put down at 3s. instead of 2s. 11d. per 1000 cubic feet; and there have been some official changes which are not recorded. The Directory contains abstracts of 14 Acts of Parliament affecting local government which were passed last session, as well as a number of short articles and paragraphs dealing with this subject. This section of the book is called "The Local Government Companion," and among its features are memoranda for members and officials, points about Parish Council law, information respecting the growth and cost of electric traction, the legal decisions of the year affecting local government, facts about the Local Government Board and its work, and figures bearing upon municipal rating and finance. The Directory portion, which the Editor says has been "officially revised and brought up to the latest possible date," contains the names of the chief officials of the public bodies in England and Wales.

The Wonders of Modern Mechanism. By C. H. Cochrane. (J. B. Lippincott Company.)

The author of this compilation has attempted to supply the public with an account of the results obtained within recent years by engineering and mechanical science, and a forecast of the achievements of future research, more accurate than those furnished by the newspaper Press, and less detailed than the descriptions given by technical journals. He has succeeded, we fear, in being sufficiently technical, in many of his articles, for his book to fail of appreciation by the general public; while the subjects are, of course, dealt with in too general a manner to interest, or at least to inform, those acquainted with any particular branch of mechanical science touched upon. It is a pity the author did not steer more successfully clear of technical detail, as, freed from that defect, his work would be calculated to engage the attention of, and stimulate a desire for knowledge in, those with a bent towards mechanical engineering.

It would be quite impossible, in a review of reasonable length, to examine and criticize the writer's description of the many and varied achievements of mechanical science, or to consider his pronouncements upon their respective value and future. He includes in his survey some two hundred subjects, ranging from bicycles to battleships, and from sugar-refining to the Suez Canal. In regard to the question of artificial illumination, Mr. Cochrane, who is an American, prefers water gas to coal gas, acetylene to water gas, and electricity to any of them, as the source of light. In his preface, the author pours scorn upon the knack which newspaper writers undoubtedly possess (on the other side of the Atlantic even more markedly than on this) of claiming for each newly-announced invention the most extravagant and impossible results. He, however, is himself by no means free from undue optimism in his estimates as to the probable future of inventions that have been, or are about to be, made by his fellow-countrymen. He has evidently an unbounded faith in the ingenuity of Edison and of Tesla, who are periodically announced to have invented some means of annihilating armies and fleets by the touch of a button several hundreds of miles distant, or some other world-staggering triumph of mechanical science. Far be it from us to minimize the extent of their actual achievements; but it is a mistake for their countrymen to be constantly heralding the birth of unhatched swans—they have more than once come out geese. We do not, therefore, tremble when our author speaks confidently of the time "when we shall buy calcium carbide as we now buy coal, only at about double the price; and it will furnish us [with] light, heat, and power at about one-fourth the present cost. Doubtless gas companies will soon take to furnishing it in the mains to consumers, though its easy liquefaction makes it so suitable for household use that it may eventually kill off the coal-gas industry altogether." We have heard of another property of acetylene gas which, if that illuminant were generally adopted for household use, might end in its eventually killing off the consumers altogether.

The author has also unbounded faith in the possibilities of liquid air—"a new motive fluid that promises to supplant the steam-engine, and give almost costless power, cold, heat, &c." In this field, Charles E. Tripler is the hero who "has stated" what he can do. He "claims" to have accomplished this, that, and the other, but is not, we notice, said to have proved that he can do any of them. Among the supposed *faits accomplis* is that which is "to all practical purposes perpetual motion. It is not perpetual motion, however, since it uses a natural force—the sun's heat—in expanding the air that drives the machine." This is modesty, indeed!

Among other chapters dealing with subjects interesting to "Journal" readers, we may mention that on "Coal-Handling Machinery," in which the latest American contrivances are briefly explained—chiefly the apparatus manufactured by the C. W. Hunt Company, for which much is claimed. At the end of the chapter a recently suggested plan of conveying coal is described. The conveying is to be done by "pulverizing all the coal at the mines, and sending it through pipe-lines by a flood of water. Coal is very little heavier than water, and can be carried along readily. On receipt, it is proposed to subject the powdered coal to hydraulic pressure, moulding it into lumps of any desired size. If this shall prove feasible, the methods of coal-handling may be changed entirely; and the railway monopolies that now control the output of coal may give way to a pipe-line monopoly that will strive to emulate the Standard Oil Company." We really do not think Mr. Cochrane can mean us to take this as a serious suggestion. It is either a good joke (Fancy Beckton turning on the coal tap from Seaham Harbour!) or a reflection upon the intelligence of its author, and of anyone who thinks it of practical value. We have said what we think is the defect of the descriptions of what has been accomplished; we must add that we infinitely prefer them to the author's prognostications of what may be achieved. At the present time such of the general public as may look through this work will probably be most interested in the records and forecasts contained in the chapter on "Guns and Armour." That is, however, beyond our province.

A SCHEME OF RURAL SANITATION.

All things come to an end, and the indefatigable Special Commissioner of the "Daily News" has, at length, penned the concluding article of his interesting series on "Rural Sanitation" and cognate topics. The subject, more particularly in connection with the problem of village water supply, is one which appeals to many readers of the "Journal;" and we have already taken occasion to touch upon some of the leading features of the Commissioner's campaign. It has been abundantly proved that there are scandalous shortcomings in the system, or lack of system, which at present obtains in respect of village sanitation. The disease granted, it is imperative to find a remedy; and to that end the Commissioner has now propounded "A Rural Programme." Unfortunately, a programme of legislative reform has been proved by experience to be a thing full of peril and pitfalls; and, cordially as we sympathize with our contemporary's zealous efforts in a worthy cause, we dare not hold sanguine hopes that the prescribed remedy will be promptly available or wholly efficacious if and when introduced.

The first step, says the writer of the articles, must be the repeal of the special disabilities under which rural districts suffer, and the raising of their building powers to the same terms as those now possessed by urban districts. It is suggested that "there is no conceivable reason why the ridiculous difference should ever have been made." For our part, however, with some knowledge of the men who bear rule in village communities, we can well imagine that reasons exist for making the exercise of their statutory powers conditional. Indeed, it appears to us that it is in this respect that the Rural Programme somewhat misses its mark. Methods must depend upon the men. It is of little use to change the methods if the men retain their old characteristics; and since no Rural Programme can reform human nature, the difficulty of changing a time-dishonoured system may well daunt the spirit of the most ardent reformer. In truth, anything like a drastic and sudden revolution is altogether out of the question. Reform is only possible within the limit of practical politics; and though that is by no means an argument for letting ill alone, the position does distinctly call for gradual amelioration, rather than for any sweeping attempt to correct abuses.

The fabled king kept 3000 oxen for thirty years in stalls that were never cleansed. Hercules, as we know, cleansed the stable in one day by diverting the course of two rivers. But the Special

Commissioner of the "Daily News" is not Hercules; and the two rivers are not available. The Augean stable of rural insanitation cannot be wholly cleansed in one day, or in many days; and we greatly doubt whether the cleansing process would be expedited by conferring new or unrestricted powers on District Councils. But though, so far, we doubt the efficacy of the Rural Programme, and regard the Special Commissioner's vision of simplified legislation as a fond thing vainly invented, it is far from our wish to discourage practical attempts to introduce "sweeter manners, purer laws." There is, no doubt, a fine flavour of scorn in the condemnation of the cumbrous machinery of both Houses of Parliament, Special Committees, specifications, and deposits of notices, the eloquence of the Parliamentary Counsel, and finally the Lord Chancellor in a cocked hat, and with all the solemn paraphernalia of the Royal Assent, permitting a Rural Council to buy two acres of land. This, as the writer of the articles declares, may be too wildly grotesque for belief. But there it is; and it is to be feared that any programme, rural or urban, which starts with a proposal to remove the anomalies of the British Constitution is foredoomed, if not to failure, at least to indefinite postponement. When, however, we come to less ambitious suggestions, we find ourselves entirely at one with our contemporary in holding that it is in the position and personality of its officials, rather than of its members, that a District Council can best be kept up to the mark. It is but too probable that no effectual reform will be feasible in respect of sanitation, nuisances, water supply, and so forth, unless a great change is made in the status, first, of Rural Medical Officers of Health, and, secondly, of Sanitary Inspectors. The conditions under which the medical officers carry out their statutory duties are undoubtedly as hostile to efficiency as they well can be; and even more detrimental are the conditions of appointment affecting inspectors.

And, now, what of the suggested remedy? (1) That no Medical Officer of Health shall engage in private practice, or be removable from office without the consent of the Local Government Board. (2) That Sanitary Inspectors should be required to possess some practical qualifications for the exercise of their duties, and be liable to dismissal only with the consent of the central authority. What is the current state of things? The Medical Officer of Health can give only the odds and ends of his much-occupied time to the discharge of the public functions for which he receives an insignificant salary. He must occasionally be torn with conflicting impulses—the consideration of his own interests on the one hand, and his duty to the public, especially the poorer public, on the other. While as to the Sanitary Inspector—who may be a broken-down farm bailiff or a local publican in humble intimacy with the farmers on the District Council—he probably knows nothing about sanitation, but, like other men, is fully alive to his own interests, and therefore earns with discretion the £50, £60, or £70 a year which is supposed to ensure his discharging his duties without fear, favour, or affection. "The more quietly he gets through the year, the better the property-owners of the district will like it. He is the tamest of tame cats among local officials." Here, then, without essaying "catastrophic change," is where a beginning should be made, and even that beginning will involve considerations eminently calculated to disturb rural ratepayers, the majority of whom are averse to "new-fangled notions." If you want exclusive medical services, you must pay for them; if sanitary inspectors are to be fit for their work, they must no longer be recruited from the ranks of the nondescript and the needy. This, of course, is a fiscal question. In truth, the whole problem is one of pounds, shillings, and pence; and, viewing it in this light, we cannot feel entirely confident that the new century will soon see the "Daily News" programme carried into effect by a statesman prepared to initiate remedial legislation "not to be written merely in the words of the statute-book, but in the happier homes and healthier lives of a great population."

The Society of Chemical Industry and the Metric System.—On Monday of last week, Dr. W. S. Squire delivered before the London Section of the Society of Chemical Industry an amusing dissertation on "Recent Objections Urged Against the Adoption of the Metric System." The correspondence in "The Times" last year on this subject was the incentive which urged Dr. Squire to put forward his plea in favour of the system. He waxed especially wroth with Sir Frederick Bramwell's championship of the English weights and measures, and poured irony on certain coincidences which that apologist had pointed out as evidences of the practical convenience of the English methods. Among these, the following will be very familiar to gas engineers: A gallon of water weighs 10 lbs., and a cubic foot of water contains 1000 ounces. We may add to these the following coincidences, which Dr. Squire did not name, and are without parallel in the metric system: The carbonization of a ton of gas coal yields approximately 10,000 cubic feet of gas, and the carbonization of a gallon of oil yields about 100 cubic feet of gas, having an illuminating duty, in round figures, of 1000 English candles. No doubt Dr. Squire's good-natured sarcasm would have been turned on any speaker who had made bold to mention these coincidences as a supplement to those named by Sir Frederick Bramwell. As a matter of fact, however, Dr. Squire met with very little relevant criticism in the discussion on his paper.

PERSONAL.

Mr. ALFRED LASS has resigned his position as one of the Auditors of the Crystal Palace District Gas Company.

Mr. F. TRETHEWY has been appointed Secretary of the Devonport Gas Company, in succession to the late Mr. Williams.

Mr. JAMES LORD, Deputy-Borough and Water Engineer, of Blackburn, has been appointed Borough Engineer of Halifax.

Mr. G. H. STEWART, of Ennis, has obtained an appointment under Mr. W. Nixon, Manager of the Southbank and Normanby Gas-Works.

The appointment of Engineer and Manager of the Buxton Gas-Works, in succession to Mr. G. B. Smedley, has been obtained by Mr. MATT. DUNN, of Goole.

Owing to advanced age, Mr. JOHN PICKUP has resigned the position of Secretary and Manager of the Westhoughton Gas Company, after 31 years' service.

The Directors of the Windsor Gas Company have elected Alderman JOHN LANHAM HOLLIS, J.P., Chairman of the Company in succession to the late Sir G. H. Long.

Mr. JOSEPH W. BUCKLEY, the Engineer and Manager of the Falmouth Gas-Works, has been installed W.M., for the current year, of the Lodge "Love and Honour," No. 75.

Mr. HARRY GRUNDY, the Borough Treasurer of Stockport, has been voted by the Borough Council £250 additional remuneration, in respect of the extra services rendered by him in connection with the purchase of the water-works.

Mr. HARRY PICKFORD has (out of 53 applicants) been selected to fill the position of Assistant-Manager of the Farnworth and Kearsley Gas Company. He has already been in the Company's service, in another capacity, for the past 16 years.

The resignation of Mr. G. D. Malam, the Gas Manager of the Bingley District Council, will shortly take effect. For the vacancy there were 29 applicants; and from these the Gas Committee made a selection of four. On Monday last week, the Committee finally resolved to appoint Mr. E. H. SWAINE, Assistant-Manager to the Oxford Gas Company.

At the annual social meeting of the employees at the Dawsholm and Temple Gas-Works of the Glasgow Corporation, noticed elsewhere, Mr. JOHN PHINN, late Secretary of the Works Friendly Society, was presented with a marble timepiece and side-ornaments, together with a silver tea service for Mrs. Phinn, in recognition of his valuable services to the Society.

NOTES.

The Pneumatic Pyrometer.

At a recent meeting of the Cleveland Institution of Engineers, Mr. Edward A. Uehling read a paper on the pneumatic pyrometer and automatic recording gauge. It was explained that the principle of this instrument is to utilize for thermometric purposes the law of the flow of air through two successive minute apertures. As now perfected, the instrument has been tested and calibrated at the Stevens Institute of Technology up to 2500° and even to 3000° Fahr., without injury or alteration of the zero point, which is in this case the boiling point of water. The pyrometer is credited not only with the accurate indication of high temperatures, but it also makes an automatic record of its indications. It thus supplies a convenient and reliable check upon furnace working, which is invaluable for showing what temperature conditions go to the production of known results, and whether the attendants do their work according to instructions. Practically, the pneumatic pyrometer is an aspirator, with an inlet and an outlet at different temperatures. The rate of flow of the air depends on the temperature; and although this is a simple physical law, it has taken much study and ingenuity to render it available in pyrometry. Mr. C. Lowthian Bell has criticized the pneumatic pyrometer to its general disadvantage, as compared with the electrical pyrometer, but admits that it is better as a recorder. It is further described as being valuable as a check upon boiler attendants. Possibly it would be serviceable in connection with water-gas producers.

Expanded Metal and Concrete Construction.

Attention is drawn by Mr. J. P. Allen, of Newcastle, in a paper reproduced in the "Builder," to the advantages of expanded metal as a new material of building and engineering construction. The manufacture of this material has been greatly improved since its first introduction; and it is now highly suitable for employment as reinforcement for concrete. It is a clean-cut, neat steel meshing, of many sizes, adaptable for all kinds of plasterers' and concreters' work. Mr. Mansergh is stated to have used great quantities of it in the new Birmingham Water-Works; and he has also specified it largely for the North Shields reservoirs. In making concrete floors, the expanded metal is buried in the concrete, as in the Monier system of construction; 3-inch meshes being the usual size for this application. The iron joists may be 42 inches apart, and the concrete 3 inches thick; the top being finished off with coke breeze concrete, which takes nails. The ceilings underneath these

floors are best made of an independent layer of the metal lathing, plastered. Partitions can be made with gauged plaster—a mixture of portland cement and plaster of Paris—on the extended metal. In short, the material offers to architects an exceptional aid to improvement in building, with the advantages of fire-proof, sound-proof, and vermin-proof construction. It is claimed that the addition of expanded metal to concrete increases the bearing strength of the slabs from about five to eight times. Unfortunately for the popularity of this system of construction for ordinary dwellings, it appears to run to about double the price of the common wooden flooring.

Steam Packings.

Some information on the friction of steam packings has been given by Mr. C. H. Benjamin to the American Society of Mechanical Engineers. It is remarked that ordinarily this is one of the most serious sources of loss of power; it being, indeed, possible to bring to a standstill a small engine or pump by injudicious treatment of the stuffing-boxes. There is no means of knowing, short of this, what amount of power is being wasted by the packings. Experiments designed to elucidate the matter were made, under Mr. Benjamin's direction, by the students of the Case School of Engineering. Many kinds of engine packings were used. It was ascertained generally that the softer india-rubber and graphite packings, which are self-adjusting and self-lubricating, consume less power than the harder varieties. The old-fashioned braided flax stuffing gave very good results. Oiling the rod will reduce the friction with any packing. There is almost no limit to the power that can be lost by an injudicious use of the wrench on the gland nuts. The power loss varies almost directly with the steam pressure in the harder varieties; while it is approximately constant with the softer kinds. The experiments were made on a 2-inch diameter piston-rod, and therefore correspond to all engines of between 50 and 100 horse power. Good practice appears to consist in the application on the glands of the very least pressure which will prevent leakage —first with the fingers only, and then very gently by means of the wrench. Some packings will run for awhile without oiling the rod; but many kinds require oiling from the first. The experiments amply bore out the importance of the subject to the power user, but unfortunately did not disclose any expedient by which bad handling could be detected. The softer and more economical made-up packings chiefly owed their quality to the presence of graphite and oil.

The Midland Association of Gas Managers will hold their annual meeting in Birmingham on Thursday, the 1st prox.

The Prepayment Meter Collections of the Gaslight and Coke Company.—During the past year, 75,258,000 pennies, weighing 647 tons, were dropped into the penny-in-the-slot gas-meters supplied by the above-named Company to 114,668 consumers.

The Export of Carbolic Acid.—We learn that, upon representations made to them by a deputation of manufacturers, the Government have removed the embargo upon the export of carbolic acid to the extent of giving the Customs authorities power to permit shipments of crude carbolic, upon receipt of satisfactory assurances from the exporters that such shipments will not be used to the disadvantage of this country.

The Will of Mr. Horatio Brothers, of The Elms, Putney Hill, who died on Dec. 19, 1899, was proved on the 26th ult. by Mrs. Marianne Brothers, the widow, and Francis William Brothers, the son, two of the Executors. The value of the personal estate is £104,470. The testator gives £200, his wines, &c., and the use of his household furniture, to his wife, £500 to his daughter Kate Alice, £100 to his niece Rose Wilson, £100 to the Consumption Hospital, Brompton, and £100 each to his trustees. The residue of his property he leaves, upon trust, during the life of his wife, to pay annuities of £700 to her, £400 to his son Francis William, £300 each to his daughters, and £150 to his son Arthur Horatio; and the remainder of the income thereof between his son Francis William and his daughters. On the decease of Mrs. Brothers, a sum of £4000 is to be held upon trust for his son Arthur Horatio.

British Association of Water-Works Engineers.—The winter meeting of the Association, which will be held next Saturday, at the rooms of the Geological Society, Burlington House, under the presidency of Mr. W. Watts, F.G.S., will be of special interest, as a question will be discussed thereat which is daily growing in importance. It may be remembered that, at the annual meeting last June, Mr. C. E. Jones, one of the Council, speaking in support of the resolution drafted by the Special Committee appointed to consider the subject of the control of watershed areas, expressed regret that there had not been constituted long ago a National Board for this specific purpose. We learn from the circular issued by Mr. Percy Griffith, the Secretary of the Association, that Mr. Jones purposes dealing at greater length with this question, in a paper entitled "The Nation's Water Supply and its Effective Control." He will recommend the centralization of the control of all sources of water supply, and define the powers and duties of the National Water Board which he suggests should be formed and entrusted with this duty. As the subject is of vital and national importance just now, and various technical and other societies will be invited to send delegates to the meeting to represent their views thereon, the Council desire to have a large attendance.

TECHNICAL RECORD.

THE WHITE DEPOSIT ON CEILING-PROTECTORS AND ON THE CHIMNEYS OF INCANDESCENT GAS-BURNERS.

The white deposit often found on the under-side of ceiling-protectors, and on the inner surface of chimneys of incandescent burners, has not hitherto been exhaustively investigated. Dr. C. Killing, however, has lately given, in the "Journal für Gasbeleuchtung," an account of some interesting researches which he has made on this and similar deposits. He was unable to find any references to earlier experiments bearing on the subject, with the exception of a report of an investigation by Priwoznik on the deposit which is found on laboratory water-baths. To this report he makes allusion in the sequel.

The material for analysis was scraped off the under-side of some small copper bell-shaped ceiling-protectors, hanging about 7 inches above the chimneys of incandescent burners. The highest yield from a single protector was about 8 grains; and as every protector which had been in use for a moderately long time was coated with the deposit, there was no difficulty in collecting ample material for analysis. The deposit usually was of a dirty white colour; but frequently it was pure white, or delicately tinged with blue. It could readily be scraped off the protectors, but not without some black scales of cupric oxide being removed along with it. The deposit was amorphous. When heated in a tube to incandescence, it first gave up water, and its bluish tint changed to gray, which as the heat increased gave place to brown, while white pungent vapours were evolved. Ultimately the mass became black. When mixed with soda, and submitted to a reducing blowpipe flame on charcoal, a red ductile bright bead of copper was obtained. The deposit was analyzed by boiling it, in the first place, in distilled water, and filtering off the insoluble matter, which was then treated with dilute hydrochloric acid. The black scales of cupric oxide were thereby dissolved; and the matter which still remained undissolved was fused with acid potassium sulphate, treated with water acidified with hydrochloric acid, evaporated, and the silica thus separated and filtered off. In the acid solution, iron was separated from the rare earths by precipitating the latter as oxalates. One portion of the aqueous extract was acidified; and the copper present was precipitated by means of sulphuretted hydrogen. After expulsion of the sulphuretted hydrogen from the filtrate, and addition of ammonium chloride, the rare earths were thrown down by means of ammonia, filtered off, and identified by means of oxalic acid. In the filtrate, lime and magnesia were precipitated by means of ammonium oxalate and phosphate respectively. In a second portion of the aqueous extract sulphuric acid was determined in the usual manner by precipitation with barium chloride. The water in the deposit was determined by heating to about 400° Fahr. The results of the analysis are appended:—

	Per Cent.
Portion insoluble in water—	
Silica	0·30
Ferric oxide	0·21
Rare earths	0·55
Cupric oxide (black scales)	8·90
Portion soluble in water—	
Rare earths	0·83
Sulphuric acid	30·76
Cupric oxide	28·70
Lime	0·76
Magnesia	0·28
Water	28·03
	99·32

The white deposit found on glass and porcelain ceiling-protectors, apart from very slight traces of ammonia, has always consisted wholly of sulphuric acid. Likewise the stains on the glass chimneys of incandescent burners, when washed off by means of hot water, were found to consist of free sulphuric acid. In some cases, the glass had been corroded, and thousands of very minute furrows on its surface prevented thorough cleaning by the hot water; but free sulphuric acid was always detected. No doubt traces of lime, magnesia, and silica were present, along with the free acid; but they were not discovered.

The analyses indicated that the deposit on the copper ceiling-protectors consisted chiefly of copper sulphate. Silica was derived from particles of dust from the atmosphere which had been incinerated in passing through the flame. Ferric oxide was partly derived from the same source, but partly also from the iron mantle-props. The scales of cupric oxide were rapidly formed on the metal under the influence of heat and the hot gases; and hence the presence of copper in both the soluble and insoluble portions of the deposit was readily accounted for. Lime and magnesia were partly derived from atmospheric dust, and partly from the upper part of the mantle, which consisted to a large extent of magnesia. The rare earths were, of course, derived from the mantles, which would gradually give up a portion of their friable substance under the influence of a strong upward current, and the jar received each time the burner was re-lighted. These effects would be more marked with imperfectly hardened mantles.

The view which is prevalent in England, and to a less extent in Germany, that cerium oxide is more readily volatilized than thorium oxide, if correct, would lead one to expect a preponder-

ance of cerium oxide in the portion of the deposit on ceiling-protectors which consists of the rare earths. But, on examining the rare earths collected from the deposit with hydrogen peroxide, which is a very delicate reagent for detecting cerium oxide, the colour produced was precisely similar to that obtained from the same quantity of the fresh material of the mantles. Also, when the rare earths recovered from the deposit were mixed with 100 times their weight of pure thorium oxide and made into a mantle, the mantle thus produced showed no marked difference in its photogenic properties from a mantle of pure thorium oxide, or from one consisting of thorium oxide and 0·01 per cent. of cerium oxide. If the rare earths recovered from the deposit had the same composition as the original mantle—viz., 99 per cent. of thorium oxide and 1 per cent. of cerium oxide—the mantle produced by mixing them with 100 times their weight of thorium oxide would contain 0·01 per cent. of cerium oxide, and would have the same composition as the last mantle referred to. Photometric tests showed that there was no difference in the photogenic powers of the three mantles; whereas if the rare earths recovered from the deposit had contained more cerium oxide than did the original mantle, the mantle in which they were embodied would have displayed a higher photogenic power than the others. The quantity of rare earths recovered from the deposit on ceiling-protectors was in all only 1⅓ grains. Consequently, a mantle could not be formed wholly therefrom in order definitely to prove that they did not differ in composition from the original mantles. Nevertheless the evidence deduced almost certainly proved that the proportion of cerium oxide in the rare earths recovered from the deposit was not greater than in the mantles.

The deposit of which the analysis has been given above was obtained from Delstern, in Westphalia. The following is the analysis of deposit obtained from Düsseldorf :—

	Per Cent.
Portion insoluble in water—	
Silica	0·81
Ferric oxide	0·61
Rare earths	trace
Cupric oxide (scales)	2·16
Portion soluble in water—	
Rare earths	Nil
Sulphuric acid	30·48
Cupric oxide	31·45
Ferric oxide	0·58
Lime	0·70
Magnesia	0·15
Water	32·02
	98·96

The rare earths could not be detected in the portion soluble in water, and only in scarcely recognizable traces in the insoluble portion of the deposit. The Düsseldorf deposit must therefore be regarded as almost free from the rare earths. In face of these analyses—especially that of the Düsseldorf deposit—can volatilization of the rare earths be deemed to occur, or a greater predilection to volatilization be ascribed to the cerium oxide than to the thorium oxide ?

The sulphuric acid found calls for further comment. The commercial preparations of thorium, in use in mantle manufacture, contained until quite recently considerable quantities of sulphuric acid. In 1896 and 1897, the lowest proportion found by Dr. Killing was 1·1 per cent., and the highest 3·9 per cent. Even at the present time, the majority, though not all of the thorium preparations contain sulphuric acid. On the other hand, cerium nitrate never was found to contain sulphuric acid. Hence many technical men have been inclined to regard the sulphuric acid of the thorium preparations as the cause of the deposit on ceiling-protectors. But on the bells and chimneys there might often be found more sulphuric acid than any mantle would afford. Taking the highest amount of sulphuric acid found in a mantle—viz., 3·9 per cent.—one mantle would yield at the most 0·6 grain of sulphuric acid, even assuming that no loss took place in the processes of incinerating and hardening the mantles. In one case, however, 2·3 grains of sulphuric acid were present in the deposit recovered from a copper ceiling-protector placed over a burner on which two mantles only had been used. The sulphuric acid thus found could not, therefore, have arisen wholly from the mantles.

In order to determine more precisely whether the acid in the thorium nitrate played any part in the formation of the deposit on ceiling-protectors, mantles were made from thorium nitrate containing 3·9 per cent. of sulphuric acid. In a burnt-off, but unhardened mantle, the acid could still be detected. In a second mantle, which had been burnt off and raised to incandescence for a quarter of a minute by means of high-pressure gas, only traces of the acid could be found. A third mantle from the same thorium nitrate, after being raised to incandescence for two minutes, just as it would be in the ordinary course, contained no trace of sulphuric acid. Consequently sulphuric acid cannot be present in mantles made from the commercial thorium nitrate, which now contains very little sulphuric acid compared with the thorium nitrate from which these experimental mantles were made. It may therefore be regarded as certain that the white deposit has not been formed from sulphuric acid derived from the thorium nitrate used in the production of mantles.

The following table shows the quantities of sulphuric acid which were found on a copper ceiling-protector, in the form of copper sulphate, after 100 hours' consumption of gas, under a pressure of 16·10ths, calculated for a uniform rate of consumption of 3·5 cubic feet per hour :—

—	Batswing Burner.	Argand Burner.	Incandescent Burner.		
			Without Mantle.	With Mantle of Pure Thorium Oxide.	With Ordinary Mantle.
Grains of sulphuric acid	0·073	0·358	0·401	0·433	0·451

These figures indicated that with all burners in which the products of combustion were directed by a chimney straight up to the copper bell-protector, practically the same amount of sulphuric acid was collected on the bell. The absolute quantities were not identical, because the rates of consumption actually used varied—being for the batswing 7·75, for the argand 5·65, and for the incandescent burner 3·5 cubic feet per hour.

When a porcelain ceiling-protector was used, in place of a metal one, the sulphuric acid collected thereon only amounted to about 0·05 grain after 100 hours' burning, with either a pure thorium oxide mantle, or an ordinary one. The non-conducting porcelain bell was so hot that little sulphuric acid condensed on it; whereas the copper bell remained comparatively cool owing to the rapid conduction of heat from it. The copper also, for another reason, might collect more sulphuric acid than the porcelain bell. The layer of cupric oxide which rapidly formed as the copper became heated, would, like platinum, be capable of oxidizing vapours of sulphurous acid to sulphuric acid, and then would retain the latter in the form of cupric sulphate. The small quantities of sulphuric acid found on the porcelain bell (with which the effects of this action of cupric oxide were absent) did not enable any conclusion to be drawn as to whether the cerium oxide in the ordinary mantle played any part in oxidizing sulphur or sulphurous acid to sulphuric acid.

The facts established by the researches may be summarized thus: Sulphuric acid in the thorium nitrate used in the manufacture of the mantles is not responsible for the deposit on ceiling-protectors and chimneys, which must arise from the small amount of sulphur present in the gas consumed. The gas used in the researches contained no sulphuretted hydrogen; and the total sulphur, on the average, did not exceed 3¼ grains per 100 cubic feet. Even in the case in which the largest quantity of sulphuric acid was collected on a copper bell, the amount was equivalent to only 0·05 grain of sulphur per 100 cubic feet of gas consumed. Therefore only 1·5 per cent. of the total sulphur in the gas was ever recovered in the deposit formed on the ceiling-protector.

Priwoznik, in his investigation already referred to, concluded that neither luminous nor non-luminous coal-gas flames developed free sulphuric acid. This conclusion cannot be regarded as prejudiced by the fact that small quantities of free sulphuric acid were found, in the course of the researches now described, on porcelain ceiling-protectors and glass chimneys. Any contact of the gases formed on combustion, or of the flame, with copper or brass, would result in the production of sulphuric acid, as soon as a layer of cupric oxide had formed on the metal. Dr. Killing wishes to reserve to himself further investigation of this question, by examination of the gases produced on combustion when the apparatus is quite free from metals. He anticipates that he will be able to prove that the cerium oxide of the mantle extends its intense oxidizing action even to the sulphur of illuminating gas, and produces sulphuric acid therefrom.

THE VALUE OF PRODUCER GAS AS A FUEL.

The following article, sent to the "Iron and Coal Trades Review" by a special contributor, appeared in the number of that publication for the 2nd inst.

The question, What theoretical loss of heating power does coal suffer when burned indirectly as "producer" gas ? is one which has already been dealt with by some authorities; but the inquiry is not exhausted. The idea current in the minds of many who give some thought to the subject is that indirect burning of this kind causes a loss of something like one-third of the heating-power of the coal. Such an idea is likely to have arisen in this way: Carbon burnt to carbonic oxide—the most important component of producer gas—parts in the burning with 30 per cent. of its full heating power; and as carbon is the chief constituent of coal, the loss in the case of the one body has evidently been placed over against the other. Coal, however, is far from being all carbon. Moreover, the carbon of coal is of two kinds—volatile and fixed. Each kind behaves in its own way inside the producer. The carbon that is fixed is the only carbon to suffer loss of heating power by the burning inside the producer. The volatile carbon suffers no loss of heating power. It becomes rather the absorbent of much of the heating power the other carbon loses.

To make this plain, it is necessary to bear in mind certain facts relating to coal and its combustion. The burning of coal is both a heat-giving and a heat-absorbing operation; and this

is so, no matter how the coal is burned, whether a producer be used or not. Before the first appearance of flame can kindle on a piece of ordinary coal, heat must have been absorbed and work done upon that piece. This work is the liberation of gas and vapour out of its solid mass. The change in volume which takes place on the gas and vapour substance so liberated is very great. A single cubic foot of coal may yield several hundreds of cubic feet of gas and vapour, and this, too, while the coal to outward appearance is suffering no diminution of its own bulk. Such a change in volume in any body has a close connection as to amount with the amount of the heat which must disappear in working the change. Thus a cubic inch of boiling water in becoming a cubic foot of steam works up, or causes to disappear, heat sufficient to make boiling hot other 6 cubic inches of cold water. Of the whole substance of the coal, there is usually about one-third (in many cases a good deal more) over which there passes this great change in volume. From this, it will be seen that heat absorption on a scale too great to be overlooked has to be reckoned with in the combustion of a lump of coal.

Of the particular form of combustion which takes place inside the producer, it is necessary also to say something. The only combustion there which need take place is that of the fixed carbon of the coal burning to carbonic oxide. The carbon by this burning becomes dissolved away from its solid form into a fluid combustible gas until only its incombustible ashes remain. This burning produces a definite quantity of heat, and out of the sum of that heat is supplied whatever part may be necessary to drive out all the vapour and gas referred to above. But this sum of heat has to be drawn upon to supply heat for work of another kind as well. The air which burns the carbon to carbonic oxide is, of course, ordinary atmospheric air. Atmospheric air carries with it a small proportion of water vapour, variable in amount, but never entirely absent. This water vapour becomes decomposed in its passage through the red-hot carbon in the lower part of the producer, and there results from this decomposition another enlargement in volume compensated for by a further absorption of heat. The supply of this heat is another drain upon the heat which results from the burning of the fixed carbon to carbonic oxide, but a drain which means in this case no permanent loss.

Heat, then, being absorbed to a considerable extent in any burning of coal, and that amount of heat which is generated within the producer being only the fraction of a fraction, it would appear to be possible to have a balance established between the heat produced and the heat absorbed inside the producer.

This matter, so important, is one which fortunately can be brought to the test of figures—approximately so tested, at least. Before the figures are brought in, it may be explained that one of the chief factors of the calculation to be entered upon—the proportion of heat absorbed in driving out a given weight of gas and vapour from coal—has not as yet had an exact value assigned to it. The value which will be given to it here is the same as that attributed to it by Sir Lowthian Bell in his work on the "Principles of the Manufacture of Iron and Steel." In that work, calculations have been made of heat absorption of this kind in coke making, and also in iron smelting where raw coal is the fuel. A second doubtful factor of the calculation is the amount of heat produced by the burning of mixed hydrocarbons. A value not likely to be far wrong has been taken for this—a value based upon the findings of the chief authorities. But any error on this head can have very little effect upon the conclusions drawn.

Returning, then, to the main question of the effect on heating power in using the gas-producer, it would appear that the nature of the coal must have consideration. Lanarkshire splint coal might be taken in the first place as possibly a fair representation of the common or manufacturing coals of Scotland. The composition of this coal is given in Bell's work referred to above as the following :—

	Per Cent.		
Water given off at 212° Fahr.	11·62		
Carbon	66·00	—fixed 53·41 and volatile	12·59
Hydrogen	4·34	total	16·37
Oxygen	11·09		
Nitrogen	0·94		
Sulphur	0·59		
Ash	5·42		
	100·00	Total gaseous constituents	28·96

This coal, if burned in an open fire-grate in the usual direct fashion, would give something like the following value in heating power :—

	Heat-Units.
Carbon (fixed), 53·41 × 8000	= 427,280
Hydrocarbons (carbon, 12·59; available hydrogen, 2·96), 15·55 × 12,000	= 186,600
Together	613,880

But this heat is not all available. Deduction, as explained, has to be made therefrom for—

	Heat-Units.
Evaporation of water in coal, 11·62 × 622 (537 + 85)	= 7,227
Expelling gaseous matters in coal, 28·96 × 2000 (Bell)	= 57,920
Together	65,147

The net heating power works out therefore to 613,880 − 65,147 = 548,733 heat-units.

Comparing this result with the heating power of the producer gas from the same coal, the gas being burnt cold, the figures are :—

	Heat-Units.
Carbon, 53·41 = carbonic oxide, 124·62 × 2400	= 299,088
Hydrocarbons (same as above), 15·55 × 12,000	= 186,600
Hydrogen derived from moisture of blast, 0·288 × 28,600	= 8,236
Total heating power of gas	493,924

The difference between these two sums, 548,733 and 493,924 is 54,809, which means that 9·98 per cent. of the heating power of the coal would be lost by burning it as producer gas.

Coal might be taken next, where the composition is more than of the average of the coals of the whole United Kingdom. To such coal it might not be far wrong to give a composition of fixed carbon, 60 per cent.; volatile matters, 30 per cent., whereof 20 per cent. are combustible; and moisture and ash, 10 per cent. (moisture 5 and ash 5).

This coal, burned directly in the ordinary fire-grate, would give probably the following value in heating power :—

Carbon (fixed)	60 × 8,000 =	480,000 heat-units.
Hydrocarbons	20 × 12,000 =	240,000 ,,
Together		720,000 heat-units.

Deduct now—

Evaporation of moisture	5 × 622 =	3,110 heat-units.
Expelling volatile matters	30 × 2,000 =	60,000 ,,
Together		63,110 heat-units.
Net heating power	720,000 − 63,110 =	656,890 heat-units.

Converted into producer gas, and this gas burnt when cold, the result in heating power from this same coal would be—

Carbon 60 = carbonic oxide	140 × 2,400 =	336,000 heat-units.
Hydrocarbons	20 × 12,000 =	240,000 ,,
Hydrogen derived from moisture of blast	0·324 × 28,600 =	9,266 ,,
Total available heating power of gas		585,266
656,890 − 585,266	=	71,624 heat-units of loss

The loss per cent. of heating power in burning this coal as producer gas would be 10·9.

As the fixed carbon of a coal increases, it will be seen this calculation makes the proportion of loss by indirect burning to increase likewise. Again, with a coal containing very low fixed carbon—say, down to about 40 per cent., and volatile matters coming up to about 50 per cent.—the calculation would show no loss whatever for conversion to producer gas. Not many ordinary coals are found in this country where the ratio of fixed carbon to volatile matters is so low as 4 : 5; but even a much lower proportion of fixed carbon to volatile matters than this is found among the carbonaceous shales of the coal measures.

If anthracite coal be taken as representing the very highest ratio of fixed carbon to volatile matters in the whole of the coal family, the carbonaceous shales might be taken as the representatives of the other end of the scale. Anthracite may have nine or ten parts of fixed carbon for a single part of volatile matter; the shales a single part of fixed carbon to five or six parts of volatile matter. Anthracite as a fuel for making producer gas, when tried by the calculations used above, might show a loss in heating power as high as 25 per cent., or even fully more. The shales tried in the same way could not show any loss. Mixed with ordinary coal in a producer, the shales might even become the useful absorbents of surplus heat taken by the producer out of the coal, and thus make the gas-making process theoretically perfect so far as the heat equation is concerned.

The conclusion this points to is favourable to the use of the gas-producer. Previous calculations do not appear to have taken account of the heat-absorption side of the question. It is difficult, however, to see how this can be disregarded in reasoning upon either the theory or the practice of the matter. Carbonic acid in the shape of gas, and water in the shape of vapour, become discharged as the ultimate products of burnt-out fuel in all the forms of burning; and the latent heat of a vastly increased bulk must with these be carried off with no chance of recovery.

The correction in these calculations which has to do with moisture in the air that burns the carbon to carbonic oxide is based upon the average amount of such moisture in the air of this country. No allowance is made here for steam additions such as are common in the generation of producer gas. Steam, no doubt, can be used with advantage to store up the surplus heat of the producer, just as the natural moisture of the air is seen to store it up; but to generate steam requires heat. Besides, there seems likely to be a difficulty in using it exactly in the quantity required if carbonic acid is to be kept down in the gas.

The heat which hydrogen is assumed to absorb for its decomposition, and afterwards to give out again in burning, is not the full heat value of hydrogen burnt to water. The latent heat of the vapour is deducted. This latent heat comes with the air, and departs again with the products of combustion.

It has been proposed, for the sake of certain advantages, to melt out as a liquid slag the incombustible ashes of the fuels used in producer, gas making. This operation would absorb heat not absorbed in ordinary burning. Any solid body in becoming a liquid body absorbs heat for the work spent in making the change. The amount of this heat appears to be

affected very much by the nature of the body itself. The cinders or slags of iron-smelting blast-furnaces appear to be the only substances of a similar nature which have had their latent heat of fusion determined. Authorities differ in the value they give for the fusion of these. The value taken by Sir Lowthian Bell is 550 units. Assuming this to be correct, as applied to the earthy matters of coal, then for each 5 per cent. of these matters in the coal the absorption for latent heat of fusion would be 2·750 units, or less than one-half per cent. of the full heating power of the coal. Heat for this work would be drawn, as in the other cases, from the producer combustion—that is, from the carbon there burning to carbonic oxide; and the work would be done with no lessening whatever of the heat potential in the producer gas.

The sum of all the foregoing would seem to be—

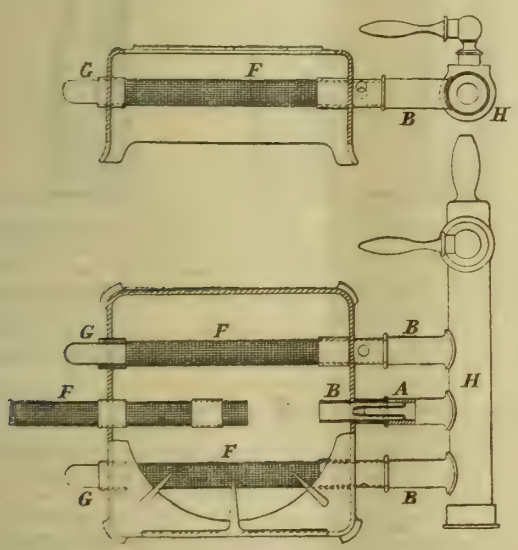
1.—That in making producer gas with coal of average quality, the loss in heating power need not be much over 10 per cent.

2.—That this 10 per cent. of loss might be wiped out by certain changes in the fuel.

REGISTER OF PATENTS.

Gas Heating-Burners.—Mills, B. J. B.; a communication from La Société Anonyme des Fontaines à Gaz, of Fontaines-sur-Saône, France. No. 3552; Feb. 17, 1899.

This heating apparatus consuming low-pressure gases is characterized by the supply of air being obtained by means of the combustion of the gas burning on the surface of one or several wire-gauze tubes, of suitable form, arranged horizontally or vertically—the supply of air being obtained partly through this wire gauze and partly through exterior openings arranged around the jets supplying the gas to the burners.



As shown, a part of the arrangement adopted in an ordinary bunsen burner is utilized—namely, the flow of the gas through a conical ajutage A into a larger tube B, formed with openings, which can, by means of a moveable sleeve, be more or less closed. Besides the diameter of A being greater than in gas-heating apparatus burning gas at ordinary high pressure, the flow of air through the openings is no longer due to the pressure of the gas (as this latter is almost of no account), but is rather due to the combustion of the gas itself by special burners.

These burners are attached to a main conduit H, serving to receive the gas from the main. They are formed of tubes F of wire gauze, having very fine openings or meshes, arranged parallel with each other, and are fixed by one of their ends around the tubes B, and closed at their other ends by a hollow stopper G.

In these conditions, the gas burns above the wire-gauze tubes, and its combustion draws in a supply of air partly through the holes of the wire gauze, and partly through the openings in B.

Treating Coal and other Illuminating Gases.—Colman, H. G., of Birmingham. No. 4742; March 4, 1899.

In view of the interest attaching to the subject dealt with by the patentee in his paper presented to the last meeting of the Nottingham Section of the Society of Chemical Industry—see "JOURNAL" last week, p. 330—we give practically speaking in its entirety the specification (not illustrated) of the above invention, which was issued on Saturday.

The invention relates to the treatment of coal or other illuminating gas at the stage of manufacture known as condensing; and its object is to obtain increased illuminating power and a more complete removal of the naphthalene.

The first part of the invention consists in removing the finely divided tarry matters suspended in the gas before permitting it to enter the condensers proper, and while it is still warm—say at about 100° to 140° Fahr. This is preferably accomplished by means of a centrifugal separator. The second part of the invention consists in diverting a portion of the gas before it is completely cooled, and causing it to rejoin the gas in the condensers when the main part has been wholly or completely cooled. The hydrocarbons carried by the uncooled gas are thus added to the main body at a time when they can be retained, and aid the illuminating power. A bye-pass may be used for this part of the invention. The third part of the invention consists in passing the gas before entering the condensers through a washer containing warm hydrocarbons, which removes the naphthalene, while adding to the gas a considerable quantity of vapour of low boiling liquid hydrocarbons.

The treatment may be divided into three parts, each of which may be applied separately, or any two of them together, or finally all three in succession.

The object to be attained in the first part of the invention is the removal from the hot gas, previous to its entering the condensers, of the whole of the liquid matters which have then separated, including not only the stream of tar flowing with the gas, but also the finely divided tarry particles mechanically suspended in the gas. These particles in the ordinary method of condensation pass with the gas into the condensers; and in the subsequent cooling they attract considerable quantities of the low boiling substances present as vapour in the gas, which are thus run away to the tar-well instead of being retained in the gas. By the present proposal for the removal of the particles from the gas at temperatures at which their attraction for the low boiling substances is small, the patentee claims to be enabled to retain a larger proportion of the latter (chiefly benzene and toluene) in the thoroughly cooled gas than would otherwise be the case—thus increasing its illuminating power. Further, owing to the removal of these high boiling constituents of the tar before the condensers are reached, the hydrocarbons which separate in the latter consist mainly of light oils, with very little of the higher boiling compounds; and such light oils, being then capable of dissolving a greater amount of naphthalene than is the case with the tar separating out under the ordinary method of condensation, effect a more complete removal of the latter hydrocarbon from the gas.

The apparatus employed for the removal from the gas of suspended tarry particles is of the ordinary centrifugal separator type. An appliance similar to the well-known cyclone dust collector is found quite suitable; an ordinary flap or other valve being provided thereon, by means of which the linear velocity of the gas entering the cyclone can be regulated to a constant quantity with varying volumes of the gas passing through the apparatus. A vertically adjustable outlet pipe is also arranged, to allow of a variation in the height at which the gas leaves the separator; and a syphon to discharge the tar from the bottom of the separator.

The second part of the invention consists (as hereafter described) in the bye-passing of a portion of the gas from the inlet of the condensers, and re-introducing it therein at one or more subsequent points, after the main stream of gas has undergone partial or complete cooling; and it may be used alone or in conjunction with the prior separation process already described. The secondary stream of gas which will, under usual conditions, have a temperature varying from 100° to 140° Fahr., will always be saturated with the hydrocarbon vapours at that temperature; and on mixing it with the wholly or partially cooled gas, it is suddenly reduced in temperature, with the result that a considerable quantity of the hydrocarbons is deposited in the form of mist or fog, which exposes an immense surface to the gas. An interchange then quickly occurs between the particles of the light oils and the gas; the latter taking up a portion of the lowest boiling constituents of the light oils, while the still liquid portions of the particles, which consist of hydrocarbons having a very great dissolving power for naphthalene, absorb the latter hydrocarbon from the gas and carry it finally to the tar well.

In carrying out the process, streams of hot gas previously diverted (by means of any suitably arranged bye-pass and connections) from the main bulk or stream of the gas, may be returned to the condenser and mixed with the main bulk when at different temperatures; but in all cases 10 to 20 per cent. of the hot gas must be added to the main stream when the latter has been reduced to a temperature of at least 70° Fahr., by which time the greater quantity of tarry matters will have been removed, even if no preliminary removal of these has been made—as indicated in the first part of the invention. The gas is then always capable of taking up considerably larger quantities of benzene and toluene, which are supplied to it by the secondary stream of gas. If the tarry particles separator is not used before the condensers, it may be used with advantage for the secondary stream of gas.

The result obtained by this part of the invention is therefore the same as in the previous case—the low boiling constituents of the hot gas are more completely retained in the gas, while the naphthalene is more completely removed.

The process comprising the third part of the invention is as follows: Before entering the condenser, the gas is passed through a suitable washer (preferably of the Livesey type), in which it is divided into a large number of fine streams, which bubble through a seal of the liquid hydrocarbons separated out in the condenser—these latter being heated, previous to running into the washer, by passing through a coil of pipe in the main conveying the hot gas; the washer itself being maintained, by any suitable means, at a temperature equal to that of the hot gas. If the tarry particles have not been previously removed by the cyclone separator in accordance with the first part of the invention, the washer will effect their removal; but the previous use of the separator will greatly minimize the chance of a block in the washer. Further, the contents of the washer then remain nearly free from high boiling tar constituents; rendering them more effective for the purpose in view. The tarry particles being thus removed, the hydrocarbons which separate out in the subsequent condensation will consist of such as have an appreciable vapour tension at 120° to 140° Fahr.—*i.e.*, chiefly the light oils; and the hot gas, therefore, passes in fine streams through these hot light oils, which dissolve out the naphthalene, while at the same time the gas picks up a certain proportion of the lower boiling constituents of the light oils, especially benzene and toluene, which pass on into the condenser. In this manner, there is always present in the condenser a larger proportion of low boiling hydrocarbon vapours than is in the gas produced by destructive distillation; this extra proportion continuously circulating through the condenser, and separating out in the cold portion, returning them to the washer where it is again taken up by the hot gas. By this means, the partial pressure of these vapours during condensation is greater than would otherwise be the case—thus causing a larger quantity to be retained in the gas, and increasing the illuminating power. Also the presence of an additional quantity of the light oils in the condensers assists in the removal of any naphthalene which may have escaped the action of the hot light oils in the washer at the inlet to the condensers.

In place of supplying the washer with the hydrocarbons separating

out in the condensers, it may be fed with the light oils obtained by the distillation of coal or oil tar. Where the condenser tar is used, this must only be allowed to remain in the washer sufficiently long to allow of the lowest boiling portions being taken up by the hot gas; if allowed to remain too long, the latter takes up appreciable quantities of naphthalene, instead of losing it.

The claims made for the invention are: 1. In the manufacture of coal and other illuminating gas, the removal from the gas, before it enters the condensers proper, of the stream of tar and of the finely divided tarry matters suspended therein, as described. 2. The diversion of a portion of the gas from the inlet of the condensers, and subsequently causing such portion to rejoin in the condensers the part from which it was separated. 3. The passing of the gas, before it enters the condensers, through a washer wherein it is divided into fine streams, and caused to bubble through a seal of heated liquid hydrocarbons. 4. The treatment of the gas by a combination of any one of the three processes named in the preceding claims with either or both of the others.

Obtaining Cyanogen Compounds.—Mactear, J., of Victoria Street, S.W. No. 5037; March 7, 1899.

The patentee's object is to obtain ammonium cyanide by submitting a mixture of gaseous ammonia and gaseous carbonic oxide, in a decomposing chamber—preferably charged with a suitable catalytic substance—heated internally (by employing an electrical resistance), to a temperature sufficient to decompose the gaseous mixture, and to cause the formation of the ammonium cyanide; also to obtain the ammonium cyanide in such manner as a step in the production of other alkaline cyanides and cyanogen compounds.

In carrying out the invention, the gaseous ammonia and the gaseous carbonic oxide are first mixed, in the respective proportions of about two volumes of the former and one volume of the latter, in a closed chamber, to which they are supplied by rotary pumps or blowers of such sizes, and driven at such speeds, as will deliver the gases in the required proportions. The gaseous mixture is then led into the decomposing chamber, wherein the mixture is heated to a temperature (approximately 1800° to 2000° Fahr.), sufficient to decompose it, and to cause, as the products of the reaction, the formation of ammonium cyanide and water.

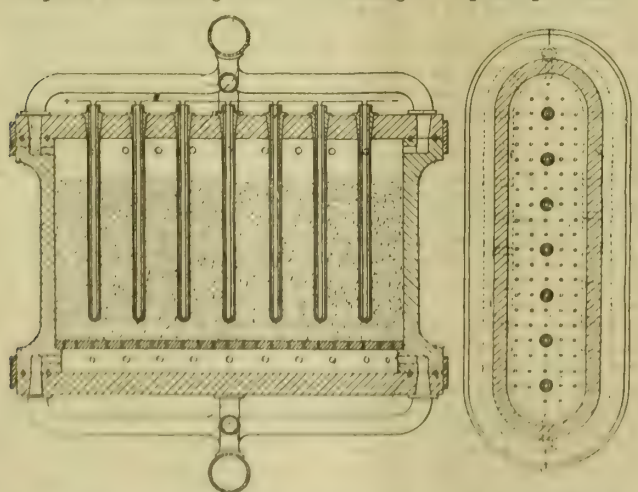
These products are led from the chamber and cooled, and, if (say) alkaline cyanides are required, are directed into suitable absorption vessels containing appropriate alkaline hydrates in solution in water or alcohol—such, for example, as caustic soda when sodium cyanide is required, or caustic potash when potassium cyanide is required, or a mixture of caustic soda and caustic potash when a mixture of sodium and potassium cyanides is required—with the consequent formation of the required cyanide or cyanide mixture, and liberation from the ammonium cyanide of the ammonia, which latter may be recovered and again used in the cycle of operations.

The solution of the alkaline cyanide or mixture of cyanides obtained is evaporated, preferably *in vacuo*, and the resultant cyanide or mixture of cyanides prepared for sale as a crystalline mass or else fused.

If ferrocyanides or other cyanogen compounds are required, the cooled products from the decomposing chamber are in like manner submitted to the action of known means of obtaining such compounds from ammonium cyanide.

To keep the volume of the gases entering into the reaction in the production of the ammonium cyanide as small as possible, the gaseous carbonic oxide should be used as pure as obtainable; and to this end, the patentee prefers that it should be procured by decomposing carbonic acid in sufficiently heated closed vessels charged with coke or carbon, and by freeing the resultant carbonic oxide from any carbonic acid in suitable purifying vessels. If, however, for any reason, the volume of the gases to be dealt with is not of material importance, a mixture of gaseous carbonic oxide with nitrogen or with nitrogen and hydrogen (such as may be obtained by the limited combustion of carbonaceous matter with air or with air and steam—as "producer gas" or "Dowson gas") may be used, in lieu of the gaseous carbonic oxide, in mixture with gaseous ammonia.

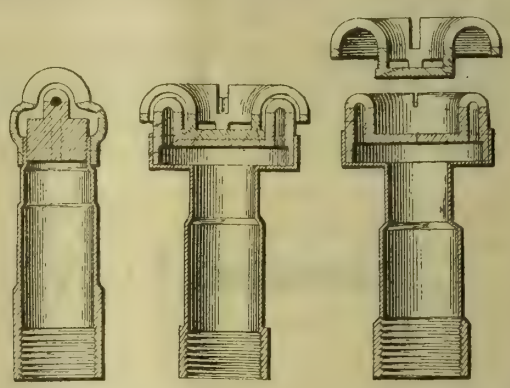
The heating of the decomposing chamber internally by the employment of an electric resistance is said to be of special utility and advantage, in enabling a practically equal temperature throughout the chamber to be obtained, "which is so essential a requirement to the economical obtainment of the required products," and also in enabling the chamber to be made of such a size, and of such internal dimensions, as will "enable the process to be carried out on a commercial scale with considerable economy as compared with existing means of obtaining the required products."



The accompanying drawings represent one form of the electrical furnace employed in carrying out the invention. It is a vertically arranged chamber, made of porcelain or other refractory material, and formed of an oblong shape with open ends and flanged extensions, the end faces of which are each formed with a surrounding annular channel, communicating with the interior of the chamber by lateral perforations. The chamber-ends are closed by covers, each of which is formed with through openings, adapted to communicate with the adjacent channels of the chamber. The openings at the inlet-end of the chamber communicate by branched piping with a main leading from the mixing chamber of the gases to be decomposed; and the openings at the outlet end of the chamber communicate by branched piping with a main, by which the products of the reaction of the gases in the chamber are led to the absorption vessels, wherein the ammonium cyanide is converted into the alkaline cyanide or other cyanogen compound required. The chamber is heated internally by a series of electrical resistances in the form of coils of platinum wire wound upon a support of refractory material mounted in a tube of refractory material passing into, or through, the chamber; the resistances being connected with a dynamo by means of which their temperature can be raised to such a point as will give the required equal temperature in the spaces between the adjacent tubes, and also in those between each of them and the adjacent sides of the chamber, whereby the desired equable temperature of the whole interior of the decomposing chamber is effectually obtained.

Acetylene Burners.—Dolan, E. J., of Philadelphia, U.S.A. No. 6116; March 21, 1899.

This invention has for its objects (among others) the provision of a burner by the use of which a flat-flame is produced from acetylene having "great illuminating power, the flame being absolutely smokeless." Another object is to provide for the mixing of the gas with a suitable quantity of air, to ensure perfect combustion, and also to cool the lower gas-tip, and prevent combustion taking place thereon. A tip is employed, having a slot preferably of the peculiar construction shown in the

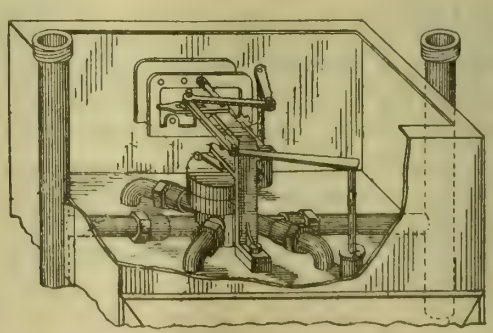


engraving as to its dimensions; and above this is fitted a cap having a combustion slot of greater area than the lower tip, with provision for the introduction of air at a point intermediate of the two slots. The invention is as applicable to a burner with a plurality of slots as it is to a burner having a single slot.

The illustration gives two forms of such a burner—in the second case with the cap shown also in its raised position for purposes of cleaning.

Detachable Valve for Gas-Meters.—Seymour, J., and Clark, W. J., of Toronto, Canada. No. 16,141; Aug. 8, 1899.

The object of this invention is "to simplify the mechanism for controlling the passage of gas in the meter, and to make it readily removable for repairs." It consists essentially of a valve-seat having detachable connections with the gas-spaces of the meter, the inlet-pipe, and the outlet-pipe; and of a rotary valve—the parts of the valve-seat and valve

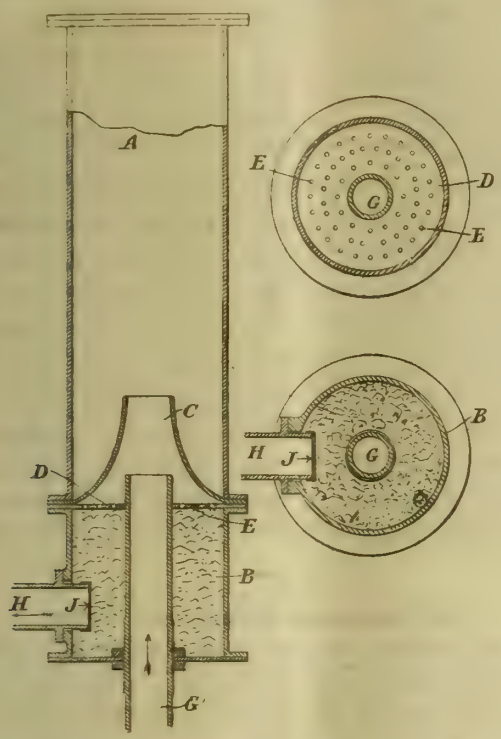


being provided with ports, and so shaped that those to the gas-spaces of the meter are successively placed alternately in connection with the inlet and outlet pipes of the meter by the rotation of the valve. The standard supporting the mechanism for rotating the valve is detachably secured to the meter, as shown in the engraving, which is a perspective view, and will sufficiently indicate the scope of the invention without further description.

Silencers for Gas-Engine Exhaust.—Evans, A. F., of Cambridge. No. 24,349; Dec. 7, 1899.

This invention relates to apparatus for reducing the effects of the intermittent escape of exhaust gases after explosion in a gas-engine cylinder, by providing two vessels or chambers, preferably cylindrical in form, and both having the same diameter the upper chamber being about four times the length of the other chamber. The outer end of each chamber is closed by a flanged cover-plate; and between the two chambers is a perforated plate, over which is fixed a funnel tapering towards the larger chamber. A smaller pipe leads through the middle of the smaller cylindrical chamber and the perforated plate into the funnel; and it is connected with the exhaust pipe of the engine. Another similar pipe leads out of the side of the smaller cylindrical chamber for conveying away the spent gas.

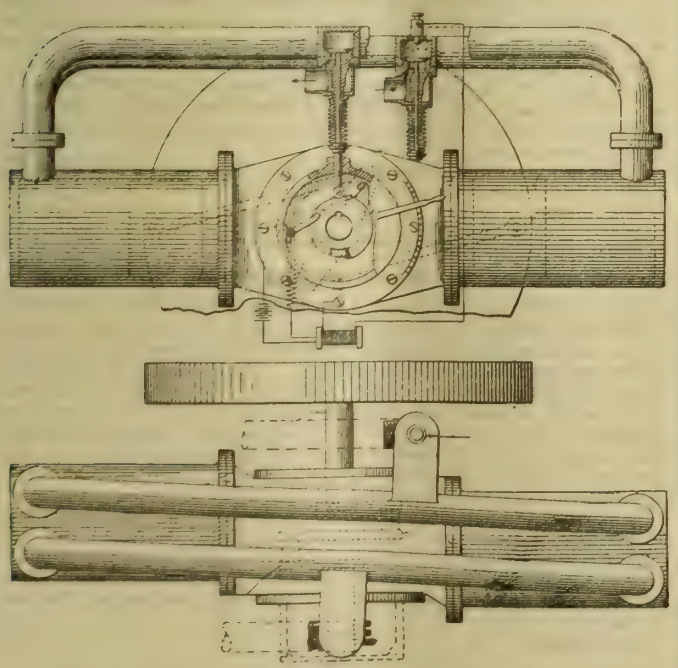
In the engraving is represented an elevation (partly in section) of the apparatus, a plan of the perforated plate, and a sectional plan of the smaller chamber and outlet-pipe.



A is the larger (the "buffer") chamber; B, the smaller or outlet-chamber; C, the injector-funnel; D, the perforated division-plate, with perforations E; G, the discharge-pipe leading from the engine cylinder to the cone of the funnel; and H, the outlet-pipe, which, if preferred, may be provided with a grating J. The chamber B can be filled with coke or other material, in order to scour or deodorize the issuing products from the engine. On a spent charge issuing from the cylinder, it enters the chamber A, and increases the pressure therein, but is prevented from escaping until the incoming gases have diminished in velocity sufficient for the gases in it to overcome the injection action of the funnel C, when they will eventually escape to the atmosphere through the chamber B and pipe H.

Explosion-Engines.—Smith, H., of Springfield, Mass., U.S.A. No. 18,425; Sept. 12, 1899.

This type of gas or explosive engine embodies a pair of cylinders oppositely arranged, but axially approximately coincident or parallel; each having a piston operating on a common crank-shaft. The outer ends of both cylinders are connected by a common comparatively large bow-shaped conduit, which constitutes a continuation of the explosion chambers of both cylinders, and permits simultaneously the action of the exploded gas oppositely inwardly on both pistons.



In such an engine as heretofore proposed, a common valve-chest or chamber has been provided in communication with the common conduit extensions formed as continuations of the explosion chambers for both the cylinders, in which valve-chest both an inlet-valve for supplying gas to the engine for both cylinders, and a valve for the exhaust from both of the cylinders through the common extension conduit, were provided. In such an engine, after the gas which entered the common conduit extension and simultaneously into both the cylinders has been exploded, the next stroke of the piston following the explosion or working stroke forced the dead-gas endwise outwardly in the opposite cylinders, and through the common conduit and cylinder extensions towards (and partially out through) the discharge-port—the discharge or exhaust valve at such period being open. But at best, a certain portion of the exhaust or dead-gas would remain in the chest or chamber in which both the inlet and exhaust valves are provided, and also in the common conduit extension—impairing, or preventing the perfection of, the operation of the engine, because the next incoming supply of fresh gas into the valve-chest and common conduit necessarily became admixed with the residue of the dead-gas from the preceding operation, and the highest efficiency of the engine was not derived.

The principal object of the present invention is to so construct the engine shown in the engraving (having the endwise oppositely arranged cylinders, each having a piston therein, operating upon a single intermediately disposed crank-shaft, the outer ends of both cylinders being closed, and provided with a common bow-shaped extension conduit connecting the closed outer end of both cylinders, and serving as a continuation of the cylinders), with means separate from the common conduit cylinder extension into and through which the gas is introduced and conveyed, for the exhaust and discharge of the dead-gas or residue, and all with the necessity of employment in the organization of the engine of but a single exhaust-valve and its operating mechanism and fittings, of but a single inlet-valve and fittings, and of but one igniting or spark-producing device. Another object is to provide for gas-engines mechanism combining both the exhaust-valve operating devices and the means not only for producing the igniting spark within the explosion chamber, but for regulating or determining at will the exact instant at which the explosion will take place for the most satisfactory results. A further object is to provide for gas-engines an improved form of valve adaptable both as the admission-valve and the exhaust-valve.

APPLICATIONS FOR LETTERS PATENT.

1815.—Davies, I. R., "Incandescent gas-burners." Jan. 29.
1827.—Lane, H., "Internal combustion motors." Jan. 29.
1845.—Simmance, J. F., and Abady, J., "Gas-meters." Jan. 30.
1893-4.—Haddan, H. J., "Retorts." A communication from A. G. Clark. Jan. 30.
1941.—Wright, J. W. B., and Darwin, H., "Gas-fires." Jan. 31.
1959.—Boult, A. J., "Production of water gas." A communication from E. Fleischer. Jan. 31.
1976.—Grierson, G., "Gas-meters." Jan. 31.
1996.—Dresser, S. R., "Stopping leaky joints in gas or other pipes." Jan. 31.
1997-9.—Dresser, S. R., "Pipe-joints." Jan. 31.
2063.—Sugg, W. T., "Incandescent gas lighting." Feb. 1.
2094.—Lyncker, G. A., and Mohr, M. L., "Indicating the presence in the atmosphere of coal gas or other gases." Feb. 1.
2099.—Snell, F. A., "Burners for incandescent gas lighting." Feb. 1.
2100.—Welch, W., "Incandescent mantelet gas-fires." Feb. 2.
2138.—Coxeter, S. & H., "Gas-stand." Feb. 2.
2145.—Voysey, A. A., "Working valve-controlled mechanism from a distance." Feb. 2.
2146.—Dewrance, J., and Paul, J. H., "Desulphurization of sulphuretted hydrogen." Feb. 2.
2161.—Cope, G., "Acetylene gas-valves." Feb. 2.
2170.—Barralet, T. E., "Valve for controlling the supply of gas to water-heaters." Feb. 3.
2184.—Jeffery, F. W., "Incandescent gas-lamps." Feb. 3.

New Gas-Works at Zurich.—New works have lately been constructed for the supply of Zurich with gas. The plant, which is all of modern type, is equal to the production of 3½ million cubic feet of gas per day; and the three gasholders will store 900,000 cubic feet. The works have cost £320,000.

The Higham Ferrers Water Bill.—The Bill promoted with the object of obtaining power to form a Company for the supply of Higham Ferrers and neighbouring parishes with water, has aroused a good deal of local dissatisfaction; and it has been decided, at a meeting of the representatives of the parishes, to strongly oppose the measure in both Houses. The promoters recently informed the Wellingborough Urban District Council that they were willing to exclude Wollaston and Irchester from their operations, and also to omit from clause 27 the words which give powers to the Company to take water from any other parish except those in which the works are to be situated. The Council thereupon decided not to oppose the measure.

Water Supply and Storage at Morley.—In a report to the Morley Corporation on the past year's work in the Water Department, the Borough Engineer (Mr. W. E. Putman) states that, should the consumption of water increase at the same rapid rate in the future as in the past, it was only a question of a few years before the Corporation would have seriously to take in hand the question of providing additional storage and means of delivery to the town. With regard to the work of reconstructing the Bruntcliffe service reservoir, he said that his previous explanations of the probable causes of leakage had been, and were continually being, substantiated as the work of reconstruction proceeded, and that up to the present time there had not been the slightest cause to suppose that the leakage was due to mining operations.

Gijon Gas Supply.—The Asturian Industrial Society have become the owners of the gas-works of the seaport town of Gijon, in Spain. In places as prosperous as Gijon, the "Revista Minera" remarks, gas-works are always very safe speculations, and if the Society purposes entering the gas industry, no other organization is better qualified to take the necessary steps for selecting an Asturian town to be supplied with water gas alone for lighting and heating. The above-named publication adds that if a Water-Gas Company, selling gas at 1s. 9¾d. per 1000 cubic feet, succeed, it would be adopted all over Spain, and the pipe-works of Asturias would have an unlimited market. There would then, moreover, be brought into existence an important industry for stoves and cooking ranges; and the use of solid fuel in houses ought to disappear.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Little Ways of the Officials of the Gas-Workers' Union.

SIR,—The ways of the officials of the Gas-Workers, &c., Union are "peculiar" if not "past finding out." By what has recently appeared in your columns, and from other sources of information, it is clearly shown that it is important to exercise caution in holding any communication with them. If, as a matter of courtesy, a letter is sent to them, or an interview had with them, or a statement made in regard to them of the most simple and formal character—these, and such like things, are at once paraded before the men and the public generally, as evidence that the "Union" is "recognized." If a kindly word is spoken in public in commendation of the Union's legitimate objects, and the speaker further says that concessions as to work and wages could and would be given equally well or better on application from the men themselves without the intervention of the Union, a portion only of the speech is given, and all reference to the latter remark entirely omitted.

All these things, and more which might be mentioned, are done with the object of compelling the workers to join the Union, on the ground that the Union is being "recognized," and is able to dictate terms to the employers. So much is this the case that men are being intimidated and threatened in all manner of ways. It is asserted that the works are to be made too hot to hold non-Union men; and that such men are the first to be discharged by the employers, and never taken on again! What a pity it is that steady working men should be misled by these fussy officials of what is only a Strike Union. The Union provides nothing in case of sickness, or help when out of work, or assistance to bury in case of death. A very large percentage of its funds is spent on officials and cost of management; and even when a strike arises the money is not available to keep wives and children from semi-starvation, or there are no funds at all, and an appeal has to be made to public charity.

Past experience clearly proves that it is requisite, on behalf of the employers and employed, to guard against misrepresentation in dealing with Gas Union officials; and it is equally clear that it is open to question whether the Union has been the means of securing any advantages to the workmen which justify its existence. At the same time it has been proved that its methods have been very costly both to men and masters, and terribly cruel to women and children.

Difficulty is also being caused in gas-works in the following manner: At the present time the plan is being adopted of appointing certain of the men to subordinate positions in the Union—thus constituting them officials. The result is that these men, "dressed in a little brief authority," almost demand to be employed, whether there is any suitable work for them or not—certainly to be first employed when there is work, and last to be dismissed when there is no work. The question of fitness is not to come in at all. In these cases, again, if the Union is in this manner recognized, the workmen have played into the hands of these busybodies, and the authority of the master or responsible manager is set at naught, and mischief caused. Such are some of the little ways of these Gas Union officials.

C. N.

Feb. 9, 1900.

Gas Fountains.

SIR,—Gas fountains seem to spring up perennially. Nearly forty years ago, one M. Mongruel—a Frenchman—had an apparatus for impregnating air with hydrocarbon vapour; and, if I recollect rightly, a Company was formed, which was called the Photogenic Gas Company, Limited. The apparatus was exhibited in Bishopsgate Street; and I had some correspondence in the "JOURNAL" about it in 1862 or 1863, by which I sought to show that what M. Mongruel stated he could do, could not be proved by "the irresistible logic of facts." Nearly all of these men try to make out that, by means of their particular apparatus, they can get more out of the hydrocarbon than there is in it. I then stated that to get as much light as from 1000 cubic feet of 16-candle coal gas, burnt under ordinary conditions, from 4 to 5 gallons of gasoline would be required; and this I still say, no matter how the liquid may be manipulated.

Some time ago a well-known Member of Parliament who was interested in an air-light apparatus—the invention of a Pole—requested me to experiment with it, and to report the result. It was represented that a light of 16 candles could be obtained with 5 cubic feet, carburetted at the rate of 2 gallons of gasoline per 1000 cubic feet of air. This gentleman undertook to find £1000 if I reported favourably. An apparatus was sent to me, which I fitted up (with other plant) to enable the experiments to be conducted properly. The inventor came down, and stayed two or three days. When the experiments were concluded, the result was that 4 gallons of gasoline were required to give the duty the inventor had stated as only necessary. I believe the inventor did not mean to be wilfully incorrect; but he was himself deceived by carelessly conducted experiments. I saved my friend from having to take £1000 out of his pocket; but because I had not put £1000 into it, he grumbled at paying me a very moderate charge, and to this day I have not been fully paid.

Some little time ago there was an exhibition of another wonderful apparatus in Lombard Street the invention of an American and a gentleman with long hair, and who looked and spoke like a German Professor of Music. I was asked by a friend to advise him as to the value of the invention. The arrangement consisted of a small blowing apparatus, to drive air into a holder for giving constant pressure; and there was a square box in the corner of the room, which, according to these gentlemen, was a sort of Pandora's box, with all the virtues inside. Lights were burning, which were represented to cost next to nothing.

I began by asking a few questions—such as, "What is the light due to?" "Oh," said the American, "that is just what our secret is. Here is some of the material, which is absolutely a new discovery." I inquired if the air took up some of the newly discovered material; but the answer was: "Are you prepared to plant $10,000 to be applied in part purchase of the patent, in case I convince you that what I have told you can be proved practically?" My reply was: "Not exactly; but if you will plant £10,000 which shall be mine if I prove to honourable experts that you are wrong, I will not take the £10,000 if even I win, but I will take a £10 note to give to some charitable purpose."

To convince me of the wonderful properties of his newly-discovered carburetting material, he blew through a cylinder the size of a 1 lb. coffee canister; and, sure enough, there was a light. "Pro-dee-geous; you must be Mephistopheles," I said. But as I smelt not exactly a rat, I came to the conclusion that the wonderful discovery was that either fossil meal or magnesium oxide was the *corpus*, impregnated with volatile hydrocarbon; and I then thought that it was not a Mephistophelean matter, but the scheme of a 'cute yankee, aided and abetted by a German "philosopher."

The advice I gave to my friend was "Don't." I offered to have another interview with these Masters of Arts; but they told my friend that I knew a d—— deal too much for them. The light "paled its ineffectual fires," and where the inventors are now, I know not.

I come now to this latest invention of the "Gas Fountain." Like Mongruel's, it seems to be of French origin; but what there is novel about it, I cannot make out. There certainly is nothing new in having the carburetting vessel *above* the lights, so as (as it were) to syphon the air charged with hydrocarbon vapour. It will, when so charged, be much heavier than air, and will fall by its own gravity; but the supply is affected by atmospheric conditions, and will vary considerably both in quantity of gas and quality of light. But the fact cannot be got away from that, to render 1000 cubic feet of air illuminating, there must be at least 4 gallons of hydrocarbon in the form of vapour. That is the difficulty; for, if even the air be denuded of its moisture before it comes in contact with the gasoline, it cannot carry the vapour through any great length of pipe without dropping a considerable quantity *en route*.

GEORGE BOWER.

St. Neots, Feb. 9, 1900.

The Registration of Gas-Liquor Works.

SIR,—One is unfortunately reminded at this season of the year that a fee of £3 must be paid to the Local Government Board for the registration of gas-liquor works under the Alkali Act. I think this tax a most disproportionate one, and in the case of small works it becomes a very heavy item per ton on the sulphate produced. In my own case, it amounts to about 4s. 6d. per ton of salt made; and in a works I know of, producing about 4 tons of sulphate per annum, the charge becomes 15s. per ton. It seems manifestly unfair that works turning out this small quantity of sulphate should have to pay the same fee as the large works which produce several thousand tons of salt per annum; and I think it is a matter well worth taking up by one of our Gas Associations. Representations might be made to the Local Government Board or to the proper authorities, pointing out the anomaly of the thing, and trying to obtain either a proportionate fee or else a nominal fee for small works producing less than (say) 50 tons per annum. Surely a simple registration fee of 10s. 6d. would suffice for this purpose; and I think the authorities would probably concede the matter, were it laid before them in an intelligent and powerful manner.

J. H. CORNISH.

Bridport, Feb. 8, 1900.

The Treatment of the Spent Acid from the Washing of Crude Benzol.

SIR,—Can any of your correspondents suggest a cheap and efficient method of dealing with the spent acid formed in washing crude benzol? At the gas-works with which I am connected, we have to get rid of about 100 gallons weekly. There is a waste-heap a few hundred yards away, where the stuff can be run off. The method in use now—viz., running into 40-gallon casks which are rolled away and emptied through the bung-hole—is expensive and nasty, as the casks are speedily rotted, and there is a constant morass of spent acid near the washer. I have tried a larger cask; but the stuff, if not quickly emptied, goes partially solid, and will not pass the bung-hole. A lead-lined tank is expensive; earthenware, brittle; cast iron, very heavy; and wrought iron would, I imagine, soon be corroded.

If you can give this letter space in the "JOURNAL," I am certain to receive some valuable suggestions.

R. C. S.

Feb. 8, 1900.

Gas-Stoves and Coal Prices.

SIR,—Travelling into the City a few days ago with a friend who holds a prominent position in the coal trade, I naturally asked him the cause of the exorbitant prices of coal this winter, and was met with the reply: "Why, the penny-in-the-slot gas-meters." Upon asking for an explanation, my friend made the following statement: "We sell hardly any coals for household purposes during the summer months, owing to the increased popularity of the penny-in-the-slot gas-meter for cooking and general domestic purposes. Therefore we have to make our profits for the year during the winter." As this seems very feasible, coal merchants must take care, or they will get beaten at their own game; for at the present time the gas companies throughout the kingdom cannot keep pace with the demand for gas-fires, cookers, &c. Paterfamilias finds gas at 2s. 1d. per 1000 cubic feet cheaper and cleaner to use than coal, at its present prohibitive prices—saving time, labour, and much worry. In the near future, therefore, we shall be able to dispense with the coal merchant all the year round.

NO COAL.

Feb. 9, 1900.

Gainsborough Water Supply.—On Monday last week, the Gainsborough District Council decided to borrow, with the sanction of the Local Government Board, a further sum of £8400 for artesian well purposes. The Chairman of the Water Committee said he hoped this would be the last time they would have to come to the Council for money for new works. They had spent on an old borehole £1733, and on a new boring £5750; while land had cost £1000, machinery for the old boring £2856, and a reservoir, water-tower, &c., £7490—making a total of £21,829. They hoped £8400 would complete the work.

PARLIAMENTARY INTELLIGENCE.

PRIVATE BILLS (SESSION 1900).

Last Tuesday, the Chairman of Ways and Means of the House of Commons (the Right Hon. J. W. Lowther) reported that he had conferred with the Chairman of Committees of the House of Lords (the Earl of Morley) for the purpose of determining in which House the respective Private Bills of the Session should be first considered. It was decided that the following Bills should originate in the Upper House:—

Barnsley Corporation Bill, Bristol Water Bill, Bury and District Water (Transfer) Bill, Cleethorpes Gas Bill, Dorking Water Bill, East Shropshire Water Bill, East Stirlingshire Water Bill, Edinburgh Lunacy Board (Water) Bill, Exmouth and District Water Bill, Exmouth Urban District Water Bill, Falkirk and District Water Bill, Falkirk Corporation Bill, Fishguard Water and Gas Bill, Glyncorrwg Urban District Council Gas Bill, Great Berkhampstead Water Bill, Gwyrfai Rural District Council Water Bill, Hemel Hempsted Corporation Water Bill, Higham Ferrers Water Bill, Kingston-upon-Thames Gas Bill, London Sea Water Supply Bill, Margate Corporation Bill, Menstone Water (Transfer) Bill, Morley Corporation Bill, Motherwell Water Bill, Mountain Ash Water Bill, Newport (Mon.) Gas Bill, Otley Urban District Council Water Bill, Paignton Urban District Water Bill, Ramsgate Corporation Improvements Bill, Rotherham Corporation Bill, Salford Corporation Bill, South Essex Water Bill, South Essex Water Board Bill, Walsall Corporation Bill, Westgate and Birchington Water Bill.

The following Bills will therefore originate in the Lower House:—

Aberdeen Police and Improvement Bill, Airdrie, Coatbridge and District Water Trust Bill, Bedford Gas Bill, Bradford Corporation Bill, British Gaslight Company (Staffordshire Potteries) Bill, Cambridge Corporation Bill, Chelsea Water Bill, City of London (Various Powers) Bill, Crowborough District Water (Gas Transfer) Bill, Dublin Corporation Bill, East London Water Bill, Gaslight and Coke Company Bill, Gaslight and Coke, Commercial Gas and South Metropolitan Gas Companies Bill, Glastonbury and Street Gas Bill, Glastonbury Corporation Gas Bill, Grantham Gas Bill, Halifax Corporation Bill, Hamilton Burgh Bill, Hartlepool Gas and Water Bill, Hastings Corporation Bill, Ilfracombe Improvement Bill, Lambeth Water Bill, Lea Conservancy Bill, London Water (Purchase) Bill, London Water (Welsh Supply) Bill, Lymington Corporation Gas and Electric Supply Bill, Maidenhead Gas Bill, Metropolitan Water Companies Bill, Mid-Kent Water Bill, Morecambe Urban District Council (Gas) Bill, Newtown and Llanllwchaiarn Urban District Gas Bill, North Warwickshire Water Bill, Oldham Corporation Bill, Ossett Corporation Gas Bill, Ossett Gas Bill, Redhill Gas Bill, Rickmansworth and Uxbridge Valley Water Bill, Rugeley Gas Bill, St. Albans Water Bill, Scarborough Corporation Bill, South Metropolitan Gas Bill, Southport Extension and Tramways Bill, Southport Water Bill, Spalding Urban District Council Water Bill, Sutton District Water Bill, Taunton Corporation Bill, Tottenham Urban District Council Bill, Wandsworth and Putney Gas Bill, West Bromwich Corporation Bill, Wetherby District Water Bill, Wolverhampton Gas Bill, Woodbridge District Water Bill.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Thursday, Feb. 8.

(Before Mr. Justice BUCKLEY.)

The Welsbach Incandescent Light Company v. The New Sunlight Incandescent Company.

This was the first of two actions between the above-named Companies, the hearing of which has for some considerable time been looked forward to with great interest.

Mr. FLETCHER MOULTON, Q.C., Mr. T. TERRELL, Q.C., Mr. ROGER WALLACE, Q.C., and Mr. WALTER appeared for the plaintiffs; Mr. BOUSFIELD, Q.C., and Mr. NEIL represented the defendants.

Mr. MOULTON, in opening the case, said this was an action for infringement of the patent of 1886, for the use of oxide of thorium in incandescent mantles. The defence did not raise the ordinary list of defences; but it denied the practicability and utility of the invention, and also infringement. This was the second in order of the important inventions by which Dr. Auer von Welsbach had created the present system of incandescent gas lighting. Before his first patent in 1885, incandescent lighting was practically confined to the limelight or similar arrangements with a block of magnesia; it being well known that a solid body which would stand being raised to an extremely high temperature would give out more light than gases at the same temperature. The merits of the original invention were several; but the two principal features were these: First, a totally new mode of preparing the incandescent body to be heated; and, secondly, the discovery of a new class of bodies—the rare earths—out of which it could be formed. The learned Counsel then minutely described the method of preparing mantles, and the materials—zirconia, lanthana, &c.—employed in their manufacture. Welsbach still continued his researches, until at the present day 1 cubic foot of gas per hour could be made to give a light of 20 candles; whereas at the date of his first patent, only 3 candles was produced. But this was not done all at once. The first step, which he had just described, was the most important; and the next most important probably was that which formed the subject of the patent now in question—the discovery of a new body, a rare earth, but of a different type to those mentioned in the first patent, which possessed certain great advantages for the making of mantles. This substance—oxide of thorium, which up to then was hardly known out of chemical museums, had never been used, and had never been referred to in connection with lighting. Thorium had the great advantage that it made a tough, strong mantle; but it had the disadvantage that it gave a comparatively small amount of light. Some years afterwards, it was discovered that, by the addition of a very small percentage of another rare earth, cerium, to thorium, mantles were produced giving a light far superior to anything before known, though the reason for this remarkable change was even yet unknown, and he would not attempt to explain it. Of course, he could not claim this later discovery as being embodied in the patent; the discovery was made in two stages. In the present patent, the use of thorium for making a strong mantle was claimed; and the utility of the invention was vastly increased when the means of making it highly illuminating were discovered.

Justice BUCKLEY asked if the effect was that the discovery of 1886 was not useful, because thorium was a bad incandescent, but it became useful by the addition of cerium later.

Mr. MOULTON said the first patent had utility, but not such great utility as it acquired afterwards. He then went on to describe the defendants' mode of manufacturing mantles out of threads of artificial cotton, made of cellulose dissolved in collodion, which he thought might be relied on to show that there was no infringement; and he said the infringement alleged was not in the mode of manufacture, but in the materials employed. The defendants practically made a thorium mantle, to which they added something which made it more brilliant. He then read from the specification of 1886 the list of substances described as useful for making incandescent mantles, which included pure thorium oxide and various mixtures in which it formed the principal ingredient. This was the first mention of thorium for such a purpose—in fact, no anticipation was alleged—and the use of thorium, either alone or in combination with the substances named, was claimed. The learned Counsel concluded by pointing out, and citing authority to show, that a very small amount of utility was sufficient to support a patent, especially when it was a new invention capable of development—illustrating his argument by the case of the steam-turbine.

Professor *James Dewar*, examined by Mr. TERRELL, said he had from the first been connected with the litigation respecting the Welsbach patents, and had fully investigated the subject of the rare earths and incandescent gas lighting. He found no mention of thorium in connection with lighting prior to the 1886 patent. He thought its discovery was the greatest step ever made in incandescent gas lighting, because it enabled thoroughly practicable, portable mantles to be made. He had tried all the mixtures mentioned in the patent. They were all practical, and gave a light very similar to that obtained from the prescriptions mentioned in the 1885 patent. A pure thorium mantle gave light, but not a good light. He knew the analysis of the defendants' mantle made by Mr. Ballantyne. One analysis gave oxide of thorium 89·93 per cent., oxides of the cerium group 0·67, oxide of calcium 9·56, and traces of oxides of iron and magnesia. Another gave thorium 98·1 per cent., cerium 0·64, calcium 1, magnesium a trace, and iron 0·25. In one case there was lime, and in the other substantially none; but it made little difference, as the lime would very soon disappear at the high temperature employed. Such mantles were substantially oxide of thorium.

Cross-examined by Mr. BOUSFIELD: The mantle containing the lime was, to all intents and purposes, thorium directly it was used, because the lime would volatilize. Assuming the lime remained, it would represent one of the mixtures. The lime might be taken as an equivalent for magnesia, to which it was nearly allied, and which was mentioned in the patent. Magnesia was not so volatile as calcium; and the proportion prescribed in the patent was much more than 9 per cent. In comparison with thorium, lime was very volatile; magnesia less so. Thorium was one of the least volatile; and lanthanum and yttrium very slightly so. Alumina was less volatile than the alkaline earths, such as lime and magnesia. One prescription in the patent, to give a yellow light, was a mixture of the oxide of thorium to magnesia and alumina. He could not say whether, after long burning, the thorium would be hardly affected, the alumina a little, and the magnesia the most. The oxides might behave somewhat differently when mixed from what they did individually. He had not investigated that problem. He had seen a mantle made entirely of alumina; and it was very strong, but gave practically no light. A mixture of zirconia and alumina made a strong mantle. He remembered such a mantle being produced in the first Sunlight case, which gave a good light when sprayed with chromium. He could not agree that the 1885 patent had no commercial utility. It was the basis of the whole system, though it took a long time to reach its present development. The standard for the illuminating power of coal gas was 3¼ candles per cubic foot per hour. A mantle made according to the 1885 patent gave 4 candles, if made of cerium, lanthanum, and yttrium; or if made with zirconium and lanthanum, 4·5 candles. With Siemens and Wenham burners, a light of 8 to 10 candles per cubic foot could be obtained. A mantle of pure thorium oxide gave from 3 to 4·4 candles. The thorium was not absolutely pure, but contained traces of cerium.

Friday, Feb. 9.

Professor *Dewar*, in further cross-examination, said cerium was exceedingly difficult to separate from the rare earth oxides entirely. A sample of pure thorium sent over by Dr. Welsbach gave a light of 1·3 candles. To this different proportions of cerium had been added; but he could not state the exact increment of light obtained by the addition of $\frac{1}{10}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, and 1 per cent. of cerium. The figures might be found by interpolation in the luminosity curve that had been obtained. He could not say that 0·25 per cent. of cerium would give 6·5 candles; but it would probably be somewhere about that. The illuminating power of the purified thoria of 1886 was from 4·3 to 3 candles. Witness was then cross-examined as to the sources of thorium and its mode of preparation. He said the principal source was the mineral known as thorite or orangite, which was practically a silicate of thorium. He quoted some analyses from "Watts's Dictionary," the edition of 1868; but they contained no mention of cerium. The amount was so small that it was neglected. He believed the proportion would be about 1 to 2 per cent. There might have been this amount in the sample he took; it was purified by the most approved method. It was first dissolved in hydrochloric acid, which separated the silica.

Then it was treated with sulphuretted hydrogen to get rid of sulphides. After this the whole of the rare earths were precipitated with sulphuric acid, and dissolved in oxalic acid, which produced oxalates of the whole group of rare earths. There were then two methods known of separating thoria, the best of which was precipitation by hyposulphite of soda —leaving the cerium, yttrium, &c. The other method was separation as double sulphates, which was not so exact. It was now known that a certain amount of cerium was precipitated with the thorium; but in 1886 this was not known—the thorium was supposed to be quite pure. It did not contain more than 0·25 per cent. of impurities, and that might be termed pure. He knew now that by a repetition of the process, and using high dilutions, the purity was increased. At the time he experimented, he only precipitated once. The amount of cerium left in depended to some extent on the care with which the operation was conducted. With regard to the other mixtures mentioned in the specification, he made use of the same thoria as that employed for No. 1. There were two sets of experiments—one with the pure thoria obtained from Welsbach, the other with thoria prepared by himself and Mr. Ballantyne. The zirconia, lanthana, &c., were not specially purified. He felt certain they contained no cerium. The results as to luminosity were: No. 1, 1·3 candles; No. 2, 1·2; No. 3, 2·46; No. 4, 2·5, or with cerite earth instead of lanthanum, 5·14; No. 5 he had not got; No. 6, 0·66; No. 7, 2·8; No. 8, 1·8; No. 9, 2. If a small amount of cerium were added to any other mixtures, the candle power was multiplied several times. These were the experiments made with thoria sent by Dr. Welsbach. With thoria of their own manufacture, the results were as follows: No. 1, 3 candles; No. 2, 1·3; No. 3, 3·3; No. 4, 4·2; No. 6, 1·1. He did not try the other numbers, which were for coloured lights. It was now known that a good general test of the amount of cerium present in a sample of thorium oxide was the amount of light it would give. He should not rely on it as a test. He did not experiment on the addition of certain proportions of cerium. It was not until 1893 that it was known that a pure thorium mantle gave hardly any light. He could not say that for some years after 1886 it was supposed that pure thorium oxide gave a better light than any other pure oxide.

Mr. Bousfield then read some figures given by Mr. Mackean in a paper in 1891, in which the luminosity of pure thorium oxide was put at 25 candles.

Witness said he did not remember it. In the original patent, the zirconia was a dominant factor. He could not say that the other ingredients were relied on to give the light. The effect of the 1886 patent was to substitute thorium for zirconium. It also pointed out that thorium oxide might be used by itself. The great point was that thorium made a rigid mantle when incandescent; it did not contract or alter its shape as the zirconia mixtures did. No. 2 prescription gave a flexible mantle. Flexibility was put as a good quality. A thing could not be rigid and flexible at the same moment, in the ordinary sense. He did not suppose Welsbach intended to convey the reverse of flexibility, but that it would not contract. By rigid, he meant flexible. Perhaps the translation was not exact. Mantles might be used with non-illuminating gas—such as water gas. The point was to get a flame of high temperature. He did not know of any use in this country of water gas for illuminating purposes directly; it was employed after enrichment with hydrocarbons. Fahnejelm combs used with water gas gave about 4 candles per cubic foot. The process used by the defendants for making the mantles was not, in his opinion, the same as that used for the Clamond threads. The baskets were made of magnesia expressed through small orifices. They were very fragile. The Fahnejelm comb was manufactured in a similar way. The defendants made a mixture of collodion with the oxides.

Mr. Moulton said it would be convenient to put in the description of the process given in answer to interrogatories, which he proceeded to read. From this, it appeared that the solution of thorium and cerium in the proper proportions was added to the solution of cellulose, from which the threads were formed, and then woven into mantles and burned off. He added that since the writ the defendant Company had been reconstructed.

Cross-examination continued: Witness had read the description. He did not see the analogy between that and the Clamond process; it was no more like that process than it was like Welsbach's method of impregnating a cotton thread. The artificial cotton was a support for the oxides, in the same way as the natural cotton was in Welsbach's mantle. It was a far-fetched analogy to compare the collodion to the gum or glue used in the Clamond process. Some photographs of mantles were shown to witness, representing (magnified) the appearance before and after burning. He said the amount of shrinkage was rather startling. The structure of the cotton fibre was visible in the burned-off mantle. Photographs of the defendants' mantles were then shown. When burned off, some of the threads broke; but sufficient remained to hold the structure together, leaving a rod of oxide. Artificial silk could be impregnated with salt solutions, given time. He did not suggest that in defendants' case the artificial cotton was impregnated in this way, because the other mode was easier. He agreed that the 1886 patent pointed out that if one dealt with thorium, as he did with zirconium in the former patent, it would give similar results. It had no reference to any suggestion that thorium could be used in the manner Clamond had proposed. It was common knowledge that oxide of thorium, like all irreducible bodies, would give light when heated. The mantle with 9 per cent. of calcium would be equivalent in some respects to prescription No. 2, putting lime instead of magnesia. He did not agree that all the rare earths might be taken as equivalents. For certain purposes, and within certain limits, they were the same with magnesia and lime. He considered that a mantle made of 99 per cent. of thorium and 1 per cent. of cerium came within the patent—say, within prescription No. 1. It was substantially an oxide of thorium mantle. Thorium with 1 per cent. of cerium in it would not have been considered pure thorium in 1886. The discovery was made in 1893 that a small percentage of cerium had a wonderfully stimulating effect on thorium. In 1886, Welsbach might have said that 99 per cent. of thorium and 1 per cent. of cerium would not do. He suggested the use of thorium as pure as it could be obtained. Welsbach warned people in 1885 against cerium; and the 1886 patent could not be understood apart from the former one. In 1886, pure thorium meant no greater impurity than 0·25 per cent. At that date methods of purifying thorium were well known. The method of purification described by Bunsen in 1875 had not been improved upon; but it would be utterly impracticable for commercial purposes. There were other processes also.

Re-examined by Mr. Moulton: However the thorium was purified, a mantle made of the oxide was rigid when incandescent, and would be so if it contained impurities up to 1 per cent. He repeated his opinion that there was no similarity between Welsbach's invention and Clamond's. There was practically no difference between the defendants' method of manufacture with artificial cotton and Welsbach's with natural cotton. Thorium belonged to neither the ytterite nor the cerite group. Its use had never been suggested before this patent. He himself had never seen thorium until he was engaged in the litigation on the 1885 patent.

Mr. *Horatio Ballantyne* was next called and examined by Mr. Terrell. In 1886, what was considered pure thoria always contained certain impurities, including ceria. In conjunction with Professor Dewar, he examined samples. One had a total impurity of 0·2 per cent., of which 0·05 was ceria. He had made experiments on the luminosity of mantles manufactured according to the prescriptions in the patent. The thoria employed was that they had determined to contain 0·05 of ceria. No. 1 gave 3 candles; No. 2, 1·3; No. 3, 3·3; No. 4, 4·2; No. 5, 3; No. 6, 1·1; No. 7, 2·8; No. 8, 1·8; No. 9, 2. In No. 4 he made an experiment, substituting cerite earth for lanthanum. It gave 6·5 candles. He also tried it substituting yttria for half the lanthana; the result being 4·5 candles. Subsequently using pure thoria derived from Dr. Welsbach, the result was 1·3 candles, as stated by Professor Dewar. He found that thoria gave a very rigid mantle. After burning, the sides did not collapse or swell out, as some mantles did. This was extremely important in incandescent lighting, because if the mantle got distorted it did not remain, as it should, in the hottest zone of the flame. No other single oxide had the same property; and therefore the use of thoria was the foundation of the success of the system. Mixtures of thoria possessed the same quality approximately in proportion to their percentage of thoria. He knew the method of manufacture adopted by the defendants. The nitrates of thorium and cerium were partly dissolved and partly suspended. The fabric produced was practically the same as Welsbach's. He had made mantles in this way. He had also made them of artificial silk obtained from Besançon, dipped them in aqueous solutions of the oxides, and burned them off. He produced mantles made in this way. He had analyzed defendants' mantles, and they contained 9 per cent. of lime. The lime quickly volatilized.

Cross-examined by Mr. Bousfield: He had a curve of luminosity showing the candle power given by mantles with varying proportions of cerium added to pure thoria. One per cent. gave 18 to 20 candles, ¾ per cent. 14½, ½ per cent. 13, ¼ per cent. 10½, and 0·1 per cent. 5·3. These were the average results of a number of experiments. The tests were taken in the ordinary Bunsen-Letheby photometer. He believed the pressure was ½ inch, but was not sure about that. At any rate, the tests were made under uniform conditions, in the same way as all mantles were tested. The pure thoria prepared contained 2·5 per cent. of impurities, of which about ¼ per cent. was ceria; the amount of the other impurities was not determined individually. He could not say what increase of luminosity would be occasioned by the quantity of ceria. In 1886, and for some years afterwards, thorium oxide was supposed to give a good light by itself. He had no doubt Welsbach himself thought so—not realizing the presence of cerium. In 1891, Mr. Mackean said pure thoria would give a light of 8 candles; but he did not think Welsbach expected so much as that. In 1886, Welsbach said that of all the separate oxides used for incandescent purposes, thoria was the one which possessed the greatest power of emitting light. There was no doubt now that the power was due to the presence of impurities. Two specimens of pure thoria were prepared by Professor Dewar and himself. It was done at the plaintiff Company's premises, and from material supplied by them. He believed the two parcels of thorite earth came from different sources. In the first place, they made a fairly large quantity; the second experiment was merely corroborative, and the quantity was less. A pure thorium mantle was not entirely useless. It could be used with water gas or Dowson gas; he had done it himself. He did not suggest that it had been done practically. There were other means of obtaining light from a non-luminous gas which might be preferable. For ordinary use with coal gas, a pure thorium mantle was useless; but the addition of 1 per cent. of cerium made it the best mantle known. Both rigidity and flexibility were useful; flexibility in forming the mantle, and rigidity afterwards. A thorium mantle was flexible under a very high temperature; and when in the ordinary bunsen flame, it was rigid. A mantle according to No. 2 prescription rapidly shrank and deteriorated. No. 6 was somewhat similar. He had analyzed defendants' mantles. One contained 9 per cent. of lime; another 1 per cent. The last was one sent by Mr. Duncan as representing what defendants proposed to make. The first was handed him by Mr. Mackean. He thought the defendants' mantle came substantially within the first prescription in the patent if it had 99 per cent. of thorium; and if it had 9 per cent. of lime, within No. 2. Anything which was substantially thoria and gave a good light, he should regard as coming within the patent. If 99 per cent. of thoria and 1 per cent. of didymium gave a good light, he should say it was within it; if it could not be called an illuminating appliance, it would not be within it. Iron had a deleterious effect; 1 per cent. would probably spoil any mantle, and it was a common impurity in these oxides.

Re-examined by Mr. Moulton: The claim was for oxide of thorium, or in admixture with other oxides. The statements in the patent about the various mixtures were accurate. There was no doubt he had durability in his mind as a very desirable quality. Thorium was the most durable of all known substances employed for this purpose. In 1886, it was the rarest metal—hardly known at all.

Mr. Moulton stated that was the plaintiffs' case.

Mr. Bousfield said his friend had not proved infringement. He wanted to see Mr. Mackean in the witness box.

Mr. Moulton understood infringement was admitted on the pleadings; they admitted the sale of mantles to Mr. Mackean. He also read the answers to the interrogatories. Mr. Mackean was not in England.

Mr. Bousfield said he did not object to an adjournment; but if his friend left his case there he should offer no evidence, and submit there had been no case made out. The defendants had never manufactured at all.

Justice Buckley said it was not denied in the answers to interrogatories that the defendants had manufactured.

Mr. Bousfield said the answer was that, according to their information and belief, the mantles complained of were manufactured in a certain manner.

A considerable discussion ensued; Mr. Bousfield submitting that the plaintiffs had not proved either manufacture or sale, and that there was no admission of manufacture.

His Lordship having intimated that, in his view, there was an admission of manufacture,

Mr. Bousfield proceeded to argue the merits of the case on the evidence as it stood. He submitted that Welsbach's method of impregnating cotton fibre with a solution was totally different from that adopted by defendants in making a plastic substance containing the necessary materials, which was formed into fine threads in the same way as artifical silk was produced. He quoted from the 1885 patent to show that Welsbach's claim was confined to impregnating the fabric by dipping it in a solution; this process being incorporated in the 1886 patent. He had not concluded his address when the Court rose.

Saturday, Feb. 10.

Mr. Bousfield (continuing his speech on behalf of the defendants) pointed out that mantles, as sold, contained 9 per cent. of lime, though the greater proportion of the latter might disappear soon after they were used by customers. Such mantles had been described by Professor Dewar as corresponding with prescription No. 2, which was 3 parts thorium oxide and 2 parts magnesia, and was said to give a flexible hood. No evidence had been given as to the rigidity or flexibility of defendants' mantle. If it were said to infringe prescription No. 1, it must be shown to be rigid; but to infringe No. 2, it must be flexible. Reading the whole specification, it looked as if Welsbach desired to attain flexibility. He cited one or two authorities dealing with the question of equivalents, and said there was no evidence whatever that a mixture of 90 per cent. thorium and 9 per cent. calcium was an equivalent to 60 per cent. thorium and 40 per cent. magnesia—still less that it was known in 1886 to be an equivalent, which was the real question. He further pointed out that if calcium, magnesium, and aluminium were to be treated as equivalents, prescriptions Nos. 2 and 6 would give the same results (No. 2 being 3 thorium and 2 magnesia; while No. 6 was 3 thorium, 1 magnesia, and 1 alumina), which they evidently did not. If it were suggested that defendants infringed prescription No. 1 for pure thorium oxide, because when the lime had volatilized the mantle was practically 99 per cent. thorium and 1 per cent. cerium, the answer was that the addition of 1 per cent. of cerium made all the difference between 1·3 and 20 candles; and the two things, therefore, could not possibly be equivalents. In former actions, the plaintiffs had relied on their right to have the chemical ingredients pure; but now they were relying on the impurities in thorium to support the patent. He submitted that the word "pure" in prescription No. 1 must be given due effect to, and went on to press the same point on the question of utility. The whole claim was, by reference to the 1885 patent, for a mantle giving a brilliant light; but pure thorium gave hardly any light. The learned Counsel also contended that there was nothing in the specification to show that durability was a point specially aimed at. The patent was for an improvement on the previous one; and it was substantially from the discovery that thorium might be substituted for zirconium. But this really gave much less light; and therefore it had no utility. In a pioneer invention, it was true, commercial utility was not the test—the smallest possible utility capable of development would support a patent. But it was quite different with patents for improvements. In connection with this point, he urged that prescriptions Nos. 2 and 6 were absolutely useless according to Mr. Ballantyne's evidence. He then cited authorities to show that a patent could not be granted for the use of a new substance generally to a known purpose; it must be for the mode of application. The learned Counsel submitted that the defendants' mode of application was quite different to that of the plaintiffs. This led to a comparison of the Welsbach skeleton mantle—which was a simulacrum of the structure of cotton thread which had been impregnated with the solution—with the expressed threads of plastic material used by defendants. This process was a development of the lines followed by Clamond and Fahnejelm, which Welsbach had left, and gone in an entirely different direction. On the whole, the learned Counsel submitted that the patent was invalid on the ground of non-utility, and that, neither as regards the matter of prescription nor process, had the defendants infringed. Of course, he also submitted, as he did at the outset, that plaintiffs had proved neither sale nor manufacture by the defendants.

Mr. Moulton then commenced his reply by submitting that the question of subject matter not having been raised, it was not open to his friend to argue that the construction of the patent must be guided by any consideration of patentability or not. At the same time, he did not agree with the statement of the law as put by Mr. Bousfield. After discussing this question for some short time, the case was again adjourned.

Monday, Feb. 12.

Mr. Moulton this morning resumed his reply, and dealt first with the construction of the specification. The patentee claimed the use of thorium alone, or in admixture with zirconium and a number of other substances. He did not think the words "substantially as herein described" applied to the mode of manufacture of the hoods. He submitted it was a claim to the use of thorium in hoods prepared for luminant appliances, without regard to the mode in which they were made. He next argued at some length the question of utility; submitting that each prescription gave a result which might be useful for some purpose—either flexibility, cheapness, or colour. He contended that "pure thorium" simply meant thorium alone, not absolutely pure, but substantially so, and not purposely mixed with other substances. At the date of the patent, the thorium used by Welsbach was considered pure; being extracted in the ordinary way. The learned Counsel went on to submit that the use of a mixture of 99 per cent. thorium and 1 per cent. cerium was an infringement of the patent for pure thorium; and he concluded his speech by saying, in answer to his Lordship, that he asked for an injunction, notwithstanding the denial by the defendants that they were manufacturing or selling.

Mr. Neill asked leave to shortly comment on some of the cases cited by Mr. Moulton, after which,

Mr. Terrell added a few remarks on the form of relief, on which some discussion ensued. He asked for an injunction against the Directors individually, so that it might practically be operative against the new Company, and also to make them liable for costs. He further asked for costs as between solicitor and client, on the ground that the validity of the patent had been previously established in another case. He put in the certificate in the De Mare action.

Mr. Neill objected that this ought to have been put in before the plaintiffs closed their case, when defendants would have met it by evidence to show that the question had not been tried and decided.

His Lordship said he would give judgment in a few days.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Tuesday, Feb. 6.

(*Before Justices* Channell *and* Bucknill.)

Dewsbury and Heckmondwike Water-Board v. Assessment Committee of Penistone Union.

This was a special case stated by the Justices of the West Riding of York. The case stated that there was an appeal against a poor-rate made on Oct. 6, 1898, by which the Water Board were assessed in respect of certain works situated within the Union of the respondents. The appellants were incorporated by the Dewsbury and Heckmondwike Water-Works Act of 1876; and the premises in question were part of the property vested in them. Upon the hearing of the appeal, the financial statements of the appellants for the two years ending March 25, 1897 and 1898, were produced. There were sales of surplus water by the appellants, and receipts for the same; and in each year a considerable profit was made by the Board after paying all the expenses, including rent, rates, and taxes. Such surplus profit was handed over by the appellants to the Dewsbury Corporation and the Heckmondwike Urban District Council respectively. It was contended, on behalf of the appellants, that by reason of the terms of the Act, no tenant would give more than a nominal rent to occupy the premises, and that the assessment should be reduced to a nominal sum. It was further contended for the appellants that, as the Act merely authorized the Water Board to receive sums of money in respect of water sold by them in bulk, and no others, the sums received by the Dewsbury Corporation and the Heckmondwike Urban District Council were not to be taken into consideration in fixing the amount of the assessment. For the respondents, it was contended that the liabilities of the old Board, to which the appellant Board succeeded by the Act of 1876, included the liability to be rated to the poor, and to be assessed in the manner and form in which the assessment appealed against was made. It was further contended for the respondents that the property occupied by the appellants yielded, or was capable of yielding, a net annual value over and above the repairs and other expenses necessary to maintain the property in a state to command a rent partly derived from the sale of surplus water by the appellants, and partly from the moneys paid to the Dewsbury Corporation and the Heckmondwike Urban District Council by the water consumers; and therefore the property was rateable upon its value, though the appellants were trustees, and derived no personal benefit from the occupation. The Justices held that the appellants' contentions were wrong, and that the premises were rightly assessed; and they dismissed the appeal with costs, subject to the case stated for the opinion of the Court. The question for the Court was whether they were right in so holding. The amount of the assessment in dispute was £9.

Mr. Balfour Browne, Q.C., and Mr. Waugh appeared for the appellants; Mr. Castle, Q.C., and Mr. Glen represented the respondents.

After hearing arguments from Mr. Balfour Browne and Mr. Waugh for the appellants, and Mr. Castle for the respondents,

Justice Channell said the case did not seem to represent all the points raised.

Mr. Castle said this was really an appeal against the rating of an ordinary water-main which connected a reservoir with the towns which were supplied with water. In the usual way, it would be rated on structural value, as that was the principle always adopted in these cases.

Justice Channell remarked that the case did not tell them anything about that.

Mr. Castle said the appellants entered an appeal, not only against this, but also another appeal against a reservoir in a neighbouring parish. When the case was heard, Mr. Balfour Browne for the appellants declined to call witnesses; and said it was not a question of the amount of rateable value if it was to be assessed. He, however, produced an Act of Parliament, and said upon that there was no rateable value. This was the only question their Lordships had to consider—whether the Act of Parliament had struck this main with sterility so as to take away its rateable value. He was surprised to hear such a proposition after the decision by the High Court in the Mersey Docks case.

Justice Channell said the case had been stated wrongly. His strong impression was that the appellants were merely trustees to receive profits for the Dewsbury and Heckmondwike Corporations; and that the Act incorporating them was mere machinery for enabling Dewsbury and Heckmondwike conveniently to combine together. If that was so, the main must be rated upon structural value.

After further argument,

Justice Channell said the appeal must be dismissed. The difficulty arose entirely from the way in which the case had been stated. It was stated apparently with a desire to get the decision of the Court upon certain points which, when they came to be considered, did not arise. The only question really raised here was as to the rating of the main; and as it appeared to have been rated according to structural value, it was rightly so rated. The appeal would have to be dismissed; but this would not in any way prejudice either party upon the question of the other appeal relating to the reservoir, nor would it prejudice an appeal against the amount of the assessment.

Justice Bucknill concurred.

The appeal was therefore dismissed with costs.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Monday, Feb. 5.

(*Before Justices* CHANNELL *and* BUCKNILL.)

Crystal Palace District Gas Company v. Idris and Co.

Mr. BARTLEY DENNISS appeared for the defendants, who were appellants; Mr. T. ERNEST SAUNT for the respondents.

Mr. DENNISS said this was an appeal by the defendants from a decision of a County Court Judge in an action brought against them by the plaintiffs, who claimed damages for the negligence of a driver of one of defendants' mineral water carts in knocking down a lamp-post in July last, and causing damage to the extent of 19s. 6d. As there were a great many of these cases, the defendants had thought it advisable to take the opinion of the High Court, and the Judge gave leave to appeal. He found there was negligence on the part of the driver, and the defendants did not desire to dispute this, as the amount involved was only 19s. 6d; but they wanted to bring on the appeal on the question of procedure. He had to contend that no proceedings could be taken in the Courts against the master for such a cause of action. The Crystal Palace Gas Company's Act incorporated the Gas-Works Clauses Act, 1847, and the two together formed a code of law which provided for two things, among others. First of all, the 1847 Act gave power to the Company to erect lamp-posts in highways, and under this enactment they had no common-law right to proceed—in fact, lamp-posts were "nuisances" which might be indicted. Further, sections 19 and 20 provided a code by means of which all injuries to these lamp-posts were guarded against, and the remedy prescribed against the persons who damaged them. Section 19 specified that "every person who shall wilfully remove, destroy, or damage any pipe, pillar, post, plug, lamp, or other work of the undertakers for supplying gas . . . . shall, for each offence, forfeit to the undertakers any sum not exceeding £5, in addition to the amount of the damage done." Section 20 said: "Every person who shall carelessly or accidentally break, throw down, or damage any pipe, pillar, or lamp belonging to the undertakers, or under their control, shall pay such sum of money by way of satisfaction to the undertakers for the damage done, not exceeding £5, as any two Justices or the Sheriff shall think reasonable." Their Lordships would notice that in section 20 the words "carelessly" and "accidentally" were included for the first time; so that every person who walked or drove along a street became an insurer of all lamp-posts to an amount not exceeding £5. The person who actually damaged a lamp-post could only be sued before a Magistrate; and the question here was whether the master could be sued under common law. He contended that this remedy was ousted, and that the remedy under this Statute was exclusive. It was a special remedy which was wider than anything in the common law, and therefore ousted the common law remedy. Proceedings had also been taken against the master before the Justices;* but the summons was dismissed, and the Company then proceeded in the County Court, and obtained judgment. There were, as he had said, a number of cases awaiting this decision, because all over London lamp-posts were constantly being knocked down.

Mr. SAUNT contended that the Company had a common-law remedy long before the Act was passed. If a lamp-post were a "nuisance," and any private person came along and injured it, or took upon himself to remove it, there would be a cause of action against him if it were damaged.

Justice CHANNELL said if the lamp-post were an obstruction to the highway, and a person knocked it down, he was not sure that an action would lie.

Mr. SAUNT submitted that the Company had a common-law remedy prior to the giving of this extra remedy, and therefore they were not bound down to their statutory remedy.

Justice CHANNELL said he thought the appeal must be dismissed. He did not see the slightest ground for saying that this was an exclusive remedy, or that it was intended there should be no other. It did not seem to him to exclude the ordinary jurisdiction of the Court in cases where it was applicable. As regards accidentally knocking down a lamp-post, the Act did make it an offence, and the plaintiffs could only proceed under the Act.

Justice BUCKNILL concurred.

The appeal was therefore dismissed, with costs.

The Willenhall Gas Company Fined for Deficient Illuminating Power.

At the Wolverhampton Police Court last Wednesday, the Stipendiary (Mr. N. C. A. Neville) was engaged in hearing a case in which the Willenhall Gas Company were summoned by the Willenhall District Council for supplying gas of a less illuminating power than 15 candles. Mr. R. Tildesley, the Clerk to the Council, represented that body; and Mr. R. C. E. Plumptre defended. Mr. Tildesley, in opening the case, stated that the Company contracted to supply the Council with gas equivalent to 15-candle power; and an expert Gas Examiner appointed by the Council, made periodical tests. On Dec. 29 two tests were made; the first being found to be 14·26 candles, the second 14·94 candles. Under the Act, the tests were bound to be made at the works of the Company, which in this instance were situated one mile from the town. Mr. Alfred Cresswell, the Gas Examiner, spoke to making the tests in question. In cross-examination, he said he would not swear that the illuminating power on Dec. 29 was not 15 candles. Mr. Plumptre said that, by section 37 of the Company's Act of 1892 it was provided that: "No penalty shall be incurred by the undertakers for insufficiency of pressure, for defective illuminating power, or for impurity of gas so produced by an unavoidable cause or accident." During the week covering Dec. 29, the Company were in difficulties owing to the supply of coal having been cut off. It was well known that at the time trucks of coal were standing on the railways; and as the Gas Company were unable to obtain the coal, "through an unavoidable cause," to make the finest quality of gas, they had to fall back upon stock which was something like six months old. From this coal, through it having imbibed moisture, the Company were unable to produce the finest quality of gas. The Stipendiary remarked that it was not an unavoidable cause, but avoidable bad management on the part of the Company. The Manager of the Company (Mr. Walter Cranmer) bore out the statement of Mr. Plumptre. The Stipendiary decided to convict, and imposed a fine of £1 and the costs; the total amount being £5 14s. 6d.

* See "JOURNAL," Vol. LXXIV., p. 771.

The Incandescent Mantle Remover.

In the Chancery Division of the High Court of Justice last Friday, before Mr. Justice Cozens-Hardy, Mr. Everitt, Q.C., moved, on behalf of the Incandescent Mantle Remover Company, Limited, for an interim injunction to restrain the Welsbach Incandescent Gas-Light Company, Limited, from infringing their patent by using a certain appliance for removing incandescent mantles. Mr. A. J. Walter, for the defendants, said the validity of the patent was attacked on the ground that it did not contain the subject-matter of a patent, and that there was want of novelty. Mr. Everitt said, in these circumstances, if the defendants would keep an account, the motion could stand over till the trial of the action. His Lordship said the defendants would keep the ordinary books. The costs of the motion would be costs in the action.

Henley-on-Thames Gas Supply.—The demand for gas has augmented to such an extent at Henley-on-Thames that strenuous efforts have lately been required on the part of the Manager (Mr. J. Theobald) to keep up the supply. The make in the year ending Dec. 31, 1898, amounted to 18,247,300 cubic feet; whereas last year it was 22,382,400 cubic feet—an increase to the extent of 4,135,100 cubic feet. In face of this rise, the Directors have decided to extend the manufacturing plant, and have accepted the plans prepared by Mr. Theobald for the necessary alterations, which are estimated to cost £1200.

Sales of Shares.—Last Wednesday, Messrs. Waters and Rawlence sold some fully-paid £10 shares in the Fisherton Anger and Bemerton Water Company at £19 5s. each. New ordinary 8 per cent. £12 10s. shares in the Salisbury Gas Company were disposed of at £18 5s. to £18 12s. 6d. each, and 7 per cent. shares at £16 17s. 6d. and £17 apiece. A £25 5 per cent. debenture in the same Company fetched £28 12s. 6d. On the following day, Messrs. Drew and Son sold, at the Greyhound Hotel, Richmond, £390 of "A" and £230 of "B" stock of the Richmond Gas Company. There were seven £50 lots of "A" stock, five of which fetched £121, and two £122 each; one lot of £40 of similar stock realizing £100. Three £50 lots of "B" stock were sold for £120 each, one lot of £40 of stock for £97, and a similar lot for £96.

West Bromwich Gas Supply.—The West Bromwich Gas Department report that the extensions and alterations in the retort-house which were carried out during last autumn have been utilized during this winter as found necessary, and they have thus been able to meet the increased demand for gas during the months of November, December, and January. The sales of gas for the nine months of the financial year ending in December are the highest in the history of the undertaking. In consequence of the increased demand for gas, as well as the inability to obtain full delivery of the coal contracted for, owing to congestion of railway traffic and other causes, the Committee have been compelled to make additional purchases of gas coal for delivery during January and February to the extent of between 2000 and 3000 tons. The sales of gas for the Christmas quarter were 98,307,000 cubic feet; and the amount of gas-rental (excluding public lighting) was £11,546.

Hastings Water Supply.—The Mayor of Hastings (Alderman Tuppenney) last Tuesday turned on the water at one of the two reservoirs at Fairlight which are to be used in connection with the scheme for the supply of water to the borough. The reservoir, which is an underground one, is some 150 feet in diameter. The second reservoir is nearing completion, and it is intended to use them alternately, although they can each be filled in the short space 14 hours. The holding capacity is 1½ million gallons each. After the Mayor and several members of the Corporation had inspected the reservoir, and his Worship had performed the ceremony, Alderman Weston, the Chairman of the Water Committee, mentioned that the water scheme would probably cost £150,000 before it was completed; but he added that they were all agreed that if they obtained the results they anticipated, it would be money very well spent. The Mayor congratulated the Borough Engineer (Mr. Palmer) upon his work.

Wages and Holidays at the Newcastle and Gateshead Gas-Works.—The questions at issue between the Newcastle and Gateshead Gas Company and the men employed by them in the retort-houses at the works have not (according to our latest information) entirely reached the point of settlement; but they are in a fair way of doing so. Briefly the history of the affair is this: In November last, the men sent in an application for 10 per cent. advance of wages, increased holidays, and double pay for Sunday and Good Friday work. Correspondence ensued; and ultimately an interview took place between a Committee appointed by the Directors and the officials of the National Amalgamated Union of Labour, on behalf of the men, in January. A settlement, however, was not effected; and the men, numbering about 1000, handed in their notices. The notice had expired last Thursday. The Company offered an immediate advance of 2½ per cent. to all grades, and arbitration on other points in order to effect an amicable arrangement; but for a time the men were not inclined to favourably view this form of procedure. After a meeting of the Directors last Wednesday, the Chairman of the Committee of Directors, along with the Secretary of the Company (Mr. T. Waddom), had an interview with two of the representatives of the men; and arrangements were made that there should be no cessation of work for a few days, and that in the meantime a vote of the men should be taken on the Directors' proposals. The result was announced on Friday night; the votes recorded being 534 in favour of arbitration, and 428 against. This means that the vote was in favour of arbitration by a majority of 106 on a total poll of 962. Accordingly the notices have been withdrawn; and the arbitration is expected to take place this week.

MISCELLANEOUS NEWS.

BRENTFORD GAS COMPANY.

The Half-Yearly General Meeting of this Company was held last Friday, at the Charing Cross Hotel—Mr. Howard Charles Ward in the chair.

The Secretary (Mr. W. Mann) read the notice calling the meeting; and it was agreed to take as read the report and accounts, of which the principal points were given in last week's issue.

The Chairman, in moving the adoption of the report and accounts, said it was with great pleasure the Directors and officers met the shareholders on this occasion, for they had a very excellent report indeed to submit to them. The amount available for dividends was £75,409; and the dividends recommended were at the rate of 5 per cent. per annum on the preference stock, 12 per cent. on the consolidated stock, and 9 per cent. on the new stock, 1881. Following this up, he would first turn to the revenue account before dealing with the other portions of the report. The amount received from the sale of gas in the half year was £126,869, against £117,497 in the corresponding period of 1898. As the shareholders would perceive, this was a considerable increase; and it was equal to just about 8 per cent. Then in the rental of meters and stoves, there was a substantial increase; the sum received being £10,372, compared with £9209. The receipts for coke, tar, and ammoniacal liquor were also considerably larger—the amount being £31,882, as against £25,703. The total of these sums, with a small amount for rents and transfer fees, was £169,163. Going to the other side of the account, the shareholders would, of course, expect to find that, with such a growth of business as they had had, there would be an increase in the expenditure on materials. On coal and oil £60,270 had been spent, as against £53,673, or about £6598 more. The great bulk of this was due to the larger quantity of material used; the price paid having gone up very little at present. The next item calling for attention was repairs and maintenance of works and plant. It was £12,493, compared with £11,778. The remark which he had to make upon this was that in the £12,493 was included a sum of £1000, being the last item of the suspense account that was created for the purpose of paying the expense of converting the system of manufacture, with the exception of one house, from horizontal to inclined retorts. In point of fact, after having changed about five-sixths of the system from horizontal to inclined retorts, they had written off the original cost of the horizontal retorts; and the capital account now only stood charged with the inclined retorts, just as though the horizontals had never been in existence. In the distribution of gas, a considerable sum had been spent on the repair, maintenance, and renewal of mains and service-pipes, and the repair and renewal of stoves. He thought it right to call attention to the fact that the cost of the meters, stoves, automatic meters, and fittings was gradually wiped out—they had, indeed, wiped out the original cost charged against capital of a good many of them. So far as the meters and automatic meters were concerned, they wrote off 10 per cent. every year; so that every one in ten years became the property of the Company without any charge against capital. With regard to stoves, they wrote off 12½ per cent. from their original cost, so that every stove in eight years became their property, without any charge to capital. With fittings they dealt in even a more liberal way, because they wrote off 15 per cent. The result of this was that their capital account, so far as these things were concerned, was in a very wholesome and strong position. Naturally, the wiping off of the cost of these appliances meant a very large sum. He believed it was about £12,000 a year; and, of course, as long as they went on fixing meters, stoves, and things of that sort (which would be as long as their business continued to increase), they would always have something of this kind to write off. They had already experienced great relief from the amount written off. They had been doing this in connection with the stoves for about eighteen years; but when the automatic meters came up a few years ago, there was a great rush for them, and great delay in getting them. Wiping off from these 10 per cent. made the item of repair, maintenance, and renewal of stoves rather heavy. Rates and taxes had also gone up a little. The total result of the half-year's business was this, that they had received £169,163, and the expenditure had been £117,953—giving a balance of £51,209. This gross profit would be sufficient to pay the dividends recommended, and to leave a balance of £11,823. From June last, they brought forward £27,386, which would enable them to carry to the next accounts £39,209. The third paragraph in the report referred to the continued and satisfactory increase in the sale of gas (amounting in the half year to 8 per cent., compared with the corresponding period of 1898), and to the fact that the automatic meter consumers were still increasing rapidly. The additional gas manufacturing plant at Southall was complete and at work; and the shareholders would not be surprised to know that, with such increases as they were having in their business, some more manufacturing plant was required at that station. It happened that, when they put up the last new plant, they provided a house large enough to accommodate another installation of water-gas apparatus. They proposed now to add to the existing plant; and they had entered into a contract with Messrs. Cutler and Sons for its erection. It was also stated in the report that more capital was wanted; and a glance at the capital account would justify it. In the past half year, although they had done very little in the way of expending money on capital account, excepting for mains and services, and meters and stoves, they had spent £8365; and they had only a balance of £7425 to the credit of capital. Now it was evident that £7425 was not sufficient to carry on a business like theirs; and if it had not been for the undivided profits (which were scattered over the business), they would have been obliged to make a call for capital before this. Then looking at the balance-sheet, it would be seen that, for the quarter ending Dec. 31 last, there was due to the Company, for gas and meter rental, £74,231. Of course, a great deal of money was required to purchase materials and to pay for the labour for making the gas which was represented by this sum of £74,231. He mentioned this to show that the £7425 which they had remaining on capital account was altogether inadequate for the necessities of the Company. Therefore the Directors proposed to issue a further portion of the 4 per cent. debenture stock. They thought this was the cheapest way of raising the money; and he did not think it would be a breach of confidence to tell the shareholders that the minimum price had been fixed at £115, which would give about 3½ per cent. The next subject was one to which he alluded with regret—indeed, more than regret. That was the retirement of his old friend, and the companion who sat by his side for so many years at these meetings—Mr. William Croxford, the late Secretary. He had been in failing health for some two or three years; and whenever he came out to do his work—and he struggled on manfully to do it—he always went home quite beaten down, and with a worse illness than he had before. Therefore, he (the Chairman) thought Mr. Croxford had been very wise in retiring from work. He had resigned with the greatest respect of the Directors and his brother officers; and they could only hope he would be spared for many years to enjoy his ease and retirement. Mr. Croxford had been 46 years in the service of the Company—a long time, but not so long as he (the Chairman) had been connected with it—and they gave him the highest retiring pension that the Board of Trade allowed: viz., two-thirds of his salary of £1000. Therefore he would take £666 13s. 4d. a year. Having lost their Secretary, they had to look about for a new one; and they were happy to say they had Mr. Mann, who was an old officer of the Company, having been with them 32 years. Well he recollected Mr. Mann coming to them from his father, who was the Engineer of the old City of London Gas Company. Knowing everything connected with the Brentford Company, Mr. Mann was likely to be a most efficient Secretary. He was well known to all of them; and they had the greatest confidence in him. A resolution would be submitted later for the purpose of fixing his salary. Proposals would also be made to re-elect the retiring Directors—Mr. R. Shafto Adair and Mr. Frank Morris. The former was a valuable Director; and about the latter it would be superfluous to say anything. He was, as he (the Chairman) liked to call him, the "apostle" of inclined retorts in this country, as he was the first man to introduce them here. The Auditors (Mr. John W. Field and Mr. M. F. Monier-Williams) also offered themselves for re-election. There was only one other matter about which he wished to make a remark, and that was with reference to coal. They all knew the state of the coal market; but he did not know the reason for it. The Company had a contract for a good quantity of coal yet, which would last them quite to the end of the autumn. If there was no change before then, they would have to pay more for their supplies. If they had to do this, the consumers would see that they would have to pay more for gas; and if they had to pay more for gas, the shareholders would suffer a reduction of their dividend.

Mr. Ulick J. Burke seconded the motion.

Mr. W. Hughes called attention to the bad debts, which amounted to £436, as against £218 in the corresponding half of 1898; and he asked whether the Company did not require a deposit from new consumers.

The Chairman thought they were very lucky to get out of such periods as these with this small amount. Considering the extent of the business, the bad debts were low; and the Directors wrote them off very liberally. They had deposits from many of the consumers; and the amount in their hands now on deposit was between £3000 and £4000. Sometimes, however, the consumers' accounts exceeded the deposit.

The motion was unanimously carried.

The dividends recommended were also declared; and a resolution was passed transferring to the reserve fund, from the £39,209 carried forward, the sum of £3250, being equal to ½ per cent. for the year 1899 in respect of the dividends on the consolidated stock. The Chairman observed that the reserve fund amounted to £4816; and the £3250 would be added to it. They did not divide up to the hilt the dividend to which they were entitled; but they paid 12 per cent. instead of 12½ per cent., and placed the ½ per cent. to the reserve fund.

By subsequent resolutions, the retiring Directors were re-elected, the commencing salary of the Secretary was fixed at £700 per annum, and the Auditors were re-appointed.

The services of the Chairman and Directors and officers having been suitably acknowledged,

On the suggestion of Mr. Hughes, the shareholders, by resolution, expressed the hope that Mr. Croxford would have improved health and long life to enjoy his well-earned rest and pension.

This concluded the proceedings.

CRYSTAL PALACE DISTRICT GAS COMPANY.

The Half-Yearly Report and Accounts.

In the report which the Directors of the above-named Company will present at the half-yearly meeting next Friday, they state that, notwithstanding the reduction in the price of gas to 2s. 6d. per 1000 cubic feet from Midsummer last—a reduction of gas-rental to the extent of £2350—the balance to the credit of the revenue account amounts to £18,909 15s., which is sufficient, after meeting all charges for interest, to pay the same dividend as before, and leave a surplus of divisible profit to be added to the reserve fund. The Directors recommend the payment of dividends at the rates of 5 per cent. per annum on the preference stock, and 5½ per cent. per annum on the ordinary stock, less income-tax in both cases. There has been the very satisfactory increase of 9 per cent. in the quantity of gas sold over the corresponding half year of 1898, due partly to a general increase in consumption, and partly to the continual growth in the demand for gas-stoves and for the supply of gas to small houses by means of "slot" meters. The Directors express their regret at having to report the death within the half year of their late esteemed friend and colleague Mr. Alfred T. Layton, who was a most capable and painstaking Director. They announce the appointment, already notified in the "Journal," of Mr. Robert Morton as his successor.

The accounts accompanying the report show that in the six months ending December 31 there was expended a sum of £22,946 for capital purposes; £16,221 being for new buildings and plant in extension of the works, £2785 for new mains and services, and £3940 for meters and stoves. The total expenditure up to the close of the year was £721,004, and only £719,582 raised (with premium capital); showing an overdraft of £1422. The revenue from the sale of gas was £70,438, as compared with £67,067 in the corresponding half of 1898; the rental of meters (15,131 ordinary and 9523 prepayment), £1802, against £1648; and of stoves (6099 ordinary and 7511 prepayment), £1649, against £1348. The

residuals produced £28,369, as compared with £23,642; and the total receipts were £102,268, against £93,715. The expenditure on the manufacture of gas was £68,245, against £57,672 (coals, oil, and labour costing £46,609, as compared with £37,553); on distribution, £7594, against £7521; on management, £3364, against £3268; and the total expenses were £83,358, as compared with £72,766. The balance carried to the net revenue account is £18,909, as compared with £20,949 this time last year. Under the supervision of Mr. S. Y. Shoubridge, the works produced in the past six months 622,004,000 cubic feet of coal gas and 8,824,000 cubic feet of oil gas—together, 630,828,000 cubic feet, against 581,994,000 cubic feet in the latter half of 1898. The raw material used was 62,184 tons of coal, 226 tons of cannel, 39,637 gallons of gas oil, and 1693 gallons of carburine. Of the total make of gas, 570,937,000 cubic feet were sold and 577,862,000 cubic feet accounted for. The following are the quantities of residuals produced: Coke, 780,125 cwt.; breeze, 13,841 yards; tar, 582,308 gallons; and ammoniacal liquor, 11,918 butts. There were 431 tons of sulphate of ammonia made and 418 tons sold; the stock at the close of the year being 84 tons.

CROYDON COMMERCIAL GAS COMPANY.

The Half-Yearly Report and Accounts.

According to the report which the Directors of the above-named Company will present at the half-yearly meeting next Friday, the quantity of gas sold in the six months ending Dec. 31 was 30,370,100 cubic feet more than it was in the corresponding period of 1898—an increase of 9·56 per cent. This was caused to a considerable extent by the augmentation in the number of consumers (400 ordinary, 842 prepayment, and 101 automatic), and the additional number of gas cooking and heating stoves supplied on hire. The receipts from residuals benefited greatly during the half year by the improved market values. On the other hand, there was a large increase in the cost of coal, iron, iron pipes, &c.; and from the present appearance of the markets, there is a prospect of a further advance in the prices before the expiration of the existing contracts next June. Additions and alterations have been, and are being, made to the manufacturing and purifying plant at the Company's works, in order to provide for the largely increased demand for gas; and the Directors have, upon the advice of their Engineer (Mr. J. W. Helps), decided to lay an additional trunk main to Purley.

The accounts accompanying the report furnish evidence of the expenditure referred to above. In the past six months, a sum of £2633 was laid out upon new buildings and plant, £1893 upon new mains and services, and £1144 on new gas-stoves. The outlay on capital account was £6621; bringing up the total expenditure to £383,271. As the total receipts at the close of the year only amounted to £372,012, this account has been overdrawn to the extent of £11,258. The Directors therefore purpose issuing some additional ordinary and debenture stock, and making a call of £2 on the Carshalton capital shares. The revenue from the sale of gas was £48,279; the rental of meters, stoves, and fittings brought in £3417; the sale of residuals produced £14,739; and the total receipts were £66,510, as compared with £59,577 this time last year. The expenditure on the manufacture of gas amounted to £35,425 (coal, oil, &c., costing £23,841, against £19,283 in the corresponding half of 1898); on distribution, to £6055; and on management, to £2226—the total expenses being £48,792, against £42,430. The balance available for distribution is £18,844; and the Directors recommend the declaration of dividends at the rates of 14, 11, and 9 per cent. per annum on the various stocks, free of income-tax. This will absorb £15,447, and leave a balance of £3397 to be carried forward. The portions of the accounts relating to the manufacturing operations show that 25,315 tons of coal, 10 tons of cannel, and 322,224 gallons of oil were used in the production of 383,536,000 cubic feet of gas, of which 347,871,200 cubic feet were sold and 352,063,100 cubic feet accounted for. The estimated quantities of residuals produced were: Coke, 15,195 tons; breeze, 3580 tons; tar, 329,610 gallons; and ammoniacal liquor, 644,004 gallons. The amount of sulphate of ammonia made was 206 tons; and 131 tons of it were sold.

BROMLEY GAS CONSUMERS' COMPANY.

The Half-Yearly Report and Accounts.

At the Half-Yearly Meeting of the above Company on the 22nd inst., the Directors will report that the business is making satisfactory progress. The quantity of gas produced in the six months ending Dec. 31 was 9½ million cubic feet more than in the first half of the year, and nearly 8 millions in excess of the corresponding period of 1898. Reference is made by the Directors to the exceptionally high price of coal; but, by way of compensation, the sales of coke and sulphate of ammonia have been at improved rates. The accounts accompanying the report show that the receipts from the sale of gas in the half year amounted to £17,570, residuals produced £6426, and the total revenue was £24,921. The expenditure on the manufacture of gas was £13,820 (coals costing £10,667); on distribution, £701; and on management, £1559—the total expenditure being £17,422. The balance carried to the profit and loss account is £7499; and the balance available for distribution is £9003. The Directors recommend the payment of dividends at the rates of 12 and 9 per cent. per annum upon the original and ordinary capital, both subject to income-tax. This will absorb £6555, and leave a balance of £2448 to be carried forward. Under the supervision of Mr. W. Woodward, the Company's Engineer, 12,375 tons of coal and 50 tons of cannel were employed in the production of 125,262,000 cubic feet of gas, of which 116,134,450 cubic feet were sold. The residuals produced were: Coke, 12,425 chaldrons; breeze, 1052 chaldrons; and tar, 125,064 gallons. Sulphate of ammonia to the amount of 114 tons was made; 65 tons of it being sold.

At last Wednesday's meeting of the Salford Town Council, the salary of the Gas Engineer (Mr. W. W. Woodward) was increased by £100 per annum.

PROVINCIAL GAS AND WATER COMPANIES.

Gas Companies.

The annual report of the Airedale Gas Company states that the profit for the year is £2579. The Bradford Corporation have given notice of a Bill to purchase the works; and the Directors have taken the necessary steps for the protection of the Company's interests. The dividends recommended are at the rate of 5 and 3½ per cent. on the different stocks.

At the 94th half-yearly meeting of the Bristol Gas Company, next Thursday, the Directors will report a satisfactory increase in the sale of gas for the six months ending Dec. 31. Notwithstanding the reduction of 1d. per 1000 cubic feet in the price as from the 1st of July, the revenue account shows a balance of profit, after providing for the interest on the debenture stock and the dividend of 5 per cent. on the ordinary stock, of £3124. The accounts accompanying the report show that there was an expenditure of £19,688 on capital account in the past half year; £7589 of it being for new mains and services, and £5928 for new stoves. The total expenditure on capital account up to the close of the year was £1,028,121. The revenue from the sale of gas was £103,103, against £100,549 in the latter half of 1898; residuals produced £37,611, against £31,150; and the total receipts were £144,087, as compared with £134,636. The expenditure on the manufacture of gas was £89,213 (coal, oil, &c., costing £58,607), against £83,105 and £52,361 in the corresponding half of 1898; on distribution, £6922, against £6463; and on management, £5321, against £5298—the total expenses being £111,637, as compared with £104,687. The balance carried to the profit and loss account is £32,450, against £29,949. The sum available for distribution is £49,802.

At the recent half-yearly meeting of the Bury St. Edmunds Gas Company, the Directors reported a considerable increase in the consumption of gas during the past six months. They recommended payment of the usual dividend of 11s. per share on the 1849 capital, 8s. 6d. per share on the 1859 capital, and 8s. per share on the 1879 capital, free of income-tax. The Chairman (Mr. F. C. Andrews), in moving the adoption of the report, remarked that the gratifying aspect of the balance-sheet was largely attributable to the increased consumption of gas, which had been unprecedentedly large. Five out of six steam-engines had made way for gas-engines. The dark days during December had also sent up the consumption. There were 30 prepayment meters in use. The Directors had made a good contract for coal up to next June. The future price of coal, however, would probably determine whether the full dividend would be paid next half year. The Company had really no working capital, but had been spending the savings of past years. The report was adopted.

The half-yearly report of the Directors of the Chester Gas Company (noticed last week) was submitted at the meeting of the shareholders on Wednesday. The Chairman (Mr. John Gamon), in moving its adoption, said that during the past year the gas actually sold had increased by 7,632,000 cubic feet, and brought in an additional revenue of £1052. There had been a considerable extension of mains (4400 yards), which had made this great increase possible. There had been an addition of 31 ordinary consumers; and the cookers, prepayment meters, and gas-fires that had been hired out had exceeded the number of any previous year. Public lamps had decreased by 152. As to the works, there had been formulated a scheme for the improvement of the retort-house, by which they would obtain an increase of 37 per cent. in the manufacturing capacity. The report was adopted; and dividends were declared at the rate of 7 per cent. on the preference stock, 10 per cent. on the ordinary "A" stock, and 7 per cent. on the "B" and ordinary "C" stock.

The annual report of the Clayton, Allerton, and Thornton Gas Company states that the balance of net profit for the past year amounts to £3038. The Directors recommend the payment of a dividend at the rate of 11 per cent. per annum on the original shares and of 5 per cent. per annum on the "A" shares; making, with the interim dividend, 8½ and 7½ per cent. respectively for the year, and leaving a balance of £403.

The annual meeting of the Coatbridge Gas Company was held last Tuesday. The Chairman (Mr. J. Young) made reference to the astonishing rate at which the demand for gas as an illuminant, and for cooking, heating, and motive power, was increasing. During the past few months, he said, they were almost at a loss for means to cope with the requirements of the district; and as the present plant had more than reached its maximum efficiency, large extensions and alterations would necessarily require to be proceeded with at once. The report of the Directors was approved; and dividends at the rates of 10 and 7 per cent. on the old and the new stocks respectively were declared. Mr. T. Wilson, the Engineer of the Company, is to be congratulated upon the success with which he continues to guide the business. As will be seen by our "Notes from Scotland," he has a new enemy to face, in the shape of the Gas-Workers' Union. But he is a man of indomitable will and untiring energy; and, as he has succeeded in baffling the promoters of electric lighting, it may be expected that he will be able to keep his workpeople loyal to their employers, by whom they live.

The half-yearly meeting of the Derby Gas Company was held last Tuesday. The Chairman (Mr. H. Swingler) said that, like other gas companies, they were rather troubled about the supply of coal. In May, when they made their contract, the price was 9s. 7d. per ton; but in October, not because they were short, but to protect themselves and the public from contingencies, the Directors purchased enough coal to last them till next midsummer at 12s. 11d. per ton. This policy had already proved a wise one, as coal was still rising enormously in price, and was more difficult to get delivered. Fortunately, things were not yet bad enough to justify an increase in the price of gas; but unless there was some improvement, such a result might be witnessed in the near future. The report, which the Chairman described as the most satisfactory that had yet been issued, showed an increase in the receipts from the sale of gas of £1278 for the half year, and an increase on the sale of residuals during the same period of £5084. The completion of the extensions of the works had enabled the Company to make 33¼ million feet more gas at an extra cost for labour of only £120. The report was adopted; and the maximum dividend was declared.

The accounts of the Dorchester Gas Company for the six months ending Dec. 31 show that the revenue was £3803, and the expenditure

£2673; leaving £1130 to go to the profit and loss account. The amount available for distribution is £1215; and at the meeting of the Company to-day the Directors will recommend the usual dividends on the ordinary and preference stocks. The quantity of gas sold in the past half year was 474,000 cubic feet in excess of that of the corresponding period of 1898; showing a gradual and satisfactory growth of the Company's business. Incandescent gas lighting has been introduced in the town, and has given general satisfaction.

The report presented by the Directors at the annual meeting of the Durham City Gas Company last Tuesday showed that, including the amount of £368 drawn from the reserve fund, the profit and loss account gave an available balance of £2457, after deducting an interim dividend of £2480. The Directors recommended that a dividend for the past half year of 5 per cent. on the original capital and 3½ per cent. on the additional capital be paid; making a total dividend for the year of 10 and 7 per cent. respectively. In consequence of the advance in the cost of material, the Directors stated that they had been obliged to advance the price of gas 3d. per 1000 cubic feet, subject to the present discount. The revenue account showed a total expenditure of £10,161, and an income of £15,629. The report was adopted.

The Directors of the Elland-cum-Greetland Gas Company report that during the past year the expenditure on capital account was £709; this sum having been spent upon new mains and new prepayment meters. The profits, including the balance brought forward, amount to £6032. An interim dividend at the rate of 12s. per share was paid for the June half year, absorbing, with the prescribed dividends on the preference shares and interest on the loan capital for the year, £2632; leaving a balance of £3400 available for distribution. The Directors recommend that out of this sum a dividend of 14s. per share upon the ordinary capital be declared for the December half; making 13 per cent. for the year.

At the meeting of the Epping Gas Company, Limited, on Monday, the 5th inst., the Directors presented the 35th annual report. The accounts accompanying it showed that the revenue from the sale of gas last year was £1639, against £1523 for 1898; and that the total receipts amounted to £2183, as compared with £1965. The expenditure was £1487, against £1451; and the balance £696, against £513. A dividend at the rate of 5 per cent. per annum was declared, with a bonus of 2 per cent. The Company was formed with a capital of £4500, in £10 shares. In 1871, 100 new shares were issued; bringing up the capital to £5500. In 1874-5, with gas at 7s. 6d. per 1000 cubic feet, there was no dividend, and the Company had a loan of £900. In 1880, this was all paid off; and in the following year a sum of £200 was set aside as a reserve. In 1895, the reserve amounted to £900; and from that year down to the present time more than £2500 has been spent on the works, in the erection of a holder to contain 100,000 cubic feet of gas, together with a new retort-house and scrubbers. The result is that the works are now in first rate condition. The price has been brought down to 4s. 2d. per 1000 cubic feet; everything has been paid for; and the Directors hope to revive the reserve fund. The capital remains the same—£5500.

The Grantham Gas Company met last Tuesday, with Dr. J. W. Jeans in the chair. Dividends at the rate of 10 and 7 per cent. per annum on the old and new shares respectively were declared. A special meeting was afterwards held to consider the promotion of a Bill in Parliament for further powers. It was stated by Mr. J. G. Thompson that the Company had a consumption of over 90 million cubic feet of gas a year; and during the last three years, it had increased 30 per cent. If the Bill came into operation, the Company not only hoped to keep up their dividends, but to decrease the price, if possible, from 2s. 11d. to 2s. 6d. per 1000 cubic feet. They proposed to ask for a further sum of £45,000; and they wished to alter the nature of the shares. The holder of a £20 share paying 10 per cent. would have 40 shares of £1 each, with a maximum payment of 5 per cent. dividend, and the holder of a £20 share, paying 7 per cent., would have 28 shares of £1 each, with a maximum of 5 per cent. dividend. It was also proposed to issue the £45,000 in £1 shares. The extension of the operations of the Company to Great Gonerby and Barrowby was contemplated. A resolution approving of the Bill was passed.

Some extensive alterations have been made at the works of the Launceston Gas Company; and the Directors have purchased some adjoining property with the view to improving the approach to the premises. The capital has also been increased by the issue, to the existing shareholders, of 300 shares at £2 premium. The profit for the year was £605; and a dividend of 7s. per share has been paid.

The Longwood Gas Company netted a good increase in consumption last year—14·1 per cent. The Directors recommend dividends of 5 per cent. on the original shares and 3½ per cent. on the new ordinary stock, which, with the interim dividend, makes 7½ and 5¼ per cent. for the year respectively.

The report of the Malton Gas Company for the half year ending Dec. 31 shows that the results are satisfactory. The sale of gas continues to increase; the quantity sold for private consumption being 1,400,000 cubic feet more than in the corresponding half of 1898. The balance of the revenue account is £1852; and the amount available for distribution, after adding the balance brought forward and paying the interest on the mortgages, is £2942. The Directors recommend the payment of a dividend at the rate of 5½ per cent. per annum, free of income-tax. They propose to extend the use of Welsbach incandescent gas-lights.

The accounts for the six months ending Dec. 31 last, which were presented at the meeting of the Town and County of Poole Gas Company yesterday, showed that the revenue amounted to £4499, and the expenditure to £3102; leaving a balance of £1397, as compared with £1383 this time last year. The amount available for distribution was £7063; and the Directors recommended the payment of the maximum dividends. The prosperity of the Company has been maintained; the increase in the sale of gas for the past year being nearly 7 per cent.

Last Thursday, Mr. T. Winch presided over the half-yearly meeting of the Rochester, Chatham, &c., Gas Company. The report, which was adopted, showed a total revenue for the half year of £33,886, on which the profit amounted to £3067. The usual maximum dividends of 10 per cent. on the "A" and "D" shares, and 7 per cent. on the "B" and "C" shares, were declared.

The half yearly report of the Scarborough Gas Company states that the net revenue, including £374 brought from the last account, and after deducting all interest charges for the half year, is £7764. The Directors recommend the payment of the maximum dividends upon all the stock, less income-tax. The payment of these will leave a balance of £1665 to be carried forward. Fifty mortgages of £100 each, bearing interest at the rate of 3½ per cent., and new ordinary 5 per cent. stock to the amount of £6280, were allotted during the six months.

The annual meeting of the Shanklin Gas Company was held last Wednesday—Mr. F. Cooper, the Chairman of the Company, presiding. The report of the Directors showed that, as the result of the year's work, they had £2268 for division; and dividends were declared of 9 per cent. on the original, and £6 6s. per cent. on the new ordinary shares.

The receipts of the Sleaford Gas Company for gas supplied during the past year amounted to £3437, and the entire revenue to £5878. The expenditure being £5031, the balance carried to the profit and loss account is £847. The amount available for distribution is £3482; and at the meeting of the Company to-day, the Directors will recommend a dividend at the rate of 7½ per cent. per annum, free of income-tax. Under the supervision of Mr. H. Wimhurst, 1974 tons of coal were carbonized last year; the quantity of gas sold to private consumers being 18,930,600 cubic feet, and for public lighting and under contracts 1,211,900 cubic feet. The Directors report a steady increase in consumption; and the number of prepayment meters now in use is nearly 400.

In moving the adoption of the report—noticed last week—at the meeting of the York Gas Company on Thursday, the Chairman (Mr. J. R. Hill) remarked that, so far as the Directors could see, there was not the slightest need for gas shareholders to feel nervous about the future, either on account of the price of coal or because of competition with the electric light. There was not an instance in the country where the electric light had prejudicially affected the dividends of gas undertakings. The continued growth of the Company's business, however, implied the necessity of keeping the plant abreast of the demand which the future had evidently in store. The report was adopted.

Water Companies.

The half-yearly meeting of the Brompton, Chatham, &c., Water Company was held last Thursday, under the presidency of Mr. J. Baird. The maximum dividends at the rates of 10 and 7 per cent. on the "A" and "B" shares were declared. The issue of 2000 £5 new ordinary shares was authorized during the half year. The capital account has been raised by the issue of 1500 new "B" shares, which, with the 500 shares sold by auction on the 23rd ult., realized a total sum of £20,000.

The shareholders of the Chester Water Company met on Thursday, and were informed that the accounts for the half year showed a surplus of revenue over expenditure of £2989, giving a total disposable balance of £10,564. The interest on preference capital required £450; leaving in hand £10,114. It was recommended that the statutory dividends be paid (free of income-tax), which would absorb £1890, and leave £8224. The Chairman (Mr. W. Brown) observed that it was very satisfactory to notice that the opinion which was once entertained in regard to the water had now disappeared. Nearly a mile of fresh pipes had been laid; and the result was that the income from rates had not fallen, although they had taken nearly £700 off the charges for baths. The report was adopted.

The East Worcestershire Water Company during the past half year have raised their total connections (excluding Droitwich and Rednal) to 5357. The average daily consumption of water in the same period was 825,822 gallons; being largely in excess of any previous half year. Progress is being made with additional works; and new extensions foreshadowed are estimated to cost £15,000. To meet capital outlay, the shareholders are to be invited to take up further shares and stock. The accounts exhibit a total disposable amount of £2692, from which it is proposed to pay a dividend at the rate of 4 per cent. per annum.

The Grantham Water Company had a balance on the past half-year's revenue account of £7294; and at the meeting last Tuesday, it was agreed to pay a dividend at the rate of 10 per cent. per annum. The balance to be carried forward will be £5544.

A satisfactory increase in revenue is shown by the annual report of the Southport Water Company; the total income from water-rents, &c., being £37,300. An interim dividend at the rate of 9 per cent. on the original and "A" shares and 7 per cent. on the remainder of the paid-up capital of the Company was paid; and the Directors now recommend the payment of dividends at the same rates for the second half of the year.

In the report of the Directors which will be submitted to the proprietors of the South Staffordshire Water Company at the meeting to be held on the 22nd inst., they state that the number of houses laid on during the half year ending Dec. 31 was 2483; making the total supplied 103,965. The gross amount of water-rates for the half year was £54,228, against £51,095 in the corresponding period of the previous year. After providing for interest on the debenture and preference stocks, the amount left for division (including £8687 brought forward) is £27,573; and the Directors recommend the declaration of a dividend for the half year on the ordinary stock at the rate of 6 per cent. per annum, free of income-tax. The amount of this dividend being £17,850, there will remain £9722 to the good. The report of the Engineer (Mr. H. Ashton Hill, M.Inst.C.E.) as to the condition of the Company's works shows that they are in substantial order and repair.

At the half-yearly meeting of the Truro Water Company last Thursday, the Chairman made some comments on the progress of the undertaking. In 1893 the revenue amounted to £1355, the net balance of profit was £790, and the dividend was 2½ per cent. Last year the revenue amounted to £2351, the net profit to £1158, and the Directors proposed to pay a dividend of 5 per cent. In reality, they could pay 7½ per cent. if they had not thought it wise to transfer various sums to the capital account. The concern was therefore in a very progressive state. With reference to the negotiations with the Town Council for the purchase of the undertaking, the Chairman explained that an offer had been made by the Corporation which the Directors considered totally inadequate. They had informed the Council of this opinion, and there the matter rested. The report was adopted, and a dividend of 5 per cent. declared.

The Whitby Water Company's half-yearly report shows a disposable balance of £1974; and at the meeting last Tuesday, dividends were declared at the rate of 3½ per cent. on the preference stock, 8s. 6d. per share on the original shares (being equal to 8½ per cent.), and 5s. 11½d. per share on the new 1897 shares (being equal to £5 19s. per cent. per annum). These payments leave £795 to be carried forward.

MANCHESTER GAS AND WATER SUPPLY.

The New Gas Engineer—Electrolysis and Its Effect on the Water-Mains.

At the Monthly Meeting of the Manchester City Council, on Wednesday last, one or two important recommendations in connection with the Gas and Water Departments came up for consideration.

Alderman GIBSON moved the adoption of the Gas Committee's minutes, which included a recommendation that Mr. John Gibson Newbigging, Assoc.M.Inst.C.E., be appointed Engineer to the Department at a salary of £800 per annum.

Mr. HODGE observed that at the last meeting of the Council the Chairman of the Gas Committee passed a high eulogium upon the late Mr. Stevenson. If Mr. Stevenson was worthy of all Alderman Gibson had said of him, it seemed a strange thing that the Gas Committee should appoint as his successor a man with less experience and knowledge at a greater salary. He thought an explanation was due from the Chairman with respect to the appointment. To his mind, it was a case of the Chairman of the Gas Committee coming before the Council and asking them to shut their eyes, open their mouths, and swallow all.

Alderman GIBSON: There is no reply to make to a statement of that kind; and I must tell my friend, and every other member of this Council, that when he expects any reply from me he must treat me as a gentleman. If Mr. Hodge had asked the question as he should have done, without unfair and ungentlemanly criticism, I would have told him why we have adopted the recommendation. As it is, I will not.

Mr. SUTTON said the question was whether the Chairman could give the Council any reason why another £100 a year should have been put on the new Engineer's salary. It seemed to him rather strange that the new man should have £800, while the late Manager should only have had £700. He should like to know the reason for the change.

The LORD MAYOR said he could answer that question. Prior to Mr. Stevenson's death, he did not think that gentleman was at all satisfied with his position; and had he lived, no doubt his salary would have been advanced. The new Engineer came with very high credentials. He was selected out of a good number as the best man; and in view of the large amount of engineering work in front of him, which he would be quite capable of doing, they had agreed to increase the salary. He would earn a great deal of it in this extra engineering work—in getting out plans, specifications, &c.; and if this were paid upon percentage, they would have had to give any other engineer a great portion of the salary in that way. Under these conditions, they had got the best man they could for the position, and had, of course, to pay a good salary.

Mr. HAMPSON, who is a member of the Gas Committee, said he did not think the strictures made by Alderman Gibson on Mr. Hodge were at all justified. Personally, he failed to see anything of a discourteous nature in Mr. Hodge's remarks. He joined with him in protesting against starting the new Engineer at £800 a year. He was a young man of 38, who had never earned more than £300 a year before; and it was a reflection on the dead Manager to start the new comer with £100 a year more than they paid the man who had perished in his labours, and who had been with them for a considerable number of years.

Mr. BROCKLEHURST asked whether the advertisement stated that the salary would be £800 a year.

The LORD MAYOR answered in the affirmative.

Dr. BISHOP thought that the appointment of a new servant of the Corporation at a salary of £800 was a most fitting time for the Chairman to give some little explanation of the position of his Committee on the matter.

Alderman GIBSON said several members of the Committee did not think £800 at all sufficient. He himself, like Mr. Hampson, would not agree to anything more than £800. The fact that Mr. Stevenson did not get £800 was his own fault entirely. He might, and would, have had it if he had gone the right way about it. Had Mr. Stevenson lived, he did not doubt that he (Alderman Gibson) would have asked for an advance of £200 a year for him. The salary of £800 a year had been decided on by a large majority of the Committee, and brought before, and approved by, the Council. The vacancy was advertised in accordance with that decision; and there was now no question as to the salary, but only of the fitness of the man for the position.

The minutes of the Gas Committee, including the appointment of Mr. Newbigging, were then adopted.

Sir J. J. HARWOOD, in moving the adoption of the proceedings of the Water-Works Committee, referred to a report which had been issued to members of the Council respecting the injury caused to the water-mains by electrolytic action. In this report, which had been supplied by Mr. Haynes, General Inspector and Surveyor of Mains, and Mr. L. Holme Lewis, Engineer and Manager of the hydraulic power supply, the former gentleman stated that in many cases of burst lead service-pipes that had occurred recently it had been found on examination that they had been damaged by electrolytic action, caused by the current escaping from the electric cables laid underground. The effect of this was to pit the pipe; thus reducing its strength to resist the pressure of water. With regard to iron mains, it was asserted that the result might be still more serious—especially as the extension of the electric supply for the purposes of traction would be worked at considerably higher tension than the present system. No one, Sir John remarked, could give an absolute statement as to the damage caused to pipes by electrolytic action; but there was no doubt as to the risk involved, and the Water Committee accordingly suggested that the Chairman of the Technical Instruction Committee be respectfully requested to afford at the Technical School such facilities as might be considered necessary in order to make a full investigation into this important matter. Referring to the recommendation of the Committee to increase the water supply from Longendale, he observed that in times of heavy rain much water ran to waste, because more could not be conveyed than 25,000 gallons per day; and it was now proposed to put in a 40-inch main to increase the supply, which could be done at a cost of £25,000.

The motion was seconded by Sir B. T. LEECH.

Alderman HIGGINBOTTOM, Chairman of the Electricity Committee, said his Committee were wishful to avoid damage to Corporation property. They were working under Board of Trade regulations, which were most stringent, and had been compiled by the greatest electrical experts with a view to prevent electrolysis. He asked the Council not to adopt the report as issued, because it was not correct in many of its statements. There had been, he admitted, a few cases of lead water service-pipes that had been damaged when the first electric installation was laid down, but with the new kind of electric service cable that was instituted several years back, there was no possibility of leakage. He also denied that there would be any damage to iron mains from the institution of higher voltage for electric traction and electrical extensions at higher tension. His Committee did not deny that damage could be done to mains if certain conditions existed. But those conditions did not exist to-day; and the regulations of the Board of Trade, and the special safeguards that were adopted, were such as to prevent them being set up. His Committee had no objection to an inquiry; but it should be a proper one. It should be carried out by electrical experts in consultation with the Committees affected, and then the result could be presented to the Council as a joint report.

Alderman HOY suggested that the report under discussion be referred to the Technical Instruction Committee.

Sir B. T. LEECH said he could show iron pipes pitted over with soft places; and as these were in proximity to electric mains, they believed it was the electricity that affected them. There were so many gas and water pipes in the city that it was only fair to the Gas and Water Committees that some protection should be afforded against anything that might injuriously affect them.

Mr. LAMBERT said if the Chairmen and Deputy-Chairmen of the Water, Electricity, Tramways, and Gas Committees had been put to consider the matter, they would have arrived at some resolution which would have obviated the needless alarm that had been raised.

Mr. WILSON remarked that he never knew a cable yet which would not leak; and in this matter they had to consider the bad and scamped work sometimes put in when the cables were laid in the ground. He supported the Water Committee in their recommendation for an immediate inquiry on the question of electrolysis.

Alderman GIBSON said they were indebted to Sir John Harwood for having brought the matter into the light of day. They should have the very best scientific and expert evidence which the country could produce, in order to satisfy the Council and the city on this very important subject. He thought, however, it would have been better if Sir John Harwood had consulted with the Gas, Electricity, and Tramways Committees before bringing forward his resolution, because it affected all the Committees mentioned.

Mr. BOYLE pointed out that the water-mains, gas-mains, tram-rails, electric cables, &c., were all the property of the Council; and the question was simply that of considering the effect of one part of their property upon another.

Alderman RICHARDS remarked that failures in the electric light were so frequent that people were plunged in darkness on an average once a week. Only recently a son of his had been carried 6 feet off the ground by the force of an explosion. There was waste in water, gas, and electric current that could not be avoided. It was no great affair for the Water Committee to seek further information on the question of electrolysis.

Mr. DREYFUS observed that the city was honeycombed with gas-pipes, water-pipes, hydraulic pipes, telephone wires, and electric cables; and the streets were constantly "up," which interfered greatly with traffic. The manner of laying pipes was most primitive, if not barbaric. The time had come to consider whether tunnels ought not to be laid under the footways, where the pipes could be placed, preserved, and easily "got at" without interfering with traffic. He suggested that if a Committee were appointed this matter also should be laid before the experts.

Sir J. HARWOOD said neither the Board of Trade nor any other power could prevent the electric current running to earth in some degree. The Electricity Committee might take all possible precautions; but when they had done their best, there was a power they could not control. The report was simply one asking the Council to be good enough to institute an inquiry. They wanted information; and wherever it came from the Water Committee would be very glad to have it. They would have been neglecting their duty if they had not taken the course they had, in view of the damage done. He did not think a report coming from the Electricity Committee would have had the same reception by the public as one coming from the representatives of the Water Department.

Alderman HIGGINBOTTOM said it was the publishing of the present report that he objected to.

Sir J. HARWOOD: Very well then, do not publish it. The Committee have no feeling whatever on the point.

Alderman SOUTHERN thought if the report was withdrawn, something should be put in its place. He moved that the Chairmen and Deputy-Chairmen of the various Committees concerned should meet together and appoint such experts as they thought fit to make the investigations, and present to the Council a definite report on the question.

Alderman GRIFFIN seconded the motion, which was accepted by Sir John Harwood, and approved of by the Council.

Ottoman Gas Company, Limited.—The Directors of this Company, at the half-yearly meeting next Thursday, will report that the gas-rental for the six months ending Dec. 31 last amounted to £10,487 (for the corresponding period of 1898 it was £10,264), and that the net profit is £2875. The amount standing to the credit of the profit and loss account is £3336; and the Directors recommend a dividend at the rate of 7 per cent. per annum on both classes of shares, amounting to £2625, leaving a balance of £711 to be carried forward.

Gas-Meter Testing and Public Lighting at Bristol.—In a report issued by Mr. Benjamin Kitt, the Gas Examiner of Bristol, it is stated that the number of meters tested by his Department during the past year was 1587. The total number tested since the commencement of the Gas Act amounts to 44,124. The number of certificates issued was 12,627; and up to the present time £1453 has been received as fees. The total number of public lamps amounts to 7591; being 5844 in the old area and 1747 in the extended area. The total number of new lamps erected during the year was 255. The total number of gas-lamps discontinued in all the districts now lighted by electricity is 599; and the total number of electric lamps installed is 306. The total consumption of gas for public purposes in the year was 163,602,126 cubic feet. Compared with the previous year, this is a decrease of 7,469,374 feet, and is principally due to the extension of the electric light in areas formerly lighted by gas.

THE POWERS OF THE MASSACHUSETTS (U.S.A.) GAS COMMISSIONERS.

A Gas Company Ordered to Reduce their Price.

A correspondent has forwarded a cutting from the "Boston Daily Advertiser" of the 24th ult., containing a report of a decision given by the Gas Commissioners of Massachusetts in an application by the citizens of Haverhill for a reduction of the price charged for gas. The circumstances which gave rise to the application will be understood from the following particulars extracted from the Commissioners' judgment.

The Haverhill Gaslight Company was organized under a special Charter in February, 1853, with a capital which was originally $45,000, subsequently increased in 1871 to $75,000. In addition to the payment of an average dividend of about 8 per cent., they have accumulated a surplus, invested in the plant, estimated to represent $275,000. The Commissioners say it is probable that a part of this will disappear in the near future through the abandonment of existing plant in making improvements which are likely to prove necessary for properly supplying the public; but the surplus is much larger than can be utilized for any such purpose. This accumulation appears to have been due in part to exceptional care in the management, and in part to a rapid gain in wealth and population in the community supplied. Its growth has been steady through a long series of years, and not excessive in any single year. Its existence thus appears to be due to a certain extent to causes over which the Company have had no control, and for which they are entitled to no particular credit. Accumulated as it has been out of profits in the performance of a public service, its existence affords exceptional facilities and imposes peculiar duties upon the corporation towards the public. As the Company have applied this surplus in improving and enlarging their plant as needed to satisfy the public demand, the property in which it has been invested must otherwise have been represented by new capital contributed by the shareholders.

This use of the surplus, the Commissioners allow, may properly be made of substantial benefit to the consumers and shareholders alike; and, by every principle of law, is the property of the corporation. They have an undoubted legal right to distribute it as a dividend as it is acquired, or *pro ratâ* to the shareholders in case of liquidation. But, notwithstanding this, the circumstances attending its accumulation impose upon the Company, so long as they continue to exercise the functions of a public monopoly, the duty to employ it for the joint advantage of the consumers and the corporation. It need not be dealt with as the exclusive property of either.

The Commissioners say that fortunately, in the majority of Companies of this class in Massachusetts, the recognition of this duty by the Directors has been a part of the policy of their management; and until recently it was the policy also of the Company in Haverhill. Now, however, this policy appears to have undergone a very decided change. They then explain the nature of this change.

In July, 1899, the Haverhill Gas Securities Company was chartered under the laws of this Commonwealth with a capital of $500,000, and with the avowed purpose "to transact a general brokerage business, and to purchase, hold, sell, assign, transfer, mortgage, pledge, or otherwise dispose of, the shares of capital stock of, or any bonds, securities, or evidence of indebtedness created by, any other corporation or corporations of the Commonwealth of Massachusetts, and while owner of such shares of stock to exercise the rights, powers, and privileges of ownership." Subsequent events seem to indicate that in these words its real purpose was adroitly concealed. Its promoters and principal incorporators had already completed negotiations for the purchase of all the outstanding stock of the Haverhill Gaslight Company, the par value of which was $75,000, and agreed to pay therefor substantially the entire capital of the Securities Company. Either with this stock or the cash collected for purchase, in order to complete a perfunctory compliance with the laws, the entire capital of the Securities Company was paid in. It then proceeded to issue and sell 5 per cent. debentures for the full amount of the $500,000 with the entire stock of the Gas Company deposited with a trustee as collateral security therefor; leaving to the promoters as their profit on the transaction the entire capital stock of the Securities Company and the control of the Gaslight Company.

We have been unable to learn that the Securities Company possesses or expects to acquire any other property or source of income in addition to the equity in the Haverhill Gaslight Company's stock and the returns from its business.

In 1868, the Legislature passed the following Act, which is now a part of the Public Statutes: "No railroad corporation, telegraph or gaslight company, chartered under the laws of this Commonwealth, shall hereafter declare any stock dividend or divide the proceeds of the sale of stock among its shareholders."

This is not merely a prohibition against stock watering, but against the division of a surplus into new capital stock. The principle announced in this statute is not to be defeated by any shrewdly contrived method of stock manipulation.

The obvious purpose and tendency of the Securities Company is to evade and annul the policy which this statute declares. It is indirectly, but distinctly, an effort to capitalize the Company's surplus. To pay interest upon the new bonds will annually require a sum greater by more than 60 per cent. than the highest regular dividends ever paid by the Gas Company.

The existence of this burden is a virtual declaration of a purpose in the Securities Company practically to take out of the Gaslight Company, directly or indirectly, sooner or later, that portion of the profits which the management has been accustomed to reserve within the corporation for the joint benefit of the Company and its consumers. It has already taken, by a single act, the sum of $20,000, which it claims was in anticipation of a dividend not yet earned.

In view of these facts, there is no reason to believe that the former policy of the Company in the treatment of profits will be continued, but there is ample reason to assume that it will turn over to the Gas Securities Company until its needs are satisfied whatever provision for contingencies may be allowed in the price. To such a policy consumers ought not to be asked to contribute. The Board, therefore, recommend that the net price to be charged for gas supplied by the Company from and after Feb. 1, 1900, shall not exceed 80c. per 1000 cubic feet.

A METER-RENT QUESTION AT MELTHAM.

A lively discussion, which towards the close led to personalities, took place at the monthly meeting of the Meltham District Council on Monday last week. The minutes of the Gas and Lighting Committee contained a recommendation "that the payment of meter-rents be re-established on the same basis as formerly." Mr. Mellor, in moving the adoption of the minutes, explained the reason for including the recommendation therein. He said the matter had been considered by the Council in the past, and in some quarters it was regarded as a mistake when it was decided to abolish meter-rents. Owing to the financial state of the Gas Department, the question had become a serious one. As they were all aware, wages had been advanced two or three times within the last three or four years; but the charge for gas supplied by the Council had remained unaltered, although other gas manufacturers had put up the price owing to the increased cost of production. At the time they decided to abolish meter-rents there was an alternative proposal—of which he believed he was the mover—that the price of gas should be reduced to the extent of 5d. per 1000 cubic feet. A number of people were burning gas as a kind of luxury—he meant to say that they were only using it on special occasions—because they had no meter-rent to pay; and people who used large quantities had to make up for these small and occasional consumers. Mr. Brook seconded the motion. Mr. Preston said he thought the proposal was one of the most retrograde the Council had ever to his knowledge had to consider. What was the reason for the abolition of the meter-rents? At the time it was found that a large number of consumers wanted a reduction in the price of gas; but the majority of the Council decided in favour of the abolition of meter-rents. There were between fifty and sixty consumers who were using less than 2000 cubic feet of gas a year; and when the matter was before the Council last time, Mr. Mellor practically suggested the disfranchisement of these people. The reimposition of the meter-rents would only make a difference in the receipts of the Gas Department of about £70 per annum; but since the rent was abolished, the profit for the concern had been larger. As to the argument that the price of coals had gone up, what difference would it make to them, when they had their coal under a twelve months' contract, five months of which were still to run out? If it was a question of the financial position of the Gas Department, they should put up the price of gas, and he would support them. He moved that the minute be referred back to the Gas Committee. Mr. Brook could not see that the minute contained a retrograde proposal. He thought it was wrong to abolish meter-rents, because the abolition of capital values was invariably wrong in principle, for capital should always pay interest, which should be the first charge in any concern after the working expenses had been completed. Twelve months ago they had a number of meters out that were earning nothing; and capital was thus lying dead. He appealed to the Council to consider the question from a practical, businesslike point of view. Mr. Manchester said he would have supported the amendment if Mr. Preston had proposed that the matter be referred to the General Purposes Committee. Mr. Preston expressed his willingness to refer it to them; whereupon the amendment was altered to this effect. Mr. Mellor then replied. He said the question had been discussed and re-discussed by the Gas Committee for several years, and he did not see that there would be any advantage gained by referring it back to the Committee. He would like the Council to settle the matter at this meeting. Eventually the amendment was declared carried. Thereupon Mr. Mellor tendered his resignation of the chairmanship of the Committee.

LEEDS CORPORATION GAS UNDERTAKING.

Increase in the Salary of the General Manager.

In the "Journal" last week it was stated that a proposition was to be submitted to the Leeds City Council by the Gas Committee, that the salary of the General Manager of the Gas Department (Mr. R. H. Townsley) should be raised by £200 per annum. Mr. Townsley has been in the service of the Corporation since 1878; and about twelve years ago he was appointed Manager of the York Street works. Early in 1895, he was promoted to the position of Superintendent of the Gas Department, in succession to Mr. Lupton, who had died in the previous November. At that time, hand stoking was the only system in use. But since then very large extensions and improvements have been carried out at all the stations, notably the installation of stoking machinery at New Wortley, and a reconstruction of the works generally; also the inclined retort installation at the Meadow Lane works, a new purifier-house, and a general extension of the auxiliary plant. At the York Street works the whole of the mains have been relaid; and coal-stores have been built at all the works. In addition to these alterations, very considerable extentions and enlargement of the mains in the city have taken place. The quantity of gas made in the year ending June 30, 1895, was 2,586,102,800 cubic feet; whereas the make in the twelve months ended June last was 3,016,979,254 cubic feet—an increase of 430,876,454 cubic feet, or 16·6 per cent. The carbonizing wages in the first-named year, with hand work, were at the rate of 3s. 3½d. per ton of coal; last year, with stoking machinery and inclined retorts in use, they were 2s. 0½d. The quantity of gas sold per ton of coal used in the past year was greater by 324 cubic feet than it was in the twelve months ending June 30, 1895; and it is the highest sale figure ever reached in the history of the gas undertaking. While the improvements carried out under Mr. Townsley's supervision, which have involved an expenditure of no less than £150,000, have resulted in increased profits for the gas undertaking, they have also, and necessarily, entailed a progressive increase in his ordinary duties, and added largely to his responsibilities. These facts were duly considered by the Gas Committee, in conjunction with the annual make of gas and the salaries paid to Gas Engineers in other large towns; and the result was a unanimous decision to recommend an increase in Mr. Townsley's remuneration by the above-named sum. The proposition was brought before the Council, at their meeting last Wednesday, by Alderman Lowden, the Chairman of the Committee, who alluded in favourable terms to the work of the General Manager, against whom, he added, there had never been the slightest complaint; and it was agreed to without a single question being asked or a dissentient vote recorded.

A COMPARISON OF THE COST OF INCANDESCENT GAS AND ELECTRIC LIGHTING.

Facts are Stubborn Things.

The following is a letter, signed "An Old Inhabitant," which appeared in the "Belfast News-Letter" last Thursday. The writer's simply-worded but pointed statement needs no comment.

"In the spring of last year, the writer, a retailer in the centre of the city, removed into new premises. With an outlay of between £40 and £50, I had my new premises fitted with the most approved electric lamps, consisting of 28 incandescent lamps of 8, 16, and 32 candle power, also two arc lamps. My old establishment was lit by 24 ordinary (Welsbach) incandescent gas-burners, and two large Wenham lamps. When I decided to adopt the electric light for my new premises, the firm who estimated for fitting up, very considerately told me that my account for lighting would be about double my usual gas account. The following has been the result: My gas account for *six* months, July to end of December, 1898, amounted to £1 17s. 9d. (in these winter months the lights were kept going much longer for heating purposes than the corresponding months when using electric light), my electric account for *three* months ending January 8, 1900, amounted to £16, including 3s. meter-rent. There are two points which I wish could be brought under consideration, and, if possible, revision in the proper quarter. Firstly, the rating at which the consumer is charged '7d. per unit for first hour's use' of the consumer's maximum demand per day (for 182 days each half year), and 2d. per unit for all used afterwards. According to this rate, I believe that in the six months (observe three autumn and three winter months, or three spring and three summer months) my account would have to total at least £20 before I could obtain the advantage of the 2d. per unit rate. In my case, which must be the case of many others, I am powerless to obtain any advantage of the reduced rate, as my business day closes at six o'clock each evening, and on Saturdays at three o'clock. This brings me to my second point—namely, the clause 'for 182 days each half year.' This applies only to those consumers who keep their business places open, and necessarily their assistants confined, until six, eight, or eleven o'clock each day from Monday till Saturday night. The electric light has great advantages in convenience of lighting up each evening, and also from the standpoint of health; but as far as brilliance is concerned, I honestly believe that I had as good results proportionately for the number of lights, with an expenditure of 37s. 9d. for gas—my six months' account—as for 320s. for electric supply, my three months' account."

ELECTRIC LIGHTING NOTES.

The Finance and General Purposes Committee of the Heywood Town Council have approved of a scheme of electric lighting submitted by Mr. W. P. Adams, of London; and they recommend the Corporation to apply for the necessary borrowing powers.

Alderman Hind, the Chairman of the Electricity Committee of the Stockton Corporation, calculates that the cost of electricity is about one-and-a-half times that of gas. It is hoped that the works for the supply of electricity will be ready for business next August.

It was reported at the meeting of the Electric Lighting Committee of the Middlesbrough Corporation that the total demand from 88 applicants for the light was equal to 4525 8-candle power lamps. The capacity of the installation is 6666 lights, so that the demand is considered so far satisfactory.

It was reported to the Hereford Town Council last Tuesday that the number of 8-candle power lamps connected with the electricity system was now 2283, 1413 lights were ready for connection, and a further 1252 would, it was thought, be added before the end of the current half year. It was also stated that the estimated cost of the works—£20,000—had not been exceeded.

Failing at the present time to secure the approval of the ratepayers to a scheme of electric lighting, the Great Malvern District Council have resolved to ask the Board of Trade to extend their Provisional Order for a further term of three years, or failing this, to allow the Council to transfer the Order to a company on the best terms obtainable. Two Companies have offered to treat for the supply of the town.

The Leeds City Council last Wednesday authorized the Lighting Committee to proceed with the development of the Britannia Mills site for an electricity station, by the erection of buildings thereon, and the provision of the machinery necessary for the supply of current on the two-phase system at 50 alternations, in accordance with the recommendation contained in a report by Messrs. Hopkinson and Talbot.

The Newcastle Corporation are going to make an effort to have the city excluded from the Bill of the Tyneside Electric Power Company. There are already two Companies supplying the city; and the Council are thinking of having a supply of electrical power on their own account. With a new comer, the streets would be over-run with cables. Strenuous opposition is also to be offered to the Tyneside Bill by Gateshead and Tynemouth.

For eighteen years the question of electric lighting has been under discussion by the Birkdale District Council. Our authority for saying this is Mr. Clinning, a member of the Council. The end of this lengthened and, we suppose, profound consideration was witnessed last Tuesday, when the Council assented to the affixing of their seal to an agreement with the British Electric Traction Company, by which the electric lighting powers obtained by the Council were handed over.

In his report to the Fire Brigade Committee of the London County Council, the Chief Officer of the Metropolitan Fire Brigade (Commander Wells) states that nine fires occurred last year on the premises of electricians—five being caused by short circuiting of electric wires, one by overheating of the boiler, one by hot ashes, and the causes of two were unknown. There were ten fires at electric lighting works, caused as follows: Overheating of boiler, 1; short-circuiting of electric wires, 5; spark from fire, 1; spontaneous ignition, 3. Of the 3846 fires in London during the year, 18 were attributed to short-circuiting.

A Local Government Board inquiry was held at Blackpool on Tuesday last with reference to the application of the Corporation to borrow £42,515 for electric lighting. Colonel Luard was the Inspector, and to him the Town Clerk explained that this was the fifth application for sanction to borrow money for the electricity undertaking; and since 1893 £120,000 had been borrowed. The consumers had increased from 112 to 900. It was absolutely necessary, with a view to meeting the increasing demands and providing for the trams, that the works should be extended. There was no opposition, and the Inspector intimated that he would report favourably to the Board.

The Sevenoaks District Council have been dilly-dallying with the electric lighting question for a long while; and now they have practically arrived, by roundabout procedure, at the position they were in at the start. They have withdrawn their petition to the Board of Trade for a Provisional Order, and assented to an application by the Electrical Power Distribution Company. Of course, clauses are to be inserted in the Company's Order giving the Council certain rights in connection with the purchase of the undertaking; but what the Company have now conceded could no doubt have been obtained from them, or some other company, long since by the application of a little pressure.

At the quarterly meeting of the Oswestry Town Council on Monday last week, the Town Clerk (Mr. J. Parry-Jones) reported that the Local Government Board had written to say they had received the report made by their Inspector (Mr. Bicknell) after the inquiry held by him with reference to the application of the Council for sanction to borrow £18,000 for the purchase of the undertaking of the Oswestry Electric Light and Power Company, Limited, had carefully considered it, with the evidence submitted at the inquiry, and had come to the conclusion that they could not sanction the proposed loan. The announcement was received with applause; whereupon the ex-Mayor (Mr. W. A. Aylmer-Lewis) remarked that the decision put Oswestry back twenty years.

A conference was held at Cardiff last Wednesday, in response to a circular sent out in the joint names of the Town Clerks of Cardiff, Newport, and Swansea, of all the local bodies affected by the Bill which is being promoted in the present session of Parliament by the South Wales Electrical Power Distributing Company. The opinion of the meeting was that the Bill should be vigorously opposed on second reading. To give effect to this, it was agreed to prepare petitions, and to forward them to all the local authorities concerned for their adoption. The parliamentary representatives are also to be asked to support the opposition to the measure, as well as to the other Electrical Power Bills which are being promoted. If the opposition is unsuccessful on the second reading, it will be continued in the further stages of the Bill.

Exeter is again complaining of the eccentricities of the electric light. According to one of the local papers, the light has "no consistency of quality," being now low, then lower, then brightening up splendidly only to die down again, and rarely giving satisfactory illumination. As a means of ascertaining whether consumers are getting value for their money, and if not why not, it is suggested that independent reports should be made of the electric light as they are of the illuminating power of the gas. As to the arc lamps in the streets, the Electric Lighting Committee are recommended to look after what is described as the "jumping-Jenny" performances of their pets. The lamps do seem to be a little troublesome. Sometimes arc lamps and the side incandescent lights are all alight at once. At others there is hardly light enough to show the iron standard. These eccentricities are certainly not confined to Exeter.

A short time ago the Yeadon District Council received an intimation from the Board of Trade that, unless steps were taken within the ensuing twelve months to put into operation the Electric Lighting Order obtained in 1894, the Board would seriously consider whether or not to cancel it. Mr. J. Enright was thereupon engaged to advise the Council on the best method of carrying out the powers they possessed. In his report he says that, from an examination of the township, and taking the price of gas and all the circumstances into account, he estimates that, within a year or so from current being available for lighting, the Council would have wired the equivalent of 4500 8-candle power lamps. He suggests the provision of plant at an estimated expenditure of £12,600. The annual expense he puts at £1540; and the yearly income, including £160 from the street-lamps, at £2035. He fixes the price per unit at 5d.—a figure which he strongly advises the Council not to exceed.

Misfortunes crowd upon the Manchester Corporation Electricity Department; but the officials may find a little consolation in the knowledge that they are gaining a large and varied experience of the many disorders to which an electric light system is subject. The latest mishap occurred about half-past five on Monday evening last week. At that inconvenient hour, a reporter writes, "the electricity supply went wrong, and the city was suddenly enshrouded in darkness. At business establishments where the electric light is duplicated with gas, the difficulty was quickly overcome; but at many places candles had to be temporarily used as the only available illuminant. As the interruption had not been corrected until considerably after six o'clock, some alarm began to be felt for the success of the entertainments at the theatres in the city. Mr. C. H. Wordingham, the Electrical Engineer, however, was able to locate the spot where the 'hitch' had occurred; and at half-past six the engines at the works in Dickinson Street were again running full speed, and the supply of light was renewed."

The Cardiff Corporation Electrical Committee have been investigating the causes of the frequent failures of the electrical service in the borough. As the result, they seem to be pretty well convinced that their system is not all that could be desired, and that it is necessary there should be a more methodical management of the department. The system adopted by Cardiff, it is stated, compels the use of rectifiers; and it is to these rectifiers that eleven out of fourteen failures are attributed. As to the other point, it is apparent the Engineer (Mr. Applebee) has hitherto had very limited powers over his subordinates; but now he is to have entire control of the whole of the staff for the next six months. Altogether, the Engineer seems to have had more than enough to do in the past, and has not had sufficient freedom of action for a man holding his responsible position. To this, and to the shortsightedness of the Committee (who seem to be endowed with a fair share of pomposity), is due, perhaps, much of the trouble that has come upon the department. During the six months' experiment (it is nothing more), it is to be hoped that the people of Cardiff will be relieved—if not entirely, to a large extent—from the constant difficulties which they have experienced since the advent of the electric light in their streets.

THE FINAL REPORT OF THE METROPOLITAN WATER COMMISSION.

We conclude to-day our abstract of the document by dealing with the suggestions made by the Commission on the subject of control.

It may be remembered that the Commissioners were directed to inquire whether, in the event of the water undertakings not being acquired, "additional powers of control should be exercised by local or other authorities;" and, if so, "what those powers should be." A wide divergence of opinion upon the meaning of the word "control" was made apparent in the course of the inquiry. The London County Council submitted to the Commission a paper which contained, among other things, the following conditions of control in the event of there being no purchase by a public authority:—

I.—Present System of Control.—(*a*) Extent of control as affecting finance and quality and quantity of water. (*b*) General powers of the Local Government Board; no authority representing Londoners has any power of control. (*c*) Insufficiency of present control. (*d*) Present remedies of consumer inadequate.

II.—Further Provisions for the Future.—(*a*) County Councils in London and outside to have power to analyze water, and to compel Companies to improve method of treatment, and make provision against possible failure of supply; to demand returns and improved form of accounts; to appeal to Auditor against items of expenditure. (*b*) Avoidance of agreements between the Companies, so as to bring into activity the competition intended by Parliament to operate for the benefit of the consumers. (*c*) As an alternative to competition, compulsory amalgamation. (*d*) Reduction of rating powers—(1) to one uniform basis over the whole county; (2) to such figure as will carry out the intentions of Parliament in 1852. (*e*) Limitation of power of charge for sale of water. (*f*) Revision of nominal capital. (*g*) Limitation of dividend to total amount actually paid at the present moment; balance to be devoted either to rebate to consumers or to reduction of charges for water supplied for public purposes. (*h*) Limitation of the quantity of water to be taken from the Thames and Lea, independently of any permission given by the Conservators of those rivers. (*i*) Obligation upon Companies to bring into Parliament forthwith proposals for additional supplies adequate for the requirements of the next sixty years. (*j*) Obligation upon Companies to forthwith carry into full effect the requirements of the Royal Commission of 1892-3 with regard to the waters of the Thames and Lea.

Mr. Dickinson, the Chairman of the Water Committee of the Council, was careful to explain to the Commission that this summary represented only various heads which the Council thought worthy of consideration, and not a suggestion of the control they recommended. The position of the Council was that no control could be a possible settlement; and until they saw a definite, well thought-out scheme of control, they said purchase was the only solution. They came to the conclusion that, however efficient control might be, the question of purchase must crop up again in a very few years. They believed it to be impossible to formulate any scheme of control. The Commissioners express the opinion that measures of this kind, "which consist in depriving the Companies of the statutory rights on the faith of which their share and loan capital has been subscribed," cannot properly be described as measures of "control." They understand by "control," measures by which "the due performance of the existing statutory obligations of the Companies can be efficiently and conveniently secured and enforced."

Having set out the main obligations of the Companies, as defined in the Water-Works Clauses and other Acts, the Commissioners remark that these various enactments cover the whole ground; and, although criticism may be made on the tribunals selected and on the principle, which runs through all the statutes, of postponing action until a breach of some statutory duty has been committed, they consider it may safely be asserted that some remedy is provided for every such breach. They have been struck by "repeated instances of ignorance or neglect on the part of local authorities and consumers, for whose benefit these enactments were intended;" and they cite a number of cases. This apathy of the local authorities appears to be explained partly by the complexity of the Water Acts, which the Commissioners think stand very much in need of consolidation, and partly by the difficulty of proving a default in any particular instance.

Various suggestions were submitted for improving the machinery of control, and making it more effective. Mr. Dickinson thought there might be effective control if representatives of the London County Council were placed on the Boards of the Companies in a majority; but even this control would not, in his view, reduce the demand for purchase. His suggestion amounted to conferring the whole direction and management of the water undertakings upon representatives of the consumers, whose interests are directly opposed to those of the shareholders, and giving them nearly all the advantages of purchase without any payment or compensation. The representative Directors might reduce water charges, and thereby reduce dividends to a vanishing point. This, the Commissioners think, can hardly be regarded as a practical suggestion. Sir John Lubbock put forward one somewhat similar, but of a more moderate character. The Water Committee of the Corporation of London laid before them, through the Remembrancer (Mr. Prior Goldney), a scheme of control which they suggested was worthy of consideration, and was a possible solution of the question, although they did not go so far as to say it was desirable to adopt it. The Commissioners found the scheme extremely difficult to understand; but they say it went far beyond control, and amounted to a remodelling of the whole system of water supply in a manner which certainly did not seem to them to be advantageous.

Turning to matters which come more properly under the head of control, the Commissioners proceed to consider what additional powers seem advisable with regard to the drawing of water from the Thames, the Lea, and from wells; and with regard to the storage and filtration of the water so drawn, and its delivery and distribution to the consumers. They say it is clear that some effectual means should be provided for ascertaining from day to day the quantities of water pumped by the Companies from the Thames. The Thames Conservancy Act, 1894, appears to them sufficient for the purpose; and the only addition they suggest is that provision should be made for paying the costs of the Conservators in the event of an arbitration taking place under that statute. With regard to the Lea, the existing provisions are less effective. By the River Lea Water Act, 1855, the New River Company are required to maintain a gauge limiting the quantity of water taken by them to 22½ million gallons a day; and this gauge is subject to the inspection and control of the Secretary of State for War. But although there is an enactment requiring that all other draughts on the river by that Company or the East London Company shall be measured by gauges, there is no control provided over them, except by each Company over the gauges of the other. This legislation, in the Commissioners' opinion, requires amendment; and the Lea Conservancy Board ought, they think, to be able to inspect all gauges, and to have the same powers as are possessed by the Thames Conservancy.

One of the most important matters in connection with the purity of a water supply from the Thames and the Lea is the question of subsidence by means of storage and filtration. The Royal Commission presided over by Lord Balfour recommended that, after competent inquiry, regulations should be drawn up prescribing the proportionate area of the filter-beds, the depth of sand, the frequency of renewal, the rate at which water should be allowed to percolate, and the number of days' storage sufficient to obviate the necessity of taking in turbid flood water and to allow of due settlement. They also recommended that the enforcement of the regulations should be entrusted to the Water Examiner. No inquiry such as that Commission recommended has yet taken place, and the present Commissioners think the question is not yet ripe for final settlement. They proceed to deal with the various points raised in evidence before them, and the extent of control they are able to recommend in the present state of scientific opinion.

The first point taken into consideration is whether water should be drawn from the Thames, when the river is in flood, for domestic supply. Sir Alexander Binnie thought none should be taken when the river was in a turbid state. But when he was asked how he would define "turbid" water, he admitted that he was unable to do so without careful inquiry. Floods differ so much in their character that the number of days from the commencement of a flood was a bad test; and he suggested that the difficulty might be met by providing that the water should not be drawn when it contained a certain number of grains per gallon of suspended matter. He deemed it better to lay down a positive statutory obligation, to be enforced by penalties, rather than to leave it to the discretion of the Engineers of the Water Companies to decide when the water was fit to be taken into reservoirs. Mr. Middleton, who represented the Companies, expressed the opinion that it was impossible to define a flood, and stated that he would allow water to be drawn at once into reservoirs in all conditions of the river, leaving it to the Engineer to say how soon he would pass that water on to the filters. With sufficient storage and the use of alternate reservoirs to draw from to the filter-beds, he thought this discretion might safely be allowed.

So much for the engineering evidence. Coming to that furnished by the Chemists, Sir William Crookes stated, as the result of his experience, that water might be taken into the reservoirs at the time of, or at most a few hours after, a flood; and that by filtration, properly conducted, water was turned out practically free from microbes, however many there might have been in the raw water. He added that the microbial impurity of Thames water had much diminished since the passing of the last Thames Conservancy Act. His colleague Professor Dewar regarded efficient filtration as the real security for the purity of the water; and he objected strongly to adopting a more rapid rate because the raw water was assumed to be purer, and to have less sediment in it. The only objection to putting flood water from the Thames on to the filter-beds would, he said, be that they would be sooner choked, and require to be more often washed. Thames water could be effectually filtered by methods now known. The late Sir Edward Frankland differed from the Companies' Chemists to this extent—that he thought, as a rule, when the Thames is in flood, and the raw water contains more microbes, the number in the filtered water was also larger. Notwithstanding this difference, Sir Edward did not absolutely condemn taking flood water into reservoirs; but, in the present state of knowledge, he did not consider it advisable to utilize the very top of the flood, especially the first part, which contains the washing out of ditches and fields. If there were sufficient subsidence reservoirs, he thought that possibly even the top of the flood might be drawn without danger, and that two or three days after the maximum flood the water could be taken with perfect safety.

Although these eminent authorities differed on one point, they were in full agreement upon another—viz., that, in the whole course of their experience, they had never discovered in the filtered water a single pathogenic organism. Sir William Crookes told the Commission that the whole question of microbes was a sentimental rather than a practical one; and Sir Edward Frankland said that no one had yet discovered, even in the raw Thames water, a harmful microbe, and that he had never been able to find even a suspicious one. He was also of opinion that it had not yet been established that the engineers in charge of the filtration could work up to a standard of 100 microbes per cubic centimetre of filtered water as a maximum; that the standard failed to be attained at times, from some unknown causes, both in severe frosts and in summer heats; and that it would be impracticable at present to enforce that standard by statutory penalties.

A scientific witness whose opinion the Commissioners think is entitled to weight was Mr. Groves, the Chemist to the Thames Conservancy. He examines the water of the Thames and the effluents which pass into it, in the neighbourhood of the intakes of the Water Companies, to ascertain the amount of organic impurity contained therein, both in times of flood and when there is no flood. He put in tables showing the results of his investigations; and the conclusion he drew was that the flood waters of the river might safely be taken at any time of the flood. He had carried out experiments which showed that, after settlement, the flood water was better than the average of the water when the river was not in flood. He was therefore of opinion that flood water when placed in a large storage reservoir would, after subsidence, be better than that which was taken from the Thames when it was not in flood. Mr. Walter Hunter, one of the Engineers of the Staines reservoirs scheme, stated that, in his opinion, the first two days of any flood would be sufficient to cleanse the surface of the land and the ditches, and that the rejection of water during those two days would be all that was desirable, by way of precaution rather

than of necessity. Sir Frederick Bramwell and Mr. Hawksley expressed concurrence in this view.

As the result of all this evidence, the Commissioners came to the conclusion that it is unnecessary to impose any restriction upon the taking of flood water from the Thames; and that it may safely be left to the discretion of the Engineers of the Companies how soon after a flood they will draw water from the river. They think it should be imperative on the Companies to pass water drawn from the river into a storage reservoir before letting it on to the filter-beds. The reservoirs provided by the Staines Joint Committee, and those which the Commissioners have recommended in a former part of their report, for any additional supplies to be drawn from the Thames, will, they consider, be sufficient for purposes of subsidence as well as storage.

With regard to filter-beds, their construction, and the rate of filtration—all matters which the Commissioners regard as of the highest importance—they think that the time has not yet come when any detailed regulations thereon can be usefully laid down, either by Act of Parliament or by any controlling authority; and that the wisest plan is to leave the responsibility of these details to the Companies, who should have the task of finding and adopting the best means of getting a good result, rather than to throw upon a Government officer or a local authority the responsibility of the processes to be adopted and followed. The more useful control would, they think, be to test the results of filtration; and, in order that this may be effectually done, they specify some minor regulations which they consider are desirable. The Water Examiner should have the right of entry upon the works of the Companies, and of inspection of every part thereof, including intakes, reservoirs, and filter-beds. At present he is allowed to enter and inspect by the courtesy of the Companies, and no impediment has ever been thrown in his way; but this is not the position the Commissioners think he ought to have. He should be able to enter as of right; and they believe the Companies would have no objection to his doing so. He should have authority to prohibit the distribution of water to consumers from any filter-bed which he finds defective in operation; and disregard of his orders should entail penalties after the first default. During the inquiry, a suggestion was made by the late Sir Edward Frankland that bacteriological laboratories should be established close to the spot whence samples of water are taken; and the Commissioners think these experimental works might be undertaken, in order to ascertain what processes of treatment give the best results, and what bacterial standard of effectual filtration can be reasonably adopted for practical use. The Companies should be required to provide the structural and other facilities suggested by Sir Edward for obtaining and testing samples of water close to the works.

Bearing upon the subject now under consideration, the Commissioners are of opinion that the powers of inquiry into the quality of the water vested in the Local Government Board by the 35th section of the Metropolis Water Act, 1871, should be strengthened by giving to the person appointed by the Board to hold the inquiry similar powers to those of an Inspector holding inquiries under the Public Health Act, 1875. He should have authority to employ experts to make examinations, carry out experiments, and report to him. The Official Water Examiner should have the general direction and control of all the examinations of experts on behalf of the Local Government Board. Their reports should be sent to him and should be periodically submitted by him to the Board, together with his own report. The reports of these experts, if endorsed by the Water Examiner, should, as well as the reports of the Water Examiner himself, have the force and effect of reports made under the 35th section of the Metropolis Water Act, 1871, and the 9th section of the Metropolis Water Act, 1852. The Commissioners think the application of the last section should be extended; and that the Local Government Board should have power, on receipt of a complaint from any local authority or on their own initiative, to order an inquiry into the quantity of water supplied by any Company or as to the pressures maintained. It should be made clear that "frost, unusual drought, or other unavoidable accident," will not excuse a failure of supply, if it can be shown that the failure occurred "because the works of the Company were not in an efficient condition, and had not sufficient reserve capacity of supply." Suggestions were made that local authorities should have powers conferred upon them to enter the Companies' works, take samples of water from their reservoirs, inspect their filter-beds, and make detailed inspection of their works generally. The Commissioners think that if the system of inspection and control by the Water Examiner above referred to is adopted, it would be undesirable to have a duplicate inspection by the local authorities.

Another point of importance in connection with a proper water supply is the pressure at which the water stands in the mains. Mr. Dickinson, speaking for the London County Council, expressed the opinion that the pressure at every hour of the day should be reported to whatever authority had the control of the Companies. The Commissioners recognize that some caution would be necessary in drawing conclusions from a return of pressures; but, upon the whole, they think it would be reasonable to require the Companies to record and return to the Water Examiner the pressure in their service-mains at certain specified hours, and also the minimum depth of water in their service-reservoirs in each 24 hours. They do not advise that any power of prosecution or suing for penalties should be vested in the Water Examiner, if the returns show that the Companies are not acting up to their statutory duties. They think it is better that he should communicate the returns to any local authority in whom the law vests a right of proceeding; leaving them to take such action as they deem proper.

A further matter in respect to which additional control was much insisted upon before the Commission was the pumping operations carried on by some of the Companies. It was contended by witnesses who appeared on behalf of the county of Hertford that the pumping of the New River and East London Companies had diminished the flow of the Lea, had caused other rivers to rise far below their usual source, had either exhausted or diminished the yield of springs, had lowered the level of various private wells, and had depleted the reservoir of water in the chalk above as well as below the points of pumping. The same contention was made before Lord Balfour's Commission, and was carefully investigated by them. The conclusion they came to was that both facts and theory failed to support the contention. The present Commissioners did not feel that they were either qualified or empowered to review this judgment of their predecessors; and they declined to reopen the question. Moreover, it was made clear that, even if the facts and the theory of these witnesses were true, the Companies were doing no more than the law entitled them to do; and that the only practical step which could meet the alleged grievance was an alteration of the English law as to underground waters. They were clearly of opinion that it was beyond their province to consider or advise a change of the law such as that. They, however, express concurrence in the recommendation of the Balfour Commission that "distinct obligations should be laid upon any Company or local authority who are allowed to pump water from the chalk for purposes of public supply, to keep accurate observations of the effect of their operations on the level of the water in the wells from which they pump, and return the results to the Water Examiner, under such regulations as may be framed."

With regard to financial matters, the Commissioners consider the provisions of the Act of 1871 satisfactory and sufficient. The London County Council wished that the Companies' accounts should show how much they received for domestic, and how much for trade supply. This matter appears to have already been under the consideration of the Local Government Board; and the Commissioners say that Board, if they think fit, can at any time require this information to be given under their existing statutory powers. The Council also desired to have the power of appearing before the Official Auditor, for the purpose of challenging items of expenditure, or their allocation to capital and revenue account respectively. The Commissioners point out that if this power were granted to the Council it must also be given to the Councils of all the Metropolitan counties within which the Companies have powers of supply; and they do not think the intervention of all these bodies would tend to improve the character of the audit. There is, however, a blot in the system of audit which they think should be remedied. If the Companies feel aggrieved by any decision of the Auditor, the matter in difference is referred to arbitration, and the Auditor has to fee Counsel and pay his own costs of the arbitration. The Commissioners consider that provision should be made for paying these expenses out of public moneys, as the Auditor is a public officer; and that he should not be discouraged from asserting his views, in opposition to the Companies, by the prospect of being out of pocket if he does so.

We now come to a very interesting part of the report relating to control—that dealing with the subject of the prevention of waste. This, as the Commissioners point out, is rather in aid of than against the Companies. According to the figures they were able to obtain, the supply per head varies greatly between the different water districts, and between one year and another. The tables in the Water Examiner's returns to the Local Government Board show the daily average supply of water per head given by the different Companies from 1891 to 1897 in each year. The daily average supply per head of all the eight Companies was in 1891, 32·08 gallons; in 1892, 33·20 gallons; in 1893 (a year of drought), 35·46 gallons; in 1894, 34·77 gallons; in 1895 (a year of great frost), 38·47 gallons; in 1896, 35·31 gallons; and in 1897, 35·43 gallons. Between the several Companies the differences are striking; the Grand Junction Company being the most extravagant. The annual average daily supply of this Company reaches and exceeds 44, 48, and 48 gallons per head, as compared with 29, 31, and 29 gallons per head supplied in the same years by the Kent Company. The explanation given by the Engineer of the Grand Junction Company was that they found it cheaper to pump water to waste than to prevent the waste. The Chelsea Company also gave supplies in excess of the average during the whole period from 1891 to 1897; and the East London Company, from 1891 to 1895. The Commissioners say that a great deal of this excessive supply is due to preventible waste. The Chelsea Company have lately, however, vigorously prosecuted the inspection of waste, and have applied the system of Deacon's waste-water meters to parts of their district. In one portion of their district, they have reduced the supply per head for domestic purposes and businesses not supplied by meter from 25 gallons to 18·6 gallons per head. In some portions of this area, the reduction was about 50 per cent.—from 39·5 to 19·5 gallons, and from 30·3 to 15·5 gallons per head. This reduction has been brought about by effective supervision of the waste due to imperfect fittings. The average daily supply per head of the Chelsea Company has for some years been over 43 gallons, including trade supplies. To the 18·6 gallons above mentioned, trade supplies would add about 4½ gallons, making (say) 23 gallons per head instead of 43. The East London Company supplied the Commissioners with a table showing the reduction of supply effected by more careful supervision with the help of Deacon's waste-water meters. In six districts of their area, the number of gallons per head had been reduced by considerable amounts—*e.g.*, from 52·70 to 38·86 gallons, from 32 to 26·94 gallons, and from 38·78 to 26·35 gallons. Since constant supply was resumed by this Company in 1898, the average daily supply per head for all purposes has been about 28½ gallons; whereas in previous years it ranged from 32·58 gallons in 1896 to 40·02 gallons in 1895. On behalf of the Southwark and Vauxhall Company, the Commissioners had put before them tables of a like kind; showing how, by repeated inspection, great reduction of consumption followed the prevention of waste, and this "without the inhabitants being aware that any reduction had been made in the amount of water passing through their pipes." The Lambeth Company have made the same efforts at inspection and prevention of waste, with the result that in 43 districts having 22,707 out of their total number of 110,000 supplies, with a population of 158,000 persons, they have reduced the consumption from 30·54 to 19·76 gallons per head per day.

It appears from the report that the New River Company have carried the waste-water meter system farther than the other Companies, and have applied it to 145,000 out of the 151,000 houses that have constant supply in their district. They have also succeeded in inducing 95 per cent. out of the new supplies to adopt fittings tested and stamped by the Company. To these two causes is due a large reduction in the consumption of water per head per day. Mr. Collins, their Distributing Engineer, put in a series of tables furnishing the results arrived at in various districts of the Company's area. They showed that supplies of 36·8 gallons and 47·2 gallons per head per day were brought down to 15 and 10·8 gallons. Mr. Collins also supplied particulars of two abnormal districts which are of special interest. One is in the City of London, where the population are largely printers, working by night as well as by day, and using water for washing type. The consumption there per head per day is 59·4 gallons, of which 32·8 gallons are used in the day-

time, and 26·6 gallons at night. The other district is in Finsbury Park, where the consumption, not including metered supplies, per head per day ranged from 105·4 gallons in June, 1897, to 32·5 gallons in September, 1897, of which 18·3 and 24·9 gallons were used by day, and 87·1 and 7·6 gallons respectively by night. This large night consumption was due to the inhabitants letting their garden hoses run all night. The Company do not think it worth while to meter these services, even assuming they are entitled to do it, owing to the expense of a meter supply; and they make only a small charge for the gardens, because people would not pay a high one. The exertions of the Company have reduced the supply per head per day throughout their district, which is a fairly representative one, containing houses of every class, to 30·5 gallons in 1896, and 31·5 gallons in 1898. The Commissioners point out that if all the London Water Companies had reduced their supply to the same figure, there would have been a saving of 28,006,049 gallons a day in 1897, and 22,743,253 gallons a day in 1898, during which year the East London Company were not giving their full supply for some months. If this saving could be effected, not only would a considerable amount of money be saved, but the problem of finding a sufficiency of water for the supply of London would be rendered less difficult.

When the population of Water London reaches the estimated number of 12 million persons in 1941, a difference of 5 gallons in the consumption per head per day will represent an addition of 60 million gallons to the daily supply. Taking even a moderate estimate of the works that would be necessary to supply 60 million gallons, the Commissioners think it will be found that the interest and sinking fund on the money borrowed to execute these works, and the cost of distribution, maintenance, and management, would not be far off half-a-million a year. This, they say, would be "the penalty for waste to the extent of 5 gallons per head per day." The Commissioners remark that in some cases this waste of water, which benefits nobody and is wholly indefensible, proceeds from wilfulness or neglect, as when taps are left running all night, or are even cut off and removed bodily. In such cases, the remedy is under the penal clauses of the Water-Works Clauses Act, 1847, and of the Metropolis Water Act, 1871. The latter Act appears to give a company the further power of cutting off the supply of any person who fails to do what ought to be done in order to prevent waste of water. The provisions of the Act of 1871 are now extended to the whole area of supply of the Companies. These provisions appear to the Commissioners to be sufficient. There exists some doubt as to whether the Companies have the right to insist on charging by meter for non-domestic supplies. The Commissioners think it should be made clear that they are to have this right, which might possibly enable them to check such cases of abuse as that of the Finsbury Park district above described.

In many cases, of course, waste is due to imperfect fittings; and the Commissioners express the opinion that if the Water Companies were authorized to insist on all fittings being tested and stamped by themselves, they could prevent a great deal of this waste. Several of the northern towns have adopted it; Bradford being one of them. This borough introduced the regulations in 1893, and the result was that the consumption of water, which had averaged 24 gallons per head per day, was reduced to an average of 17½ gallons. Mr. Hawksley supplied the Commissioners with a table showing the consumption of water in 15 large provincial towns in the year 1897. The average per head per day, for domestic and unmetered trade supplies, was 18·18 gallons; and the average metered supply per head per day was 10·26 gallons—making a total of 28·44 gallons per head per day. They think the Water Companies may properly be empowered to require that all fittings shall be approved and tested by themselves, and shall be renewed or repaired from time to time on their requisition, and brought into conformity with regulations properly framed. There appears to be a jealousy on the part of some of the local authorities to giving these powers to a trading company. The Commissioners see no ground for it. They say the prevention of waste is a matter of public interest, as it ensures the sufficiency of the supply of water under the growing demands of an increasing population. Moreover, the Companies who supply the water are best able to detect the waste, and have a private interest in preventing it, which does not exist where the supply is in the hands of public authorities. No legislation is necessary to introduce the new regulations they recommend. The Act of 1871 enables the Companies to propose new regulations for the approval of the Local Government Board. The Commissioners consider the Companies have been remiss in not proposing a change before now; and they feel assured that the Board would not withhold their approval of regulations calculated to prevent a public evil.

The Commissioners cite the question of cisterns as an illustration of the need for intelligent revision of the regulations, and even of the legislation, on the subject of fittings—a cistern being a "fitting" in the language of the Metropolis Water Act, 1871. Neither the regulations, nor it seems the Special Acts of the Companies, prescribe the size or character of the cistern which the Companies are entitled to require before they lay on water to a house for the purpose of a constant supply. They are, therefore, obliged to be content if a cistern of wholly inadequate size is put into a house. Moreover, it not infrequently happens in the Essex district of the East London Company that a cistern is put into a house by the builder, who applies for water to be laid on, and as soon as that is done he removes the cistern into the next house, where the same process is gone through; so that one cistern does duty for a whole row of houses. The Commissioners were informed that the Company are powerless to prevent this state of things; that the question whether they are entitled to recover penalties for the removal of a cistern is doubtful; and that the question whether they can cut off the supply of a house which is without a cistern is now *sub judice* in an action against the Company. Under these circumstances, the Commissioners do not consider it would be becoming in them to offer any opinion of their own as to the effect of sections 24, 30, and 33 of the Metropolis Water Act, 1871. They consider, however, "that the Company or body which supplies water, whether the supply be constant or intermittent, should have power to require that a properly constructed cistern, approved by them, of dimensions proportionate to the number of persons likely to inhabit the house, should be placed, and should remain in good order and repair, in any house supplied with water; and should further have power, if the cistern is removed or is out of order, either to cut off the supply of water to the house, or to replace or repair the cistern, at the expense primarily of the occupier and ultimately of the owner of the house." The local authorities, as guardians of the public health, may, they think, be empowered to see that cisterns are properly cleansed, or that their construction is modified so as to prevent fouling of the water; but they should not have power to order the removal of a cistern altogether, unless it is at once replaced by another.

In a previous part of their report, the Commissioners adverted to the consolidation of water legislation as being desirable with a view to ensuring efficient control. They think there are some matters in respect of which amendment is needed. In the event of failure of duty by a Water Company, the existing remedies, by action for heavy penalties or by application to the Railway Commissioners, are useful chiefly for the larger questions which may conceivably arise as to the quantity and quality of the water supply. But the Commissioners consider they are "too cumbrous and expensive" for the minor cases which arise from day to day, and in which a householder has supplied to him water which is bad in quality or deficient in quantity. For these cases, they think that there should be an extension of the provisions of the Water-Works Clauses Act, 1847, and that the householder should be able to apply to a Police Magistrate, and recover some minor penalty, if his supply is bad or deficient, or if the charges demanded of him are excessive.

Another matter which, in the opinion of the Commissioners, calls for amendment is this: There is at present no statutory obligation on the part of the Water Companies to furnish either the Local Government Board or the Water Examiner with information regarding their works or supply. All the information on these subjects which now appears in the monthly reports of the Examiner or in his annual report to the Local Government Board is supplied as a matter of courtesy. As these reports have been used in the course of inquiries by Parliamentary Committees and Royal Commissions as authoritative sources of information, the Commissioners think that power should be given to the Local Government Board to prescribe periodical returns containing such information, or to call for special statements, plans, or documents, from time to time, as may appear to them to be necessary or desirable; and it should be a statutory duty of the Companies to supply all such returns, statements, or plans.

While on the subject of the jurisdiction of the Local Government Board to institute inquiries, the Commissioners put forward the view that this jurisdiction, or that of the Railway Commissioners, upon whom judicial powers were conferred by the Metropolis Water Act, 1897, might be usefully extended in another direction. The suggestions of the Commissioners on this matter are so important that we give in full the paragraph of their report. It runs as follows:—

> One matter of considerable importance is now left entirely without control—that is, the provision made by the Companies for future wants. It is obvious that a Company, in order to be in a thoroughly efficient state, should have a reserve capacity of supply in excess of its average wants, and sufficient to meet contingencies and cases of emergency. It ought also to exercise a prudent foresight, and to set about such works as increased reservoirs, enlarged filter-beds, and increased pumping power, in advance of the time when they will actually be required, if the supply is to remain constant and efficient. Those who believe in individual enterprise will think that the responsibility of providing in time for future wants had better be left to the Companies, whose interest will inspire them with prescience and with sufficient motive to take all necessary precautions. On the other hand, in the case of a Company whose dividends are low, there is a tendency to save capital expenditure by not maintaining a reserve capacity of supply beyond their average wants, or not commencing in time to make such additions to their works as the increase of population will ultimately require. There are also cases in which a Company, anxious to provide for the future, cannot induce Parliament to give them the necessary powers. The failure of the East London Company to maintain a constant supply in 1898 might have been prevented, or mitigated, if Parliament had not in 1893 rejected the Bill by which they asked for powers to construct additional reservoirs; and the same Company have again in the present year been prevented by Parliament from extending their reservoirs.* Weighing all these various considerations, and feeling strongly the difficulties that surround the subject, we are inclined to think that it would be useful to extend the powers of inquiry of the Local Government Board under section 35 of the Metropolis Water Act, 1871, so as to include inquiry into the provision made by a Company for the present and future wants of their area of supply. Such an inquiry ought to be made only upon the initiative and under the responsibility of the Local Government Board. Any order that they may, after inquiry, make upon a Company, must, of course, be conditional upon the Company obtaining the assent of Parliament to the powers necessary to carry out the order. It seems improbable that Parliament would refuse to grant the powers necessary to comply with an express decision of the Local Government Board.

We have deemed it advisable to quote this paragraph *in extenso*, in view of the fact that the Bill which the associated Water Companies are promoting this session, and of which notice was, of course, given last November, has been framed to confer upon the Local Government Board the power suggested by the Commissioners.

Before parting with the subject of control, the Commissioners add that the recommendations they have made appear to them to be equally applicable and desirable whether the water undertakings are purchased or not. Some of the witnesses for the London County Council claimed that, if purchase by a municipal authority took place, that authority should be left totally without control, and that the consumer should have no remedy if his supply of water failed, or was bad in quality. This was not, however, the opinion of other witnesses. Sir Alexander Binnie thought the same control which was proper for the Companies should also be applied to the County Council if they were the purchaser; and Sir Arthur Arnold thought he should like the Council, after purchase, to be subject to the same methods of control as the Companies, although he was of opinion it was unnecessary, as representatives of the people could be thoroughly trusted. Without expressing the least distrust of any representative or other public authority, the Commissioners think the various measures of control they have suggested—such as checking the quantity of water drawn from the Thames and the Lea, conditions of storage and filtration, control by the Water Examiner, and so forth—

* The report is dated Dec. 30, 1899; and the reference is, of course, to the Company's Bill of last session.—Ed. J. G. L.

should certainly be kept alive in the event of purchase. The machinery of penalties would, of course, have to be altered and reconsidered when dealing with a public authority.

The remaining question referred to the Commissioners—namely, the practicability of connecting two or more of the different systems of supply now administered by the Water Companies, the cost of such connection, and the legal powers necessary to give effect to the arrangement—was dealt with in their first report, issued on Jan. 19, 1899; and they say they have nothing to add.

WEST MIDDLESEX WATER-WORKS COMPANY.

A Special General Meeting of the proprietors was held at the Offices, Marylebone Road, on Tuesday last—Mr. E. Boulnois, M.P., presiding—to consider the Bill in Parliament for conferring further powers upon the Local Government Board, and for imposing further obligations on the Metropolitan Water Companies, &c.

The Solicitor (Mr. Gillett), at the request of the Chairman, explained the provisions of the Bill.

The Chairman, after expressing his readiness to answer any question, reminded the proprietors that the Local Government Board, by a Government Act of last session, were empowered to call upon the Water Companies to present schemes for an interchange of water, in order to prevent a deficiency of supply in any district in the Metropolis. The Companies now proposed (those whose names were attached to the Bill, at all events) that this should be further extended—that the Local Government Board should be empowered to call upon the Companies to present schemes for the storage of water from the Thames, and to appoint an inspector to hold an inquiry into any such schemes; the Companies to be bound to carry out those which were reported on as being advisable. It was a singular thing, but it was a fact, that the Companies who were promoting the Bill had anticipated the report of the Royal Commission, which distinctly laid it down that it was advisable that the Local Government Board should have more powers of control in the direction indicated; and to show that they were perfectly ready that a State Department should have such control, the Companies—some months before the report of the Royal Commission was issued—determined that they would go to Parliament and place themselves under such State Department, who should say what was desirable and what was not with regard to storage schemes in the valley of the Thames. Another important point in the Bill was that the Local Government Board were to have the power to say that the Companies might, on occasions—of course, with the consent of the Thames Conservators—take more water than they could legally do at the present time from the river. It seemed a most ridiculous thing that the Companies should be tied down to a certain amount of water from day to day, when there was plenty in the Thames, and when it would be most advisable to take the water, and store it, in order to avoid anything like a deficiency during the hot weather. The Bill now before the meeting proposed to alter this, and also to give the Local Government Board the other powers he had mentioned. He concluded by moving—"That the Bill now read, entitled 'A Bill to confer further powers upon the Local Government Board, and to impose further obligations upon the Metropolitan Water Companies, with a view to providing for the future needs of the Metropolis in regard to the supply of water,' be, and the same is, hereby approved, subject to such additions, alterations, and variations as Parliament may think fit to make therein."

The Deputy-Chairman (Mr. Jackson Hunt) seconded the motion, which was carried unanimously, without discussion.

SOUTHWARK AND VAUXHALL WATER COMPANY.

A Special General Meeting of the proprietors of this Company was held last Tuesday, at the Offices, Southwark Bridge Road—Alderman Sir Henry E. Knight in the chair—to consider the Bill in Parliament "to confer further powers upon the Local Government Board and to impose obligations upon the Metropolitan Water Companies with a view to providing for the future needs of the Metropolis in regard to the supply of water."

The Secretary (Mr. Montague Watts) having read the notice convening the meeting,

The Chairman proposed a resolution approving the Bill, which, he remarked, was exceedingly simple and very short. It was founded upon the experience which the Chairmen of the Water Companies had gathered as to what would be considered an improvement in the position of the Companies as regarded the public, and for setting at rest any doubts which might have existed in the minds of some as to the possibility of the Companies putting themselves in such a position that the water supply of the Metropolis, or any portion of it, could not in any circumstances be jeopardized. He then referred to the report of the Royal Commission, and said he desired to read a paragraph from it, because if the proprietors paid attention to it they would see, when he came to explain the Bill, how thoroughly the Companies had anticipated the report. The paragraph he referred to was No. 185, in which the Commissioners suggest an extension of the powers of the Local Government Board. [This paragraph is given *in extenso* in our abstract of the report which appears elsewhere.] He expressed a hope that the proprietors would bear in mind this part of the report, for the remarks he had read were exceedingly potent and just. At the same time, it could not be said that their Company, at any rate, had been deficient in making preparations in advance of their requirements, because they placed themselves in such a position, as regarded future needs, that they were enabled last year and the year before to supply a Company wanting water up to 10 million gallons a day. It did not, however, do for one Company alone to be in such a position; every Company should be so. He then explained the various clauses of the Bill. Commenting on clause 10, he stated that it gave the Companies power to act together if two or any more of them thought it better to proceed jointly in constructing a large system of reservoirs. As far, however, as their Company were concerned, they had always kept to themselves; and it was certainly a fortunate thing for London that they had done so, as, if they had taken part in the Staines scheme, London could not have had that assistance which it received owing to their having followed their own plan, and constructed their own reservoirs. Moreover, the Company had saved an enormous sum by their independent action. One of the clauses of the Bill gave the Companies power to construct the reservoirs referred to therein by means of the creation of debenture stock; and a very important point in the clause was that this stock was not to be subject to contribution to a sinking fund. The Companies had promoted the Bill jointly, considering that what was proposed was beneficial for the whole of the Metropolis; and he was very glad to find that it was thoroughly in accord, as the proprietors would have gathered, with the report of the Royal Commission.

Mr. C. M. Vialls seconded the motion.

Mr. H. S. Makins expressed the opinion that the Bill would enable the Local Government Board to make rather onerous conditions against the Companies.

The Chairman said that he did not think so. Before the Board made an order, an inquiry would have to be held, at which the Water Companies would be heard; and they would have to stand on the justice of their cause.

Mr. Makins said he thought that the Companies were doing so many things for their mutual advantage that it might be desirable to consider the question of amalgamating them.

The Chairman: That is quite a matter of opinion. I have a very open mind on the subject myself; but I think if you read the report of the Royal Commission it will enlighten you a little on that point.

The motion was then put and carried unanimously, and the proceedings terminated.

GRAND JUNCTION WATER-WORKS COMPANY.

A Special General Meeting of this Company was held at the Offices, South Molton Street, last Wednesday—Mr. F. Tendron in the chair—for the purpose of submitting to the shareholders a Bill introduced into Parliament by the Metropolitan Water Companies, entitled "A Bill to confer further powers upon the Local Government Board and to impose further obligations upon the Metropolitan Water Companies with a view to providing for the future needs of the Metropolis in regard to the supply of water."

The notice convening the meeting having been read,

The Chairman explained that the object of the Bill was to make provision for the construction, when necessary, of additional storage reservoirs in the Thames Valley, as recommended in the report of the Royal Commission presided over by Lord Balfour of Burleigh. He then submitted a resolution approving of the Bill, and moved its adoption.

The motion was seconded, and at once carried unanimously.

EAST LONDON WATER-WORKS COMPANY.

A Special General Meeting of this Company was held last Thursday at the Offices, St. Helen's Place, E.C., to consider Bills (1) to authorize the Company to construct additional storage reservoirs and other works and (2) to confer further powers upon the Local Government Board. Colonel Lockwood, M.P., presided.

The Secretary (Mr. I. A. Crookenden) having read the notice calling the meeting,

The Solicitor (Mr. Bonner Maurice) explained the Bills; pointing out that the measure which was promoted by the Company themselves authorized them to construct two storage reservoirs and certain cuts, conduits, and other ancillary works. It also enabled them to take the necessary lands, and, under certain conditions, and with the consent of the Local Government Board, to take a further quantity of water from the Thames for emergency purposes. The Bill also empowered the Company to raise by debenture stock, under the auction clauses, and subject to the sinking fund, £1,800,000 for the purposes of the proposed works. With regard to the second Bill, it was promoted by other Companies as well as by the East London Company; and he drew attention to its main objects.

The Chairman then stated that the first Bill was practically identical with that which was passed by the House of Commons last session, but which was unfortunately rejected by a Committee of the House of Lords. Its main provisions were to enable the Company to construct the necessary reservoirs for the purpose of catching and retaining the water which was now allowed to run to waste in hundreds of millions of gallons into the sea in wet seasons, so that it might be stored and purified and distributed to the Company's district in dry periods. The Bill was entirely consistent with the recommendations of two Commissions, including that which had just finished its labours. The second Bill was a joint measure promoted by some (not all) of the Companies for the purpose of establishing a like provision in respect to the Thames waters—a policy which had also been approved by the two Commissions mentioned. Both schemes might be considered as having been preferred by the Royal Commission to the more extravagant and doubtful policy of going to Wales for water while there were such enormous quantities at their doors, if there were but the means of taking and holding it against possible drought. The broad policy involved in the schemes was one which was accepted and approved by all dispassionate authorities; and he thought it might be fairly hoped that the Government, under the terms of the report of the Royal Commission, would cordially approve of the measures. He concluded by moving a resolution approving the Bill to authorize the Company to construct additional storage reservoirs and other works, to take further water from the River Thames in cases of exceptional drought and other emergency, to raise further money, and for other purposes, subject to such additions, alterations, and variations as Parliament might think fit to make therein and as the Directors should approve.

Sir Herbert Barnard seconded the motion, which was carried unanimously.

The Chairman afterwards proposed a resolution approving the Bill "to

confer further powers upon the Local Government Board, and to impose further obligations upon the Metropolitan Water Companies with a view to providing for the future needs of the Metropolis in regard to the supply of water."

Mr. G. Banbury seconded the motion, which was carried unanimously.

CHELSEA WATER-WORKS COMPANY.

A Special General Meeting of this Company was held last Thursday, at the Offices, Commercial Road, Pimlico—Mr. F. S. Clayton presiding.

The Secretary (Mr. G. H. Gill) having read the notice calling the meeting,

The Governor stated that the shareholders had been called together for the purpose of considering two Bills—one promoted by the Company alone, and the other by the Company jointly with some of the other Metropolitan Water Companies. Dealing with the Company's own Bill, he stated that it was to confirm the allotment of £34,215 of ordinary stock and the payment of dividends to be made on this stock. As mentioned at the last half-yearly meeting, the Government Auditor had not certified the accounts up to March 31 last. The audit of these accounts took place in May last; and it was the duty of the official to give the Board a formal intimation of the reason why he refused to certify them. He had merely told them, however, generally, that he considered that the issue of this amount of stock was *ultra vires;* but no formal objection had been handed in to the Company from that time to this. He (the Governor) might remind those who were present at the half-yearly meeting that he said he had reason to believe, although the Directors had not heard from the Government Auditor in regard to the specific objection to be taken by him, that the matter would yet be settled, and that the objection might possibly be withdrawn. At that time he thought he was a little optimistic, perhaps, in making the statement; but, as the result had proved, he was not so, for the Directors had had a further intimation from the Legal Adviser of the Government Auditor to the effect that they might possibly receive the certificate confirming the accounts in question. The certificate, however, had not yet been received; and it became necessary for the Board to proceed with the Bill, the purport of which he had explained. The measure also conferred powers on the Company to acquire the fee-simple or freehold of additional land for the purposes of storage, and especially to purchase the reversionary interest in land, subject to a long term of years, already vested in the Company. The proprietors were aware, from previous reports, that 70 acres of land at West Molesey had been acquired on a long term of years; and it was thought desirable that power should be taken by them to purchase the freehold interest in this land. The other Bill, which was promoted by the Company in conjunction with some of the other Companies, proposed to confer powers on the Local Government Board to make an order on any of the Water Companies to provide further storage in the Thames Valley should the Department think fit to make such an order. The measure would not affect their Company so much as it would some of the others, as the Chelsea Company were not likely to require more water from the Thames than they were at present authorized to take, and the 70 acres of land which they had already acquired for storage purposes would, in the Directors' opinion, be amply sufficient for any further storage that might be required by them. At the same time, he should mention that the Bill had been promoted spontaneously on the part of the Companies, and not at the suggestion of anyone outside themselves. They hoped that it might be passed by Parliament, and in due course receive the Royal Assent. He might state that if it were passed it would be a material guarantee on the part of the London Water Companies of their intention to do what might be legitimately required of them to give an abundant water supply to the Metropolis.

The Solicitor (Mr. John Hollams) then explained the chief provisions of the two Bills. He stated that clause 4 of the Company's own Bill enabled them to purchase by agreement land not exceeding in the whole 100 acres. Clause 7 provided that the creation and issue by the Company of the shares, to the nominal amount of £34,215, mentioned in the preamble, and their conversion into stock, should be sanctioned and confirmed and declared to be valid *ab initio.* This was a matter upon which the Government Auditor had been pondering for ten months; but there was reason to believe that at last he saw that the difficulties which had occurred to him had no foundation. The clause in the Bill following provided that the dividends paid on this stock had been rightly paid. Power was taken in the Bill to issue not exceeding £20,000 of debenture stock, with the usual clauses required by Parliament as to the issue of the stock if it should be thought worth while. With respect to the Bill promoted by the Companies jointly, it was precisely to the effect mentioned by the Governor; but although, as Mr. Clayton had said, the introduction of the Bill was the spontaneous act of the Companies, it was very remarkable that the Royal Commission in their report had foreshadowed, without having this measure before them, the very principle which it proposed to carry out. It, in fact, followed the principle of the Bill which was introduced by the Government last year enabling one Company to aid another, and empowering the Local Government Board to provide that this should be done. The Bill extended the principle not only to existing sources, but also to new sources of supply in the valley of the Thames. In regard to the schemes mentioned in the Bill, before anything could be done as to carrying them into execution there must be the approval of a public inquiry, confirmed by the Local Government Board; and if there were anything of importance in connection with any scheme, it must also be confirmed by Parliament. There could, therefore, be no hasty proceedings. The other clauses, he thought, were merely formal ones.

The Governor then proposed a resolution approving the Bill promoted by the Company.

The Deputy-Governor (Mr. Jackson Hunt) seconded the motion.

The Governor, in answer to a question, stated that the Company had power to take 22 million gallons a day from the Thames; and the Directors believed that this was really in excess of their requirements.

The resolution was carried unanimously.

The Governor afterwards proposed a resolution approving the Bill for conferring further powers on the Local Government Board, &c.

The Deputy-Governor seconded the motion.

The Governor, in reply to Mr. H. P. Kelly, stated that all the Companies had joined in promoting the Bill excepting two, and one of these was not a Thames Company.

The resolution was then put and carried unanimously.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 396.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.	Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.	£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 13	10½	Alliance & Dublin 10 p. c.	20½—21½	..	4 17 8	150,000	5	Nov. 30	8	Oriental, Ltd.	7—7⅛	..	5 6 8
100,000	10	,,	7½	Do. 7 p. c.	14—15	..	5 0 0	135,000	5	,,	8	Do. New, £4 10s. pd.	6¼—6⅝	..	5 6 8
800,000	100	Jan. 2	5	Australian 5 p. c. Deb.	100—102	..	4 18 0	15,000	5	,,	8	Do. do. 1879, £1 pd.	1¼—1⅝	..	4 11 5
200,000	5	Nov. 15	6	Bombay, Ltd.	5¾—6¼	..	4 8 11	500,000	100	Dec. 1	6	People's Gas 2nd Mtg. of Chicago Bonds	102—106	..	5 13 2
40,000	5	,,	6	Do. New, £4 paid	4—4½	..	5 6 8								
880,000	Stk.	Aug. 16	12	Brentford Consolidated	275—280	..	4 5 9	851,070	10	Oct. 13	7	River Plate Ord.	10¾—11¼	..	6 4 5
270,000	,,	,,	9	Do. New	210—215	..	4 3 9	250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	99—101	..	3 19 3
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0	250,000	10	Sept. 15	10	San Paulo, Ltd.	12—13	..	7 13 10
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb.	124—128	..	3 2 6	135,000	Stk.	Sept. 15	10	Sheffield A.	249—251	..	3 19 8
220,000	Stk.	Sept. 15	11½	Brighton & Hove Orig.	255—260	..	4 8 6	209,053	,,	,,	10	Do. B.	249—251	..	3 19 8
226,320	,,	,,	8½	Do. A. Ord. Stk.	185—190	..	4 9 6	447,427	,,	,,	10	Do. C.	249—251	..	3 19 8
973,500	Stk.	Aug. 16	5	Bristol, 5 p. c. max.	125—130	..	3 16 11	5,600,000	Stk.	Aug. 16	5⅓	South Metrop., 4 p. c. Cnl.	133—136	..	3 18 5
420,000	20	Sept. 29	10	British	43½—44½	..	4 9 10	1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb.	100—102	..	2 18 10
50,000	10	Aug. 31	12	Bromley, Ord. 10 p. c.	25—27	..	4 8 11	120,000	Stk.	Aug. 31	6	Tottenham A. 5 p.c. and B. 3½ p.c.	141—143	..	4 3 11
75,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8	250,520	,,	,,	4½		102—104	..	4 6 6
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd.	9¾—10½	..	5 17 1	55,100	,,	Dec. 14	4	Edmonton 4 p. c. Deb.	113—117	..	3 8 5
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	98—100	..	4 0 0	182,380	10	Jan. 12	5	Tuscan, Ltd.	8½—9½	..	5 5 3
150,000	20	July 13	8½	Cagliari, Ltd.	28—29	..	5 13 10	149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.	101—104	..	4 16 2
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	13½—14½	..	5 10 4								
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	56—58	..	5 3 5								
550,000	Stk.	Oct. 13	13½	Commercial Old Stock	305—310	..	4 7 1					WATER COMPANIES.			
260,750	,,	,,	10½	Do. New do.	240—245	..	4 5 9								
200,750	,,	Dec. 14	4½	Do. 4½ p. c. Deb.	140—145	..	3 2 1	780,399	Stk.	Dec. 29	11	Chelsea, Ord.	307—312	..	3 10 6
900,000	Stk.	Dec. 14	9	Continental Union, Ltd.	177—181	..	4 19 5	150,000	,,	,,	5	Do. 5 p. c. Pref.	157—162	..	3 1 9
200,000	,,	,,	7	Do. 7 p. c. Pref.	178—183	..	3 16 6	160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	145—150	..	3 0 0
51,600	Stk	Aug. 31	14	Croydon A 10 p. c.	335—340	..	4 2 4	175,785	,,	Sept. 29	4½	Do. 4½ p. c. Deb.	148—153	..	2 18 10
168,400	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5	1,720,560	Stk.	Oct. 18	7	East London, Ord.	202—206	..	3 8 0
555,000	Stk.	Aug. 16	5½	Crystal Palace Ord. 5 p.c.	125—130	..	4 0 9	654,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb.	145—150	..	3 0 0
60,666	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0	390,000	,,	,,	3	Do. 3 p. c. Deb.	98—100	..	3 0 0
436,000	10	Jan. 26	11	European, Ltd.	20½—21½	..	5 2 4	700,000	50	Dec. 14	7½	Grand 10 p. c. max.	107—109	..	3 8 10
354,660	10	,,	11	Do. £7 10s. paid	15—16	..	5 3 2	310,000	Stk.	Sept. 29	4	Junction 4 p. c. Deb.	131—136	..	2 18 10
14,999,975	Stk.	Feb. 9	4%	Gas-light and Coke 4 p. c. Ord.	106—108*	..	4 10 0	708,000	Stk.	Aug. 16	14	Kent	348—353	..	3 19 4
2,500,000	,,	,,	3½	3½ p. c. max.	98—98*	..	3 11 5	160,000	,,	,,	7	Do. New, 7 p. c. max.	200—210	..	3 6 8
3,749,735	,,	,,	4	4 p. c. Con. Pref.	119—122*	..	3 5 7	1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.	295—300	+2	3 10 0
3,000,375	,,	Dec. 14	3	3 p. c. Con. Deb.	98—100	..	3 0 0	406,200	100	,,	8	Do. 7½ p. c. max.	215—220	..	3 12 9
75,000	10	Nov. 15	8	Hongkong & China, Ltd.	13½—14½	..	5 10 4	350,000	Stk.	Sept. 29	4	Do. 4 p. c. Deb.	135—138	..	2 18 0
3,999,000	Stk.	Nov. 15	10	Imperial Continental	215—220	+2	4 10 11	500,000	100	Aug. 16	13½	New River, New Shares	425—430	+2	3 3 1
473,600	Stk.	Feb. 9	3½	Do. 3½ p. c. Deb. Red.	100—103*	..	3 8 0	1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb.	130—135	..	2 19 3
75,000	5	Dec. 14	6	Malta & Medn., Ltd.	5—5⅛	..	5 9 1	902,300	Stk.	Dec. 14	7½	South-wark Ord.	203—205	..	3 13 2
500,000	100	Oct. 2	5	Met. of 5 p. c. Deb.	110—114	..	4 7 9	126,500	100	,,	7½	7½ p. c. max.	190—195	..	3 16 11
250,000	100	,,	4½	Melbourne 4½ p. c. Deb.	107—109	..	4 2 7	489,200	Stk.	,,	5	and 5 p. c. Pref.	160—165	..	3 0 7
541,920	20	Nov. 15	3	Monte Video, Ltd.	11—12	..	5 0 0	1,019,585	,,	Oct. 13	4	Vauxhall 4 p. c. A Deb.	131—136	..	2 18 10
617,946	Stk.	Aug. 31	9½	Newc'tle & Gateshd Con.	220—225	..	4 2 3	1,155,966	Stk.	Dec. 14	10	West Middlesex	288—293	..	3 8 3
264,355	Stk.	Dec. 29	8½	Do. 8½ p. c. Deb.	104—107	..	3 5 5	200,000	,,	,,	4½	Do. 4½ p. c. Deb.	147—152	..	2 19 3
60,000	5	Sept. 29	7	Ottoman, Ltd.	5—5¼	−¼	6 12 7	200,000	,,	Sept. 15	8	Do. 8 p. c. Deb.	100—102	..	2 18 10
					* Ex div.								*Ex div.		

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

A question of general importance (the employment of duly qualified tradesmen, at standard rates of wages) was brought before the Corporation of Aberdeen on Monday. It was the Trades Council—those vigorous guardians, everywhere, of the rights of the privileged classes in the ranks of labour—who brought the subject before the Town Council. A deputation from that body, who attended, represented that since 1892 the Town Council had executed a considerable amount of work in the shape of fixing gas burners, stoves, fires, and cooking apparatus generally. Previous to that time, the work had been done by master plumbers throughout the city; and as a natural consequence they were able to employ operative plumbers at a fixed standard rate of wages. Since the Town Council began to extend their operations, the work had been done by their own men; and there is not, it was said, a single operative plumber inside the Gas Department. The most recent development in this connection had been the introduction of the penny-in-the-slot meter; and, so far as was known, there was not a single plumber employed in fixing these meters up. The plumbers considered that they had a reasonable and legitimate claim to some recognition on the part of the Town Council. So far as they had been able to gather, the Town Council had approximately eight employees in the Gas Department. Those employees were paid from 25s. to 28s. per week; while the standard rate of wages recognized by plumbers throughout the city, was 34s. The plumbers had a grievance in respect that the men were not being paid the wages recognized by the trade generally, and that those who were being employed were not qualified plumbers; they had not served their apprenticeship—at any rate, a number of them. In view of these facts, the Trades Council thought it desirable to lay the matter before the Town Council. Lord Provost Fleming assured the deputation that the matter would be carefully considered; and it was remitted to the Gas and Electric Lighting Committee for the purpose. Now, this is quite a different subject from that of the recognition of a Union which claims the right to have a say in the whole management of the undertaking. Workmen are at liberty to combine for the purpose of keeping up wages; and from that there follows the right to see that men who are not qualified are not employed, so as to bring down the wages of those who are qualified. We concede so much to the doctor, the dispenser of medicines, the clergyman, the lawyer, and the accountant; and we cannot, in reason, refuse it to the working tradesman. But those privileged classes employ assistants who are not qualified, and many of whom have no intention of ever qualifying. The lawyer, for instance, employs a staff of copying clerks who are mere copyists, and who never profess to study law. The work they do is cheaper than that of qualified men; and their employment has the effect of keeping qualified men out of work. I know that there is grumbling on the part of passed men, that their bread is taken out of their mouths by those who have not passed; and I know also that these same copying clerks are already grumbling that they are fast losing their work by the introduction of typewriting, nearly the whole of which is done by female labour, at a still cheaper rate than the copyist requires. If we take it, then, that there is a gas-fitting department in the Corporation gas undertaking, in which some qualified plumbers are employed (for the statement of the deputation that they are unaware of any such being employed is scarcely to be accepted), and that labourers, or handy men, are sent to do such work as is involved in the screwing off and on of fittings, the operative plumbers in the city are in no worse position than are countless numbers of people in other walks of life. If they can prove that labourers are employed to do what is strictly plumbing work, the case is different. It is a matter of degree, and not of principle. The Corporation yield up nothing in agreeing to consider the matter; and when they consider it, if there be the same reasonableness on both sides as has been hitherto manifested, there need be no rupture of friendly relations.

The Town Council of Aberdeen, on Monday, disposed of the subject of the chartering of the steamship for the carriage of coal for the gas-works, regarding which there have been complaints of late by Trade Unionists. It was stated on behalf of the Gas and Electric Lighting Committee, that it had been found that the contractor for the discharge of the vessel was paying as high wages as any similar employer in the port, though he was not paying the Union rate. The Committee thought that, in the circumstances, they could not interfere—that, in fact, if they did so, the contractor might hold them liable in damages. The Committee therefore moved that no action be taken. It was moved, on behalf of the Union, that the contract be cancelled, on the ground that the standard rate of wages was not being paid. The action of the contractor was denounced as tending to keep down wages at the port. The recommendation of the Committee was adopted by 25 votes to 4. So far as the Town Council are concerned, this is the end of the matter; but at a meeting of the Trades Council on Wednesday night, it was intimated that it is to be brought up again. The conduct of three labour representatives who voted in the majority was specially held up to desecration.

The Glasgow Town Council, on Monday, dealt with what has the appearance of being an insidious attempt to get the recognition of the Labourers' Union introduced by the thin end of the wedge. A petition by that extraordinarily mobile body, the Gas Workers and General Labourers' Union, had been presented, praying for an increase of wages to the humble body of decayed men who are employed to do sweeping in the closes and courts in the city. The Cleansing Committee, presided over by Mr. Battersby, a Union sympathizer, considered the petition; and the Committee, by 7 votes to 4, recommended that no advance in wages be given. Mr. Battersby, in the Town Council, moved the adoption of this recommendation; and it was likely to be agreed to without comment, when Mr. Graham, apparently perceiving what lay underneath, moved, as an addition to the recommendation of the Committee, that the resolution of the Council be communicated to the men through the Inspector of Cleansing. That Mr Graham was right in his intervention was shown by the alacrity with which the pro-Unionists in the Council attacked him. It was thrown at his head that the Gas Committee, who had refused to recognize the Gas Workers' Union, were in the habit of recognizing the Tinsmiths' Society.

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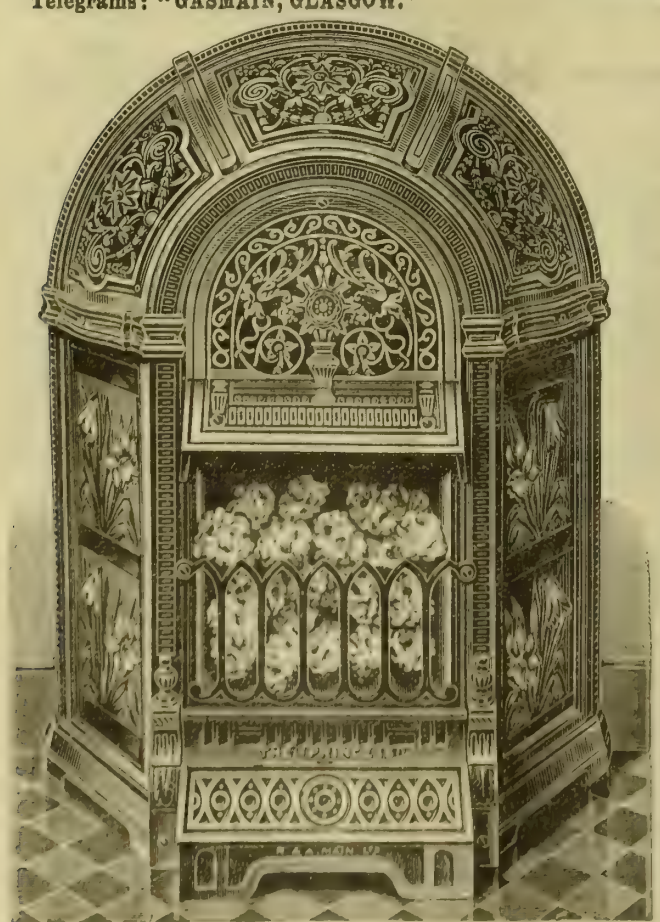
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Mr. W. Stevenson, the Sub-Convener of the Gas Committee, having recalled the experience of his Committee, and hinted that the petition in this instance emanated from the same person who had stirred up the gas workers to action, was taken to task by one of the Union supporters, for this statement; and there was what is commonly called a scene over the matter. After a long discussion, the minutes of the Committee were adopted as submitted; Mr. Graham's proposal being lost. The Council have thus committed themselves to sending a reply to the Secretary of the Union. The answer is a negative one, and therefore does not admit that the Union have exerted any influence over them. It is a question whether it will not be claimed, however, that in sending this reply the Council have "recognized" the Union. As a matter of fact, they have "recognized" it; but their recognition is of the order of the kick downstairs. The question is whether the pain of the kick will not be soon forgotten, and the recollection of the Union be that they were, on one occasion, permitted to hold converse, on terms of equality, with the Corporation of Glasgow. In this view, though the immediate cause was lost, the Union will likely claim tha tthey have obtained a footing. The vote of Monday is therefore to be regretted.

An instance of how a reporter may be made the medium of promoting a movement, without his being aware that he has been harnessed to the car, is furnished by an account which has been published of a meeting at Coatbridge, held last Saturday, for the purpose of forming a branch in that district of the National Union of Gas Workers and General Labourers of Great Britain and Ireland. It is described as "a public meeting, which was largely attended." It is also said that the Chair "was supported on the platform by a host of speakers;" and that "the various speakers spoke at length on the benefits to be derived from union, after which the following resolution was put to the meeting and carried with unanimity: That this meeting of semi-skilled and unskilled workers, recognizing union as a principle of betterment, agrees forthwith to establish a branch of the Gas Workers and General Labourers' Union of Great Britain and Ireland in this district; and that we proceed at once to elect the officials necessary for carrying on the business of the branch." Then it is added: "The meeting was a very enthusiastic one; and a number of men were enrolled as members of the Union." I think it is evident that the reporter was not present, but procured his account of what took place from one who was in the position of being "a ruler of the feast," whose sympathies were pronouncedly in favour of the movement; and that the reporter had not the good sense to sub-edit it. Had the bare facts been given, the narrative would have been slightly different. One thing which would then have been given, and which would have been of more value than all that was communicated, would have been the number of men who joined the Union. The expression "a number of men" would be justified by two. But the object of the author would not have been served had this been stated. I daresay the Union would like very much to have a strong following in the Coatbridge district, where there are many gas workers, for whom they might be able to do something, and many more general labourers, for whom they can do nothing, but whose subscriptions would be useful. It is among the general labourers that the Union will carry on their propaganda with most benefit to themselves; but it is the gas workers whom they will urge to take action. The writer of the paragraph seems never to have reflected that in giving a veiled commendation to this double-headed trouble he was doing that which may result in annoyance and trouble being given to the owners of righteously conducted industries in their midst, and, it may be, in loss both to the owners of those undertakings and to the communities.

When I wrote last week about the report of proceedings of the meeting of the North British Association of Gas Managers at Stirling last July not having come to hand, I fear that I did so in haste. I have to-day received from Mr. R. S. Carlow, the Secretary of the Association, a copy of the book, which bears internal evidence of having been out for some time.

The Gas Committee of the Helensburgh Corporation are finding it extremely troublesome to get a site for a new gasholder, which is much needed. They have already been refused permission by the Sheriff to erect a holder upon a site which they had selected in the outskirts of the burgh. They have, since then, fallen back upon a site beside the gas-works; but as regards this, there is active opposition threatened. At a meeting of the Burgh Commission this week, it was stated that a protest against its erection, signed by 200 householders within the 300 yards' radius of the proposed site, had been received. The Commissioners are helpless in such a state of circumstances. They can only do what is possible to justify their policy before the Sheriff; and that is what has been resolved upon. This is the first occasion in which a second inquiry into a proposal to erect a gasholder has been found to be necessary. Helensburgh is almost entirely a residential town; and in such places it is more difficult to get a site for gas-works or gasholders than it is where they can be mixed up with public work.

It was reported by the Depute Town Clerk at a recent meeting of the Glasgow Sub-Committee on Works that an action had been raised in the Sheriff Court, at the instance of Messrs. John Paterson and Son, Limited, against the Glasgow Corporation, for the sum of £12,974; being the amount alleged to be due to them in respect of extras under their contract for the construction of the tank for the new holder at the Temple Gas-Works. The Sub-Committee instructed the Town Clerk to defend the action.

At the last meeting of the Glasgow Gas Commissioners' Sub-Committee on Finance, Mr. R. M. Mitchell reported that he and his colleagues nominated for the purpose had had a conference with a deputation from the Directors of the Glasgow Workmen's Dwellings Company, Limited, as to the supply of automatic gas-meters to the tenants of houses belonging to the Company, and that they had to recommend prepayment meters to be put into such houses as the Company might require; the Company undertaking to get the tenants to sign the usual form of application for supply. The minute was approved of.

The Newcastle Corporation have accepted an offer by the Newcastle and Gateshead Gas Company of 1000 incandescent Welsbach lamps, similar to those at present burning in Grainger Street, for other thoroughfares in the city.

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WINDSOR STREET WORKS, BIRMINGHAM (Second Contract)	2,000,000	COLCHESTER (Second Contract)	300,000
HALIFAX	1,000,000	YORK	750,000
TORONTO	250,000	ROCHESTER	500,000
OTTAWA	250,000	KINGSTON, ONT.,	300,000
LINDSAY (Remodelled)	125,000	CRYSTAL PALACE DISTRICT	2,000,000
MONTREAL	500,000	DULUTH, MINN.	300,000
TORONTO (Second Contract; Remodelled)	2,000,000	CATERHAM	150,000
BELLEVILLE	250,000	LEICESTER	2,000,000
OTTAWA (Second Contract)	250,000	ENSCHEDE (HOLLAND)	150,000
BRANTFORD (Remodelled)	200,000	BUENOS AYRES (RIVER PLATE CO.)	700,000
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LIVERPOOL, *Feb.* 10.

Sulphate of Ammonia.—There has been sustained activity in the market, resulting in a further improvement in values; the quotations at the close being £11 17s. 6d. to £12 per ton, delivered f.o.b. at the ports. The buying has been mainly speculative, and for "covering" contracts—consumers having, for the most part, held aloof; but demand has been sufficient to absorb supplies, which continue to be offered as they become available. There has been more doing in the forward position—up to £11 16s. 3d. per ton having been paid, Beckton terms; and the quotation at the close is £12 per ton. In Scotland, £11 18s. 9d. per ton has been paid, f.o.b. Leith, ordinary terms; and a further advance is now required.

Nitrate of Soda is a strong market in all positions. Spot quotation for fine quality is 8s. 9d. per cwt.; and for March delivery, 9s. to 9s. 3d. is being quoted.

LONDON, *Feb.* 10.

Tar Products.—The leading feature in this market is the pressing inquiry for carbolic acid in every strength and form. The embargo placed upon it appears rather to have strengthened its value than otherwise, as to-day it is quoted higher than heretofore. There is a better tone in respect to anthracene, which is now moving a little more actively. The restriction in its production is still going on. Indeed the price for "B" qualities is no inducement to manufacture it. It is worth more money sold in the form of grease oil. Benzols are still marked at the exceptionally low figures that have lately prevailed; but there is more inquiry, and more business being done. This is not an article that can be well stocked, nor is it a desirable stock. Therefore very few makers hold more than "hand-to-mouth" quantities. There is no change in the value of oils; but large quantities are again being consumed for fuel purposes, owing to the high price of coal.

Values obtaining during the week are: Tar, 17s. to 26s. Pitch, east coast, 35s.; west coast, 33s. Benzols, 90's, ordinary, 7d.; special qualities for gas, 8½d.; 50's, 9d. Toluol, 90's, 1s. 2d.; pure, 2s. Solvent naphtha, 1s. 3d. Crude, 30 per cent., naphtha, 4½d. Heavy naphtha, 1s. 2d. Creosote, 3½d. Heavy oils, 3¾d. Carbolic acid, 50's, 2s. 10d.; 60's, 3s. 3d. Crude naphthalene, 55s. Anthracene, nominal, "A," 4d.; "B," 2½d.

Sulphate of Ammonia is steady at advanced prices. There are very many inquiries from legitimate buyers; and for forward delivery something more might be obtained than is now quoted. The average value at all points may be taken at £11 17s. 6d. per ton, less 3½ per cent.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The spell of severe weather during the past week has necessarily brought an increased demand upon the better qualities of round coal suitable for house-fire purposes, and has lessened any surplus quantities in this direction which previously had been available for augmenting the continued very restricted supplies for iron-making, steam, and general manufacturing purposes. Otherwise, the position remains without any very material change; and there is no further upward move in quoted rates, beyond the special prices which are occasionally obtained where anything like quantities are needed for immediate delivery, and upon orders for shipment. The demand for house-fire purposes is now taking away all that collieries are raising in the better qualities of round coal; and prices are exceedingly strong at the maximum rates of 14s. 6d. to 15s. per ton at the pit for best Wigan Arley, 13s. to 13s. 6d. for Pemberton four-feet and seconds Arley, and 12s. 6d. for common house coal. Common round coals continue in pressing request for steam and forge purposes, with supplies short, and 12s. to 12s. 6d. per ton at the pit readily secured. Engine classes of fuel are also in much the same position; supplies of all descriptions of slack at the Lancashire collieries continuing scarce. The average prices are not under 9s. 6d. to 10s. per ton at the pit for medium, and 10s. 6d. to 11s. for best qualities. In one or two outside districts—notably Derbyshire—prices have been somewhat irregular recently; and collieries here and there are not adhering to the full advance they put on at the commencement of last month. But the increasing pressure that has been coming forward during the past few days for house coals is tending to strengthen the position in this direction; and taking prices all through, they may be said to be very firm. For shipment, there has been quite a pressure of demand in excess of supplies; and 15s. 6d. to 16s. per ton is obtained without difficulty for ordinary steam coals, with 17s. up to 17s. 6d. for the better qualities, delivered at ports on the Mersey.

Northern Coal Trade.—The demand is a little fuller this week; and there is thus abundant work at the collieries. In the steam coal trade, the inquiry is stronger; and the placing of the large orders of the Swedish State Railways has given a better tone to the market. Best Northumbrian steam coals, for prompt delivery, are quoted at 18s. to 18s. 6d. per ton f.o.b.; and steam smalls are rather scarce at 11s. to 11s. 6d. Manufacturing coals are without noticeable change. In the gas coal trade, the demand is still very full, though the consumption is decreasing. There is still a very large shipment of coal to the southern gas companies; and thus the quantity for sale beyond contracts is not very great, while the price (though lower than a fortnight or so ago) seems now steady. For best Durham gas coal the quotation is now about 16s. 6d. per ton f.o.b.; but contracts for Sweden are under negotiation, which are likely to be at a lower figure. The coke trade is firm. Gas coke is steady; but the prices fluctuate largely for different uses. On the whole, they may be said to have an upward tendency.

Scotch Coal Trade.—Strong demand continues for both home and foreign consumption. The foreign is necessarily a forward demand. Prices are, if anything, advancing. The quotations are: Main 14s. 6d. to 15s. per ton f.o.b. Glasgow, ell 15s. 6d. to 16s. 6d., and splint, 15s. 6d. to 16s. The shipments for the week amounted to 207,751 tons—an increase of 17,495 tons upon the previous week, and of 41,727 tons upon the corresponding week of last year. For the year to date, the total shipments have been 809,418 tons—an increase of 147,354 tons upon the same period of last year.

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CONTENTS.

EDITORIAL NOTES:—

GAS, LIGHTING, &c.— PAGE.

Mr. Livesey on South Metropolitan Affairs. 457
The Weather and Coal Stocks 458
The Affairs of the Crystal Palace District Gas Company—Mr. Livesey on Oil Gas 458
The Companies Acts Amendment Bill 458
Welsbach *versus* Sunlight—The Patent of 1886 459
Mr. Ruegg, Q.C., on the Workmen's Compensation Act. . . . 459
No Petroleum Legislation this Session 459

WATER AND SANITARY AFFAIRS—

Opposition to the London County Council's Water Bills . . . 459
The Electrolysis of Water-Mains. 460

ESSAYS, COMMENTARIES, AND REVIEWS:—

Gas and Water Companies in the Stock Market 460
Electric Lighting Memoranda. 460
Some Fantastic Standards of Light 461
Our Coal Resources and Consumption—A Reconsideration of Some Estimates 462
The Redemption of Gas and Water Companies' Capital. . . . 463
In the Cause of Intelligent House Building 464
An Early Worker in the Gas and Water Industries 465

NOTES:—

The Manufacture of Wire Ropes 467
Lighting and Stre et Electric Lamps. 467
Improving the Quality of Steam 467
The Tempering of Steel 468
Furnace Management 468

TECHNICAL RECORD:—

The Charlottenburg Gas-Works 468
A Laboratory Method for the Analysis of Coals for Gas Manufacture 470
British Association of Water-Works Engineers 472
Covered Reservoir Construction in the United States. 472

REGISTER OF PATENTS:—

Prepayment Gas-Meters—Whitham, C., and Large, E. 473
Acetylene Generators—Leigh, H. H. (Carey, J. W.) 474
Generating Acetylene—Rouma, A. 474
Patent Notices 474

PARLIAMENTARY INTELLIGENCE:—

Progress of Bills 475

LEGAL INTELLIGENCE:—

High Court of Justice—Chancery Division—
The Welsbach Incandescent Gas-Light Company *v.* The New Sunlight Incandescent Company 475
Damages for Personal Injuries Sustained in a Gas Explosion . . 476
Fraudulent Interference with a Gas-Meter 476

MISCELLANEOUS:—

Meeting of the South Metropolitan Gas Company. 477
Meeting of the Crystal Palace Gas Company 479
Meeting of the Croydon Commercial Gas Company 481
Sheffield United Gaslight Company—The Half-Yearly Report and Accounts 481
Tottenham and Edmonton Gas Company—The Half-Yearly Report and Accounts 482
The Price and Illuminating Power of London Gas—Statement by Mr. George Livesey 482
Provincial Gas and Water Companies 483
Meeting of the Ottoman Gas Company, Limited 485
Manchester Corporation Gas and Electricity Supply—The Electrolysis Committee; The Gas Supply during the Severe Weather; Another Failure of the Electric Light 486
Wages and Conditions of Labour of Birmingham Corporation Workmen—A General Movement; The Gas and Water-Works Men Ask for Higher Pay 486
Loss of Gas and Damage to Mains at Shrewsbury through Sewerage Operations 486
Electric Lighting Notes 486
Gas and Water Companies' Stock and Share List. 487
Notes from Scotland. 488
Current Sales of Gas Products 490
Coal Trade Reports 490

PARAGRAPHS:—

PERSONAL: Alderman T. Speight; Mr. C. F. Kent; Mr. J. C. Hall; Mr. G. Airth; Mr. W. J. Brooke; Mr. J. F. Sissen; Mr. A. V. Daniel; Mr. James Kay; Mr. Turriff; Mr. Thomas Guyatt; Mr. George Rait Guyatt; Mr. S. Stewart; Mr. Alexander Dickson. 467
OBITUARY: Mr. W. Barratt; Mr. W. H. Chatfeild Clarke; Mr. Joseph Cowen; Mr. W. B. Davidson 467
The Origin of the Word "Acetylene" 460
A New Gas-Engine 464
A Vitrified Clay Water-Pipe—The Duty of Pumping-Engines . . 466
Coal in Western Australia—Manchester Institution of Gas Engineers—Electric Incandescent *v.* Auer Incandescent Gas-Lamps. 471
South London Local Authorities and the South Metropolitan Gas Company's Bill. 474
Chipping Norton Water Supply—The Quality of the Carmarthen Water Supply 485
Reduction in Price 487
The Powers of the Massachusetts Gas Commissioners—Increase in the Price of Gas at Cape Town—Sales of Stocks and Shares—New Pumping-Station for the Farnham Water-Works—Manchester Water Supply 491
Price of Gas for Power Purposes at Widnes—The Horbury District Council and the Ossett Gas Bills—Public Lighting Curtailed Through Shortness of Gas Coal at Walsall—The Leeds Corporation Gas Committee and Water Gas—The Quality of the Gas at Leeds—Rawtenstall and the Bury Joint Water Board—The Port Elizabeth Gas-Works Flooded—Gas-Works Borrowing Powers and the Price of Gas at Milton-next-Sittingbourne 492
Suffocated by Gas—Gas-Works in the Market—Gas Explosion at Hanley—Settlement of the Gas Question at Rugeley—A De Brouwer Coke-Conveying Plant for Birmingham—Barnet District Gas and Water Company—Opposition to the Welsh Water Scheme for London—Incandescent Gas Lighting in Plymouth and East Stonehouse—The Cardiff Corporation and the Gas Company—Shrewsbury Water Scheme 493
A Gas Manager Charged with Embezzlement—Part of Guildford in Darkness—The Cambridge Town Council and the South Essex Water Bills—The Sale of Sulphate of Ammonia in America Last Year—Heysham Water Supply—Opposition to the Exmouth Water Company's Bill 494

EDITORIAL NOTES.

Mr. Livesey on South Metropolitan Gas Affairs.

THE meetings of the South Metropolitan Gas Company on Wednesday last were held for the first time in the Great Hall of the Cannon Street Hotel, and the experiment was so successful in respect of the comfort of the numerous proprietors who take an intelligent interest in the proceedings on these occasions, that it is to be hoped it will become the practice of the future. There is plenty of room in this hall; and the acoustic properties of the apartment are so good that every speaker can be heard without straining—which is a great thing when there is so much to do as was the case on Wednesday. Mr. Livesey presided; and although he set out to be brief in dealing with the report and accounts, he nevertheless found plenty of matter for a luminous exposition of the actual condition and prospects of the undertaking. He first of all laid stress upon the regularity with which all the London Gas Companies do their work and keep up the supply. This, like the daily miracle of the victualling of the great Metropolis, is by the general public taken for granted. All the same, it is a work that "takes some doing;" and, particularly during the present winter, the task of maintaining the supply of gas has not been done automatically. And yet Mr. Livesey did not utter one word of complaint against the coal people. It would have been futile; and futility is not attractive to Mr. Livesey.

From the subject of the shortage of coal, the Chairman passed to the question of finance. He showed that the Company are doing all their work for an average return to the shareholders of $3\frac{3}{4}$ per cent. This, as he remarked, is not enough for a trading concern. Mr. Livesey has often girded at the tyranny exercised upon stock quotations by the Stock Exchange; and he is always on his guard lest anything done by the South Metropolitan Board should play in any way into the hands of the magnates of Capel Court. He fully realizes, therefore, that those who have the charge of an industrial property paying only $3\frac{3}{4}$ per cent. to those investors who buy at current market values, cannot be too careful of the stability of the investment. This consideration is adduced to justify the policy of the Board in keeping in hand a margin of dividend-paying power. Besides, it is still an open question what next year's supply of coal will cost. Dear coal is compensated for, to a certain extent, by enhanced residuals. True; but it is a question of degree. An advance of a shilling or two per ton on the price of gas coals will in all probability be recouped by the coke and possibly other residuals; but when it comes to advances of 7s. a ton and more, this set-off fails to operate.

Respecting the London County Council and their portable photometer craze, Mr. Livesey was content to give this authority credit for good intentions, which, however, are not compensation for lack of knowledge. The legalization of the portable photometer would cost the South Metropolitan consumers £84,000 a year; and all for nothing. It would not, however, cost the shareholders a penny. Shareholders, in the judgment of Spring Gardens, are miscreants undeserving of the slightest sympathy. Anything that tends to diminish the profits of an undertaking must be admirable, whether it benefits the public or not. Such, at least, appears to be the doctrine favoured by the London County Council. Perhaps after they have heard from Mr. Livesey on this head, they may reconsider the photometrical question; but the chance is not a very great one.

All this led up to a really striking explanation of the reason why the price of gas in South London has been lowered by 5d. per 1000 cubic feet since 1886. It has not been in consequence of any improvement in the method of manufacture, or the cheapening of the raw materials, or anything else of a technical nature. It is simply due to the capital burden having been relieved to a corresponding amount. This passage of Mr. Livesey's address may be commended to the careful study of those who in all countries are concerned with the problem of cheap gas supply. It has often been argued in these columns how hopelessly misled were the framers of the Paris Gas Company's Treaty with the Municipality, when they pinned the hope of reduced prices to scientific and technical improvements in manufacture. These words of the head of the organization which alone has managed to bring the price of

gas in London down to 2s. 1d. per 1000 cubic feet, are as good as a treatise on this aspect of gas economics.

The Chairman's remarks on the Company's relations with their workpeople were interesting, as usual. Particularly striking was the statement regarding the way in which the Company and their men are dealing with the matter of the Reservists' families. It is most gratifying to note how the sentiment of public duty seems to thrive and bear fruit with the South Metropolitan men, while in so many cases workpeople of the same order expect everything to be done for them. The sense of free citizenship and the love of independence must be strong and lively in men who are willing to tax themselves for it. The Chairman concluded his address on the report and accounts without mentioning the proposed Nine Elms transfer.

In explaining the Company's Bill, at the Wharncliffe meeting, Mr. Livesey gave himself a free tongue, and expounded the proposed scheme of legislation in masterly style. We shall not attempt to paraphrase this speech here, as it is reported *verbatim* in the proper place. It is a contribution of extraordinary value to the contemporary literature of gas administration.

The Weather and Coal Stocks.

THE weather experienced in London and very generally throughout the country last week was exceedingly trying to the health and temper of the individual; but it must, moreover, have been in a peculiar degree trying to the resources of the Gas Companies, in view of the emptiness of their coal-stores. The severity of the spell of cold and stormy days that prevailed cut both ways against the efforts made by the gas manager to improve the situation. The days when the bitter blizzard-like snowstorms swept the country demonstrated most clearly the growing tendency of the "consumption curve" to move inversely in accordance with the temperature line; and the output has, we believe, been far in excess of the normal for the time of the year. This tendency—due, of course, to the increasing use of gas for heating purposes—has been especially marked since the high prices of coal have prevailed; and it is a satisfactory reflection for the gas manufacturer that out of the evil of the present state of the coal market the good will come, in the permanent increase which will surely follow from the stimulation of gas consumption due to temporary causes. Once the householder has overcome his initial prejudice against gas-fires, and has learned from experience their many advantages, he will continue from choice that which he has begun from necessity. At the present moment, however, this increased and increasing demand for gas is only a source of great embarrassment to the engineer who has not (and there are many engineers just now who have not) a week's coal on the works; and the situation last week was, as we have said, doubly strained by the character of the weather. The cold sent up the deliveries of gas, while the gales impeded the deliveries of coal by the considerable derangement of shipping. The gas engineer's lot is certainly not a happy one in the present year of grace! In London, the strain upon such of the works of the Chartered Company as are dependent upon barge-carried supplies must have gone dangerously near breaking-point; for during last week the coalies employed by Messrs. Cory thought fit to strike work for higher pay. The firm named, it may be explained, own the derricks in the Thames at which coal supplies, brought by steamers from the North, are transferred to the barges used to carry the coal to its destination up river—much of it going to the in-town works of the Gaslight and Coke Company. This work was, by the action of the men, who chose their time for striking only too well (from their point of view), suspended for the greater part of the week; but as the "JOURNAL" goes to press we learn that the men have resumed unloading the ships after obtaining concessions from their employers. Such incidents at such a time are particularly exasperating; but it behoves us, perhaps, to be thankful that, so far, at any rate, the coal difficulty has not been to any but the slightest extent aggravated by labour disputes. It is in itself quite sufficiently serious to occupy the attention of, and be a source of much anxiety to, the heads of the gas-making profession for many weeks to come.

The Affairs of the Crystal Palace District Company—Mr. Livesey on Oil Gas.

AT the meeting of the Crystal Palace District Gas Company on Friday, Mr. George Livesey, the Chairman of the Company, improved the occasion by delivering his mind of several pronouncements of interest and importance to the gas industry at large. He mentioned at the outset of his speech that the Trade Unions had abandoned their intended appeal to the House of Lords against the famous judgment that made picketing, when described as besetting, illegal and punishable by a fine of £20 or three months' imprisonment. Then, after an exposition of the Company's finances, the Chairman fell upon—there is no other word—the topic of the cost of making carburetted water gas. He said that in the accounts of no gas undertaking that he was acquainted with is the cost of this accessory product stated. In the case of the Crystal Palace District Company this is going to be given. "He would promise that "the gas fraternity should know exactly what the oil gas "did cost." He will be as good as his word. Of course, everybody knows what "papers" on oil-gas manufacture say on the point; but this is not always exactly mirrored in carbonizing accounts. The same criticism has been applied to the carbonizing of coal by inclined retorts. A paper may be true; but it is not necessarily the whole truth. This engagement on the part of the Chairman will cause the eyes of the gas manager everywhere to turn to the published accounts of the working of the Crystal Palace Gas Company. Mr. Shoubridge, we may be sure, will not object to this; for in his hands the works are fast being equipped with the best gas-manufacturing appliances of all kinds, and nothing will please so capable and candid an Engineer better than to show how they work in the books as well as in effect.

The Companies Acts Amendment Bill.

A CONSIDERABLE degree of public approval has been accorded to the draft Companies Acts Amendment Bill of the Government, which the President of the Board of Trade has introduced into the House of Commons. There will not be much legislation of a general character this session, for obvious reasons; but the scandal of fraudulent company promotion has attained to such proportions, that there ought not to be any great parliamentary difficulty in the way of dealing fairly, yet stringently, with this particular Sin of the City. The part taken by members of Parliament in company-mongering should alone ensure the acceptance by the Legislature as a whole, of any well-considered means of restoring the principle of joint-stock trading to its original standing and purpose. The Government Bill certainly does not err in attempting to do too much. A good deal of the Bill is designed merely to ensure that existing forms and requirements shall have the validity, and operate to the end, ostensibly assigned to them by the Acts, but open to evasion in practice. The trickery of making illusory appointments to the Board of a Company is to be stopped by requiring a written consent of every person so named to be filed with the Registrar, together with a contract to take and pay for his qualification. A clause also prescribes the conditions under which Companies may go to allotment. The minimum amount of subscription upon which the Directors may proceed to allotment is to be fixed by the Memorandum or Articles of Association, and stated in the prospectus. If no amount is named, then it must be the whole amount of the share capital. If the conditions are not complied with, all deposits are to be returned within forty days. Important restrictions are to be imposed on Companies commencing business, to ensure their possession of the right amount of capital and the proper qualification of the Directors. All prospectuses are to be dated, and a copy signed (for filing) by every Director named therein. Prospectuses are to disclose all sorts of facts, including the particulars of all agreements with vendors. An attempt is made to void the well-known "waiver clause," and to prevent the alteration of the terms of any contract mentioned in the prospectus except in general meeting. The statutory meeting is to be held within three months after a report on the condition of the Company signed by two Directors has been supplied to every shareholder. All mortgages and charges created by the Company are to be registered within seven days. The register is to be open to inspection. Lastly, any person who makes a false return, report, or entry in a balance-sheet or other statutory document renders himself liable to imprisonment for four months, and a fine of £100. There does not appear to be anything in the Bill to discourage honest and suitable persons from becoming Directors of public

Companies—a consideration always raised as a bugbear to frighten reformers of the existing system—because every person so acting is made responsible only for his own proceedings. The point is, however, that the Bill is intended to make this personal responsibility clear, positive, and not to be escaped from by any means. It is deliberately intended to make the way of the "guinea pig" and the blood-sucking Director hard; and although specimens of these species of Directors exist in Parliament, they are marked men, and as such dare not stand in the path of reform. The chief danger to the Bill will come from the philosophic lawyers.

Welsbach v. Sunlight—The Patent of 1886.

Another round has been fought in the campaign between the Welsbach and Sunlight Companies. This is a struggle which threatens to "eternalize" itself, as the French say; and which lookers-on find tedious and vexatious to the last degree. The ordinary man cannot fail to be impressed by the circumstance that this incandescent gas-light litigation seems to go on irrespective of the life and merit of the patent involved in each case. The previous victory of the Welsbach Company was only completed after their original patent had expired, and their then opponents had gone into liquidation. Now the battle has raged over a patent which is not actually expired, but will lapse next month. This is Welsbach's 1886 patent, which protected the use of thoria in mantle manufacture. It was alleged that the defendants had taken this substance for making their mantles, and had thus infringed the plaintiffs' patent. The action was chiefly fought between Counsel—only sufficient evidence being taken to place the facts on record. In the event, the Judge decided that there had been infringement, and gave judgment for the plaintiffs, the Welsbach Company, with an inquiry as to damages, an order for the delivering up of the infringing mantles, and costs. The legal consequences of these actions, and even the manner in which they are carried on, are affected by the reconstructions which both the Welsbach and the Sunlight interests have undergone. We cannot indulge in any reflections upon the case in point, because it has been promptly appealed; and where it will end no man knows. It used to be said in the legal profession that every respectable lawsuit ought to go up to the House of Lords before it eventually died. Our readers must bear in mind, also, that there is yet another action pending between the same parties which will probably possess more importance for incandescent gas lighting at large than any suit of the kind since the original Welsbach master-patent was vindicated. One hesitates to say in respect of any incandescent gas-light action that it is of critical value; but the coming tussle will at any rate settle or unsettle the monopoly of the manufacture of mantles, as now made by the Welsbach Company under a patent which expires in 1907. This is something worth fighting for. Our special report of the hearing before Mr. Justice Buckley is interesting reading. The most satisfactory feature of the proceedings, for the general public, lies in the indication they supply that in Mr. Justice Buckley the country has another learned Judge who can make up his mind within a reasonable period of time after the close of the arguments.

Mr. Ruegg on the Workmen's Compensation Act.

Mr. Ruegg, Q.C., has established himself as an authority on the new branch of law which has broken out from the old jurisprudence by the Workmen's Compensation Act; and it is interesting to find, from his recent lecture on the Act to the members of the Solicitors' Managing Clerks' Association, that he holds pretty much the same opinion of this statute and its consequences that has always been expressed in these pages. Many of the opponents of the Act for political objects (among which dislike of Mr. Chamberlain and the desire to discredit his legislative work preponderate) have based their condemnation of the Act upon the supposed enormous amount of litigation that has sprung out of it. Mr. Ruegg denies this altogether—contending that, so far from having caused an undue amount of litigation, no change of the law of such fundamental character and far-reaching importance ever caused less. Mr. Ruegg does not like every principle or detail of the Act; and he particularly objects to the obligation imposed on employers to compensate workmen for accidents which are due more or less to their own negligence or misconduct. He would apparently have preferred the onus of proof as to liability to be shifted to the other side. But though this view is quite in accordance with abstract justice, those who have a practical knowledge of work and workmen realize, better than lawyers can be expected to do, that the line of negligence cannot be drawn very hard and fast around active operations. A clerk who has been out to a dance overnight may nod over his ledger, and no bodily harm comes to him in consequence; but if he were driving a barrow-load of concrete along a plank over a gasholder tank, the results might be serious. The real difficulties of the Act have not arisen over this question of misconduct, but with reference to problems of interpretation and limitation. These have been of a knotty character, and their solution has given the Judges some trouble. The Courts have worked upon what Mr. Ruegg called the only safe canon of construction of an Act of Parliament—namely, that "the intention of "the Legislature must be gathered by giving the usual "and ordinary signification to the words used, apart from "any consideration as to what well might have been or "should have been intended." It is advisable to bear this useful rule in mind.

No Petroleum Legislation this Session.

The petroleum industry can breathe freely for the current year, so far as any prospect of Government action is in question. This was made clear by the reply of the Home Secretary last week to Mr. Provand, who asked whether anything was to be done this session on the line laid down by Mr. Jesse Collings on March 15 last. On this occasion the Under-Secretary stated that the Government would deal with the questions of dangerous lamps and oils, and that the Home Office Bill to this intent had long been in preparation and was in a forward state. Sir M. W. Ridley has now stated that the whole question is of so controversial a nature that there is no chance of anything satisfactory being done with it while Parliament has so much else to attend to. This reply is eminently satisfactory; for it cannot be successfully argued that the subject is urgent. Besides, events in the commercial world are tending in the direction of the automatic settlement of the matters at issue in the sense desired by those who raised the factitious clamour against the "deadly low-flash American oil." This commodity was otherwise classified as the refuse of the American refineries, which could not be disposed of elsewhere. The United Kingdom was spoken of as being the "dumping-ground for Rockfeller's rubbish," and so forth. During the past year, the course of the market has hardly justified this view of the trade. The so-called "trash" has been steadily growing scarcer and dearer; the imports showing a falling off of 43¼ million gallons (all in lamp oil) as between 1897 and 1899. On the other hand, the imports of Russian oil have attained such magnitude that nobody need burn a pint of American oil unless he likes; and if he prefers the "deadly rubbish," he has to pay rather more than a penny a gallon extra for it. A curious way, that, of "dumping" a commodity upon the market! Moreover, the independence of the American dealers has almost become a proverb in the trade. So far from their seeking custom, they have not sufficient supplies to satisfy the demand. If the followers of a "fad" were amenable to reason, they would see in all this ample justification for leaving the oil trade alone. If they still rage against American oil at 1¼d. per gallon more money than its largest competitor, they only lay themselves open to the damaging inquiry as to how much dearer they would like it to be. Which would expose the trick.

WATER AND SANITARY AFFAIRS.

It will be seen by our "Parliamentary Intelligence" today that the Private Bill business of the session began in earnest last week; a number of Bills having passed the second reading stage in the House of Lords, while those in the Commons were read the first time, and either ordered for second reading or referred to the Examiners for their usual certificates as to compliance with further Standing Orders. The two Water Bills of the London County Council are in the former group in the Commons; but their progress has been checked by "blocking" motions put upon the paper by three members. Sir F. Dixon-Hartland, the Chairman of the Thames Conservancy Board, is only waiting for the second reading stage to be

reached to move the rejection of the Welsh Water Bill; and Mr. Whitmore and Mr. Goulding, the members for Chelsea and Devizes, will support him, and extend their hostility to the Purchase Bill. The Vestry of the combined parishes of St. Margaret and St. John, Westminster, are petitioning against both Bills, and the Middlesex County Council against the latter. Looking farther afield, we find the Glamorgan County Council have been keeping their eyes upon the little Parliament in Spring Gardens, and have not been particularly satisfied with their gigantic scheme for appropriating some of the water which is considered to belong of right to Wales; and therefore they have instructed their Parliamentary Committee to petition against the Bill promoted with the object of obtaining legislative sanction to it. But in the event of the Government introducing a Bill to carry into effect the recommendations of the Royal Commission—a step which, as already remarked in these columns, is hardly to be expected in the present position of political affairs—there will be a poor prospect of the Council carrying their two measures through. Even if the Government decline to take up the Metropolitan Water Question again this session, and the Council endeavour to profit by this inaction to further their plan of campaign against the Water Companies, there are already indications that their success, if achieved, will not by any means be the result of a "walk over."

The pages of the "JOURNAL" during the past few months have borne evidence of the fact that water engineers and those who are responsible for maintaining a supply of water have, one way or another, a good deal of anxiety in connection with their duties. When the skies refuse for a prolonged period to yield rain, they view with much concern their gradually diminishing stores of water; and even when they have plenty of water, they are sometimes hampered in distributing it. A few weeks ago, we showed how Mr. Ingham, the Borough Water Engineer of Torquay, had been troubled by the obstruction of his mains through the formation therein of a deposit which in the course of a few years reduced the delivering power of the pipes to 51 per cent. of their full discharging capacity. His colleague at Plymouth has had a similar difficulty to contend with; but in both places scraping has been very beneficial. In these cases the pipe is attacked from within. But the engineer is now beginning to find out that it is liable to be attacked from outside. The introduction of electric tramlines lays his mains open to the action of electrolysis—a cause of deterioration which is every day receiving more and more attention. We have dealt with this subject from time to time in the "JOURNAL," and quite recently gave the results of Professor Blake's experiments in Kansas City, where the pipes of the Water Company were affected. The trouble has now come nearer home. At a meeting of the Manchester City Council only a few days ago, Sir John Harwood, the Chairman of the Water Committee, called attention to the damage caused to the water-mains by the escaping electric current, and the consequent danger. Alderman Higginbottom, the Chairman of the Electricity Committee, tried to make out that the conditions which give rise to electrolysis do not exist in Manchester, as the Committee are working under Board of Trade regulations. His remarks, however, did not go for much in face of the statement by Sir B. T. Leech that he could show iron pipes pitted over with soft places; and as they were in proximity to electric cables, the inference was justifiable that it was the electricity which had affected them. It was decided—wisely, we think—to have a conference between the Chairmen of the various Committees concerned, with the view of instituting an investigation by experts. This subject has been studied a good deal in America since the effects of electrolytic action were first discovered in Boston some eight years ago; and it appears that there is only one real remedy for the trouble, and that is to prevent the pipes from being traversed by electric currents. Professor Blake says that no asphalte coating will protect them; and that nothing but the avoidance of conduction will ensure immunity from electrolysis.

The Origin of the Word "Acetylene."—According to M. Capelle, the author of "L'Eclairage au Gaz Acétylène," Berthelot gave this name to the well-known gas in honour of Berzelius, who called the hypothetical radical of acetic acid "acetyl." The composition of acetylene (C_2H_2) bears the same relation to acetyl (C_2H_3) as ethylene (C_2H_4) does to ethyl (C_2H_5).

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 487.)

BUSINESS on the Stock Exchange still drags along. Markets continued in a very lifeless condition during the early days of last week. A little more activity followed the advance of Lord Roberts into the Orange Free State; but the improvement was chiefly the result of professional operations. There is no real backbone to any movement without public support; and this is withheld for the present. Nor is it likely to revive until some decisive advantage is gained over the Boers. The Government announcement that the total amount required to meet the war charges will be £23,000,000 led to the impression that there is no intention to make a first issue of Consols; and the market accordingly stiffened up. But all gilt-edged securities have shown remarkable steadiness. The upward tendency of the Money Market is, however, against any marked rise in Consols, which is not likely to occur just at present. As regards Gas stocks, we have again to chronicle a small business, taking the market as a whole, though early in the week a fair amount was done in Gaslight ordinary, which has declined 1. The market has since presented a firmer appearance, as no business is recorded under 105½ since Thursday, when the price was put down to 105-107. The secured issues were very quiet, and maintain their values. A few transactions were marked in the other Metropolitan Companies; but quotations are unaltered. As regards the Suburban and Provincial group, Brentford consolidated and ditto new were put down 2 points, and British Gas ½ to 43-44. There was rather more doing in the Foreign group, especially in Malta, which are quoted ½ lower, at 4½-5½. A few dealings were recorded in Imperial Continental, River Plate, San Paulo, Oriental, and Buenos Ayres. As to Water stocks, the market was absolutely stagnant, till Saturday, when East London were quoted 2 points higher, Grand Junction 1, and West Middlesex 2; but Kent fell 3.

Concerning the daily operations: The only feature on Monday was a decline of ½ in British Gas to 43-44; business being done at 43 and 43½. Gaslight was active, dealings being recorded between 106 and 107; 4 per cent. preference was dealt in at 120½; and the 3 per cent. debentures at 99½ and 100. South Metropolitan changed hands at 135½ and 134⅝. The only change on Tuesday was a decline of ½ in Malta Gas to 4½-5½; but Gaslight was again active at rather easier figures—the stock changing hands between 105¾ and 106¾. The maximum 3½ per cent. was dealt in at 97 and 97½. There was business recorded in Imperial Continental at 216 and 217½, Oriental new 6 9/16, River Plate 11 1/16, and in South Metropolitan and San Paulo. Wednesday was extremely quiet, even in Gaslight stock, which changed hands at 106½. Brighton and Hove ordinary was dealt in at 256, and the "A" at 187; Buenos Ayres new at 9⅞; and River Plate debentures at 101. Southampton Gas ordinary rose 1½ to 115-120. Thursday was also a quiet day; and lower prices were accepted for Gaslight stock, changing hands at 105, and the 4 per cent. preference at 121½. Commercial was dealt in at 309½, Imperial Continental 216, South Metropolitan 136½ and 135, ditto debenture 100, and San Paulo 12. There was a little more doing on Friday; business being recorded in Gaslight between 105½ and 106½, European at 20¾, Imperial Continental at 218. Malta was active at about 15; and Monte Video changed hands at 11½. Saturday as usual was quiet and featureless, and very little business recorded even in Gaslight, which marked 106 and 105½. Some business was done in Brighton and Hove at 257, and in Imperial Continental at 217¾. Water stocks, which have been idle all the week, showed some changes, though there was no business recorded.

ELECTRIC LIGHTING MEMORANDA.

Electric Traction an Experimental Success on the Metropolitan Railway—Positive Advantages—Limitations—Free Wiring at Lincoln.

A HIGHLY important statement concerning the results so far obtained from the electric traction trials undertaken by the two Metropolitan Railway Companies was made by Mr. J. S. Forbes at last Thursday's meeting of the District Company. We are particularly interested in this authoritative communication, inasmuch as Mr. Forbes dealt categorically with some of the queries put in this column on the 30th ult. This is what was to have been expected of the Chairman of the Metropolitan District Company, who knows perfectly well what are the essentials of successful railway working, and is too much a master of his trade to waste the time of a meeting with the twaddling generalities of the ornamental director. What Mr. Forbes says about railway working "goes," as the American language has it; and, therefore, when he declares that the experiments with electric traction have established the fact of its possessing certain positive advantages over steam locomotive traction, this statement is deserving of respect. We are careful to make it perfectly clear that this intelligence is important chiefly owing to the fact that it is Mr. Forbes who publishes it, because, as was remarked on Jan. 30, there is no trusting the mere electrical prophet in any matter. Mr. Forbes does not require credentials from the "JOURNAL" as to capacity or integrity, and it would be impertinent in us to

offer anything of the kind as a compliment to himself. In saying so much about the responsibility assumed by the District Chairman in this connection, the object is to explain why the information is to be regarded as of such importance.

Mr. Forbes states that the essential factors of electric traction for the Metropolitan Railways have been determined by Sir J. Wolfe Barry and Sir W. H. Preece. They are satisfied that with electricity they could move a much larger weight than that of the Companies' ordinary trains. The train capacity could be increased from 450 to 500 passengers; and the greater weight could be moved more rapidly, with greater certainty, with much less exhaustion of time in stopping and starting, and, they fully believed, more economically per train-mile than in the case of ordinary trains. These answers meet the desire we expressed for proof of positive advantages of electric over steam hauling. Everybody will agree with Mr. Forbes that this is a very satisfactory statement for him to be able to make. These positive gains, of course, will have to be realized after a considerable expenditure of fresh capital on the alteration of the system of working; and it will be for the Directors to determine whether they are worth having at the price. The Chairman said enough on this score to indicate that, to his mind, at any rate, the probability is great that the economy to be effected, and the increased capacity in working, will quite compensate for the cost and trouble of making the change. He did not doubt that "all this would be a matter of history three years hence." Upon the tender point of the running powers of other Railway Companies over the Metropolitan lines, Mr. Forbes would say no more than that the Great Western and London and North Western Companies "might be persuaded to make the change if they were shown it would be to their advantage to do so."

It may be advisable to remark that the last question refers only to the local working. It is necessary to guard against the assumption, to which some people may be expected to jump instantly on hearing of Mr. Forbes's communication, that the days of the steam locomotive are numbered, even in the case of the great railway lines, and that within the space of three years electric traction is going to whisk passengers and goods from Liverpool to London, and from London to Penzance. The Chairman of the District Railway Company was speaking with respect to the Metropolitan traffic only, which is a different matter altogether from main-line work. It may lie within the bounds of possibility that the great trunk lines will be worked wholly or partially by electricity within the lifetime of readers of these words; but nothing that the Metropolitan and Metropolitan District Companies have done towards solving their own local traffic problems applies equally, if it applies at all, to trunk railway conditions. It should be remembered that if electricity is adopted for working the underground railways of London, it will be only coming into its own inheritance, reserved for it from the beginning of these undertakings. Of course, when this happens, a great impetus will be given to electric traction generally; but it is well that the public should understand that there has been no epoch-making invention to this advance. It is quite possible that some soaring promoter will arise and claim to have the future of electric railways in the hollow of his hand; but it will not be true. Money will be needed for this and other extensions of electric engineering; but there will be no risk if the public only remember always that electricity is only a tool like another, and shut their pockets the moment anybody begins to talk about it as being a "magic wand," and so forth.

An interesting account of a year's experience of a "free wiring" system has been given in the "Electrician" by Mr. C. S. Vesey Brown, who represents the Corporation of Lincoln in this matter. Here, as elsewhere, the wiring difficulty was a serious one; and the Corporation entered into a contract with the National Electric Wiring Company for doing all that was required in this line "free of cost" to the consumer, who was charged for the accommodation 1d. per unit extra on his average maximum demand, and a halfpenny per unit extra for everything beyond. There does not appear to be much of a gift about this arrangement; but Mr. Vesey Brown confesses that with gas sold at 2s. 1d. per 1000 cubic feet, inclusive of meter-rents, the electric lighting business in Lincoln has to be cut very fine. He thinks the arrangement a fairly successful one, all things considered; because out of 185 houses in the area of supply 45 took it up. This is all very capital; but he proceeds to state the number of connections per quarter since the commencement, which "gives the whole show away." For the first quarter there was a big rush, for Lincoln, of fifteen shops and nine residences. The following quarter only three shops and three residences came in; and this stupendous crowd of six applications per quarter has been the average ever since. If the Corporation Electrician and the Free Wiring Company are satisfied with this amount of patronage of their mutual arrangement, all that can be said is that they must be easy to please. The plan is reasonable enough in its way, for obviously something is required to induce a yearly tenant to venture upon electric lighting. But in Lincoln, at least, the number of people who are attracted by this facility is small.

According to the Russian "Board of Trade Gazette," the total production of petroleum at Baku last year amounted to 524,200,000 poods, as compared with 486,000,000 poods in 1898—an increase of 38,200,000 poods.

SOME FANTASTIC STANDARDS OF LIGHT.

From time to time we have called attention of readers of the "Journal" to the persistent efforts of M. Violle and others to produce standards of light by the aid of platinum heated to its melting point or thereabouts, or of carbon or platinum raised to incandescence by the expenditure of electrical energy. We surmised that no practical working standard of light would result from the labours of these visionaries, and were not surprised to find that well-recognized flame standards were subsequently suggested as suitable practical reproductions of the fantastic model standards which it was claimed had been elaborated. Lately Mr. J. E. Petavel has made a lengthy communication to the Royal Society on researches which he has carried out in the Davy-Faraday Laboratory, on several electrical and platinum standards of light. We append a *résumé* of this paper, the text of which will be found in No. 422 of the "Proceedings of the Royal Society."

Flame standards are briefly mentioned, and the Harcourt pentane gas standard and the Hefner-Alteneck amyl acetate lamp are stated to be the lights which, from every point of view, have been found most satisfactory. Of the two, the Hefner-Alteneck lamp is said to be the better known, and to be fairly representative of its class. Dr. Liebenthal's researches, described in the "Journal" (Vol. LXVII., p. 125), are quoted to show the serious effect of moisture and carbonic acid in the atmosphere on both these standards. It may be pointed out that the multitude of pentane standards devised at various times by Mr. Harcourt appears to have confused Mr. Petavel, who first gives a reference to the original pentane air-gas flame, which has been accepted by numerous Committees on Photometry as the most reliable representation of the average light of one standard candle. He then quotes Dr. Liebenthal's researches, which were made on a portable pentane 1-candle lamp, as evidence of the unreliability of the "Harcourt lamp"—leaving his readers to infer that this is identical with the Harcourt air-gas flame. The Harcourt 10-candle lamp, which is now in use in the Metropolitan testing-places, was evidently not in Mr. Petavel's mind; and Dr. Liebenthal's researches in no sense apply to it. It is a curious fact that this lamp does not yet appear to have been tried by Continental photometrists, though it has very marked advantages over the Hefner-Alteneck lamp, which is generally adopted by them.

On the strength of Dr. Liebenthal's work, which, as we have indicated, does not refer to the most practical and readily-produced modern flame standard, and in direct conflict with the conclusions on the effect of humidity of the atmosphere on the light emitted by luminous flames arrived at by the late Board of Trade Committee on Photometric Standards, Mr. Petavel passes condemnation on the whole class of such standards, and proceeds to discuss "incandescent standards." With regard to these, he remarks that the constancy of the light depends essentially on the constancy of the temperature at which the radiating body is kept, and on the constancy of the emissivity of the body at that temperature. The occurrence of some definite physical phenomenon—such as the fusion of platinum—may define the temperature, or it may be arbitrarily determined. The choice of a substance, to serve as a radiator, which will not disintegrate at 3100° Fahr., is confined to carbon or one of the metals of the platinum group. Bearing in mind these facts, and the essential qualifications of a standard of light—viz., that it must (1) continue constant, (2) be reproducible, and (3) resemble in spectral composition or colour the artificial lights in common use—Mr. Petavel proceeds to describe attempts he has made to utilize a portion of the area of the crater of the electric arc as a standard of light. In this endeavour, he was following in the footsteps of Swinburne, S. P. Thompson, and Blondel.

It is difficult to obtain a suitable disposition of the crater of the arc for the purpose, since the negative carbon ordinarily hides the crater. After some other arrangements had been tried, the carbons were eventually placed at right angles, and provided with suitable means of adjusting their relative positions. Light emanating from a small area in the centre of the crater of the positive carbon, was allowed to pass through a hole, 1·47 square millimetres in cross section, in a cooled diaphragm, to the photometer. In one series of experiments, in which the arc was in a metallic enclosure kept at about 68° Fahr., by water circulation, the mean intrinsic brilliancy of the crater was found to be 147 candles per square millimetre. With the enclosure at a temperature exceeding 1650° Fahr., the mean brilliancy appeared to be about 4 candles less; but as variations from the mean of 10 per cent. occurred in the observations under both conditions, the difference was probably due to unavoidable experimental errors. Mr. Petavel concludes that the crater of the arc does not possess the qualities required of a standard, though provided the arc is silent, variations of current, &c., will not cause the intrinsic brilliancy to vary by more than 10 per cent. from the mean value. He also made observations on "hissing" arcs, with a view to computing therefrom the temperature of the electric arc. Mr. Petavel estimates this temperature at about 7000° Fahr., and considers that his experiments confirm the theory that the crater of the arc is at the temperature of volatilization of carbon.

Mr. Petavel then proceeds to describe experiments which he made with the incandescent platinum standard proposed by

Drs. O. Lummer and F. Kurlbaum. This consists of a strip of platinum foil 25 mm. wide and 0·015 mm. thick, raised to incandescence by an electric current of about 80 ampères. The temperature is increased until one-tenth of the total radiation, as determined by a bolometer, is found to be transmitted through a water-trough 20 mm. in width. The remark that "the construction of the instruments require (*sic*) the greatest care, and three months had passed before I was able to obtain the first observations," prepares the practical photometrist for the conclusion that the light is impracticable as a working standard. The pity of it is that any scientist should have spent so much valuable time, and wasted the resources of the Davy-Faraday Laboratory, in arriving at what anyone but an electrical enthusiast would have accepted as a foregone conclusion. The standard does not fail because of variations in the light when the conditions prescribed by the inventors are observed, but because of the practical difficulties of maintaining these conditions. The colour of the light, also, is too red. Nevertheless, it is used in the Imperial Physical Institute at Charlottenburg, to check the values of Hefner lamps.

Mr. Petavel passes on to deal with the molten platinum standard proposed by M. Violle in 1881. It is noteworthy that, though M. Violle does not speak of any great difficulties in the production and use of this standard, other experimentalists who have attempted to reproduce it—including the physicists at the Charlottenburg Institute—have signally failed. Recent work has been confined to attempts to produce suitable practical substitutes for the Violle standard. In 1896, the International Congress of Electricians held at Geneva adopted the Hefner unit as the practical standard representing the *bougie décimale* of M. Violle, which earlier congresses had precipitately accepted. Mr. Petavel essayed to reproduce the Violle standard. He made many endeavours to keep pure platinum in a state of fusion by means of the electric arc; but these were frustrated owing to the avidity with which the molten metal combined with incandescent carbon, silica, and other matters. It is essential that the molten platinum should have a clean surface; and as the slightest trace of foreign matter clouds it, some other method of fusing the platinum had to be selected. It was found that when a strong current was passed through a semi-circular bar of platinum, supported on a cooled nickel trough, a central channel of molten platinum contained in a shell of solid platinum could be secured. Mr. Petavel considers that this method is very promising, and hopes that it may be tried by others on large bars of platinum. The bars he employed were only 30 square millimetres in cross section.

On proceeding to attempts to melt the platinum by means of the oxy-hydrogen blow-pipe, he was met by a host of difficulties, and six months were spent on preliminary experiments. In order to obtain a clean surface of the molten platinum, it was found that pure platinum must be fused in a crucible of pure lime. The lime was obtained by igniting calcium carbonate which had been precipitated from calcium nitrate by means of ammonium carbonate. The fusion was effected by means of 4 volumes of hydrogen free from hydrocarbons and 3 volumes of oxygen. These proportions did not cause much superheating of the molten metal. An ingenious device was adopted for regulating the flow of the gases to the blow-pipe, and for cutting them off when the platinum was fused. Both the light which passed through a hole, 1 square centimetre in area, in a diaphragm placed above the surface of the platinum, and the light from the incandescent electric lamp which was used as the standard of comparison, were reflected by mirrors on to the screen of the Lummer-Brodhun sighting-box. The mirrors were interchanged after each series of observations, so that the effect of any inequality of absorption was eliminated from the mean of the results. The sources of light were fixed 130½ inches apart; and the sighting-box was moved on the bar, and each setting marked and subsequently read off. Settings were made at intervals of 10 seconds, until the platinum had cooled below its melting-point.

The standard of comparison was an incandescent 50-volt lamp, with a specially constructed divided resistance placed across the terminals, so that the pressure on the terminals could be kept constant for many hours, within 0·01 per cent. Under these conditions, the light afforded by the lamp remained constant. The superficial area of the platinum ingot was varied from 17 to 30 and 10 square centimetres; the weight of the ingot being 345 grammes. Observations were made in each case; and then observations were made with an ingot weighing 510 grammes. Mr. Petavel concludes that the probable variation in the light emitted by molten platinum does not exceed 1 per cent. when the following somewhat arbitrary conditions are observed: Total mass of platinum = 345 grammes in the shape of a disc; diameter of the hole in the cover of the furnace = 16 mm.; observations made after the blow-pipe, consuming 0·8 cubic foot of hydrogen and 0·6 cubic foot of oxygen, had been alight for 15 minutes. With more nearly perfect apparatus, with a mass of 1000 or 2000 grammes of platinum shaped as a half-sphere, and the quantity of gas burnt altered to suit the increased mass of metal, Mr. Petavel thinks it not impossible that the accuracy of the molten platinum standard would surpass the limit of accuracy of photometrical work which physiological limitations impose.

The investigations of which we have necessarily given a very incomplete account, have occupied Mr. Petavel for nearly three years; and he now asks for the advice of persons interested in photometry to aid him in continuing his researches to a more satisfactory conclusion. We imagine, from the general trend of his labours, that he will continue to work on the interesting, but impracticable, standards of light which apparently present so great an attraction to the academically nurtured physicist. If so, he will leave to others the investigation of problems of immediate practical importance—such as the determination of the effect of variations in the amounts of moisture and carbonic acid in the atmosphere on the Harcourt 10-candle lamp, which is now officially used for gas-testing in the Metropolis.

OUR COAL RESOURCES AND CONSUMPTION—A RECONSIDERATION OF SOME ESTIMATES.

The present excess of the demand for over the supply of coal, in the presence, not of a restricted or diminished, but of what—leaving out of consideration the temporary restrictions due to the war—is a considerably increased and increasing output, not unnaturally renews interest in the question of the extent and estimated duration of the coal resources of the country.

It is over thirty years—a full generation—since the public mind was considerably agitated by alarmist reports of the near approach of the exhaustion of our coal mines. The rapid increase in the consumption of coal in the first half of the century, consequent upon the general adoption of steam-power, the creation and development of the railway system of the country, the substitution of iron for wood in the construction of ships—with the attendant growth of the iron and steel trades—the upspringing of the industry of coal-gas manufacture, and the progress of the arts and crafts of modern civilization generally, had for some time been impressing itself upon the minds of a few thoughtful men, when the debates in the Parliament of 1860 upon the Commercial Treaty with France demonstrated the lack of any reliable information relating to the coal resources of the British Islands, and of any intelligent forecast of the probable duration of the supply.

To provide the information so lacking, and thereby to afford some basis for the required estimate, Professor Edward Hull, the Director of the Geological Survey of Ireland, published in 1861 his excellent and comprehensive work on "The Coal-Fields of Great Britain; their History, Structure, and Resources," the fourth and last edition of which appeared twenty years later. [The book is now out of print; and we are sure that a further edition would be welcomed by all who know Professor Hull's work.] In the first edition of this book, Professor Hull gave estimates of the quantity of coal, both in the known and in the hidden fields, down to a depth of 4000 feet from the surface, based upon the best available data, which were not, in all cases, official and exact. In 1865, Professor Stanley Jevons—adopting Professor Hull's estimate of the coal stock of the United Kingdom—published his celebrated *brochure* on "The Coal Question," in which he sounded a loud note of alarm—giving for its justification an estimate of the probable growth of the consumption of coal in this country, and the consequent rapid and not far distant exhaustion of the mines. The agitation and concern to which the forecast of Jevons gave rise—not only in the minds of the general public, but in those of the leading statesmen of the day—resulted in the appointment in the following year (1866) of the famous Royal Commission on Coal. The Commission were ordered to investigate the probable quantity of coal contained in the coal-fields of the United Kingdom, and to report on the quantity of such coal which might be reasonably expected to be available for use. They were further to report as to whether it was probable that coal existed at workable depths under the permian, new red sandstone, and other superincumbent strata. Also they were to inquire as to the quantity of coal at that time consumed in the various branches of manufacture, for steam navigation, and for domestic purposes, as well as the quantity exported; and how far, and to what extent, such consumption and export might be expected to increase. The Commission, of which the Duke of Argyll was Chairman, and on which were some of the most eminent of the geologists of the day (including the late Sir Roderick Murchison, Director General of the Geological Survey of the United Kingdom), pursued their inquiries in the most thorough and exhaustive manner by means of Sub-Committees of Investigation, and did not produce their voluminous and most valuable report until July 27, 1871. We have now, therefore, some thirty years' statistics by which to examine, first the forebodings of Professor Jevons, and, secondly, the estimates of the Royal Commission. Since both the book of the former and the report of the latter are probably by no means fresh in the memory of our readers, and are, moreover, neither easily accessible to, nor purchasable by, many of them, we may usefully recall the most essential particulars of each, for the purposes of examination now and of reference at any future time.

We have first to deal with the question of the quantity of coal contained in our coal-fields, and the proportion thereof which may be looked upon as available under normal conditions of mining. The latter point is, of course, of the utmost practical importance; for coal may exist beneath our feet in infinite quantities without being of the least value to the community, if it lie at such a depth, or beneath such strata, as to make the

raising of it a matter of physical impossibility, or of such difficulty that the expense would be prohibitive. So soon as the supply of easily accessible coal shall have been exhausted, and the cost of production in respect of the remainder found to be considerably higher than the present cost of raising, coal from the vast beds of America will be able to compete with, and finally replace, English coal. Such an event will, so far as it is possible at present to foresee, synchronize with the decay of the iron and steel trades and the commercial supremacy of this country. In the words of the Commissioners, "it may well be doubted whether the manufacturing supremacy of this kingdom can be maintained after the importation of coal has become a necessity."

Professors Hull and Jevons, and subsequently the Coal Commissioners, took, as the limit of depth at which coal could be practically recovered, 4000 feet below the surface; though Professor Jevons expressed, but did not base his estimates upon, the opinion that a mine might, if necessary, be driven to the depth of 5000 feet. Professor Hull, in the book to which we have referred, devotes a chapter to the possibilities of deep coal mining. "The two main impediments to the prosecution of mining operations at great depths are,"* he says, "the increase of temperature in the strata themselves, and the pressure due to the weight of the strata. But as the latter obstacle is capable of being overcome in most cases, especially under the 'long-wall system' of mining, it may be omitted from consideration. . . . That the temperature of the earth's crust increases as we descend is a proposition which has been determined in the affirmative by observations extending over a large portion of the land surface itself. It is, however, to be observed that, compared to the radius of the earth, these observations extend only to a very small depth. Nevertheless, they are perfectly sufficient for determining the problem as far as it is calculated to influence the question of deep mining, though not as regards the physical constitution of the interior of our globe." The writer then proceeds to give various statistics of the increases in temperature found on descending different coal mines, "sufficient to show that the increase of temperature is a reality, which becomes a sensible obstacle at a slightly variable depth, and will have to be encountered and overcome by artificial means when the depth exceeds 800 or 900 yards [say, 2500 feet]. On this point, the Commissioners on Coal Resources have arrived at the conclusion that, at a depth of 1000 yards (3000 feet), the temperature of the earth would amount to 98°. Under the 'long-wall system' of working, a difference of about 7° appears to exist between the temperature of the air and that of the working faces . . . so that the depth at which the temperature of the air would, under the present conditions, become equal to the heat of the blood, would be about 3420 feet. Beyond this point the considerations affecting increase of depth become so speculative that the Commissioners leave them in uncertainty. But they consider it may be fairly assumed that a depth of at least 4000 feet may ultimately be reached in coal mining."† This may be achieved, it is hoped, through a reduction in the temperature by means of effective ventilation; it being possible for miners to work in temperatures approaching blood heat, owing to the comparative dryness of the atmosphere at great depths. It may be remarked, in answer to the thought that naturally arises that gas stokers and iron smelters work at times in much higher temperatures, that the heat they have to endure is radiant heat, not that of the air they are constantly breathing. Summing up on the whole question of deep coal mining, Professor Hull says‡: "I have considered it Utopian to include in calculations having reference to coal supply any quantity, however considerable, which lies at a greater depth than 4000 feet. Beyond that depth, I do not believe it will be found practicable to penetrate. The physical barriers appear insurmountable."

Having, then, arrived at the conclusion that coal lying more than 4000 feet below the earth's surface could not be reckoned as part of the available resources, Professor Hull estimated the quantity available, but unmined, in 1861, at 83,000 million tons. No account was taken in this estimate of any of the coal contained in the concealed coal-fields, by which is meant the coal-beds believed to exist, but as yet untapped, below the permian, triassic, and liassic strata. The estimate of 83,000 million tons was adopted by Professor Jevons as representing the coal stock of this country. Deducting therefrom the quantity estimated by Jevons to be raised in the eight years ending 1869—viz., 757 million tons—the stock as calculated by him at the end of 1869 equals 82,243 million tons. The Royal Commission, while adopting the depth of 4000 feet as being the limit of practicable mining, included in their report estimates of coal lying below that depth, and also of the quantity in the concealed beds. Their estimates of the country's stock of coal at the end of 1869, after allowing for the probable loss in hewing and raising, may be summarized as follows:—

	In Known Coal-fields. Millions of Tons.		In Concealed Coal-fields. Millions of Tons.		Total. Millions of Tons.
At depths not exceeding 4000 feet . .	90,207	..	56,273	..	146,480
Between 4000 and 6000 feet . . .	5,922	..	25,841	..	31,763
Over 6000 feet. . .	1,397	..	15,303	..	16,700
Total . .	97,526	..	97,417	..	194,943

* "The Coal-Fields of Great Britain." Fourth Edition, p. 482.
† *Ibid*, p. 492. ‡ *Ibid*, p. 505.

It will be seen that the careful investigation of the Commission resulted in an estimate of the known coal above 4000 feet, differing from that adopted by Professor Jevons from Professor Hull's calculations, by 7964 million tons—a quantity equal to less than 10 per cent. on Professor Hull's estimate. When, however, we say, as is the fact, that the total quantity of coal raised in the thirty years ended 1899 (a period equal to nearly a third of the time at the end of which Professor Jevons declared that we should be in dire straits for coal) only amounted to 4780 million tons, the difference mentioned will be seen to be a material one. The further quantity of 56,273 million tons estimated by the Commissioners, and admitted by Professor Hull (in the later editions of his book) to be rightly estimated, as existing at accessible depths under the permian and other strata—equal to somewhere about 250 years' consumption at the present rate—also modifies very considerably the forecast made by Professor Jevons. It is further to be remarked that neither Professor Hull nor the Commissioners took into account any estimate of the quantity of coal underlying the South-east of England. Sir Joseph Prestwich, one of the geological experts on the Commission, and one possessing a very full acquaintance with the geology of the Home Counties, was of opinion that coal would be found there at practicable depths. This opinion was embodied by the Commission in their report; but no calculation of the quantity of such coal was included in their estimates. Sir Roderick Murchison, on the contrary, was so decided in his belief that no coal-beds existed in those districts, that he qualified his endorsement of the report by appending thereto a protest against Prestwich's opinion. Events have decided in favour of Prestwich; but time alone will show—for it has not yet been proved—whether the coal that has been discovered in the south-eastern counties, is recoverable in such way, or in such quantities, as to make it of any commercial value. Should that eventually prove to be the case, the whole contents of the mines will be an addition to the coal resources of the country as calculated in the estimates we have quoted.

(To be continued.)

THE REDEMPTION OF GAS AND WATER COMPANIES' CAPITAL.

It will be remembered that one of the recommendations of the Powers of Charge Committee (Metropolitan Gas Companies) of last session was "that an effort should be made by any company having obsolete or unproductive capital to redeem such capital by sinking fund or otherwise." No suggestion was made at the time of a means for carrying this counsel into effect; and the Bills now pending do not touch the subject. This avoidance of the matter, by common consent of the parties interested, is open to the interpretation that they are at a loss for an acceptable plan of action upon the recommendation. There is much to regret in this course, on general grounds, and we deplore it for the special reason that it recalls our own abortive effort to get up a discussion of the question of the expediency and possibility of reducing gas companies' capital. We showed years ago that the operation of paying off municipal gas-loans must inevitably have the effect at some future time of making municipalized gas supplies compare with artificial advantage, in respect of capital burden, with gas companies' undertakings. This position was granted; but it was pointed out that gas companies have no right nor means of redeeming their capital, either from or outside the statutory dividend. Since the question was raised in these pages, many, including some of the most important companies' gas undertakings, have converted and consolidated their capital upon a basis not differing greatly from the market value of the property. Consequently, their capital now stands in the books on nearly the same footing as that of municipal gas capital; so that one great difference between gas company and gas committee accounts is to this extent removed. Even so, there has not been the slightest advance in suggestion, or in fact, towards treating of the two kinds of capital alike.

Hence, the recommendation of the Powers of Charge Committee must be regarded as pointless, not to say impertinent. The only ordinary way of writing off capital is by applying profits to this use; and where dividends are paid in full, or the selling price cut down to the barest margin, there are no surplus profits available for the purpose. The qualification of the recommendation—that only "obsolete and unproductive capital" should be redeemed—is plausible on the face of it, but cannot be sustained on the merits. It is not only their obsolete and unproductive capital that the gas-supplying municipalities have to pay off, but the whole of it. The distinction sought to be made here is just what the popular gas reformer would fancy; but it does not exist in fact. On the contrary, indeed, the loans that corporations have to pay off the quickest are those incurred for any actual and reproductive purposes—new Acts of Parliament, works extensions, and so forth. If there is any distinction made at all, therefore, between active and dead capital, it is that the former must be paid off first. Very properly, too; because this rule ensures that those for whom the new accommodation is made have to bear the expense of it.

But all this sinking fund business, be it observed, is dead against the cheapening of the product. How serious a question

this is for the consumers of a commodity provided by redeemable capital, is exhibited by the report of the Metropolitan Water Commissioners. The transference of a gas or water undertaking to a local authority at its fair value entails the institution of a sinking fund to repay the money borrowed for the purchase, in a certain number of years. The financial effect of this condition is far from being fully appreciated by all amateurs of municipalization. Doubtless posterity will profit by the arrangement; but meanwhile, unless the purchased income exceeds the interest of the loan taken up for this purpose, the sinking fund is an added burden on those who carry on the business, which necessarily makes the product dear. In other words, if municipal public debt were not all redeemable, the municipalization of certain permanent, freehold kinds of property would appear to offer more concrete advantage than it can present under the actual conditions.

It is necessary to break off here, and admit, parenthetically, that the London Water Companies are as a matter of fact subject to the obligation to redeem part of their capital by what is known as the Chamberlain's Sinking Fund. The nature of this quite exceptional arrangement is known to all those who follow our annual abstracts of gas and water legislation. It dates from 1886, at which time the purchase of the water undertakings was contemplated; and the idea was to prevent any additional value accruing to the undertakings, as a whole from the exercise of borrowing powers on easy terms. All additional capital needed by the undertakings was required to be raised on the best terms by the issue of debenture stock. It was assumed that all the money so raised earned its rateable proportion of the average profit made by the company employing it. The excess of the average percentage over the interest payable on the debenture stock issued, *plus* 1 per cent. for management, is taken as the profit earned by the new capital. This difference has to be paid to the Chamberlain of the City of London, as trustee, for the purpose of purchasing and holding shares of the Company and investing the dividend thereon, with a view to ultimately extinguishing the capital of the Company.

We have long regarded this experiment with a suspended judgment, and gladly take note of the deliberate opinion of the Royal Commissioners on the matter. They think that the operation of the clause goes beyond the intention of the Parliamentary Committee who passed it in the first instance. If the assumption that the dividend capital will always be employed at a profit greater than its cost, is not realized—as in the case of expenditure on improvement works not necessarily profitable—then the payments to the Chamberlain are so much loss to the shareholders, and retard the attainment of the maximum statutory dividend with the consequential diminution of charges to the consumers. Where the maximum dividend is paid, they may retard or diminish the reduction of charges. This is a lesson on the difficulty of tapping the "unearned increment" of profit, due to improved financial facilities, for the purpose of draining it off for outside uses. But there are other practical objections. The Chamberlain has to buy stock which is continually diminishing in quantity; and being always in the market purchasing against himself, he naturally has to pay dearly for the investment.

There remains to be considered the effect of such an arrangement on the transfer value of an undertaking. Are these payments to be dropped *ipso facto* with purchase by a public authority, on the score that the end for which they were enacted was attained? At the first blush, it would seem that this is the fair thing to do; but the Royal Commissioners have their doubts. After discussing the question with regard to various considerations, they can get no further than an opinion that an arbitrator would have to take their existence into serious account; while Parliament would probably make them useful in connection with the redemption of the purchase money. Altogether, it does not appear that this peculiar provision of Metropolitan water legislation is a great, if any, improvement upon the ordinary disposition of premium capital. Inasmuch, however, as the existence of the arrangement is due to the "wisdom" of the financial advisers of the City of London, it is deserving of particular study.

The net result of collating the recommendation as to the extinction of gas companies' obsolete or dead capital, with the observations of the Water Commissioners as to the means actually in operation for the reduction of the water companies' share capital, leaves the former exactly where it was before—as a mere "pious opinion." This may be esteemed unfortunate, or the reverse, according to the point of view. It is at least certain that we are left as far off as ever from any practicable opening whereby the formation of a sinking fund might be approached without appreciably increasing the capital burden pressing upon the shareholders or consumers, or both.

A New Gas-Engine.—A new vertical high-speed gas-engine, for which many advantages over the ordinary horizontal type are claimed, has just been constructed at the works of Messrs. T. Melvin and Sons, Engineers, Glasgow. The new engine is 4 feet long, with a breadth of 2 feet, and depth of 3 feet, and the weight is 1½ tons. The compactness of the machine, and its steadiness in running at high speed, are considered to be its most important features; and it is claimed for the engine that it is eminently suitable for electric lighting installations.

IN THE CAUSE OF INTELLIGENT HOUSE-BUILDING.

The art of building human habitations is one of the least progressive of all arts. Considering the innumerable opportunities for advance and experiment offered by the incessant building operations that constitute the growth of towns, the statement might be strengthened into the positive declaration that there is more unintelligent repetition, and less invention and design, in house building than in any other department of human productive industry. House after house, terrace after terrace, suburb touching suburb—up they go, year by year, with a dreary, soulless monotony that weighs like a tangible burden upon the intelligent observer. Professional architects meet together and talk about their art; but they shudderingly repel the suggestion that they are in any way responsible for the making of suburbs. That is the work of the speculative builder, who is naught to the exalted artists of the R.I.B.A.; while he, for his part, as a fairly honest tradesman with a living to get and a public to serve, cannot afford to have any dealings with these Olympian eminencies. The architect differs from the engineer in many respects; but perhaps the greatest difference of all lies in the attitude of the members of these two professions towards the pounds, shillings, and pence of construction. The cheapest possible engineering construction is, with rare exceptions, also the best. The greatest triumphs of engineering are those most strictly bound to the severest economy of capital outlay and working costs. Most engineering is, in the end, adapted to the service of the mass of the community, and tends to cheapen common life and to ease it for the poor.

As regards building, the work of providing houses for the mass of poor, and comparatively poor, people to live in is left in the hands of the ordinary builder, who has to make the most of every brick and plank, and study the attractive power of a bit of stained glass or a quaintly-shaped porch against costly plumbing which is not seen by the casual eye of the "house hunter." This enterprising tradesman gets no guidance from the professional architect, who, indeed, is powerless to give it. Architects do not work for the "market"—the market, that is to say, where houses of over £50 rental are the higher limit. There was a meeting not long ago of surveyors interested in the practical development of building estates; and they all agreed that there is no "market" for houses of £80 rental. These expensive residences are the beginning of a fancy class of the builder's trade; but the popular "market" draws the line at £50 rental. The number of such houses built, and building every year, is enormous; and they are one and all outside the magic circle of professional architecture. The public who make this market cannot afford to have anything to do with professional architects; because where a speculative builder will provide a decent house "with all modern improvements" for £45 a year, if an architect is called in the annual cost will run up to half as much again. This is not altogether, not even chiefly, the architect's fault. It is mostly the difference between the price of a "ready made," and a "bespoke" article; but the result is deplorable, all the same. We are writing now facts, not fancies; and the facts of the housing of the mass of the population are of the utmost importance to many interests.

Among others, the interests represented by the "Journal" are deeply concerned with the housing of that order of the people of England the members of which live in dwellings rented at from £20 to £50 a year. They constitute the bulk of private gas consumers for all purposes; and they are also the most heavily rated and taxed, in proportion to their means, of the English people. They do not see the "Journal," and would be incapable of carrying out our suggestions and acting upon our counsels if they did; so we must be satisfied with endeavouring to serve them indirectly, through the public officials and professional men who do read these pages regularly. Here and there, perhaps, a little improvement may be helped forward thereby; and every little is so much to the good. We cannot hope to lighten the heavy monotony of character that makes the modern suburb so inexpressibly uninteresting; because this is due to the necessity, already acknowledged, of the most being made of every brick and piece of material. The modern "developed building estate," in effect, is an example of that standardizing process which in all organized manufactures is the key to the greatest economy of production. So it is that the experienced eye is able at a glance to classify row after row of "eligible villa residences" by their rental, to a pound; and the instructed vision can also see beneath the surface and tell exactly how they are put together.

The Public Health Acts, and the Building Bye-Laws of local authorities have done much to raise the standard of construction of suburban residences, by stopping the worst of the trickery of the dishonest builder. There is very much more to be done, however, in the way of securing co-operation in regard to the opening up of new "estates" between the proprietary interests, the local authority, and the public services of gas, water, telephone, and conveyance. Much deserved odium has been cast upon the English "building lease" system. This system has doubtless in the past been fruitful of "slum" settlements; but it exists, and the wise man will rather try to make the best of it which is possible, than waste time in devising fiscal traps for the "unearned increment." The necessity of road making offers the local authority their opportunity to have a hand in

the performance of suburb manufacture. The gas and water interests have also their part to play in regard to new roads. It ought to be possible to ensure the regularity of the building upon these roads, so as to avoid the awful gaps and stretches of "No-Man's land" which depreciate new neighbourhoods before the first houses built are a season or two old. There should be some rule of building continuously from one end, thus enabling the gas and water pipes and the road and side paths to be made good as the development goes on.

The improvement of building construction is a thing that cannot be forced far ahead of the demands of the public. These are very effective so far as they go, as is proved by the general addition of circulating boilers and fixed baths to all but declared cottage property. This luxury was such a heavy tax upon builders that improvement stopped with the same. We have recently looked over a number of houses to let, and examined some architects' designs for small residences, without discovering any advance upon the now standardized "bath-room, h. and c." of the house-agents' advertisements. It is the fashion; and having conformed to it, no attempt is made to do better, and some of the old-world conveniences of ample kitchen and scullery room, adequate cellarage and so forth, are sacrificed for its sake. It never seems to occur to anybody that people are not always bathing, or that, having the circulating boiler to start with, a good many things might be done with it besides providing one or two baths a day. Still there is no systematic provision in the small house for gas-cooking stoves and gas-fires. Consequently, these appliances are put in as extras—and the gas-cooker is only too apt to announce its presence in the house by a vile odour reaching right out to the front door, all for the want of a little provision for ventilation. The householder is hardly to be blamed for this. He hates "extras" and charges for accessories of all kinds. He has no objection to a gas-cooking stove, or to the cost of hiring it; but when he understands that the kitchen floor will have to be taken up for the gas-pipe, and that sundry other arrangements will be needed, he is discouraged. As to having a ventilation hood over the stove, which may or may not answer its purpose—he will not "run to it."

All these things are questions of fashion. Time was when nobody expected fixed baths, or circulating boilers with hot and cold water laid on, much less gas connections for stoves and lights. Not one shillingsworth of such fixtures will builders and landlords provide until they are made to realize that desirable tenants expect them. There are other matters, moreover, which go to improve building construction, but for which the £50 rent-payer will have to wait. Much work awaits doing in the way of fire-delaying construction. No house is really safe with the actual match-box staircases; and to sanction these for anything above one storey is worse than carelessness. The establishment of a rational practice in dwelling-house ventilation is still in the future. In the "Journal" for the 30th ult., we gave an extract from a paper by Mr. Arthur Rigg on the ventilation of interiors, which is only another indication of the slight fashion in which the subject is commonly treated, even in relation to public buildings. Private-house ventilation cannot be said to exist apart from the common infliction of draughts. The wearisome controversy over ventilation methods for large public buildings, and the argument as to whether the foul air should be drawn off through high or low level openings, will never be settled until somebody goes to the trouble of ascertaining what happens in the actual working of typical arrangements. No record of ventilation systems on the large scale is worth the paper on which it is printed, without the addition of a certificate by some independent investigator that the intention of the designer has been achieved.

As regards private house ventilation, Mr. Arthur Rigg, who, in his paper already cited, laid such stress upon the removal of carbonic acid from and near the floor of rooms, will perceive that this is precisely what the common fireplace does. A floor-level temperature a degree or two above that of the outside air is thus preserved, while the temperature at the ceiling is about double this figure, for winter averages. Not an ideal condition of the domiciliary atmosphere, when it is freezing outside! But that such a state of things should be possible is entirely referable to the stereotyped fashion of building. The builder, as Professor Lewes remarks in one of his popular lectures, most scientifically provides against the danger of asphyxia by making doors and windows, flooring boards and skirtings, of a nice easy fit. But he spoils all, unfortunately, by making his ceilings and cornices tight—until the plaster falls off.

We began this essay by remarking on the generally unprogressive character of the art of building, and have gone into some details connected with a few householders' requirements to prove the allegation. A book might be written on the subject, if it were worth any one's while to perform such a thankless task. It is to be desired that whoever is solicitous to work in the cause of progress in this regard should collect, and put into circulation, all the facts it is possible to get hold of. Mr. C. F. Botley, for example, is working out at Hastings an interesting problem in artificial lighting and ventilation by the aid of a simple thermometer. More things can be done with a thermometer than the ordinary man wots of; and its competence to answer questions of ventilation is high. It is hardly necessary, for instance, to analyze the top stratum of the air of an inhabited apartment for carbonic acid when the temperature at the cornice is 90° and that at the floor line 45° Fahr. Nor is it wonderful that the family doctor is a frequent visitor to dwellings where this state of things commonly prevails throughout the winter season. If these things are constantly being observed and exposed to view, householders will begin to inquire about the general sanitary condition of their dwellings; and then improved building will follow.

AN EARLY WORKER IN THE GAS AND WATER INDUSTRIES.

It not unfrequently happens, in connection with the rise and progress of a great industry, that some of the men who have taken a by no means insignificant part in helping to establish it upon a permanent basis, are entirely lost sight of, or are known by name to only a few, when, in the process of time, the object for which they laboured has been attained, and the development of the industry passes into other hands. To a certain extent, this is the case with the gas industry. This is rather to be regretted; and when, some months ago, we had the pleasure of being introduced to a relict of one of these early workers in a field which has of late years yielded such rich harvests, we took the earliest opportunity of giving our readers some particulars respecting him. Within the past few days we have received an account of another of these early workers—William Matthews—contained in a biography written by his great-grandson.* The preparation and production of this story of his ancestor's work has evidently been a labour of love to the author; for not only has he been at infinite pains to collect the necessary material, but he has actually printed the book at his private press. As to how he has executed this part of his task, we shall say nothing—being concerned rather with the matter itself than with the manner in which it is presented. We will only say that we think it was a pity, while his book was in the press, he decided to limit the issue to 66 copies. But it may be presumed that the original intention was to distribute it among the remaining members of the family.

William Matthews was born at Birmingham on Feb. 26, 1771; his father being a saddler carrying on business in the Bull Ring. Nothing is known about his boyhood; but at the age of seventeen he became acquainted with Dr. Priestley. Having a taste for literature, he readily took to the Doctor's works, and entered deeply into theology and science. In April, 1802, his attention was first attracted to gas lighting, to which he was devoted all his life. He witnessed the illumination of Messrs. Boulton and Watt's factory at Soho, carried out by Murdoch to celebrate the Peace of Amiens, and described it as an "extraordinary and splendid exhibition of gaslight." He was thus early, as he acknowledged nearly thirty years later, "led to appreciate its value, and to anticipate the great advantages which would probably result from its gradual improvement and extended adoption at some future period." Shortly after this event, a friend of his—one Josiah Pemberton—made numerous experiments, at his premises in Bull Street, in the manufacture and purification of coal gas, and discovered its utility for manufacturing purposes, such as soldering, &c.

Owing to stagnation of trade in Birmingham, Mr. Matthews came to London in 1805. During his first few years' residence in the Metropolis, he took the opportunity of seeing some of Winsor's exhibitions of gas lighting; but, owing to their frequent failure, they did not meet his approbation. Moreover, being aware of Murdoch's previous experiments, he felt that his former fellow-townsman was being deprived of his right to be called "the discoverer of gas lighting." On subsequently learning that Winsor had been assistant to Le Bon, who had shown gaslight in Paris in 1801-2, Mr. Matthews was led to minutely criticize many of the German's pretensions, and attack them from time to time. In fact, he was always a firm supporter of what he regarded as a prior claim. An instance of this is recorded in the case of a Mr. Cook, who, in 1810, was awarded a silver medal by the Society of Arts for a gas apparatus for soldering tubes and other articles. Mr. Matthews was indignant at the award, knowing that his friend Pemberton had constructed and fixed the appliance in Cook's shop.

In 1815, Matthews went back to his native town, and started a carpet and furniture warehouse; but he was unsuccessful, and returned to London in 1821. During his second residence in the Midland capital, however, he devoted himself ardently to gas lighting, having become personally acquainted with Samuel Clegg, from whom he obtained a considerable amount of information. Little is known of his life for the next few years; but his great aim appears to have been to oppose the establishment of new gas and water works in the Metropolis, on the grounds that the existing Companies were able to supply all that was needed. One of the earliest of the projects to be denounced by him was that brought forward in 1823 for the establishment of the London and Westminster Oil-Gas Company; Ricardo and others maintaining that oil gas was better than that made from coal. Many gas makers, however, held the contrary opinion; and Mr. Matthews sided with them. About this time he began to write on gas lighting—obtaining some useful information from both Pemberton and Clegg. His earliest published article appeared in the "Technological

* "A Biography of William Matthews, the Expositor of Gas and Water Engineering." By Arthur Weight Matthews. Published by the Author at 330, City Road, London.

Repository" for July, 1827, respecting a statement made that a Mr. Leadsom, of Birmingham, had patented an "ammoniacal process" for purifying gas. Mr. Matthews asserted that such a process had been employed by Mr. Wilson, of Dublin, in 1817. It was also stated that Mr. Cook, of Birmingham, recommended the use of lime for purification; and Mr. Matthews pointed out that this had been already done by Murdoch in 1805. His literary efforts resulted in the production, in October, 1827, of his first book, entitled "An Historical Sketch of the Origin, Progress, and Present State of Gas Lighting," which was favourably reviewed. In the following month he published "A Compendium of Gas Lighting," in which he claimed that he had conveyed to his reader "a clear and intelligible description of the general principles and practice of gas lighting." These publications, the latter of which is noticed in the first volume of "King's Treatise on Coal Gas," were received with but little favour by those who had already written upon the subject; and a controversy ensued between Mr. Matthews and Mr. F. A. Winsor, son of Winsor of Lyceum fame. Peckston criticized them unfavourably; and some strong language was used on both sides.

Early in 1828, Mr. Matthews endeavoured to obtain the position of Secretary to the Imperial Gas Company; but in this he failed. About the same time he became a contributor to the columns of the "Morning Advertiser," advocating the use of meters by licensed victuallers. His attention was also drawn to proposals to establish new Gas Companies in London; complaints having arisen as to the charges and the monopoly of the Chartered Gas Company. One of the new undertakings was the British Gas Company, and the other the West London Gas Company. Mr. Hedley, the principal Engineer of the former, having published a pamphlet which he addressed to the Lord Mayor, censuring the Chartered Company for their "excessive charges and the inferior quality of their gas," Mr. Matthews published another, also addressed to the Lord Mayor, repudiating the assertions, and declaring the object of the writer to be to "depreciate and degrade the Chartered Company in order to elevate the British Company with a plea of supplying the Metropolis with purer and cheaper gas." He also denounced the scheme of the West London Company as "an artful plan for the sordid interest of its projectors, and not, as professed, for the benefit of the citizens." During the year, a patent appeared for a "domestic gas apparatus," to enable householders to make their own gas by the aid of a common fireplace. Although he vigorously attacked this apparatus, he was not opposed to real improvements in gas appliances, as he thought very highly of those made by Clegg and the Crosleys.

In 1827, Mr. Matthews got into a controversy on the Thames water question, complaints having been made against the use of that water for dietetic purposes. How history repeats itself! He thought the water was not so impure as it was represented to be. A great point was made of the pollution of the Thames by gas-works refuse; but Mr. Matthews endeavoured to show that the assertions were erroneous. A Mr. Vanhesan, a chemist, supported him—saying that "ammoniacal liquor, commonly called gas water, is too valuable to be thrown away." Coming back to gas, we find Mr. Matthews, towards the close of 1828, in the midst of controversies on "portable gas" and Mr. Winsor's claims. A Mr. Thick, a Director of the proposed West London Gas Company, now enters the lists, and comes in for some hard knocks. About this time a prospectus appeared for a "South Metropolitan Gaslight Company," which Mr. Matthews put down to Mr. Thick. An incident not unworthy of notice was the fatal explosion in the oil-gas manufactory at Covent Garden Theatre. This accident led Mr. Gordon, the patentee of the "portable gasholder," to recommend it as producing the safest of all lights; whereupon Mr. Matthews disputed the statement. This controversy lasted some months. It ended by Mr. Gordon stigmatizing Mr. Matthews as the advocate of great incorporated coal-gas companies, and attributing his hostility to "portable" gas to fear of rivalry. The latter retorted that to talk of rivalry was absurd in view of the fact that the companies' price was one-seventh that of portable gas.

During these controversies, Mr. Matthews had not neglected water matters. In an anonymous pamphlet entitled "The Water Question," he severely criticized the assertions made with respect to Thames water. He characterized the alarm which had been raised concerning this water as a contrivance for getting up a new company. A parliamentary inquiry took place; and, as the result, in August, 1829, Sir Robert Peel addressed a letter to the three Water Companies in West London, recommending a scheme for improving their supply by obtaining water from the Colne and from the Thames above Richmond. The Companies rejected the proposal; whereupon Mr. Matthews published a pamphlet on the subject of the letter, and addressed it to "one of the proprietors of the Grand Junction Water-Works." It was his "Water Question" pamphlet, with a postscript justifying Sir Robert's action as being prompted by the "purest motives and an ardent desire to serve the public."

The death of Winsor in Paris, in 1830, once more drew the attention of the public to his claim to be the discoverer of gas lighting; and as the obituary notices which appeared in the papers gave him this credit, Mr. Matthews once more stood up in support of Mr. Murdoch. This led to more newspaper correspondence and some hard hitting. In 1832, second editions of the "Compendium" and the "History" were published; but the contents of the books were practically the same as in the first edition. In 1834, Mr. Matthews was employed in one of the departments of the New River Company; and in November of that year he issued a prospectus of a work to be entitled "Hydraulia," which he had prepared from materials collected in the previous four years. The book appeared in April, 1835, and was received with general commendation by the Press. Just after the closing pages were printed, and prior to publication, the author's attention was drawn to the prospectus of a "Pure Spring Water Company." Finding it contained many of the old stories concerning the river being polluted with gas refuse, he commented upon the scheme in the preface of "Hydraulia," and repudiated the idea that a sufficient quantity of water could be obtained from borings. About this time a Bill for supplying London with water in accordance with a scheme prepared by Mr. Telford was rejected by Parliament, much to Mr. Matthews' satisfaction. His engagement with the New River Company gave him an insight into the internal working of the concern; but his excessive anxiety to elucidate what seemed to him to be not very clear led to his dismissal. He thereupon addressed the shareholders by means of a pamphlet, in which he exposed the "great expenditure unaccounted for by the managers." At this time there were great complaints as to the Company's supply, especially at fires; but Mr. Matthews' criticism of their affairs did not prevent him from supporting them, and declaring that they were capable of supplying all the water that was requisite. An inquiry into this matter was held by the City Lands Committee of the Corporation, extending over several weeks.

As Mr. Matthews began with gas, so his last publication was issued in defence of this illuminant. In September, 1835, complaints were made by the parishioners of Lambeth in regard to the dulness of the gas-lights; and several meetings were held at which the supplying Company were reprimanded. Mr. Matthews made an investigation into the matter, and in November published a pamphlet entitled "Gas Lighting Projects," in which he complained of the Parochial Authorities heavily taxing the Company's pipes—thus raising further contributions from them—and then, disregarding the terms of the Act of Parliament requiring them to give a proper light in the streets, bringing the bright light "down to the murky glimmering of oil-lamps," in order to save about one farthing per night on each public light. He therefore thought that, if fair play were given to the Company, there would be no need of a rival which pretended that it could manufacture gas at a cheaper rate and give a better light. The views expressed in this pamphlet by Mr. Matthews were supported by the "Mechanics' Magazine," "not only because of his long and familiar acquaintance with gas matters, but because of the perfect honesty of purpose which characterizes everything that issues from his pen." This pamphlet, as already stated, was his last publication. He died at his daughters' house at Hampstead on Sunday, March 27, 1836, in his 66th year; and his remains were interred a few days later in the detached burial-ground of Hampstead Church.

In addition to gas and water works, Mr. Matthews took great interest in other branches of engineering, among them being canal navigation. His writings were received with some favour abroad; his "Compendium" being translated into French by M. Merle, for his "Traité sur le Gaz," a short extract from the "History" being added. His "Hydraulia" was reviewed in the "Journal des Savans;" and extracts from his various letters appeared in Dingler's "Polytechnisches Journal." He is described by his biographer as being "persevering in all he undertook; weak in business habits, but fond of learning, and very quick at figures. A good critic, though his replies were often embittered with sarcasm and ridicule." Finally, he was "ever ready to give assistance for the benefit of his fellow-beings."

A Vitrified Clay Water-Pipe, about 2 miles long, was laid in La Salle (Ill.) in 1884, as a gravity supply line from springs to a pumping-station. The pipe was 24 inches in diameter, and put together with portland cement joints. It was laid through bottoms along the Illinois River, and a portion of the route was across very swampy land which was overflowed every year. The pipe is now leaking in many places, due, it is believed, to the settlement of the line and the breaking of the joints. It will be replaced by a 24-inch cast-iron main.

The Duty of Pumping-Engines.—In a recent number of the "Engineer," there is a report by Mr. W. Cawthorne Unwin, F.R.S., of two trials of a pair of triple-expansion vertical pumping-engines supplied by Messrs. Hathorn, Davey, and Co., of Leeds, to the Corporation of the town. The effective work in the case of the second engine was $167{\cdot}6 \times 1{,}980{,}000 = 331{,}850{,}000$ foot-pounds per hour. The actual coal consumption was 296·5 lbs. per hour. Hence the actual duty was 125,350,000 foot-pounds per 112 lbs. of coal. Mr. Unwin explains that the efficiency of the boiler was not good; and therefore the duty was not exceptional. With a good boiler, hand fired with Welsh coal, the evaporation might, he says, very well have been 9·5 lbs. per pound of coal. Then the coal consumption would have been 240·8 lbs. per hour. In that case the duty would have been 154,350,000 foot-pounds per 112 lbs. of coal—an exceptionally high duty. The practical result of the installation has been that, in spite of the growth in population, the coal consumption at the Corporation (Headingly) station has now been reduced to about one-half its former amount.

PERSONAL.

Alderman T. Speight, of Bradford, who was for some years Chairman of the Gas Committee, has sent in his resignation.

Mr. C. F. Kent, of Wokingham, succeeds Mr. W. C. Jones as Manager of the Kingswinford works of the Brierley Hill Gas Company.

Mr. J. C. Hall, of Ilford, and formerly of Ruthin, has been appointed Manager of the Ennis Gas-Works, in succession to Mr. G. H. Stewart, who goes to Southbank.

The management of the Dundalk Gas-Works, which has been relinquished by Mr. G. R. Love in order to take the position at Guildford vacated by Mr. Reilly, has been entrusted to Mr. G. Airth, of Paisley.

The Directors of the Manningtree and Mistley Gas Company, Limited, have appointed Mr. J. W. Brooke, of Mistley, to be Secretary and Manager, in place of the late Mr. Mauldon. Mr. J. F. Sissen has been re-appointed Managing Engineer.

Mr. A. V. Daniel has resigned his position as Manager of the Portishead Gas-Works, and will be succeeded by Mr. A. W. Stone, formerly a pupil of Mr. T. Canning, the Engineer and Manager of the Newport (Mon.) Gas Company, in whose department he has recently been engaged.

The Town Council of Elgin have resolved to disjoin the offices of Gas and Water Manager. Mr. James Kay, the Gas Manager, who was appointed last year, will have charge of the gas undertaking only; and the duties of Water Manager will be performed by Mr. Turriff, who is also Burgh Surveyor.

After thirty years' service as Secretary of the Ceara Gas Company, Limited, Mr. Thomas Guyatt has been offered a seat at the Board, which he has accepted; and his second son, Mr. George Rait Guyatt, has been appointed Secretary in his place. It will be seen by our report of the meeting of the Crystal Palace District Gas Company last Friday, that Mr. T. Guyatt was unanimously elected to fill the vacancy in the office of Auditor caused by the retirement of Mr. Alfred Lass.

It will be with a feeling of regret that the information will be received that Mr. S. Stewart, Gas Engineer to the Corporation of Greenock, contemplates retiring. Mr. Stewart has held the position of Manager of the gas undertaking at Greenock for more than forty years. The members of the Gas Trust have every reason to be satisfied with Mr. Stewart, and they are very unwilling to part with him. It is understood that an endeavour will be made to arrange that, while he will be allowed to retire from active duty, his services will be retained as Consulting Engineer.

Mr. Alexander Dickson, who has been Secretary of the Kent Water-Works Company for the past thirty years, has resigned his position; and, in appreciation of his long and valuable services, and of his earnest and successful labours in furtherance of the interests of the Company, he has been granted the full retiring allowance to which he is entitled, and been appointed to fill a vacancy on the Board caused by the death of Mr. George Smith, who was formerly the Chairman. The Company are much to be congratulated on the fact that, though parting with one who has rendered such great assistance in furthering the interests of the shareholders as well as those of the consumers in the district, and who has seen the Company rise to its present state of prosperity, Mr. Dickson will still be associated with the direction in any action that may be necessary as the result of the report of the Royal Commission on Water Supply. Mr. Dickson has occupied the combined positions of Clerk, Secretary, and Accountant to the Company; and we understand that, by desire of the Board, he will continue to supervise the transaction of business pending the completion of existing negotiations and the transfer of the full duties.

OBITUARY.

We regret to record the death of Mr. W. Barratt, who, up till 1895, was Engineer of the Grantham Gas Company—a position he had occupied for rather more than twenty years. Deceased was one of the founders of the Eastern Counties Gas Managers' Association, of which he was the first President.

The Board of the Ventnor Gas and Water Company have had the misfortune to lose within the past sixteen months four of their members; the last to be removed being one of the most recently elected—Mr. W. H. Chatfeild Clarke, who died suddenly, at his residence at Niton, on the 3rd inst.

We regret to record the death of Mr. Joseph Cowen, of Stella Hall, Blaydon-on-Tyne. The name of Cowen, as our readers are aware, has been identified for a very long period with the manufacture of fire-clay utensils—an industry which was established at Blaydon Burn more than 150 years ago. The first gas-retorts were made there in 1826; and Messrs. Cowen's goods have ever since been celebrated all the world over, the firm having shown retorts and other "objects in fire-clay" at most, if not all, of the great exhibitions. Deceased was known to members of the North of England Gas Managers' Association from his attendance at their meetings. He had been in indifferent health for some few years; but a serious change took place last Sunday afternoon, and he passed away during sleep—the cause of death being cardiac failure. He was in his 71st year.

We regret to record the death, on the 10th inst., in his 71st year, of Mr. W. B. Davidson, who for about 45 years was connected with the Tynemouth Gas Company. He joined the staff as a young man; and his persevering efforts and business ability obtained for him the position of Secretary, which he filled with conspicuous credit to himself and to the entire satisfaction of the Directors and shareholders until about two years and a half ago, when he retired. The officials and workmen then presented him with a handsome reading-chair, towards the purchase of which the Directors also subscribed. Mr. Davidson is survived by four sons and two daughters. The interment took place on Monday last week at Preston Cemetery; the Company with which deceased was so long associated being represented by the Chairman (Mr. J. B. Williamson), the Vice-Chairman (Mr. W. S. Oxley), and the Engineer (Mr. W. Hardie).

NOTES.

The Manufacture of Wire Ropes.

Mr. J. Dixon Brunton, in a paper read before the Scotch Iron and Steel Institute, treats of the actual state of the industry of wire manufacture, which is a fast growing one, as fresh uses for metal wire are found every day. Roping wire is a branch of trade of great and increasing importance. Mr. Brunton claims to have made a special study of this class of wire, and to be able to produce plough steel rope wire with a very high breaking strain and exceptionally tough. The difficulty hitherto in manufacturing this class of wire has been to get the correct temper of the steel required for the various strains, and the correct temperature at which to heat these different grades of steel before tempering. Modern improvements in iron-works laboratory practice, and especially the advance in pyrometry and knowledge of the use of the microscope, has removed much of the difficulty; and wire-making practice has consequently become much more exact. The qualities specified by the rope makers vary considerably; the tensile strain alone ranging from 30 to 130 tons per square inch. The diameter of the wire must also be very rigidly adhered to. Mr. Brunton described the process of, and the necessity in some cases for, galvanizing the wire intended for rope-making. Wires for hausers and the ropes used in wet mines are galvanized; but Mr. Brunton did not say anything as to the reliability of this means of preventing corrosion.

Lightning and Street Electric Lights.

A remarkable series of photographs of electric street lamps during a thunderstorm, by Mr. Sydney Webb, of Dover, was published in "Nature" for the 8th inst. Professor G. G. Stokes, of Cambridge, appends some critical observations on the photographic record. It appears that Mr. Webb's original intention was to photograph the lightning which was expected; but when the pictures were developed it was found that the public arc lamps had come into the field. Every one of these was betrayed to be sending off a flow of visible electricity to the ground in an irregular line. Thus the lightnings of the lamps were more novel and interesting than those of the sky; and next time there was a thunderstorm at Dover, Mr. Webb was ready with his camera to register the effects. On the second occasion, the electric arc lighting was supplemented by the seasonal decorative lighting by incandescent electric lamps festooned between the arc-light standards along and across the roadway. The effect of the arrangement on the sensitive plates was striking. The discharges of lightning overhead were accompanied by a maze of irregular discharges from every electric lamp to the ground, which, as Professor Stokes says, look as if they might be dangerous. He is inclined to regard the phenomenon as "a case of Nature's wireless telegraphy." He joins with Mr. Webb in hoping that photographers will follow up the inquiry by exposing a few plates in the neighbourhood of electric lamps when there is a thunderstorm. It is thought that the currents of these local discharges is chiefly spent in electrifying the air. If so, they may not be so dangerous as some of them look. Still, says Professor Stokes, "until we know more about the subject, it might be prudent in a thunderstorm to keep a little away from arc lamps in a street"—but on the other side from the high-potential mains.

Improving the Quality of Steam.

A suggestive article on the quality of steam has appeared in the "Engineer." It was apparently inspired by the reflection that fuel for steam raising is, and is likely to remain, dear. Consequently, anything tending to economy of steam, and to its most advantageous use, is of present interest. As regards the quality of steam, it is remarked that very few steam-users appear to have even a remote idea that it has any qualities at all—that it can be good, bad, or indifferent. Yet it is understood upon reflection that there is such a thing as dry, clean steam; but few power-users trouble themselves to make sure that this is what they are getting from their boilers. Good steam is quite dry—that is to say, it does not carry suspended water with it. Neither does it carry suspended dust or dirt; and it has about 10° of superheat. This is the working fluid with which all steam-engines will give the best possible results; and when engines are required to run continuously for a long time, this is the quality of steam which least provokes breakdowns. Unfortunately, superheating is still the exception rather than the rule; while

priming is the rule instead of the exception. When boilers are clean, fed with clean water, of ample power, good design, regularly fired, and near the engines, the proportion of entrained water may be as low as 5 per cent. in the steam. When the entrained water is sandy or gritty instead of clean, and there is enough of it, trouble is sure to follow. The drying of steam is an extra. It can be effected by an oil-jacketed attachment to the main steam-pipe, with the oil kept hot after the manner of a circulating boiler; or it can be done at small expense by a gas-heating arrangement, something of which nature was years ago tried by Mr. Bryan Donkin. Possibly the subject may be reopened by this suggestion of superheating by means of oil.

The Tempering of Steel.

Mr. A. Campion, discoursing on the heat treatment and the micro-structure of steel, remarks that the variety of definitions of annealing given in books and current among theorists and practical men induced him to investigate the matter, with the object of ascertaining the methods that were most suitable for annealing various grades of steel. This inquiry has not yet been completed; but Mr. Campion has published an interim statement of the results so far attained. Beginning with the point of the best temperature to which steel should be raised in order to anneal it, and how, the author found a very considerable difference of opinion prevalent in this regard. It was proved by physical and microscopical tests that, in the case of mild steel, such as is usually supplied for constructional uses, there is a fairly wide latitude of temperature to which the metal can be heated to anneal it, or at any rate to considerably increase its ductility. The best results were given by experiments in which the sample was heated fairly rapidly to the required temperature, which did not exceed 750° C., or a red heat. The change from hardening carbon to cement carbon takes place somewhere about 40° or 50° below this critical temperature; and as the time-element comes into important play at this stage of the process, it is imperative to let the steel, after having been made red hot, cool down as slowly as possible through this modifying temperature. Tempering may be done without raising the metal to the higher temperature named, though only by keeping it for a long time at the modifying temperature; but the result is not so good. In the case of higher carbon steels, it is necessary to work to closer limits of temperature, which must be ascertained for every particular instance. A properly annealed steel is defined as a metal which possesses the highest possible ductility with the lowest possible tensile strength for its grade, accompanied in all cases with fine grain. The metal is then in the best condition for withstanding dynamic strain.

Furnace Management.

A thoughtful letter on the dearness of fuel and the economies that may ensue from this condition of the fuel market, has been communicated to "Engineering" by Mr. George Craig, F.I.C., of Glasgow. The writer remarks that all improved and labour-saving methods of stoking boiler and other furnaces make greater demands on the intelligence of the users, the more they do away with mere drudgery. This is a general law of mechanical progress, which is liable to be overlooked occasionally. Mr. Craig also draws attention to the fact—not usually to be found mentioned in treatises on heat—that the calorific value of a fuel is not everything. Even of greater importance is a right understanding of the conditions under which a boiler, or whatever it is, is capable of producing the best results, and also of the suitability of different fuels or methods of firing for realizing these conditions. It is through attention to this consideration that extraordinary results have been obtained from oil and gas firing. In the case of steam raising, for example, it has been proved that 1 ton of fuel oil is equal to 2 tons of coal, although the relative theoretical evaporative powers are only as 17 to 14. The great economy of the oil fuel is simply due to the greater facility it affords for being burnt with just the right quantity of air, and no more. Those who have had to deal with gaseous firing know that a similar result follows from its use. Notwithstanding the vast importance thus shown to attach to the proper burning of all kinds of fuel, users of solid fuel have been the last to act upon this warning. Mr. Craig has devised an instrument which he calls a "Combustion-Tester," for continuously and automatically ascertaining and registering the proportion of carbonic acid gas in the flue gases of a furnace. It is urged that no works manager having furnaces to look after should be satisfied without some means of knowing at any and all times what these are doing. From 19 to 20 per cent. of carbonic acid in the steam-free fuel gases is the theoretical ideal; but by the use of the testing instrument, as much as 17 per cent. may be expected with gaseous firing. With solid fuel the proportion, and consequently the saving of fuel, is much less; but still Mr. Craig holds out the hope of getting this figure up to 15 or 16 per cent. Very often, where there is no check, the carbonic acid is down to 8 per cent., or even to 4 per cent., which means a waste of 30 per cent. of the fuel burnt.

Mr. Norman E. Cash, son of Mr. Thomas Cash, has commenced business at 32, Trinity Road, Birmingham, as representative of a number of firms dealing in gas specialities—Messrs. Alder and Mackay, of Edinburgh, the Anchor Tube Company, of Birmingham, Messrs. John E. Williams and Co., of Manchester, and Messrs. Nicholson and Co., of Halifax, being among the list of firms in which he is already specially interested.

TECHNICAL RECORD.

THE CHARLOTTENBURG GAS-WORKS.

We are now able to continue our translation of the description, furnished us by Herr A. Müller, of the Municipal No. 2 Gas-Works at Charlottenburg, of which he is Manager. The first instalment, together with a ground plan of the works, appeared in the "JOURNAL" for Nov. 14 last (p. 1188); but, to facilitate reference, the plan is reproduced to-day.

The No. 2 retort-house, marked B on the ground-plan, was erected on the site indicated, on account of the local conditions. Borings of the ground for the retort-house had revealed the fact that it was everywhere very bad building ground; and a firm foundation was not to be obtained at a depth less than 20 feet. The building was therefore constructed entirely of iron; and brickwork was used only as a lining for the walls. The construction was designed to transmit the pressure of the wind on the side directly to the middle of the house, where the firm soil for the foundations was highest. The roof is partly grooved tiles, and partly Monier; the latter being adopted where only a slight inclination is available. The ventilation is by turrets in the roof, and light is admitted by windows both in the upper part of the sides and in the roof of the house.

The question whether stoking machines or sloping retorts were to be employed, was decided in favour of the latter, owing to the bad building ground, which was only fitted for the erection of a narrow house, while stoking machinery necessitates wide charging-stages. The No. 2 house is intended for a make of 6,400,000 cubic feet of gas in 24 hours. There are to be 64 Coze settings of nine retorts, each 15½ feet long, arranged in eight stacks, each consisting of eight settings. There are four stacks on each side of the house; and the settings are back to back, so that the coke can be immediately conveyed from the sides of the house to the coke-yard. One chimney serves for every eight settings. The working is conducted in the following manner.

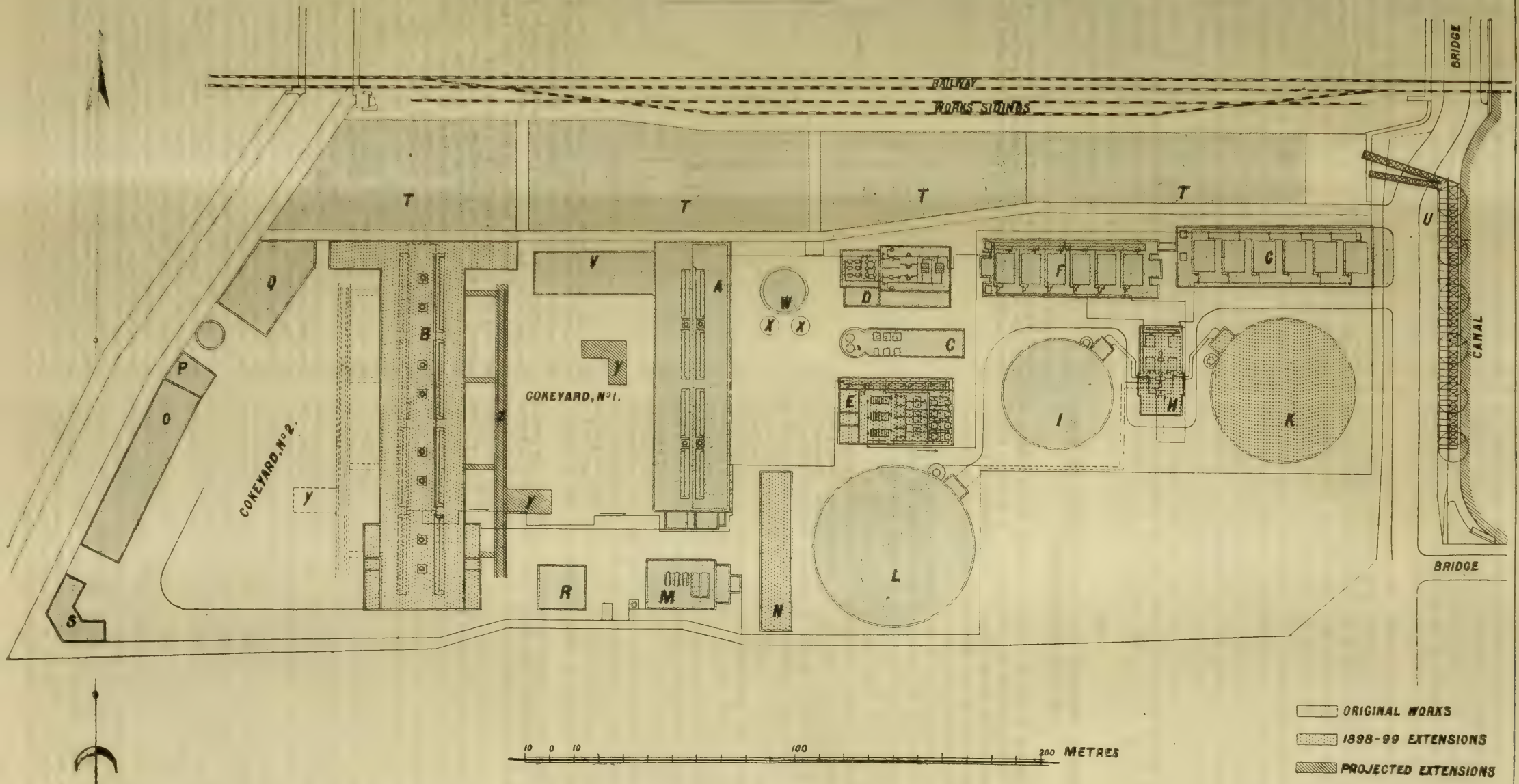
The coals are shot into the coal-breaker erected in the northerly annexe to the retort-house, from the coal-stores (coal-sheds have still to be built); and after they have been broken, they are transferred by means of a band-convevor to a coal-receiver placed beneath the roof of the house. From this they fall on to a horizontal band-conveyor, which passes above the whole range of settings and conveys the coals into receptacles, arranged one above each stack. From these receptacles the coal is drawn off into charging hoppers of special construction, each of which contains only the charge for one retort. The charging hoppers travel along a suspended rail in front of the settings. When a hopper has been filled, the mouthpiece of the retort is opened, and the charge drops into the retort. The coal distributes itself uniformly on the bottom of the retort by gravitation. After carbonization is complete, the coke is discharged through an opening which is provided in the stage in front of each mouthpiece, on to a De Brouwer conveyor trough which runs beneath the stage in front of each stack. The coke is carried by this to a band elevator by which it is raised to the high-level tramway for conveyance to the coke-preparing plant, where it is broken and sorted according to size into four distinct classes.

Gas passes from the retorts through ascension-pipes, 26 feet high, to the hydraulic main on top of each stack. It goes thence to a large foul main, and is drawn by the exhauster to the apparatus—or No. 2 condenser—house. The retort-house is provided with five elevators. Two of these are for raising coal to a stage above the hoppers, for conveyance in trolleys to the section of the house where it is required. These are for use only in case the coal-transporting machinery fails. Two elevators are provided on the high-level coke tramway, to raise the coke to it for conveyance to the coke-preparing plant. The fifth elevator carries fire-bricks, iron goods, coke, &c., up to the discharging stage. All elevators are worked by hydraulic power at a pressure of 50 atmospheres. The power is generated in the hydraulic power house, in the water-tower building. Attached to the retort-house are bath-rooms and workmen's lobbies.

The apparatus house (D) is massively constructed with an iron roof, covered with slates. It is divided into four sections for apparatus thus: (*a*) the tar-extractors, (*b*) the condensers, (*c*) the washers, and (*d*) the tar centrifugals. There are five tar-extractors, each consisting of a rectangular wrought-iron vessel containing perforated plates, which offer resistance to the passage of the gas, and thereby deprive it of a portion of the tar it contains. The tar passes through suitably arranged pipes into tar wells beneath the extractors. The gas, after traversing the tar-extractors, enters the condensing plant, which comprises eight Reutter condensers. These are furnished with self-acting sprinklers; and the condensation products are conveyed to the tar-wells already referred to. There are three exhausters for drawing the crude gas from the hydraulic main through the tar-extractors and condensers, and forcing it through three washers arranged to work in parallel, three scrubbers similarly disposed, meters, and purifying plant, to the holders. The same portion of the building also contains tar and liquor pumps, and the steam-engines which drive them. The tar and liquor from the washers and scrubbers are conveyed to an adjacent room, where they are dealt with by five centrifugal tar

GROUND PLAN OF THE MUNICIPAL GAS-WORKS (NO. II.) AT CHARLOTTENBURG, NEAR BERLIN.

CAPACITY OF COAL-GAS PLANT, 8,830,000 CUBIC FEET PER 24 HOURS; CAPACITY OF WATER-GAS PLANT, 2,649,000 CUBIC FEET PER 24 HOURS.



A Retort-House No. 1.
B ,, ,, No. 2.
C Pumping Plant.
D Condenser-House No. 1.
E ,, ,, No. 2.
F Purifying-House No. 1.
G ,, ,, No. 2.
H Meter and Governor House.
I Gasholder No. 1.
K ,, No. 2.
L Gasholder No. 3.
M Boiler-House.
N Workmen's Lobby.
O Workshops.
P Experimental Gas-Works.
Q Boiler and Engine House.
R Stores.
S Offices.
T Coal-Stores.
U Coal Unloading Plant (Hydraulic Cranes).
V Water-Gas Plant.
W Gasholder for Water-Gas Plant.
X Oil-Tanks
Y Coke Plant.
Z Coke Transporting Plant

separators, and run off into underlying tar and liquor tanks. A second purifying house—marked G in the plan—is now arranged for, and will be provided with six purifying vessels and two revivifying floors. Four station meters, placed in the governor-house, deal with the whole of the gas made. The same house contains the governors which control the pressure in the distributing system.

A third gasholder of 3½ million cubic feet capacity will be erected in front of No. 2 condenser and apparatus house.

The steam for the complete plant is to be produced by an extended boiler installation in the boiler-house. The existing hydraulic plant is likewise to be extended to a corresponding degree. The present coal-raising apparatus will also be increased by the addition of four hydraulic cranes provided with grabs. In connection with this, a coal-shed is to be erected, and furnished with Hunt's coal-discharging apparatus, to automatically convey coal from the stores to the retort-houses.

Other buildings are the offices, the workshops, the coal-testing place, the water-gas house, the coal-breaking and sorting installation, and a new engine and boiler-house. The average consumption of gas per head of the population of Charlottenburg in 1898-99 was about 3600 cubic feet per annum. The number of inhabitants was 170,000; and the extension of the works will, on the basis of the same rate of consumption per head, serve for the supply of a population of 490,000.

A LABORATORY METHOD FOR THE ANALYSIS OF COALS FOR GAS MANUFACTURE.

At the Meeting of the Manchester Section of the Society of Chemical Industry on the 5th ult., Mr. J. G. A. Rhodin, F.I.C., read a paper on the above subject. The following is the text, with a short report of the discussion, as given in the current number of the Society's "Journal."

From the point of view of the analyst, this subject presents many difficulties, as the technical users require to know not only the chemical constituents of the coal, but also certain physical properties, the determination of which falls rather outside the sphere of the ordinary analytical practice.

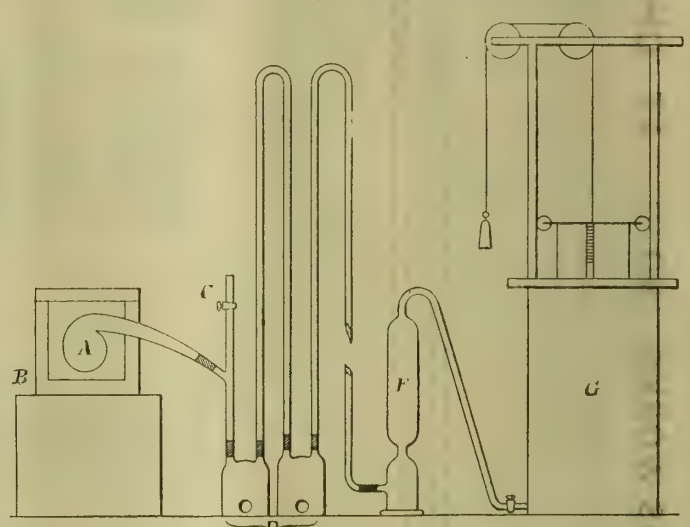
In consulting most of the written works on gas manufacture and the assay of the materials for the purpose, the chemist finds not what he wants, but a description of a certain amount, or rather large amount, of special apparatus designed for use in gas-works. However ingenious the apparatus may be, it is generally too cumbersome, expensive, and arbitrary for use by the scientific chemist. Nothing is left to the skill and judgment of the analyst, and everything depends upon the apparatus in the first instance, and the instructions accompanying the same in the second instance. To take an example: When you are requested to determine the amount of gas developed from a ton of coal, and its illuminating power, you are supposed to use iron retorts 3 feet long, and gasholders weighing something like half a ton, and all kinds of gauges and apparatus for regulating the flow of gas, &c. You are told to use 1000th part of a ton (roughly 1 kilogramme), for the experiment, and also to use pieces of the size of a walnut. The question whether an average sample can be obtained in this way is not discussed; and you are told to repeat your determination several times, and take a mean of the results.

In considering the question, I could not exactly see the reason why work on this large laboratory scale should give a better result than work on a smaller scale, selecting your sample more carefully, crushing the coal to smaller particles and quartering the sample, and selecting a final example of (say) 100 grammes. In fact, I made up my mind that a sample obtained in this way ought to be more representative than the sample obtained in the other way, even if the latter were larger, considering the size of pieces recommended. All practice of mineral, metal, and ore analyses has proved that, if a proper average sample be chosen, it can be made fairly representative, even if small in quantity. When it is a question of gas coals, however, where the gas evolved has to be examined as to its illuminating power, the sample must not be too small. We require at least 20 to 30 litres of gas for the determination of the illuminating power. A specimen of 100 grammes is quite sufficient for this purpose. This is so much more to be recommended as the temperature required for driving an equal amount of gas out of cannel coals, as that produced in technical practice is the most extreme white heat obtainable by ordinary fuel. I tried different temperatures on a sample of cannel coal, and found that only from 60 to 70 per cent. of the gas could be obtained by heating the coal in an ordinary muffle furnace for gold and silver assays, the temperature being about 1000° C.

The furnace used by myself was a Fletcher furnace for draught. I then determined to use unglazed porcelain retorts with the Fletcher injector furnace, and I constructed an apparatus for the purpose, the details of which are given below.

The apparatus consists of the following parts: B is a Fletcher injector furnace, and through its side a porcelain retort A is fitted by drilling a hole through the material. The neck of this retort communicates with an air condenser, the tube having a branch C closed by a cock. I constructed the air condenser out of small Woulff bottles with a bottom tubulure, which can serve for letting the tar out when the apparatus is cleaned. The main part of the condenser is made out of long U-shaped tubes, about 6 feet in length and 10 millimetres internal diameter, connected with these bottles by rubber ligatures, as shown in the illustration. Five or six of these tubes are sufficient for all practical purposes. For purifying the gas, I use a large-sized Fresenius tower F, which I charge with soda lime. Two of these towers might be used, one charged with lime and the other with ordinary ferric hydrate, such as is used in gas-works; but the soda lime, on account of its physical properties, is better for laboratory experiments, as it ensures the apparatus against accidental stoppages. From this purification tower the gas is led into the gasholder G, which is constructed both for measuring the gas and the regulation of its subsequent flow; and I have chosen a very small diameter in order to get large readings on the scale. The divisions being about 3 centimetres for 1 litre, the bell is roughly 20 centimetres in diameter and 1 metre long, and fitted with a tube for holding the thermometer, &c. The counterpoise is also arranged on well-made rollers, and the gasholder constructed so as to be perfect and as smooth in its run as any regulator which it is possible to obtain.

When making an experiment, I charge the retort with 100 grammes of the coal to be analyzed; and through the tube C I displace all the air in the condenser and purifying apparatus, either by gas from the mains, or else by working a small charge of 10 grammes of coal in a small retort through the same. The unoccupied volume of the condenser and the purification apparatus in the retort being only a small percentage of the volume of the gasholder and the gas to be measured, the filling of the apparatus from the main would not cause any appreciable error apart from the great saving in time and labour. As it is always desirable to control results by repeated experiments, I prefer to work on three charges of 50 grammes, one after the other, and



Scheme of Arrangement for Developing Gas.

to let out the gas from the first charge—making an approximate estimation of the illuminating power, and utilizing the gas from the two last charges for its accurate determination.

For some classes of coals, 150 grammes might be found to be too much for the capacity of the gasholder which I have constructed, and which holds 30 litres. In this case, the first working off of 50 grammes will show what quantity will be carried. One mode of procedure is as follows: I work off the charge by heating the retort slowly during the first five minutes, and afterwards increasing the heat as soon as possible to an intense white. It is generally next to impossible to prevent all the tar from entering the gasholder; but in the construction which I have made, this holder can be easily cleaned from the inside. In about 20 minutes the charge is worked off, and the apparatus is disconnected from the gasholder, which is left to stand for a short time to allow the gases to assume a uniform temperature, which is then observed together with the barometric pressure. Afterwards the volume is reduced to gas of a temperature of 60° Fahr. and 30 inches barometric pressure (the gas saturated with water vapour). The coke formed out of cannel coal can easily be removed out of the retort by shaking the same—a thing which is not the case with caking coals, which require a rather larger retort made of iron to screw apart.

When the gas has been measured, the gasholder is connected with the burner on the photometer, and you can then easily proceed to take the illuminating power. According to the usual custom, you regulate your flow of gas so as to have, roughly, 5 cubic feet passing in an hour from the burner; and it is customary, for gas from cannel coals, to utilize an ordinary batswing burner. For coal gas an argand burner is required, the normal burner being described very particularly in the "Instructions" of the Referees. For those who prefer to do so, a burner fulfilling exactly the requirements can be obtained from any firm supplying chemical apparatus. The regulation of the flow of gas is done by means of a large tap with a rather long lever. The approximate flow is observed on a suitable indicator, such as, for instance, Thorpe's instrument. The actual flow of

gas is taken by time observations and measurement on the gas-holder, and the pressure in excess of that of the barometer by means of a small water-gauge on the holder.

I do not propose to give the exact operations with the photometer, which are all well known. I only wish to remark that for the measurement you ought always to compare with at least two spermaceti candles, as the readings become larger than is the case when only one is employed. It is self-evident that, even with the best arrangement for regulating the flow of gas, it is impossible to make this flow to correspond absolutely with 5 cubic feet an hour; and hence corrections have to be made to reduce the actual result to that obtainable when the exact amount of gas is passing. The ordinary procedure for doing so is to reduce the volume of gas per hour, as shown by the gas-holder, to 60° Fahr. and 30 inches barometric pressure, afterwards to divide by 5, and divide by this figure the result in candle powers obtained before. Correction is also made for the spermaceti burned per hour, and the candle power reduced to that corresponding to candles burning 120 grains per hour.

I may say there are very grave objections to this method of calculation, and the results are not absolutely accurate. For instance, when the gas burns in air of less density, a smaller bulk is burned than if the air had the normal temperature and pressure. As the illuminating power depends upon the fierceness of the combustion, it is evident that a somewhat larger correction ought to be made for the low pressure, as this gas, when issuing, does not come in contact with as much and as dense oxygen per surface unit as it should do when burned under normal conditions. Theoretically, a gas issuing from an orifice has work exerted upon it by the weight of the gasholder; this work being converted into heat when the gas issues from the narrow slot—the heat being retained by the issuing gas. This gas also exerts a certain amount of work upon the surrounding air; the equilibrium of temperature being slowly brought about by the cooling effect of the air into which the gas issues. Under the same conditions of temperature and barometric pressure, we can therefore supply a different amount of energy to the issuing gas, inversely proportional to the size of the slot in the burner, and directly proportional to the pressure above the atmospheric pressure exerted by the gasholder. If the same volume of gas issues per unit of time, your pressure depends upon an alteration of the burner orifice. If the formula usually employed for reducing the illuminating power to the normal conditions be correct, such an alteration in the potential energy of the gas would not affect the illuminating power.

The experimental evidence required for arriving at an accurate formula for the purpose of reducing illuminating power, can be obtained by burning the same kind of gas in burners with different orifices under the same conditions of pressure and temperature. Another factor that will have to be taken into consideration is the moisture in the air, as this will strongly influence the cooling effect upon the flame, for obvious reasons.

With reference to the photometer to be used, this instrument may be of any construction which allows an accurate estimation of candle power. The main part of the instrument—namely, the photometer head—ought to be of a construction which is less liable to personal errors than the old-fashioned grease spot; and we have in the Lummer-Brodhun photometer head an excellent development in the right direction. This has an arrangement of prisms which enables one to observe and compare the light reflected from the two sides of a white porcelain disc in one visual observation; and I find that this instrument will distinctly indicate very minute variations in candle power long before any effect can be observed on a grease spot. Messrs. Hartman and Braun, of Frankfort, make a large photometer provided with this class of head, which has been adopted as a standard at the German National Laboratory at Charlottenburg. I do not, however, quite approve of the way of mounting this instrument, and I made slight modifications in the same—suspending the bars from brackets on the wall, &c. Among other things, I provided the tube on the photometer which serves for holding the gas-burner with a Thorpe's indicator, which shows approximately the flow of gas. From the above, you will see that the only appliances required outside what is generally found in any laboratory are the photometer and gasholder. The photometer is, of course, useful for other purposes, although its employment may not be very extensive in analytical practice. The actual cost of this apparatus is, when constructed on my plan, about £25, which is not very much out of the way.

With reference to the other determinations to be made, I can only recommend certain methods. For determinations of volatile matter, take a small crucible, and enclose it in a larger one, surrounding the little crucible with finely powdered charcoal; then heat the whole to a bright red heat, and take the loss as volatile matter. The results agree far better than those obtained when heating direct over a burner in a platinum crucible. For instance, in two determinations of the same cannel coal, I got 34·6 and 35·2 per cent. of volatile matter. A slightly higher result would, of course, be obtained by increasing the temperature; but, expressed as a percentage of weight, the gas evolved beyond a bright red heat is very inconsiderable. I must remark, however, that the heating must be continued for a considerable time. Constant weight is obtained only after a couple of hours' heating. The determination of ash is, of course, well known to all of you, and also the fact that hygroscopic water has to be determined by direct weighing of the water. The determination of the specific gravity of a coal is of great importance, and no other than the pycnometer method is sufficiently accurate. It is also to be recommended to put the pycnometer under the receiver of an air-pump, in order to take away gas bubbles adhering to the particles of coal. I mention this as some classes of coal when heated in water give off a certain amount of soluble substance. The sulphur can be determined by heating with mixed carbonates of potash and soda in a roomy platinum crucible, using a large excess of the reagents, and heating over a small luminous flame for at least 1½ hours before increasing the heat to any considerable extent. The ordinary method of using lime in the combustion-tube can also be employed. The results of the two methods agree well; but in both cases care has to be taken against quick heating. The analysis of the coal gas produced can be carried out according to the choice of the analyst himself.

I find that, by adhering to the instructions given above, results are obtained agreeing with practical working exceedingly closely, and closer by far than the results obtained in the small furnaces with iron retorts ordinarily used in gas-works. With this latter apparatus, it has always been the case that the analyst has found a smaller quantity of gas of a higher illuminating power than that which is obtained in practice. This no doubt depends upon the fact that the heat used is not intense enough for driving out the last traces of gas. Working on the lines I have laid down, I arrive at a slightly larger quantity of gas of approximately the same illuminating power as that obtained in practice; this depending upon the fact that the temperature of the small injector furnace can be raised to anything practicable.

In the discussion which followed the reading of the paper, several speakers who had had considerable experience in analyzing and testing gas coals for illuminating purposes, both in the laboratory and also in the works, expressed an opinion that laboratory methods are practically valueless from a gas manager's point of view. The only practical method of testing coal intended to be contracted for in large quantities was by passing from 50 to 100 tons through the works. It was thought that Mr. Rhodin's apparatus would give too low results, both as regards the quality and quantity of gas, on account of the large condensing area. Having to start with a cold retort which had to be heated gradually would result in condensation of the rich benzol products—the toluene and naphthalene—which ought to go into the gas. Dr. J. Grossmann explained that Mr. Rhodin had described a laboratory method for the analysis of a number of samples of coals. They all knew that analyses contained in text-books did not always give the same results; but they were considered to be near enough for comparative purposes. He expressed his disappointment that Mr. Rhodin had not shown in his paper in what respect his method agreed with, or differed from, the old methods, and how much closer would be the result obtained by the same coal on a large scale. If Mr. Rhodin could give the figures, they would be exceedingly useful. Mr. Rhodin, in reply, said that he only wished to show one method whereby research could be made which was less cumbersome than so-called laboratory methods; and he maintained that by his method better results could be obtained than by a retort which contained 1 kilogramme. All he attempted to do was to reduce the present "laboratory" methods to a smaller scale. Everybody knew that it would not represent large quantities of coal, but it would give some idea of the quality of the coal under examination. He contended that, the small apparatus being made of glass, the heat carried to the gas would go down to the lower temperature very gradually. He could not answer the points raised on the technology of the gas manager, nor put before the meeting an analysis which he had been making for others; but he would furnish on some future occasion the figures required.

Coal in Western Australia.—According to a cablegram just received from Perth, Western Australia, the result of the sinking of a drill on the property of the Collie Coal Trust Development Company, Limited, has been the discovery of three magnificent seams of coal—one 4 ft. 11 in., at a depth of 301 feet, another 3 ft. 9 in., at a depth of 323 feet, and a third 4 ft. 9 in., at a depth of 411 feet.

Manchester District Institution of Gas Engineers.—The thirtieth annual meeting of this Institution will be held at the Grand Hotel, Manchester, next Saturday. According to the circular issued by the Hon. Secretary (Mr. S. S. Mellor, of Northwich), the business will consist of the election of one new member, the reception of the Committee's report and the statement of accounts, the election of office-bearers, and the delivery by Mr. T. N. Ritson, of Kendal, of his Inaugural Address.

Electric Incandescent v. Auer Incandescent Gas-Lamps.—The electric incandescent lamp and the Auer incandescent gas-lamp were recently compared for effect and economy in the "Giornale Scientifico." For economy in illuminating, the latter is found superior; but the life of a mantle is stated to be considerably less than that of an electric incandescent lamp. Figures are given showing the percentage loss of candle power of two English and three German mantles, after burning 100 and 500 hours; the means of these being respectively 15 and 45 per cent. For the loss of light in electric lamps, the author gives 20 per cent. after 500 hours as a practical figure, taking perfect and faulty lamps together.

BRITISH ASSOCIATION OF WATER-WORKS ENGINEERS.

The members of the Association held their half-yearly meeting last Saturday, in the Geological Society's Rooms, at Burlington House, W. The PRESIDENT (Mr. William Watts, of the Little Don Water-Works, Sheffield) occupied the chair; and a considerable number of gentlemen from other Societies were present by invitation for the purpose of ascertaining their views on the principal subject entered on the *agenda* for consideration.

CONFIRMATION OF MINUTES.

The proceedings commenced by the SECRETARY (Mr. Percy Griffith) reading the minutes of the meeting held in London in June last; and on the proposition of Mr. C. H. PRIESTLEY (Cardiff), seconded by Mr. R. H. SWINDLEHURST (Bolton), they were confirmed.

NEW OFFICE-BEARERS AND ADDITIONS TO THE ROLL.

Messrs. Shaw and Wells were appointed Scrutineers of the balloting-lists. They subsequently reported that the following gentlemen had been selected to take office:—

President.—Mr. C. H. Priestley, of Cardiff.

Vice-Presidents.—Mr. W. A. Richardson, of Birkenhead, and Mr. Frederick Griffith, of Leicester.

Members of Council.—Messrs. C. E. Jones, W. A. Paskin, H. Roberts, C. Sainty, E. Sandeman, R. H. Swindlehurst, W. Terrey, E. A. B. Woodward, F. J. Bancroft, and W. Millhouse.

Hon. Secretary and Treasurer.—Mr. W. G. Peirce, of Richmond.

The following additions to the roll were also reported:—

Members.—Mr. Arthur Andrew, of Oldham; Mr. G. Cochrane, of London; Mr. Augustin Gonzalez, of Buenos Ayres; Mr. G. W. Lacey, of Oswestry; Mr. W. H. Morris, of Cavan; Mr. G. E. Vint, of Holmfirth; Mr. W. H. Wood, of Banbury.

Associates.—Mr. C. Aburrow, of Johannesburg; Mr. F. A. Carter, of Newport; Mr. W. F. H. Creber, of Cardiff; Mr. A. E. J. Hubbard, of Lowestoft; Mr. J. H. Parkin, of Kendal; Mr. A. Riley, of Fleetwood; Mr. B. E. F. Sheehy, of Limerick.

The PRESIDENT announced that Mr. Priestley had cordially invited the Association to receive the hospitality and kindness of Cardiff at their summer meeting, which would probably be held as soon as possible—probably the first week—in July. They had elected on this occasion members and associates to the number of fourteen; and he might take this opportunity of saying that the Association now, with the elections that day, represented about 220 towns in the country. They had on their books 235 members and associates; so that he thought this spoke well for the success of the Association, which was also in a good financial position.

THE NATION'S WATER SUPPLY, AND ITS EFFECTIVE CONTROL.

Mr. C. E. JONES (Leyton) read a paper on the above subject; and it evoked a long and animated discussion, in which the views of at least twenty-five gentlemen (many of them visitors) were elicited. The paper, with an epitome of the debate, will be given in next week's issue.

Before the members separated, votes of thanks were accorded to the delegates who had attended from various Societies, to the Geological Society for the use of their rooms, to Mr. John Shaw for auditing the accounts, and to Mr. De Rance for his gift of books and pamphlets.

COVERED RESERVOIR CONSTRUCTION IN THE UNITED STATES.

At the last Meeting of the Boston Society of Civil Engineers, a paper was read by Mr. FRANK L. FULLER on the above subject, in which he gave an account of several covered reservoirs constructed under his direction. It has since been printed in the "Journal of the Association of Engineering Societies," and the following abstract appeared in a recent issue of the "Engineering Record."

In 1895-6, a covered reservoir was constructed at Winchendon (Mass.) for the storage of underground water. The plans were prepared in 1889; but the work was not put in hand. The reservoir has an internal diameter of 69 feet at the bottom and 71 feet at the top; the depth of water being 17 ft. 8 in. The wall is of rubble masonry, 5 feet thick at the bottom and 2 ft. 6 in. at the top. The total height of the wall is 21 feet; 2 feet being below the bottom of the reservoir. The capacity to the high-water line is about 504,000 gallons. Two sets of 12 in. by 16 in. brick piers, laid in Germania portland cement mortar, and connected by lintel arches, support two rings of brickwork, which, in turn, support the concrete dome at the centre and two circular concrete covering arches. The brick rings are 12 inches, and the concrete roof is 8 inches in thickness. An embankment surrounds that part of the masonry wall which is above the original surface of the ground; and the filling is extended over the roof, and properly graded and seeded to grass. Test pits were sunk at the site, in order to ascertain the location and depth of the ledge, which was known to exist. It was found impossible to entirely avoid this ledge; and considerable rock excavation was required at the bottom on the westerly side. The rubble masonry wall was begun in April, 1896. The core was left until the wall had been built, when it was removed and placed in layers, wetted, and rammed about the back of the wall. This was built of local rubble stone; and considerable difficulty was experienced in obtaining stone of suitable quality. The ledges in the vicinity were found to be unfit; and the wall is largely composed of split field boulders. At the top of the wall a skewback was cut, from which to start the outer concrete covering arch. A derrick and hoisting-engine were used in making the excavation and laying the wall. The ledge was excavated to a sufficient depth to allow of 6 inches of concrete being placed on the bottom. It was more or less disintegrated, and but little of that removed was fit for use in the wall. All piers rest on solid ledge or on large granite blocks firmly bedded in the bottom. The piers are laid in portland cement mortar; the lintel arches connecting them and the spandrel filling between them being of American cement brick work 12 inches thick. The covering arches and the dome at the centre are of portland cement concrete 8 inches thick. The proportions were one of cement, two of sand, and five of broken stone not more than 2 inches in its longest dimension. Centring for the entire roof was put in place before any concrete was used. Before the dome or the covering arches were started, the embankment about the masonry wall was raised to the top of the wall and thoroughly rammed; thus assisting the wall to resist the thrust of the arches. The concrete was put in place in sections bounded by radial lines. The positions of these sections of covering arches and dome were such that they were on radial lines extending entirely across the reservoir from circumference to circumference; thus tending to transmit any horizontal thrust to the rubble masonry wall. After the last of the concrete had been in place fourteen days, the wooden centring was removed; and the roof was found to be hard and smooth, and no cracks or settlements could be detected. At the centre of the roof is a ventilator consisting of an 8-inch cast-iron sphere perforated with ½-inch holes. Entrance to the reservoir is had through a 26-inch manhole in the roof, on the top of which is placed a heavy cast-iron cover secured by a padlock. The soil on the top and sides of the reservoir was seeded to grass to protect the bank from being washed by the rains. A 6-inch vertical overflow-pipe connected with a waste-pipe of the same size prevents the reservoir from overflowing.

Water can be withdrawn from the reservoir by a 14-inch main only to within 6 inches of the bottom at the centre. All below that level must be drawn out through the 6-inch waste-pipe, which can be done by opening a 6-inch gate in the bottom of the reservoir. This arrangement prevents any sediment from entering the distribution system. The 6-inch waste-pipe passes through the bottom of the reservoir with a slight inclination, and comes to the natural surface of the ground a few hundred feet below the reservoir. On account of the large amount of ground water in the soil, a hole was made in the 6-inch cast-iron waste-pipe, so that it acts as a drain for reducing the level of the ground water under the reservoir, and prevents any upward pressure on the bottom when the reservoir has been emptied. There is also a 2-inch composition pipe set vertically in the concrete bottom, making direct connection between the space under the concrete bottom and the reservoir. This pipe is about 1 foot long, and at the top has an elbow, and on it a check-valve opening towards the reservoir. In case the water in the reservoir is drawn lower than the outside ground water, this check-valve will open, and the ground water flow into the reservoir, so that no pressure can be exerted on the concrete bottom. An under drain, composed partly of 4-inch Akron pipe, laid with open joints, and partly of broken stone, is laid on the inside of the masonry wall, and just below the under side of the concrete bottom. This collects the ground water, and brings it near the point where the 6-inch cast-iron waste-pipe passes through the wall. The sides and bottom received carefully applied plaster and brush coats of portland cement, and the reservoir is practically water-tight. The cost of the reservoir, as shown by the final estimate of the contractor, was $8218.

In 1891, a circular covered reservoir was built for the water-works of Franklin (N.H.), from the design made for the reservoir above described. It is 69 feet in diameter at the bottom, and 71 feet at the top. The height from the bottom to the springing is 19 ft. 6 in. The brick piers supporting the roof measure 12 in. by 12 in., and were laid in portland cement mortar. The roof is of brick masonry, laid in Rosendale cement mortar, and is 8 inches thick. The average load at the base of each pier is a little less than 23 tons per square foot. The cost of this reservoir, as shown by the final estimate, was $9032.

In 1893, a covered masonry reservoir with a capacity of 1,013,000 gallons was built by the town of Methuen (Mass.). It is similar in design to the Franklin reservoir, but has an inside diameter of 95 feet at the top and 93 feet at the bottom. The piers are also larger, and the reservoir is deeper. It is practically an enlargement of the Franklin reservoir by the addition of another circular covering arch of the same span and rise. The roof is supported by 60 brick piers, 16 inches square, laid in portland cement mortar. The dome and covering arches are of brick, 8 inches in thickness, laid in Rosendale cement mortar. The average load per square foot at the base of each pier, including a possible load on the roof of 50 lbs. per square

foot for snow and ice in winter, is about 14·1 tons. The height of the middle row of piers from the bottom of the reservoir to the springing line of the lintel arches is 18 ft. 3 in. The piers are 7·54 feet apart on centres, measured along the circumferences of their respective circles. Most of the work was done by day labour; and the total cost of the reservoir, exclusive of land, was $16,864.

At Monson (Mass.) there is a circular covered reservoir used in connection with the water supply for the Massachusetts Hospital for Epileptics. It is 39 feet in diameter at the bottom and 41 feet at the springing line of the roof, which is 20 feet above the bottom. When full, the water is 19 feet deep, and the reservoir contains 178,000 gallons. The bottom of the excavation for this reservoir was entirely in rock. The wall is 4 ft. 6 in. thick at the bottom and 2 ft. 6 in. at the top. It was built of rubble masonry laid in mortar composed of one part of Hoffman cement and two parts of sand. When the rubble masonry wall had been carried to an elevation a little below high-water level, a band made of two plates of soft steel, each 12 inches in width by ½ inch in thickness, was riveted together in place on blocking, so as to enclose the wall when completed. The band was 46 feet inside diameter, and was made of ten plates, each about 29 feet in length. The plates break joints, and have a splice-plate on each side. That on the continuous side is 24 in. by 12 in. by ¼ in. in thickness. That on the other side is of the same size, but ⅜ inch in thickness. Each of the joints has 26 rivets ⅞ inch in diameter. There is a rivet at every 3 feet between the joints. One coat of boiled oil was applied at the shop, and two coats of red lead after the band was in place. After the paint was dry, the wall was completed inside the band, and the band enclosed in masonry or concrete to protect it from rusting. The object of the band is to resist any thrust caused by the action of the concrete roof, which has a diameter of 41 feet and a rise of 4 feet. The concrete is 10 inches in thickness at the springing line, and decreases to 8 inches at the centre. It was put in place on accurately and thoroughly built wooden centring, covering the entire reservoir. The centring was supported on large chestnut posts, which rested on a set of hardwood wedges, which were driven out when the centring was removed. The boarding of the centre was of good quality planed spruce, tongued and grooved. The concrete was composed of one part, by measure, of Alsen portland cement, 2½ parts of good sand, and 4½ parts of broken stone not over 2 inches in its longest diameter. It was thoroughly mixed as dry as could be well rammed, and put in place as quickly as possible. The amount required for the roof was about 40 cubic yards. The work was begun about 10 o'clock in the morning on Nov. 4, 1897, and completed at noon the next day, or in twelve working hours. As soon as the concrete had begun to set, it was covered with 5 or 6 inches of earth to prevent freezing. Afterwards about 2 feet thickness of soil was put on in the centre, increasing to about 3 feet at the circumference. An embankment was also built about the part of the masonry wall above the natural surface of the ground. On Dec. 3, 1897, the wedges under a number of the posts supporting the centring were removed; but there appeared to be no settlement of the concrete roof. On Dec. 24, the entire centring was removed; and the concrete roof appeared hard and smooth. No settlement occurred, and no cracks could be discovered. The masonry wall was then carefully pointed up, and a ½-inch plaster coat, composed of equal parts of Alsen portland cement and sand, was put on. The object was to make the reservoir as nearly water-tight as possible. Later the wall was gone over with a brush coat of neat portland cement in the form of a thin paste.

In building the masonry wall, great care was taken to leave no voids, and to have a wall of solid stone and mortar (preferably with as much stone and as little mortar as possible), and still have all the joints filled. No stone was allowed to extend entirely through the wall, as this would form a continuous joint along which the water might escape. At the point where the 8-inch outflow-pipe and the 6-inch waste-pipe enter the reservoir, the wall is carried somewhat deeper, and is carefully built under and around the pipes. Cast-iron flanged sleeves are secured to both pipes by a lead joint at the centre of the wall, to prevent the water following the outside of the pipe through the wall. On the 6-inch waste-pipe, nearly under the manhole, is a 6-inch T, in which is placed a 6-inch pipe with the upper end at high-water level. On the inner end of the 6-inch waste-pipe is a 6-inch gate, which is closed except when draining the lower part of the reservoir. The outer end of the waste-pipe comes to the natural surface of the ground about 170 feet from the centre of the reservoir.

Considerable ground water was found in the excavation. In order to relieve the bottom from an upward pressure when the reservoir is empty, the bottom of the excavation was under-drained by placing a layer of broken stone over the top of the ledge. By means of 4-inch Akron drain-pipe, the ground water is brought together under the concrete bottom, and passes through the footing course of the masonry wall and out to the natural surface of the ground through a 4-inch cast-iron pipe. Outside the reservoir is a 4-inch gate on the 4-inch cast-iron drain-pipe. By closing this gate, the flow of the ground water from around and under the reservoir is checked; and it will rise to such a level outside the reservoir wall that it will escape at some point. If the reservoir is emptied when the outside water is above the level of the bottom, as before mentioned, there will be an upward pressure on the bottom, which will tend to push it in. To relieve this upward pressure when the reservoir is empty and the gate on the drain-pipe closed, two 2-inch composition pipes, with check-valves similar to that mentioned in connection with the Winchendon reservoir, are provided. The cost of this reservoir was $5644, exclusive of the steel band, which cost $248.

REGISTER OF PATENTS.

Prepayment Gas-Meters.—Whitham, C., and Large, E., of Oldham. No. 5708; March 16, 1899.

This invention in prepayment gas-meters consists of an improved construction or arrangement of mechanism for actuating the gas-valve and opening the gas-inlet by means of the coins inserted.

Fig. 1 represents a vertical section of the prepayment mechanism through the axis of the valve and spindle; fig. 2, a front view; fig. 3, a vertical cross-section of fig. 1; fig. 4, a section of the coin-carrier in the coin-delivering position, after operating the delivery-valve; fig. 5, a plan

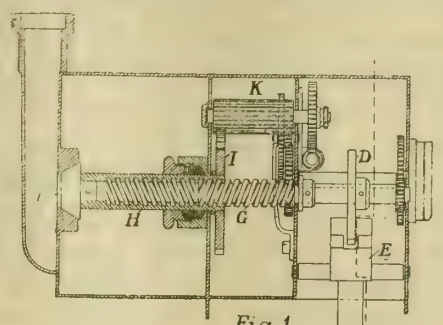


Fig. 1.

Fig. 2.

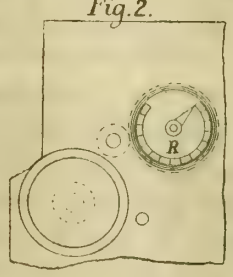
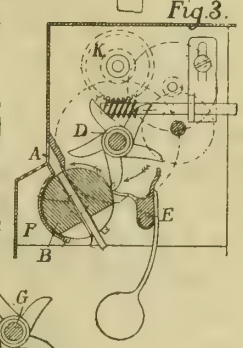


Fig. 3.



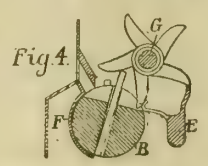
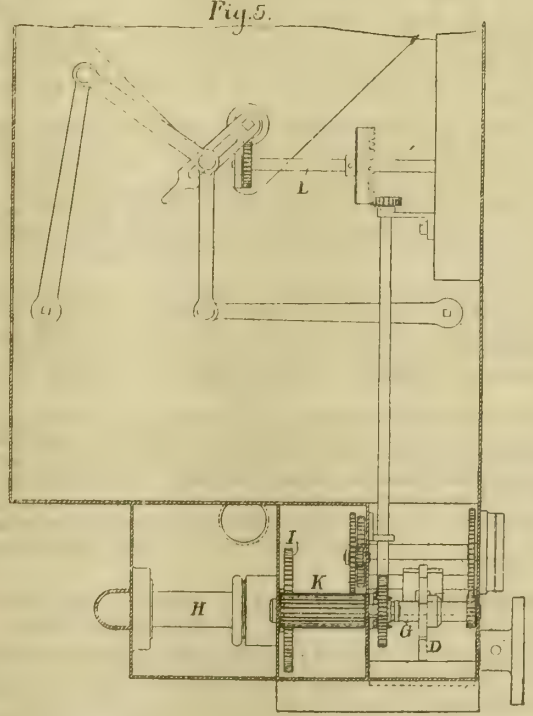


Fig. 4.

Fig. 5.



of the prepayment mechanism and gas-measuring chamber and index-mechanism. The mechanism is shown applied to a dry meter, but is equally applicable to a wet meter.

In the meter-case a slot and shoot A are arranged for the insertion of the coins, and below is a horizontal cylindrical coin-carrier B, fitted with

a knob or handle on a spindle projecting to the outside of the casing, with pegs on the cylinder abutting against suitable stops, so that the coin-carrier can be turned forward and backward between the stops for rather more than half a revolution. The coin-carrier is slotted through; the slot being of such length at the top side that the coin to be used with the apparatus (for instance, a penny) can drop into the slot, and of shorter length at the lower side so that a coin of the correct value does not drop through, while a smaller coin (a halfpenny, for instance) drops through into the cash-box. The diameter of the cylindrical coin-carrier is such that the coin, when level with the top side, projects on the underside, as shown in fig. 3.

Parallel to the coin-carrier is a shaft carrying a spider D, with curved arms; and below the coin-carrier is pivoted a forked pawl E pressed upwards by a balance-weight or spring, and so formed that, while one prong or limb rests against the circumference of the coin-carrier, another prong is in the path of the tips of the arms of the spider. It is only a short distance from one of them; while the top of the preceding arm rests upon the surface of the coin-carrier—the spider thus being prevented from turning in the direction of the arrow in fig. 3 while the meter is delivering gas. When the coin-carrier is turned after the insertion of a coin, the projecting part of the coin first pushes one part of the pawl back, and another part out of the path of the spider-arm, and then seizes under the convex side of the arm and turns the spider—the upper part of the coin-slot passing under a cylindrical segment F fixed to the casing during this movement, so as to prevent the protruding part of the coin from being pushed back. When the spider has moved forward, the pawl drops back into its former position, and prevents the carrier being turned backwards; and it also arrests the movement of the spider beyond the position shown in fig. 4. The arm seized by the coin will then be in a position shown; and as the coin-cylinder is turned a little farther, the coin drops out of the slot into the cash-box below. If the coin should not drop out, it would project on the underside, and would catch against the cover F when the carrier was turned backwards; and unless it could be made to fall out by knocking it repeatedly against the cover, the meter would have to be opened. The coin-carrier is notched out at the side of the projecting coins, to allow the arms of the spider to pass. As will be seen in fig. 4, the next arm enters a little into this notch; and as the coin-carrier (after delivery of the coin) is turned back, the arm will also be turned back so as to rest against the cylindrical surface of the carrier in the same position as the arm in fig. 3—the spider being thus turned exactly by one arm or division for each coin paid in, even if the coin should be enlarged at the projecting side by hammering.

The spindle G of the spider is cut with a quick screw-thread, and a cylindrical nut H is placed thereon, having fixed to it at one end the gas-valve and at the other end a spur-wheel I engaging into a long pinion K, placed parallel to the spindle G, which pinion is rotated from the index-driving shaft L of the meter through a crown-wheel pinion and shaft. When gas is consumed, the nut turns in such a direction that it moves the valve towards its seating when the screw-spindle is stationary—that is to say, in the same direction as the spider is turned by the coin. The turning of the spindle by a coin inserted draws the nut and valve away from the seating; the nut being prevented from turning by the wheel I and pinion K. The gas enters from the inlet-pipe P through the valve-seating into a gas-tight chamber communicating with the inlet to the meter bellows or drum; and a stuffing-box is arranged for the cylindrical nut to pass through into this chamber. For each additional coin inserted, the valve is drawn further away from its seating; and in order to close it, the meter must deliver a quantity of gas corresponding with the number of coins inserted. When the valve is brought against its seating, the delivery of gas is stopped, even if there should be some leakage of the valve, as the friction of the valve on its seating will prevent the further rotation of the nut, and thereby arrest the motion of the index-driving mechanism and the bellows or drum of the meter. The worm-wheel on the spindle of the long pinion K is made exchangeable, in order to be able to vary the quantity of gas delivered for each coin.

If an attempt were made to insert a coin attached to a string, the arm on the spider could be partly moved round without letting the coin drop out of the coin-slot in the carrier; but the coin could not be withdrawn without moving the carrier back into its starting position. This could, however, not be done after the coin has passed the prong of the pawl E; while if the carrier were turned back before the prong has slipped off the coin, the arm would be pushed back into its starting position by the face of the notch.

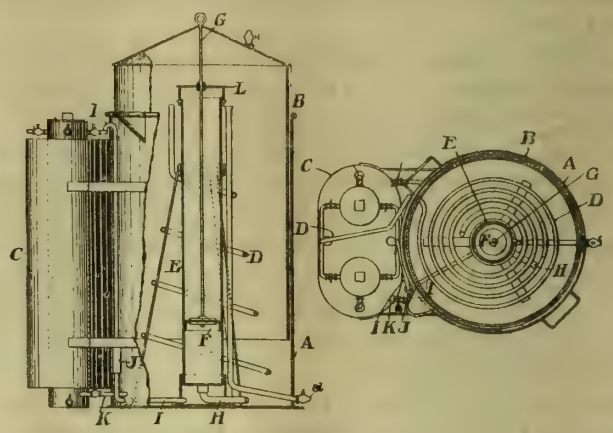
While gas is consumed, the friction of the screw-spindle G in the nut H tends to turn the spindle and spider in the same direction as it is turned by the coin; so that the arm in contact with the coin-carrier is held against it in the position shown in fig. 3, and the exact delivery of the predetermined quantity of gas for each coin inserted is assured thereby.

In order to enable the quantity of gas paid for, but not consumed, to be read at a glance, a rotatable dial R is geared with the spindle G, and an index-finger is geared with the long pinion K by means of a train consisting of a toothed-wheel pinion and spur-wheel. Each coin inserted is indicated upon the dial by the dial moving forwards one point; but as each coin's worth of the gas is passed through the measuring chambers the finger moves in the same direction as the dial, and reduces the indicated quantity upon it.

Acetylene Generators.—Leigh, H. H.; a communication from J. W. Carey, of Brisbane, Queensland. No. 23,988; Dec. 1, 1899.

The patentee provides a pump centrally within a gasholder tank; the bucket or plunger, as the case may be, being connected by a rod with the crown of the holder, while a suction pipe or valve is connected either to draw from the holder tank or from a separate water supply. A delivery-pipe (fitted with a non-return valve) is led from the pump above the highest part of the generator, and turned into the carbide chamber in such a manner that the carbide is brought in contact with the water from the bottom upwards—thus allowing the damp gas given off to dry (by the absorption by the carbide of its moisture) as it passes up through the carbide contained in the upper divisions of the generator.

A is the gasholder tank; B the gasholder; C the generator with water jacket; D the delivery-pipe coiled to increase the cooling surface; E the pump-shell; F the bucket or plunger; G the pump-rod or spear connecting it to the crown of the holder; H the suction-pipe and valve; I the delivery-pipe with valve J; K a pipe with tap provided for conveying water for starting the apparatus; and L a cover over the pump-shell used as a guide to steady the rod and holder.



The carbide is put in through the caps in the top of the generator, which having been done, a little water is admitted by means of the tap, through the pipe K, into the generator—thus causing (by the reaction of the water on the carbide) the immediate production of gas. Passing into the holder B, the gas causes it to ascend, and with it the plunger or bucket F; and, as the latter rises, it draws in water through the suction-pipe H. Then, when the production of gas ceases, or the consumption overtakes the supply, the holder falls, and the pump discharges the water through the delivery-pipe I into the generators, and causes the production of more gas, which in turn raises the holder. The apparatus thus works so long as there is any carbide in the generator.

Generating Acetylene.—Rouma, A., of Liége, Belgium. No. 24,364; Dec. 7, 1899.

This invention, relating to acetylene generating apparatus, has for its object to provide mechanism for automatically regulating the production of the gas by the fall of calcium carbide into water—the regulation of production proportionately to requirements, with regard to consumption, being effected by the rise and fall of the bell of a gasholder. The automatic liberation of the carbide is effected by employing two pins arranged upon a pulley actuated by the bell of the holder, one of which at the time of the rise of the bell draws a hammer, while the other during the descent of the bell pushes back the hammer, which, in its fall, strikes a lever operating the stopping pawl of the carbide distributor. In combination with this regulating mechanism, is a safety mechanism, consisting of a two-armed pivoting lever, controlled by a pawl, in such a manner that, when the latter disengages from a ratchet-wheel, the hooked arm of the lever falls into a tooth of the wheel.

APPLICATIONS FOR LETTERS PATENT.

2248.—Beese, R., "Hanging gas-burner for incandescent lamps." Feb. 5.
2252.—Potter, W. G., "Incandescent burners." Feb. 5.
2258.—Rowbotham, K. A. & W., "Gas and oil engines." Feb. 5.
2276.—Cloudsley, J. L., "Gas-meters." Feb. 5.
2288.—Duncan, W., "Water-meters." Feb. 5.
2300.—Stansfield, A., and Meters, Limited, "Prepayment gas-meters." Feb. 6.
2303.—Rowden, W. T., "Gas-engines." Feb. 6.
2308.—Sadtler, J. P. B., "Generating gas and water vapour for heating purposes." Feb. 6.
2337.—Le Mat, M., "Acetylene gas apparatus." Feb. 6.
2391.—Wood, W. T., "Burners." Feb. 6.
2414.—Darby, H., and Punchard, W. C., "Circular-flame gas-burners." Feb. 7.
2453.—Allen, C. E., "Driving any ordinary engine by gas or oil." Feb. 7.
2456.—Cruickshank, A., and Bryant, G. W., "Gas-stoves." Feb. 7.
2475.—Chandler, D. & S. B., "Condensation of gases." Feb. 7.
2476.—Simpson, S., "Incandescent burners." Feb. 7.
2590.—Kimball, R. D., and M'Kenzie, A. A., "Conduits for gas, water, and like pipes." Feb. 9.
2594.—Scott-Snell, C. & F. A., and The Scott-Snell Phillips Syndicate, Ltd., "Incandescent gas lighting or heating." Feb. 9.
2606.—The Victor Light Syndicate, Ltd., and Powers, V., "Acetylene generators." Feb. 9.
2627.—Craven, R. E. P., "Fluid pressure-actuating valves." Feb. 9.
2631.—Hervieu, G. A., "Generating acetylene." Feb. 9.
2632.—Beckmann, O., "Incandescent burners." Feb. 9.
2642.—Veillard, C., "Illuminating apparatus." Feb. 9.
2663.—Gibbons, W. P. & G. B. A., "Regenerative furnaces." Feb. 10.
2667.—Crane, R., "Valves for fluids and gases." Feb. 10.
2672.—Nielsen, R. A., "Incandescing media for lighting." Feb. 10.
2682.—Glover, J. G., "Torch for street lighting." Feb. 10.
2709.—Leroy, P., "Gas-generators." Feb. 10.

South London Local Authorities and the South Metropolitan Gas Company's Bill.—At the meeting of the Vestry of St. George-the-Martyr (Southwark) last Tuesday, the General Purposes Committee reported that their attention had been called to the provisions of the South Metropolitan Gas Company's Bill, and they recommended that a conference of Local Authorities in South London should be held with regard to the matter, and that in the meantime a petition be presented against the Bill. This was agreed to. The conference will take place on the 26th inst.

PARLIAMENTARY INTELLIGENCE.

PRIVATE BILLS (SESSION 1900).

HOUSE OF LORDS.

The following progress has been made with Private Bills:—

Bills presented and read the first time: Barnsley Corporation Bill, Bury and District Water (Transfer) Bill, East Shropshire Water Bill, East Stirlingshire Water Bill, Edinburgh District Lunacy Board Bill, Exmouth Urban District Water Bill, Falkirk and District Water Bill, Falkirk Corporation Bill, Glyncorrwg Urban District Council Gas Bill, Gwyrfai Rural District Council Water Bill, Hemel Hempstead Corporation (Water) Bill, Higham Ferrers Water Bill, Margate Corporation Bill, Menstone Water (Transfer) Bill, Morley Corporation Bill, Motherwell Water Bill, Mountain Ash Water Bill, Newtown and Llanllwchaiarn Urban District Gas Bill, Otley Urban District Council Water Bill, Paignton Urban District Water Bill, Ramsgate Corporation Improvements Bill, Rotherham Corporation Bill, Salford Corporation Bill, South Essex Water Board Bill, Walsall Corporation Bill.

Bills presented, read the first time, and referred to the Examiners: Bristol Water Bill, Cleethorpes Gas Bill, Dorking Water Bill, Exmouth and District Water Bill, Fishguard Water and Gas Bill, Great Berkhampstead Water Bill, Kingston-upon-Thames Gas Bill, London Sea Water Supply Bill, Newport (Mon.) Gas Bill, South Essex Water Bill, Westgate and Birchington Water Bill.

Bills read a second time: Bury and District Water (Transfer) Bill, East Shropshire Water Bill, East Stirlingshire Water Bill, Edinburgh District Lunacy Board Bill, Falkirk and District Water Bill, Hemel Hempstead Corporation Water Bill, Higham Ferrers Water Bill, Margate Corporation Bill, Menstone Water (Transfer) Bill, Morley Corporation Bill, Motherwell Water Bill, Mountain Ash Water Bill, Newtown and Llanllwchaiarn Urban District Gas Bill, Otley Urban District Council Water Bill, Paignton Urban District Water Bill, Ramsgate Corporation Improvements Bill, Rotherham Corporation Bill, Salford Corporation Bill, South Essex Water Board Bill.

Petitions have been presented against the Mountain Ash Water Bill and the Rotherham Corporation Bill.

HOUSE OF COMMONS.

The following progress has been made with Private Bills:—

Bills presented and read the first time: Aberdeen Police and Improvement Bill, Airdrie, Coatbridge, and District Water Trust Bill, Bradford Corporation Bill, City of London (Various Powers) Bill, Dublin Corporation Bill, Gaslight and Coke, Commercial Gas, and South Metropolitan Gas Companies Bill, Glastonbury Corporation Gas Bill, Halifax Corporation Bill, Hamilton Burgh Bill, Hastings Corporation Bill, Ilfracombe Improvement Bill, Lea Conservancy Bill, London Water (Purchase) Bill, London Water (Welsh Supply) Bill, Morecambe Urban District Council (Gas) Bill, Oldham Corporation Bill, Ossett Corporation Gas Bill, Scarborough Corporation Bill, Southport Extension and Tramways Bill, Spalding Urban District Council (Water) Bill, Taunton Corporation Bill, Tottenham Urban District Council Bill, West Bromwich Corporation Bill, Woodbridge District Water Bill.

Bills presented, read the first time, and referred to the Examiners: Bedford Gas Bill, British Gaslight Company (Staffordshire Potteries) Bill, Chelsea Water Bill, East London Water Bill, Gaslight and Coke Company Bill, Glastonbury and Street Gas Bill, Grantham Gas Bill, Hartlepool Gas and Water Bill, Lambeth Water Bill, Maidenhead Gas Bill, Metropolitan Water Companies Bill, Mid-Kent Water Bill, North Warwickshire Water Bill, Ossett Gas Bill, Redhill Gas Bill, Rickmansworth and Uxbridge Valley Water Bill, Rugeley Gas Bill, St. Albans Water Bill, South Metropolitan Gas Bill, Southport Water Bill, Wandsworth and Putney Gas Bill, Wetherby District Water Bill, Wolverhampton Gas Bill.

Mr. Pickersgill and Mr. Lough have blocked the Gaslight and Coke Company Bill; Mr. Whitmore and Mr. Goulding, the Welsh Water and Purchase Bills of the London County Council; and Sir F. Dixon-Hartland has taken a similar course with respect to the Welsh Water and Rickmansworth and Uxbridge Valley Water Bills.

Petitions have been presented against the Dublin Corporation Bill and the Hamilton Burgh Bill; also against the London Water (Purchase) Bill and the London Water (Welsh Supply) Bill from the Vestry of the parishes of St. Margaret and St. John, Westminster, and from the Middlesex County Council in respect of the former Bill and the Metropolitan Water Company's Bill.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Thursday, Feb. 15.

(Before Mr. Justice BUCKLEY.)

The Welsbach Incandescent Gas-Light Company v. The New Sunlight Incandescent Company.

Judgment was this morning delivered in the above-named action.

Mr. FLETCHER MOULTON, Q.C., Mr. T. TERRELL, Q.C., Mr. ROGER WALLACE, Q.C., and Mr. WALTER appeared for the plaintiffs; Mr. BOUSFIELD, Q.C., and Mr. NEIL represented the defendants.

Justice BUCKLEY having stated the nature of the case, said the defences raised were non-infringement, non-utility, and incomplete description of the nature of the alleged invention in the complete specification. There was no plea of non-patentability or a want of subject matter. Before dealing with the merits, he must dispose of the point raised by defendants' Counsel at the conclusion of the plaintiffs' case—that no evidence had been given of the manufacture or use of the mantles complained of. It was true that no evidence had been given on either of these points; but answers to interrogatories had been put in which, in his opinion, amounted to an admission of manufacture. Having read the interrogatories and answers to support this view, his Lordship proceeded to deal with the facts. Down to 1885, he said, incandescent lighting was practically confined to throwing on a solid body—such as a block of magnesium—an exceedingly hot flame. The most familiar example of this was the lime-light. But in the year 1885, Dr. Welsbach took out a patent which was, in fact, the creation of the modern system of incandescent gas lighting. This patent embraced two matters—first, the mode of forming the body which was to be rendered incandescent; and, secondly, the selection of the materials to be employed. After describing the process of making the mantles, his Lordship said by this means a body of excessive tenuity was obtained; and its fragility, while in one sense its weakness (because the body was liable to be destroyed by the impulse or energy of the flame in which it was bathed), was in another sense its strength (because its tenuity enabled it to bear excessive ranges of temperature without breaking). The materials to be employed were zirconia, lanthia, yttria, &c., in certain proportions. He then read from the specification and the claim, which was "the manufacture, substantially as herein described, of an illuminant appliance for gas and other burners, consisting of a cap or hood made of the fabric and impregnated with the substances mentioned, and treated as set forth." The claim therefore was duplex; it was both for the formation of the appliance and for the materials employed in constructing it. The provisional specification was dated Dec. 12, 1885; and the complete specification, March 15, 1886. But before the latter was filed—viz., on March 13—and therefore before the public had been informed of the nature of the invention, Mr. Imray, on a communication from Dr. Welsbach, applied for a further patent, which was the one on which the present action was brought. Shortly stated, this patent was for the use of certain substances other than those mentioned in the previous patent, which could be advantageously employed in producing an illuminating appliance the substance of the 1885 patent. It was impossible to introduce these further substances into the patent of 1885, because they were not included in the provisional specification. As usual, in cases of this description, a question arose as to the true construction of the specification. It commenced by referring to the provisional specification of 1885, because at the date of the application the complete specification of 1885 had not been filed. After reciting the effect of this provisional specification, it went on to say that Dr. Welsbach, continuing his researches, had found that certain other substances could be advantageously employed. Then the specification gave certain prescriptions—nine in number—for making an illuminating cap or hood, and also said that for impregnating the fabric solutions of the salts of the metals were employed as described in the previous specification. But it was not necessary that all the substances should be in solution; some of the salts might be in a pulverulent, amorphous, or finely divided condition, and might be mixed with the solution of salts so as to produce a thickish liquid in which the undissolved salt was suspended, and that with this liquid the fabric could be repeatedly soaked. It then gave certain variations which might be introduced into the process—the omission of the treatment with ammonia—and claimed: "In hoods prepared as illuminating appliances for burners, the use of oxide of thorium alone or in admixture with the oxides of zirconium, lanthanum, yttrium, neodymium, erbium, magnesium, or aluminium, substantially as herein described." This claim did not extend, as the claim of the 1885 patent did, to the manufacture of the form of the illuminant appliance, as distinguished from the use of certain materials in the formation of the illuminant appliance. It was a claim for the use of the oxides of certain rare earths in hoods prepared as illuminant appliances. The words at the end of the claim "as herein described" were, in his judgment, to be read as qualifying the words "the use of," and not as extending also to qualify the word "prepared." The patent of 1885 had described how to prepare the appliance in the sense of producing its form; and the patent of 1886 made no claim to any new invention or improvement in that respect. The claim for the use of the materials in the patent of 1886 was restricted to the use of the materials in respect of hoods or mantles, but was not restricted to their use in respect of hoods or mantles formed in a particular way. The substance of the prescriptions appeared to be this: The discovery was that a substance called thorium oxide, either pure (which was the word in the first prescription) or mixed with the oxides of certain rare earths (as in the subsequent prescriptions), made a hood of which the inventor said that in each case it had a certain quality. In the one case, it was rigid when incandescent; in other cases, it was flexible, or very flexible, when incandescent; and in others, that it gave certain colours. Having given the prescriptions, the inventor went on to say that it was better to avoid the use of certain substances, as hoods containing them were not so durable as those from which they were absent. In his judgment, the claim made was substantially the use of thorium oxide, alone or in admixture with certain other rare earths, as the means of obtaining hoods which had particular characteristics—such as rigidity, flexibility, or durability. The claim was not to a process producing a hood whose advantage resided simply in brilliancy, but one which had other qualities combined with that—viz., rigidity, flexibility, or durability. With regard to the word "pure" in the first prescription, he thought it was used, not as describing thorium oxide free from every impurity, but pure in the sense of the oxide alone, as distinguished from the oxide in admixture with other oxides. The word "pure" was found nowhere else in the specification; and in the claim, the words were oxide of thorium alone or in admixture. Next came the question, What was the meaning of thorium oxide, in this specification? In 1886, thoria was a rare earth which had been for many years known to chemists, but was of no known use to any human being. It had been analyzed, and was to a large extent known; but pure thorium in 1886 was a thorium which, with the knowledge of to-day, a chemist would call impure. From subsequent investigation, chemists now knew that what was regarded in 1886 as thorium was not thorium alone, but thorium with the admixture of an exceedingly small quantity of cerium and certain other impurities. It had been proved that the methods of purification remained the same to-day as they were in 1886; and it

would have been possible at that time, by spectroscopic examination, to have arrived at the result that what was regarded as pure thorium, in fact contained about 0·25 per cent. of impurities. A spectroscopic examination, however, was not the process which a chemist would employ in 1886 in his laboratory for the purpose of arriving at pure thorium. No one knew then, as was known now, that cerium had an extraordinary quality of adhering closely to thorium; and that to remove a very small percentage of cerium from thorium required repeated purification. He considered it proved that in 1886 thorium which contained so small a proportion as 0·25 per cent. of impurity, would by any chemist have been regarded as pure; that the prescription was to be read in this sense; and that pure thorium oxide in No. 1 would include thorium containing a small percentage—such as 0·25—of impurity, including 0·05 of cerium. Subsequent knowledge had proved the extraordinary fact that, while really pure thorium oxide produced a mantle of low illuminating power, the addition of a very small percentage of cerium raised the illuminating power in a most remarkable degree; 1 per cent. of cerium giving 18 to 20 candles, ¾ per cent. 14½ candles, ½ per cent. 13 candles, 0·2 per cent. 10 candles, and 0·1 per cent. 5·3 candles, while pure thorium only gave 1·3 candles. The defendants said that, inasmuch as the illuminating power of ordinary coal gas burned in the usual way was 3 candles, and the mantles produced under the 1885 patent gave 4 or 4½ candles, the patent of 1886 was not an improvement at all, but a falling off. To this, there were two answers. First, the 1886 patent did not claim to be an improvement on the patent of 1885, but to give a useful choice. Secondly, if the matter had to be tested by the value of the mantle as an illuminating appliance alone, the contention might be well founded; but there were advantages other than brilliancy to be considered – such as rigidity, flexibility, and durability—and experience had shown that the thorium mantle was tougher and stronger in use than any other mantle which could at present be prepared. To have a mantle of sufficient strength, was a matter of very great importance. To attain the maximum incandescence, it was desirable that the mantle should remain bathed in the hottest part of the flame. Some mantles became deformed in use, by contracting or falling out of shape when exposed to an exceedingly high temperature; and the thorium mantle had the advantage of being less deformed by use. This advantage might be set against the disadvantage that, with pure thorium, the illuminating power was small. It was now known, however, that if 1 per cent. of cerium were added to the pure thorium, one obtained not only the strength and stability of the thorium mantles, but a light of from 18 to 20 candles. Utility, in patent law, as he understood it, did not mean either abstract utility, comparative or competitive utility, or commercial utility. It had been described by Mr. Justice Grove, in *Young v. Rosenthal*, as meaning "better than the preceding knowledge of the trade as to a particular fabric;" and he would adopt this, if the word better were understood as meaning better in some respect, and not necessarily better in every respect. A cheaper article might be better in point of cost, though not better in point of quality. An invention was patentable which offered the public a useful choice; and the patent of 1886 offered an opportunity of making, with thorium, an appliance which up to that date it had been suggested could only be made with zirconium, lanthanum, or yttrium. The amount of these rare earths to be found on the surface of the globe was in some cases very limited. Until the importance of thorium was known, it was supposed to exist only in extraordinarily small quantities; and it was not until recently, after a great deal of exploration, that there had been found a large bed of monozite sand which contained thorium. A very small amount of utility was sufficient to support a patent; and the suggestion of the use of this rare earth as a means to an end, was enough in the present case. Again, it was not a question whether the patent of 1886 was or was not an improvement on that of 1885, not whether the 1886 patent enabled the public to make illuminating appliances better than they could under the 1885 patent, but whether it gave the public a useful choice of another substance to be employed in making illuminating appliances. The defence of non-utility, therefore, failed. Turning to the question of infringement, his Lordship again read the answers to interrogatories, and the analysis of the mantle. He said the defendants laid stress on the fact that the mantle as sold contained 9·56 per cent. of oxide of calcium; and Professor Dewar was pressed whether this fact would not bring the mantle within prescription No. 2, rather than No. 1. He answered that if the calcium were assumed to be non-volatile, it would be so; but it was admitted that when the mantle was used the oxide of calcium rapidly became volatilized, and then it practically consisted mainly of 99 per cent. of thorium and 1 per cent. of cerium. In Professor Dewar's view, such a mantle came substantially within prescription No. 1; and he thought this was the true view. For the purpose of this part of the case, it did not signify whether the 1 per cent. other than thorium was something useful—such as cerium—or something which neither improved nor deteriorated the mantle. Then it was insisted that defendants' method of producing the fabric was essentially different to that of the plaintiffs; and that therefore, even if the materials used were the same, they were outside the patent. In his opinion, this was not so. Defendants said their process was substantially the same as the one used by Clamond in the construction of his baskets; but he did not see that this was material. Plaintiffs were not now insisting on the process which produced the form which was under the patent of 1885, which had now expired; and defendants were entitled to use it. The substance of the matter seemed to him that defendants produced an illuminating appliance by using the material—namely, thorium – suggested by the patent of 1886, and substantially in the proportions suggested by that patent; and in so doing, he thought they had infringed the patent. He need say but little on the defence raised based on an allegation that the specification did not so describe the invention as that the results described could be obtained by following the directions given. He was satisfied on the evidence that this defence could not be maintained. Professor Dewar and Mr. Ballantyne had made mantles by following each of the prescriptions, and had given the results. On the question of what relief should be given, he had been pressed to grant an injunction; but he did not see his way to do so. The only evidence of infringement against the defendants was the admission in the answers to interrogatories; and they there stated that they did not intend to make in future. In the second place, the patent would expire in a few weeks. A third consideration was this: The defendants said that their successors in business were making and selling, and he understood that, in point of fact, the defendant Company had been wound up and their business transferred to another Company, who were not a party to this action. It was suggested that the natural persons who were also named as defendants were, in fact, the Directors and officers of the new Company, and that if he restrained them he would in substance be restraining a defendant who was not present—viz., the new Company—in an indirect form. Why the plaintiffs did not amend by adding the new Company as a defendant, he did not know; but they did not, and the new Company were not before him. Under these circumstances, it appeared to him that he ought not to grant an injunction. Damages were asked; and it followed from what he had said that there must be an inquiry as to damages. The plaintiffs were also entitled to an order for the delivery up or destruction of all infringing mantles. With regard to the costs, the plaintiffs having obtained in a previous action a certificate that the validity of the patent had been called in question, under section 31 of the Act of 1883, a certain result ensued, unless he saw reason to certify to the contrary. He did not find any reason why he ought to deprive the plaintiffs of the benefit of that section; and the plaintiffs would therefore have their costs as between solicitor and client.

After a short discussion as to the form of the inquiry as to damages,

Mr. MOULTON asked that costs might be allowed on the higher scale.

Justice BUCKLEY, however, declined.

Mr. BOUSFIELD asked that the usual undertaking should be given on the payment of costs, to repay them if there were a successful appeal.

Mr. MOULTON suggested there was no reason for making any special order on that matter.

Justice BUCKLEY said he could not imagine the defendants wanted any special protection in the shape of an undertaking. They had heard of the plaintiffs before.

Mr. BOUSFIELD said it was the usual course. He was only surprised that his friend should refuse it.

Regarding the above report, the Solicitors for the Sunlight Company (Messrs. Michael Abrahams, Sons, and Co.) inform us that they have already served notice of appeal from the decision of Mr. Justice Buckley.

Damages for Personal Injuries Sustained in a Gas Explosion.

Sitting at the Newport (Mon.) County Court last Thursday, His Honour Judge Owen heard a claim brought by Henry Gatehouse, of the Little Crown Inn, Maindee, against the Newport Gas Company for £47 2s. as damages for personal injuries which he sustained through an explosion of gas on Dec. 20 last. Mr. Parsons appeared for the plaintiff; and Mr. T. B. R. Wilson represented the Company. It appeared that on the evening of the day named, Mr. Gatehouse went into his cellar with a naked light; and there was an explosion of gas. He was blown over three barrels, and had his eyebrows and eyelashes burnt off. Plaintiff suffered from the effects of shock to the nervous system, and had not yet fully recovered. According to plaintiff's evidence, for several weeks before the explosion there was an escape of gas in the street in front of his house; and on Nov. 22 he complained of the leakage to the Company's officials. It appeared that in laying the service defendants' servants left a hole leading from the cellar to the street, through which it was stated the gas entered the cellar. On an examination being made after the explosion, it was found that there was an escape through the breakage of the pipe at its connection. Witnesses were called by the Company to prove that the service was properly laid, and that the damage to it was caused either by the frost or through the settling of the building, which was a new one. His Honour held that the Company were liable, and that their servants should have closed the hole which they made in the cellar. Judgment was given for plaintiff for £20 damages, and £2 2s. medical fees, with costs.

Fraudulent Interference with a Gas-Meter.

Last Tuesday, George Carter, a cycle repairer, of 25, Stanley Place, Preston, was sued before the Preston Justices for fraudulently interfering with a gas-meter, the property of the Preston Gas Company. The interference which was the cause of action consisted in the removal of the plug to the tap on the inlet-pipe of the meter, and the insertion of a wooden plug and an india-rubber tube, to which was attached a wooden tap. From this tap another india-rubber tube was carried to the defendant's fittings; and in this way a supply of gas was obtained which had not passed through the meter. One of the Company's inspectors visited the premises in Carter's absence, and saw the contrivance in position. He subsequently interviewed defendant on the matter, and called his attention to the fact that he was getting gas which had not been registered. Defendant professed ignorance; but, on examining the arrangement in the presence of the inspector, he said he could see that he was doing as had been stated. He admitted that he had put on the india-rubber tubing, and had made the plug. The Company's meter tester stated that the interference with the meter had caused an escape of gas, which might have resulted in a serious explosion. Defendant informed him that he did not know he was consuming gas without its being registered. On behalf of the defendant, it was urged that the making of the plug was a "perfectly innocent transaction;" and that if he had had any fraudulent intention it was unlikely that he would have left it for the Company's servants to see. Defendant was exceedingly sorry for what he had done, and threw himself on the mercy of the Court. The Bench imposed the maximum penalty of £5 and costs, or a month's imprisonment; the Chairman (Mr. W. H. Woods) remarking that the defendant had been guilty of a very serious fraud, and that he might consider himself very fortunate that the Company had treated him as leniently as they had done.

The Newcastle Water Company have entered into an agreement to supply the Ryton District Council with water at the rate of 7d. per 1000 gallons, with a minimum payment of £400 per annum.

MISCELLANEOUS NEWS.

SOUTH METROPOLITAN GAS COMPANY.

The Ordinary Half-Yearly General Meeting of the Company was held last Wednesday, at the Cannon Street Hotel, E.C.—Mr. GEORGE LIVESEY in the chair.

The SECRETARY (Mr. Frank Bush) having read the notice convening the meeting and the minutes of the previous meeting, the seal was affixed to the register of proprietors.

The CHAIRMAN: Ladies and Gentlemen—My duty is to move: "That the report and accounts now presented be received and adopted, and the report entered on the minutes." As I am afraid this will be rather a long meeting, I shall endeavour to curtail my remarks on the report as much as possible. In fact, the report is so full and so long in itself, that I think there is very little which it is necessary to add or to explain. Paragraphs 1 and 2 speak for themselves. With regard to paragraph 3, the only remark I have to make is that I do not think gas companies get sufficient credit for the regularity of the supply of gas. It is not an easy matter to supply a great city like London with gas, with the regularity with which it is supplied; but it is done with such great uniformity—there is never a failure of the gas supply—that I fancy the public are apt to think it is a very simple matter indeed. But I can assure you that those who have to do it—especially our officers—have a good many anxieties. They have had them this winter, at any rate. I can say that, had it not been for the energy and devotion of our officers, and the hearty co-operation of our workmen, we should not have come through the winter so well as we have done. Paragraph 4 relates to the policy of the Company. Our policy has been for a number of years now to pay something short of the dividend to which the shareholders were entitled. The reason for the adoption of this policy was in order to increase the reserve fund. In the bad times succeeding 1890 and 1891, when the price of coal went up very much—though to nothing like the price it has reached this winter—we were in hopes that we should be able to tide through without raising the price of gas. Consequently, we used up our large reserve of £250,000, until at last it was reduced to £37,000 at Midsummer, 1892. Then we were obliged to increase the price of gas; and seeing that the reserve fund was so small, we did not think the position of the Company was safe. We therefore suggested to the shareholders, and obtained their approval to, the adoption of measures for restoring it to something like a reasonable amount. The £37,000 to which it was reduced in 1892 has now risen to nearly £130,000, by contributions from the divisible profits, by the shareholders foregoing dividends to which they were entitled in order to strengthen the position of the Company. And now in this paragraph there is a little reference also to the dividend. It shows how contented our shareholders have been. In 1886, we reduced the price to 2s. 6d. per 1000 cubic feet, and increased the dividend to 13 per cent., as it was then on the old capital—equivalent to £5 4s. on the converted capital. We simply multiplied the capital by 2½, and divided the dividend by 2½. I was rather surprised, in looking through these figures, to find that since 1886 we have only increased the dividend 2s. 8d., or if you go on the 13 per cent. scale 6s. 8d. We increased it from 13 per cent. in 1886 to £13 6s. 8d. in 1899, or from £5 4s. (which is the correct way of putting it) to £5 6s. 8d. But even this does not represent the actual dividends received by the shareholders. Under the auction clauses, which were introduced in 1876, all our additional capital has had to be sold by auction or tender at the market price. That price lately has been £140 for £100 of stock. This is really the capital of the Company; and it is the amount on which we ought to estimate the dividend. It is only a nominal £5 6s. 8d. on £100; but the £5 6s. 8d. on the nominal £100 becomes only 3¾ per cent. on the actual £140 which the public have given for the stock. So that the dividend paid to the shareholders in the Company is at the ridiculously low figure of 3¾ per cent. I think it is too low. I must confess that the Stock Exchange has put the value of the stock too high. Gas stock ought to pay more than 3¾ per cent. However, we have no control over the Stock Exchange; they do what they like. We are now entitled to pay £5 14s., which would bring the actual dividend up to a trifle over 4 per cent.; but, for the reasons already stated, we have not recommended an increase of dividend, and now unfortunately we have two very potent reasons why we should not recommend it on this occasion. We say in our report: "Two possibilities in the early future may, however, considerably increase the cost of gas making; otherwise the Directors think the patience of the shareholders might have been rewarded by increasing the dividend to 5½ per cent." Those possibilities are first of all the increased cost of coal; and unfortunately I am afraid gas coal has risen more than any other description of coal—more than house or steam coal. And I suppose the reason is that gas coal is a coal specially adapted for manufacturing purposes. Gas coal is a good coking coal; and whenever the iron trade is very brisk, there is an enormous demand for coke—any coal which would otherwise be used for gas production is devoted to coke making for the manufacture of iron. Gas coal was bought some two or three years ago at 6s. 9d. a ton. In 1897, it was 6s. 6d. a ton f.o.b.; but last winter it actually went up to 18s. or 19s. a ton, and a large contract I believe was made with a Foreign Company or the Corporation of Copenhagen a month ago at 15s. a ton—a rise from 6s. 6d. to 15s. No other coal has risen in like proportion. Then we say: "The rocks ahead are the present very high price of coal, which may not come down to a reasonable figure before the new contracts are made." Now if coal has not come down to a reasonable figure before the new contracts are made, there is no help for it but to increase the price of gas. I think that is perfectly fair—it is part of the bargain. The consumers are partners with the shareholders; and when special circumstances like these arise, the burden ought to be spread over both partners. This is the real object and purpose of the sliding-scale. That is why it was proposed, because the whole burden at that time was thrown on the consumer, and it was thought the shareholders should bear a part of it. We now say it is not fair that the shareholders should bear all the burden, but that the consumers should bear a proportion. It is often said, however, that when coal goes up in price, coke also rises, and thus meets the extra cost. That is not so. If coal only goes up 1s. or 2s. per ton, the price of coke no doubt will nearly meet it; but when coal goes up from 5s. to 8s., the additional price to be derived from coke will not meet it at all, or will go a very little way indeed towards meeting it. For instance, I may compare two half years. In the half year to December, 1898, we received for coke 6s. per ton of coal used; in the half year to December, 1899, we received 6s. 10d. for coke per ton of coal used. There was an increase of 10d. in the receipts for coke, besides the little increase in the price of tar and ammonia; bringing up the total increase in products from 7s. 11d. to 9s.—or about 13d. But coal went up 1s. 7d.; it cost us in to the works 12s. 7d. in 1899, and only 11s. in December, 1898. So that the extra receipts for residuals have not recouped the additional price of coal, even though the extra cost of coal was only 1s. 6d. a ton. The reserve fund, moreover, is too small to meet a serious rise in coal—the laborious accumulations of eight years might go in as many months. I think I have dwelt long enough on this point to show that the only way to meet the extra cost of coal will be, if the price remains at anything like the present figures, to ask the consumers to bear their share of the burden. The next paragraph deals with another important matter which may affect our dividend. I do not think it will; because I do not believe the Bill will pass. And here I have to speak of a very important body. I wish to speak respectfully of them; they are a very important and powerful body. I refer to the London County Council. They are a very zealous body, and very well intentioned; but unfortunately good intentions do not make up for want of knowledge, and they very often deal with matters with which they are very imperfectly acquainted. The Council are now promoting a Bill to alter a contract made by Parliament in 1876 between the Gas Companies and the public as to the quality of the gas supplied. Parliament has known for the last forty years—they were first told it, I believe, by Dr. Letheby in 1860—that gas loses a certain amount of luminosity by travelling through the mains. Dr. Letheby said it lost about two candles in travelling from the gas-works at Bow Common to the City, and it loses something more in travelling through the small mains. Parliament knows that. It was made known at the time, and it has been made known from time to time in Parliamentary Committees ever since, that gas loses in luminosity, sometimes more, sometimes less, and sometimes not at all, but generally loses something in travelling from the works to the consumer. With that knowledge, Parliament fixed the quality of gas that we were to supply at 16 candles, to be tested in a certain defined manner, in certain places, and be tested by sample taken in bulk from leading mains. The London County Council have now devised a peripatetic portable photometer which is to be taken out and about in a cab. Testing gas is by no means a certain operation; for very delicate apparatus is required, and very careful conditions have to be observed as to temperature. Various rooms are fitted up with special apparatus for this purpose; and the temperature must be kept at one uniform point. The Council now propose to take a portable photometer to any part of the district, and attach it to a lamp-post or to a fitting in some house or building where the gas may have been lying stagnant for some time; and they find that, instead of 16-candle gas, it is very often under 16—sometimes it is about 15, sometimes it is under 14—and now they say that Gas Companies ought to supply 16-candle gas everywhere, though Parliament had fixed it at 16 candles tested in a certain way. Here comes in their ignorance. If the gas is to be supplied of 16 candles tested anywhere, instead of making it 16½ candles or 17 as we do at the works, we should have to make 19-candle gas. And who would have to pay for it? The worst of all these local authorities is that, whenever a gas company goes to Parliament, they think they should squeeze something out of it; the stupid people do not see it is the consumer who has to pay for it all. The gas company gets its maximum dividend; and if any additional cost is to be put upon us in the manufacture of the gas, it necessarily must be transferred to the consumer. From time to time when gas companies have been in Parliament, pressure has been put upon them to increase the illuminating power beyond what could have been obtained from the available coal supply; and this necessitates enrichment. This enrichment means that the consumers have to pay a considerable sum more for the extra quality than it is worth to them. If we had to make nearly 19-candle gas to meet the requirements of this portable photometer, we should certainly have to increase the price at least 2d. per 1000 cubic feet; and you may be quite certain if we increased the price 2d. per 1000 cubic feet the consumers will have a circular sent to them giving the reasons in the plainest terms—the reasons being that the London County Council have forced us to increase the quality, an increase the consumers have not asked for, and which they do not want, but for which they will have to pay this Company alone £84,000 for an inappreciable improvement in quality which would be of no use to them whatever. While on this point, I may say it is in the hands of the consumer to make the quality of his gas what he likes. We sent to some of the consumers' houses and got their burners and tested them with gas the illuminating power of which was 16¼ candles, and one of the burners gave a quality of 14·4 candles. That was the highest. The next highest was 12·6, the next 10·9, the next 10·4, the next 10, the next 9·6, the next 8·6, and then 7·9. The consumers reduced the 16 candles to 8 in some cases; but, on the other hand, the consumer has it in his power to increase 16-candle gas to 100 candles by the use of the Welsbach incandescent mantles, or by the use of the Siemens burners or the "Wenham" to 30 candles. By the use of the original Welsbach, the light can be increased to 60 candles; and by the use of the improved Welsbach, the consumer can get from 16-candle gas a light equivalent to 100 candles. That shows the absurdity of this action of the London County Council. When they see what will be the effect of it, they will be rather surprised, and probably they may alter their views. Now, under these circumstances, the Directors do not feel that it would be right to propose an increase of dividend. If we were to propose an increase of dividend, and to pay it, the Stock Exchange would put up the value of the shares; and in three or four months' time, from one or other of the causes referred to, we might have to raise the price of gas 2d. or 4d. per 1000 cubic feet, and down would come the value of the stock. Having 4d. in hand, we can raise the price 4d. without diminishing the dividend. With such a strong case, we feel it would be unwise to increase the dividend; but we will keep the 4d. in hand to meet the contingency. In paragraph 8, there is a statement showing how the position of the Company has been strengthened within the last ten years; and although I need not detain

you upon that, there is a singular fact to which I may refer. I go back to 1886, and I find that since that year we have reduced the price of gas 5d. per 1000 cubic feet. It was reduced to 2s. 6d. in 1886, and it is now 2s. 1d. The whole of the saving has come out of the amount required to pay dividend. Whereas in 1886 we required 13·4d. per 1000 cubic feet to pay the dividend, in 1889 we required 8·4d., or a difference of 5d., which is the same as the difference in price. This shows that we have been increasing the business to this extent, and yet we have not been able to reduce the cost incurred in the manufacture of gas. Coal is dearer, labour is dearer, and the whole of the saving has come out of the amount required to pay the dividend. We have done this by raising our capital on the most economical terms, and by spending it most carefully. The next paragraph relates to the profit-sharing system. We have sent out with the report a statement which I prepared for another purpose, though I had this in view—a sort of historical statement of what has been done. We feel that a full statement is due to the shareholders because this has now come to be a large thing—over £20,000 a year being paid—so that the shareholders have a right to ask: Is it commercially advantageous? If not, the thing is a failure and ought to be stopped, because we are not a philanthropic body. I think you will see, as we have seen, that it has been advantageous to us as a Company. The next paragraph deals with the question of the superannuation fund, which was started in the year 1855 by my father, the late Mr. Thomas Livesey. The rules are now being revised; and though the Company have been morally bound to maintain the payments fixed by the rules, we have never definitely or formally inserted that obligation in the rules. The Directors now propose to insert in one of the rules that the Company guarantee the stability of the fund. The fund is on the mutual system; and it is on the principle so commonly adopted now with regard to the officers of all great bodies. The Corporation of London and many Companies have superannuation funds for the pension of their officers. The officers contribute a certain percentage on their salaries, and the Company contribute an equal amount. This is the principle on which we act. The workmen contribute 3d. a week, and we contribute 3d. a week. We say to our people: "If you will help yourselves, we will help you; but we will not help you unless you show a disposition to help yourselves." This brings me to another interesting episode, which is in connection with the war in South Africa. A good many Companies have dealt liberally in this matter; and the Commander-in-Chief, speaking recently at the Mansion House, referred to the liberality of great employers of labour in very complimentary terms. When we saw the different Companies were resolving to give the wives of reservists half pay during their absence, it struck us that this was not quite the right principle. We did nothing for a week or so; and then one of our foremen—William Harvey—made the suggestion to his fellow workmen that they should contribute half the cost of supporting the wives of reservists. My consent was asked to the holding of meetings at the different stations. The men held their meetings, and agreed unanimously to contribute 1d. per week per man, which would be sufficient to provide half the cost for these people; and they asked the Directors if the Company would contribute an equal amount. I was pleased in two ways—first, that the suggestion came from the men; and, in the second place, that they had asked us to help them. It shows a mutuality of interest and feeling which is very gratifying. Generally, employees hesitate to approach their employers on any subject. We were pleased that the men approached us, as it is in accord with the system of keeping the employer and employees in touch. The Directors and officers were not going to be behind; and as a result £52 per week was contributed. The workmen pay £18, the Company £18, and the officers pay their contribution. Last week £52 was contributed, while £51 was expended in making provision for the women and children. The provision is 10s. a week for each wife, and 2s. for each child under fifteen; and they also receive something from the Government. The whole thing is worked and managed by the men; and it is managed as well as anyone in the office could manage it. The next paragraph deals with the Bill which the Directors are promoting; but as I shall have to refer to this matter presently, I will not touch upon it now. Paragraph 12 relates to the recommendation of the dividend. I may explain why we go by thirds. The usual thing is to go by halves and quarters. It is a matter of convenience. It enables us to pay all our dividends by even pennies. If we went by quarters, it would not be so. We propose that the dividends shall go by steps of 3s. 4d.—from £5 3s. 4d. to £5 6s. 8d., and £5 10s., and so on. The next paragraph relates to the retirement of the Directors; and I may mention that we have had a retirement and election of a Director since our last meeting. Since November, 1898, we have had two Workmen Directors elected by their fellow shareholders among the workmen, who have sat on the Board ever since. One retired last November; and I am very glad to say that Mr. Austin, the retiring Director, was re-elected by a very large majority. We did not know how the workmen would act—whether they would re-elect the Director or want to make a change. But in this case they have very wisely determined to re-elect the Director who had served them and the Company so well during the previous twelve months. I have nothing more to add; but I shall be very glad to hear any remarks, or to answer any questions. In conclusion, I propose the resolution which I have already read.

Mr. John Mews seconded the resolution.

Mr. Kennard said he understood the Chairman to state that the consumers had a remedy in their own hands for increasing the luminosity of gas—namely, by employing incandescent mantles; but he wished to point out that after the mantles had been in use for a short time, they became foul, thereby diminishing the light. He was very glad to hear that their employees were on such friendly terms as to approach the Company upon matters concerning them; and he wished that these friendly relations existed in other places.

The resolution was then put, and carried unanimously.

Mr. Robert Morton proposed—"That a dividend at the rate of 5¼ per cent. per annum be now declared, and that the warrants be transmitted to the registered addresses of the proprietors by post."

Mr. Henry Austin said that he had much pleasure in seconding the motion—first, because he had had a finger in the pie in making the dividend; secondly, because he had a finger in the pie in distributing it; and, thirdly (and this was not the least pleasure), because he had to receive some of it. These three things all tended, no doubt, to the strengthening of that relationship which should always exist between employers and employees, as it tended to consolidate the union which was so requisite for the carrying on of any business with success. When there was friction, there was always extra cost. The principle of mutual contribution towards the maintenance of the wives of reservists was the very line of action that carried them throughout the distribution of the social order of the South Metropolitan Gas Company. Another thing of which he felt proud was the compensation for accidents. Instead of workmen being so foolish as to instigate litigation, they now mutually contributed week by week so much in order to meet any accident that might occur at the works; and cases which would not be recognized by law were now entertained. This had an educational effect upon their feelings. With regard to the action of the County Council, he might say that housewives did not want a luminous gas to cook by or to heat an incandescent mantle. The step proposed by the County Council was a retrograde one. If they could be as practicable as they were idealists, everyone would have more confidence in them. He was authorized by his fellow-workmen and shareholders to express their thanks and gratitude to the shareholders for having sanctioned so humane a principle as the profit sharing system.

The resolution was carried unanimously.

Mr. Ewart proposed the re-election of Mr. Livesey and Mr. Morton as Directors.

Mr. Howlett seconded the motion, which was carried unanimously.

Mr. Charles Mortimer was afterwards unanimously re-elected an Auditor of the Company.

An Extraordinary General meeting was then held, to obtain the shareholders' approval of the Company's Bill.

The Secretary having read notice convening the meeting,

The Solicitor read the heads of the Bill.

The Chairman: I now move—"That the Bill now submitted to this meeting, intituled 'A Bill to empower the South Metropolitan Gas Company to alter the provisions as to the standard price and illuminating power of the gas supplied by the Company, to construct a railway in the Parish of Greenwich, and to purchase by agreement so much of the southern portion of the undertaking of the Gaslight and Coke Company as is situate in the County of London south of the Thames, and for other purposes,' be, and the same is hereby, approved, subject to any amendments which shall be made thereon by Parliament and approved by the Directors." In making the motion, the Directors feel that it is due to you that definite explanation should be given as to the purposes of the Bill. I may deal with half of it very shortly. Sixteen out of the thirty-two clauses relate to the railway, which is only about three-quarters of a mile long. It is a very small and unimportant matter. We have done without it a good many years; and we could still do without it. However, it gives us a railway connection; and we propose to take parliamentary powers to construct it. These sixteen clauses are the regular stock clauses which are inserted in all Railway Bills. The other parts of the Bill are of vastly greater importance. In the paper sent out with the report, it is stated that: "The main object in promoting this Bill is to carry out the recommendation of the Select Committee on the Metropolitan Gas Companies of last session." You will probably remember that last session a Committee was appointed to enquire into the question of the charges made by the Metropolitan Gas Companies. That Committee investigated the matter very thoroughly, and made certain recommendations, one of the most important being that the initial price of the three London Companies—the Commercial, the Gaslight and Coke, and our own—should be reduced to 3s. 3d. Our initial price was 3s. 6d.; and for every penny reduced below that, we were allowed to pay an extra ¼ per cent. on the nominal capital. This initial price, when once fixed, is a parliamentary bargain which ought not to be altered. However, last session it was altered in the case of a Suburban Gas Company, where the House of Lords reduced the initial price 6d. Following that, the Committee to which I have referred reported that it was advisable that the initial price of the London Gas Companies should be reduced to 3s. 3d., the Commercial and the Gaslight and Coke Company's being 3s. 9d.; but they added a provision which would give us at the lower end of the scale what they proposed to take off at the upper end. For instance, by reducing the initial price to 3s. 3d., for all prices above 2s. 6d. at which we might sell gas we should have a smaller dividend under their proposal than we are now entitled to; but when we got to 2s. 6d., the dividend under their system would be the same as under our Act, and below 2s. 6d. there was a slight advantage, and we were to get a little extra dividend when we were below 2s. 6d. under their new proposal than we are now entitled to. Taking our converted capital as the basis, we are entitled at the present time to an increase in dividend of 2s. per cent. for every 1d. reduction in the price of gas. They proposed that, in addition to the 2s. for each 1d., there should be an extra 2s. for every 3d., which amounts to an average of 2s. 8d. for each 1d., giving us one-third more for the 1d. than we are now entitled to. This extra third, when gas is below 2s. 6d., makes the dividend rather higher than it would have been. That would not have been a sufficient inducement to us to accept the proposal; but we thought the time had come when something of the sort was necessary. The Directors gave a very great amount of consideration to it. I do not know that I ever knew them give so much consideration to any subject as to the report of the Committee; and at last they decided it would be desirable to accept the proposal of the Committee as to the reduction of the initial price, and their chief reason was this: The fact that an initial price had been reduced 6d. by a Committee of the House of Lords—the fact that the Committee had recommended that the initial price of the London Gas Companies should be reduced—made us feel that it would be used against any gas company going to Parliament for additional powers in the future. Instead of being able to maintain the inviolability of their initial price, they would be attacked in this way; and it is extremely probable that Committees will reduce the initial price of companies going to Parliament. Under these circumstances, we thought it better to take the proposals of the Committee at once, rather than wait until something, probably very different, had been carried in Parliament, and then when our turn came we might find ourselves very much worse off than we should be if we had accepted the proposal of the Committee. As a matter of fact, we shall not be any worse off at all. I do not think there

is a probability of our price going above 2s. 6d.; and, so long as it does not, we shall be better off under the new proposal than under the old. That is the reason why the Directors thought that it would be wise to take the proposal of the Committee and embody it in a Bill. We have not exactly adopted the proposal. The Committee suggested another proposal—2s. for each 1d. and a further 2s. for each 3d. We thought that a little complicated, and we made the two into one, and have put 2s. 8d for each 1d. If any shareholder has any question to ask about this, I hope it will be asked, as the alteration of the initial price is a very serious matter. The principal witness for the London County Council, Mr. Haward, who gave his evidence very fairly, made the singular remark that the sliding-scale had become almost practically inoperative. The amount of increase of dividend accruing to the shareholders under the sliding-scale is not sufficient to induce them to make reductions in price. Whereas when the sliding-scale was first introduced the shareholders got one-fourth of the saving—supposing £8000 were saved, the shareholders would get £2000, and the consumers £6000—now the shareholders only obtained half that, they only got one-eight. If we can make a saving of £8000, the shareholders would get £1000, and the consumers £7000. In fact it comes to this, we must give the consumers £42,000 a year to get an increase of dividend of 1s. 5d. per cent. on the actual value of the stock. Practically, we should have to reduce the price 3d. per 1000 cubic feet before there would be anything worth dividing among the shareholders. Mr. Haward was perfectly right in declaring that the sliding-scale was becoming inoperative. The Committee have gone a step in the right direction; but whether they have gone far enough is a question. Another recommendation of the Committee was that the district of the Gaslight and Coke Company south of the Thames should be transferred, on equitable terms, to the South Metropolitan Gas Company. The Gaslight and Coke Company in 1882 amalgamated with the London Gas Company, of which Mr. Morton was Engineer for a number of years. The late Secretary of the Gaslight and Coke Company was a man of large ideas. One great idea of his was to have one enormous Gas Company for London; and he thought in amalgamating with the London Company, who supplied gas on both sides of the river, it would be a great strategic movement towards the attainment of his object—absorbing the whole of London into the Gaslight and Coke Company. It failed. In considering the proposal, the Board of Trade made a very important and onerous condition. The condition was that the Gaslight and Coke Company should never charge a higher price for their gas on the south side of the Thames than the charge for the time being of the South Metropolitan Company; and at present the difference between the two is 10d. per 1000 cubic feet. From Mr. Phillips's point of view, I can understand it was a reasonable and proper step to take; but the strategy failed, as other strategical movements have done, and it has landed that Company in having to supply one-tenth of their gas at 10d. per 1000 cubic feet less than the price they charge for it upon the other side of the river—including the public lights. When they are selling gas at 10d. per 1000 cubic feet less to one-tenth of the consumers, it means that they are charging the other nine-tenths 1d. per 1000 feet more than they should pay. The Committee said that it is not fair to consumers on the north side that they should pay a penny more, in order that consumers on the south side should pay less; and they recommended that a transfer should take place. We opened negotiations last August; and so far as we are concerned, we may say they are closed. We had a very friendly meeting, and we agreed on everything, as Colonel Makins said the other day, but the price. They wanted more than we thought it was worth. We made a calculation of what it would be worth to us. It would not be proper to give figures; but I may state the principle. We took their own figures of the cost of making gas, and we took our selling price; and we said: "Between your cost of making gas at Nine Elms and our selling price, there is so much per 1000 cubic feet difference; that amounts, on the gas sold on the south side of the river, to so much money." We calculated what capital this money would pay interest on at 3¼ per cent.—we took the very lowest rate at which we could raise capital—and we said: "The revenue we should derive, based on your own figures with the sale of gas in the south of London, will enable us to pay interest on so much capital at 3¼ per cent." We offered this amount of capital for the southern district and its proportion of the works. The works at Nine Elms are capable of doing more than double what is necessary to supply the southern district. We said: "We are constructing new works at East Greenwich. We will give you the same price for the surplus old works as we can construct new ones for." We thought we were dealing very liberally with them; but they said: "Oh, no; these old works cost us more, and you must pay us what they cost." We replied: "We cannot do that." We did not take into consideration their other disadvantages. We made an estimate of the value, as far as we were able to do to see what we could afford to give for the property. If we had taken into consideration the great disadvantages under which they labour—through having to sell gas at so much lower price, and the necessity for additional capital—we might very well have said that these disadvantages are worth so many hundred thousand pounds to you, and you ought to take that off the price we propose to give. But we did not attempt to take advantage of the drawbacks; and we offered the highest price we felt justified in doing. We declared at the outset, before any negotiations were opened, at our meeting in August last, that we would have no arbitration. Colonel Makins, at the meeting of the Gaslight and Coke Company, said: "We are quite ready to submit the matter to arbitration; but the South Metropolitan are not. Therefore they feel their case is a weak one." We know perfectly well—better than any arbitrator—what the concern is worth to us; and we will trust no arbitrator whatever. He would be misled probably by the evidence, and by the specious talk of the lawyers. We can do just as well without the southern district of the Gaslight and Coke Company as with it. We are quite big enough. We have gained nothing in economy since 1886, and our business has about doubled. Last winter we used 1,050,000 tons of coal; and we do not want to add to our burdens. But we are quite ready to accept the suggestion of the Committee to relieve the Gaslight and Coke Company of a great incubus, and take it upon ourselves to simplify the gas supply. There is another matter in the Bill to which I may refer—namely, the proposal to reduce the illuminating power. I touched upon that in my previous speech; but I may just say it comes to this: The most economical and the best illuminating power for the consumer is that which can be obtained from the available supply of coal. It has been forced up to something more than we can get out of the coal; and as a consequence various enriching materials have been adopted. The best enricher is cannel coal; but we cannot use this, as it has become so scarce and dear that it is out of the question. Another enricher is petroleum spirit, which is not altogether satisfactory, as it does not carry to the full extent of the district. A further means is by carburetted water gas, which is objectionable upon other grounds. The best gas with which consumers can be supplied is coal gas. We cannot make a 16-candle gas, but we could probably make 15-candle gas; and we therefore propose that we should supply unenriched gas—unadulterated gas, for enrichment after all is only adulteration—at a reduction of price. If the quality is reduced 1 candle, the initial price would be reduced 1d. under the Bill; and if the initial price is reduced 1d., we should have to lower the selling price by 1d. in order to get the same dividend. A good many people have considered that this is rather a novel idea; but it is gaining ground. I may tell you that at least 50 per cent. of our gas is consumed for purposes other than lighting—namely, for cooking, heating, manufacturing, and power—and a large proportion of that employed for lighting is used with Welsbach burners; and I may say it is for the advantage of gas consumers to change their mantles when they deteriorate, as by so doing money will be saved. A friend of mine recently told me that he obtained as much light from three Welsbach burners as he formerly did from eight ordinary gas-burners; so that the saving in his case was considerable. Using 12 cubic feet of gas per hour did the work of 40 cubic feet. I have no doubt that mantles will become cheaper. In Germany, they are supplied at 3d. each; and in Central Germany, 85 per cent. of the lighting is done by means of the incandescent system. If that is coming—and I believe it is—a cheap heating gas is what is wanted, because a cheap heating gas would be far more advantageous to the public than an expensive high-candle gas such as we are now forced to supply. This will be all dealt with; but it is a proposal in the Bill of which you ought to be informed. Another part of the Bill relates to the adoption of regulations for the supply of gas by means of slot meters. This was a recommendation of the Committee also. They thought that the poor consumers ought to be protected against expensive charges. We find this is necessary. We supply gas at a certain rate. We profess to supply the slot consumers at the same rate as the others; and it would not be fair to supply them at less, or to charge them more. Such consumers are charged 9d. more; but that goes to pay the rent of meter and cooking-stove, repairs and maintenance, and cost of collection. We find that, by charging this extra 9d., he is paying the same sum as the ordinary consumer. It is considered necessary that the charge should be regulated by Parliament; and we have put in a clause that the maximum charge should be 9d. There is just one other matter with regard to the capital account. Since we converted our capital, there has been a little difficulty, with the result that no one can tell from this account what is the amount of capital on which we pay dividend. In statement No. 1 you will see the amount, including premium, is £6,072,971; but the amount on which we pay dividend is £5,641,885. No one can tell it, except by intricate calculation. In the case of debenture stock, it is worse. The debenture stock stands at £1,795,160; and we are paying interest on £1,520,000. In the capital account, No. 3, we state the exact amount of money which we have received—so much for ordinary stock, so much premium; so much for debenture stock, and so much for premuim—making a total of £4,016,464. We think we should make it clear what is the exact amount of capital on which dividend and interest are paid; and therefore we put a clause in our Bill to carry this out. There is the Bill; but we are in this happy position, that we do not care a rush whether it passes or not. We are honestly trying to carry out the recommendation of the Committee; but if an attempt is made to impose onerous conditions, we are in a position to drop the Bill. We are endeavouring to carry out a suggestion which we believe will be for the advantage of the consumers, and we will try our best to carry it out. But we are in the happy condition that we can go on for seven or eight years without approaching Parliament; and if difficulties are put in the way, or onerous conditions are attempted to be placed upon us, we shall say: "Very well, gentlemen, the Bill is withdrawn." I now beg to move the resolution.

Mr. Morton seconded the motion, which was put and carried unanimously.

On the motion of Mr. Stock, a hearty vote of thanks was accorded to the Chairman, Directors, officers, and staff.

The Chairman, on behalf of his colleagues and himself, briefly acknowledged the compliment.

Mr. C. C. Carpenter and the Secretary also briefly returned thanks; and the proceedings then terminated.

CRYSTAL PALACE DISTRICT GAS COMPANY.

The Half-Yearly General Meeting of this Company was held last Friday, at the Albion Tavern, Aldersgate Street, E.C.—Mr. George Livesey in the chair.

The Secretary (Mr. Charles M. Ohren) read the notice calling the meeting; and the report and accounts, which were summarized in the Journal last week, were taken as read.

The Chairman said it was his duty to move the adoption of the Directors' report and the accounts. Before dealing with them, however, he should like to say that there was a very satisfactory piece of news for employers and workmen who were anxious for freedom, in the fact that it was now settled by the Courts that picketing was illegal, except for purposes only of giving or receiving information. All besetting, or watching, or bringing pressure to bear upon men was declared illegal. It had gone through the Courts; and the Trade Unionists were going to take it to the House of Lords. But they had given up their purpose of appealing; so that any picket now, if he violated the law, was subject to a fine of £20, or three months' imprisonment. This was indeed good news for employers and workmen. He thought the report which the Directors presented was of a satisfactory character. At one time, the Directors had a stereotyped form of saying: "The Directors have the pleasure of presenting a satisfactory report." They had dropped this now, simply because they thought it became so usual that it might be considered a mere matter of form. But he could

assure the proprietors that the report he had to present that day was really of a satisfactory character. They had got down again to the lowest price at which they ever sold gas. Some years ago, they charged 2s. 6d. per 1000 cubic feet; but the price had to be increased in consequence of the extra cost of coal, labour, and other things. Now they had returned to the price of 2s. 6d., which for a Suburban Company was, he thought, a very low figure. There was, however, one Suburban Gas Company which beat them hollow. It used to be called the "little" Wandsworth and Putney Company. But it was not so "little" now, and they sold gas at 2s. 1d. per 1000 cubic feet. Mr. Shoubridge would see what he could do to overtake them; but he (the Chairman) thought he would find it hard work to do it. The reduction of a penny, as stated in the report, was equivalent to £2350 advantage to the consumers in the half year; but, notwithstanding, they had a balance on revenue account of £18,909. Seeing that the interest on the debenture stock and the dividend on the capital stocks only amounted to £18,068, they had a surplus of nearly £900, from which had to be taken £243 as interest on a temporary loan. Still it left a surplus of some £600 on the half-year's working, notwithstanding the reduction in price. This was no doubt partly due to the satisfactory increase of 9 per cent in their business, which was something like going back to the old times. Many years ago, gas companies used to reckon upon an increase of 10 per cent. per annum. Then they dropped to 3 or 4 per cent.; but now they were getting up again to the old figures. He thought this was largely due to the great increase in the use of gas for cooking and heating purposes, and to its employment by the working classes or weekly tenants by means of slot meters. Until this invention was brought out, the working people of London did not use gas, because they could not pay a quarter's gas bill, and they were not willing to bear the expense of fitting up their houses. Now the gas companies did this for them. They supplied the meter, cooking stove, and fittings, and kept them in repair, adding a certain charge for them to the price of the gas. They were selling gas to the ordinary consumer at 2s. 6d. per 1000 cubic feet; and to the slot-meter consumer at 3s. 3d., which was an extra 9d. The 9d. paid for the meter, stove, and fittings rent, maintenance, and the little additional cost of collecting. This, he thought, accounted to a considerable extent for the increase in business. Another reason was that the weather was rather cold in December; and this helped to increase the consumption of gas. But while these things were all very pleasant for the shareholders, there was another side to the question. These increases, in times like the present, entailed a great deal of anxiety on the management. For instance, there had been great difficulty—this Company had experienced it in common with all other gas companies—in getting their supplies of coal, because the demand for manufacturing purposes had increased so largely, and gas coal was more in request for manufacturing purposes than house coal or steam coal. Consequently, the run upon gas coal had been something exceptional; and all their contractors had found some difficulty in supplying the monthly stipulated quantities. This had been one cause of the anxiety and difficulty which had fallen on the shoulders of the responsible management of the Company. However, they had got through it; and he thought the Directors and proprietors might congratulate themselves on having men who, when there were difficulties, did not hesitate to cope with them in the right spirit. They had brought the Company through very satisfactorily; and the consumers had had a better supply of gas this winter than they had ever had before. What a consumer wanted was an abundant supply, particularly in cold weather, because he said, and very rightly too, "You recommend me to use gas-fires, and you let them out on hire; but when I want gas most, in the coldest weather, you reduce your pressure." This could not be said of the Crystal Palace Gas Company, because this winter, as he had remarked, they had had a better supply than ever. The next paragraph in the report related to the dividend. The Directors recommended the payment of a dividend at the rate of 5¼ per cent. on the ordinary stock. Now for every reduction of 1d. per 1000 cubic feet, they were entitled to pay an extra dividend of ⅛ per cent. Previously, they had a penny in hand, and were entitled in June last to pay 5⅜, or £5 7s. 6d. per cent. The extra penny reduction in the December half year gave the proprietors the right to another ⅛ per cent.; so that now they were entitled to 5½ per cent. But the policy of the Directors had been not to divide an odd ⅛ per cent.; but when they had a right to even money, they recommended its payment. Some of the proprietors might say, "Then why do not the Directors recommend a dividend 5⅛ of per cent. on this occasion?" He thought there was a sufficient reason. They did not know what would be the condition of the coal market when they had again to make their contracts. The contracts were made yearly, to run from the 1st of April to the 31st of March; and they would have to see about the new ones next month certain. If anyone could tell the Board that the price of coal in March would be the same as it was last March, then he (the Chairman) would say it was a great pity they did not recommend the payment of the 5½ per cent. But no one could tell them that. The probability was the price of coal would be a great deal dearer than it was last March; and it might happen it would be so much dearer that they would not nearly be able to make both ends meet at the present price of gas. Therefore, the possibility that coal might be considerably dearer entailed the possibility that the Board might be compelled to raise the price of gas, which would necessitate a reduction of the dividend if they were paying the full amount. They thought it better to let the dividend stand at the same figure; so that, under present circumstances, they could increase the price of gas to 2s. 8d. per 1000 cubic feet without suffering any loss of dividend at all. It might be said, "The Company have a large reserve fund." Granted. In their case, he admitted, the reserve was large. For instance, comparing it with another Company its neighbour the reserve fund of the Crystal Palace Company was equal to 8d. per 1000 cubic feet of gas on the year's consumption, while the South Metropolitan Company's reserve was not more than 3d. per 1000 feet on the year's consumption. Therefore the Crystal Palace reserve was nearly three times as large in proportion as the South Metropolitan. If the rise in the price of coal should be only slight, the Board would feel it right to take a moderate amount from the reserve; but if the rise was great, then they felt it would be only fair and proper to put part of the burden on to the consumers. That was really the bargain of partnership between them. When the cost of making gas was reduced, both shareholders and consumers derived advantage; the latter to a greater extent than the former. A penny reduction gave to the consumers about £4600 a year; and it entitled the shareholders to about £700 of additional dividend. These were the proportions. The consumers got the lion's share of the benefit; and, this being so, he certainly ought to bear his proportion of the extra expense entailed upon the Company by the higher cost of coal. The Directors would, if necessary, be prepared to take some of it out of the reserve fund; but not all. The next paragraph of the report related to the loss the Company had sustained; but he believed he mentioned this at the last meeting. They all very greatly regretted the loss of Mr. Layton; but fortunately they had found a successor in Mr. Robert Morton—a man of life-long experience in gas matters. In regard to the accounts, it was commonly said that when coal went up in price, coke followed. So it did. But he would like to call attention to the figures for two half years. He found that in the corresponding half of 1898, they received for coke 6s. 6¼d. per ton of coal used; while last half year they obtained 7s. 1⅞d., which was a difference of 7½d. But the price of coal went up from 13s. 4d. in the December half of 1898 to 14s. 7½d. in the December half of 1899—a rise of 15d. in coal, as against the extra 7d. obtained for coke. He thought this showed that, while coke brought them back something, if the price of coal rose extensively, coke did practically little or nothing. There was one feature in the accounts which was rather a novelty. They had introduced an oil-gas plant, or what was technically known as a carburetted water-gas plant. This had helped them very materially, because they were able to buy oil (it was true at a high price) when they were short of, or in difficulties about, coal in December. But the point he wished to call attention to was this: There were many English companies using this oil-gas plant; but the cost of making the oil gas was not stated in the accounts separately or distinctly. He confessed he had never been able to make out what it did cost. It was not, however, fair to take their short experience. They were only working the plant about three weeks last half year, and during that time they made 8,824,000 cubic feet of gas. But they had entered the cost in the accounts separately. In the revenue account under the expenditure for coal, they stated that they spent for oil £672, for coke for the oil gas £253, and for labour £30—a total of £956. Then the purification of the oil gas cost £63; and under "wages" £30 was charged. These items worked out to 2s. 4½d. per 1000 cubic feet; but it was hardly fair to take this figure, because he believed Mr. Shoubridge would tell them they would eventually be able to manufacture cheaper than this.

Mr. SHOUBRIDGE: It is not fair to take that figure, because there was the heating up, and getting the whole thing to work.

The CHAIRMAN (continuing) said the cost would not come down to that of coal gas, the cost of which, taking the similar items, was only 10⅔d. Then there was something extra on the coal-gas plant for interest; it was more expensive, and required a little more for repairs. But he did not think the coal gas would come to more than 1s. 1d. per 1000 cubic feet for manufacture and purification; while the oil gas had cost them 2s. 4½d. But it must not be assumed that this would be the cost in future. It ought to be stated, however, that the price of the oil used was 4d. per gallon; and the quality of the gas was from 17 to 18 candles. He would promise that the gas fraternity should know exactly what the oil gas did cost. They certainly did not expect the oil gas would be so expensive; but the plant would be of use for one of the purposes claimed for it—and a very important purpose too. The manufacture of oil gas could be started at very short notice. In three hours the apparatus could be got into full work; whereas in coal gas manufacture it was about three days before the retorts could be in full operation. In any sudden emergency—heavy, cold, or foggy weather—a greatly increased supply of gas could be obtained at three hours' notice. He thought this would be the main purpose to which their oil-gas plant would be devoted. If they did not use it constantly, they would always have it ready for emergency; and for that purpose it would be very valuable. He concluded by formally moving the adoption of the report and accounts.

The DEPUTY-CHAIRMAN (Mr. Frederic Lane Linging) seconded the motion, which was unanimously carried.

On the proposition of the CHAIRMAN, seconded by Dr. FREDERIC HETLEY, a dividend of 5 per cent. per annum on the preference stock and of 5¼ per cent. on the ordinary stock, less income-tax, was declared.

The CHAIRMAN next moved the re-election of Mr. James Glaisher as a Director. Mentioning that, owing to the inclement weather, Mr. Glaisher had wisely abstained from attending the meeting, the Chairman stated that on April 7 next their esteemed colleague would complete his ninety-first year. His intellect was as good as ever; and he was a painstaking, conscientious, and capable Director.

Dr. HETLEY seconded the motion, which was cordially passed.

The DEPUTY-CHAIRMAN moved the re-election of Mr. Robert Morton to the Board, remarking that the proprietors might congratulate themselves upon having secured his assistance in the direction of their affairs.

The CHAIRMAN seconded the motion, which was unanimously agreed to.

Mr. MORTON thanked the proprietors for confirming his appointment by the Directors; and he hoped by-and bye to justify their confidence.

On the proposition of Mr. H. E. JONES, seconded by Mr. F. E. LINGING, Mr. A. G. Hounsham was re-appointed as an Auditor.

The CHAIRMAN remarked that Mr. Alfred Lass, who was a man of great experience in gas matters—perhaps none more so in gas accounts—owing to the general decline of his health, had resigned his position as Auditor. For the vacancy, there was only one candidate.

Mr. F. E. LINGING moved that Mr. Thomas Guyatt be elected an Auditor in the place of Mr. Alfred Lass. Mr. Guyatt, he observed, was a gentleman who had been connected with gas and gas undertakings all his life—mostly in the secretarial department. He had been Secretary of the Ceara Gas Company for something like 30 years. He (the speaker) understood he had just retired from that position; and, as a recognition of, and reward for, his long and valuable services, the Directors had very wisely offered him a seat on the Board. He was also Secretary of the Ottoman Gas Company, and held many other appointments in connection with gas. With such a record as this, he (Mr. Linging) felt it would be fulsome on his part to reiterate or dilate upon the fitness of Mr. Guyatt for the vacant position.

Mr. E. K. BLYTH seconded the nomination; and the CHAIRMAN endorsed the remarks made by the proposer.

The motion having being carried, Mr. GUYATT suitably acknowledged it.

Mr. H. E. Jones said the proprietors would not like to disband without recording their obligations to the Chairman and Directors for their services. If they wanted a testimonial, it would be found in the Stock Exchange list, which placed their stock at about the highest price but one of any stock in the gas market.

Mr. C. Beadle seconded the motion, which was heartily agreed to.

The Chairman replied; and then moved a vote of thanks to the officers and staff. He referred to the devotion to the Company of Mr. Shoubridge and Mr. Ohren, and to the loyalty of the men. As evidence of this, he mentioned that the carbonizing wages were still going down. Last half year, they amounted to 2s. 8½d. per ton of coal, whereas a year ago they were 3s. 1d. They had been continuously falling under the joint co-operation of Mr. Shoubridge and those under him. One other little fact he should like to refer to. It was that a number of the men had been called out as reservists; and their fellow-workmen, quite on their own initiative, started a fund for the wives and families. As soon as the Directors were informed of this, they gladly co-operated with the men; and, between them, the wives and children of those who were away on active service were being provided for.

Mr. Shoubridge and Mr. Ohren briefly acknowledged the vote; and the proceedings terminated.

CROYDON COMMERCIAL GAS AND COKE COMPANY.

The Ordinary Half-Yearly General Meeting of this Company was held last Friday, at the Offices, Katharine Street, Croydon—Mr. Charles Hussey, J.P., in the chair.

The Secretary (Mr. W. J. Russell) having read the notice convening the meeting, the report and accounts, which were summarized last week, were presented.

The Chairman said he had the greatest possible pleasure in proposing that the report of the Directors and the statement of accounts be received and adopted. The first thing, naturally, to which the Directors referred on these occasions was the sale of gas; and they were very glad to be able to present to the shareholders a satisfactory increase. The quantity of gas sold showed an increase of 30,370,100 cubic feet over that of the corresponding period of 1898—equal to 9·56 per cent., or in money value to £4332. He thought this was very satisfactory, when they remembered that they had to struggle against the electric light, which was being very strongly pushed by the Corporation. But he felt sure that as they went on, and gas became more used for cooking and heating purposes, they would be able to show still more satisfactory results. He had seen the balance-sheets of several different companies; but in few was he able to find anything like the increase shown here, and only one that was larger. This, he thought, spoke well for the low price of gas in Croydon, compared with that of other companies, and also for the way in which their customers were treated. They had supplied 400 additional ordinary, 842 prepayment, and 101 automatic meters; and 888 more gas cooking and heating stoves had been let out on hire. This showed that they had still a large increase going on in this branch, and that they were able to hold their own notwithstanding the electric light competition. He thought a great many of those who used the electric light were dissatisfied with it, as they had seen lately that a deputation had waited upon the Chairman of the Electric Light Committee of the Corporation, and they did not come away altogether pleased. The receipts from residuals were naturally higher, coal having gone up in price; but there was not the increase that should be shown. He did not think people realized the difference in price between coal and coke, and that they would find coke broken up was a good thing to cook with. He assured them that they would find broken coke a great saving. They had been able to make contracts for many things up to the end of June next; and therefore during this half year they did not find the difference which they were afraid they would have to meet when their present contracts ran out. But "sufficient unto the day is the evil thereof," and he would not anticipate, for prices might go down again before that time arrived. They had necessarily made several alterations to cope with the increased business. They had partially duplicated their new water-gas plant, and had to put down a new purifier. They also intended to lay an additional trunk main from the works to Purley, for the purpose of giving an increased supply to South Croydon, Purley, Kenley, and Coulsdon, including Cane Hill Asylum. They all knew that South Croydon was growing very much; and in the past few years they had practically doubled their supply down the Brighton Road. Still this was not sufficient; and they had no alternative but to lay down a new main. They had spent during the half year £6620 18s. 7d. on capital account; and he thought, considering the work carried out, they had been very economical. It included new buildings, water-gas plant, purifiers, mains in 22 roads, and gas-stoves and house-fittings—making the total expenditure on capital account up to Dec. 31 last £383,270 19s. 8d. Coming to the receipts, he said from private consumers in the Croydon district they received £36,978, being an increase of £3028; from the Carshalton district, £4671, or an increase of £611; and from public lighting and under contracts, £6629, or an increase of £594. This was in spite of the Corporation lighting additional roads with electricity, and removing many lamps. For the rental of gas-stoves they received £1428, or an increase of £213; and for the rental of house-fittings, £611, or an increase of £97. Thus a total increase was shown of £4686 10s. 4d. on the half year. Turning to the sale of residuals, he said for coke they had received £10,980, or an increase of £1791; and the net average price realized was 1·01d. per cwt. increase. Breeze, however, was £92 less than in the corresponding half year—being £599; tar realized £1507, or an increase of £402; and sulphate of ammonia, £1651, or £143 more—there being an increase of 18s. 4d. per ton over the net price in 1898. Some might say that they ought to have made more; but the more oil gas they made, the less sulphate of ammonia was produced. This gave a total increase of £2244 17s. 6d., which he thought must be considered very satisfactory. Thus they had received from all sources £66,370 6s. 2d.; the total increase being £6932 15s. 10d. Now he came to one of the most important items of expenditure in the manufacture of gas—coal, oil, &c., £23,841 12s. 7d., being an increase of £4557 14s. 11d. over the corresponding half year. They had carbonized 2707 tons more coal, and used 57,080 gallons more oil. Of course, this extra expenditure was mainly owing to the increased price of 1s. 6d. per ton for coal. He was afraid that when their contract came to an end, judging from the present view of things, they would have to pay a much higher price than this; but, on the other hand, between now and then the prices might come down. He hoped it would be so, both for the sake of those burning coal in the house and of those using it in gas-works, because it was not an agreeable thing to have to go back to a higher price for gas. He did not mean to say that they would have to adopt this course; but he might give them a few figures to show what the result of increased prices would be. Supposing they had to pay 1s. per ton more for coal, in using the same quantity as now it would cost them £1226 more than they were at present paying. But he would say 4s. would more likely be the figure they would have to pay, which would mean an increase of £5065 in the half year. Supposing they had to raise the price of gas 1d.—making it 2s. 9d. per 1000 cubic feet, instead of 2s. 8d.—they would thus get £1449 8s. 5d., or about equal to 1s. per ton on the price of coal. If, however, they increased the price by 4d., they would get £5797. The Chairman then proceeded to say that the purification of gas cost £1332, or £349 more, partly on account of the increase of oil gas; wages and gratuities, £4266, were £491 more; repair of works, &c., £5034, or £374 less; and repairs to mains, £2603, or £513 more. There were various other small items of increase, bringing up the total additional expenditure to £48,792 7s. 6d.—thus leaving a balance to be carried forward to net revenue account of £17,717 18s. 8d. He thought this must be considered very satisfactory. It would be seen that they had spent a good deal on capital account; and they were contemplating the spending of a good deal more. They would see that the Directors had decided to offer £5000 consolidated "B" ordinary stock and £2500 5 per cent. perpetual debenture stock for sale by auction, in March next; and a call of £2 per share would be made on the 2500 Carshalton capital shares of £10 each (£6 paid). He felt sure the Carshalton shareholders would appreciate the fulfilment of the promise held out to them for a long time. After providing for all fixed charges, and paying the usual dividends, there would be a balance of £3396 to carry forward to the next account; and he thought, with a reserve fund of £32,326 and an insurance fund of £15,584, they could prove to investors that the Croydon Gas Company offered one of the best investments they could have.

Mr. Lambert seconded the motion, which was carried unanimously.

Mr. Corbet Woodall then moved that the usual dividends of 14, 11, and 9 per cent. on the various classes of stock and shares should be paid. He remarked that the balance-sheet showed they had earned sufficient in the half year to pay the usual dividends and carry forward a good sum. He expressed a hope that it would not be necessary to raise the price of gas, and said he thought it would be bad policy on the part of coal-owners to keep up the price of coal, as something would be sure to spring up that would tend to right it.

Mr. S. Spencer seconded the resolution; and it was unanimously agreed to.

Mr. A. J. Lambert, Dr. T. R. Adams, and Mr. W. Cash were then re-elected Directors, and Mr. Benwell was re-elected Auditor.

The Chairman, in replying to a vote of thanks, announced that the Directors had decided, subject to the sanction of the shareholders, to vote 25 guineas to the Surrey County Fund for the equipment of volunteers.

A vote of thanks to the officers and staff was also unanimously passed.

Mr. W. J. Russell and Mr. J. W. Helps replied; the latter emphasizing the remarks of the Chairman as to the good feeling existing, which would continue, he said, while the men were looked after as now.

The proceedings then terminated.

SHEFFIELD UNITED GASLIGHT COMPANY.

The Half-Yearly Report and Accounts.

At the forthcoming half-yearly meeting of the above-named Company, the Directors will report an increase of 120,675,000 cubic feet in the quantity of gas sold in the six months ending Dec. 31 last, as compared with the corresponding period of 1898; being 9·87 per cent. more. This augmentation in the consumption affords a further illustration of the continued popularity of gas for all purposes. The revenue from its sale was £117,692; residuals produced £55,066; and the total receipts were £181,688. The manufacture of gas cost £109,463 (coals figuring for £61,612); distribution, £12,929; and management, £5121—the total outlay being £136,690, leaving £44,998 to go to the profit and loss account, the balance on which is £64,338. The dividends recommended, which the Directors say have been fully earned, will absorb £42,392, and there will be a surplus of £3494 to add to the balance of £18,452 brought forward. The difficulty which the Company have experienced, in common with other gas undertakings, in obtaining delivery of coal, has necessarily caused the Directors much anxiety. Anticipating that there might be some trouble, a larger stock than usual was placed in the stores; and at the end of August the total quantity of coal and cannel in hand was 46,772 tons. Unfortunately, however, in September a portion of it was found to be heating, which compelled its immediate use; and the stock was thereby reduced by about 10,000 tons. But for this occurrence, the Company would have been able to tide comfortably over the winter. The Directors report that on the night of the 21st of December last a fire, the origin of which has not been ascertained, resulted in the destruction of the Company's sulphuric acid works, and also of a portion of the buildings containing the sulphate of ammonia plant. The whole of the premises were, however, insured.

The Barnsley Town Council last Tuesday endorsed the acceptance of a tender by the Water Committee for the pipes required for the pipe-line from their new reservoir at Midhope to the proposed service reservoir at Wortley. The successful tenderers were the Stanton Iron-Works Company; and the amount of their offer was £17,700. The pipes are to be delivered by March 1, 1901. Owing to the present price of iron, and for engineering reasons, the contract for the pipe-line from Wortley to Barnsley is being held in abeyance.

TOTTENHAM AND EDMONTON GAS COMPANY.

The Half-Yearly Report and Accounts.

The statement of accounts which the Directors of the above-named Company will present at the half-yearly general meeting next Saturday shows an increase of 28,804,300 cubic feet, equal to 10·74 per cent., in the sale of gas for the latter half of last year, as compared with the corresponding period of 1898. The extra demand was experienced alike with ordinary and "coin" meter supplies, as well as with stoves for both cooking and heating. The revenue from the sale of gas amounted to £44,425; the sale of residuals brought in £7466; and the total receipts were £55,351. The expenditure on the manufacture of gas, inclusive of the cost of coal and oil (£11,845 and £7548) was £31,876; on distribution, £6070; and on management, £1939—the total being £44,281. The balance carried to the profit and loss account is therefore £11,070; and the amount available for distribution, inclusive of £1693 brought forward, is £11,386. The Directors recommend a dividend at the rate of 6 per cent. per annum on the "A" stock, and of 4½ per cent. per annum on the "B" stock, less income-tax. The payment of these will absorb £8929, and leave £2457 to be carried forward. Reference is made in the report to the loss sustained by the Company by the death last October of Mr. W. H. H. Broadberry, the Engineer and Manager, to whose faithful services for a period of 25 years testimony is borne. The appointment of his son, Mr. Arthur E. Broadberry, to fill the vacancy is announced. The working statements for the half year show that 15,117 tons of coal and 521,708 gallons of enriching oils were employed in the manufacture of 310,515,000 cubic feet of gas, of which 296,947,000 cubic feet were sold. The estimated quantities of residuals produced were: Coke, 9070 tons 4 cwt.; breeze, 2526½ chaldrons; tar, 252,048 gallons; and ammoniacal liquor, 4199 butts. The quantity of sulphate of ammonia made was 128 tons 11 cwt. Of the total bulk of coke produced, 2110 tons 15 cwt. were used in the manufacture of coal gas, 2906 tons 19 cwt. in the production of carburetted water gas, and the rest was sold, together with a portion of the stock, which was reduced from 433 tons 18 cwt. on June 30 to 50 tons at the close of the year. As has been the case with other gas companies, the Company experienced towards the close of the past year and during last month great difficulty in obtaining the quantity of coal required for keeping up the manufacture of gas; and the Directors were obliged to make special purchases. Fortunately, they were able to maintain a full supply of gas to the consumers.

THE PRICE AND ILLUMINATING POWER OF LONDON GAS.

The following is the statement on the above subjects which has been issued to the shareholders of the South Metropolitan Gas Company, as mentioned in the half-yearly report adopted at the meeting last Wednesday. It is signed by Mr. George Livesey.

The evidence given by representatives of the consumers before the Metropolitan Gas Companies (Powers of Charge) Committee of last session made it perfectly clear that a low price of gas was by far the chief *desideratum*. The illuminating power, within a range of 2 or 3 candles, is practically of no importance, because it is entirely in the hands of the consumer. By the use of bad ordinary burners, he often reduces 16-candle gas to 8 candles, or less (the burners commonly used generally give about 10 candles), whereas by the best burners he can get 16 candles, or perhaps a little more. With Siemens or Wenham burners, over 30-candle power can be obtained; with the original Welsbach, 60 candles; and with the improved Welsbach, he has it in his power to make it anything up to 100 candles, or more. The gas company has no control whatever over the method of burning adopted by the consumer.

It is distinctly to the disadvantage of the consumers to have gas of a higher illuminating power than can be obtained from the available supply of coal, because it necessitates "enrichment," which costs the consumer considerably more than it is worth.

The London Companies being under the sliding-scale, between 80 and 90 per cent. of the cost of enrichment is borne by the consumers. If the full sliding-scale dividend is not paid, the consumer bears all the cost of enrichment, and the company none of it. The South Metropolitan Company could now raise its price 4d. per 1000 cubic feet with a reduction of only 8d. per cent. of dividend—viz., from £5 6s. 8d. to £5 6s. per cent. Enrichment is not only expensive, it is also uncertain, and generally unsatisfactory.

The only supply of gas coal practically available for London is from the Durham coalfields, seaborne. The railway carriage on Yorkshire coal adds so much to the cost as to render its use impracticable.

Durham coal will not now produce 16-candle gas. The quality of Durham coal is slowly deteriorating, owing to the best gas-coal seams being gradually worked out.

There are three methods of enrichment: (1) By an admixture of cannel gas. (2) By petroleum spirit used by this Company. (3) By carburetted water gas.

No. 1 is unquestionably the best, and the only method that can be considered thoroughly satisfactory; but cannel has become too scarce and dear to be available. When the price of cannel was reasonable, to raise the quality 1 candle cost about 2d. per 1000 cubic feet.

No. 2 is simple and comparatively cheap; but it is uncertain, and cannot always be relied upon to carry the enrichment all over the district. The cost, as given in "The Chemistry of Manufacturing Processes" by Blount and Bloxam, is about 1d. per candle per 1000 feet.

No. 3 is also comparatively cheap; but there are serious objections to its use. Its heating power is lower, and it is not so suitable for lighting, heating, or power as ordinary unmixed coal gas.

A very large proportion of gas is now used for its heating power in various forms—how much it is impossible to say; but during about eight months of the year at least 50 per cent. of the South Metropolitan gas is used during daylight hours, and a large proportion during hours of darkness is also used for heating. Enrichment of gas used for power or manufacturing purposes, cooking, or heating is waste of money.

The Metropolis Gas Act of 1860 fixed the illuminating power at 12 candles, tested by samples from bulk at testing places "as near as may be 1000 yards from the works." Dr. Letheby, the Official Gas Examiner for the City Corporation, stated in evidence on that Bill that ordinary coal gas lost almost exactly 2 candles in travelling the three miles from the gas-works at Bow Common to the City.

The South Metropolitan Gas Act of 1869 increased the illuminating power to 14 candles; the testing-places to be "as near as may be, but not less than, 1000 yards from the station from which the gas to be tested thereat is supplied;" and by the Company's Act of 1876, the illuminating power was increased to 16 candles.

This raising of the standard is due to the fact that, whenever a gas company applies to Parliament for further powers, the local authority generally presses for an increase of illuminating power, under the impression that thereby something to the advantage of the consumers will be extracted from the company. This view is obviously unsound; the fact being that the whole cost of the increased standard will be borne by the consumers of gas. Almost all gas companies pay full dividends; and any increase in the cost of gas making either causes an increase in the price of gas or retards a reduction of that price.

Parliament has thus been misled, with the result that gas companies, as a rule, are now obliged to supply gas of a higher quality than can be obtained from the available supply of coal—necessitating enrichment in some form, which always costs the consumer more than it is worth. In fact, so far as the consumer is concerned, when proper burners are used, the difference between 14 and 16 candle gas is inappreciable. It is not a deficiency of illuminating power, but an insufficient supply—*i.e.*, short quantity or low pressure—that brings complaints from consumers.

The illuminating power of gas cannot by any possibility be maintained at one uniform standard. It is subject to considerable fluctuations from causes absolutely beyond control. Coal varies in quality from different pits and different seams. At one time it may be used freshly wrought and dry, at another it may be wet, or it may have been in store a long or a short time. All these circumstances affect the quantity and quality of the gas. Even a change of wind, causing a variation in the heat of the retorts, and changes of weather from warm to cold or from dry to damp, cause variations, and render it impossible to supply gas of uniform quality.

Further, gas testing is not by any means an exact operation, even with all the scientific refinements and precautions possible in a properly fitted-up testing-place. The tests have become more stringent, and some of the testing-places have been fixed at a greater distance than 1000 yards from the works, though the principle of testing by samples from bulk taken from leading mains is still maintained. This is the universal practice all over the kingdom, both for corporations owning gas-works and for gas companies. Again, gas loses sometimes more and sometimes less by travelling through the pipes. All these elements of uncertainty compel the companies, in order to be on the safe side, to enrich their gas to an average at the testing-places of something over 16 candles, although there is no penalty until the quality falls to 15½ candles.

Parliament has known since 1860, by Dr. Letheby's and other evidence, that gas loses considerably in illuminating power in travelling from the works to the consumer, and, knowing this, has invariably prescribed an illuminating power to be tested either at the works or at some central position by samples from bulk. In fixing the standard, surely Parliament acted on this knowledge. If, for instance, it had been the intention that London gas should be of 16-candle power tested at the houses of the consumers anywhere and everywhere, the quality, as tested by samples from bulk at 1000 yards from the works, would surely have been fixed at 18 candles at least. In fact, if London gas is to be of 16-candle power tested anywhere by the portable photometer, the Companies will have to enrich it to at least 18½ candles.

This raises three questions: (1) How is it to be done? (2) What will it cost? (3) Who is to pay for it? The answers are: (1) Only by enrichment with a large proportion of water gas. (2) The cost will be from 2d. to 3d. per 1000 cubic feet, at least. (3) The price of gas must be raised to cover the increased cost.

Further, the position of the Companies is at present sufficiently difficult and uncertain. They endeavour to supply, and believe that from day to day they are supplying, gas up to the standard; but the examination of the official returns every morning is always accompanied by anxiety lest there should be an adverse report. If the portable photometer were legalized, this uncertainty, which in various ways is to the disadvantage of the consumer, would be greatly increased. Either the portable photometer must be very unreliable, or all the elaborate and delicate arrangements for testing, as prescribed by the Referees for the legal testing-places, are unnecessary and useless.

The Gas Companies are at present subject to certain penalties if the illuminating power falls to 15½ candles or lower, unless it be the result of unavoidable cause or accident. The penalties are adjudicated by the Magistrate of the Police Court, and are a charge on the dividend, though, so far as this Company is concerned, they have never affected the dividend in the slightest degree. The proceedings, however, are a cause of great annoyance to the Company, because every failure is treated as if it were a wilful and almost criminal offence. I have for a long time told the officers of this Company not to trouble themselves when they receive an adverse report, but to treat it with indifference, knowing as I do that they have done their best, and knowing also from my own experience, when Engineer to the Company, the worry and anxiety caused by this vexatious system. In place of it, the Company's Bill proposes to substitute a system whereby the sliding-scale of price shall be extended to include quality also. This was suggested many years ago by Mr. Vernon Harcourt, F.R.S., then, and now, one of the Gas Referees. The Bill provides that the initial price under the sliding-scale shall vary according to the illuminating power of the gas, as shown by the average of all the testings every half year. If the average is above 16 candles, there shall be no alteration in the initial price. If the average is between 15 and 16 candles, the initial price shall be reduced 1d., necessitating an *actual* reduction of dividend for the half year, unless the price has been reduced 1d. per 1000 cubic feet to the consumers. If the average quality is between 14 and 15 candles, the initial price shall be reduced for that half year another 1d.; but should any test fall below 14 candles, the Company to be liable to the same proceedings and penalties as are at present in force when the quality falls below 16 candles.

The question that will be raised, supposing the principle to be approved, is whether 1d. reduction of the initial price for each step downwards is a fair proposal. It is not possible to determine this exactly; but I should not have made the proposal if I did not think it fair. *The Company desires to give the whole of the saving, whatever it may be, to the consumers.* The object is to cheapen the price of gas, which is as necessary to the Company to enable it to maintain its position against the strong competition to which it is exposed, as it is desired by, and is to the advantage of, the consumers.

But supposing the 1d. reductions of initial price are not the exact equivalent of the gradations of quality, the sliding-scale supplies the correction either way. Whatever the saving may be, between 80 and 90 per cent. of it would go to the consumers in any case. The working will therefore be as follows: The present quality is 16 candles, with 15½ candles as the minimum for any day. The average is rather over 16 candles. Without enrichment, the average quality will fall to something between 15 and 16 candles. This will reduce the initial price 1d., and will by the Bill, which adopts the proposal of the Powers of Charge Committee, reduce the dividend 2s. 8d. per cent., or about £7500 a year. If the shareholders are not to lose this £7500—or £3750 for the half year—the price of gas must be reduced 1d. per 1000 cubic feet, which will give the consumers over £21,000 in the half year. If the saving from the discontinuance of enrichment amounts to more than 1d. per 1000 cubic feet, the reduction to the consumer will be greater; or if the saving should be less than 1d. per 1000 feet, the reduction of price will be less. Consequently, any inequality will be met by a self-acting adjustment. The Company, true to its traditions of the last forty years, and more especially since the advent of the sliding-scale, recognizes that it is its interest as well as its duty to sell gas at the lowest practicable price.

I expect that unenriched gas will average about 15½ candles, and that it will seldom fall below 15. The Bill provides for a possible reduction of illuminating power to a minimum of 14 candles. The late Dr. Letheby said this was the proper standard for London. If, therefore, it should be found advantageous to the consumers to make such reduction, the Bill, if passed, will confer the necessary power. At any rate, it prescribes limits within which actual working experiments can be made to ascertain, and to practically adopt, the most suitable standard of illuminating power for London.

The probably rapid improvement and cheapening, leading to the general adoption, of the incandescent system of lighting, may in the early future render a further great reduction of illuminating power, and consequent cheapening of the cost, of gas advisable—its heating power becoming then the chief, if not the only, consideration. The ideal which may soon become practicable is cheap non-luminous heating gas, and universal incandescent lighting. The latter has already been realized to the extent of 85 per cent. in Central Germany.

A few words on the new sliding-scale. The provision in the Company's Bill differs from the recommendation of the Committee only in that their double scale is made single. The proposal of the Committee, adapted to the Company's converted capital, is that there shall be an increment of 2s. per cent. for each 1d., and a further 2s. per cent. for each 3d., variation in the price of gas. The Bill puts it at 2s. 8d. for each 1d. The Bill also adopts the recommendation of the Committee that the initial price shall be reduced to 3s. 3d. This gives the Company a slight nominal advantage when gas is sold at less than 2s. 6d. per 1000 feet, on the intermediate pennies; but it is so slight as to be of no practical importance, for no one would think of increasing a dividend by so small a sum as 8d., or even 1s. 4d., per cent. per annum.

The Company's present standard of increase of dividend of 2s. per cent. for each 1d. reduction in price raises the point mentioned by Mr. Haward in his evidence (Questions 199-201). He said in effect that the increment of dividend has now become so small for 1d. reduction as to fail to be an incentive to a company to reduce their price. This is perfectly true. Taking the actual price paid under the auction clauses for this Company's stock—viz., £140 per cent.—the increase of dividend is only 2s. per cent. on the nominal, and only 1s. 5d. per cent. on the actual, investment. The sliding-scale has, therefore, become inoperative, because the price must be reduced nearly 4d. per 1000 feet before the shareholder can get an increase of ¼ per cent. on his investment, or over £150,000 to the consumers before the shareholders become entitled to £14,000 increase of dividend.

The Committee consequently made a move in the right direction by taking something off at one end and adding at the other; but it may be a question whether they went far enough in this direction to restore the sliding-scale to its original purpose—viz., to offer an inducement to reduce the price of gas.

PROVINCIAL GAS AND WATER COMPANIES.

Gas Companies.

The revenue of the Airedale Gas Company for the past year amounted to £6545, and the expenditure to £3966—leaving a balance of £2579; being £1292 for the past, and £1287 for the preceding, six months. The gas sold during the past half year was 18,741,100 cubic feet, which, added to the June portion (16,705,400 cubic feet), makes a total for the year of 35,446,500 cubic feet, or an increase of 5,647,000 cubic feet over the sales for 1898. Residuals produced an income of £213 in excess of that of the previous year. On the other hand, coal, wages, and materials of every kind increased in value; making the cost of production greatly in excess of the year 1898. At the ordinary general meeting of the Company held on Monday last week, the Directors' report, in which they recommended the payment of dividends of 5 and 3½ per cent. on the different stocks, was adopted.

The revenue account of the Bath Gas Company for the six months ending Dec. 31 amounted to £36,729; the sale of gas for public and private lighting producing £27,749, and the residuals realizing £6601. The expenditure on the manufacture of gas came to £20,987 (coal costing £15,207); on distribution, to £3905; on management, to £1527—the total being £28,428. The balance carried to the revenue account is £8301; and the amount available for distribution is £12,029, which will enable the Directors to pay the maximum dividends. There was an increase of 11 million cubic feet, equal to nearly 5 per cent., in the consumption of gas during last half year, compared with the corresponding period of 1898; and there was a satisfactory improvement in the revenue from residuals, which helped to meet the extra cost of coal.

The half-yearly meeting of the Bristol Gas Company was held on Thursday, when Mr. J. W. S. Dix submitted the report of the Directors which was noticed last week. He thought the shareholders might congratulate themselves on the result of the trading of the past and preceding half year. There had been a very satisfactory increase in the sale of gas. Notwithstanding the reduction in the price by 1d. per 1000 cubic feet from July 1, the revenue account showed a balance of profit, after providing for interest on debenture stock and the dividend on the ordinary stock, of £3124. There had been an increase in gas-stoves of 1271, prepayment meters 833, ordinary meters 1244, and new services 2036. As an instance of the way in which business was expanding, he mentioned that there had been an increase of 7½ per cent., or about 38 million cubic feet, on the output of gas in the half year. The call upon their supply the last few days had been severe; the increase during the fortnight being 11,698,000 cubic feet. With all their prosperity, however, the Directors had not been free from anxiety. They had been very anxious with regard to coal. They had pulled through so far; and he hoped they would do so to the end without a check. The rise in the price of coal had been a great temptation to some people to profit by supplying outsiders. But the Company had been dealt with fairly; and their contractors had done what they could, although the Directors had had to keep them up to the mark. Notwithstanding the increase in the price of coal, the Directors had not increased the price of gas, nor did they intend to do so unless they were absolutely obliged to by the markets being against them. The report was adopted, and the dividend declared.

The development of the Bromsgrove Gas Company during the past four years has been equal to 50 per cent. This was the pleasing statement made by the Chairman (Mr. John Green) at the meeting of the shareholders yesterday week. In view of the enormous increase, it is not surprising to learn that it is the intention of the Directors during the present year to make further improvements and extensions at the works, a large portion of the expenditure on which will be charged to revenue. It is therefore proposed to call a special meeting to sanction the issue of £4000 in "B" shares. Including the amount of £738 brought forward from 1898, the accounts showed an available balance of £2023, out of which a dividend of 7½ per cent. on the ordinary shares and seven-tenths of 7½ per cent. on the "B" shares for the year, free of income-tax, is to be paid.

The annual meeting of the Calverley and Horsforth District Gas Company was held last Wednesday. The report disclosed an available balance of £2939; and it was decided to pay the statutory dividends at the rate of 10 and 7 per cent.

The annual meeting of the Colchester Gas Company was held last Friday—Mr. C. Coleman, the Chairman, presiding. The Directors, in their report, congratulated the shareholders on the year's work. Under the supervision of their Manager (Mr. H. S. Pike), they had made 2,681,000 cubic feet more gas than in the previous year, or an increase of 2¼ per cent. It was satisfactory to notice that gas was more generally employed for heating and cooking purposes than formerly, and that its use for motive power was more fully recognized. They could, therefore, anticipate a large increase in its consumption for other purposes than lighting. The report was adopted.

The annual meeting of the Halesowen Gas Company was held last Wednesday—Mr. C. E. Bloomer, the Chairman, presiding. The report for the past year submitted by the Secretary (Mr. D. W. Sluter) showed a considerable improvement upon previous years; and it was also pointed out that the exhibition of gas appliances held in April last was attended with satisfactory results. There had been an advance in returns from residual products, and the price of gas had been reduced during the year, which had given general satisfaction. The Directors recommended a dividend of 7 per cent. on the "A" shares, and £4 15s. per cent. on the "B" shares. The Chairman, in moving the adoption of the report, congratulated the shareholders upon the continued prosperity of the Company. The report was adopted.

At the annual general meeting of the Hoddesdon Gas Company next Monday, the Directors will have the pleasure of drawing the shareholders' attention to the satisfactory increase in the sale of gas, and the consequent higher profit, which characterized the working in the past year. The gas-rental amounted to £3543; and the total receipts were £4355. The expenditure was £2643; and the balance £1712—an increase of £190 on that of 1898. The balance brought forward was £2292; and the amount available for distribution is £2591—in round figures, an advance of £300. The Directors will recommend dividends at the rates of 5 and 3½ per cent. for the past six months; making, with the interim dividends, 10 and 7 per cent. for the year. Under the supervision of Mr. Harry D. Duesbury, the Company's Manager and Secretary, several important renewals of plant have been carried out at the works, which are being maintained in good and satisfactory condition.

The annual report of the Directors of the Ipswich Gas Company states that the consumption of gas continues to increase rapidly; the quantity manufactured being 28,140,000 cubic feet in excess of the previous year. The residual products have also yielded a satisfactory increase. The expenditure has been much heavier, owing to the large rise in the cost of materials and labour; and unfortunately there is no immediate prospect of a fall in prices. The balance of profit and loss account is £16,958, out of which an interim dividend has been paid. The Directors recommend a further dividend at the full statutory rates; and a balance of £7079 will then remain to be carried forward. The completion of the new purifiers in the early part of last winter is also referred to; and it is mentioned that they are working satisfactorily.

The half-yearly meeting of the Kettering Gas Company was held last Tuesday—Mr. J. T. Stockburn presiding. The revenue account showed receipts amounting to £11,977, and expenses totalling £9760; leaving a balance of £2217. Dividends were declared at the rate of 11¼ per cent. on the "A" stock, 8¼ per cent. on the "B" stock, and 5⅝ per cent. on the "C" stock.

The half-yearly general meeting of the Kingston-upon-Thames Gas Company was held last Thursday, when the Chairman (Alderman Bedford Marsh) moved the adoption of the Directors' report, the accounts accompanying which showed that the amount received for gas sold and the rental of meters and stoves was £27,561, and that the balance to the

credit of the profit and loss account was £4601. The payment of the usual dividend was recommended; and this was agreed to. The shareholders subsequently sanctioned the promotion of the Bill which the Company now have in Parliament.

The annual meeting of the Longwood Gas Company took place last Thursday—Mr. E. Armitage, J.P., presiding. The Engineer and Manager (Mr. J. H. Brearley), in response to the Chairman's invitation, made a few remarks upon the operations of the Company. The consumption during the past year was over 14 per cent. more than in the preceding one, and 47 per cent. more than it was three years ago. It had gone up from 39 to more than 57 million feet. In the three years, the number of meters had increased from 2300 to 3664; and the leakage had been reduced from 16 to 7½ per cent. The Chairman, in an interesting speech, paid a high tribute to the manner in which the Engineer had served the Company. In moving the adoption of the report and accounts, he alluded to the upward tendency of rates and taxes, which was represented by a sum of no less than £539. The dividend of 7½ per cent. which the Directors recommended to be paid was 1¼ per cent. more than in 1898, and 2½ per cent. more than in 1897. The last time a dividend of 7½ per cent. was paid was in 1892. The Corporation of Huddersfield were laying electric cables in the Longwood district; but the Directors did not anticipate any appreciable diminution in the consumption of gas, for hitherto the electric light had proved itself both fickle and expensive. Although the consumption during the past year for private purposes showed a large increase, there was actually a decrease in the quantity of gas used for public lighting. This arose through the lighting authorities of one district deciding to extinguish the lamps for five nights at each moon. Some people had blamed the Gas Company for this, whenever the moon withheld its patronage; but it was well that it should be understood that they were not the lighting authorities, but simply supplied the gas according to contract. The report was unanimously adopted; and dividends were declared at the rate of 7½ per cent. on the original, and 5¼ per cent. on the new ordinary shares.

At the annual meeting of the Newcastle-upon-Tyne and Gateshead Gas Company to-morrow, the accounts submitted will show that the revenue in the past year amounted, to £302,920; the expenditure to £222,304—leaving a balance of £80,616. Adding the balance brought forward, a total of £84,195 is produced. After payment of the interest on debentures, loans, &c., and dividends at the rate of 5 per cent. per annum on the preference, and of 9¼ per cent. per annum on the ordinary stock, less income-tax, and adding £8000 to the reserve fund, there will be a balance of £3406 to be carried forward. In the course of the year, 234,217 tons of coal and 13,008 tons of cannel were carbonized; the quantity of gas made being 2,676,872,000 cubic feet, of which 2,373,956,000 cubic feet were sold and 2,405,764,000 cubic feet accounted for. The bulk of gas delivered last year was an increase on that sent out in 1898. The quantities of residuals produced were: Coke, 149,851 tons; breeze, 14,574 tons; and tar, 2,353,867 gallons. Sulphate of ammonia to the amount of 2113 tons 12 cwt. was made and sold, together with about 31 tons of what was in store. The Directors report an improvement in the markets for residuals. The extension of the manufacturing, storing, and distributing plant continues. The carbonizing and purifying plant at Redheugh is complete, and the stoking machinery working satisfactorily.

The half-yearly general meeting of the Newport (Mon.) Gas Company was held on Monday last week—Mr. R. Laybourne presiding, in the absence of Mr. E. J. Phillips, J.P., the Chairman of the Company, who was seriously ill. A resolution, expressing the shareholders' sympathy with Mr. Phillips, who has been a Director of the Company for 48 years, for 18 of which he has occupied the chair, having been passed, Mr. Laybourne moved the adoption of the report and accounts. In doing so, he expressed his pleasure that there had been an increased demand for gas during the past half year, and that they had earned sufficient profit to pay the statutory dividend without resorting to their reserve fund, which they had to do in the corresponding half of 1898. The sale of gas was very encouraging, and it was in a great measure owing to the adoption of penny-in-the-slot meters, which appeared to have supplied a long-felt want. A marked improvement in the value of residuals sold had also assisted them. The adoption of gas cookers and fires for domestic purposes had added to the consumption of gas. The increase in the quantity sold amounted to £2891, and in residuals to £1167; making together £4058, which enabled them to increase the balance on the profit and loss account by £3461. This was earned with an additional expenditure of £597. In answer to questions, the Chairman said the loss from robberies from prepayment meters was very insignificant. They had in use 3296 of these meters, 4026 cookers, and 1589 gas-fires. The report was adopted; and the usual dividends were declared. A vote of thanks having been accorded to the Chairman, Directors, and officials of the Company, for their able and energetic services, the Chairman replied, and referred to the assistance the Directors received from the officials, for whom Mr. T. Canning, the Engineer and Manager, and Mr. E. F. Marfleet, the Secretary, briefly responded. The meeting then closed. Subsequently, a special meeting was held to consider the Bill which the Company now have in Parliament to enable them to convert the existing, and raise further, capital. Some explanations having been given by the Chairman, he moved the approval of the Bill; and the motion was carried unanimously.

The half-yearly report of the Pontefract Gas Company states that the amount divisible is £1508, out of which the Directors recommend a dividend at the rate of 10 per cent. per annum on the original shares, and of 7 per cent. per annum on the new ordinary shares.

The accounts presented at the recent annual meeting of the St. Austell Gas Company showed that the revenue from the sale of gas and the rental of meters in the past year amounted to £1980, and that the total receipts were £3358. The expenditure being £3014, there was a balance of £344 to go to the net revenue account. In their report, the Directors stated that the increase in the consumption of gas had been 11 per cent.; while the number of consumers had increased also from 416 to 450. The improved furnaces erected in the retort-house had effected a considerable saving in fuel, as shown by the increase in the sales of coke, the receipts for which had risen from £349 to £449. The Directors recommended a dividend at the rate of 7 per cent. per annum.

The report and accounts of the Wakefield Gas Company for the half year ended December last have been issued. The report states that the balance available for distribution is £7893; and the Directors recommend the payment of the usual dividends at the rate of 11½ per cent. per annum on the 1000 shares of £25 each, and also on 3660 shares of £5 each; of 9 per cent. on 7340 "B" 5ths shares of £5 each; and of 8½ per cent. on the 2500 new ordinary £10 shares (£4 paid).

At the annual meeting of the Walker and Wallsend Union Gas Company held last Friday, the report of the Directors, noticed in the "JOURNAL" for the 6th inst., and the accounts, were taken as read. In moving the adoption of the report, the Chairman (Mr. T. Crawford) referred to the high price of coals, which, he said, would probably cause the price of gas to be increased at an early date, when the existing contracts expired. The dividend for the second half of the past year at the rate of £4 12s. 6d. per cent., less income-tax, making £9 5s. for the year, was agreed to. At the close of the general business, an extraordinary meeting was held, when the following resolution was passed: "That this special meeting of the proprietors of the Walker and Wallsend Union Gas Company, having had submitted to them the Bill now being promoted by the Company, intituled, 'A Bill to enable the Walker and Wallsend Union Gas Company to supply electricity within the borough of Jarrow and urban district of Hebburn, in the county of Durham, to raise additional capital, and for other purposes,' approve of the said Bill, subject to such additions, alterations, and variations as Parliament may think fit to make or sanction therein."

At the meeting of the Waltham Abbey and Cheshunt Gas Company next Friday, the accounts presented will show that the revenue in the six months ending Dec. 31 was £5337; and the expenditure, £3732—leaving a balance of £1605. There is a sum of £2349 available for distribution, as compared with £2156 this time last year; and the Directors will recommend dividends at the rates of 7½ per cent. per annum on the "A" and of 5½ per cent. per annum on the "B" and "C" shares, less income-tax. Under the supervision of Mr. W. Bince Randall, the Company's Engineer and Manager, 2068 tons of coal were employed in the manufacture of 22,491,000 cubic feet of gas, of which 18,485,000 cubic feet were sold for private lighting, and 21,509,000 cubic feet accounted for. The quantities of residual products are estimated as follows: Coke, 1261 tons; tar, 18,609 gallons; ammoniacal liquor, 574 butts of 108 gallons. There were 22 tons of sulphate of ammonia produced in the six months covered by the report.

The balance-sheet of the Yeadon and Guiseley Gas Company for the past half year shows an income on revenue account of £6360, and an expenditure of £5069; thus leaving a profit of £1291. This will pay the maximum dividends of 10 and 7 per cent. per annum on the two classes of stock, and leave a balance of £88 to be carried forward.

Water Companies.

It was reported at the half-yearly meeting of the Camborne Water Company last Tuesday that, owing to the drought in the past summer, the supply of water for trade purposes had to be discontinued for a short time. A new 10-horse petroleum engine had been added to the pumping plant, and the underground cutting had been extended, with the result that a good stream of water had been added to the supply. Further work of this kind was to be undertaken, in the hope that more water would be obtained. The accounts showed an available balance of £743; and the Directors recommended the payment of dividends at the rate of 9 per cent. per annum on the "A" shares, and £6 6s. per cent. per annum on the "B" shares. Mr. W. C. Pendarves, the Chairman, in moving the adoption of the report, said the expenditure showed a slight increase, owing to the extra pumping charges. The Directors proposed to carry to the capital account the balance of £128 left after payment of the dividends, in order to cover the cost of driving fresh adits. The drought of last summer, besides inconveniencing their customers and causing the loss of the sale of water, cost the Company £150 in pumping charges. Mr. Vivian suggested that another reservoir should be provided. He said it was a serious thing that the trade supply should be cut off at a busy period. The Chairman said the Directors felt that it was a most serious matter. If they could see their way to increase the storage, they would do so. The report was adopted.

The 63rd half-yearly ordinary general meeting of the Cleveland Water Company was held at Saltburn last Wednesday—Mr. W. H. R. Wharton, J.P., presiding. The Directors' report showed that, after providing for all expenditure, there remained a balance of £4872; enabling them to recommend a dividend at the rate of 9½ per cent. per annum on the original and "A" shares, and £6 13s. per cent. per annum on the "B" shares (free of income-tax), and leaving £125 to be reserved for contingencies. This would absorb £3355, and leave £1517 to be carried to the credit of the next half-year's account.

There was a ring of prosperity throughout the proceedings at the half-yearly meeting of the Colne Valley Water Company last Tuesday. The Chairman (Mr. J. R. Holland) presided. His first words were that he had frequently on these occasions—particularly of late years—had to congratulate the shareholders on the increased prosperity of the Company; and now he had double reason for doing so, for the past year had been the most prosperous in the history of the concern. To illustrate this, he gave the amounts of the water-rates for the past four years. In 1896, the sum received was £16,712, in 1897 £17,946, in 1898 £19,623, and in 1899 £22,284. The last figure was a gain of £2661 upon the previous year, which was a much greater advance than had ever before been experienced. The new supplies showed the cause for the increase in the water-rates. The number laid on in 1896 was 419, representing an annual rental of £883; in 1897, 399, representing a rental of £934; in 1898, 551, representing a rental of £1233; in 1899, 702, representing a rental of £1800. The total amount received from building supplies in 1896 was £530, 1897 £673, 1898 £810, and 1899 £1227. As to the expenditure of the half year, the fuel bill was decidedly higher, owing to the increase in cost and the larger quantity of water pumped. The total consumption of water in 1899 was 527 million gallons, which was 41 millions more than in 1898; the increase being due to the large number of additional consumers, and to the long dry season. The Directors were able to propose a dividend at the rate of 6 per cent. per annum, against 5 per cent. for the corresponding half of 1898, and to carry forward £1090, as compared with £390. In three years, there had been an increase of 2 per cent. in the dividend. Additional capital was now necessary. The large new service reservoir at Bushey Heath was nearly completed; and other works were now required to meet the demands of the district. All the capital authorized had been raised; and

the capital account was overdrawn to the extent of £2086. It was therefore proposed to create 3000 new £10 shares, either wholly, or partly, ordinary and 4 per cent. preference shares. To meet immediate wants, it was only intended to issue 1200 of the shares at present. Mr. C. E. Keyser seconded the motion; remarking that he looked forward with no apprehension to the large additional capital expenditure the Directors were asking the shareholders to authorize. Everything they had done in this direction had paid them well. Mr. Hepburn favourably commented upon the position of the Company financially, and in connection with the works and the supply. The report was adopted, the dividend was declared, and the retiring Directors and Auditors re-elected. A special meeting was then held, at which a resolution was passed giving the Directors authority to create 3000 new £10 shares. In explaining the nature of the new works which it was proposed to carry out, the Chairman mentioned that the nearly completed service reservoir would bring up the storage capacity to close upon 7 million gallons in place of 2½ millions.

At the annual general meeting of the Consett Water Company last Friday, the Chairman (Alderman U. A. Ritson), in moving the adoption of the report, noticed in the "JOURNAL" a fortnight ago, said the Company had purchased the plant, works, and goodwill of the Chester-le-Street Water Company (who supplied that place with water prior to the advent of the Consett Company laying pipes in the town in 1888) for £2000. By acquiring this undertaking, the Directors had removed all opposition, and had obviated the friction which would necessarily be caused between two distinct Companies supplying a small place with water. There had been expended during the year, on the maintenance of plant, works, &c., £7067. The report was adopted. Dividends at the rate of 4 per cent. per annum (subject to the deduction of income-tax) on the preference shares, and of 6½ per cent. per annum on the ordinary shares—making an average for the year of 6¼ per cent.—were ordered to be paid, absorbing £7082 of the £10,453 available; the balance of £3371 being carried forward.

The Frimley and Farnborough District Water Company held their ordinary meeting on the 10th inst., when the Directors reported that for the half year ending Dec. 31 there was a net balance of £1102 available for distribution. Out of this they recommended the declaration of dividends at the rates of 5 and 4 per cent. per annum, the payment of which would leave a balance of £382. In moving the adoption of the report, the Chairman (Mr. A. C. Pain) referred to the satisfactory growth of the Company, as shown by the fact that 180 houses had been supplied, and 12 meter connections made, during the period covered by it. The service mains had been extended about two miles; making a total length of 62·94 miles. A proof of the confidence of the public in the management of the Company was afforded last November, when 700 of the new £10 shares were sold at an average price of £12 1s. 9d. each. The report was adopted, and the dividends recommended were declared.

At the recent annual meeting of the Marlow Water Company, at which General Sir G. W. A. Higginson presided, the report, which was adopted, stated that the revenue of the Company continues to increase; the water-rental for the past year amounting to £1680, as against £1442 in 1898. At the same time the expenditure increased from £886 to £1039. The balance to the credit of the profit and loss account was £1315, against £1177—an increase of £138. From this the Directors recommended the payment of a dividend at the rate of 6 per cent. on the original, and £4 4s. on the additional, shares.

The revenue of the Newcastle and Gateshead Water Company continues to make a steady and substantial increase. The gross receipts for the past year amount to £148,827; and after deducting working expenses, interest, and the interim dividend, there remains £52,006. The Directors recommend the payment of the dividend on the preference stock, £18,581; a dividend at the rate of 9 per cent. per annum on the ordinary stock, making 8½ per cent. for the year, £17,477; and a dividend at the rate of £6 6s. per cent. on the ordinary stock, making £5 19s. per cent. for the year, £10,080—leaving £5867 to be carried forward. The report mentions that the drought of 1898 was continued during the past year. From June until December, no increase in the store of water took place. The Directors, however, are pleased to state that this did not in any way affect the full and unrestricted supply throughout the district. Since the opening of the year, there has been a large increase of water into the reservoirs; and the quantity now in store is 2716 million gallons out of an available storage capacity of 3060 million gallons. To meet growing demands, the Directors have determined, during the present year, to lay the new trunk main from Whittle Dene to the proposed reservoir at Byker, for which land has already been purchased. It is also intended to carry out other important extensions of main pipes, and to construct the new aqueduct and tunnel between Hallington and Whittle Dene. The large reservoir on the River Rede is making satisfactory progress.

The water-rental of the Sunderland and South Shields Water Company in the past year amounted to £82,494. The expenditure being £45,415, the balance carried to the profit and loss account is £37,049. The amount available for distribution is £44,469; and at the annual meeting next Thursday the Directors will recommend the following dividends for the six months ending Dec. 31: At the rate of £4 10s. per cent. on the ordinary and preference stocks, of £3 3s. per cent. on the additional capital stock (maximum dividend 7 per cent.), and of £2 5s. per cent. on the new (5 per cent. maximum) stock; making, with the interim dividend paid in September last, 9 per cent. on the ordinary and preference stocks, £6 6s. per cent. on the additional stock, and £4 10s. per cent. on the new 5 per cent. maximum stock for the year, free of income-tax.

OTTOMAN GAS COMPANY, LIMITED.

The Half-Yearly General Meeting of this Company was held last Thursday, at the London Office, No. 9, Queen Street Place.—Colonel JAMES LE GEYT DANIELL in the chair.

The SECRETARY (Mr. Thomas Guyatt) read the notice convening the meeting; and the report and accounts were taken as read.

The CHAIRMAN said he trusted the shareholders would regard the accounts as satisfactory, taking into consideration the circumstances of the seasons through which they had been passing. Dealing at once with the items in the balance-sheet, he said it would be observed that sundry creditors stood at £1182, which was something like £1700 less than for the corresponding period of 1898. But at that time the depreciation fund was included in the item; and it had since been invested in Consols. The bills payable were about £400 more; and this was on account of coal. The depreciation fund stood at £1657; but, on the other side, £1100 was entered as having been invested in Consols. The item also included the half-year's depreciation or sinking fund—£550—which had also since been invested in Consols. The sundry debtors amounted to £9799; but in the corresponding period, they were much greater (£18,512), because the capital expenditure was not then closed. Stocks were entered at £6383, which sum was somewhat larger owing to the fact that it included a greater quantity of coal. There was very little difference in the items on the expenditure side of the revenue account, except depreciation, renewals, and repairs, which were £1485, compared with £2486. The gas-rental was very satisfactory—the total being £10,487, as against £10,264. The income from bye-products was about the same—£2054. Leaving the figures, the Chairman said he thought he ought to mention that he was strongly urged by their Engineer (Mr. John Gandon) to pay a personal visit to Constantinople and afterwards to the works; and, in the interests of the Company, he went. Knowing several people there, he was in a position to inform himself very carefully of all that was going on; and he believed the result would be advantageous to the Company. As the shareholders were aware, their present contract was for forty years; but negotiations had been entered upon for securing an extension over the period they originally wanted—viz., seventy years. It was too soon to say anything definite in regard to this matter; but if they did get a prolongation to seventy years, it would be a great benefit to the Company, and would well repay the costly outlay they would have to incur on capital account, and which they would have to make as a consequence of getting the contract extended. Of course, it would not be seventy years from now, but from 1902. One of the immediate advantages would be that the sinking fund would be much lessened annually. The shareholders would know if the extension was agreed upon, as in that case it would be necessary to issue the balance—viz., £5000—of the £25,000 of debentures which the Directors were authorized to raise. While in Smyrna, he was immensely surprised and pleased with all he saw; and he took the opportunity of seeing everybody he could who was in a position to promote the interests of the Company. Among the gentlemen with whom he had interviews was the Vali, who was at one time the Turkish Ambassador in this country; and it was certainly an advantage to the Company to have a man at the head of municipal affairs in Smyrna who understood the manners and customs of the English people. Their Manager (Mr. Gandon) seemed to be very popular there; and everybody spoke very highly indeed of him. It afforded him (the Chairman) the greatest possible pleasure to personally see and hear these things; and he was sure the shareholders were equally pleased to hear the opinion he formed on the spot. The works were in excellent condition, and the new gasholder (which was capable of holding 250,000 cubic feet) was a splendid piece of engineering work. The condition of their affairs generally in Smyrna was most gratifying to him. He concluded by moving the adoption of the report and accounts.

Mr. CHARLES GANDON seconded the motion.

Mr. A. M. PADDON thought the statement of accounts was eminently reassuring; and the margin of profit was highly creditable to the administration. If anything exercised the minds of the proprietors of gas undertakings at the present day, it would be rather of a prospective than a retrospective character. The coal difficulty was a very great one; and it would be gratifying to learn that the Company stood secured with some little margin ahead of what they required.

The CHAIRMAN was happy to say that the present coal contract ran on to October next.

Mr. GANDON added that they had a second resource in some native coal—heraclia. Their Manager reported that it was a very good coal. It gave above 10,000 cubic feet of gas per ton, and could be obtained at a reasonable price.

The motion was unanimously carried.

A dividend at the rate of 7 per cent. per annum on both classes of shares having been declared,

On the motion of the CHAIRMAN, seconded by Mr. H. W. ANDREWS, Mr. Charles Gandon was re-elected a Director; and on the proposition of Mr. A. W. COOPER, seconded by Mr. WILKINS, the Auditors (Mr. C. K. Butt and Mr. T. H. Cooke) were re-appointed.

The CHAIRMAN moved, and Mr. J. TYSOE seconded, a vote of thanks to the Secretary, Manager, and staff.

The motion was cordially agreed to; and Mr. GUYATT responded on behalf of those included in the vote.

A similar compliment was paid to the Directors, on the proposition of Mr. W. HUGHES, seconded by Mr. PADDON.

An acknowledgment by the CHAIRMAN concluded the proceedings.

Chipping Norton Water Supply.—A special meeting of the Chipping Norton Town Council was held last Wednesday, to consider the steps to be taken to resist an injunction to restrain the Corporation from proceeding with their proposal to obtain an additional water supply. A scheme has been sanctioned by the Local Government Board, the money obtained, and the works are now in progress, to enable the Corporation to increase the water supply by tapping certain springs which flow into the River Glynne; but the owners of Lidstone Mill, situate on the river, are proceeding with an injunction to restrain the construction of the works, on the ground that the water will be diverted which is necessary for the full working of the mill. The Town Clerk was instructed to resist the application for an injunction.

The Quality of the Carmarthen Water Supply.—At the meeting of the Carmarthen Town Council last Tuesday, the report of Mr. H. P. Charles, the Borough Analyst, upon the water from Rock and Fountain, under the new gravitation scheme for the supply of the town, showed that, though it was of good quality for all purposes, it had a very marked action on bright lead. Mr. Charles added that, in his opinion, it would be very unsafe to use the water from lead pipes or cisterns for drinking purposes, as there would always be a danger of lead poisoning. The Town Clerk (Mr. R. M. Thomas) pointed out that the present water had been shown to have a similar action on lead; and eventually it was decided to send samples of both to Mr. Dupré for final analysis, he having previously stated that the Rock and Fountain water was safe for drinking purposes after it had been exposed in the proposed reservoir.

MANCHESTER CORPORATION GAS AND ELECTRICITY SUPPLY.

The Electrolysis Committee—The Gas Supply During the Severe Weather—Another Failure of the Electric Light.

At the Meeting of the Gas Committee of the Manchester Corporation last Friday, the Chairman (Alderman Gibson) and the Deputy-Chairman (the Lord Mayor) were appointed to represent the Committee on the Special Committee who, in accordance with the resolution passed at the last meeting of the Council (*ante*, p. 416), are to institute an inquiry as to the effects of electrolytic action on the gas, water, and other mains in the city. The Water Committee, it was mentioned, had already appointed their Chairman (Sir John Harwood) and Deputy-Chairman (Sir Bosdin T. Leech) as their representatives; and it was understood that the Electricity Committee were taking a similar course. This Special Committee will appoint experts to make the necessary investigations, and ultimately present a report to the Council.

It was stated that the Gas Department had got through its duties satisfactorily during the severe weather of the past week. The consumption of gas in that period showed an increase of more than 18 per cent. over the corresponding week of 1899. There had been very few complaints, even of stoppages on account of the frost; and the full supply of gas had been kept up throughout. This is a position which compares very favourably with that of the electric light supply, which, since the report we gave of the several breakdowns on the Manchester Royal Exchange, has been subject to numerous other more or less annoying vagaries; the most recent being a total eclipse at the Manchester Art Gallery reception last week.

WAGES AND CONDITIONS OF LABOUR OF BIRMINGHAM CORPORATION WORKMEN.

A General Movement—The Gas and Water Works Men Ask for Higher Pay

An agitation, which has been pending some time among the employees of the Birmingham Corporation for an improvement in their wages and conditions of labour, has taken the shape of a formal notice. The movement commenced early last year with the men working for the Health Committee. Deputations waited on the Committee; and, after some negotiations, concessions were granted, chiefly in regard to such matters as working hours and holidays. It was stated at the time that this was part of a general movement on behalf of the Corporation workmen. But the Committees concerned were not disposed then to make concessions, having in view the wages paid by other employers for similar work; and the officers of the Unions with which the men were connected did not think the time opportune for bringing strong pressure to bear. The Executives of the men's Societies have now sanctioned the making of a formal demand; and memorials have been sent in from about 4000 men in various Corporation departments asking for wages which represent an advance of 2s. a week all round. Among the men concerned are the stokers, engine-drivers, rough-fitters, machine-men, and wheelers in the employ of the Gas Committee; and the engine-drivers and stokers at the water-works. The stokers and machine-men in the carbonizing departments of the gas-works ask for an advance of 6d. a shift, and the wheelers for one of 4d. In support of their application, the men point to the high price of coal and the advance in house rents. The latter, it is stated, have increased during the past two years by from 6d. to 9d. a week. The memorials are being considered by the Committees; and the course to be taken by the men will be discussed as soon as the replies have been received. In the meantime, the Committees are to be asked to receive deputations from the men.

LOSS OF GAS AND DAMAGE TO MAINS AT SHREWSBURY THROUGH SEWERAGE OPERATIONS.

At the Quarterly Meeting of the Shrewsbury Town Council, yesterday week, the Special Committee appointed on the 1st ult. to consider the circumstances connected with the Shrewsbury Gaslight Company's claim of £1583 4s. 1d. for damage and loss arising from the shifting of their pipes during the main-drainage operations, reported that they had perused the correspondence which had passed between the Company's Solicitors and the Town Clerk; and that the Company having proceeded to arbitration and appointed Mr. Corbet Woodall as Arbitrator on their behalf, the Committee had selected Mr. J. H. Redman, Barrister-at-law, as Arbitrator on behalf of the Council. The two Arbitrators had appointed Mr. James Mansergh as Umpire. The Committee submitted for the information of the Council the whole of the correspondence with the Company affecting their claim. From this, it appeared that on the 2nd of Sept. last Messrs. Sprott and Morris, on behalf of the Company, wrote to the Town Clerk calling attention to the fact that serious damage had been, and was being, sustained by the Company, which would in due course become the subject of a formal claim for compensation. On Sept. 5, the Town Clerk replied that the letter would be laid before the Sanitary Committee; and on Dec. 4 Messrs. Sprott and Morris made a formal claim for the sum mentioned, and stated that, unless the claim was admitted, they were instructed to proceed to arbitration. On Dec. 15 particulars in detail were asked for, and supplied; and on Dec. 28 the Town Clerk was instructed to say that the Committee did not admit any damage, and denied all liability, and had no intention of entering into any compromise in respect to it. In a letter dated the 16th ult., Messrs. Sprott and Morris stated: "This last letter speaks for itself, and it must be remembered that it was not until after we had received it that the Gas Company appointed their Arbitrator, and we served the statutory notice thereof upon the Corporation. When these facts are known, we think it will be generally admitted that there was ample justification for the course which was taken, and that in interpreting your letter to mean that there was no disposition on the part of the Corporation to come to any amicable arrangement whatever in the matter, we were placing upon it the only construction it could reasonably bear." The Committee, on the other hand, append a foot-note to the letter referred to, as follows: "This letter was sent out from the Town Clerk's Office at 1 p.m. on the 28th of December. On the evening of the 29th a copy of the appointment of their Arbitrator and notice of the appointment was served on the Town Clerk—showing that the whole matter had been decided by the Gas Company previous to the receipt of the Town Clerk's letter of the 28th." The correspondence also dealt with the explosion which occurred at Coleham in 1898. The Town Clerk in December of that year wrote to the Manager of the gas-works (Mr. W. Belton) stating that the Main Drainage Engineers reported that the explosion was due to the infiltration of coal gas into the sewer through the brickwork of the man holes. To this Mr. Belton replied that the nature and attendant circumstances of the explosion were altogether opposed to those of a coal gas explosion; but even if coal gas was the agent, its presence arose from the result of sewerage operations. The Committee added that they had retained Mr. F. A. Bosanquet, Q.C., and Mr. A. Graham as Counsel for the Corporation; and that they were taking the steps necessary to resist the claim. The report was adopted.

ELECTRIC LIGHTING NOTES.

The Local Government Board have refused an application by the Morecambe District Council for a further loan of £24,000 for electric lighting, on the ground that they have already reached the limit of their borrowing powers.

The Corporation Electrical Engineer of Great Yarmouth reports that the number of applications received for electric current during the past five years has risen from 193 to 390, and the number of lamps connected with the mains from 5800 to 19,500.

The Ramsgate Corporation have decided to strenuously oppose a Bill that is being promoted by the Isle of Thanet Light Railways Company with a view of obtaining electric lighting powers in the borough. The Corporation have a scheme of their own, so that it is not likely they would consent to a rival project.

The Walsall Corporation electric lighting undertaking is not exactly speeding along the path of prosperity. Though it has been in existence four years, the last one was the first in which a profit was made; and it amounted to £61! In 1898, there was a loss of £279; and we suppose in the previous years there were deficiencies of even greater amount. If this is so, then there must be a nice little sum to wipe off the slate.

At the meeting of the Carlisle City Council last Tuesday, discussion took place regarding the charges for the electric light; numerous complaints having been made by householders and other consumers. A member remarked that the light had been treated too much like a new toy; and users had put in too many and too powerful lamps. Some of them had since reduced the number, and then said they could not see.

In prominent type, the Alliance and Dublin Consumers' Gas Company are advertising in the local newspapers a comparative statement of the cost of producing a light of 48-candle power for 1500 hours by electricity and gas. Of electricity, 270 units would be required, which, at 5d., would work out to £5 12s. 6d. With a No. 2 Welsbach burner, consuming 2 cubic feet of gas per hour, 3000 cubic feet would be needed, which, at 3s. 5d. per 1000 feet (Dublin price), would cost 10s. 3d. Thus a saving of £5 2s. 3d. is shown in favour of the latter system.

The Tiverton Town Council decided last week to engage the services of Mr. W. P. Adams, of London, to report upon a scheme for supplying electric light in the borough. The Borough Surveyor (Mr. J. Siddalls) has already reported generally upon the subject; and in the event of the scheme of Mr. Adams being adopted, Mr. Siddalls is to supervise the execution of the work, and generally act with the Consulting Engineer in the interests of the Council. Both are to be remunerated by commission on the outlay; Mr. Adams receiving 3 per cent., and Mr. Siddalls 2 per cent., on the cost.

Among the items of business "rushed" through at the end of Wednesday's meeting of the Liverpool City Council, was a recommendation of the Electric Power and Lighting Committee that the sum of £300,000 be voted for purposes connected with the supply of electrical energy. The resolution was disposed of without discussion. Alderman Paull, as the members were dispersing, entered a protest against the manner in which the matter had been disposed of. He said the Council had wrangled over a paltry sum of £250 for an hour, and yet a question of £300,000 was rushed through without comment. He thought this was a disgrace and a scandal.

Representatives of the District Councils of Lancashire last Tuesday conferred together at Manchester on the question of the attitude they should adopt towards the Lancashire Electric Power Bill. It was decided to organize a joint opposition to the measure; but the District Councils do not desire, as do the greater municipal bodies, its complete annihilation. The lesser authorities will be satisfied if they obtain protective clauses. Some of them have in view the making of a little money out of the venture by laying the electric mains in their own districts, and leasing them to the Company. Others, again, think the Company's service will be beneficial in districts that cannot afford a supply of their own; and only a few seem to prefer the complete rejection of the Bill.

The Bath Corporation have not thus far found their electric light undertaking to be a financial success; and at the next meeting of the Council the Committee will ask that £1937—nearly equivalent to a 2d. rate—shall be provided from the public funds to pay off the deficit which has accrued since the works were purchased from the Company three years ago. The accounts for 1899, just out, show that there was a gross profit, when working expenses only are considered, of £2165; but adding interest and repayment charges, and bringing forward last year's adverse balance of £125, this is converted into a deficit of £1937. "It is generally conceded, however," says a local paper, "that the lighting has not yet had a fair trial;" but on this subject, opinions may well differ.

Revised estimates for an electric lighting installation at Chesterfield were submitted at the meeting of the Town Council last Tuesday. They totalled to £25,000; and the Electrical Energy Committee advised that the Council should apply for the necessary sanction to a loan of that amount. A little discussion was raised on a remark by Mr. Robinson, in moving the adoption of the minutes, that the Engineer of the Westinghouse Company was of opinion that "it would be better to use steam rather than gas engines" for generating the electricity. Alderman Clayton was averse to being bound down to act on the opinion of

a gentleman who was interested in the supply of a particular kind of machinery; and he advocated the employment of an independent expert. Personally, he believed gas could be used as cheaply as steam. He was supported by Mr. Locke; and Mr. Markham considered that, seeing the Corporation owned the gas-works, they should employ gas-engines. However, the Electrical Committee succeeded in persuading the Council to adopt their minutes.

At the meeting of the Halifax Town Council on the 8th inst., the Gas and Electricity Committee submitted the following report, which they had adopted, of the Engines and Boilers Sub-Committee: "That a bonus be given to the following staff of the electricity works on the total works and management costs when these are brought below 1·5d. per unit. The total cost per unit last year was 1·65d. It is proposed that for every 1-10th of a penny (and *pro ratâ* for every 1-100th of a penny) a bonus of £130 be given to the staff in the following proportions: To the Chief Engineer, £50; to the Assistant-Engineer, £40; to each Charge Engineer (at present three), £10; to each driver (at present four), £2 10s.—total, £130. The scheme to be in operation for the two years ending March 31, 1901, after which it shall be subject to revision. The bonus to be paid on each 30th of June. The bonus to be available for a total cost of 1·1d. per unit, but not lower. The stations having lowest total costs in England are as follows: Edinburgh, 1·21d.; Nottingham, 1·36d.; Chester, 1·38d.; Bradford, 1·43d.; Southport, 1·45d.; Leeds, 1·5d.; Manchester, 1·53d.; Sheffield, 1·55d.; Whitehaven, 1·6d.; and Halifax, 1·65d. Assuming our output to be 1½ million units, every 1-10th of a penny per unit on costs saved means a saving to the Corporation of £625. Under this scheme, the staff receive £130 out of the £625." The scheme was, however, withdrawn from the minutes on the latter being laid before the Council.

At last Wednesday's meeting of the Sheffield City Council, the annual report of the Electric Light Committee was presented. It made an interesting statement in reference to the accounts of the undertaking for the year 1899. The total revenue from all sources was £23,342, against £19,038 in 1898. The cost of production for 1899 was £9021, against £6334 for the previous year. The gross profit was £14,321, against £12,703. There had been paid for interest on loans during 1899 £9409; and for the sinking fund contribution £3996—leaving a net profit for the year of £914. At the commencement of the year they had left from the previous year's account £1330 of profit; so that they had now a free surplus amounting to £2244. The current sold during 1899 showed an increase of 35·9 per cent.; and the number of lamps had increased by 34·8 per cent. Having regard to the gloomy forecasts made in the Council Chamber a few weeks ago, the Chairman of the Committee thought he "might fairly speak of the result of the year's work as very satisfactory." The minutes were approved without discussion. A local paper referring to this matter said: "There were grave forecasts of immediate loss on the working of this municipalized industry; and the citizens were warned that they must expect to only gradually realize the advantages of the purchase, because the price had been high. The City had to buy its way into the business, and at once lay down capital for its expansion. Imputations had been made that before the purchase the concern had been inflated for sale. . . . The report is another triumph for the policy of municipalization which many of us have pushed with the earnestness of a fully-assured faith." It is full early to speak thus confidently.

The Leicester Town Council having applied to the Local Government Board for power to borrow £100,000 for electric lighting purposes, an inquiry into the matter was held last Wednesday by Colonel H. F. Turner, R.E. The Town Clerk (Mr. J. Bell) said the capital already raised with the sanction of the Local Government Board for works and plant for the supply of electricity amounted to £76,293, or £78,207 including the expenses of the issue of the stock. The profit of the undertaking since the supply commenced in December, 1894, to June last, had been £6488; and after £6830 had been charged to the sinking fund, the amount of net loss up to June was £342, which would no doubt be met by the profit from the working of the past half year, the accounts of which had not been published. In the first complete year of working, the total output in units was 123,480; and in the year ending December last it had risen to 780,270 units. The capacity of the present central station was equal to 1400 kilowatts, or, allowing for a spare machine, 1050 kilowatts, with a total boiler capacity somewhat short of that. The maximum demand for electricity during the half year ended December, 1899, reached 880 kilowatts; leaving a margin of 170 kilowatts only. The receipts for current increased from £3320 for the half year ended December, 1897, to £4765 for the similar period ending December, 1898. The Gas and Electrical Engineer (Mr. Alfred Colson) gave a detailed estimate of the cost of the works he recommends to be carried out, amounting to £86,268, which, together with £13,732 overspent on the original estimate, made up the total of £100,000 the Council asked for authority to borrow. He also furnished particulars of the growth of electric lighting in Leicester, and said the increase in motors from December, 1897, to December, 1899, was from 344 to 632; in the lamps installed, from 27,578 to 52,526; and in the total output, from 204,084 to 437,943 units. Since the 1897 inquiry, the demand had more than doubled; and since the reduction in price from 5d. to 4d. per unit in June last, 31 motors had been fixed. The desire for current was never so great as it was at the present time. There were being wired 37 premises, representing 3500 lamps; and, in addition, there were a large number of other premises which would be wired before next autumn. He had recommended a considerable extension of the central station, which, when completed, would contain four additional alternators of 1000 kilowatts each. To meet the immediate probable requirements, he had advised the erection of two of these machines and five boilers, together with the necessary auxiliary apparatus; bringing the capacity of the station up to 3400 kilowatts. He estimated at £86,268 the total cost of the work proposed. No electric lighting undertaking in the country occupied a more enviable position than that of Leicester with regard to capital outlay. The results were pre-eminently satisfactory; and experts said that the Leicester works were the most scientific and up-to-date in the country. The capital expenditure did not exceed £55 per kilowatt, and the cost would be considerably less with the new works. Up to June, 1899, the loss was £342, and the profit in the past half year was £1089; leaving a net gain of £747.

Reduction in Price.—The Directors of the Hoddesdon Gas Company have reduced the price of gas by 2d. per 1000 cubic feet from the 1st ult.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 460.

Issue.	Share	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 13	10½	Alliance & Dublin 10 p. c.	20½—21½	..	4 17 8
100,000	10	,,	7½	Do. 7 p. c.	14—15	..	5 0 0
300,000	100	Jan. 2	5	Australian 5 p. c. Deb.	100—102	..	4 18 0
200,000	5	Nov. 15	6	Bombay, Ltd.	5¾—6¼	..	4 8 11
45,000	5	,,	6	Do. New, £4 paid	4—4½	..	5 6 8
800,000	Stk.	Aug. 16	12	Brentford Consolidated	273—278	−2	4 6 4
270,000	,,	,,	9	Do. New	208—213	−2	4 4 6
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb.	124—128	..	3 2 6
220,000	Stk.	Sept. 15	11½	Brighton & Hove Orig.	255—260	..	4 8 6
226,320	,,	,,	8½	Do. A. Ord. Stk.	185—190	..	4 9 6
973,500	Stk.	Aug. 16	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Sept. 29	10	British	43—44	−½	4 10 11
80,000	10	Aug. 31	12	Bromley, Ord. 10 p. c.	25—27	..	4 8 11
75,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd.	9½—10½	..	5 17 1
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	98—100	..	4 0 0
150,000	20	July 13	8½	Cagliari, Ltd.	28—29	..	5 13 10
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	13½—14½	..	5 10 4
50,000	50	Nov. 2	6	Do. 6 p. c. 1st Mort.	56—58	..	5 3 5
550,000	Stk.	Oct. 13	13½	Commercial Old Stock	305—310	..	4 7 1
200,750	,,	,,	10½	Do. New do.	240—245	..	4 5 9
200,750	,,	Dec. 14	4½	Do. 4½ p. c. Deb.	140—145	..	3 2 1
800,000	Stk.	Dec. 14	9	Continental Union, Ltd.	177—181	..	4 19 5
200,000	,,	,,	7	Do. 7 p. c. Pref.	178—183	..	3 16 6
51,600	Stk	Aug. 31	14	Croydon A 10 p. c.	335—340	..	4 2 4
168,400	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
555,000	Stk.	Aug. 16	5½	Crystal Palace Ord. 5 p. c.	125—130	..	4 0 9
60,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
486,000	10	Jan. 26	11	European, Ltd.	20½—21½	..	5 2 4
354,000	10	,,	11	Do. £7 10s. paid	15—16	..	5 3 2
14,993,075	Stk.	Feb. 9	4⅞	Gas- 4 p. c. Ord.	105—107	−1	4 13 5
2,800,000	,,	,,	3½	light & 3½ p. c. max.	98—98*	..	3 11 5
3,799,735	,,	,,	4	and 4 p. c. Con. Pref.	119—122*	..	3 5 7
3,993,975	,,	Dec. 14	3	Coke 3 p. c. Con. Deb.	98—100	..	3 0 0
70,000	10	Nov. 15	8	Hongkong & China, Ltd.	13½—14½	..	5 10 4
3,800,000	Stk.	Nov. 15	10	Imperial Continental	215—220	..	4 10 11
473,600	Stk.	Feb. 9	3½	Do. 3½ p. c. Deb. Red.	100—103*	..	3 8 0
75,000	5	Dec. 14	6	Malta & Medn., Ltd.	4½—5½	−½	4 7 9
520,000	100	Oct. 2	5	Met. of 5 p. c. Deb.	110—114	..	4 7 9
250,000	100	,,	4½	Melbourne 4½ p. c. Deb.	107—109	..	4 2 7
541,920	20	Nov. 15	3	Monte Video, Ltd.	11—12	..	5 0 0
617,346	Stk.	Aug. 31	9½	Newc'tle & Gateshd Con.	220—225	..	4 2 3
264,856	Stk.	Dec. 29	3½	Do. 3½ p. c. Deb.	104—107	..	3 5 5
60,000	5	Sept. 29	7	Ottoman, Ltd.	5—5½	..	6 12 7
					* Ex div.		

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
150,000	5	Nov. 30	8	Oriental, Ltd.	7—7½	..	5 6 8
185,000	5	,,	8	Do. New, £4 10s. pd.	6¼—6⅝	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.	1¼—1⅜	..	4 11 5
500,000	100	Dec. 1	6	People's Gas 2nd Mtg. of Chicago Bonds	102—106	..	5 13 2
851,070	10	Oct. 13	7	River Plate Ord.	10⅜—11¼	..	6 4 5
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	99—101	..	3 19 3
250,000	10	Sept. 15	10	San Paulo, Ltd.	12—13	..	7 13 10
135,000	Stk.	Sept. 15	10	Sheffield A.	249—251	..	3 19 8
209,053	,,	,,	10	Do. B.	249—251	..	3 19 8
447,427	,,	,,	10	Do. C.	249—251	..	3 19 8
5,600,000	Stk.	Aug. 16	5⅓	South Metrop., 4 p. c. Cnv.	133—136	..	3 18 5
1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb.	100—102	..	2 18 10
120,000	Stk.	Aug. 31	6	Tottenham A. 5 p. c.	141—143	..	4 3 11
250,520	,,	,,	4½	and B. 3½ p. c.	102—104	..	4 6 6
55,100	,,	Dec. 14	4	Edmonton 4 p. c. Deb.	113—117	..	3 8 5
182,380	10	Jan. 12	5	Tuscan, Ltd.	8½—9½	..	5 5 3
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.	101—104	..	4 16 2
				WATER COMPANIES.			
780,399	Stk.	Dec. 29	11	Chelsea, Ord.	307—312	..	3 10 6
150,000	,,	,,	5	Do. 5 p. c. Pref.	157—162	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	145—150	..	3 0 0
175,785	,,	Sept. 29	4½	Do. 4½ p. c. Deb.	148—153	..	2 18 10
1,720,560	Stk.	Oct. 13	7	East London, Ord.	203—208	+2	3 7 4
654,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb.	145—150	..	3 0 0
390,000	,,	,,	3	Do. 3 p. c. Deb.	98—100	..	3 0 0
700,000	50	Dec. 14	7½	Grand 10 p. c. max.	108—110	+1	3 8 2
310,000	Stk.	Sept. 29	4	Junction 4 p. c. Deb.	131—136	..	2 18 10
708,000	Stk.	Aug. 16	14	Kent	345—350	−3	4 0 0
160,000	,,	,,	7	Do. New, 7 p. c. max.	200—210	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.	295—300	..	3 10 0
406,200	100	,,	8	Do. 7½ p. c. max.	215—220	..	3 12 9
350,000	Stk.	Sept. 29	4	Do. 4 p. c. Deb.	135—138	..	2 18 0
500,000	100	Aug. 16	13½	New River, New Shares	425—430	..	3 3 1
1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb.	130—135	..	2 19 3
902,300	Stk.	Dec. 14	7½	South- Ord.	200—205	..	3 13 2
126,500	100	,,	7½	wark 7½ p. c. max.	190—195	..	3 16 11
489,200	Stk.	,,	5	and 5 p. c. Pref.	160—165	..	3 0 7
1,019,585	,,	Oct. 13	4	Vauxhall 4 p. c. A Deb.	131—136	..	2 18 10
1,155,066	Stk.	Dec. 14	10	West Middlesex	290—295	+2	3 7 10
200,000	,,	,,	4½	Do. 4½ p. c. Deb.	147—152	..	2 19 3
200,000	,,	Sept. 15	8	Do. 3 p. c. Deb.	100—102	..	2 18 10
					* Ex div.		

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Corporation of Glasgow have taken prompt action in dealing with one of the firms contracting to supply them with coal, who for the past three months have been short in their deliveries. The contractors in question are Messrs. John Watson, Limited, who hold a contract for 50,000 tons of coal. The Town Clerk has been instructed to intimate that, on account of the non-delivery, the Corporation will exercise the option conferred upon them by the agreement of purchasing coal in the open market, as against the short deliveries, and will charge the difference in price against the contractors. The remedy is quite a feasible one; but it is one which is very difficult to enforce.

The proposal to form a Friendly Society for gas workers in the employment of the Glasgow Corporation was discussed in a meeting of the Town Council on Thursday. Mr. R. M. Mitchell, the Convener of the Gas Committee, who has now returned to his post after being absent for some time on account of his health, moved the approval of the recommendation of the Committee. Mr. Cronin, one of the labour men in the Council, thought that the proposal was a one-sided one, and that the Committee should re-consider it. Mr. Shaw Maxwell, another labour member and co-operator, supported this view. Both gentlemen declared that they were not opposed to the formation of a Friendly Society, but they wished more information. There was some confusion of ideas as to whether they should approve of a scheme first, or should get parliamentary powers to contribute to a scheme, and after that consider whether or not they would go on. It was pointed out that the Corporation could not go to Parliament asking powers without having first agreed to the formation of a scheme; and that the details could be considered afterwards. The recommendation of the Committee was adopted by 50 votes to 10.

A movement has been set on foot for the transfer of the undertaking of the Galashiels Gas Company to the Corporation. This is not the first time that the proposal has been made; and it is just probable that on the present occasion the matter will make no more progress than it has done before. The Corporation on Monday agreed unanimously to remit the matter to a Committee to make inquiries as to the terms upon which the Corporation could acquire the undertaking. The only doubt which was expressed as to the expediency of a transfer went no further than a suggestion that they might probably require to first adopt the Burghs Gas Supply Act of 1876; but Provost Dun said this question would be included in the remit, which was then agreed to. It was spoken of as being a profitable transaction to the town, now when money is cheaper than it once was, if a reasonable price could be secured. It is upon this matter of reasonable price that the parties are likely, if they ever get into negotiation, to hopelessly differ. The cheapness of money will have the effect of raising the amount of the price. Then the price of gas being only 3s. 4d. per 1000 cubic feet also enhances the value of the undertaking. But when the low price of gas is considered, it is difficult to think of any reason why a transfer should be sought by the Corporation or entertained by the Company, unless for academic reasons. Of course, the great success which has attended the transfer in the neighbouring town of Peebles, may be an incentive; and the Corporation of Galashiels may be convinced that they have, in their town, an unoccupied field as lucrative as that which the Corporation of Peebles have found to their hand, and have developed with so much benefit to themselves. Inquiry may bring this out; and if it does, no harm will be done.

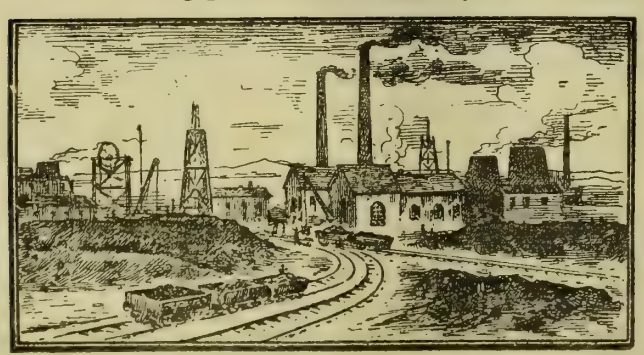
The Falkirk Gas Commissioners have, like many others, had difficulty in procuring coal during this winter. It was agreed that the Convener of the Works Committee and the Manager (Mr. J. Kincaid) should look out in the open market for 500 or 600 tons of splint coal. They have been successful, as it was reported to the Commissioners on Monday that they have obtained 300 tons of splint. The terms are not given; but the price, except to the Falkirk Commissioners, is not the most interesting feature of the transaction—it is that, notwithstanding asseverations as to the scarcity of coal, such coal can be had. This leads to the reflection that, granted the industrial world is busy, and the demand for coal great, this does not really explain the state of the coal market.

The Falkirk Commissioners had before them on Monday a report on borings which had been made for the purpose of ascertaining whether the ground at the place where the new gasholder stands would be suitable for the erection of gas-works. One adviser of the Commissioners had said it would be, and another had said, more emphatically, that it would not. The latter seems to have carried the day; for, on the joint recommendation of the Works and Finance Committees, it was unanimously resolved by the Commissioners to proceed with the Gas Bill now before Parliament. Two other sites are mentioned in the Bill; and it is evident from this week's resolution that one or other of them will be adopted.

Another subject which the Commissioners had before them was as to the publication of the illuminating power of the gas. The Burgh Police (Scotland) Act, 1892, requires that where gas is supplied by the burgh commissioners, it shall be tested by a person to be appointed by the Sheriff; and the Commissioners are required "to publish the results at least once a month." This is a very loosely-drawn provision. For instance, it is not required that the tests shall be monthly; and therefore two tests—although taken, say, on Jan. 1—might be published monthly during the remainder of the year, and the statute would be complied with. But, granting that it is the results of monthly tests which is meant, there is no direction as to where publication is to be made. Some members of the Commission hold that it means advertisement; others that it means handing the figures to the Press representatives, for publication as news. The matter was left with the Clerk. I should say that neither of the contentions is correct. Publication is merely making public, which can be done by reading over the figures at a public meeting; and the Press may make use of them or not. If the Act of Parliament had meant advertisement, it would have specified some description of publication.

Mr. Hubert Pooley, Gas Engineer to the Corporation of Dunfermline, has an excellent practice of once a year submitting a report to the Commissioners on the condition of the works and plant. In his latest report, Mr. Pooley says that the ordinary repairs this year will include repairs

COAL SCARCE.



There is a tide in the affairs of men (and Gas Departments), which, taken at the flood, leads on to fortune.

Julius Cæsar IV., 3.

STOVES PLENTIFUL.



to retort-bench £220, painting of ironwork, &c., £90, and repairs to fittings and to foreman's house £45. The whole of the carbonizing plant was in use for a short time during the past winter; and, although the price of materials and labour had gone up since his last report, the Commissioners should now consider the best means of increasing their producing power. The possible results of a curtailed supply of gas during the winter months might be very serious. The present margin of producing power was only about 7 per cent., estimated on the maximum day's manufacture of the past season. At the present time, the approximate cost of extending the retort-bench, and of providing a smithy and store, would be about £3150. The condensers and scrubber were both being fully employed at the end of December; and these should also be extended at an early date. The purifiers, meters, governors, and gasholders were all sufficient for some years to come. No. 1 gasholder was not showing any signs of increased corrosion at the water-lute; and the measures taken last year with this end in view appeared to have been quite successful. In January, 1898, Mr. Pooley pointed out that there were a number of mains which were quite inadequate; and a comparatively small number of these only had been relaid. However, he thought it was advisable to postpone the relaying of the pipes to a more favourable opportunity. The sulphate plant authorized last year is being erected at the present time. The report goes to a Committee for consideration. In the course of their meeting on Monday, arrangements were made for the holding of an exhibition of gas appliances; the exhibitors being the Northern Syndicate.

I am glad to learn, through an independent channel, that friendly relations have begun to be manifested between the Corporation of Stirling and the Stirling Gas Company. The information is confirmed by the fact that the Corporation this week sanctioned the use, free of charge, by the Gas Company, of a few lamps in the burgh for a trial of incandescent gas lighting; and a remit was made to have the positions of the lamps fixed. The Corporation are about to inaugurate an installation of electricity; and this is doubtless an endeavour by the Gas Company to show that they can compete with electricity in the matter of lighting. The fact that the Corporation are willing to give them the opportunity, is what is worth noting. The Gas Company should have their eye on the new railway station which is being erected. It would be a pity to allow the lighting of it to pass into the hands of the electricians, when the Gas Company could do it so much better and cheaper.

Johnstone is one of the smaller burghs in Scotland where the consumption of gas has increased greatly of late. During the past five years, the increase has been from 26 to 38 million cubic feet. Extension of the works has consequently become a necessity. The Commissioners have consulted Mr. J. M'Gilchrist, of Dumbarton, on the subject; and on Monday the plans which he had prepared for the proposed extension were submitted. These will involve an outlay of about £9000. The Commissioners authorized Mr. M'Gilchrist to issue schedules for the preparation of tenders for the work, and also to approach the Glasgow and South-Western Railway Company with a view to securing a railway siding into the gas-works.

Mr. A. Wilson, Gas Engineer, of Perth, brought under the notice of the Works Committee of the Gas Commissioners the fact that he had experienced great difficulty on several occasions, owing to the non-delivery of coal contracted for, and that he had, in consequence, ordered coal from various companies. The Works Committee approved of his action; and on his recommendation it has been resolved to invite offers for 3000 tons of a good splint or gas coal.

His Excellency the Chinese Ambassador in London paid a visit to Glasgow this week. On Wednesday, he was shown over the engineering works of Messrs. Sir William Arrol and Co., at Dalmarnock. He is reported to have displayed considerable interest in gas-works plant which the Company have constructed, or have under construction. Is there here a foreshadowing of the opening up of China to gas supply? He displayed, it is added, an unconcealed delight in the many ingenious machines he was shown. Among these was a large installation of gas-works plant which is going to Turin. When he saw a drawing-machine at work, he gave utterance to a prolonged "Ah!" of admiration. It was explained to him by Mr. Biggart, the Managing-Director of the Company, that the coal-waggon is tipped, the retorts charged and drawn, and the coke loaded into waggons and drawn out, without being touched by human hands. The Ambassador was much impressed, and remarked: "Here machinery is man's slave." The expression is a happy one, and will live in the memories of those who provide industrial appliances. The reflection it calls up is that had it not been for the attempt by workmen to enslave their employers, the machine would, in all probability, not have been evolved.

Mr. Henry Johnston, Q.C., the Sheriff of Forfarshire, is a gentleman whom I have spoken of before as having a habit of letting it be known that he is the master, and will do his work in his own way. He did so in the matter of the extension of the boundaries of Broughty Ferry; and he has done so again in the matter of the appointment of Auditors for the public accounts of the burgh of Forfar. The Gas Corporation of the burgh asked his Lordship to appoint Mr. Andrew Bennie; and the Police and Water Departments of the Corporation wished the appointment of Mr. S. J. M'Lees for their accounts. The Sheriff has disregarded the requests, and has appointed Mr. A. Mackay, of Dundee, to be Auditor of all the burgh accounts. In a note which he has written to his interlocutor making the appointment, he says, with some apparent heat, that he thought he had expressed himself with sufficient clearness in dealing with a similar application from the burgh of Montrose last year, to remind the members of corporations in the other burghs of their and his relative positions in the matter of the appointment of an auditor. He regretted to find that the terms in which he then expressed himself had either not reached the burgh of Forfar, or had failed to penetrate into the minds of the town councillors of the burgh. He should have thought that the situation was not capable of misapprehension. But he found it necessary to state as clearly as he could that, in making the appointment of a burgh auditor, he was responsible to the ratepayers; that the duty was committed to him as Sheriff because he was assumed to be independent of local interests and local politics; and that in the performance of this duty he should accept no suggestions from the members of the Corporation. Alluding to the utter inadequacy of the remuneration, his Lordship said

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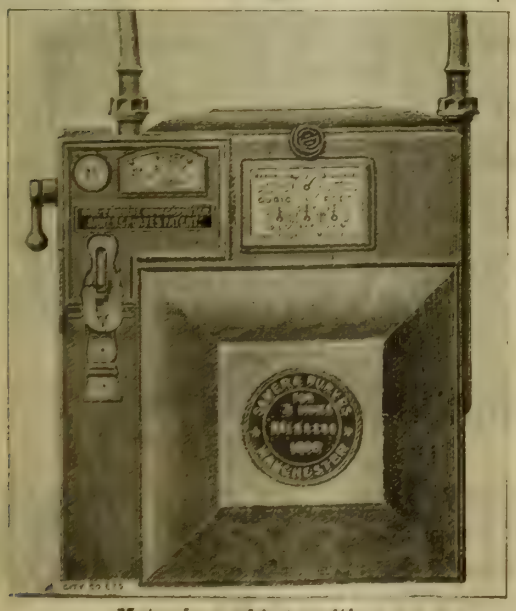
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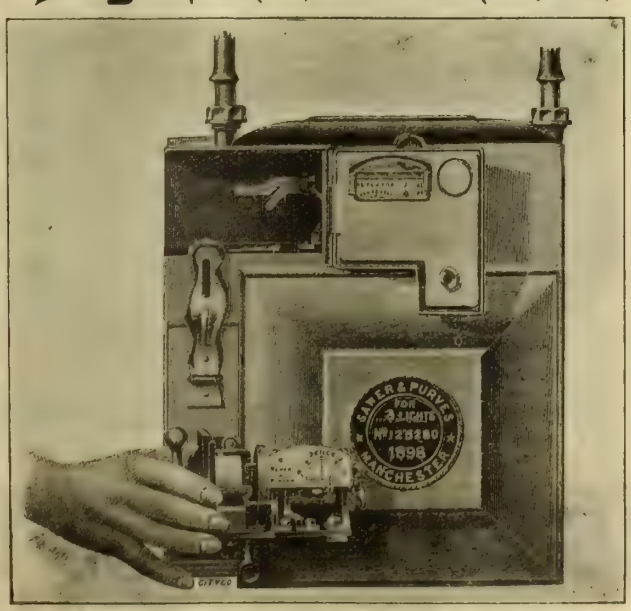
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Meter with attachment removed without uncoupling.

he had no doubt the Commissioners had obtained an audit more than the equivalent of their fees (£6 10s.); but he was convinced they had not secured the kind of audit which the statute intended, and to which the ratepayers and consumers were entitled. It was no disparagement to the local auditors that he declined to accept the suggestion as to their appointment, but because he esteemed it his duty to break down the idea that the members of the Corporation had any say whatever in the selection of the auditor, upon whose independent service the ratepayers and consumers were entitled to rely.

The annual report of Mr. J. M. Gale, the Engineer to the Glasgow Corporation Water Department, states that during 1899 the quantity of water sent into the city averaged 49,627,523 gallons from the Loch Katrine works, and 4,955,328 gallons from the Gorbals works—making a daily average of 54,582,851 gallons. During 1898, the daily average was 52,634,665 gallons, or 1,948,186 gallons less than during 1899. Mr. Gale also reports that the new works at Loch Katrine are making good progress. Arrangements have been made for raising the level of the loch 18 inches above its former top-water level this month, in order to provide against another dry summer such as we had in 1899. During the past year, 96 new hydraulic machines have been supplied with water, making a total of 393 machines in use. There are 38 applications on hand. In 1898, the hydraulic supply was 59,977 gallons daily. Last year it was 85,943 gallons.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Feb.* 17.

Sulphate of Ammonia.—The market has been quiet; and values have barely been maintained, but quotations remain at £11 17s. 6d. to £12 per ton, delivered f.o.b. at the ports. There has been no pressure on the part of makers to sell; but, on the other hand, buyers have for the most part refrained from purchasing in the absence of orders from abroad. Hence business actually done has been only on a limited scale. In the forward position, important business has been reported; the quotations remaining at £12 per ton, Beckton terms, and ordinary terms, f.o.b. Leith.

Nitrate of Soda keeps firm at 8s. 9d. per cwt. for fine quality on spot, and 9s. for March delivery.

LONDON, *Feb.* 17.

Tar Products.—Benzols continue flat; and, although they are more readily saleable, the tendency is rather to lower than higher prices. Large quantities are being taken up for gas enrichment purposes, which relieves the position considerably; and if this goes on, the increasing quantities that are said to be coming on the market may not be so injurious to values as has been anticipated. The unexpected fall in the price of alizarine does not present a hopeful prospect for anthracene. Anthracene, however, is well held, and in decreasing production; and its present price cannot possibly go lower. Solvent and other naphthas for export are weaker than their quoted value in certain industrial centres; but a prohibitory high rate of carriage prevents manufacturers in other parts participating in these markets. Tar oils are in good request at former rates.

Business during the week has been marked at: Tar, 17s. to 26s. Pitch, east coast, 35s. 6d.; west coast, 33s. 6d. Benzol 90's ordinary, 7d.; special qualities for gas, 8½d.; 50's, 9d. Toluol, 90's, 1s. 2d.; pure, 2s. Solvent naphtha, 1s. 2d. Crude, 30 per cent., naphtha, 4¼d. Heavy naphthas, 1s. 2d. Creosote, 3¼d. Heavy oils, 3¾d. Carbolic acid, 50's, 2s. 10d.; 60's, 3s. 3d. Crude naphthalene, 55s. Anthracene, nominal, "A," 4d.; "B," 2½d.

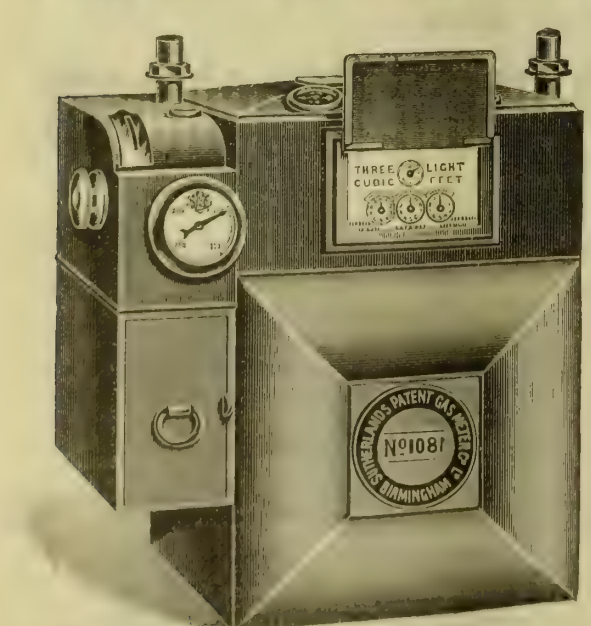
Sulphate of Ammonia has kept steady during the whole of the week. Sellers are firm, stocks are low, and the demand is unusually good. £11 17s. 6d., less 3½ per cent. at all ports, is about to-day's figure. For forward delivery, makers are asking 5s. to 10s. more; and it is not unlikely that this advance may be realized for the spring months.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—During the past week there has been a further upward move in prices, brought about by the continued exceptional pressure for all descriptions of fuel, and the special conditions connected with the recent spell of very severe weather. The principal colliery firms in the Manchester district, who last month only partially followed the upward move in other portions of Lancashire, on Thursday further advanced their prices 10d. per ton where they had previously been put up 10d., and 5d. where they had been raised 1s. 3d.—making an all-round advance of 1s. 8d. per ton. List rates in other Lancashire districts remain without actually quoted change; but supplies of both round coal and engine fuel continue so short that in the open market all sorts of special prices are still being obtained. At the pit, list rates may be quoted about 14s. 6d. to 15s. 6d. per ton for best house-fire coals, 13s. to 14s. for medium, 12s. to 12s. 6d. for steam and forge coals, 9s. 6d. to 10s. for medium, and 10s. 6d. to 11s. for best slack. So far no official move has been made with regard to the prices that are to be quoted for the ensuing season's gas coal contracts. But the question is being very generally talked of in the market; and the prevailing opinion is that there will be an advance of at least 3s. to 4s. per ton upon the prices at which contracts were taken last year—representatives of many collieries adding that, considering the present condition of the coal trade, users of gas coal may consider themselves very fortunate if they get off with an advance which does not exceed the above amount. On any special quantities that have been required by gas companies recently beyond contracts, advances of 4s. have generally been quoted; and these have had to be paid to ensure their requirements being covered. If anything, the pressure in the shipping trade increases; while supplies are certainly no more plentiful, but perhaps even shorter than they have been. The result is that, where cargoes are absolutely needed for prompt shipment, exceptional figures have to be paid; and the general basis of prices is quite as high as 15s. 6d. to 16s. per ton for ordinary steam coal, to 17s. and 17s. 6d. for the better qualities, delivered at the ports on the Mersey.

SUTHERLAND'S
PATENT
PREPAYMENT GAS-METERS



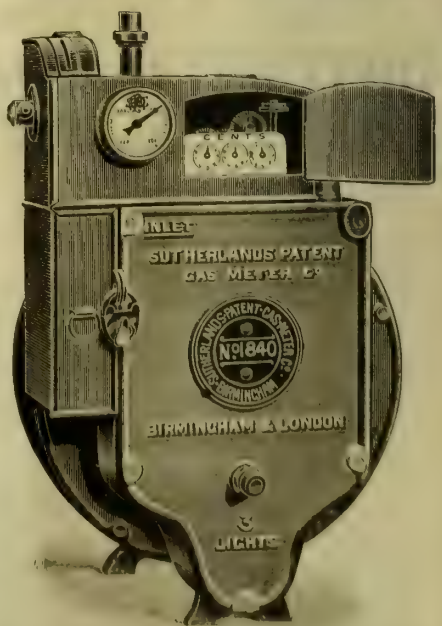
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THE SUTHERLAND GAS-METER COMPANY
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For all descriptions of coke there is a continued very pressing demand, and most of the manufacturers are a good deal behind-hand with deliveries. For gas coke, prices continue to tend upwards; and during the past week there has been a further advance—bringing quotations at the works in the Manchester district to 15s. and 15s. 10d. per ton.

Northern Coal Trade.—Though there has been, through a severe snowstorm, some disorganization of the coal trade, the demand has been full, and there are heavy orders in course of negotiation. Prices show now the influence of contracts which have in degree defined the rates likely to be paid both for steam and gas coals. In two contracts, the supply of gas coal for Stockholm has now been settled; the quantity being about 84,000 tons for the season, and the price about 20s. 6d. to 20s. 9d. c.i.f. at Stockholm. The exact price thus left for the coal, f.o.b., depends on the amount allowed for the freight; but taking an average freight, the coal price f.o.b. might be put at perhaps 14s. per ton—a very substantial increase on the prices for the same contracts last year. Such a result will help to decide rates for the large gas coal contracts that are approaching. In the meantime, other export gas coal contracts are nearing conclusion. The steam coal trade is stiffened by some Governmental contracts that have been given out in the last few days. For best Northumbrian steam coals, the quotation for occasional cargoes is about 18s. per ton f.o.b., and for steam smalls 11s.

Scotch Coal Trade.—The market continues strong, with no change. Forward sales are common, at full current prices. The quotations are: Main 14s. 6d. to 15s. per ton f.o.b. Glasgow, ell 16s. to 16s. 9d., and splint 15s. 6d. to 16s. The shipments for the week amounted to 194,580 tons—a decrease of 13,171 tons upon the previous week, but an increase of 46,155 tons upon the corresponding week of last year. For the year to date, the total shipments have been 1,003,799 tons—an increase of 193,313 tons upon the same period of last year.

The Powers of the Massachusetts Gas Commissioners.—A correspondent writing from Boston to the "American Gaslight Journal" on the above subject, dealt with in the "JOURNAL" last week, says: "The recent decision of the Massachusetts Board of Gas and Electric Light Commissioners, recommending the reduction of price of gas in Haverhill to 80 c. per 1000 cubic feet on Feb. 1, bids fair to bring about a vast amount of agitation as to the proper price for gas in the various Massachusetts cities and towns, and is causing much uneasiness among gas officials and shareholders. . . . Already demands have been made for reductions in gas-rates in Boston, East Boston, Lowell, and other places. Several Bills are in the Legislature asking for reductions in the Boston gas-rate anywhere to and between 50 c. to 75 c. per 1000 cubic feet; and the Boston parties who, by such extensive advertising of a year or more ago, sowed the wind of 35 c. and 50 c. gas, will reap a whirlwind which is liable to blow their gas securities out of sight. It is not believed that the Haverhill Company will attempt the apparently impossible task set by the Commission, but will appeal to the Courts. In such an event, the matter of reduction may be indefinitely prolonged, in Haverhill and elsewhere."

Increase in the Price of Gas at Cape Town.—We learn by the last mail that the local Directors of the Cape Town Gas Company had received instructions from the London Board to raise the price of gas by 10d. per 1000 cubic feet from the 1st inst. This will bring the price up to 10s. per 1000 cubic feet. The causes of the increase are a rise in the price of coal, and the higher charges for freight as well as for the landing of coal at Cape Town.

Sale of Stocks and Shares.—At the Mart, Tokenhouse Yard, E.C., last Tuesday, Mr. Alfred Richards sold some fully-paid £10 "B" shares in the Eastbourne Gas Company, the last dividend on which was at the rate of 11½ per cent. per annum, at £24 10s. each. He also submitted for competition, by order of the Directors, a new issue of £7000 of "C" (5 per cent.) stock of the Ilford Gas Company; the last dividend on similar stock having been at the rate of 6 per cent. per annum. With the exception of one lot, which fetched £128, it was sold at prices ranging from £124 to £126 per £100 of stock, which may be regarded as a fairly satisfactory result.

New Pumping-Station for the Farnham Water-Works.—Last Tuesday, the new pumping-station which has been erected by the Farnham Water Company was formally opened. It contains two pumps of the Worthington type, each capable of delivering 192,000 gallons in twelve hours. The present consumption is about 150,000 gallons per day; but in summer it rises to 170,000 gallons. The new machinery was manufactured by the Coalbrookdale Company, Limited, to the design of Mr. J. White Lewis, the Engineer and Manager of the Water Company, who superintended the whole of the work in connection with the building of the new station, the well at which has been made 8 feet in diameter and 30 feet deep.

Manchester Water Supply.—At a meeting of the Water Committee of the Manchester City Council held last Thursday, it was reported that the laying of the new 15-inch main from Irlams-o'-th'-Height to Eccles was completed on the 10th inst. It is expected to prove most beneficial to the district concerned. Hitherto Thirlmere water has been conveyed from the Prestwich reservoir by means of a 24-inch main to Pendlebury, and from Irlams it has passed to Eccles along only a 7-inch pipe. This small main will continue in use, and the addition to it of the 15-inch pipe will raise the pressure at Eccles by 35 lbs.; bringing it up to 60 lbs. or 65 lbs. per square inch. The scheme for securing the storm water from Longdendale by a 40-inch pipe two miles long to the Godley Tunnel, which was recently approved by the Council, once more came before the Committee. It was mentioned that tenders had been invited for the supply of 2385 tons of pipes of the dimensions indicated. These will cost £15,000 to £16,000. The whole work is estimated to require about £25,000, and will be carried out by the Committee's Engineer (Mr. G. H. Hill) and servants. It is being seriously considered by the Committee that speedy steps should be taken towards commencing to lay the second pipe from Thirlmere in those parts of the route where the greatest difficulties will be met with, and the longest time required for the operation. Mr. Hill has been requested to prepare a special report upon this subject for an early meeting.

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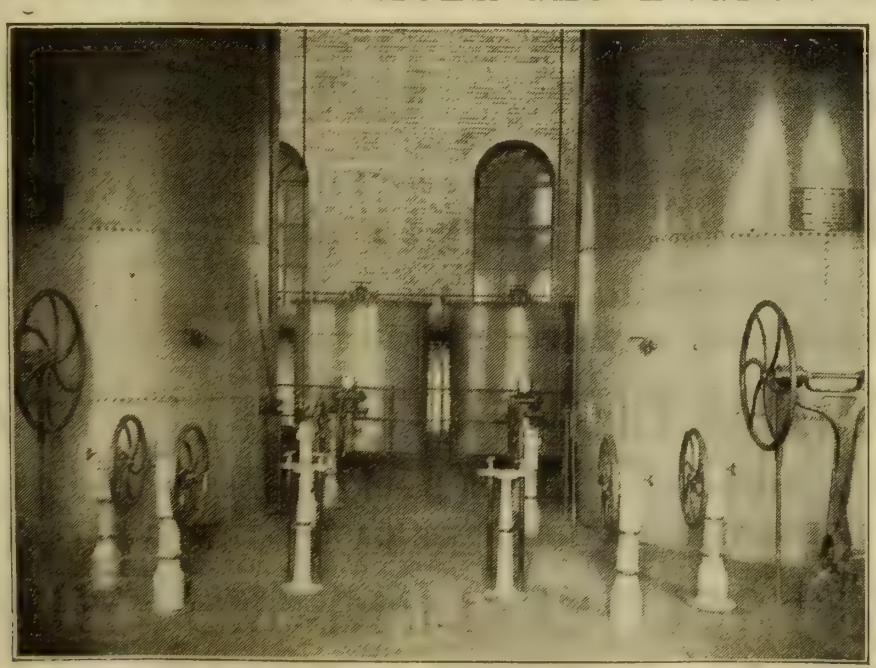
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Price of Gas for Power Purposes at Widnes.—It was announced by the Gas and Water Committee at last Tuesday's meeting of the Widnes Town Council, that they had resolved, subject to the approval of the Council, to reduce the price of gas for motive power from 1s. 5d. to 1s. 3d. per 1000 cubic feet, less 2d. per 1000 feet discount. The minute was approved.

The Horbury District Council and the Ossett Gas Bills.—At a public meeting of the ratepayers at Horbury recently held, it was resolved to oppose the Bill promoted by the Ossett Gas Company to obtain an extension of powers and authority to sell their undertaking to the Ossett Corporation, and also the Bill to enable the latter body to purchase, although the Council are willing to assist them in obtaining possession of the gas-works. The opposition, in their case, is only to safeguard the interests of Horbury.

Public Lighting Curtailed Through Shortness of Gas Coal at Walsall.—At the last meeting of the Walsall Town Council, the Gas Committee reported that, owing to the difficulty of obtaining a sufficient supply of gas coal, they had deemed it expedient to reduce the number of public lamps lighted for a few weeks; but as the deliveries were now improving, the Engineer and Manager (Mr. W. Gorse) had been instructed to light all the lamps, but to extinguish such of them as he might think fit at an earlier hour than usual so long as the short supply of coal continues.

The Leeds Corporation Gas Committee and Water Gas.—The Leeds Corporation Gas Committee left home last Thursday in order to inspect the carburetted water-gas plants at the Crystal Palace District Gas-Works and at Brighton. Should their inspection prove satisfactory, they intend adopting the system at the Meadow Lane works, where there is ample space for the erection of plant capable of producing 2½ million cubic feet per day. While in the Metropolis, the Chairman of the Gas Committee (Alderman Lowden), the Deputy-Chairman (Dr. Heald), and the General Manager (Mr. R. H. Townsley) proposed to pay a separate visit to a second London gas-works, where a Maxim carburetter is in use. At Sheepscar, some difficulty has for a long time been experienced in keeping up the gas to the required standard of 18-candle power; but it is hoped to overcome this drawback by employing a carburetter.

The Quality of the Gas at Leeds.—The Gas Examiner of Leeds (Mr. C. Buckley) has made his annual report to the Justices of the Peace. He states that the gas manufactured in different parts of the city was tested at the various testing-stations provided by the Corporation 616 times, and the number of times the gas was below the standard of 18 candles was 141. The average illuminating power of the gas at each testing-station during the year was: York Street 18·23, Sheepscar 17·87, Kirkstall 18·06, Wortley 18·02, and Dewsbury Road 18·06. The general average for the year was 18·04 candles. This, compared with the previous year, shows a very slight decrease in the illuminating power of the gas; the average for 1898 having been 18·09 candles. The number of times the gas was below the standard of 18 candles at each testing-station was: York Street 18, Sheepscar 58, Kirkstall 13, Wortley 25, and Dewsbury Road 27.

Rawtenstall and the Bury Joint Water Board.—At a meeting of the Rawtenstall Town Council last Thursday, it was decided to join the Bury and District Joint Water Board now being formed. Hitherto the Council have stood aloof from the proposal to form a Board to take over the Bury Corporation Water-Works; but now all the authorities in the water-supply area have agreed to it.

The Port Elizabeth Gas-Works Flooded.—The position of Mr. W. Arnott, the Manager of the Port Elizabeth Gas-Works, is not just now a particularly enviable one. After a spell of dry weather, the rain which had been so eagerly looked for came on the 9th ult.; and, as usually happens, it fell in rather too plentiful quantities. A great thunderstorm burst over the town about 11 p.m., and continued for more than a couple of hours. Roads and pavements were torn up, tram-lines obstructed, and houses flooded. In one street the gas and water mains were undermined, and a recently laid composition pavement was broken up and shifted in blocks a yard square—holes 3 or 4 feet deep being made underneath it. At the gas-works, there was about 2 feet of water; and some anxiety was necessarily felt. Mr. Arnott, however, and all the men available were upon the spot as soon as the water collected; and by their exertions they were able to keep up the fires, and adopt precautionary measures to prevent the town from being left in darkness. The rain was really too heavy and too local to do the country much good. But on the succeeding night it came down in a steadier and more refreshing manner. Mr. Arnott was consequently relieved of his terror of water; but unfortunately there is an ever-present one of a rather more serious nature. During the excitement caused by the war, there is fear of the Dutch rising round Grahamstown; and so the gas-works have to be kept under lock and key, with a guard always on the premises.

Gas-Works Borrowing Powers and the Price of Gas at Milton-next-Sittingbourne.—At a recent meeting of the Milton District Council, the Clerk read a letter from the Local Government Board with reference to the borrowing power of the Council for gas-works purposes. It informed the Council that their Provisional Order gave them a borrowing power of £3000, of which the sum of £2150 had been taken up, leaving £850 as the margin of borrowing power. The Board stated that a fresh Provisional Order could be issued to extend their borrowing power, but not during the present parliamentary session. The Chairman subsequently presented a report by the Gas Committee, showing the financial position in which the Council stood with regard to the gas-works up to date. There was, he said, in the hands of the Treasurer a balance in favour of the works amounting to £181 8s. 10d.; and there were bills awaiting payment amounting to £688. With the balance in hand, the amount outstanding, and the sale of residuals, it was contended that the Council could reckon upon a total of £421, which left a balance of £267 still owing. He thought that the time had come when a loan should be taken up in order to put the works into a more efficient state. He concluded by proposing that the price of gas should be raised 5d. per 1000 cubic feet, and that at the end of every half year £100 should be placed to the reserve fund. After a long discussion, an amendment was carried that the price be raised 3d. per 1000 feet.

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CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE.
Our Coal Resources . . . 523
End of the Hull Gasholder Litigation . . . 524
The Liverpool Gas Company—The Question of Dearer Gas . . 524
Mr. T. N. Ritson's Address . . . 524
The Ambition of the Rockefellers . . . 524
In the Interest of Just Local Government . . . 525
The Government Bill for Improving the Housing of the Poor . . 525
WATER AND SANITARY AFFAIRS—
Opposition to Water Bills . . . 526
The Association of Water-Works Engineers and the Control of the Nation's Water Supply . . . 526
ESSAYS, COMMENTARIES, AND REVIEWS:—
The Stevenson Memorial . . . 527
Gas and Water Companies in the Stock Market . . . 527
Electric Lighting Memoranda . . . 527
Our Coal Resources and Consumption—A Reconsideration of Some Estimates . . . 528
A New Principle in Machinery Depreciation . . . 529
Some Views of Engineering Training . . . 530
Electricity Generation in Bulk—The Schemes in Parliament . . 531
The Uses of Steam in Modern Civilization . . . 531
NOTES:—
The Perishing of Paint . . . 532
The Premium Plan of Labour Remuneration in England . . . 532
Throwing a High Chimney . . . 532
The Oxidation of Ammonia by Iron . . . 532
TECHNICAL RECORD:—
Manchester District Institution of Gas Engineers—Annual Meeting in Manchester—
General Business . . . 533
Inaugural Address of Mr. T. N. Ritson . . . 534
Water-Clad Hydraulic Mains, Coal Bunkers, &c. . . . 540
The Jasper Mantle . . . 540
A Large Gas Roaster . . . 541
British Association of Water-Works Engineers—Mr. C. E. Jones on the Nation's Water Supply and its Effective Control . . . 541
CORRESPONDENCE:—
Damage to Mains from Electrolysis . . . 545
The Price of Gas for Power Purposes at Widnes . . . 545
A Remedy for Stopped Ascension-Pipes . . . 545
PARLIAMENTARY INTELLIGENCE:—
Progress of Bills; Petitions; The Exportation of Carbolic Acid, &c. 545
LEGAL INTELLIGENCE:—
House of Lords—Sutton, Southcoates, and Drypool Gas Company *v.* Jordeson; The Hull Gasholder Case . . . 545
High Court of Justice (Ireland)—Chancery Division—Alliance and Dublin Consumers' Gas Company *v.* Thompson and Harris; Gas Traction-Engines and Damages to Gas-Pipes . . . 547
The Morley Corporation and their Catchwater . . . 547
The Incandescent Gas-Light Litigation . . . 547
Wath-upon-Dearne Gas and Lighting Company, Limited . . . 547
Selling Infringing Incandescent Mantles . . . 547
The Cost of Gas and Electric Light . . . 548
A Decision against the Brymbo Water Company for Refusing a Supply . . . 548
A Paltry Action against the South Shields Gas Company . . . 548
Embezzlements by a Gas Company's Manager and Clerk . . . 548
Charge of Falsifying Books and Embezzlement . . . 548
An Agreed Award under the Workmen's Compensation Act Dealt With in the County Court . . . 548
MISCELLANEOUS:—
The Damage to Gas-Mains through Sewerage Operations at Shrewsbury—Arbitration Proceedings . . . 549
The Leeds Corporation Gas Committee and Carburetted Water Gas 550
Meeting of the Liverpool United Gaslight Company . . . 550
Meeting of the Tottenham and Edmonton Gas Company . . . 551
Meeting of the Bromley Gas Consumers' Company . . . 552
Meeting of the Ascot District Gas Company . . . 552
Meeting of the Barnet District Gas and Water Company . . . 553
Provincial Gas and Water Companies . . . 553
The Flood at Guildford—Interruption of the Lighting and Water Supply . . . 556
Gas *v.* Electricity at Newmarket . . . 557
Electric Lighting Notes . . . 557
The Falmouth Water Supply and the Public Health . . . 557
The Supply of Water by Meter at Bradford—A Substantial Loss on Metered Supplies . . . 557
Notes from Scotland . . . 558
Gas and Water Companies' Stock and Share List . . . 558
Current Sales of Gas Products . . . 560
Coal Trade Reports . . . 560
PARAGRAPHS:—
PERSONAL: Mr. R. Darney; Mr. Alfred Easton; Mr. John Hilton; Mr. William Carr; Mr. Matt. Dunn; Mr. Harold Barker . . 532
OBITUARY: Mr. E. J. Phillips, J.P; Mr. Alex. Osborne . . . 532
The Coal-Tar Colour Industry in Germany . . . 526
Midland Association of Gas Managers—Competitive Plans for New Gas-Works—The Gas Supply of Paris—Another Pamphlet on Sulphate of Ammonia—Electric Power in the United States . . 533
The Southern District Association of Gas Engineers and Managers 544
Ilkeston Water Supply . . . 558
Increase in the Price of Gas—Suffocation by Gas—Hull Gas, Electricity, and Water Undertakings—The Dorking District Councils and the Water Company's Bill—Wolverhampton Gas Company's Bill—City of St. Petersburg New Water-Works Company, Limited—Gas and Electric Lighting at Coventry . . . 561
Acetylene Lighting at Sydney (N.S.W.)—The Budleigh Salterton Gas-Works Flooded—Incandescent Gas Lighting at Seaford—A French Gas Lighting and Meter Making Company—The Reigate Corporation and the Redhill Gas Company's Bill—Ashford and the Mid-Kent Water Bill—Heysham and the Morecambe Gas Bill—Reconstruction of the Madrid Gas Company . . . 562
The Opposition to the Exmouth Water Bill—The Yeadon Water Supply and Lead Poisoning—Kingsbridge Water Supply—The Gas Workers' Union—Extension of the Devonport Water-Works 563

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

EDITORIAL NOTES.

Our Coal Resources.

WE conclude to-day our review of the estimates made some thirty and more years since by the Royal Commission on the coal supply of the kingdom, of the stock of available coal in this country, and its probable duration. The estimates, and also the prognostications of Professor Jevons (which made so much stir at the time of their publication), we have compared with the actual statistics for the thirty years which have passed since they were made. The results of the comparison are to show that the forecasts of Professor Jevons were altogether wide of the mark, and that, although the Coal Commissioners slightly underestimated the increase in the consumption of coal, the calculation which they based upon a constant increase of three million tons per annum has hitherto proved substantially correct. According to the estimate, we have coal enough to last for another 250 years, and our examination of actual facts and future probabilities would only reduce this figure to about 200 years. That we shall go on steadily using more and more coal every year for the next two centuries, until the supply is suddenly and completely exhausted, is, however, for reasons which are discussed elsewhere, extremely unlikely; and the period named serves, not to indicate the date of the final working-out of the mines, but rather to enable one to form some idea of the length of time that will elapse before the increased price of coal, due to its growing scarcity and the enhanced cost of raising, will seriously check its use.

After a careful consideration of the available facts, there seems little doubt that a crippling of our industrial activity from such a cause will not be witnessed by any of those who may read these notes. We should, however, welcome the appointment, which is elsewhere suggested, of a Committee of experts to determine what proportion of our coal supply may be expected to be put upon the market at the same, or practically the same, cost per ton as the present average. We feel confident that such an inquiry would prove that we have a supply of easily accessible (which is to say cheap) coal sufficient to last for many years to come; but we are obliged to base this belief upon general rather than upon particular and official information. A perusal of the findings of the Commission, and a comparison of the estimates upon which these findings were based with subsequently ascertained facts, leave one thing certain beyond doubt. It is that, whatever else be the cause or causes of the present shortage of coal in the market, it is not a dearth of it in the mines. The one thing needed then to secure a return to reasonable prices, if not to the lowest quotations of recent years, is an accelerated output of the coal we possess. A 10 per cent., probably a 5 per cent., increase in the quantity raised would immediately prick the bubble of the present inflated rates. We are, of course, now speaking of more than the immediate future; for the departure of winter will witness a marked fall in Coal Exchange quotations. But, unless we are destined to experience a similar scarcity of coal next winter season, one of two things must meantime be brought about—a reduced consumption or an increased output. The signs of the times (the present condition and future prospects of the iron and steel trades especially) are not favourable to a reduced consumption. The question is, Will the output be increased?

There are two obstacles in the way of an immediately higher output. The one is the present scarcity of skilled miners, due to temporary causes. Of these, the prevalence of influenza is rapidly disappearing, and will soon cease to exist; but the chief source of depletion—the calling out of the Reserves, the Militia, and, just recently, the Veterans—appears likely to subsist for a good many months to come. Some of the vacancies so caused—most, indeed—have been, or will be, temporarily filled up from the ranks of the unemployed, which, however, are becoming rapidly exhausted. But skilled miners are not made in a day; and therefore, even if all places in the stalls are occupied, the output per man is likely for some time to be below the average. The other obstacle to an increased output in the near future is the considerable length of time that must elapse before fresh seams in our coal-beds can be tapped. The sinking of new shafts, and the getting of them into working order, is necessarily a matter of months, and often of years; so that not much immediate relief

of the situation is to be expected in this direction. Such addition to the supply as can be hoped for in the next season of maximum demand will come from pits that were left unworked, because unprofitable during the period of minimum prices. Were we responsible for the maintenance of a gas supply, we should not like to be found next autumn with a low stock of coal, and some of the winter requirements unpurchased.

End of the Hull Gasholder Litigation.

A REMARKABLE end has been reached by the gasholder litigation of the Sutton, Southcoates, and Drypool Gas Company. This case would fill a respectable-sized volume; and at last it came before the House of Lords, where, as one has grown accustomed to believe, all litigious parties receive their final *quietus* for this world. Doubtless, if some lawsuits could be carried to Mars or Saturn, or that great conference described by Milton, they would go there as a matter of course. As a fact, however, the House of Lords is charged, under the terms of the British Constitution, with the duty of giving the final answer to all legal questions arising in these realms; and the Law Lords never fail to rise to the measure of their responsibility—that is to say, they hardly ever shrink from solving the problems which continually come before them in the ordinary way. But the Sutton gasholder case was too much for them. The Lord Chancellor was the first to weaken. His Lordship had an interesting conversation with the Counsel on both sides, carried on in that charmingly free-and-easy style which is found only in the highest and the lowest Courts of Justice of the realm. For there is nothing at all terrifying about the House of Lords, sitting as the ultimate Court of Appeal. Its proceedings are as human and simply ordered as Petty Sessions; but they are usually very definite and to the point, as naturally follows from the ever-present consideration that their Lordships' words are the last that will be said concerning the matters in dispute. The Lord Chancellor, after his inquiries had been answered, found himself and his colleagues confronted with such a tangle of fact and law that he was unable to unravel it. As to the facts, there were three hypotheses, any one of which might be the true one; and whichever was adopted would determine the law. But which was the true hypothesis? When in doubt, ask Lord James of Hereford to settle it. This is the new rule of procedure in the House of Lords, and in not a few other connections also. At any rate, the Lord Chancellor asked the parties if they thought Lord James could assist them in coming to terms if they saw him in his private room. "He might conciliate them, and "give them some wholesome advice on which they could "come to terms." The Lord Chancellor was really and truly anxious not to destroy that gasholder by an injunction, which might be the due course of the law, but would be such a pity in all the circumstances! Lord James, when appealed to, was ready and willing to do his best to bring about a settlement—as he always is. When the list of the truly great and noble men who have served their country in this fleeting century comes to be made up, the name of Lord James will not be a long way down in the roll of honour. But—there is always a "but"—would the parties engage beforehand to follow the advice of Lord James? Because the peculiarity of this extraordinary reference was that its outcome should be as conclusive as the judgment of the House of Lords itself. The Lord Chancellor was properly firm upon this condition. He would not trouble Lord James in the matter unless his arbitrament was to be taken as final. This was eventually agreed to by both parties; and Lord James proved himself equal to the task. An agreement was arrived at; and the House of Lords was spared the trouble of applying good law to points of fact which could never be other than hypothetical. One would like to know what the legal profession think of this new fashion of referring a House of Lords appeal to arbitration. If this is to be the finish, why not begin with it, by asking somebody who commands the respect of both parties to act as judge and jury, and settle the difficulty out of hand?

The Liverpool Gas Company—The Question of Dearer Gas.

AT the half-yearly meeting of the Liverpool United Gaslight Company, the Chairman of the Board, Sir Edward Lawrence, had the now familiar tale to tell of difficulty in getting the usual and necessary supply of coal. His remarks on this tender subject were very much to the point; and yet they were not pitched in the tone of complaint that might have been called for if the Company had not been on the "weather side" of the coal people by virtue of their auxiliary carburetted water-gas plant. The Liverpool gas is of so high an illuminating power that the suitable coal supplies are necessarily limited in number and delivering capacity—a circumstance from which the Company have suffered acutely in the past. The Directors do not feel the pinch any more, however; and the factitious local agitation against their auxiliary carburetted water-gas production having died down, the tenor of the Chairman's speech of last Wednesday was less disturbed by controversial matter than has been the case for a long time past. The local electric light business of the Corporation has possibly contributed to produce this calm, by giving the critical minority of the city population something to think about besides the imaginary misdoings of the Gas Company. Liverpool has a nice job in hand in this affair! Meanwhile, Sir Edward Lawrence is able to announce that the business of the Gas Company is going on splendidly in all respects, and that the only cloud he can see in the future is the prospect that dear coal may impose upon the Company the necessity for raising the price of gas. There is no disputing the reality of this danger. Dearer gas will be inevitable, unless the coal market gives way; and it is to be hoped no Gas Company will be so ill-advised as to waste good reserve funds in withstanding the pressure.

Mr. T. N. Ritson's Address.

THE Manchester District Institution of Gas Engineers met on Saturday, under the presidency of Mr. T. N. Ritson, of Kendal, whose thoughtful and suggestive address will be found in another column. Mr. Ritson offered some satisfactory evidence, culled from official sources, of the increasing part that the gas industry is being called upon to play in the public service. Very adroitly, too, he contrived to pay a well-deserved compliment to Mr. Thomas Newbigging, whose beneficent influence upon the development of gas engineering in the wide region covered by the Institution during the past thirty years has been reflected in the prosperous history of the organization which owes more to him than to any other living engineer. There is probably no District Association of Gas Managers in the country that has helped its members more than the Manchester Institution; and it is impossible to say how much of this admirable result has been due to the unassuming paternal interest always shown towards the members by Mr. Newbigging. Mr. Ritson, like many others, has his own ideas as to how the united force of a technical society might be made more systematically useful to the members; his suggestions in this regard being reminiscent, to some extent, of the operations of agricultural societies. The question of the coal supply naturally took up a good deal of Mr. Ritson's attention. He passed in review some of the most obvious of the assigned causes of the recent rise in prices and shortage of supplies; and, though he did not express the opinion in so many words, his explanation bore the interpretation that there is nothing to justify either one thing or the other. Valuable testimony was offered to the merits of Hislop's process for restoring spent lime to its original "virtue" as a gas-purifying agent; and after this striking recommendation, the system should be much more widely taken up in gas-works. The Kendal experience of slot meters and hired-out gas-cookers is satisfactory; and Mr. Ritson is amiably envious of the Cork and High Wycombe results of similarly encouraging the use of gas-engines. The latter movement is not going ahead one-quarter so fast as it should. With a few words to show that he had not quite forgotten his old love—the home consumption of sulphate of ammonia—Mr. Ritson brought to a close an address which was excellently adapted to the audience.

The Ambition of the Rockefellers.

IT has been said that the empire of the earth is fated to pass from the shadows of the despotic dynasties and the artificialities of democratic forms of government to the reality of financial and industrial proprietorship. In due course, the world's vast population is to cease to regard geographical boundaries, and to pay taxes only to those who supply the necessities of life. Thrones are to give place to Trusts, Monarchies to vail themselves before Monopolies, Parliaments are to cede to Providers. Instead of a United States of America, there will be a United Mineral Oil Supply Syndicate. Sewing Cotton,

Soda, Salt, Soap, Bedsteads, Wall Papers—these are to be the styles and characters of the new kingdoms of the earth. An indication of the beginning of this stage of civilization was given in the financial press only last week. It was then announced, as American news, that the Rockefellers, with the aid of the Rothschilds, have just completed a Trust of greater proportions even than the Standard Oil Company, and one which is bound to exert many times the influence that oil ever did before gas and electricity entered the field. These financial magnates, it is now stated, have secured the absolute control of copper. They have acquired all the copper mines that are worth working, and all the undeveloped copper lands that are worth owning. Complaisant American financial judgment approves of this strategy. It is reported as believing that "gas is played out for lighting purposes in the cities. "Electricity is rapidly driving it to the wall, and gas com- "panies that have not the business foresight to turn to "electricity as a supplemental system, will be outstripped "in the race for business. Of course, the Standard Oil "people can very well run the two together profitably." So that is all right. In order to open up their new copper market, the Rockefellers have bought up all the electric lighting interests of New York. They have also secured the control of the New York Street Railways, and have done the same at Chicago. Why these magnates wanted to go into electric lighting and traction because they can make their own price for copper, is not apparent. So the story runs. Now, if anybody wants a copper stewpan, the transaction goes to the emolument of the Standard Oil proprietary. It seems an odd development; but why not? The ideal and the motive of financial and commercial enterprise has been changed for the whole world by the pervid Yankee. Hitherto, the business man has gone to work to make a competence; and having secured this—or not, as the case might be—he had enough of it. He either retired from business and founded a county family, or he confessed his failure. The American has changed all that. Like the legendary sailor, having secured all the tobacco in the world, all that he wants is more tobacco. The new financier never retires from business. What could he do if he did? He wants all the dollars there are in the world; and then—more dollars. He may build himself a golden yacht, burning rough diamonds for fuel; and his riding horses may wear platinum shoes, and carry bridles studded with rubies. All the plumbing of his "up-town" residence may be in solid silver; and every paving-slab in front of it may be twice as large and thick as any other paving-stones in the wide world. But he goes to business all the same, like any office boy. The Roman tyrant is recorded to have expressed the wish that all mankind had but one head, that he might strike it off at a single blow. The mythical Rockefeller of the American newspapers is a monster of the same "stripe," as they would say. He wants to have his financial finger in every man's pie, and to pull out the biggest plums. For what? That, as the popular novelist says, is another story.

In the Interest of Just Local Government.

The friends of sane and just government for London have good reason to be thankful for the result of last Saturday's bye-election of two representatives of the borough of Woolwich on the London County Council, which was the crushing defeat of the two "Progressive and Labour" candidates. One of these—Mr. J. R. MacDonald—is a typical example of those who, while they profess to stand for Labour, with the capital letter, have little connection with anything but the political or official party which arrogates to itself this distinctive appellation. It is not our business, as a general thing, to take notice of municipal bye-elections; but this occasion is of exceptional interest, in the circumstances. There was a vigorous drumming-up of Progressive support for the official candidates of the party, whose programme was described as "particularly "strong." Mr. MacDonald, whose "services" on behalf of "Labour" were duly advertised, was regarded as having special claims on the electorate, which is chiefly industrial. This candidate's "Labour" connections were very justly described as "legion." He had started as a City clerk himself; but "for six years he has been an honorary "member of a Trade Union; for seven he has been on the "Fabian executive, and for three years on the National "Council of the Labour Party. He used to be on the "Executive of the Women's Trade Union League, and "now sits on several Committees of the Women's Indus- "trial Council, and is a member of the Executive of the "Working Men's Housing Council." After this, it is not surprising to learn that this devoted Labour politician is a literary gentleman who writes for the "Dictionary of "National Biography." The "Municipal Journal" thought he would be a "most desirable addition to the Labour "bench on the County Council." Everybody is getting to know that "bench" pretty thoroughly. It sadly needs strengthening and freshening up by some recruits of the "horny-handed" variety, if only to leaven the old "inky- "fingered" set who profess to speak in the name of the British Workman. But the Woolwich mechanics did not appreciate Mr. MacDonald. They left him, indeed, at the bottom of a very small poll, with 1405 votes to his credit out of a constituency of 15,000. Only 7739 electors voted; and the "Independent" candidate, who was reported by the Progressive journals to have been disowned by every organization in the borough, actually beat both the official candidates of the party hollow. This striking result should encourage the advocates of good local administration, in the interest of the community as a whole, to face boldly the noisy partisans of one class, and defy those extreme men who, because they belong to the order of self-appointed wire-pullers of the political "working man," think to establish a claim to the suffrages of real working people. It is distinctly solacing to find that the Socialist, Fabian, and specialist in Trade Unionism could get only a handful of votes in all Woolwich. This result should tend to chasten the minds of the members of the dominant party in the County Council.

The Government Bill for Improving the Housing of the Poor.

On Thursday last Mr. Chaplin brought into the House of Commons a Bill to amend Part III. of the Housing of the Working Classes Act of 1890. The measure, which was duly read the first time, deals with a matter the importance and difficulty of which have been admitted many times in the "Journal." Of course, the "Daily News," which has been working up this question with laudable perseverance against the apathy of the self-styled "Popular Party" in politics, denounces the Government's "miserable little "Bill" off-hand. It is, at any rate, an attempt to do something in a direction which everybody who can read the signs of the times perceives to be the way of the next great social movement. Government Bills are none the worse, as a rule, for being styled "inadequate" by those who are a little ahead of the bulk of popular opinion in regard to their subject-matter. It is best to make haste slowly in regard to social reform; and especially is it not a bit of good to give local authorities statutory powers which they do not see the necessity of putting in force. This question of the better housing of the working-class population of towns is certain to occupy the attention and absorb the energies of the municipal authorities more and more as time goes on. During the last third of the century, town improvements have been greatly to the fore; but it is beginning to be felt that an insanitary slum in the back regions is a bad set-off to a flashy central boulevard and a people's park. So much as has already been attempted in the way of clearing out the back settlements of the towns has only served to show the elementary difficulties of the work. The first thing that strikes a would-be reformer is: What is to become of the poor people who must be turned out to enable the insanitary areas to be cleared? The existing law has gone upon the assumption that these people can be sustained in suspense, somehow, until the new homes are ready for them. The practical result has been that the clearing out of one congested area has made others worse than the first. And when the improved dwellings have been completed, the evicted population has not gone to the new nests. The Bill proposes that municipal authorities shall have a chance of establishing industrial colonies outside their own districts, in cases of need. The importance of even so moderate a proposal as this is great and far reaching. It will enable a municipality to appropriate the unearned increment in land values, and give them an economic weapon wherewith to fight the "slum lord." Hitherto, only on sanitary grounds has it been possible for a local authority to deal with the rehousing problem otherwise than as bound to the ordinary methods of expropriating owners. The consequences have been deplorable. Mr. Edmund Wilson's Society of Arts paper on his Leeds

experiences in this kind, read on the 7th inst., may be referred to for testimony as to the difficulty of making good headway under existing conditions. In speaking to Mr. Chaplin's motion, Sir Walter Foster said that a central authority, or some large local authority, should have power to supervise local areas and force local authorities to do their duty. This is queer Liberalism. Public opinion is the only effective motive power for reforms of this kind; and where it does not exist, it is perfectly idle to expect Acts of Parliament or Government Departments to do anything. What can the higher authorities do as it is, in cases where a municipal corporation chooses to ignore a high death-rate?

WATER AND SANITARY AFFAIRS.

The long list contained in our "Parliamentary Intelligence" to-day of Bills against which petitions were presented during the past week affords ample evidence that much of both the gas and the water legislation of the session will be effected only after the usual contests in the Committee-rooms of the two Houses. Our readers will, of course, understand that the list does not show the actual extent of the opposition, inasmuch as several petitions are presented against one Bill. Dealing here only with the water legislation, the two Bills promoted by the London County Council are far ahead of any of the others as provokers of hostility—nearly seventy petitions having been deposited in regard to them last week. Only one of these (from the Vestry of St. Mary, Battersea) was favourable; that body appearing to approve of the Council's purchase scheme. The second reading of both Bills has been deferred till Tuesday, the 13th prox. Another Bill which will have to encounter a good deal of opposition is that promoted with the view of obtaining legislative sanction to the formation of a Water Board for South Essex. This Bill is in the Lords; and in the Private Bill Office of that House no fewer than 25 petitions were deposited last week. A measure which will apparently encounter strong opposition is the Bill of the associated Water Companies, which, as well as the Lambeth Water Bill, has already been blocked by Mr. James Stuart, on behalf of the London County Council. The latter Bill does not seem to satisfy either the County Council or the Thames Conservancy, for Sir F. Dixon-Hartland has taken just the same course as Mr. Stuart. Regarding the Provinces, the North Warwickshire Water Bill, which proposes an extension of limits, will not have a very smooth passage through the two Houses. The Bill brought in again by Mr. Cornwallis (Maidstone) to provide for the inspection of water-supply areas has been blocked. But the honourable member was probably consoled last Friday by the statement made by Mr. Chaplin that he has a Water Supply Bill in preparation, which he hopes to be able to introduce.

At the meeting of the British Association of Water-Works Engineers in June last, the members present unanimously adopted an expression of opinion of the Water Areas Committee, that "it is essential, in the public interest, that the "water supply of the United Kingdom should be subject "to the control of some independent, duly authorized, and "properly qualified body or department." There were no dissentient voices, and no reservations or qualifications—in fact, nothing could have been more precise and definite than this declaration, and the harmony with which it was accepted. But there is evidence now that the members were rather precipitate in recording, without full and individual consideration, their adherence to the proposition of their Committee. There has, indeed, been quite a metamorphosis of opinion on the subject within the ranks of the Association, and the views of members are in a somewhat confused state. The question was once more brought before the Association at their half-yearly meeting last Saturday week, in a paper by Mr. C. E. Jones, who advocated the establishment of a National or Central Water Board, and advanced some well-defined reasons in support. We fail to appreciate any distinction between the authority which Mr. Jones desires to see instituted, and that indicated in the words "independent, duly "authorized, and properly qualified body or department," contained in the resolution adopted some eight months since. But that such a body would not now be generally—or rather we ought to say willingly—accepted by the members, is clearly revealed in the discussion which followed Mr. Jones's paper, and which is reported elsewhere. But what has brought about this transformation of views? We do not know, but have a shrewd suspicion that the circular which was sent round to the water authorities of the country, recording the opinion of the Association (the members of which are their servants) did not altogether find favour with those authorities. This is a perfectly fair surmise, as it is not at all likely that the purveyors of water, as of any other commodity, would voluntarily court a tightening of the supervisory screw. Be this as it may, the discussion on Mr. Jones's paper did not advance matters; it only disclosed the now chaotic state of the feeling of the members on the subject of control. With but few exceptions, the speakers (we are referring especially to the members of the Association, and not to the representatives of other organizations who were present) conceded that something was required in the way of control and protection; but what that "something" was, no one, excepting the author of the paper, appeared ready to exactly define. The idea of a Central Authority was almost entirely rejected; District Boards, or extended powers for County Councils, appeared to be the favoured alternative; and there were a few members who thought that the present parliamentary system, which had sufficed for their predecessors and themselves up to the present, was good enough for the future. But those who think this are those who are comfortably off, and would desire to be left severely alone. But this is not an individual question; it is a national one. And, when we remember the bitter cry for water that has gone up throughout the land during the past two or three summers, we confess to great sympathy with Mr. Jones's appeal for the proper utilization and conservation of water which is the whole nation's heritage.

While we are not prepared at the present moment to commit ourselves to any particular machinery for effecting these objects, we cannot see that there is anything to dread in Mr. Jones's proposal for some central expert authority. But, at the same time, if a Central Board is established, we should hope to see the co-operation of District Boards. Without them, things would be little better than they are now. It would, however, be essential that these Boards should be thoroughly representative of the area allocated to them; and their constitution should embrace members of all the governing bodies and existing water interests within the limits of that area. Such a Board would have, or would soon gain, an intimate knowledge of the requirements of the district placed under their charge. They could watch and confer; and they would be of material assistance in advising, and regularly supplying information to, the superior Central Board. We have not space to enter into details here as to the work which the Central Board and the auxiliary bodies would be expected to undertake, as it is well known by every water engineer. But, should any plead ignorance as to its nature, it will be found clearly stated in Mr. Jones's paper. We would, however, emphasize four of the principal questions which would come within the purview of the Central Board: (1) The proper and full utilization of all the present sources of supply; (2) the allocation of new watersheds; (3) the fostering of the development of means for impounding water which at present runs to waste at the time of heavy rains and floods; and (4) the promotion of measures for bringing about a much-needed revision of the law relating to water supply and its protection. The importance of these matters cannot be too strongly insisted upon; and it is over, and in connection with, them that a competent body, having the right of surveillance and the power to take the initiative in reformation, could, and no doubt would, accomplish great and lasting good.

The Coal-Tar Colour Industry in Germany.—According to recently published reports of the German Government, there were in Germany on July 14, 1898, 25 factories of aniline and aniline dyes, and 48 establishments which besides dyes were occupied with the various products from the distillation of coal tar, picric acid, phenic acid, &c. The exports are estimated to be five times greater than those of any other country. In 1883 these were: Alizarine, 4008 metric tons; aniline oil and salts, 663 metric tons; aniline dyes and other coal-tar colours, 3819 metric tons. In 1898, the figures were 9321, 12,360, and 19,712 tons respectively. It will thus be seen that the exportation of alizarine has more than doubled, that of aniline oil and salts has increased nineteen times, and that of aniline dyes five times since the year 1883.

ESSAYS, COMMENTARIES, AND REVIEWS.

THE STEVENSON MEMORIAL.

At a Meeting held at the Westminster Palace Hotel on the 2nd inst., when the views of a large number of sympathizers were considered, it was unanimously resolved that the proposed memorial should take the form of a tablet, recording in suitable terms the death of Mr. Stevenson, and the position he held in the consideration of his professional colleagues, and that any surplus arising from the fund should be handed to the widow to be devoted to the advancement in life of the younger children. The following were appointed a Committee: Mr. J. Ferguson Bell, Mr. Thomas Goulden, Mr. George Livesey, Mr. Thomas Newbigging, Mr. R. G. Shadbolt, Mr. Corbet Woodall, Mr. Walter King, *Treasurer*, and Mr. H. E. Jones, *Hon. Sec.* Subscriptions as below have either been received or promised; and the Hon. Secretary (Mr. H. E. Jones, of the Commercial Gas Company, Stepney, E.) will be glad to be advised without delay of further contributions.

Contributions.

	£	s.	d.		£	s.	d.
John Aird	5	5	0	H. E. Jones	3	3	0
Joseph Aird	5	5	0	H. H. Jones	2	2	0
T. Berridge	1	1	0	F. H. Jones.	2	2	0
J. Ferguson Bell	1	1	0	S. H. Jones.	1	1	0
J. Cash	3	3	0	Walter King	3	3	0
"Civil Engineer"	10	0	0	William King	2	2	0
Geo. Dawson	10	0	0	Geo. Livesey	3	3	0
A. Dougall, jun.	3	3	0	Chas. Meiklejohn	2	2	0
W. Foulis	2	2	0	Thos. Newbigging	2	2	0
T. Goulden	2	2	0	R. O. Paterson.	2	2	0
W. Doig Gibb	2	2	0	J. H. Rowbotham	5	0	0
Jno. Hammond	1	1	0	R. G. Shadbolt.	2	2	0
J. W. Helps	2	2	0	W. A. Valon	3	3	0
J. Hepworth	3	3	0	W. Arthur Valon, jun.	2	2	0
W. R. Herring.	2	2	0	"Westminster"	2	2	0
Chas. Hunt	3	3	0	Corbet Woodall	5	5	0
P. C. Hunt	1	1	0				
					£100	12	0

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 558.)

The Stock Markets have brightened up considerably under the more favourable war news; and in nearly all departments prices show fair improvement. Business has been stimulated, though dealings are still restricted, pending the receipt of definite news as to the military operations in the Orange Free State. As regards investment stocks, there has been very little business doing in the best class. Consols are firmer, on the better prospect of cheaper money; and they are now 3 per cent. above the lowest points of the year. Indian sterling loans are also fractionally up; but Colonial securities remain featureless. Gas stocks have also been apathetic. Even Gaslight ordinary has been extremely quiet; only one official marking being recorded on one or two days. There is no change in the value of the stock; but the tone of the market is firm. There was a little dealing in the secured issues; and the 3 per cent. debentures are 1 higher. The stocks of the other Metropolitan Gas Companies were also very quiet, with occasional dealings in South Metropolitan and Commercial. Respecting the Suburban group, Brentford issues (which are quoted *ex div.*, as well as several other stocks) have shown renewed weakness—in fact, they have drooped since it was known that there is to be a further issue of £46,875 of 4 per cent. debenture stock next month.* The price of the previous issue of this stock has fallen five points. Among the Provincial stocks, there has been no alteration; while there was only one change in the Foreign group—viz., a rise of ¼ in River Plate. Some business, however, was transacted in European, Imperial Continental, and Monte Video. Water stocks have also been neglected—very little business being recorded. But New River debentures are 2 up, and West Middlesex ordinary 1.

Concerning the daily operations; Monday was very quiet; the only changes being in secured issues. Alliance and Dublin debentures rose 3 to 110-113; while Crystal Palace preference fell 5 to 135-140, and Brentford 4 per cent. debenture, 8½ to 115-120. A little business was recorded in Gaslight at 106¼, South Metropolitan at 134½, Imperial Continental at 217½, Alliance and Dublin at 21¾, European at 21½, and Bombay at 6½. On Tuesday, Brentford debentures recovered 3 to 118-123; but there was scarcely any business recorded, except in Gaslight between 105½ to 106½. Commercial changed hands at 308-309¾, Imperial Continental at 217, and European at 20⅞. Wednesday was a very dull day, with very few dealings, and no change in values. Thursday was also quiet, though a little more business was recorded in Gaslight ordinary between 105¾ and 106½; the only change in prices being a rise of ¼ in River Plate. Friday was another featureless day, with very little business recorded. On Saturday, Gaslight ordinary changed hands at 106⅞, and South Metropolitan at 136.

* We have since learned that the proposed issue of debenture stock has been withdrawn by the Board.

ELECTRIC LIGHTING MEMORANDA.

The Lesson of Leicester—The Policy of the Corporation—The Wisdom of Mr. Colson—A Peculiar Business—Searching Questions.

It is one of the amiable delusions of the more narrow-minded sect of electricians that electricity supply and gas supply cannot be satisfactorily worked together. Like most other human errors, this has its superficial and temporary conveniences for certain purposes. This is why it is kept alive. In the case of a municipal electric lighting department which does not appear to be wanted by the public, and consequently does little business, the discredit that would otherwise fall upon the electrical prophets who promised that it would return a handsome balance for relieving the local rates is avoided if the excuse can be made that the department is controlled by the gas committee. Usually, this explanation is regarded as sufficient; and the electrical journals are not always above the weakness of accepting it, and asking, with a fine show of indignation, what the townspeople can expect from such an unholy alliance. It is for this reason that we draw attention to the noteworthy case of Leicester, as exhibited by the evidence given by the Town Clerk (Mr. J. Bell) and Mr. Alfred Colson at the Local Government Board inquiry reported in last week's "Journal" (p. 487). It would be superfluous to say here what gas engineers think of the Leicester Corporation Gas Engineer in his original capacity; and there is no higher praise to be awarded to any electrical engineer than to say that Mr. Colson in this capacity has done the electricity supply for Leicester as well as he had already done the gas supply.

It is desirable to rub this lesson of Leicester well in to the electricians and their partisans and apologists in other and less happy localities; and it would be only fair if the electrical journals would take the opportunity offered by this inquiry to make the *amende honorable* for their past sins against the light. Meanwhile, let us see what the story of Leicester is. The Corporation have applied for an additional electricity loan of £100,000, of which upwards of £86,000 is required for extensions, and the balance is to repay an excess of capital outlay since the previous loan was obtained in 1897. The very good and sufficient reason given for this excess, and the further contemplated capital expenditure, is that the business has grown rapidly since it was started in 1894, and is still growing as rapidly as ever. In order to stimulate the demand, the Corporation reduced the price of current from June last to 4d. per unit for lighting, and 2d. per unit for power. This does not look much like keeping back the electricity department for the sake of the gas undertaking! Having thus given the venture the best possible recommendation to the public, the Corporation mean to lay out the works and distributing plant on a proper scale for ensuring an effective supply, so far as good plant and enough of it will answer the purpose.

There is to be no dodging the consumers by trying to get revenue from half as many lamps again as the plant can supply. This winter Mr. Colson has had a generating capacity at the central station equal to 1400 kilowatts, all told; or 1050 kilowatts allowing for one spare machine. The boiler capacity has been a little short of this. The maximum demand for the winter has been 880 kilowatts; leaving the narrow margin of 170 kilowatts. This is as close to the wind as Mr. Colson wishes to go; and in view of the calls for fresh lamp connections in the area of supply, he is going to bring the capacity of the station up to 3400 kilowatts, with boiler power to match. Marvellous to relate, the capital outlay up to June last was only £55 per kilowatt. At the end of last year, the "Electrician" gave it at £48·6 per kilowatt, which must surely be the best "record," with a positive excess of power. Mr. Colson may be allowed the little boast he indulged in before the Inspector, when he spoke of the excellent position of the undertaking in respect of capital burden, and claimed that the quality of the equipment of the station was second to none in the country. Indeed, most of the ingenious gentlemen who profess and call themselves electricians might be recommended to go to school with this Midland gas and electrical engineer.

It is remarkable also that the Leicester electricity supply business is of anything but an eligible character from the point of view of the professional gentlemen who are fond of talking about "load-factors." The supply is laid on for the benefit of the townspeople; and Leicester being a manufacturing place, many patrons of the electricity department only use the light for a very short time in the day. Consequently, according to the "Electrician's" analysis, the revenue per 8-candle lamp connected is one of the smallest on record, being about 4s. 9d. per lamp for the past year. The Corporation do not mind. They know their customers—in fact, the members of the Corporation in many cases are the customers; for Leicester is a town where the local government is wholly in the hands of men who have the largest and best of interests in doing what they think best for the town. That is to say, there is not one set of townspeople carrying on the business of the town, supporting the Corporation departments, and paying the rates, and another set of people in municipal office—as is the case in London, and some other places. We do not mean to imply that the municipal policy of the Leicester Corporation in all matters is necessarily commendable on this account. Far from it—the "Journal" has always held, for example, that it would be better policy for the town to sell gas at cost price and so

encourage local industries by this means, instead of making the Gas Department a municipal milch cow.

For the purpose of the present argument, however, this very action of the Leicester Corporation, as regards the sale of gas, sets in a most favourable light their treatment of the Electricity Department, which is actually run at cost price. Users of electricity are given a decided and material preference over the gas consumers; and for six years they have been supplied at a loss. Only during the current year will the revenue account of the Electricity Department clear itself; and then there will be the depreciation to provide for, which has not yet been touched. From all this, it appears that the fanciers of electricity in Leicester have every reason for thankfulness that their wants have been catered for by the Gas Committee, over and above the special advantage that the town itself has derived from the conspicuous ability with which Mr. Colson has tackled his latest extra responsibility. The Corporation, it should be noticed, will have nothing to do with fancy methods of charging for current, the price per unit being uniform, without discounts; and with all this, the increase of gas consumption is after the rate of 12 per cent. for the year. It almost looks as if the Gas Committee were anxious to shunt some of their factory lighting on to the Electricity Department—wheels within wheels? But this is a matter that cannot be gone into here.

OUR COAL RESOURCES AND CONSUMPTION—A RECONSIDERATION OF SOME ESTIMATES.

(*Continued from p.* 463.)

We have now to recall the estimates made in 1865 by Professor Jevons, and in 1871 by the Coal Commissioners, of the probable depletion of the coal resources of the kingdom in the thirty years just completed; to compare those estimates with the actual figures; and to see to what extent the result of such comparison modifies the calculations made by the experts in the sixties, as to the probable further duration of our coal supply.

Jevons founded his alarmist calculations upon the basis of an assumed constant annual increase of 3½ per cent.; the starting point of his estimate being the output in 1861—namely, in round figures, 83,600,000 tons. On this assumption, the coal supply, as he estimated it, would only have lasted a little more than a hundred years from the commencement of the calculation—namely, 1861. More than a third of that period has now elapsed; and we are able to judge of the accuracy of the forecast. Upon this basis, the total quantity of coal raised in the thirty years, 1870 to 1899 inclusive,* would have been 5683 million tons. The actual aggregate tonnage raised was, however, only 4780 millions (assuming the output for 1899 at 212 million tons); so that the total consumption was over-estimated by Jevons by about 20 per cent. The average annual increase for the period in question was, in fact, only some 2¼ per cent., as compared with the 3½ per cent. which Jevons assumed in his calculations. The difference between his estimate and the actual, will, it is to be observed, widen with every year; for, while he assumed an output for 1899 of 309 million tons, and that this figure would increase steadily by 3½ per cent. per annum, the actual output last year, according to the latest estimate, was but 212 million tons. And, for reasons into which we will enter presently, we think it is hardly probable that the rate at which the output has increased during the past thirty years—namely, 2¼ per cent.—will be exceeded, or even maintained, in the future.

The Coal Commissioners embodied in their report three estimates of the probable duration of the coal supply of the kingdom, based on as many different hypotheses, each of which assumed the stock of coal to be the 146,480 million tons estimated by the Commission to be obtainable from mines not exceeding 4000 feet in depth. The first assumed that the annual consumption at the time of their inquiry would not increase in the future, on which basis the supply would have lasted 1200 years; an estimate to which little space was devoted in the report, and to which we need give less. A second method of calculation (one apparently quite arbitrary in character) took for its basis a constant annual increase of 3 million tons, on which assumption the coal supply would last until the year 2146. Although this estimate appears to have been formed chiefly by rule-of-thumb, it has up to the present proved remarkably correct—which is not infrequently the way with rule-of-thumb calculations made by an expert. Taking the basis of an annual increase of 3 millions upon the output of 1869, the total consumption for the following thirty years would have amounted to 4605 million tons. It was actually 4780 million tons, resulting from an average yearly increase of 3¼ million tons. The output for the year 1900, on the basis of a 3 millions a year increase, would be 200 millions. It is doubtful whether a rate of increase falling from 1½ per cent. now to 1 per cent. in 33 years' time, and continuing steadily to decrease, is a sufficiently high estimate for the future; but no considerable modification need apparently be made in the probable period of duration calculated therefrom—viz., 247 years from now.

* We deal only with the figures for the period commencing with 1870, as that was the first year dealt with in the estimates of the Royal Commission. For the preceding eight years the difference was inconsiderable, the output being estimated by Jevons at 757 million tons.

It is, indeed, we think, certain that the consumption of coal in this country will not continue to increase at the average rate at which it has mounted up since 1869—a view which is supported by the fact that, while the aggregate consumption during the period 1880-9 was 26½ per cent. greater than that during the previous ten years, the total consumption in the decade just ended was only 18½ per cent. higher than the output for 1880-9. That the rate of increase in the consumption of coal must, as time goes on, more nearly approximate to the rate of increase of the population (which grows steadily by about 1·1 per cent. per annum), appears to us self-evident. The past half-century has witnessed a wonderful expansion and creation of industries involving the consumption of coal. We have already referred to some of them; and we do so again, in order to bring out the point that the development of many of these industries has now almost arrived at the stage when their growth will be much more nearly coincident with the growth of the nation than during recent years.

To mention a few considerable instances. The railway system of England is now, but has only in recent years become, practically complete—of course, speaking broadly—and the extent to which travelling facilities can be provided for the people, and availed of by them, is reaching its limit. Iron ships have almost entirely superseded wooden ones, and steam-ships replaced sailing vessels; so that the increase in the iron and machinery required in shipbuilding, and the fuel necessary for the supply of motive power, will in future be caused solely by the increase in shipping. Again, the sales of gas, although—fortunately for the industry—not showing so meagre a growth as by 1·1 per cent. per annum, depend mainly for their increase upon the displacement of coal itself as fuel. A still further cause of the increased consumption of coal in recent years has been the steady transference of population from country districts to the towns and cities; the town dweller being a much larger consumer of coal than the rustic. This migration cannot continue—nor is it, in fact, now proceeding—at anything approaching the rate at which it has taken place in the past fifty years. The agricultural districts cannot well become much more depleted than they already are.

It is, then, as we have said, apparent that, while the consumption of coal will continue to grow, it will be at a diminishing rate of increase. Were it otherwise, indeed, the outlook would be a dark one; for, while the forecast of Jevons—that, at the rate at which he estimated the consumption would expand, the stock of coal in this country would only last until about 1965—was too pessimistic, the result of a substitution of the average percentage of increase during the past thirty years (2¼ per cent.) for that assumed by Jevons (3½ per cent.), would only postpone the date of the exhaustion of our available coal supply, as estimated by the Royal Commission, until the year 2025. This, too, after adopting the much higher estimate of the present stock of coal made by the Commissioners, in the place of that adopted by Jevons. That Jevons was hopelessly wrong in estimating a perpetual annual increment of 3½ per cent. in the output, the Commissioners gave good reasons for believing; and the experience of the subsequent thirty years conclusively proves it. Time will, we venture to think, as certainly justify a rejection of 2¼ per cent. as a constant factor.

The third method of calculation adopted by the Commissioners was founded upon an estimate of the population of Great Britain, and of the quantity of coal consumed per head, in the years then to come. To the quantity so estimated for home consumption, an addition of 12 million tons per annum was made for estimated exports. The result of this calculation was to give the coal-fields a life of 360 years, dating from 1870—that is to say, they would be worked out by the year 2230. Upon this third basis, so far as it is possible to exactly determine the method of calculation (into which the Commissioners did not enter in detail), the consumption for the thirty years just past would have been 4463 million tons, as against an actual output of 4780 million tons. The difference lies wholly in the export tonnage. The Commissioners estimated a home consumption of 4103 million tons; whereas the actual quantity consumed was 3905 millions. But, while the Commissioners only reckoned upon the exports remaining a constant figure, equal in the thirty years to 360 millions, this branch of the coal trade—as we have had recent occasion to remark—has developed rapidly; the total for the period under consideration amounting to no less than 880 million tons, and the present annual export being somewhere about 54 millions. Of this quantity, rather more than 12 million tons—the total tonnage estimated by the Commission to be exported—comes under the heading "Coal shipped for use of steamers engaged in foreign trade," which thirty years ago only amounted to some 3 million tons. The growth of foreign trade, and of steam navigation, was evidently not foreseen by the Commissioners. A correction of 80 to 100 years in the length of life calculated by this method for the coal-fields is, we think, required to adjust for this under-estimate of the export trade—a correction which would bring that life down to practically the same as that estimated by the Commissioners' second method of calculation—namely, 247 years from the present time.

The Commissioners further reported that, should the quantity of coal estimated by them to lie in the known and concealed coal-fields at greater depths than 4000 feet be obtainable, the supply so afforded would be equal to a further 48 years' consumption. The probability of such coal proving accessible is,

however, so extremely small that, as a national asset, the estimated quantity cannot be valued at a single penny. Long before the country is reduced to such straits for fuel as the attempt to work at anything like 6000 feet below the surface would indicate, coal will be imported from America.

It is to be observed that, in none of the estimates that we have quoted, is any allowance made for the fact—which, however, we do not imply was altogether overlooked by the authors of the forecasts—that the output of coal will tend to diminish, not to increase, so soon as the more-easily accessible seams have been exhausted. The estimates are all founded upon the assumption that it will be possible to raise all the coal between the surface and a depth of 4000 feet, and that such coal will continue to be mined at an increasing rate each year until it is all gone. But the possibility cannot be ignored that the cost of obtaining such quantities as lie comparatively near to that limit may prove so great as to admit of the successful competition therewith of imported coal. One factor that tends considerably to increase the cost of raising deep-lying coal is the charge for capital—the original outlay being so great. As an instance of this may be mentioned the sinking of the Monkwearmouth pit—one of the deepest in the country—which required twenty years' expenditure of labour (and therefore capital) before any coal was brought to the bank for sale. But even if the cost of working the deeper mines do not prove prohibitive, the price of coal will certainly rise in proportion to the increase in the expenses of mining, until that price materially checks the consumption. Our coal-fields will, in fact, die a lingering, not a sudden, death. There will be no day arrive when the whole industry and trade of the country will come to a sudden halt because the collieries—hitherto producing, as, according to the estimates with which we have been dealing, they would have been producing, some millions of tons daily—have come abruptly to the last ton in the last seam. What will in truth happen as the time approaches when, were the same wheels to revolve for ever in the same way as in our own time, the coal supply would become exhausted no man can now foresee; the whole industrial and social machinery of the world may have been completely changed before then. Of one thing, however, we may well rest assured. So far from the present temporary scarcity of coal being due, as has been suggested—in one at least of the organs which undertake to "inform" the general public on questions of the day—to the arrival of the "coal famine" predicted by Jevons (who did not himself anticipate an appreciable scarcity before about 1920), the quantity of coal remaining in the mines of this country at the present day, and likely to be accessible, will supply all the requirements of the kingdom during the twentieth century, so far as it is possible now to estimate them. The only qualification that might, perhaps, be attached to that assurance is one suggested by the fact that we have, at present, no official estimate of how much of the coal lying in the strata of moderate depths exists in easily (and therefore cheaply) worked seams, and how much in seams so situate or so thin that the cost of winning the coal will be considerably higher than the present cost of production. Upon this point more information is desirable, and should not be difficult to obtain. The present is a time when the authorities might well be approached with a view to the appointment of a Committee of Experts to determine and report the actual facts of the case. Those facts must have an important bearing upon the possibility of this country maintaining its grounds in the commercial competition with other countries—in particular with the United States. For the cost of fuel is of vital importance to almost every industry, but especially to our great iron and steel trades. As Solon said to Crœsus, when he ostentatiously displayed his gold, "Sir, if any other come that hath better iron than you, he will be master of all this gold." Coal is, moreover, a prime necessity to our "first line of defence"—the navy. But until inquiry shall determine the contrary, we shall continue to hold the opinion that there need be no anxiety in regard to the quantity or cost of our coal supply for many years to come.

A NEW PRINCIPLE IN MACHINERY DEPRECIATION.

Thanks to the courtesy of Professor Robert H. Smith, whose previous work upon the subject has been noticed in the "Journal" (Nov. 21, 1899, p. 1240), we have received an advance proof of an article on the Depreciation of Machinery, which is to appear in the forthcoming number of "Feilden's Magazine." It is a matter for thankfulness that just now, when so many local authorities are bent upon going into trade with the money of the ratepayers, so competent and independent a teacher as Professor Smith should arise to expound the true doctrine of industrial profit. Not, of course, that any amateur of municipal trading is bound to pay the slightest heed to any teaching of the kind, even if he should happen to get to hear of it. British local authorities are seemingly at complete liberty to keep their profit and loss accounts just as they like, and vote that they mean anything they choose. Only in this way has it been possible for municipal electric lighting to make the headway it has done. There is not the smallest doubt about this; but if an illustration in support of the contention is called for, it will be found in the financial history of the St. Pancras Vestry electric lighting undertaking. The first Engineer's estimate of the working of the proposed scheme provided for a reasonable allowance for depreciation. This allowance has never yet been made, although the financial responsibilities of the Vestry in this regard have very greatly increased.

Nor is the study of depreciation something for local authorities only to take in hand. No director of a joint-stock manufacturing and industrial company can divest himself of the responsibility for taking account of this factor in the life of the business. Every honest director should be able to satisfy himself as to the answer he could give to the question whether the dividend is being paid out of profits or out of capital. This is where the criticism of such experts as Professor Smith comes in. He may or may not be absolutely right; but he has tied himself to the proposition, of which he is the author, that "the calculation of the correct charge for depreciation is quite capable of definite theoretical statement." He is careful to make the qualification that it may be doubtful whether in any individual case all the data needed for the theoretic calculation are ascertainable, or can be estimated with a usefully close approximation; but a good deal more might, and should be, done in this regard than is attempted in many instances.

What is the meaning of the word depreciation, as applied to a machine? Clearly, as Professor Smith says, it is the change in the capitalized present value of its nett earning power, taking into account the probable duration of its remaining life. In finding the nett earning power, all the money burdens it has to carry must be brought into the reckoning. This is simple enough; but at the very outset Professor Smith shows that there is a difference between the value of a machine and its actual cost. Machinery is worth its book cost, *plus* something for the intelligence employed in its selection and placing. If a machine is worth no more than the amount of the maker's invoice, added to the cost of fixing, why did the purchasers buy it? Accordingly, Professor Smith lays down the somewhat startling rule that in the case of extensions of a well-established works with certainly assured prospects, nothing but recognized custom prevents the writing-up of the value of a new machine by the inclusion of something for its profit-earning value. This plea is open to the criticism that a badly-selected machine ought to be valued at less than its actual cost; and who is to decide?

The point, however, is well taken. It also deserves much more profound study than we can give it here, or than Professor Smith can spare for the time being. It suggests a fresh principle for guiding the selection of machinery and helping to distinguish the most profitable choice. Two cranes, two pumps, two labour-saving appliances, may be priced the same, and have the same expectation of life; but which is really the more profitable? Professor Smith only touches upon this question, and goes on to describe how the actual value of a machine is to be found at any period of its life. This determination is independent of whether the capital value is going to be used up and destroyed as the machine grows older, or whether it is to be preserved intact by any form of repayment sinking fund. The problem of the present value of machinery is dealt with by Professor Smith on the convenient assumption that it has been bought and erected with borrowed money, at a certain rate of interest, repayable at the end of the life of the machine. The nature of the computation involved in this assumption is made clear by the accompanying tables and diagrams.

The calculations tend to become complicated as the various considerations of annual earning power, ultimate value, and so forth, are followed up. The next elaboration offered is the distinction between intrinsic and extrinsic values. The former changes only in consequence of change in the machine itself. The latter changes also in consequence of change in external circumstances, such as the selling price of the articles produced, the prevailing interest obtainable from investments, first cost, and efficiency and economy of new patterns of similar competing machines brought into the market. These respective ideas are easily grasped. Speaking broadly, they merely indicate the difference between old age and obsolescence. A certain tool, for example, merely grows old and wears out, when it can be replaced at about the same cost by a new one quite as good and useful. Another, perhaps, cost more than it could be replaced for at any time; or it is less valuable than it was because it no longer makes what is required. In the latter case, of course, its value is *nil*. The discovery of this deficiency is one of the secrets for which trading concerns must always be prepared. Much of the weakness of old-established firms is due to their possession of old plant which they had far better be without. Professor Smith grapples these important considerations with a power of mathematical analysis that inspires respect, even in those who must stand aghast at his formulæ.

We have no hesitation in stating that Professor Smith's application of algebra to the determination of the every-day commercial data which he has in view throughout this investigation, is at once a revelation of the power of mathematics and a justification of the science for engineering students. Naturally, as in most other exhibitions of mathematical analysis, one is occasionally struck with the simplicity and obviousness of the conclusions reached by such elaborate processes. Thus, Professor Smith claims to have exhibited very strikingly how much more damaging is an adverse change of external conditions in the early life of a machine when most of its earning work lies in the future, than is the same change occurring at a later date when its

utility has been nearly used up. But this is only another way of saying that it is much worse for a piece of plant to become obsolete early than late in life, which scarcely requires to be demonstrated.

One of Professor Smith's particular claims to renown, we understand, consists in his having been among the first to assign its due importance to the case of "antiquation" of pattern due to the introduction upon the market of new and improved machines. Meritorious novelty in new machines may lie in (1) cheaper prime cost for the same productive capacity; (2) improved quality of output, commanding a better price in the market; (3) saving of workmen's wages; and (4) economy of room and power. There may be others; but this category of advantages shows the road to the scrap-heap for the old patterns. What is the owner of the old plant to do in the circumstance of finding his appliances outclassed? That is the question of questions for the manufacturer. If he is a municipality, he will settle the matter off-hand by pleading the privileges of his monopoly, and warning the improved product off his preserves.

The paper brings out another calculated result of great and far-reaching importance—namely, that the yearly depreciation increases as time goes on and the end approaches. The general notion is that a fair charge for depreciation should decrease. Professor Smith believes that this notion is based upon the idea that the depreciation allowance should be a constant percentage of the remaining value; and, therefore, as the remaining value is always diminishing, so does the depreciation. This is an error. There are purists in industrial finance, as Professor Smith remarks, who hold that a new machine should be most heavily depreciated immediately after it is purchased, on the ground that it would never fetch so much money at a sale. But this view, as he explains, errs in taking the selling value instead of the working value. Machinery is bought for use, not to sell again. Indeed, as Professor Smith started by observing, new machinery ought to stand a going concern in more than its invoice-cost. There are mechanics, on the other hand, who hold that machinery goes on for a long time without deteriorating at all, and then breaks up in a comparatively short time. The paper now under notice is an attempt to put upon a scientific basis the feelings of this last set of friends of machinery by dissociating the idea of depreciation from the first cost, and basing the allowance upon the working value—that is, the worth of the machine to the owner during its whole life. Professor Smith gives up as hopeless the task of proportioning depreciation to first cost. He has tried, but failed, to base an intelligible system of depreciation upon this connection. It is not what a machine costs, but what it is worth to the user, that determines the amount of depreciation. That this consideration is speculative does not affect the principle. There is a very great deal in this *dictum* of Professor Smith; and, on the other hand, the author is not blind to the practical drawbacks to the application of his method. That it is deserving of particular study by all those who have the responsibility of administering industrial undertakings involving the use of much perishable machinery and plant, will not be disputed. The more one thinks about it, the stronger the conviction grows that Professor Smith is right in the main. Still, as a matter of fact engineering works are not depreciated in this way. It would be a bad look-out for the enterprising Metropolitan Electric Lighting Vestries if the London County Council were to follow Professor Smith's advice and require the plant provided out of redeemable capital to be insured on this scale. It would be a good thing if Professor Smith would take the bull by the horns and treat the Association of Municipal Corporations to a dose of his purgative mathematics—exhibited, as the faculty say, on the *corpus vile* of the Edinburgh, or some other notable municipal electric lighting undertaking. At present this exercise is, unfortunately, all in the air; and abstract reasonings break no bones.

SOME VIEWS OF ENGINEERING TRAINING.

Sir W. H. Preece recently entertained the Glasgow Association of Civil Engineers with a carefully-prepared discourse upon the "Functions of the Engineer," the text of which has been published in many scientific and technical journals. A remarkable feature of this address was an accompanying chart, composed after the pattern of a genealogical tree, which showed at a glance the author's idea of the branchments of the various specialized applications of engineering from the root-form of the science. We do not propose to reproduce this chart here, as we have no room for it, and it is composed for the most part of descriptive titles of engineering specialities with which we have small concern. Besides, many of our readers will have already seen it elsewhere. It is an ingenious way of displaying the great craft of engineering in a certain order; but it might be objected by a critic inclined to be captious, that there is not much to be learnt from it after all. We do not wish to be misunderstood as depreciating this particular exercise of Sir W. H. Preece's talents, which certainly does him credit. But the chief and the proper object of classification is instruction, and mere enumeration is not of much service. This chart, for example, starts from the originating term "Engineering." Immediately it branches into the three categories of civil, military, and naval. These in turn have their detailed developments, which in some cases result in the collection under one class of some heterogeneous entries. Thus, civil engineering is divided into domestic, municipal, interurban, national, international, and universal classes. The first of these subdivisions includes lighting, ventilation, warming, and water-supply. The second, or municipal class, embraces electrical energy, gas, public lighting, smoke-prevention, and drainage. The national class comprises chemical industries, manufacturing processes, the management of estates, and refrigeration. Sir W. H. Preece must have been considerably exercised over his classification, which is somewhat arbitrary. Oddly enough, there is no special entry of engineering works; and electricians generally will not be wholly content to see themselves relegated to the class of municipal workers.

It might be objected that the classification adopted is highly artificial, inasmuch as it does not proceed upon the same lines as those naturally followed by engineers in preparing themselves for their special place in the ranks of the profession. This is a matter of general preparation to begin with, followed by particular cultivation of the individual genuis, or the bending of personal talent to the requirements of the opportunity, or, as it is commonly called, the "opening." For enlightenment upon this order of considerations, it is necessary to leave the chart and turn to the text of the address. The root notion of the engineer is that of a man who knows more about, and can do more with, the material forces and forms of the earth for the attainment of useful ends than any man who is not an engineer. The compass-needle of the engineer is therefore common-sense, controlled by foresight, insight, and hindsight. Some of this quality can be acquired; much of it must be innate. All engineering work, of whatever kind it is, must show systematized common-sense as its predominant character. That is a product of mother-wit, impressed into a particular service by knowledge, and applied by capacity.

Those who desire to become engineers must possess as a groundwork, as Sir W. H. Preece declared, a broad, solid, general education, "not specialized in any way until the pupil has reached the stage when he can work and think for himself." A sound, liberal schooling must go first. A great deal of discussion has raged over the all-important questions of the age to which this school-period should be extended, and the character of the instruction and training that should be given to boys before they can think for themselves. Many ardent educationalists clamour for a considerable prolongation of the elementary school age; but, as Professor Ripper, of Sheffield, weightily observed the other day, purely elementary schooling is apt to be vitiated, when kept on too long, by the application to all the boys of the purely scholastic measure of ability. The Board Schools have succeeded in demonstrating that if every lad regarded by the schoolmaster as "clever" is not to be attracted to the teaching or clerical employments, he must not be kept at books and pen and ink too long. At the psychological moment when boys cease shirking their "lessons" and performing their "tasks" perfunctorily—when nascent ambition and the desire to be doing something show that the adolescent mind is awakening—is the time for putting boys to their work. Many of the most useful workers have only been saved from becoming mere pedagogues or clerks by their having happily wasted their time at school.

This is what Professor Ripper says on the point: "An idea is beginning to dawn upon us that perhaps, after all, there may be, among the very large majority of boys who are never among those selected to receive any special training to pass University examinations, and who have no special aptitude in the direction of acquiring book knowledge, much real ability in other directions—in fact, that they may be, as it were, a kind of unworked mine of possibilities and resources. Hitherto, they have been looked upon as the wasters of the school; but it is almost certain that the great inventors and mechanicians of our time have not usually come from the class of boys who are looked upon as the most successful students. Usually, the 'clever boy' is the one who, by his ability in the particular direction by which the schools measure ability, succeeds in *escaping from the workshop* and in doing, as he would consider, better for himself by obtaining other employment." These words are welcome as showing that, at last, a man eminent in the teaching profession has appreciated one of the objections taken by the industrial public to an excessive extension of the elementary school age in the case of children with their living to get. If it could be proved that the boys who remain longest and attain the highest distinctions in the elementary schools made the best workers afterwards, the "popular error," as it is commonly stigmatized by superior persons, that over-schooling spoils children for work, would speedily disappear.

It is not merely those who are concerned for the future of the handworkers of the industrial population who need be on their guard against the pedagogue. Sir W. H. Preece joins in the warning that the school age must also be a period for the cultivation of the powers of observation, the systematic training of the memory, and the encouragement of the exercise of thought. This is a little vague; but, of course, the speaker was not giving out a syllabus. He did, however, protest against the school teaching of "science," so called, which is commonly rubbish. In truth, there is now a reaction against the fashion of the last twenty years, of trying to make schooling "interesting." It is recognized that all the durable conquests of the school age—reading, writing, arithmetic, the habit of attention, and the practice of obedience—are not amusing in the winning. They are only

to be gained by sheer drudgery, and at the end of a stick if need be. Where is the practising engineer who has not had occasion to complain of the bad writing, stupid spelling, and lack of "grounding" on the part of the products of modern schooling with whom he is constrained to recruit his office and responsible junior posts?

When it comes to learning engineering science by youths who have passed the school age, specialization begins. A gift for mathematics can be cultivated, a love of mechanism instructed, and a taste for chemistry indulged—all with the strictest reference to the requirements of the chosen career or the fortuitous opening. Over and above all specialities stand the great realities of engineering practice—the knowledge of men and materials, of the value of labour and goods, and the bearing of natural forces. These cannot be acquired in colleges; nor, on the other hand, can other equally essential portions of engineering equipment be picked up in shops and works. Broadly speaking, the college professor knows what ought to be done; the works foreman knows how to go about it. The engineer needs to know it all, and more. He must be able to bring an acquaintance with finance and common business to bear upon the conclusions of the drawing office and the possibilities of the workshop. Sir W. H. Preece says in this connection: "The civil engineer of eminence has not only to know thoroughly the science, but to conduct the practical operations of his profession. The lives of human beings are entrusted to his designs. People have faith in the safety of his ships, long tunnels, bridges, and railway trains. He is called upon to advise on policy, to deal with commercial management, to act as arbitrator or judge in many important intricate judicial cases, and to appear in courts of law and committee rooms of Parliament as an expert witness. The mental qualities of the engineer must, therefore, be of the very highest order." But all this will be nothing unless accompanied by personal integrity, as regards the world; and as regards the contentment of the man himself, by the resources of a broad, cultivated mind, and a spirit strong enough to bear disappointment and delay with equanimity, and success with modesty.

So much for the personal applications of Sir W. H. Preece's address. Curiously enough, his classification of the applications of engineering science to the use and convenience of man amply bear out our contention of last week (*ante*, p. 464) that "most engineering is, in the end, adapted to the service of the mass of the community, and tends to cheapen common life and to ease it for the poor." The agreement is most conspicuous in the category of municipal engineering. Next to "Gas," in Sir W. H. Preece's list, comes "Housing the Working Classes." One other comment may be offered on the text of the address. Sir W. H. Preece observes that the first known picture of a man "depicts him as a hunter." He is that still; only, in the case of the engineer, the game has been changed. The engineer has to "hunt for the pot" first, like every other man; but he has the satisfaction of knowing that as a rule the world profits by his exertions even more than he does himself.

ELECTRICITY GENERATION IN BULK—THE SCHEMES IN PARLIAMENT THIS SESSION.

In enumerating recently the companies applying to Parliament this session for the sanctioning of schemes for electricity generation in bulk, mention was made of the Tyneside Company, and coupled therewith was the name of Mr. A. A. Campbell Swinton, the electrician. In the "Nineteenth Century" for February is an article by that gentleman, showing cause why Parliament should grant the powers applied for. The article is entitled "Electrical Engineering and the Municipalities;" and it effectively shows up the "dog in the manger" policy of the British municipalities and its effect in handicapping the development of the electrical industry in this country.

Mr. Swinton's indictment of the municipal authorities runs on these lines. It is a matter of common knowledge that, while Great Britain led the way in all other branches of engineering science—the origination and introduction of the steam-engine, the steam-ship, the railway, gas lighting, &c.—and in the earliest great discoveries and application of electrical power, she now lags far behind other countries, and especially the United States, in the development of electrical science in modern times. The names of Davy, Faraday, Grove, Varley, Wheatstone, Swan, and Hughes, recall the earlier achievements of British inventors and discoverers in the field of electrical science; Hopkinson and Armstrong, their successes in the practical application of the power. Why do we no longer occupy the foremost rank? The fact is due, says Mr. Swinton, "to the misguided action of succeeding Governments—Conservatives and Liberals being equally to blame—who, in their perhaps commendable endeavours to preserve the community from individualistic monopolies similar to those held by some of the gas and water companies, and in their less laudable desire to secure the political support of some of the less perspicacious classes of the nation, have succeeded in delaying to a very large extent in all cases, and absolutely arresting in some instances, electrical development in some of its most important directions." For this stoppage or delay, blame is cast chiefly upon the Electric Lighting Act of 1882 (with its provision for purchase at the end of twenty-one years); the opposition of local authorities to the applications of private traders to Parliament for leave to commence an electric supply, followed by their leisurely obtaining, and still more leisurely exercising, Provisional Orders themselves; and the purchase clauses in the General Tramways Act of 1870. So, while we have been advancing but slowly, America and Germany have been making enormous strides, and obtaining great engineering experience. They are, therefore, enabled to supply us with not only our electrical plant, but consulting engineers. The whole of the electrical plant for the Central London Railway, the generating machinery for Manchester, engines for Glasgow (enough "to make James Watt turn in his grave"), all these and more are we importing from the States. As to exports, "when English manufacturers are unable to compete at home, how can they expect to do so abroad?" Our readers will have been amused to notice how Mr. Swinton, in the first quotation made from his article, is led—by his jealousy of the rival illuminant of electricity, gas—into a self-contradiction. Governments are reproved for desiring to secure the political support of certain classes by doing—what? Something particularly blameworthy? Oh, no. By endeavouring to do something which is "perhaps commendable"—namely, "to preserve the community from individualistic monopolies similar to those held by some gas and water companies!" What is there heinous in the offence of seeking political support by doing that which is commendable? The electrican thanking God he is not like these gas companies, who have individualistic monopolies without any purchase clauses attached, is distinctly entertaining.

Such, in brief, is Mr. Swinton's indictment of the existing conditions under which electrical enterprise struggles to advance; and Lord Salisbury, as a practical electrician, "who must be aware of the great importance of the question," is appealed to for his personal support of the present applications to Parliament. "At bottom all improvement is due to individual effort, and where, as has hitherto been the case in the electrical world, the municipality is allowed always to step in and reap the rewards rightly due to private enterprise, progress must inevitably suffer, if it does not entirely cease."

Incidentally, a fact is mentioned which must always handicap this country in the race of electrical development—namely, the absence of the great natural sources of hydraulic power possessed and used by America, Switzerland, and Norway. But, says the writer, "we have what, when all is said and done, is the practical equivalent—vast stores of potential energy in the shape of coal." But we would ask, Is not the difference in cost between coal-energy and water-energy sufficient to account for some at least of the backwardness of this country, as compared with the countries having vast sources of natural power, in adopting electricity as an agent?

THE USES OF STEAM IN MODERN CIVILIZATION.

The number of "The Boiler Maker" for the current month contains an article on the above subject by Mr. E. A. Harman, M.Inst.C.E., Engineer and Manager of the Huddersfield Corporation Gas-Works. At the outset, the author frankly states that he considers that the power and properties of steam are but very imperfectly understood, and that its application is only in its infancy. The mania nowadays is for electricity; and it seems to be rather taken for granted that steam is getting out of date, and is being superseded by a more powerful and mysterious force. Mr. Harman, however, is of opinion that the superiority of steam for motor purposes over all kinds of liquid or gaseous fuel or air remains impregnable. The chief weakness, according to his experience, has been with reference to the design and construction of boilers. On the subject of the use of steam in gas manufacture, the author points out that it is largely employed in connection with regenerator furnaces; a continuous supply of steam from a boiler being passed under the furnace-bars in many works. Further, in the event of mains getting blocked with naphthalene, a jet of steam is known to be the best solvent obtainable, and is invariably used for such purposes. During the winter months, when the gasholder cups and purifier lutes are in danger of becoming frozen and stopped up with ice, a supply of steam is allowed to issue into the water of these self-sealing lutes, which keeps the temperature considerably above the freezing-point. In some few cases, a small jet of steam has been applied to the ascension-pipes, with the view of preventing them from being choked up with thick tar, pitch, or other residue. In the case of certain of the purifying apparatus, such as the scrubbers and washers, these are sometimes beneficially steamed with the object of washing down the thick tar which may have accumulated therein. Mr. Harman relates that he had for some years a tower scrubber 15 feet in diameter and 70 feet high full of coke. It was invariably the plan to have this scrubber well steamed; the steaming process commencing at the top, and being gradually continued to the bottom. By this method the thick tar was dissolved from the top chambers and washed down to the bottom, leaving the coke fairly clean.

The author is convinced that the uses of steam have not yet been sufficiently appreciated for domestic purposes. Food can, he says, be cooked by steam very much better than by boiling it in water; and it is somewhat surprising that it has not been more largely used for these purposes. The utilization of steam for medical purposes seems to have made little progress, except

with regard to the kettles in use for bronchitis, asthma, pneumonia, and kindred lung affections. One cannot help considering that something more might be effected most advantageously by a definite study of the use of steam intermixed with various gases for the treatment of consumption and other distressing complaints. Steam, which has played its part so successfully during the last century, will, in the author's opinion reassert its right on better examination and study. It is not merely the question of steam which requires elucidation, but the all-important one of fuels, which opens up a comprehensive subject. Nor is this question the only one that needs examination. The nature and quality of the waters used form a most important part in the consideration. The disastrous effects of hard water in scaling boilers, is well known; but the more disastrous effects of solvents and water softeners in the form of noxious chemical solutions has not received the same amount of attention. On the other hand, very soft water has been often indeed used with alarming results.

After a few remarks on forced-draught apparatus and fuel economizers, Mr. Harman concludes by saying that what is needed is for some student to get right away from the present-day environments, back to the primitive steam-kettle, and study it in George Stephenson's fashion, with the view of eliciting something further of its secrets and mysteries. Such a study cannot, he says, be undertaken in the crowd or in the workshop; it must be pursued with all eagerness and avidity in the quiet of a country home, in the study, and in the laboratory.

PERSONAL.

Mr. R. Darney, who has occupied the position of Engineer and Manager of the Faversham Gas-Works for forty years, has retired; and has been appointed Consulting Engineer to the Company. Mr. Alfred Easton, of the Commercial Gas-Works, has been chosen to succeed Mr. Darney.

Mr. John Hilton, who for fourteen years has been in the service of the Westhoughton Gas Company, for the past five of which he has filled the position of Assistant Secretary, has been appointed Secretary and Manager, in succession to Mr. J. Pickup, whose resignation, owing to advanced age, was announced in the "Journal" for the 13th inst.

We much regret to learn that the health of Mr. William Carr, the Engineer and Manager of the Stalybridge Gas-Works, has been again so unsatisfactory that he has had to leave England. He sailed for the Canary Islands on the 17th inst. It may be remembered that Mr. Carr was seriously ill rather more than two years ago, and was unable to attend to his duties. His health was much improved by the rest and change; and we are sure that all his colleagues will join us in wishing that he may return from his present journey with a large measure of his former vigour and energy restored to him.

As the result of the offer of a substantial inducement to Mr. Matt. Dunn to remain at Goole, he has declined to take the appointment at Buxton which, as announced last week, he had been chosen to fill, in succession to Mr. Smedley. Mr. Harold Barker, of Pontypridd, who was next on the list of selected candidates, will now have the position. It was for purely family reasons that Mr. Dunn sought a change of residence; his family having never been free from sickness since they went to Goole. When the District Council received his resignation, they at once unanimously resolved to offer him an advance of £100 per annum in his salary for a term of three years, and consented to his family residing out of the town if found absolutely necessary. The Council felt that the loss of Mr. Dunn's services at a time when the construction of new water-works and improvements in the gas-works were being proceeded with would be a serious thing, inasmuch as he has in his hands all the details in connection with these matters. He has always been cordially supported by the Council.

OBITUARY.

Mr. E. J. Phillips, J.P., who had been a Director of the Newport (Mon.) Gas Company for no less than 48 years, and was Chairman of the Board for 18 years, died last Saturday week. He was one of the best known and respected men in Monmouthshire; and he and his brother, Mr. Griffith Phillips, were among the early pioneers of the gas enterprises in Cardiff and Newport. The deceased gentleman was born at Carmarthen rather more than 80 years ago.

Mr. Alex. Osborne, the "Father" of the Town Council of Glasgow, died at his residence at Kelvinside, on Friday last. Mr. Osborne entered the Town Council so far back as 1862. He was for a long time one of the Magistrates of the City, and was twice offered the Lord Provostship, but declined the honour. For many years he was Convener of the Water Committee of the Corporation. It was under his auspices that the scheme for doubling the water supply from Loch Katrine was promoted; and he lived to see it all but completed. It is not too much to say that in Glasgow, on account of his public services, and particularly his labours in connection with the water supply, Mr. Osborne was revered. This feeling was given expression to about four years ago, by the public presentation to him of his portrait.

NOTES.

The Perishing of Paint.

An article on the durability of paint has been published in the "Builder" by Mr. H. C. Standage. The writer discusses the nature of paints, and the influences to which they are exposed. It is mentioned that much of the wearing away of paint on outside surfaces in some localities where there is much grit and dust in the air, is a purely mechanical action. The only remedy for this mischief is to make the paint as tough and elastic as possible, instead of hard and brittle, which can only be done by restricting the use of driers in the paint, and mixing it, if possible, with linseed-oil varnish only. Mr. Standage also deals with the blistering of paint and the permeation of the coating by water. The latter is the most destructive of all agencies; and this may be shown by simply putting test pieces of painted iron in water for a few days. The permeability of linseed oil to water is due to the presence of glycerine. The non-adherence of a paint to the surface to which it is applied is sometimes referable to the same cause. The destruction of paint coatings by acid or alkaline gases is largely a question of the sponginess of the coating. Unfortunately, no indication is given of a way to prevent the formation of glycerine as linseed oil dries.

The Premium Plan of Labour Remuneration in England.

It is reported by "Engineering" that the premium plan of paying workmen, recently discussed in the "Journal" as an American invention, has been adopted with the happiest results by the firm of Reavell and Co., Limited, of the Ranelagh Works, Ipswich. The breakfast break has been entirely done away with. The shop hours are from 7 in the morning until noon, and from 1 to 5·30 p.m. on ordinary days, the works closing at 12 o'clock on Saturdays. There are thus 52½ working hours in the week, which is nevertheless paid for as 54 hours; the extra hour-and-a-half being added as a bonus when there has been no time lost for the week. The wisdom of this arrangement is particularly evident at this time of high pressure, when missed time cannot be visited with a high hand, and the lost morning quarter has to be winked at in many a shop as the least of many evils—greatly, of course, to the injury of discipline. The premium plan as adopted by Messrs. Reavell, whose speciality is high-speed steam-engines, is exactly the same as that described in the "Journal;" the workman receiving as a premium one-half of the value of the time he saves over every job as compared with the standard allowance. Thus, the higher the wages taken by the workman, the lower the wages cost of the piece, which is consequently otherwise than with common piecework, where the labour cost per piece remains the same no matter how much money the man earns. The well-known objections to piecework do not apply to the premium system, under which the workman has every inducement to continuously increase his output.

Throwing a High Chimney.

The operation of throwing a lofty brick or masonry chimney is often a delicate one for carrying out in a crowded town. A successful performance of the kind is mentioned in the "Engineering Record" as having been accomplished in Brooklyn. This was the demolition of a shaft in brickwork 168 feet high, containing about half-a-million bricks laid in cement. The flue was 2½ feet square, and the walls 3½ feet thick at the bottom. Two men with chisels first cut away the whole of the front wall from the base to a height of 4 feet, shoring up as they went with 12 in. by 3 in. uprights, 6 in. apart, well wedged up between the top and bottom wooden sills. Then the remaining corners of the chimney were cut away, so as to leave only a narrow pier in each side. Kindling wood and coal were piled round the shores, and set on fire. In twelve minutes the shores were sufficiently burnt through to let the chimney fall slowly forward in the intended place. The whole job only took two men a day and a half. It was at first intended to throw the chimney over by means of screw-jacks, without the use of fire. By this method, one of the front walls at the bottom would be entirely cut away in the direction in which the shaft should fall, and the cutting would be continued round each corner nearly half way, so as to barely remain stable. Then two holes for jacks would have been cut in the middle of the back wall, the jacks inserted, and screwed up as quickly as possible, thus throwing the chimney over. Evidently, the weight to be dealt with limits the employment of this method to comparatively short shafts. Where there is plenty of room, dynamite or gun cotton will do the work with the smallest amount of labour; but they are uncertain.

The Oxidation of Ammonia by Iron.

A suggestive paper on the oxidation of ammonia by iron ore has been read before the Scottish Section of the Society of Chemical Industry by Dr. W. Carrick Anderson and Mr. G. Lean. The authors start from the discovery of Lowthian Bell that the reduction of peroxide of iron by carbon monoxide gas begins at comparatively low temperatures. In the case of precipitated oxide, it is found that a slight action shows itself at temperatures as low as 141° to 149° C. The oxidation of hydrogen gas would also appear, according to the same authority, to start at or about the same limits of temperature. From consideration of these results it might very fairly be concluded that other hydrogen containing gases would undergo a like decomposition by iron ores at similar

temperatures. Dr. Anderson and Mr. Roberts have already shown that on distilling mixtures of raw coal and iron ores in a retort, a considerable proportion of the ammonia liberated in the composition of the coal was destroyed through the action of the oxides; and this destruction was indicated as a possible source of loss in the recovery of ammonia as a by-product in blast-furnace working. Further experiments have therefore been carried out with the object of determining the relative amount of this decomposition at different temperatures. The results go to show that the action of ammonia on ferric oxide begins at temperatures between 140° and 150° C., a result which agrees with the statement of Lowthian Bell that carbon monoxide begins to effect a reduction of the peroxide at or about the same temperature. The action rose with the temperature, until at 200° C. a previously-heated iron ore destroyed 54·2 per cent. of the ammonia passed through it. Asked whether any examination of the iron ore after the passage of the ammonia had taken place, with the object of ascertaining the exact nature of the change, the answer was in the negative. It was concluded from the formation of water that the change was solely one of oxidation of the alkali, the peroxide of iron being reduced to protoxide.

Midland Association of Gas Managers.—The annual meeting of the Association will be held at the Grand Hotel, Birmingham, next Thursday. We learn from the circular issued by the Hon. Secretary (Mr. Charles Meiklejohn, of Rugby) that, in addition to the reception of the report and accounts for the past year, and the delivery of the Inaugural Address by Mr. J. Ferguson Bell, of Stafford, the papers read at the autumn meeting by Mr. G. Helps and Mr. B. W. Smith, on "Retort Heating" and "Inclined Retorts," will be discussed.

Competitive Plans for New Gas-Works.—Early last year, prizes were offered for the best plans for a new gas-works for Rixdorf, near Berlin; and it is now announced that nine competitors entered the lists. The first prize of £350 has been awarded to Herr L. Gumz, Engineer of the Bremen Gas-Works; the second prize of £250 to Herr E. Körting, Engineer to the Imperial Continental Gas Association at Vienna, and Herr C. Bernhardt, of Charlottenburg, for a joint design; and the third prize of £150 to the Berlin-Anhalt Engineering Company and the Stettin Fire-Clay Works, also for a joint design. The successful plans have been exhibited in the Rixdorf Town Hall.

The Gas Supply of Paris.—The revenue from the sale of gas in Paris last year amounted to 82,630,736 frs. (£3,305,229), as compared with 80,971,744 frs. (£3,238,869) in 1898; being an increase of 1,658,992 frs. (£66,360), or 2·05 per cent. We learn that negotiations have been set on foot for a reduction in the price of gas to 20 c. per cubic metre, subject to the payment of the extra 10 c. (the Company's price under their Treaty being 30 c.) by the Municipality until the expiration of the concession on Dec. 31, 1905; a loan of 182,000,000 frs. being raised for the purpose. The idea seems to be that when they take over the concern they will continue the price at 20 c., devoting the profits to the redemption of this debt. Possibly something more may be learnt in regard to this scheme from the next report of the Directors, which will soon be due.

Another Pamphlet on Sulphate of Ammonia.—The Sulphate of Ammonia Committee are determined that there shall be no lack of reliable information on the subject of the manurial value of sulphate of ammonia; for they have followed the issue of the exhaustive essay by Mr. James Muir, which gained their prize, by the publication of another by Mr. R. Warington, M.A., F.R.S., formerly Sibthorpian Professor of Rural Economy in the University of Oxford. Its title is "Sulphate of Ammonia: Its Characteristics and Practical Value as a Manure." The author has divided his essay into two parts; dealing in the first with the history and characters of sulphate, and in the second with the agricultural results obtained by its application to crops—taking in succession wheat, barley, oats, grassland, potatoes, sugar beet, mangel wurzel, and turnips. The second is by far the larger part—occupying 100 out of the 130 pages of the pamphlet, which is clearly printed, in paper wrapper, and forms an important addition to the literature of the subject.

The Supply of Electric Power in the United States.—We learn from "Nature" that a proposal which has been put forward to generate electricity on the Canadian side of the Niagara and to sell electric power on the American side, has caused a flutter of excitement among American electricians. The New York "Electrical Review" states that the question has been raised whether foreign-made electricity is not subject to a duty of 10 per cent. *ad valorem* as an "unenumerated manufactured article." This question has produced a flood of debate, and while it is purely hypothetical as yet, the Merchants' Exchange of Buffalo and the Niagara Falls Power Company have gone so far as to pass resolutions opposing such taxation. Those who desire discrimination in favour of home-made electricity argue that electric power is a vendable and valuable product of manufacture; that it can be measured easily and accurately; and that foreign-made electricity should pay duty equally with foreign-made cloth or wine. Those who believe in free trade in electricity point out that it is not an article; that it is not valuable or sold or saleable; that it has no power to do work, but only serves as a means of transmitting power; and that it is impossible to import it, as it instantly returns to its source.

TECHNICAL RECORD.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

The Thirtieth Annual Meeting of the Institution was held last Saturday, at the Grand Hotel, Manchester. Mr. R. G. Shadbolt (Grantham), the retiring President, occupied the chair at the opening of the proceedings.

The minutes of previous meetings having been approved of,

The Hon. Secretary (Mr. S. S. Mellor, of Northwich), read a number of letters received from members unable to be present.

New Member.

Mr. Edwin Harry Hudson, Manager and Secretary of the Normanton Gas Company, was elected a member of the Institution.

The Report and Accounts.

The Hon. Secretary read the annual report of the Committee as follows:—

The Committee, in presenting the thirtieth annual report, beg to congratulate the members on the continued prosperity of the Institution.

There have been elected during the year 11 members; 2 have retired under Rule 17; 2 resigned; and 2 have died—viz., Mr. J. C. Ingham and Mr. G. E. Stevenson—leaving 137 members on the roll of the Institution. Both members removed by the hand of death were useful members in their respective spheres—Mr. Ingham by his close and unremitting attendance, and Mr. Stevenson by the many ways in which he contributed to, and assisted in, our proceedings. Apart from the tragic manner of Mr. Stevenson's death, it must appeal strongly to the feelings of the Institution, inasmuch as he was at the time our Senior Vice-President and an undoubted leader among us. It is not often death strikes so high in our ranks; and we sincerely trust it may be long ere we thus suffer again. With these exceptions, the year's transactions have been of a most successful and instructive character.

The twenty-ninth annual meeting was held in Manchester, when a visit was paid to the Gaythorn station of the Manchester Corporation Gas-Works, where an installation of coke conveying machinery applied to inclined retorts was inspected; the visit being of a satisfactory character. On the meeting being constituted at the Grand Hotel after lunch—Mr. Haddock in the chair—there was a good muster of members. The minutes of the previous meeting were read, confirmed, and signed; and new members and office-bearers for the ensuing year were elected. Mr. R. G. Shadbolt was then conducted to the chair, and delivered his Inaugural Address, for which a hearty vote of thanks was accorded him. The adjourned discussion on Mr. Brearley's paper entitled the "The Balance Sheet," was then taken, and proved both interesting and animated.

The May meeting was held at Kendal; and there was a large attendance of members, who were entertained to luncheon by the Mayor and Corporation of Kendal. The courtesy thus shown to the members was suitably acknowledged. The members then paid a visit to the gas-works, where the plant and machinery were inspected. Mr. Ritson had prepared a full description of the works, which description had been distributed to the members earlier in the day. A visit was then paid to the Fisher Tarn reservoir of the Kendal Corporation Water-Works. On re-assembling at the Town Hall, further acknowledgment was made of the obligation under which the Institution had been placed by the Corporation and Mr. Ritson for the admirable character of the day's programme.

The one hundred and nineteenth quarterly meeting was held at Blackpool. The proceedings opened with a visit to the Corporation Gas-Works. Mr. Chew and his son (Mr. Wm. Chew) conducted the members over the establishment, and pointed out the various items of interest. A hearty vote of thanks was accorded to the Corporation for their permission to visit the works. Mr. Whatmough read a paper entitled "Notes on the Working of a Self-Loading Governor," which elicited a good discussion. A paper, entitled "Gas-Traction on the Blackpool, Lytham, and St. Annes Trams," prepared by Mr. Wm. Chew, was taken as read. The members next paid a visit to the tramway gas-compressing station, where the plant was carefully inspected; a hearty vote of thanks being accorded to the Tramway Company for permission to visit the station.

The November meeting was held at Bradford on Saturday, Nov. 25, under the presidency of Mr. Shadbolt. There was a fair attendance of members. Mr. T. N. Ritson, of Kendal, was unanimously elected President for the ensuing year. Mr. Thomas Newbigging, C.E., contributed a paper, entitled, "Some Disputed Points in Gas and Water Legislation," which evoked a good discussion. Mr. Graham introduced for discussion the subject of "Laying Gas and Water Mains in Public and Private Streets," and Mr. G. W. Lupton that of "Profit Sharing, or Payment by Results," which was well taken up by the members. Messrs. Graham and Lupton are to be commended for bringing forward subjects for discussion in such concise form; and we would specially call the attention of the members to the fact that we cannot, and do not, expect every communication to partake of the form of a complete essay—that we, of necessity, leave to the National Institute. We are fully persuaded that there are many of our members who could in various ways introduce subjects not only of interest but of utility also; and where there is an antipathy to the preparation of anything approaching an exhaustive essay and the subject-matter held back in consequence, we submit there is a distinct loss to the Institution as well as the individual member. We are persuaded there is vitality in our ranks and to spare. Still, successful as our gatherings have been, we would suggest that a few more volunteers and a few less pressed men would prove mutually beneficial.

R. G. Shadbolt, *President.*
Saml. S. Mellor, *Secretary.*

The report was accompanied by the statement of accounts.

Mr. W. Newbigging (Manchester), in moving the adoption of the report and accounts, observed that there was one item in the latter to which he would like to call attention. He referred to the balance standing to the credit of the Institution, which had increased from £18 14s. a year ago to £41 8s. now. He wished to ask the Committee whether they had any object in allowing the balance to increase to this extent. The Institution had no dividends to make up, or contributions in relief of the rates, or liabilities of any kind that would involve dipping into a fund of this character. It was very easy to get rid of money; but, of course, to get rid of it judiciously was another thing. There were one or two funds to which members might deem it

advisable to contribute. There was the Gas Institute, which was hampered for lack of funds, but which did excellent work, in a quiet and unostentatious manner. Then there was the question of making some payment to the Honorary Secretary for his valuable services, of which the funds at their disposal would allow. There were also other ways in which the balance might be judiciously expended; but he should like to hear the views of members on the matter.

Mr. W. W. HUTCHINSON (Barnsley) seconded the motion. He remarked that the report bore evidence that the proceedings had been of an eminently satisfactory character; and the statement of accounts, according to the previous speaker, showed that they were suffering from an over-sufficiency of funds. As to the matter of getting rid of the surplus, he thought this could be dealt with separately; and he himself might be disposed to make a proposition.

The motion was unanimously adopted.

Mr. HUTCHINSON said that, without knowing the wishes of the "inner circle" of the Institution, and speaking on the spur of the moment, he begged to propose that the sum of ten guineas be given to the Honorary Secretary and twenty guineas to the Reserve forces; leaving for more deliberate consideration by the General Committee the question of the payment of an annual sum to the Secretary.

Mr. J. WILKINSON (Drighlington) asked whether they had power, by the rules, to vote sums of money for objects outside the organization.

The PRESIDENT said he should hold at the present juncture, they had not the power. They had certainly the right to dispose of their money as they wished for the objects of the Institution; but, if he had the ruling, he should say they were not justified in voting money for outside purposes. They had not, however, had a seconder to the motion.

Mr. WILKINSON said, in order to test the question, he would second the motion.

Mr. ISAAC CARR (Widnes) said this was a simple matter, but it required to be dealt with in a proper way. He thought it should be left to the Committee who managed the affairs of the Institution. This was not the first time they had had a large balance; and the Committee on such occasions had frequently suggested ways of disposing of it. In whatever way it might go, he thought it was the duty of the Committee to submit for the approval of the members any scheme they might decide upon. He was, in any event, directly opposed to the meeting attempting to come to any decision on the point. He moved, as an amendment, that the matter be referred to the Committee for consideration.

Mr. H. KENDRICK (Stretford) seconded the amendment, and suggested that one way in which they might get rid of some of the surplus would be to do as some other Institutions did—namely, give premiums for papers read at their meetings.

Mr. HUTCHINSON said he was quite willing to withdraw his motion. He agreed that the Committee should have a voice in the selection of the objects to which the surplus should be applied, and it would have been better if it had occurred to them to make some recommendation.

The PRESIDENT said the Committee did not know what the balance would be until they received the balance-sheet at the same time as the ordinary members; and consequently they had not had time to consider the matter. So far as remunerating the Honorary Secretary was concerned, he might say that individually—he was not speaking officially—members of the Committee thought Mr. Mellor was deserving of some remuneration.

Mr. E. E. J. ANDERSON (Ripon) suggested that the President and Secretary should be presented with medals as mementoes of their year of office.

Mr. Hutchinson, as the mover of the substantive motion, and Mr. Wilkinson as the seconder, withdrew their proposal.

The PRESIDENT said, as the motion had been withdrawn, the whole thing fell to the ground, and the Committee were left to deal with the matter. They would take it as an expression of opinion that they should consider the question of the disposal of the balance; and they would, of course, have before them the various suggestions.

ELECTION OF OFFICERS.

Mr. KENDRICK moved that Mr. Charles Wood be elected Senior Vice-President for the year. Mr. Wood, he added, had given them a reason why he could not be President during the present year; but he (Mr. Kendrick) thought he would be a worthy successor to the presidential chair if, when in accordance with custom it became the turn of the Senior Vice-President to go forward to the chair, he could see his way to do so.

Mr. J. H. BREARLEY (Longwood), in seconding the motion, said Mr. Wood commanded the respect of the Yorkshire members, and, he thought, of the members generally. Some of the members, however, had perhaps no very great respect just now for Mr. Wood's Corporation; but they must not let that stand in his way.

The motion was carried with acclamation.

Mr. WOOD, in accepting the office, said he hoped that next year he might be in a better position to succeed—if they thought it desirable—to the presidential chair. He would do his best for the interests of the Institution; and he only hoped that those members who at present had any hard feelings towards the Bradford Corporation might—at any rate, some of them—before very long be part of the Bradford Corporation.

Mr. H. TOWNSEND (Wakefield) proposed the appointment of Mr. Arthur Graham, of Mansfield, to be Junior Vice-President. Mr. Graham would, he was sure, well uphold the dignity and usefulness of the Institution.

Mr. WILKINSON, in seconding, observed that Mr. Graham was well known to almost all the members, and he hoped he would continue to enjoy good health, and gain still further well-earned promotion.

Mr. GRAHAM briefly thanked the members for electing him to the post, and promised to do his utmost for the welfare of the Institution, although he was somewhat awkwardly fixed in the matter of distance.

The re-election of Mr. Thomas Newbigging as Treasurer was moved by Mr. J. BRADDOCK (Radcliffe), who remarked that whether they regarded that gentleman as the custodian of their funds, or as perhaps the most frequent contributor to the technical proceedings of the Institution, they must consider him a most valuable member.

Mr. H. FOWLER (Horwich) seconded the motion; and it was unanimously adopted.

The PRESIDENT proposed the re-election of Mr. Mellor as Secretary—remarking that he and other Presidents could testify that Mr. Mellor was the right man in the right place.

Mr. R. SURTEES (Lymm) seconded the motion, and it was enthusiastically adopted.

Mr. MELLOR, in thanking the members for his re-election, expressed the hope that the Institution would continue to grow in numbers, and that they would have some good papers at forthcoming meetings.

On the motion of Mr. MELLOR, seconded by Mr. F. BARRETT (Ramsbottom), Mr. J. Wilkinson, of Drighlington, was elected a member of the Committee in place of Mr. Ritson, the new President.

Mr. G. S. FRITH proposed, and Mr. S. MOYS seconded, a motion that Mr. S. Meunier, of Stockport, be elected a member of the Committee; and Mr. LUPTON proposed, and Mr. DAVIES seconded, the election of Mr. Tim Duxbury, of Middleton, to the Committee. These proposals were unanimously adopted.

On the motion of Mr. H. HAWKINS, seconded by Mr. BUCKLAND, Messrs. Lamb and Severs were appointed Auditors.

THE NEW PRESIDENT.

The PRESIDENT, in introducing the new President, Mr. T. N. Ritson, of Kendal, said this was a pleasant duty to perform, but one not altogether untinged with regret. He (Mr. Shadbolt) was convinced, however, that he was handing over the reins of office to a gentleman who would do credit to himself and to the Institution generally. Mr. Ritson was not unknown to the members by any means; and he had contributed to the proceedings in more ways than one. They had for some years looked upon him as one of the rising men of the gas profession; and he had the ability, willingness, and spirit to carry out the duties of the presidency in the very best manner.

Mr. RITSON then took the chair, and at once proceeded to read his

INAUGURAL ADDRESS.

Gentlemen,—It is with mingled feelings of pleasure and regret that I find myself to-day in the position of President of this important Institution. The fact that you have thought fit to confer this honour upon me is of itself a real pleasure; and I appreciate it all the more, because it is a tangible expression of that kindly feeling of good fellowship which I have always experienced at the hands of the Council and members of the Institution. On the other hand, it is with feelings of the deepest sorrow that the lamentable calamity which befell our esteemed friend and colleague, the late Mr. George Ernest Stevenson, should have deprived our Institution, not only of its President-elect, but also of one of the kindliest and most estimable men in the whole gas profession. To know Mr. Stevenson was a real pleasure. His amiability, kind and unassuming manner, combined with his many high qualities and abilities as an engineer and gas expert, placed him in the front rank of his profession. The loss to the Institution is incalculable; for his able contributions to the proceedings, his versatile and ready speech, were the admiration of all. To his sorrowing wife and family, we extend our sincerest expression of heartfelt sympathy in their sad bereavement. I regret also—and I am sure I voice the sentiments of our members—that Mr. Charles Wood found it impossible, owing to excessive pressure of business, to go forward to the chair. I am glad, however, that we are to have the benefit of his able generalship next year.

Called upon, as I have been at short notice, to fill the breach thus caused, I must crave your indulgence if I fail to rise in a manner befitting the occasion. When I look back and review the names of the many eminent gentlemen who have preceded me in the presidential chair, I feel my inability to discharge worthily the duties devolving upon me in a way I least expected when I fell a victim to your unanimous call to office. I will, however, do my best; and backed up, as I am sure I shall be, by a Council of good men and true, I am hopeful that the duties devolving upon me during my year of office may be carried out to your satisfaction.

Looking back at the century which is now nearing an end,

one is at once struck with the gigantic strides that have been made in every direction. It has been a century of constant progress, advancement, and civilization. When we consider what steam, railways, chemical and engineering sciences, gas, electricity, telegraphy, telephony, &c., have done for mankind generally, it is truly marvellous. Take, for example, the enormous development of our railway system. In the year 1825, the first railway line (Stockton and Darlington) was opened for passenger traffic. It is computed that there are now no less than 21,500 miles of railways in the United Kingdom, representing an invested capital amounting to the vast sum of £1,089,765,095.

It is beyond our power to foretell what science has in store for us in the future; but it is certain that, with the continued advance in education, and the opportunities which have been, and are still being, made for the study of practical engineering, chemical, and other sciences, great things may be anticipated. From past experience, we know that the knowledge of to-day vanishes before that of to-morrow—science never stands still. A few new facts soon upset pet theories. It is recorded of that great and renowned philosopher Sir Isaac Newton that, when dying, he said: "I seem only like a boy playing on the shore, and diverting myself in now and then finding a smoother pebble, or a prettier shell than ordinary, while the great ocean of truth lay all undiscovered before me." How truly applicable are the words of that memorable man, even in our day.

Our own industry, "The Art of Gas Manufacture," is just about a century old; and to William Murdoch must be given the premier place as the pioneer of gas lighting. What do we find to-day? There are 661 authorized gas undertakings in the United Kingdom.

Local authorities own	222
Private companies own	439
Total	661
Total coal carbonized per annum	12,841,817 tons.
Gas produced " "	138,146,994,782 cubic feet.
Gas sold " "	127,365,376,845 cubic feet.
Capital employed	£82,109,752

In addition to the above, there are over 1000 non-statutory gas undertakings in existence, who furnish no returns, but whose make of gas amounts to many million cubic feet per annum.

Figures like these tell their own tale, and show, not only the enormous development in gas engineering enterprise, but also that the undertakings which we have under our control are of widespread national importance. Whether in respect to lighting, heating, or motive power, coal gas must be ranked as among the greatest enterprises of the century. There are now few cities, towns, or villages which do not possess a gas-works; and it is satisfactory to note that, notwithstanding competition from oil, electricity, and the newly-discovered acetylene, the demand for gas is steadily on the increase, and gas stock stands to-day probably higher than at any other period in the history of gas manufacture—proof, if such be needed, of its popularity as a domestic and manufacturing agent, and of the public confidence reposed in it as a medium for sound financial investment.

The following comparative table, compiled from the Board of Trade Returns, shows the progress of the gas industry since 1882, when the first Electric Lighting Act was passed:—

——	Year.	Number of Authorized Undertakings.	Amount Authorized.	Paid Up and Borrowed.	Tons of Coal Carbonized.	Gas Made.	Gas Sold.	Mileage of Mains.	Number of Consumers.	Number of Public Lamps.
			£	£	Tons.	Cubic Feet.	Cubic Feet.			
Companies' returns	1882	352	46,906,701	32,934,935	4,928,695	49,360,289,059	45,484,910,194	11,500*	1,055,009	224,300
Local Authorities' returns	1882	148	20,911,154	17,326,183	2,352,062	23,223,054,342	21,129,033,704	5,400*	916,962	137,011
Total	..	500	67,817,855	50,261,118	7,280,757	72,583,343,401	66,613,943,898	16,900	1,971,971	361,311
Companies' returns	1899	439	63,709,947	53,494,781	7,958,669	86,705,722,752	80,077,717,158	15,451	1,670,847	319,007
Local Authorities' returns	1899	222	32,499,721	28,614,971	4,883,148	51,441,272,030	47,283,759,687	10,030	1,578,291	247,857
Total	..	661	96,209,668	82,109,752	12,841,817	138,146,994,782	127,365,376,845†	25,481	3,249,138	566,864
Increase	..	161	28,391,813	31,848,634	5,561,060	65,563,651,381	60,751,432,947	8,581	1,277,167	205,553

* Estimated. † Including 7,404,193,550 cubic feet of carburetted water gas and 82,550 cubic feet of acetylene gas.

I have never been one to regard the introduction of the electric light with disfavour, because I have always felt that there was room enough for both illuminants to work harmoniously together; and, moreover, that the demand for gas would continue to increase. Experience, backed up by the aforesaid statistics, proves this impression to have been well founded. That it is a keen competitor, cannot be denied. At the same time, it is one which has been of the greatest possible benefit to gas lighting, in stimulating inventive genius, and helping to create a demand for more light. There is no doubt our new rival has aroused gas authorities to a sense of public duty, and inspired them with a spirit of enterprise which would probably never have been dreamt of formerly; and the result has been increased output of gas and increased profits, while the public generally have benefited by cheaper gas and improved methods of lighting, both domestic and public.

The number of applications for Electric Lighting Orders and Bills grows apace. This year beats all its predecessors—there being no less than 131 schemes announced. Local authorities take the lead with 68; while private companies are represented by 63.

Notwithstanding the enormous development of electricity supply, it is interesting to note that, since the year 1882, no less than 77 gas undertakings have been purchased by local authorities from private companies; and there are several others down for the present session of Parliament. This growing desire on the part of local authorities to acquire gas undertakings not only shows that gas is more than ever regarded as a public necessity, but also the estimation in which they and the public generally regard investment therein.

I am reminded that this is the thirtieth annual meeting of the Institution; and it is a source of satisfaction to be able to congratulate you upon its continued prosperity and sound financial condition. It has occurred to me that it might be interesting, at this stage, to note the part the Institution has played since its formation in 1870, when that little band of gas engineers met together to talk over gas matters, and to bid our old and much esteemed friend Mr. Thomas Newbigging an affectionate "send-off" to Pernambuco. Gentlemen, we have Mr. Newbigging with us still; and I believe I echo the feelings of every member of the Institution, when I say how much we esteem, not only his friendly co-operation, but also value and appreciate the services he has rendered to the Institution and to the gas engineering world at large. We are glad he is among us still; and we trust he may long be spared to give us the benefit of his example, loyal devotion, and extensive experience as a gas engineer.

The Institution became at once popular, and step by step advanced into general importance, until now there are 138 members on the book, who have control of works carbonizing 2,127,000 tons of coal per annum. But what have the members generally done for the gas industry, through the medium of the Institution? I find that no less than ninety papers (a list of which I append hereto, and which I trust will be of use to the members), treating upon almost every important subject connected with our great industry, have been contributed to the "Transactions." This is noble testimony to the usefulness of the Institution, and shows that it is carrying out vigorously the objects of its promoters. Any society which can command such a succession of useful papers, and create lively discussions thereon, must necessarily be regarded as healthy and prosperous, and, moreover, of incalculable benefit to individual members and the gas industry generally. I trust in the future our members will be zealous in their endeavours to maintain the high reputation of the Manchester District Institution of Gas Engineers.

I rejoice to find that gas authorities are becoming more alive to the good work our various Institutions are doing for the gas industry, and are taking a more active interest in their welfare. I should, however, like to see them showing their appreciation in a more tangible form, by subscribing thereto for the purpose of research and other useful objects. There is a wide field in the gas industry for the scientist and lover of research; and who can tell what new discovery might be made which would convert what may now appear to be a negligible quantity into a profitable commodity?

It is the self-sacrificing efforts of individual members, who, at their own cost, have maintained and upheld the various Institutions, which have done so much for the benefit of the great industry with which we are identified. The business of a gas undertaking, outside the manufacturing department, has now grown to such magnitude, however, that the gas engineer and

manager has but limited time at his disposal for exacting and elaborate research work. In many large gas-works qualified chemists are employed; but in those of medium size, this is not always possible. Yet there are managers of such who have the ability to, and who would readily undertake research work, but are prevented from so doing because it would have to be done at their own cost, and at considerable sacrifice of time. Now, I maintain these are unreasonable demands to make of any gas manager. What I venture to suggest as a remedy, would be that gas authorities should be invited to contribute a certain small sum per ton of coal carbonized towards forming a fund for the purpose of employing one or more qualified analytical chemists, who would be at the service of members, acting under instructions of a technical committee, who would receive reports of all investigations made from time to time, and communicate the same to the Institution.

Such a scheme would, I feel sure, meet a want, and be of immense assistance to many gas managers desirous of undertaking technical investigations, but who are prevented from so doing because of the wherewithal and the necessary skilled assistance. Thus much valuable information which might see the light of day, may now be entirely lost. I believe many gas authorities would readily subscribe, if the benefits to be derived therefrom were clearly pointed out to them. This question was brought before the Southern Association by Mr. J. W. Helps in his Presidential Address, in 1897; but I regret it has not met with the attention which, in my opinion, it deserves. I trust it may be regarded of sufficient importance to receive the consideration of our Council.

The past year has witnessed an enormous increase in the price of coal, attributed to various causes—*i.e.*, increase in miners' wages, the "idling" miner, the war, and industrial prosperity. With regard to the former, this can only apply to a very limited extent, as it is absurd to pretend that the increases in wages granted are in any way proportionate to the increases in prices demanded. As to the second, now that wages are high there is no doubt a strong temptation for the miners to take matters leisurely, and so restrict the output; but I doubt very much if this plea can be borne out by actual facts. It is only to be expected that the war will have had some effect; but the abnormal rise is altogether irreconcilable under this head. The welcome revival of trade, particularly in the iron and steel industry, has naturally tended to inflate prices; but there is no doubt that prices have been forced up a great deal higher than even the industrial situation warrants. Under existing circumstances, it was quite expected that prices would be somewhat higher; but it is very questionable whether the present phenomenal rise can be justified by the actual position of either the coal trade or the industrial situation.

Colliery owners complain—and probably with reason—that the price of coal ruling of late has not returned a fair profit on the working. None would object to pay a remunerative price, so long as it was a reasonable and equitable one, if it was maintained uniform and steady. It is these extremes of depression and sudden abnormal increases that are so much to be deprecated. The policy of gas authorities of late has been to reduce the price of gas to the lowest possible limits, until there is now no margin left for such an unlooked-for and unprecedented rise in the price of raw material.

What the effect will be upon the price of gas now ruling, time will show. Already it has had an appreciable effect in some quarters; and unless prices come down to a reasonable figure before new contracts are entered into, an increase in price will be inevitable. If trade remains good—and there is every indication that it will—we must hope to be recouped somewhat by an increased output of gas, and augmented prices for coke and other residual products. I shall not be surprised, however, to see gas authorities going in wholesale for installations of carburetted water-gas plant. Then, when the "boom" has passed, coal-owners must not be surprised if they find the demand of many of their customers is diminished.

What with depleted stocks, the difficulties of getting supplies, and the troubles caused by the railway companies in dealing with the transit of material, many gas authorities have been seriously handicapped of late, and more than ordinary difficulty has been experienced in keeping up the supplies of gas. All this, in my opinion, points more conclusively than ever to the wisdom of making ample provision for the accommodation of larger stocks of coal, and so reduce these risks to a minimum. This is a subject which gas authorities will do well to take under serious consideration, if they wish to secure themselves against repetitions of the present crisis.

According to the official report of statistics relating to the mines of the United Kingdom, the output of coal for the year 1898 was 202,054,516 tons, of an estimated value at the pit mouth of £64,169,382, as compared with 202,129,931 tons, of an estimated value of £59,740,009, last year—showing a decrease in output of 75,415 tons, but an increase in money value of £4,429,373. The following diagram shows the development of the coal industry since 1870. It will be observed that, whereas the output has not quite doubled itself since 1870, exports are more than three times greater.

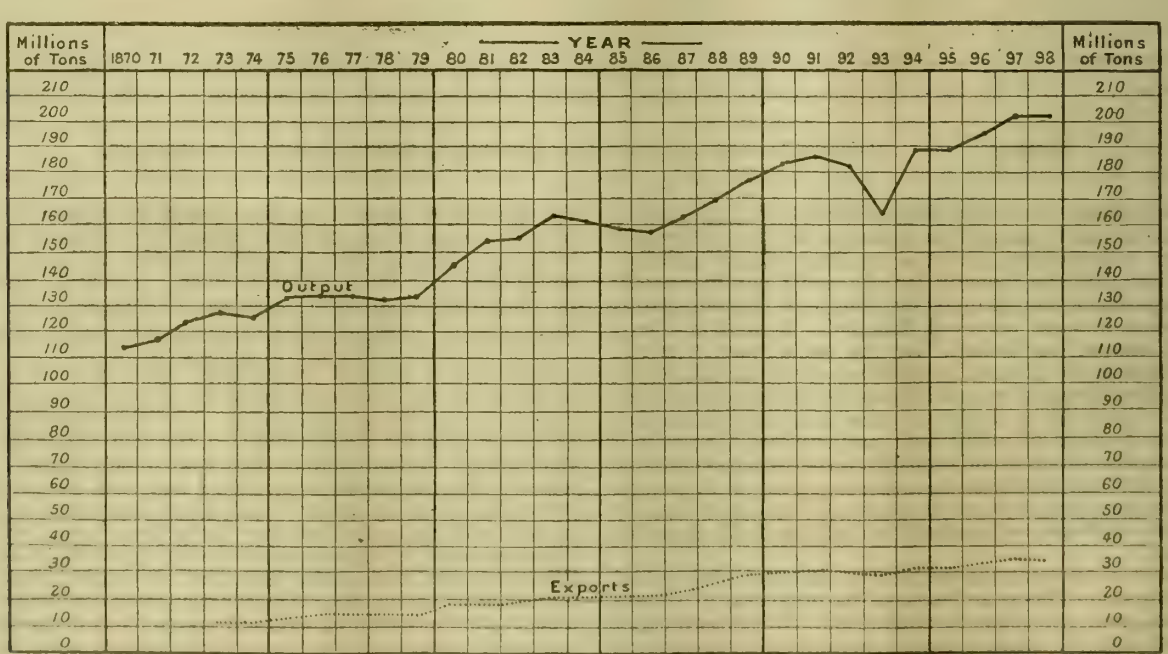


Diagram Showing the Output and Export of Coal Since 1870.

The question very properly presents itself, in the face of such figures, How long will our coal-fields stand this severe strain? Some centuries will yet elapse before the pinch is felt, nevertheless it is of the highest importance that every effort should be made to husband our coal and mineral resources, and adopt the very best plant and appliances possible in our arts and manufactures to obtain the best duty, and extract every unit of work and value out of the raw material, and not allow waste or undue consumption of this great source of our national wealth to be trifled with. That every effort is being made which science and mechanical ingenuity can devise to attain this end, in so far as the gas industry is concerned, cannot be gainsaid. The old-fashioned method of carbonization by direct-fired retorts is speedily giving way to the more elaborate and scientific systems of generator and regenerator retort settings, whereby the yield of gas per ton of coal carbonized and per mouthpiece has been largely increased, and that with a very considerable saving in fuel. In my own case, the whole of the direct-fired retorts have been replaced by generator and regenerator settings of the most modern design; and I can speak confidently of the savings effected, in every way, through their adoption. Again, the introduction of stoking machinery, coal breaking, elevating, and conveying machinery, inclined retorts, and carburetted water-gas plant are all factors in the right direction, enabling the highest duty to be obtained from the raw material.

Heat that was formerly wasted is now conserved and converted into useful energy, lessening the wear and tear of retorts, and increasing the yield of gas and the amount of the residual coke. The introduction of these scientific and mechanical appliances has effected another and none the less important function. The work of the stokers has been considerably lightened. There was a time—not so many years ago—when direct-fired retort-settings

were the rule, that clinkering and barring of the furnaces had to be done three or four times a day. Under the new *régime*, however, clinkering is only necessary once every three or four days. Moreover, while labour has been lightened, the hours have been shortened and pay increased. With such facts before us, it cannot conscientiously be said that consumers are getting cheap gas at the expense of labour. No; it is due to the advances which science has made in revolutionizing the methods of producing gas, the higher education and thoughtfulness of the men who have the control of our gas undertakings, and the spirited enterprise of the authorities in adopting the best and most efficient plant and appliances it is possible to secure.

Whether the method of continuous carbonization will ever become a "*fait accompli*" remains to be seen. Clegg tried it and failed; and others in our own day have unfortunately shared a similar fate. The fertile brain of man, however, has surmounted many obstacles; and he would be a bold person who would venture to assert that even this ideal is beyond the bounds of possibility. While the introduction of machinery and inclined retorts has done much to reduce waste, yet, when we consider the enormous quantity of gas which is still lost during the operations of drawing and charging retorts, there is still room for further improvement.

Condensation, although of such vital importance, is neither properly understood, nor has it received that serious attention it deserves. Granted that our knowledge of the behaviour of the various hydrocarbons and light-giving constituents, and the method of dealing with them, has greatly advanced during recent years, there is still much to be done before that stage of perfection, so much to be desired, is reached. This is a wide and complex subject, and worthy of extended inquiry, on the lines adopted by the Incorporated Gas Institute in 1882. I am of opinion that condensers should be placed under cover, and out of the direct action of climatic influences.

The question of mechanical washer-scrubbers *versus* tower scrubbers is one upon which a good deal of diversity of opinion exists. At my own works, I have adopted a combination of both. The use of too much washing water is to be deprecated; more damage is done by over-washing than is generally supposed. It is well known that water dissolves out small quantities of valuable illuminating hydrocarbons from the gas; and the loss of these, if the washing water is unduly great, may appreciably affect the illuminating power of the gas. The mechanical washer-scrubber in operation at Kendal has a gross volume of 254·4 cubic feet, and is capable of dealing with half-a-million cubic feet of gas per day. So far it has efficiently dealt with 360,700 cubic feet; equal to 1417·8 cubic feet of crude gas per day per cubic foot of gross volume, with an average production of 18 to 20 oz. liquor (by the distillation test), and with the employment of from ½ to 1 gallon of water per 1000 cubic feet of gas washed, according to the atmospheric temperature and time of the year. The small quantity—0·48 to 0·50 grain—of ammonia per 100 cubic feet found in the outlet gas, and taking into account the fact that analysis of the liquor shows it to be fully saturated with carbonic and hydro-sulphuric acids, satisfies me of the efficiency of this type of machine.

The question of purifying crude gas by means of the liquids obtained from condensation, washing, and scrubbing—viz., gas liquor—is a subject which requires further elucidation. Any investigation under this head would, I feel sure, well repay the labours expended upon it.

Washing and scrubbing, as ordinarily carried out, will remove about 30 per cent. of the impurities existing in crude coal gas—leaving the remainder to be taken up by the oxide of iron and lime purifiers. The question arises: Cannot the gas liquor be made to do better duty? I think it can, if properly applied. By a process which Mr. Holgate, of Halifax, has devised, and which has for its object the removal of these impurities, by means of purified ammoniacal liquor, he states that he is able to remove from 80 to 90 per cent., at the small cost of 0·024d. for each 1 per cent. of carbonic acid, equivalent to 0·048d. for each 2 per cent., which is equal to the enrichment of 1 candle.

No material alteration or improvements are to be chronicled in regard to purification. Oxide of iron and lime still hold the field. The introduction of small proportions of air, or of air moistened with steam or mixed with oxygen—the latter of which, by the way, appears to have run its day—have tended somewhat towards increasing the efficiency and reducing the cost.

The quantity of spent lime which in many towns is regarded as a waste product, is a subject of considerable interest. It is to the inventive genius of Mr. G. R. Hislop, of Paisley, that we are now in possession of apparatus which can successfully re-convert spent lime into a condition practically as good as new, and in one respect better, since the lime lies freer in the purifiers, and offers less resistance to the passage of the gas; and if the spent material is produced in the form of carbonate, it can be recovered continuously for a number of years. I have seen the process in operation at Paisley, where the make of gas is some 360 million cubic feet per annum; and Mr. Hislop informs me that while the foul gas contains on an average 3 per cent. of carbonic acid (or about double the average from English coal), the cost for purification is 0·28d. per 1000 cubic feet. With English coal, this figure would no doubt be further reduced. The following is an analysis of the original lime, and the same lime after six years' continuous restoration and use; the spent lime being in the form of carbonate, and containing about 1½ per cent. of hydrate of lime.

Analyses of Limes after Slaking and Drying at 212° Fahr.

	New Lime.		Same Lime after Six Years' Use.
Hydrate of lime	83·41	..	81·20
Carbonate of lime	3·82	..	3·15
Sulphate of lime	0·86	..	4·46
Magnesia	0·45	..	0·44
Iron and alumina	2·31	..	2·46
Silicia	2·26	..	2·32
Combined water	6·75	..	5·90
	99·86	..	99·93

These figures prove unmistakably that the lime has suffered very little indeed by its long use, and that the apparatus will do what is claimed for it—viz., re-convert spent or refuse material into an efficient and serviceable condition.

While gigantic strides have been made in plant and apparatus connected with the manufacture of gas, and the *modus operandi* of dealing with them, all tending towards lowering the cost of the manufactured article, yet probably one of the greatest advances is that relating to lighting. The older members of our profession will remember the time when a duty of 2½ to 2¾ candles per cubic foot of gas consumed was the best possible to obtain. The introduction of the argand burner was a further advance. Next came the regenerative burner, with a duty of some 6 or 8 candles per cubic foot; later the Welsbach "C" burner, developing a duty of some 14 to 15 candles per cubic foot; and more recently the new No. 4 Welsbach burner, with a duty of some 24 candles per cubic foot. Now we have introduced to us the Somzee-Greyson system of high-pressure intensified gas lighting, stated to develop 30 candles per cubic foot; and the hydro-incandescent gas-light, for which a duty of 40 candles per cubic foot is claimed. The Intensified Gas-Light Company give the following comparison of the illuminating power and cost of their system with electric incandescent and arc lamps, fishtail, argand, and regenerative gas burners, and the Welsbach "C" burner, with gas at 3s. per 1000 cubic feet.

Description of Light.	Illuminating Power. Standard Candles.	Consumption per hour in Cubic Feet.	Mantles.	Cost per 1000 Candles per hour in Pence.
		d.		
Electric incandescent light	15	0·25 per hour	—	15·2
Electric arc lamp, at 6d. per unit	—	—	—	3·0
Fishtail burner	15	5	—	12·5 to 22·5
Argand burner	25	8·8	—	
Regenerative burner	430	81·0	—	3·1
Welsbach "C" burner	50	3·5	0·8	3·3
Intensified	275	10·0	0·2	1·5

To make the foregoing comparison still clearer, they append the following table, showing the consumption for a year of a 16-candle power gas, giving a light of 4000 candles, by the intensified system, as compared with ordinary fishtail and Welsbach "C" burners:—

No. of Burners.	System.	Consumption in 1000's of Cubic Feet.	Cost, taking Gas at 3s. per 1000 Cubic Feet.
			£ s. d.
267	Fishtail	2436	365 8 0
80	Welsbach "C" burner	511	76 13 0
14½	Intensified	265	39 15 0

For places where high-power lights are required, this system is probably the most efficient and cheapest form of lighting in the market at the present time.

Professor Silvanus P. Thompson, in his Presidential Address before the Institution of Electrical Engineers, expressed the opinion, with reference to the relative merits of electric and gas lighting, that the competition between the two had been rendered very severe by the improvements introduced in the incandescent system of gas lighting. There is no doubt of this, whether in regard to internal illumination or public lighting; and it is a noteworthy fact that municipalities who possess their own electricity undertakings are largely adopting the newer system of gas for public lighting. The principle that better lighting effect can be obtained by placing lights of lower potentiality at short distances, than by employing lights of high potentiality placed at great distances apart, is now being recognized as the more scientific and practical method of obtaining the best results.

It is impossible to over-estimate the value of the gas-meter; for without it, probably the use of gas would not have attained its present vast development. Introduced about the year 1815, it has been so improved upon that to-day it is acknowledged to be a highly scientific piece of mechanism. Notwithstanding the many desperate attacks made upon it, the gas-meter is a useful and willing servant, if properly handled. Evidence in this respect is not wanting, from the popularity which has attended the introduction of the penny-in-the-slot meter. This invention has opened up a new and wide sphere of influence for gas; and it is extraordinary what a hold it has now got on the public. Mr. George Livesey, in his evidence before the Select Committee of

the House of Commons, in June, 1899, stated that, whereas the South Metropolitan Gas Company had only 439 slot meters in operation in 1892, the number had risen to 80,115 in 1898. It was estimated that, when this system was first started, there were some 90,000 houses in their district where no gas was used. Of these, over 80,000 had since been fitted up with the necessary internal fittings, gas-pipes, slot meters, &c., complete; and out of this number, 62,845 were supplied with stoves. The average cost of fitting up an ordinary house was a little over £6 (exclusive of the cost of service-pipe and everything outside the house); so that something like half-a-million of money had been expended, since 1892 alone, in the fitting up of workmen's dwellings. The average consumption by the slot meter was about 16,000 cubic feet per annum—rather more where there is a gas-cooker, and less where that article was absent. In my own case, from the time I fixed the first meter, in 1892, the system has continued to gain in favour, and the demand, although no very special effort has been made on our part, has grown to an extent least anticipated. We have now over 600 of these meters in operation, giving entire satisfaction to the consumers.

There is no doubt whatever that this system has supplied a long-felt want among the weekly wage-earning portion of the community. It is simple in its operation; and as the gas can be procured in small quantities, it fits in well with the pecuniary arrangements of this class, and is appreciated by them as affording a cheap, reliable, and safe way of securing the comforts of light and heat. The bread winners can shut up their houses, go to their work, and on returning home all that is necessary is to put a penny in the box, turn on the gas, light the cooking-stove, and obtain a good, comfortable meal at short notice. More recently we have followed in the wake of others, by fitting up cottage houses with slot meters, internal fittings, a corkslide pendant, one or two brackets, and a griller or boiling burner at the option of the consumer. This system has developed to such an extent that we have recently fitted up 187 houses, and have orders on our books for about another 50. We are proposing to make a further advance by introducing the slot-cooker system. Every endeavour should be made to increase the gas consumption per house, for by so doing the capital charges are thereby correspondingly reduced. In addition to the above, we give away to any consumer who applies a boiling ring or griller, 5 or 6 feet of india-rubber tubing, and a double tap to fit on the gas-bracket. Since the introduction of this system, we have supplied 900 boiling burners and grillers free of cost.

I hold the opinion that these slot consumers will continue to be a profitable class; and seeing they pay cash, and thus reduce the risk of bad debts to a minimum, they ought to be put on the best possible terms in regard to price. I venture to predict that the day will come when few houses will be without gas, either for lighting, cooking, or heating purpose—a system which will bid fair to a solution of the smoke problem. The hiring-out of gas cooking and heating stoves is another branch of our industry which has grown by leaps and bounds, and has aided very materially in increasing the demand for gas during the day-time. In 1892, there were only some thirty gas cooking-ranges in use in Kendal; now there are 362 in operation, consuming between 10 and 11 per cent. of the total output of gas.

The following table gives our day and night consumption per month. Column I. is for the year ending March, 1893; Column II. for the year following the gas exhibition, held in May, 1895; and Column III. for the year ending March, 1899 :—

Kendal Corporation Gas-Works—Gas Consumption in Cubic Feet.

Month.	I.—1893-4.		II.—1896-7.*		III.—1898-9.		Percentage Increase for Six Years ending March, 1893-9.	
	Day.†	Night.†	Day.	Night.	Day.	Night.	Day.	Night.
April	549,200	2,169,100	653,300	2,248,200	1,358,400	2,725,200	147·4	25·6
May	567,800	1,678,000	658,800	1,723,600	1,198,900	2,080,200	111·1	23·9
June	502,600	1,232,400	549,300	1,163,000	1,191,200	1,425,100	137·0	15·6
July	569,700	1,229,300	557,100	1,279,100	1,285,000	1,924,700	125·5	56·5
August	550,700	1,796,000	603,800	1,472,000	1,262,300	2,225,200	129·2	23·9
September	712,500	2,514,500	606,900	2,498,400	1,389,000	2,926,300	94·9	16·3
October	1,131,900	3,263,200	1,314,800	3,288,400	1,982,900	3,706,600	75·2	13 6
November	2,147,000	3,311,200	2,186,000	3,339,200	3,210,200	3,926,700	49·5	18·6
December	2,560,400	3,443,500	2,840,600	3,517,600	4,243,100	4,319,000	65·7	25·4
January	2,436,100	3,437,900	2,721,200	3,572,700	3,744,300	4,262,800	53·7	24·0
February	1,413,100	3,106,700	1,870,700	3,189,000	2,418,200	3,836,800	71·1	23·5
March	889,600	2,926,200	1,095,700	2,579,300	1,747,500	3,669,600	96·4	25·4
Total	14,030,600	30,108,000	15,658,200	29,870,500	25,031,000	37,028,200	78·4	22·9

* Year after gas cooking exhibition. † Day, 6 a.m. to 6 p.m.; night, 6 p.m. to 6 a.m.

This table shows the important part played by all gas apparatus and appliances designed to meet the day-load, and how important it is to use every endeavour to encourage demand under this head.

The development of gas for other than domestic purposes is none the less important. In many of our arts and manufactures, gas is now an indespensable commodity; and it is a noteworthy fact that many trades have been enormously simplified and perfected, the production cheapened, and labour lightened, solely through the medium of coal gas. As a means for producing motive power, gas has of late years made great strides. So great has become the demand for gas-engines, that the users of them may be ranked among our most extensive and profitable class of consumers. The development of the gas-engine is undoubtedly one of the advances of the century, and the demand is constantly on the increase. Messrs. Crossley Bros. inform me that they make fifty different types and sizes of engines, varying from ¼ up to 500 horse power, and that they turn out regularly no less than 60 to 65 per week—equivalent to more than one engine per working hour. During the last 30 years, the consumption of gas has been reduced from 30 to 15 cubic feet per brake horse power. At the present time, there are sixty gas-engines in operation in Kendal, consuming 5 million cubic feet of gas per annum, equal to about 9 per cent. of the total output.

In order to encourage the use of gas-engines, I am of the opinion that gas authorities should be prepared to let them out on the continuous hire system, or on the hire-purchase system. Such a scheme would meet a long-felt want, and would prove a boon to small traders, as well as a source of profit to the authorities. In Cork, the hire purchase system has been in successful operation for some years.

Mr. T. P. Travers, Engineer and Manager of the Cork Gas Company, has very kindly furnished me with some particulars of the system adopted by his Company. They take the net cost of the engine (about 20 per cent. off list price) and spread it over three annual payments; but, in addition, they charge 5 per cent. on the amount due at the commencement of each year. For example, suppose the list price of the engine to be £100, the net price would be (say) £80, then the customer pays :—

	£		£ s. d.
First year $\frac{80}{3}$ = £26 13 4	+ 80	at 5 per cent. = £4 0 0	30 13 4
Second year $\frac{80}{3}$ = £26 13 4	+ 54	at 5 per cent. = £2 14 0	29 7 4
Third year $\frac{80}{3}$ = £26 13 4	+ 26	at 5 per cent. = £1 6 0	27 19 4
	£80 0 0		£88 0 0

The necessary legal agreements are drawn up and signed by the parties; and, in addition, a large brass plate is attached to the holding-down-bolts of the engine, with prominent letters thereon stating: "This engine is the property of the Cork Gas Consumers' Company."

I am glad to be able to congratulate Mr. J. F. Wicks, Engineer and Manager of the High Wycombe Gas Company, on his enterprise in taking up the initiative in this country. Mr. Wicks has kindly furnished me with the following particulars of the system adopted by him. In order to render every facility to the manufacturing public and other businesses where motive power is desired, his Company are prepared to supply gas-engines, either on the hire-purchase system, payment quarterly, or on the continuous hire system. No fixed scale of prices is formulated, as in each and every case the circumstances vary, and require different estimates, as they not only supply the engine, but also fix all complete with foundations. Although the system has only been in operation a short time, five engines, varying from 4 to 25 horse power nominal, have been fixed; while he has inquiries for twelve others. At the time of writing, an engine of 75-horse power (the largest that has been fixed in the district) was being erected. The five engines already fixed are estimated to return an increased revenue of some £500 per annum.

To the electrician, the question of increasing the day-load is of paramount importance; and in order to achieve this end, some

authorities have adopted the system of hiring-out motors. The Bradford Corporation, for instance, have done so in regard to their electric undertaking. Through the kindness of Mr. A. H. Gibbings, the City Electrician, I am able to place before you a few particulars of the system now in operation in that city.

Electric motors from ½ to 10 brake horse power may be obtained on hire at the following rates:—

Brake Horse Power.	Approximate Speed.	Volts.	Ampères.	Rental per Annum.
				£ s. d.
½	1700	230	2	1 10 0
1	1450	230	3½	2 0 0
2	1200	230	6½	2 10 0
3	1100	230	9½	3 0 0
4½	1000	230	14½	4 0 0
6	800	230	19	5 0 0
7	800	230	22½	6 0 0
10	800	230	32	8 0 0

The supply of the motor and the current are subject to the Board of Trade regulations relating to electricity supply; to the rules, regulations, and conditions of the Electricity Department of the Corporation; and to the Electric Lighting Acts, 1882-1889. The charges for electricity supplied for motive power to users satisfying the department as to the continuous running of their motors through the working hours of the day, is at the net rate of 1d. per unit. For motors used for cranes, hoists, and similar purposes, the charge is at the rate of 2d. per unit. In Cork, the Electricity Company supply motors on free trial for two months, and afterwards let them on hire at an annual rental based upon 10 per cent. of the cost.

The importance of this subject cannot be passed over lightly; and it is quite evident that if gas authorities are to hold their own, it behoves them to be on the *qui vive*, and to be prepared to offer to their clients similar facilities in regard to gas-engines as the electricians are doing in respect to electric motors.

It is satisfactory to note that the residuals market has materially improved during the past year. Tar now stands fairly high; and as coke is likely to be scarce, the price will no doubt remain firm. Sulphate of ammonia has shown a marked improvement. I have said so much about sulphate of ammonia on previous occasions, and you are all so familiar with my contributions to the literature on this subject, that little remains for me to say. When I tell you, however, that the three principal crops of this country—viz., wheat, oats, and barley—could do with all, and even more than all, the sulphate of ammonia that is produced in the United Kingdom, and, moreover, if the 21 or 22 millions of acres of land under cultivation received only ½ cwt. per acre (a very moderate dressing) it would require more than three times the present production of the whole country, you will form some idea of the value of this fertilizer. In spite of this fact, more than one-half of the amount produced is exported to the Continent, and nitrate of soda is imported to take its place.

The question of enriching coal gas by means of benzol merits the fullest consideration, as any extended use of this material would have an important bearing upon the future of the tar market. Colonel S. A. Sadler, in his Presidential Address to the North of England Association of Gas Engineers, in 1894, said: "Ordinary coal gas at normal temperatures will easily carry 3 per cent.; this being nearly the point of saturation. Now, as an average gas contains less than 2 per cent.—often only 1·5 per cent.—1 per cent. may be added with great advantage where increased illuminating power is desired. An addition of 1 per cent. will raise 14-candle gas to 22-candle power—which, at to-day's price of crude benzol, would cost about ½d. per candle. For enriching gas, benzol is three times better than carburine, and four-and-a-half times better than ordinary petroleum spirit. If all the gas made in the United Kingdom were enriched by 1 per cent., it would require 11½ million gallons of benzol to do it—a quantity more than twice as great as the whole world's yearly production."

Mr. Hunt found that 0·105 gallon of almost pure benzol was required to increase the illuminating power 1 candle per 1000 cubic feet of coal gas. Dr. Bunte has stated that 15 or 16 candle gas required for an increase of 1 candle, 2000 to 2500 grains of benzol per 1000 cubic feet. Mr. J. F. Bell, of Stafford, found that the addition of 1 per cent. of benzol vapour was sufficient to raise the illuminating power of 14-candle gas to 22 candles; and it was also found that 0·05 gallon of "nineties" benzol raised 1000 cubic feet of 15-candle gas to 16 candles. Coal gas of 15-candle power was raised to 20·27 candles by the addition of benzol in the proportion of 0·0426 gallon per 1000 cubic feet per candle raised. This gas was mixed with other coal gas, and the mixture calculated to be 17·47 candles. It tested at the works 17·25 candles; and a distance of half-a-mile from the works, 17·32 candles. Assuming 0·05 gallon to be required per candle per 1000 cubic feet of benzol costing 1s. per gallon, then the cost of enrichment is 0·6d. Mr. W. Irwin has stated that, with benzine at its present price, there is no source of enrichment, whether water gas, cannel coal, or any other material, which can at all compare with it on the grounds of economy and efficiency in every respect. He found that a gallon will raise 10,000 cubic feet of 16-candle gas 3 candles, as tested with the union-jet burner, and 1·3 candles when the argand burner is employed.

Our ex-President, Mr. Shadbolt, has demonstrated that there are valuable hydrocarbons, which at present go to the tar distiller, capable, by simple and inexpensive means, of being profitably retained by the gas. To those who wish to make a study of the enrichment question in all its bearings, I would strongly recommend them to peruse the able and interesting paper contributed to the Institution of Civil Engineers by Mr. Holgate, of Halifax.*

I desire to offer a word of congratulation to the members of the Manchester and District Junior Gas Association upon the success of their organization. The Association has unquestionably supplied a much-felt want among the younger members of our profession; and its good influence will, I am sure, have a beneficial and stimulating effect upon its members, and ultimately upon the gas industry generally. We extend to them our very hearty support and best wishes for a useful and prosperous career.

I cannot close without expressing the hope that the time is fast approaching when the amalgamation of the Incorporated Gas Institute and the Institution of Gas Engineers will be an accomplished fact. It is much to be regretted that the relationship between these bodies, who have but one common object in view, should remain strained. I am yet hopeful that wisdom and common sense will prevail, and that ere the new century opens upon us, a solution of the vexed question will be found which will be acceptable to both parties, and that we shall again stand as one united body representative of our great and time-honoured industry.

Gentlemen, I again thank you most heartily for the honour you have conferred upon me in placing me in the position of President of this Institution; and I trust you may one and all have a very Happy and Prosperous New Year.

Mr. Hutchinson moved a hearty vote of thanks to the President for his valuable and painstaking address. He had gone very fully into all the passing events of the day, and his address was in every way an excellent one. The honour of the Institution was very safe in the hands of their new President.

Mr. W. Prince (Stoke-on-Trent) remarked that the President had treated the subject of gas manufacture and distribution in a masterly manner, and had dealt with it most exhaustively. The members of the Institution would derive much benefit from a careful perusal of what he had written. It contained much sound matter, collected with tact and judgment. He seconded the resolution.

Mr. Isaac Carr said, though the address was of considerable length, personally he should have liked it to be longer. The President referred to the cost of electricity per unit. He told them it was supplied at 1d. during the day-time and 2d. during the evening. Their friends the electricians were fond of comparisons, and always to the disadvantage of gas. He had been considering what price electricity would have to be supplied at to compare with the gas-engine at the lowest price at which gas was supplied in England. In an engine working, as the President had told them, with 15 cubic feet of gas per indicated horse power, a pennyworth of gas at the present lowest selling price would develop over 5-horse power per hour; and a unit of electricity at 1d. would only develop 1¼ indicated horse power. They would thus see that electricity, to compare with the cost of gas, would have to be sold at ¼d. per unit; so that they in the gas industry had something "up their sleeve" yet. He endorsed everything that had been said as to the general usefulness of the address. The President deserved the hearty thanks of the Institution for the trouble he had taken in preparing it.

The President, in responding, said he trusted that the figures and other information he had given would be of some little use to the members, He might also suggest that it would be appreciated by the members if Mr. Carr would on some future occasion come forward and give them the benefit of his experience on the question of gas *versus* electricity. He concluded by moving a vote of thanks to Mr. Shadbolt for his services in the chair during the past year. It was, he remarked, almost unnecessary to say anything in praise of their late President, who was well known to all, both for his ability as a gas engineer and in a thousand and one ways with which they were all familiar. He (Mr. Ritson) had an onerous duty to perform in following such a good man. Mr. Shadbolt had given an enormous amount of energy and time to the work of his office, with a view of carrying out the wishes of the members in a satis factory manner.

Mr. Wood seconded the motion, and remarked that they had not for a long time had a President who had worked harder than Mr. Shadbolt.

Mr. Shadbolt, in responding, said the members had supported him right loyally during his term of office. The work had been a pleasure to him; and his election to the position had reflected honour upon him. Thus, strictly speaking, he thought they were more deserving of his thanks than he of theirs.

On the motion of Mr. Kendrick, seconded by Mr. Hawkins, a vote of thanks was accorded to the retiring officers and members of Committee for their services during the past year.

The President briefly acknowledged the vote; and the business proceedings then closed.

* "Minutes of Proceedings, Institution of Civil Engineers," Vol. CXXVII., pp. 277-311; also "Journal," Vol. LXX., pp. 528, 584, 633, 679, 739, 792, 844, 897.

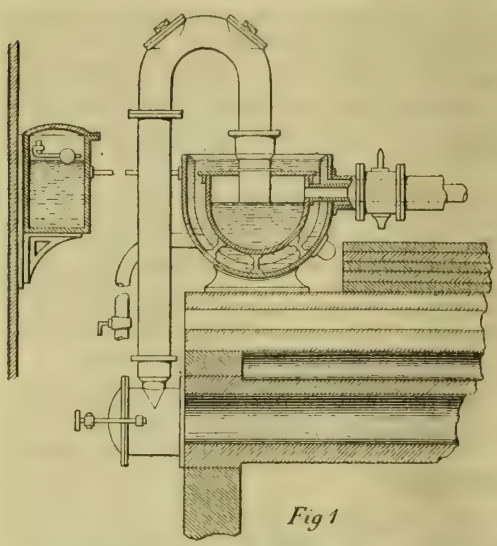


Fig 1

WATER-CLAD HYDRAULIC MAINS, COAL BUNKERS, &c.

In December last a patent was taken out by Mr. H. J. Robus, of Mansion House Chambers, Bucklersbury, E.C., for an invention designed to keep cool and regulate the temperature of hydraulic and foul-gas mains and "other pipes and vessels situated above retort-settings in gas-works," by means of an automatically controlled water-jacket. The patentee even contemplates supplying a water-jacket for cooling purposes to the bottom, and (if desired) to the sides of coal bunkers, which could then be placed directly above the retort-setting.

In his specification, the patentee points out that the hydraulic main is usually placed above the retort-setting, and is screened from the intense heat of the furnaces by several layers of brickwork. This involves placing the main at a considerable height above the retorts; and even then "the heat is objectionable, as it bakes the tar in the hydraulic main, and causes it to clog both there and in the tar and liquor main." By means of his invention, however, the hydraulic main can be placed closer to the furnaces; and the ascension-pipes are thus reduced in length. This shortens the path of the gas from the retorts to the hydraulic main, and thereby lessens the amount of tarry deposit in the ascension, arch, and dip pipes, and the hydraulic and other mains, and should tend to prevent the clogging or choking of these pipes. By controlling the flow of water through the jacket of the hydraulic main, it is also possible to "regulate the temperature of the main so as to ensure the best temperature being maintained." Further, the lowering of the hydraulic main —by reducing the length of the ascension-pipes and the necessary height of the retort-house—would allow a considerable saving in first cost of the installation.

Fig. 1 is a sectional elevation of a horizontal retort-setting, with the hydraulic main and foul-gas main fitted in accordance with the invention. Fig. 2 shows an inclined retort-setting with the hydraulic main, foul-gas main, tar and liquor main, and coal bunker all so fitted.

As shown, the hydraulic main is enclosed in a jacket, supported at intervals inside the jacket by props. The dip-pipe passes in the usual manner through the cover of the hydraulic main, and dips beneath the surface of the tar and ammoniacal liquor. Water is supplied to the jacket from any ordinary type of supply tank—the water-level in the supply tank being controlled by a floating ball-valve or other suitable means. The pipe to take away the water from the jacket may join it near the bottom, as in fig. 2, or it may draw off the water from near the top of the jacket at the side remote from the feed-pipe.

The foul-gas main leading from the hydraulic main may also be jacketed as far as necessary, and likewise the tar and liquor main, if such a main is used. The foul-gas main with its jacket is shown in both figures; while a tar and liquor main with a jacket is shown in fig. 2 only. These jackets may be connected to the jacket of the hydraulic main as shown in fig. 2, or they may be separate and have their own inlet and outlet pipes similar to those of the hydraulic main.

The coal bunker above the inclined retort-setting may also be jacketed at the bottom, as shown in fig. 2, and at the sides likewise, if desired.

A cock is attached to the outlet-pipe of the water-jacket, so that, by regulating the outflow of the water, the hydraulic and other water-jacketed mains may be maintained at any suitable temperature. The patentee says he considers it "important that means should be provided for regulating the temperature of the hydraulic main, as it is as hurtful to have too low as too high a temperature. By this device, any desired temperature may be maintained in the mains. The water from the jackets may be used to slake coke; and, therefore, need not be wasted."

We have received from the Technical Publishing Company, Limited, of Manchester, "The Practical Engineer" Electrical Pocket-Book for 1900.

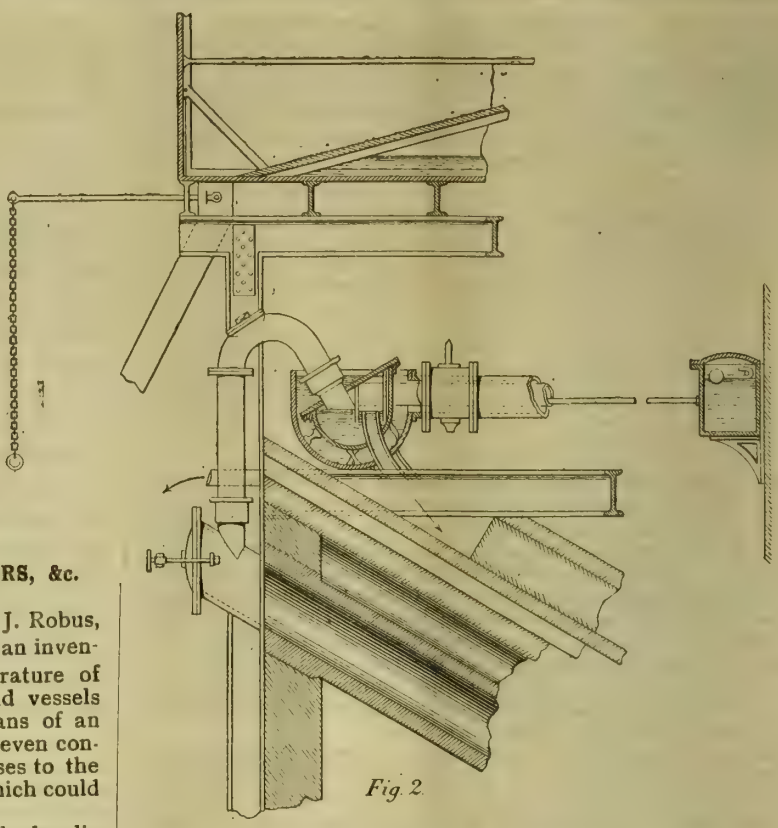


Fig 2

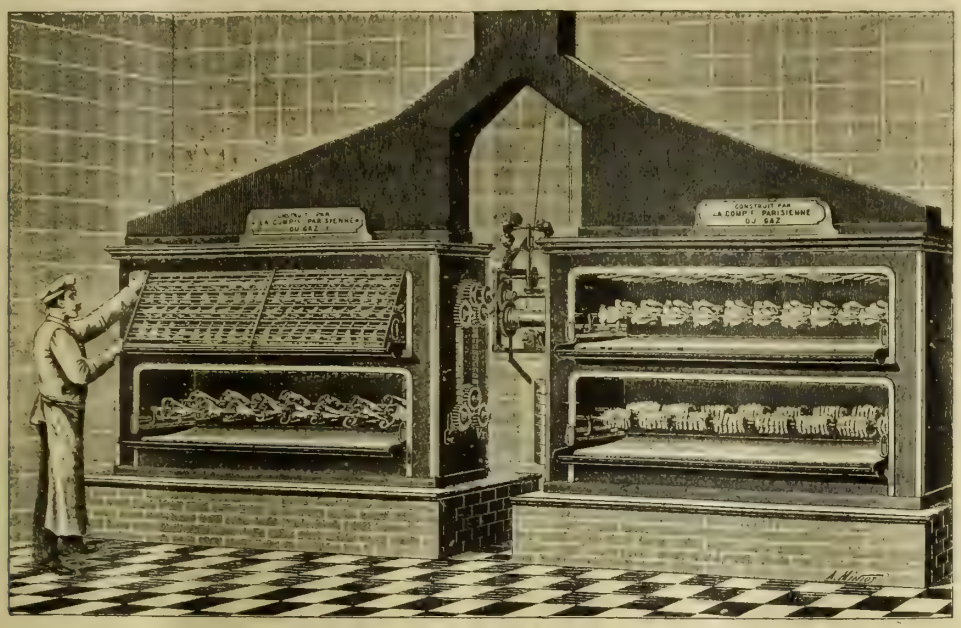
THE JASPER MANTLE.

Reports of trials made with this mantle, which is produced at a chemical works at Bernau, in Bavaria, indicate that it is far stronger and tougher than ordinary incandescent gas mantles, while its photogenic duty appears to be as high. The trials to which we allude were made in the presence of Dr. H. Lux, Editor of the "Zeitschrift fur Beleuchtungswesen," and of a representative of "Der Metallarbeiter," and they are described in recent numbers of those journals.

In the first instance, an English "Hill" Welsbach mantle was submitted to shocks on a specially devised stand, which was raised to a height of 0·4 inch, and then allowed to drop freely. The burner, on which the mantle was supported by the usual magnesia prop, was mounted upon a heavy cast-iron upright attached to the stand. The stand was raised and dropped about 50 times per minute, so that a large number of violent shocks could be rapidly conveyed to the mantle under trial. The Welsbach mantle split just below the loop attachment, as soon as it had suffered three shocks on the stand. A Jasper mantle was then placed on the burner in its stead; and the stand was raised and dropped 150 times. The mantle was several times jolted right off its supporting prop by the severity of the jars, and then fell on the indented edge of the gallery of the burner. Its bottom edge was slightly torn thereby; but otherwise the mantle appeared uninjured by the falls sustained. It was next put on a second stand, and submitted to 100 shocks of rather less severity. As these had no appreciable effect on it, it was removed from its prop, and stood on its lower edge within the chimney on the stand, which was then raised and dropped some 25 times. The lower edge was thereby broken away for about $\frac{1}{16}$ inch. The mantle was afterwards placed on its top and on its side, and similarly submitted to a number of shocks. At the conclusion of this severe trial, it was found that the only material injury suffered by it was that the mesh was torn in one spot near the base of the mantle, for a length of about $\frac{1}{8}$ inch. After these extraordinarily severe tests, the mantle was mounted on the burner; and observations were made on the photometer of the light afforded by it. It was found that, for a mean consumption of about 3·7 cubic feet per hour under a gas pressure of 14-10ths, the light was equal to 95·4 Hefner units, or 83·7 English candles. Clearly, therefore, the mantle afforded at least as high a photogenic duty as an ordinary mantle, which would not have withstood comparatively slight vibration.

The Jasper mantle on which these tests were made was drawn from stock by the Press representatives, and was incinerated and lighted in their presence before the trials. It was therefore not a specially prepared mantle. Tests of the durability of the mantle, and of the light afforded after many hours' use, are being conducted at the Physical-Technical Institute at Charlottenburg; and we hope to be able later to give the results.

The month of January, 1900, will show the highest record made for any one month in the history of the American coke trade. Nearly 500 new ovens were added to the list of ovens recently, increasing the number in the Connellsville region to a grand total of 20,072 ovens, the highest ever reported. This is an increase since Jan. 1, 1897, of nearly 2000 ovens.



Large Gas Roaster at the Polytechnic School, Paris.

A LARGE GAS ROASTER.

The current number of "Le Gaz" contains an illustration of the large gas roaster which the Paris Gas Company have fitted up at the Polytechnic School, to which special reference was made by the Directors in their last report. It is capable of roasting at one time 64 legs of mutton or 100 chickens, or grilling 250 chops. It is constructed in two sections, with the turnspit mechanism in the intermediate space. It has been in operation since October, 1898, with in every way satisfactory results. In a trial of the apparatus, the weight of meat before cooking was 171 lbs.; after, cooking, 158½ lbs. The meat therefore lost only 12½ lbs. in the operation, which lasted 1 hour and 25 minutes. The consumption of gas was 770 cubic feet, the cost of which, at the Paris price of 6s. 9d. per 1000 cubic feet, amounted to rather less than 5s. 2½d. With the old method of roasting by wood, the cost of the fuel would have been 9s. 7d.; and the meat would have lost considerably more of its weight in cooking, than it did with gas. The excellent working of the apparatus since its installation demonstrates the practicability of roasting on a large scale by gas; and apart from the greater cleanliness and convenience of this fuel in comparison with wood or coal, the figures given above show distinct economy in expenditure.

NATION'S WATER SUPPLY AND ITS EFFECTIVE CONTROL.

As mentioned in last week's issue, there was only one subject down for discussion at the half-yearly meeting of the British Association of Water-Works Engineers; but being one of universal interest, and many authorities of great and minor degree being concerned in it, it was prolific in discussion. Several authorities and societies had been invited by the Council to send representatives for the purpose of eliciting their views on the question; and among those present were delegates from the County Councils Association, the Urban District Councils Association, the Association of Municipal and County Engineers, the Society of Engineers, the Corporation of Huddersfield, the Geological Society, the Sanitary Institute, and the Institute of Sanitary Engineers. The subject was introduced by Mr. C. E. Jones, Assoc.M.Inst.C.E., in a paper which for terseness and point could not have been surpassed. Before the paper was read, the President (Mr. William Watts, the Engineer of the Little Don works of the Sheffield Corporation) disclaimed, on behalf of the Council, all responsibility for the views which might be expressed by the author or any gentleman taking part in the discussion; the simple object of the paper being to elicit the feeling on the subject of those present.

Mr. Jones read his paper, of which the following is practically the full text:—

No apology is needed for inviting the attention of the Association to a subject of such vital importance as that of the control and supply of potable water to the growing population of this country. The amount of capital expended upon water-works is enormous, and steadily increasing. Engineering works of great magnitude and efficiency, skilful design, and substantial character, have been constructed in all directions, furnishing a remarkable index of progress in this Victorian era.

In consequence of the rapid growth of towns, both in number and size, with increase of trade and expanding commerce, water is in greater request, and must be provided in ever-increasing quantities. At the same time, it is more recklessly consumed; and, as might be expected, waste leads to scarcity, usually at a season of the year when rain is absent. A disregard of the injunction, "Waste not, want not," is followed by consequences alike retributive for us and posterity. Water, the value of which is often under-estimated, should be supplied copiously, but not wastefully, apportioned with care, under just and wise control, having a single eye to the national benefit, which is in this case synonymous with Imperial control.

In the author's opinion, effective control can best be secured by the creation of an independent expert National Water Board, whose appointment should not be influenced by the passing politics of the hour, or the local feuds which periodically agitate county, municipal, rural, urban, and other elective bodies. It is only human, after all, that local interests and unwarranted apprehensions should influence and often dominate local judgment at the expense of what is best for the country at large. Hence arises the question, Are the local water authorities, as at present constituted, so qualified, either by independence of position or from their technical knowledge, as to justify their being considered able and impartial bodies, fit to be entrusted with the sole administration and future development of the national water supply? The writer fears that the answer must be in the negative, and that we must seek elsewhere for the means of efficient control.

Under the existing system of local administration, much good work has been done; and some communities are well supplied. But this observation is by no means applicable to all; and a prolonged drought soon reveals the weak places, where the miseries of a short supply have to be endured. With the return of copious rain, contemplated improvements are frequently postponed, for financial or other reasons, to a more convenient time; and a recurring drought witnesses a renewal of broken promises, with assurances of immediate reformation. The want of continuity of policy exhibited by existing water authorities is largely attributable to the mode of their election to office, and the short periods for which individual members frequently serve—some elections actually taking place yearly; while fits of extravagance as well as of economy afflict our local bodies to a serious extent.

The coupling up of distributing-mains and other apparatus in contiguous towns or systems should, wherever reasonably practicable, be made compulsory in view of possible accidents, temporarily restricted supply, or other unforeseen exigencies; and, judging by past experience, it seems hopeless to expect that this combined action will ever be attained except it be insisted upon by some duly constituted central authority. It took the London Water Companies half a century to recognize the value of intercommunication; and even then the pressure of a State Department had to be invoked in order to enforce its adoption.

Strange to say, there appear to be scattered over the country too many separate water authorities, each studying only its own interests. Many of these could be advantageously combined for purposes of water supply conformable to the physical configuration of the district, and the peculiar or special requirements of the locality. What is there to prevent a combination of all the Metropolitan Water Companies; or, speaking generally, of undertakings drawing supplies from the same source, and serving adjoining areas? The reconcilement of conflicting vested interests is surely not impossible! Such an amalgamation would tend to economy in administration, conservation of water would tend to the reduction of waste, and would secure something approaching uniformity in the supply, water-rates, charges, and regulations; it would also lessen the risk of water famines, and remove the causes of complaints of consumers, who pay for what

they do not always get. These objects are well worthy of attainment; and the question is, Who shall begin the work?

The monopolization of gathering-grounds by powerful and wealthy corporations is a growing evil, fraught with peril to smaller communities, and demands without delay the attention of the Legislature. In parliamentary warfare the longest purse generally finds Providence on its side, and secures powers and concessions denied to less influential and poorer communities. Central control is needed over all gathering-grounds, whether appropriated or not; and protection should be afforded to interested but weaker bodies or individuals, to whom the cost of opposing Bills in Parliament is prohibitive, if not absolutely ruinous. There are authorities having more gathering area than they utilize who, like Oliver Twist, but with less reason, ask for more, presumably to save the outlay that the construction of impounding reservoirs would necessarily entail. Others possess so much in excess of actual or maximum requirements that one-twentieth part of the rainfall suffices for all their purposes, and the surplusage is probably wasted; while, on the other hand, some have to purchase water in bulk from their more fortunate neighbours, in order to eke out the scanty supply to their own consumers.

The Metropolis, with a wholesome and abundant supply near at hand, is threatened with a scheme involving an expenditure of many millions sterling for tapping the Welsh lakes, because it is thought that the consumption *may possibly* overtake the supply some 40 or 50 years hence, upon the assumption that Greater London grows as fast in the future as it has in the past. The provision of additional storage capacity in the present watersheds, so as to assist the ordinary sources of supply during the summer and autumn months of least rainfall, would relegate schemes of this character to the dim and distant future.

What, however, is imperatively required is the allocation of gathering-grounds and other sources of supply, not exempting underground waters, on national, comprehensive, and equitable principles, independent of all selfish, aggressive, or local interests. It is obvious that, under the present system of procedure, this is not reasonably possible; and a new power must be requisitioned to achieve such a result and unravel the Gordian knot of water supply. The needs of civilization, of the commonweal, demand that the old order of things should give place to a new; and the author, with all deference, entertains the belief that the case would be met by the establishment of such a Central Water Board as he herein foreshadows. The efficiency of the new tribunal will depend upon the character and special qualifications of the members composing it, wherein consists the *crux* of the whole thing.

The proposed National Water-Works Board should consist of representatives of the law, geology, hydraulic engineering, chemistry, and meteorology; being at the same time practical and proficient men of sound judgment and common sense. Its jurisdiction might include the control of all fresh-water streams, rivers, watersheds, and other sources of supply not already committed to the care of Conservators. Among many other useful functions it could perform would be the allocation of the few unappropriated gathering-grounds, and the division and re-allotment of such as are not fully or advantageously utilized, and the apportionment of water on just and equitable principles to such places as are entitled to participate in the benefits of each particular source.

Powers of entry and inspection, authority to call for information, reports, returns, and analyses, and to receive evidence on oath, and to direct prosecutions for polluting water, should be within its sphere of operations. The appropriation and allocating of what is fair as compensation water, determining mean local rainfall, and the grave question of protecting areas from pollution, might be relegated to, and determined by, the Board, who in cases of dispute should decide and define the areas to be supplied by overlapping and competing undertakings, and secure, where desirable, intercommunication between the trunk mains and works; while joint schemes of supply, and even the amalgamation of existing undertakings, could be formulated and carried into effect by its means. Present well-managed Boards should be allowed to continue, and all indubitable rights be preserved intact where not proved to be inimical to public welfare. But new schemes for the acquirement of additional supplies should be submitted to, and receive the sanction of, the Central Board before being allowed to proceed. Aggressiveness on the part of wealthy and powerful bodies would thus be checked or receive its quietus; and the number of crude or unnecessary water projects be materially reduced.

A court of appeal, well worthy of public confidence, would thus be brought into existence; and being easily accessible, and eminently capable of expeditiously deciding all technical questions relating to water supply submitted to its judgment, its institution could not fail to benefit the public, as well as water undertakings themselves, by reducing to a system the many intricacies, customs, practices, and privileges of the purveyors of drinkable water.

The public advantages resulting from the effective national control of the water supply are so apparent to the author that they seem indisputable, and he ventures to hope that the discussion will result in the Association taking some steps to urge the necessity for the creation of an independent and impartial tribunal for the purpose of dealing with the many-sided question of water supply on the lines he has thus briefly and imperfectly, but earnestly and honestly, indicated. The continuation of the present system, or rather want of system, is clearly undesirable, wasteful, inelastic, and liable to gross abuse. Its perpetuation will assuredly render "confusion worse confounded," and should by some means be once and for all rendered impossible.

Discussion.

The discussion was of a somewhat prolix character, and was of from four to five hours' duration. Many of the speakers departed widely from the definite channel into which Mr. Jones had striven to direct the consideration of the subject. But while they did so, we are compelled, by the claims of other matter, to limit this notice to the views expressed on the central point.

The Secretary (Mr. Percy Griffith) read two letters which he had received in reference to the paper. The first was from Mr. C. de Rance, who stated that he agreed with every word of the paper. He rejoiced that the views he had taken up for nearly thirty years should be supported in principle by a member of the Council of the Association. Dr. J. C. Thresh wrote that he did not find himself in entire accord with the author; but his views differed more in detail than in principles. He thought that public water supplies varying in magnitude from a shallow well to immense works, a Central Board could scarcely control all. The staff required would be large and costly, since it would be worse than useless if it did not include men of the very highest standing and reputation. In Dr. Thresh's opinion, a more radical change was desirable. The present Local Government Board, with its multifarious and conflicting duties, should be abolished; and in its place there should be a Poor Law Board, confining the whole of its attention to the poor laws, and a Public Health Board (with a Minister), taking over all the public health functions of the Local Government Board, and having the powers which Mr. Jones suggested should be given to the Central Board—exercising supervision over water supplies, and reporting upon all schemes requiring the sanction of Parliament or the consent of the Board to borrowing powers. The duties and responsibilities, too, of County Councils with reference to the supplies of water to all small towns and rural districts should be greatly increased, making them responsible for seeing that all such districts had a reasonable supply of wholesome water. When both District Councils and County Councils were in default, the Public Health Board should at once exert authority. With reference to control over unappropriated watersheds, and over existing water-works generally, there was a general concensus of opinion that such was urgently required, but control over unappropriated underground water was equally imperative.

The President thought that most water-works engineers would agree that some efficient supervision should be exercised over drainage areas by a legal and properly constituted body; but with what powers this body should be invested to satisfy the claims of cities, towns, and villages seemed to him a problem not easy to determine. A national or provincial governing body would be sure to deal more justly and unselfishly with the claims of all the water consumers in a prescribed hydrographical basin than a powerful corporate body having its own wants and interests to satisfy first, although there were some honourable exceptions to this rule, which, of recent years, Parliament had recognized. Mr. de Rance suggested some time ago that the control of the rivers, and necessarily the watersheds, should be invested in the County Councils in whose districts such rivers flowed and drainage areas existed; and he (the President) was not sure whether this plan would not be a wise one to adopt, having a National Committee of Appeal in case of dispute where the interests of two counties clashed regarding the confluence of rivers and their tributary feeders. One object of the Association, it seemed to him, was to suggest that suitable men be appointed to advise on a broad basis the claims of corporate bodies to a particular watershed, such men to be practical engineers having had a proper training in the department of hydrology and meteorology to justify their appointment and sanctify their opinions. It should be seen that the rain falling upon the watersheds was properly utilized; and while every corporate body had sufficient for its immediate, and in a measure its prospective, wants, flood water should not be wasted and allowed to flow uselessly to the sea. He also remarked upon the fact that engineers did not seem to have any well-defined rules to guide them in utilizing a drainage area to the full extent. Something, he thought, should be done to compel corporate bodies to exhaust their appropriated sources before others were granted them.

Alderman E. J. Halsey (Chairman of the Surrey County Council) said the County Councils Association, which he represented, took up this question last summer, and circularized all the authorities in the country, and asked for their opinions and any evidence they could give as to the necessities of the case. Within the last few days they had had their first meeting; and a Committee of the Municipal Association had joined them—they feeling the difficulties of the case just as much as the County Councils Association had done. They had not yet been able to formulate any scheme; but, so far as his personal opinion was concerned, he thought there would be very great difficulty and practical impossibilities in going so far as the writer of the paper indicated. However, that something must be done was quite clear. He mentioned instances of the evils which existed, and then said he did not wish to see the control of water supply centralized in London, nor did he wish to see it in the hands of

too many bodies. What they wanted was an authority which should have power over a sufficiently large area to make it complete and perfect. The reconciliation of the interests of all concerned in the best possible way was the ambition of the County Councils Association.

Mr. E. K. Burstal, M.Inst.C.E., spoke at great length on the author's reference to "reckless" consumption, and quoted figures from the report of the Royal Commission on the Metropolitan Water Supply as to the excessive consumption of water in London. He said there was no reason whatever why the enormous waste which took place in London should go on. Under any circumstances, it was a standing disgrace which involved the loss of 60 million gallons of water per day, which meant £60,000 a year in pumping and filtration. The whole of this 60 million gallons had to be again dealt with by the County Council at their sewage outfall works; and yet it might be saved by efficient fittings. It was an extraordinary thing that no sustained efforts had been made to tackle this question. Mr. Jones asked whether the local authorities as at present constituted were qualified to be entrusted with the sole administration and future development of the national water supply. To a great extent, the answer to that was "No," not so much from the constitution of the authorities as from the fact that there had been so many transfers of water companies to local authorities, and then the control of the water supply was left in the hands of the borough surveyor, who was already fully worked, and had perhaps never had anything to do with water supply until the day of the transfer. It was thought that anybody could manage a water undertaking; but a greater mistake was never made. He could not agree with the proposition to couple up the mains of different authorities in contiguous towns or systems. Every district had its own system and levels; and any such action would create a great amount of confusion and difficulty. Of course, in London it was a different matter altogether. The suggestion that there should be control of underground waters was exceedingly valuable, but very difficult to carry out. If, however, Parliamentary Committees had evidence before them that an injustice would be done by any measure submitted to them, he believed they generally did what was right. Complete control of underground water would be a risky thing unless made by hydrological surveys, which was a very expensive matter. The constitution of Water Boards or Trusts was an interesting question, especially as a Board was recommended for London. Regarding this recommendation, he might be pardoned for saying that this was precisely what he and his partner (Mr. E. H. Stevenson) recommended in a little book which they published in 1892 on the question of the Metropolitan Water Supply. He hoped what they then foreshadowed would be carried out.

Mr. W. Whitaker, F.R.S., F.G.S., &c., said the author had spoken of the advantages of combination for the purposes of water supply "conformable to the physical configuration of the district." Of course, it was true there would be advantages, but they had governing bodies, and, unfortunately, their boundaries were not fixed on scientific principles, and on that account difficulties would arise. The author also asked what was to prevent the combination of the Metropolitan Water Companies. He (Mr. Whitaker) had asked the question many times; but he could never get it properly answered. There were, he knew, great difficulties—not engineering, but financial and legislative. But it was logically and utterly absurd that a great city like London should have its water supply regulated by eight independent and sometimes almost competing Companies. He did not believe they would get out of the present system in London in a hurry; and he was inclined to think that the proposed Board was never likely to come into being. He should like to say a word on behalf of the great populations who wanted water. It was the small populations who had the good gathering-grounds. Should they keep them when they did not want them? Certainly not. It was the large populations who should have the large gathering-grounds; and they should take care of the smaller populations, who, as a rule, could not take care of themselves, for the simple reason that they had not the means. In his opinion, if the Board proposed by Mr. Jones were created, it would, in two or three years, be one of the best abused bodies in the whole kingdom. They had two impartial tribunals in the House of Lords and the House of Commons; and they were so independent that one sometimes overstepped the decisions of the other. An expert tribunal was not always the best. However, he heartily agreed that something must be done; but they must go about it by degrees. Reformation, not revolution, was what was wanted.

Alderman J. Sugden (Huddersfield) thought the ideal that Mr. Jones had set before them was too high. At Huddersfield, they had spent 1½ millions on their water rights; and they were not going to give up these rights to others without some consideration. Parliament had not given them their powers for nothing. They had fifty townships in the water area which they supplied in consideration of the powers granted them, and these townships were now better off than they were before. Although the constitution of the Committee having charge of the works might change, there was a continuity of management; for they had always their Engineer and a permanent staff to guide them.

Alderman Hirst, Chairman of the Huddersfield Corporation Water Committee, thought, if something could be done to help small places who could not help themselves in this matter of water supply, it would be a good thing.

Professor Henry Robinson (representing the Society of Engineers and the Sanitary Institute) considered the storage of flood waters, and utilizing the rainfall instead of allowing it to go to waste, formed the solution of this national question of water supply. He agreed that some controlling authority or authorities should be created; and an ideal arrangement, in his opinion, would be to map out the whole country into watershed areas after careful study. He also spoke of the want of uniformity in the decisions which different Parliamentary Committees had given on precisely similar points in Bills; and he instanced two directly opposite decisions relating to underground water.

Mr. C. H. Priestley (Cardiff) pointed out that Mr. Jones had eulogized the remarkable progress made during the Victorian Era in water-works undertakings; and he reminded him that this had been accomplished without the intervention of a Government Department. Although highly desirable that some more efficient provision should be made for the wants of many districts, and for combination by means of Water Boards, yet he (the speaker) did not believe in a Government Water Department who should have a monopoly and full control over the water supplies of the country. Englishmen generally were not so fond of giving up their individual and local rights to be controlled by a body of gentlemen in London, however estimable, learned, and highly respectable that body might be. In constructing water-works, municipalities and even small towns, obtained the aid of professional gentlemen well versed in the subject, and able to recommend the best thing having regard to the local circumstances. He admitted that there were weak spots; and deplorable negligence was often shown by many small places, and even fairly large towns. But he thought if greater power was given to County Councils, and facilities provided for amalgamation (which in many cases might possibly be made compulsory), much of this might be remedied. He did not think the circumstances of the London Companies were at all comparable with any of the water supplies in the country; and he dilated on the utter impracticability of applying a universal uniformity of water rates, charges, and regulations. While at one with the author that the large and wealthy corporations should not be allowed to monopolize the gathering-grounds of the country, he thought, if sufficient provision was made for the needs of the district in the way of compensation water and compulsory supply, the objections would to a large extent be met. What the municipalities had really done in most cases was simply to provide storage for water which previously ran to waste; and in nearly every case of large gravitation works, the dry weather flow of the streams had been improved by the compensation water compulsorily sent down. In preference to central control by a Government Department, he would rely upon the local action of the County Councils, to whom he would give increased powers, in many respects similar to those the author proposed for the Water Board.

Mr. E. Crowne (Urban District Councils Association, and Clerk of the Tottenham District Council) said the district he represented was in the County of Middlesex; and he believed that the County Council were taking up the question in much the same way as the Surrey County Council. His Council were adverse to water being abstracted from a district without the persons residing in the district having first charge upon it. They would give their adherence to the general view of having some authority to better look after the interests of local bodies in certain areas than existed at present.

Mr. E. D. Cecil (Institute of Sanitary Engineers) said that what they wanted was some authority who would give especial attention to the water supply of country districts where the people were too poor to undertake the establishment and maintenance of water-works of their own. Although empowered by the Council of the Institute he represented to speak in favour of a central national control of the water supply of the country, he was sure he should be expressing their opinion in saying they did not countenance interference with existing rights and works, but rather that additional facilities should be provided for the supply of such places as were sorely in need of it.

Mr. R. St. George Moore, M.Inst.C.E., thought those who were advocating the new tribunal could hardly have had large experience of the very detailed way in which the Committees of the Houses of Parliament went into these questions, and what a tremendous advantage every person who was interfered with by any new proposals had of stating his case. One suggestion which had occurred to him was that the poorer districts who were not in a position to employ counsel and experts should have some person—some official expert—to whom they could apply to take up their case. He thought it would be a long time before they would get a body of experts who would absolutely agree; and, in his judgment, the present method of Parliamentary Committees was infinitely better than the proposed Board.

Mr. P. F. Kendall (Yorkshire College, Leeds) considered the small communities were so helpless, that they had been the prey to a large extent of the larger communities, simply from lack of organization and knowledge; and it was surely the duty of the Legislature to protect the ignorant. Some of the speakers thought that Parliamentary Committees already admirably performed the functions of the proposed central body. In a rough, general way they did; but, descending to details, it was found they did not. Cases of extreme hardship arose under present conditions; and what confidence could they have in a tribunal

consisting of two Chambers, one of which frequently gave decisions diametrically opposed to the other? At the same time, he had rather grave doubts as to the constitution of the proposed central body; but he had not yet formed any definite opinion about it. They had a central authority already in the Local Government Board, which might be strengthened by the addition of experts, who should not have any other functions than the dealing with water-supply questions; and if they acted in an advisory capacity, what was now desired might be obtained. They also required to have strong local bodies to deal with the water areas.

Mr. J. Patten Barber (Association of Municipal and County Engineers) said it seemed to him that the present safeguards of local authorities were hardly sufficient, especially when they came to consider the case of small towns, particularly with regard to their underground water supplies. He also spoke of the want of accord in the decisions of Parliamentary Committees; and agreed as to the necessity for the establishment of some authority who would take into consideration all the interests that were likely to be affected by a water scheme, so that justice might be done.

Mr. E. J. Silcock (Society of Engineers) remarked that the proposition submitted in the paper was that a Central Water Board would be a cure for all the evils to which it was admitted the present system was liable. He had a great dread of creating another State Department. Those who had had experience of the Local Government Board knew that there was so much delay and difficulty, that the remedy now suggested seemed to be worse than the disease. The control of water supplies should, in his judgment, be as far as possible in the hands of the persons in the immediate locality who were interested in the supply. He did not think a State Department could have efficient control over such a large number of districts as it would be necessary they should have; nor would they be able to exercise proper supervision. He criticized several of the arguments adduced by the author in support of his proposition, and said he agreed with the view of more than one speaker that the Houses of Parliament were very competent judges of how watersheds should be allocated. It seemed to him that what was wanted was not a new governing body, but new laws. The question, for instance, of underground water was in a peculiar position; but if the law was altered, Parliamentary Committees would carry it out. The law as to the pollution of water also required revision.

Mr. H. Ashton Hill (South Staffordshire Water-Works Company) said the subject before them had proved to be a somewhat hazy one; and he had certainly not a very clear idea of what was actually wanted. He thought the report of the Royal Commission on the London Water Supply was deserving of very serious attention, as it seemed to him to have cleared a good deal of the ground; and if they watched the development of the Commission's proposals, it would lead in great measure to the elucidation of the subject. If a Water Board succeeded in London, it would only be a step further to apply the same principles to provincial water supplies. The subject was a very wide one; and there was a great deal of detail which wanted to be worked out before they could arrive at a proper conclusion as to whether what was wanted was a Central Board or District Boards, or whether the two existing Departments—the Local Government Board and the Board of Trade—should be strengthened. If the officers of these bodies were more particularly qualified—that was to say, if, instead of appointing officers of the Royal Engineers as advisers, properly qualified water engineers were selected—this might advance matters. Altogether he did not know that any greater advantages would be derived from a Central Board than was now obtained from Parliament.

Mr. J. Shaw (Boston, Lincs.) thought the principal keynote was in Mr. Jones's statement that "the reconcilement of conflicting vested interests is surely not impossible." He (Mr. Shaw) thought vested, or selfish, interests lay at the bottom of the whole question; and to say that it was not impossible to reconcile selfish interests was a very strong statement indeed. He enlarged upon the point; and then, referring to the allocation of districts to Water Boards, said that, if this Utopian idea came into force, probably the whole of a district would be rated alike for water, while, as they all knew, it cost more to supply some portions of a district than others. In the case of water companies, they had a special charge for high services; while in the case of the local boards, the whole district was charged at one rate, though it cost more to supply the high districts. He thought the conflicting decisions given by Parliamentary Committees might frequently be traced to the nature of, and differences in, the evidence presented to them.

Mr. E. Sandeman (Plymouth) thought that, before going into this subject, they required more information, which should be tabulated and thoroughly digested. Mr. Jones's paper, while very valuable, might have pointed out a few more reasons why there should be a Board of the kind suggested.

Mr. C. H. W. Biggs (London) believed the discussion might be continued to this time next year, and they would be as far off coming to a decision upon the subject as they were then. There were certain facts upon which they were all agreed; and when these facts were put into concrete form, then they would see the next step. Before they could take the next step, they must know exactly where they stood. He advised the collection and tabulation of statistics referring, for example, to the water supply of the whole country, both utilized and unutilized.

Mr. Stephen H. Terry, M.Inst.C.E., formerly one of the Engineering Inspectors of the Local Government Board, ventured to think that the formation of a Central Water Board conducted on the lines of some other Government Departments would very seriously cripple what he might call the water industry of this country. In the House of Commons, they had men of ability, both technical and non-technical, who judged the questions put before them from a disinterested standpoint; and a better arbitrament for such questions as water supply could not, to his mind, be conceived. He thought, however, that some of the existing laws might be dealt with.

Mr. W. A. Richardson (Birkenhead), observing that there was no governing body to take into consideration the preservation of the water that fell upon the country, and to see that a particular water was fit for use, said the whole discussion pointed to the fact that something was wanted. It might be an alteration of the law; but who, he asked, was there to put the law into force, or to bring about an amendment?

Mr. W. G. Peirce (Richmond) was called upon, but stated that, Richmond being in the County of Surrey, Alderman Halsey had covered the whole of the question. He might, however, say with regard to Richmond that, even if Mr. Jones's suggestions came to pass, they would be in an awkward position, as they were surrounded by the London Water Companies, and were limited to their own area for getting a water supply.

Mr. W. H. Holttum, Assoc.M.Inst.C.E., thought there was a good deal of the dog-in-the-manger business about watersheds. He wondered how it would work if a water authority were allowed to establish themselves in a watershed for a term of years—say 100—at the end of which time an inquiry might be held as to the demands that had meanwhile arisen within the watershed area. Mere villages during that time might have become towns, and might have some claim to their own watershed. But small villages as such should not be in a position to shut out a large town who were in immediate want of water.

Mr. Jones, in reply, said he was glad to notice that the Royal Commission on the London Water Supply supported in many points the general principle he had laid down. The question of the "nation's" water supply appeared to him to have been insufficiently considered in the discussion. He did not go into the detail of every little paltry village and town; but he looked upon the water supply as belonging to the nation. The supply should be taken out of the hands of those who were incompetent to utilize it and make the best of it, and be placed under some better system of control. The rainfall was the nation's real source of water supply; and they found that very little of it was utilized. The rainfall of this country varied from some 13 inches in the East to above 220 inches in the North in a year. The Water Board that he suggested would understand these things, and would determine according to the physical configuration of the country, its aspects, and so forth, what was the mean rainfall over a particular area or water basin. Before any authority should have power to extend their works, or carry out structural alterations, they should give to the Board a strict account of how far they were utilizing the water they already had. It had been objected that another Board should not be established to revise what had already been done by two Government Departments. That seemed rather anomalous; but it should be remembered that, even in the Law Courts, one set of Judges was kept to revise the decisions of those below them. Therefore, there was really no reason why they should not have a Central Board to revise the decisions of the other authorities. He admitted that local authorities had done good work; but it had been done from their point of view. If returns could be obtained (which could not be done except by the aid of Parliament)—full and accurate returns of the water gathered, the water which might be gathered, but was not gathered, the quantity sent out, and the waste—some important information would be available. They had annual returns for gas and chemical undertakings, why not for water undertakings? As to Parliament being the proper tribunal for deciding questions of water supply, he was afraid that members of Parliament knew very little of the intricacies of the subject. He commented on the action of the House of Lords in throwing out (after it had been passed by the House of Commons) a Bill of the East London Water Company, by which it was proposed to construct additional reservoirs in the Lea Valley; and yet, coming to the meeting that day, he saw thousands of acres of land in that district flooded with water which might have been stored. A water famine in this country was a disgrace. In his paper, he did not propose to interfere with vested interests where they could be proved to be to the public welfare, nor did he propose to take away anyone's rights, or cancel any agreement. In the course of further remarks, he said he admitted that further information was wanted, and also that the law was at fault. He acknowledged the excellent reception accorded to the paper.

The Southern District Association of Gas Engineers and Managers will hold their annual meeting next Thursday, at the Holborn Restaurant. According to the circular issued by the Hon. Secretary (Mr. J. W. Helps, of Croydon), the business will, as usual, consist chiefly of the reception of the report of the Committee on the work of the past year, and the delivery by the President—Mr. D. Irving, of Bristol—of his Inaugural Address. The annual dinner will take place the same evening.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

Damage to Mains from Electrolysis.

Sir,—With reference to the remarks in your issue of the 20th inst., in the article headed "Water and Sanitary Affairs," as to damage to mains from electrolysis, I am desired to state that it is a matter to which this Association consider they should give their attention; and I am instructed to request you to be good enough to allow me, through your columns, to invite Gas Companies who have sustained damage by reason of electrolytic action on their mains and pipes to give me any information they can with reference thereto, with the view of endeavouring to get the present "model" clause for the protection of Gas and Water Companies revised.

5, *Victoria Street, S.W.*, *Feb.* 26, 1900.

F. E. Cooper, Secretary, Gas Companies' Protection Association.

The Price of Gas for Power Purposes at Widnes.

Sir,—In your issue of the 20th inst., you refer to the above matter, and state that the price of gas for motive power is to be reduced from 1s. 5d. to 1s. 3d. per 1000 cubic feet, less 2d. per 1000 feet discount. Will you kindly permit me to supplement this by stating that the prices of gas at Widnes, prior to the recent reduction, were 1s. 5d. and 1s. 3d. per 1000 cubic feet net for all purposes, and that the price now is 1s. 1d. net to all consumers of gas for motive power, which means a reduction of 4d. to the small consumers paying 1s. 5d., and 2d. to the large ones paying 1s. 3d.

Widnes, Feb. 23, 1900. Isaac Carr.

A Remedy for Stopped Ascension-Pipes.

Sir,—In perusing the "Journal," I find that the gas men of England are annoyed with the trouble which formerly caused us so much difficulty—viz., stopped stand-pipes and pitch in the hydraulic main. Eighteen months ago our foreman, Mr. D. Galligher, devised a remedy for this, and we have never since had a stopped pipe or any trouble with pitch, although our yield of gas from Pittsburg coal last year averaged 4·96 cubic feet per pound of coal. His method is to tap the stand-pipe near the top with 1-inch pipe, place thereon a syphon through which a stream of water is run into the stand-pipe, tap the latter again immediately above the mouthpiece, and insert therein a thermometer, and allow sufficient water to run through the stand-pipe to keep the temperature of the gas as it goes up at between 400° and 450° Fahr. Tar does not form pitch at less than a temperature of 550°; and we find that with the temperature above noted all the tar goes through the stand-pipe and into the hydraulic main thin enough to be handled easily. Previously to adopting this plan, we fully expected a stand-pipe to clog up at least once out of every six charges, and our hydraulic main to entirely close with pitch at least once a week; but, as stated, this simple appliance has proved a complete remedy.

S. M. Highlands, President.

Clinton (Iowa) Gas Company, *Jan.* 29, 1900.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress was made with Private Bills last week:—

Bills read a second time: Cleethorpes Gas Bill, Exmouth and District Water Bill, Exmouth Urban District Water Bill, Fishguard Water and Gas Bill, Glyncorrwg Urban District Council Gas Bill, Great Berkhamsted Water Bill, Kingston-upon-Thames Gas Bill, Newport (Mon.) Gas Bill, Walsall Corporation Bill, Westgate and Birchington Water Bill.

Petitions were presented against the following Bills: Dorking Water Bill, East Shropshire Water Bill, East Stirlingshire Water Bill, Exmouth and District Water Bill, Falkirk and District Water Bill, Falkirk Corporation Bill, Fishguard Water and Gas Bill, Glyncorrwg Urban District Council Gas Bill, Great Berkhamsted Water Bill, Hemel Hempstead Corporation (Water) Bill, Higham Ferrers Water Bill, Kingston-upon-Thames Gas Bill, Margate Corporation Bill, Menstone Water (Transfer) Bill, Motherwell Water Bill, Mountain Ash Water Bill, Newtown and Llanllwchaiarn Urban District Gas Bill, Paignton Urban District Water Bill, Rotherham Corporation Bill, Salford Corporation Bill, South Essex Water Bill, South Essex Water Board Bill, Walsall Corporation Bill, Westgate and Birchington Water Bill.

HOUSE OF COMMONS.

The following further progress was made with Private Bills last week:—

Bills read a second time and committed: Airdrie, Coatbridge, and District Water Trust Bill, Bedford Gas Bill, Bradford Corporation Bill, Gaslight and Coke, Commercial Gas, and South Metropolitan Gas Companies Bill, Glastonbury Corporation Gas Bill, Grantham Gas Bill, Hartlepool Gas and Water Bill, Morecambe Urban District Council (Gas) Bill, North Warwickshire Water Bill, Oldham Corporation Bill, Ossett Corporation Gas Bill, Redhill Gas Bill, Rugeley Gas Bill, St. Albans Water Bill, Southport Water Bill, Spalding Urban District Council (Water) Bill, Wetherby District Water Bill, Woodbridge District Water Bill.

Bill withdrawn: Chelsea Water Bill.

Petitions were presented against the following Bills: Airdrie, Coatbridge, and District Water Trust Bill, Bedford Gas Bill, Bradford Corporation Bill, British Gaslight Company (Staffordshire Potteries) Bill, East London Water Bill, Gaslight and Coke Company Bill, Gaslight and Coke, Commercial Gas, and South Metropolitan Gas Companies Bill, Glastonbury and Street Gas Bill, Glastonbury Corporation Gas Bill, Hartlepool Gas and Water Bill, Lambeth Water Bill, London Water (Purchase) Bill, London Water (Welsh Supply) Bill, Metropolitan Water Companies Bill, Mid-Kent Water Bill, Morecambe Urban District Council (Gas) Bill, North Warwickshire Water Bill, Oldham Corporation Bill, Ossett Corporation Gas Bill, Ossett Gas Bill, Redhill Gas Bill, Rickmansworth and Uxbridge Valley Water Bill, St. Albans Water Bill, South Metropolitan Gas Bill, Southport Water Bill, Wandsworth and Putney Gas Bill, Wetherby District Water Bill, Wolverhampton Gas Bill, Woodbridge District Water Bill.

Petitions against the Gaslight and Coke, Commercial Gas, and South Metropolitan Gas Companies Bill of the London County Council have been presented by the three Companies concerned as well as by the Corporation of London.

Mr. Lough has given notice to move the rejection of the South Metropolitan Gas Bill and the Wandsworth and Putney Gas Bill when they come up for second reading.

Last Tuesday, Sir C. Quilter asked the First Lord of the Treasury if he could explain to the House the circumstances which had influenced the Lords of the Treasury to authorize Her Majesty's Board of Customs to allow, upon certain conditions, the exportation of carbolic acid and other similar articles, the exportation of which was recently strictly prohibited by Royal Proclamation; whether the bulk of these articles was exported in a crude state, and was refined on the Continent (frequently being mixed with other raw material produced there), so as to make it impossible to trace the ultimate destination of any particular consignment after it had been refined or converted; and whether, as the object of the proclamation was to prevent articles which were capable of being converted into lyddite, melinite, and other high explosives, and for the supply of which Continental and other nations mainly relied upon this country, from reaching the Queen's enemies, he would rigidly enforce the original terms of the proclamation. Mr. Balfour, in reply, said he was informed that very careful inquiry had been made into the export trade in carbolic acid and other similar articles. It was proved to the satisfaction of the Government that there was a large and legitimate trade in these articles in foreign countries and in the colonies, with which it was clearly inexpedient to interfere. But the destination of these consignments could be traced very accurately—indeed, a large proportion of the exported material came back to this country. He added that the honourable member might rest assured the instructions which had been given would not in any way defeat the object of the proclamation.

On Friday, Mr. Cornwallis asked the President of the Local Government Board if he intended to introduce a Bill this session to safeguard to consumers the supply of drinking water by companies and others. Mr. Chaplin replied that he had a Bill in preparation with this object; and he had every hope of introducing it.

LEGAL INTELLIGENCE.

HOUSE OF LORDS.

Feb. 19, 20, and 22.

(*Before the* Lord Chancellor *and Lords* Macnaghten, Morris, Shand, James, *and* Brampton.)

Sutton, Southcoates, and Drypool Gas Company v. Jordeson.

This was an appeal from a judgment of the Court of Appeal in an action in which the respondent was the plaintiff and the appellants (together with a firm of Contractors trading under the style of Messrs. Holme and King) were the defendants, whereby a majority of the Court affirmed the judgment of Mr. Justice North, sitting in the Chancery Division of the High Court of Justice, by which an injunction was granted restraining the defendants from darkening ancient lights in buildings belonging to the plaintiff; the defendants being ordered to pay to him £340 in respect of damage caused by the subsidence of certain buildings by reason of the construction of works carried out by them, and his costs of the action.* The appellants contended: (1) That, assuming that the respondent's lights would be darkened, and that the appellants had damaged his buildings, no action lay against them having regard to their parliamentary powers. (2) That, as regarded the lights, assuming an action would lie, no injunction ought to be granted, and that damages only ought to be awarded. (3) That, as regarded the damage caused by subsidence, no action would lie because such subsidence was occasioned by pumping water out of the appellants' own land, and thereby draining water from under the respondent's land, which the appellants said gave no right of action. The respondent was the owner of some land near Hull, and on the land there were houses, the windows in some of which had existed more than 30 years before the commencement of the action. The appellants' works were within a short distance of the respondent's houses. The appellants had power to buy land by agreement, but not compulsorily. Their statutes incorporated the Lands Clauses Consolidation Act (except the provisions relating to compulsory purchase), and also the Gas-Works Clauses Acts, 1847 and 1871. In the district in which the plaintiff's land and the defendants' works were situate, there was a large stratum of what was called running silt, well known to persons acquainted with the geological structure of the earth at Hull, and a constant source of trouble to all who had to make deep excavations into it. This stratum of silt extended for some miles both in length and breadth. It was some 6 feet thick, and was about 22 feet below the surface where the appellants' works and the respondent's houses were. The land on which the respondent's houses stood, was, in fact, supported by this stratum of silt, and by the earth above and below it. Before 1877, the appellants' works were comparatively small; their gasholders were of no great height; and their works in no way injured the respondent. But in 1877, they resolved to enlarge their works, and to construct a very much larger gasholder than they had before. Its diameter was to be 152 feet, and its height 105 feet. The appellants began to excavate their land in order to receive this gasholder.

* See "Journal," Vol. LXXI., pp. 284, 348, 409; Vol. LXII., p. 319; Vol. LXXIII., pp. 807, 992, 1381, 1766.

They got down to, and cut through, the stratum of silt. They took all precautions to keep the silt as they cut through it; but, notwithstanding all their care, the land under the respondent's houses subsided, causing damage to the buildings. The appellants contended that, whatever their liability apart from their Special Acts, they were protected by them against such actions as the present for obstruction of light, and they based this contention on *The London and Brighton Railway Company v. Truman*. In regard to the question of subsidence, the appellants attempted to justify their conduct by their special statutory powers. Even if they failed in this, they said they were not liable at common law for the damage by subsidence, first because they only pumped water from their own land, and, secondly, because, although sand came with the water so pumped, the stratum of running silt under the respondent's land only shrunk by reason of the abstraction of water from it, and that no soil, in any appreciable quantity at all events, was removed from under the respondent's buildings. They said, in short, that the subsidence was caused by the withdrawal of underground water from the respondent's land by lawful pumping on their own land; and that, although damage ensued, no nuisance or other actionable wrong was committed by them. For this they relied on *Popplewell v. Hodgkinson* (1869, 4 Exch.).

Mr. Haldane, Q.C., who opened the case for the appellants, said the question to be determined really arose out of the peculiar formation of the soil under Hull, which consisted of running silt—a black sand of fine consistency containing 12½ per cent. of water. The result was, in digging for a foundation, a person drained not only his own, but the adjoining land. In the present case, it was not disputed that the operations in connection with the construction of the gasholder did produce subsidence in the adjoining land, and that some damage was caused; but the appellants were acting under statutory powers. They had not acted negligently; and what had happened was the natural consequence of the drainage of the soil resulting from the excavation. One important question for decision was: Had the appellants drained away dead water with silt in it, or had they taken away a substantial portion of their neighbours' soil. On this, it might be necessary to consider whether the judgment in *Popplewell v. Hodgkinson* was correct, where it was held that pumping underground water from one's own land, even if it let down a neighbour's houses, would not give cause of action. He conceded that the damage done was the natural outcome of the operations of the appellants, acting under statutory authority.

The Lord Chancellor: Was there any doubt of the fact that, rightly or wrongly, the execution of these works has damaged the neighbouring property?

Mr. Haldane said he did not dispute that damage had been done to the extent of £340.

Lord Morris: Had the houses been long erected?

Mr. Haldane replied since 1836; but he was not raising, as regarded this part of the case, any question such as was raised in *Dalton v. Angus*. It was entirely with regard to the third lift of the gasholder that the question of interfering with the light arose. The gasholder was made in three lifts; and, when inflated, it rose to the height of 105 feet. As a matter of fact, only two lifts were used, which took it to a height of 68 feet. The injunction granted did not preclude its being raised to this height, as it was said that did not interfere with the light. But the prohibition to raise the holder to its full height was a matter of considerable moment to the Company, because they were afraid they would not be able to give the requisite supply unless it could be utilized to its full capacity. In order to make the holder, it was necessary to dig a tank into which it could be sunk. The trench formed a round ring, and it was 37 feet deep. He thought he had stated enough to show their Lordships how the question arose. The appellants said, in digging the trench, they put down timber so as to keep back everything except the water. Besides this, there was a quantity of the soil in the appellants' own ground which became dry, and thus formed a barrier to prevent the most distant silt coming into the trench.

The Lord Chancellor: What have you done?

Mr. Haldane: There has been a substantial removal of silt.

The Lord Chancellor: And the taking away of that substantial amount has caused the damage?

Mr. Haldane thought it was quite possible that what caused the damage was the drying of the silt by the abstraction of the water during the progress of the works.

The Lord Chancellor: What sort of inquiry are we entering upon? There are two propositions. Are we going to try these questions?

Mr. Haldane said he believed the Court of Appeal had not sufficiently addressed their minds to what was the cause of the damage.

The Lord Chancellor: But damage was done by the removal of the silt.

Mr. Haldane admitted that damage did take place.

The Lord Chancellor: You say you have a right to take away the water, but you have no right to take away the earth which forms part of the support of your neighbour's house?

Mr. Haldane: No.

The Lord Chancellor said that, if he remembered right, what was decided in *Popplewell v. Hodgkinson* was that, assuming the support was afforded by water, you have no right to the subterranean water.

Mr. Haldane: The Judge said that what we had taken out was water, *plus* silt.

The Lord Chancellor: In other words, that you had removed such an important part of the adjacent soil as to affect the house.

Mr. Haldane said even if the appellants had done that, which he did not admit, they had done it under statutory powers; so that it was a lawful act. Further, the proper remedy of the respondent was not an injunction, but compensation under section 68 of the Lands Clauses Act. There was doubt about this point in the Court below, because it was said a clause such as was in the Private Act of the appellants excluded section 68; but he contended that this was not the case.

Lord Shand said the appellants might be right in saying that what was taken out of the trench was their own silt, but they had no right to take out so much as to affect adjacent property. Did the respondent complain that silt was taken from his ground?

Mr. Haldane said there was no allegation that any silt was taken from the adjacent land, except such as oozed through. Of course, the appellants pumped water inside their coffer dam, and they pumped out silt which was in suspension.

The Lord Chancellor: You mean that the silt came from your own ground.

Lord Shand: I understand the respondents do not contend that you took their silt.

Mr. Upjohn: Yes; we do.

Lord Morris said he had never seen a coffer dam put up in order to obtain a foundation.

Mr. Haldane: Then, my Lord, you have never been to Hull.

Lord Morris: If you have a right to build a gasholder, surely you do not require a coffer dam to enable you to make your excavations.

Mr. Haldane: The explanation is the nature of the soil at Hull.

Lord Morris: But it is for your own purpose that you make this coffer dam, because otherwise you would not have time to build your wall before it was swamped by the silt.

The Lord Chancellor: You could not build unless you build in the dry. You could not build in the dry without a coffer dam.

Lord Morris: But that is for your own purpose.

The Lord Chancellor: I do not care about that.

When the House met again on Thursday, during the course of Mr. Haldane's argument,

The Lord Chancellor threw out a suggestion that, as there had been no findings by a Jury in this case, and there were several disputed points, the parties might be well advised to try and come to some settlement in the matter.

There being no evident willingness on the part of the litigants to adopt the suggestion, the learned Counsel again proceeded with his argument; but before the adjournment for lunch the matter was again referred to.

The Lord Chancellor, addressing Mr. Haldane, said: May I again ask you to consider what has been said as to an arrangement. The question of law may be clear; but it looks to me to be absolutely impossible to say which of the three hypotheses which have been put forward as regulating the question of law is to be adopted as a question of fact. You have not dealt with the question of light. I see that Clyde Terrace comes within 6 or 7 feet of your gasholder, which is 105 feet high when inflated.

Mr. Haldane said the houses the light to which was said to be interfered with, were not so near as 6 or 7 feet.

Lord James: But all the Judges were against you on the question of light.

Mr. Haldane admitted that was the case.

The Lord Chancellor: All I say is if the injunction remains, what is to become of this gasholder. On the other hand, Mr. Upjohn, for the respondent, would be well advised to consider whether these interesting questions of law might not be decided adversely to him in some respects, and then there would be a new trial.

On returning from luncheon,

The Lord Chancellor asked if any understanding had been arrived at, and if the parties thought Lord James could assist them in coming to terms if they saw him in his private room? He might conciliate them, and give some wholesome advice on which they could come to terms.

Mr. Upjohn, for the respondent, said he was perfectly willing.

Mr. Haldane: And so am I, so far as that goes.

Lord James: If I can be of any use to you, I will do my best.

Mr. Haldane: My difficulty is this—that my clients have made a most liberal offer.

Mr. Upjohn: Confiscation, I call it.

Mr. Haldane: And they have gone to the extreme limits to which they can go.

The Lord Chancellor: Then I shall not ask my noble friend to undergo the pleasure of listening to you, if you have made up your minds already.

Lord James: If you tell me that, I shall certainly forego the pleasure of meeting you.

Mr. Haldane: We have gone far beyond any terms we ever intended making.

Lord Morris: If you are confident you have been so generous, you ought not to object to meet Lord James.

Mr. Haldane: If his Lordship will be so good as see us, I will try and get authority to determine the matter.

The Lord Chancellor: I think before we ask Lord James to take the trouble to listen to this controversy, it must be understood that the parties agree to do what he suggests as reasonable.

Mr. Haldane: There are difficulties, as the respondent says he must get all his costs here and in the Court below. We cannot consent to that, as we have offered a substantial sum.

The Lord Chancellor: I do not want to hear the terms. The question is, if Lord James is good enough to give his assistance in trying to come to an arrangement with you, will you agree to do what he suggests as reasonable?

Mr. Haldane: I must get authority before I answer that question.

After a brief consultation with his clients,

Mr. Haldane said his clients would leave the matter unconditionally in Lord James's hands.

Mr. Upjohn: I agree.

The Lord Chancellor: In that case, we will do no more to-day. If anything is to be said in the way of judgment, after what my noble friend determines between you, that can be said to-morrow.

Mr. Upjohn: I do not think that will be necessary, as we will leave it in the hands of Lord James.

Their Lordships then adjourned, and the parties retired to the room of Lord James, to lay the matter before him as a sort of Arbitrator.

When their Lordships (except Lord Shand) met on Friday,

Lord James handed in the terms which had been agreed upon between him and the Counsel for the parties. No mention was made as to the nature of the agreement arrived at; but his Lordship, addressing Counsel, said they would see that it was carried out in proper form.

Mr. Upjohn, for the respondent, said the formal agreement would be sent to his Lordship to be initialled.

The Lord Chancellor: If it is thought desirable that there should be any formal order made hereafter that you have settled the matter between yourselves, we can do it. In the meantime, you will do what you think necessary to carry out the terms.

The parties then retired.

HIGH COURT OF JUSTICE (IRELAND)—CHANCERY DIVISION.

Tuesday, Feb. 20.

(*Before the* MASTER OF THE ROLLS.)

Alliance and Dublin Consumers' Gas Company v. Thompson and Harris—Traction-Engines and Damages to Gas-Pipes.

To-day an application was made on behalf of the plaintiffs for an interlocutory injunction to restrain the defendants, who are haulage contractors at Ringsend, Dublin, from "using, or causing to be used, any steam or other traction engine in such a way as to fracture, damage, or injure the mains and pipes of the plaintiffs, until the trial of the action."

Mr. S. RONAN, Q.C., Mr. J. GORDON, Q.C., and Mr. PIM appeared for the plaintiffs; Mr. J. WAKELY, Q.C., and Mr. CHAMBERS represented the defendants.

Mr. RONAN stated, in support of the application, that the defendants had a very heavy traction-engine, and had been using it in portions of Dublin, near Ringsend. They had repeatedly broken the mains of the plaintiffs; and the results had been simply disastrous. When the pipes had been broken, the gas escaped into the soil, and made its way into the houses. He believed the death of one person had occurred in consequence; and it had been the cause of serious illness to others. Mr. W. F. Cotton, the Managing Director of the Company, had made an affidavit, in which he stated that the Company had laid down mains in certain specified streets, and that for some time past the defendants had, for the purpose of their business, used a traction-engine of enormous weight thereon. Mr. Cotton referred to letters which the plaintiffs had, on the 22nd of July last, written to the defendants calling attention to the injuries done to the gas-mains by their traction-engine, requiring them to desist using it, and informing them that the firm would be held responsible. On the 24th of January, the plaintiffs complained of more breakages. On the 5th and 6th inst., the Company wrote further letters in regard to injuries caused to mains and pipes by the weight of the engine. The defendants, however, had not discontinued the use of it; and it was feared that if they were not restrained some serious accident might occur to life or property. Mr. Cotton had been chief officer of the Company from 1873, since which year there had been no instance of injury caused to the mains or services by the ordinary traffic on the streets. Mr. Waterfield, their Distributing Engineer, had also made an affidavit in which he gave particulars of a number of breakages which had occurred between Jan. 20 and Feb. 8. From the appearance of the ground, the fractures had been caused by a traction-engine. The weight of the defendants' engine was from 10 to 12 tons, and the trucks—of which there were sometimes as many as four—weighed about 1½ tons each. Mr. Charles Thompson, one of the defendants, had made an affidavit that traction-engines and waggons similar to those recently used in the neighbourhood of Ringsend had been employed by him in all parts of the city and suburbs for the past nine years, and no claim for injury had ever been made, except about five years ago, when a gas-pipe was alleged to have been broken by an engine at Milltown; but on an investigation of this claim, it was at once withdrawn by the Gas Company. The engine and waggons were within the statutory requirements, and no allegation of negligence as to the mode of using them had been made against the defendants or their servants, who were well trained, and skilled and competent workmen. He was not in a position to admit or deny that the injuries referred to were caused by the engine; but he was willing to pay for the restoration and repair of all damage which might be proved, having regard to the mode in which the mains and pipes had been laid and the condition of the roads. The soil of the roads in which the pipes were laid was very soft, having been reclaimed from the sea, and was of a very sandy nature; and the roads were insufficiently macadamized. They were public streets, open for traffic of all kinds, but they had not been used for heavy traffic until recently. He measured the depth of the gas-pipes below the surface of one road, where an injury was alleged to have been caused by the engine, and found that it was only 18 inches. Having regard to the nature of the road, and to the quantity of metalled surface upon it, he did not think these pipes were laid at sufficient depth in the ground to be protected from the consequences of traffic other than that of a light cart or a small waggon. Counsel read affidavits from parties who deposed to illness occurring in their families as the result of the escape of gas, and submitted that the case was a clear one for an injunction.

Mr. WAKELY resisted the application. He said, first, that, assuming the traction-engine caused the damage complained of, without any default on the part of the Gas Company in the laying of their mains and pipes, as the defendants had statutory authority for taking their engines along the streets an injunction would not lie; the remedy would be by an action for damages. Secondly, it was quite clear upon the facts that a very serious question as to who was in fault arose in this action, and it could only be determined at the hearing. The defendants would satisfy the Court that they were not to blame for the damage, but the Company, for the way in which they had laid their mains and pipes in the particular streets where the accidents had occurred. If this interlocutory injunction were granted, it would prevent the defendants from carrying on their business.

The MASTER OF THE ROLLS: They can carry on their business as they like, so that they do not cause damage with their traction-engine.

Mr. WAKELY said it lay on the Company, in a district like the one in question, which had been reclaimed from the sea, to be particularly careful as to the depth at which they laid their pipes, so that they would be sufficiently protected, and they had not been so here.

Mr. CHAMBERS and Mr. GORDON having addressed the Court,

The MASTER OF THE ROLLS, in granting the injunction, said he did not decide anything finally in the case, but acted on the clear balance of evidence of proof in reference to matters now in dispute. The complaint was not that the traction-engine had been used in a negligent way, but that the consequence of using it in a certain place was that the plaintiffs' pipes were broken; and they said the defendants had no right to do this, whether they were skilful or not. Without expressing a conclusive opinion, he was bound to say that at present there was an overwhelming case that the plaintiffs' pipes were not improperly laid. If the engine had been going over them for the last nine years, and no injury had been done, this would appear to be strong testimony in favour of the proper laying; if, on the other hand, the engine had not been going over them, then they were sufficient to bear the ordinary traffic until the engine came. This was the dilemma in the case. As a matter of absolute fact, he took it that these pipes had stood the ordinary traffic, and that they were adequate to do so. As regarded negligence on the part of the plaintiffs, there was not a scintilla of evidence of it, in his opinion. The injunction would therefore be, on the plaintiffs undertaking to abide by any order as to damages, "to restrain defendants, their servants, and workmen, from using, or causing to be used, any steam or other traction-engine in such a way as to fracture the gas mains or pipes of the plaintiff Company, until further order."

The Morley Corporation and their Catchwater.

In the House of Lords last Tuesday, the Lord Chancellor and Lords Macnaghten, Morris, Shand, James of Hereford, and Brampton had before them the case of *Fielden v. Mayor and Corporation of Morley*. The action was originally brought to restrain the defendants from allowing water to overflow on to the appellant's land from a catchwater constructed by the Corporation under their Act of 1890. The appellant also asked for damages. The substantial question was whether the Corporation had, in constructing the catchwater and certain works connected therewith, exceeded their statutory powers under the Act mentioned. The action was first tried by Mr. Justice Byrne in April, 1898; and he dismissed it, and ordered the plaintiff to pay the defendants' costs—expressing the opinion that the acts complained of were justified by the Corporation's statutory powers, and that the appellant's remedy, if any, was by way of compensation under the General Acts, and not by way of action. Later in the year, the plaintiff appealed against this judgment; but it was affirmed by the Master of the Rolls and Lords Justices Chitty and Collins. The former proceedings were reported in the "JOURNAL," Vol. LXXI., p. 1015; and the latter in Vol. LXXII., p. 319. The matter was then taken to the House of Lords. Mr. Moulton, Q.C., Mr. Cripps, Q.C., and Mr. Leigh Clare appeared for the appellant; Mr. Eve, Q.C., and Mr. R. J. Parker represented the respondents. At the conclusion of the arguments for the appellant, the Lord Chancellor, without calling upon the respondents' Counsel, gave his reasons at some length for agreeing with Mr. Justice Byrne and the Court of Appeal; and, in moving that the appeal be dismissed, said he had never known "a more trumpery and frivolous action." The other learned Lords concurring, the appeal was dismissed.

The Incandescent Gas-Light Litigation.

In the Chancery Division of the High Court of Justice last Friday, before Mr. Justice Byrne, Mr. T. Terrell, Q.C. (Mr. Walter with him), moved for an injunction to restrain the New Sunlight Incandescent Company, Limited, from selling mantles infringing the 1896 patent of the Incandescent Gas-Light Company, Limited. The defendants were represented by Mr. Bousfield, Q.C., and Mr. Graham. Mr. Terrell said an action had been brought against the defendants' predecessors, and Mr. Justice Buckley had given judgment in favour of the plaintiffs, though he did not grant an injunction, for reasons which would appear when he read the judgment (*ante*, p. 475). He now moved for an injunction against the present Company and their Directors for practically the same infringement as that which came in question in the recent action. Having read an affidavit by Mr. Pugh giving the facts generally, he read another by Mr. Ballantyne stating that on the 15th inst. he purchased, at defendants' premises in Shoe Lane, three mantles which he analyzed, and found to be substantially the same as those dealt with in the previous action; the only difference being that the proportion of calcium oxide was slightly less. In his opinion, these mantles were a direct infringement of the plaintiffs' patent. Professor Dewar had made an affidavit in practically the same terms, except as to the purchase. He next read the affidavit of Mr. Selwyn Francis Edge, filed on behalf of the defendants, in which he set out the reasons why Mr. Justice Buckley declined to grant an injunction, and stated that an appeal had already been entered. Mr. Justice Byrne suggested that it would be much more convenient if Mr. Justice Buckley could hear this motion. Counsel having expressed their willingness to such a course being taken, his Lordship went to consult his learned brother on the subject. On his return, he said that Mr. Justice Buckley would hear the motion on Wednesday (to-morrow).

Wath-upon-Dearne Gas and Lighting Company, Limited.

A petition asking the Court to confirm special resolutions for the extension of this Company's area came before Mr. Justice Cozens-Hardy, in the Chancery Division of the High Court of Justice, last Saturday. Mr. Vernon Smith, Q.C., said the Company was formed many years ago to take over the business of a Gas Company who supplied two townships named Wath-upon-Dearne and Bolton-upon-Dearne, in the county of York. It was now proposed to supply gas to the following districts: Brampton Bierlow, Thurnscoe, Hickleton, and Barnborough; and resolutions had been passed altering the Memorandum of Association in this respect. It was also proposed to change the name of the Company to the Wath-upon-Dearne and District Gas Company. His Lordship sanctioned the proposed alteration.

Selling Infringing Incandescent Mantles.

At the last Sandwich Quarter Sessions, David Felix, *alias* W. Hill or Luke, 26, a barber, was charged with unlawfully and knowingly obtaining by false pretences, from James Assiter, the sum of £4 17s. 6d., between the 20th of August and the 10th of November last. The case for the prosecution was that defendant, under the name of Luke, called on Mr. Assiter, a plumber and decorator at Ramsgate, and showed him some specimens of incandescent mantles. On the assurance that they were not infringements of the Welsbach patent, and that they were manufactured

by defendant's Company—the Incandescent Light Company, Fulham—Mr. Assiter purchased a quantity of the goods, and further orders were given at subsequent dates. In course of time, he was visited by the representative of the Welsbach Company; and he then discovered that the mantles were made in Germany, and that they were cheap imitations of the Welsbach patent. This constituted the charge of fraud upon which the proceedings were taken. It was stated that there was no Incandescent Light Company, no W. Hills by whom the receipts were signed, and no Mr. Luke, except defendant himself. From the evidence of the Solicitor of the Welsbach Company, it appeared that proceedings had been taken against defendant, and an injunction obtained against him. The defence was that the prosecutor had not been defrauded of any money. He had derived profit on the sales of the mantles, and owed defendant between £7 and £8. While it was admitted that the mantles were infringements of the Welsbach patent, it was alleged that Assiter was perfectly well aware of this fact when he purchased them. The Jury found defendant guilty; and he was sentenced to nine months' imprisonment, with hard labour.

The Cost of Gas and Electric Light.

At the Westminster County Court last Thursday, his Honour Judge Lumley-Smith, Q.C., and a Jury had before them an action by the National Free Wiring Company, Limited, to recover £19 odd for fittings supplied to the defendant, Henry Austin Lambert, the proprietor of the Jolly Sailors, Lower Road, Rotherhithe. Plaintiffs' case was that the Company were in the habit of wiring premises and supplying electric light fittings. If special fittings were required, they were to be paid for; the others being supplied on a rental of ¾d. per unit of electricity supplied each quarter. There was also a charge of £10 for altering gaseliers to electroliers. The electricity was supplied by the London Electric Supply Corporation, and they collected the rental. Plaintiffs' cashier admitted that they had a man named Collins who was a canvasser, and that he obtained the orders. He was not present. Circulars (one of which was produced) were distributed by the Corporation, stating that after two hours electricity only cost 3d. per unit, which was equal to 1s. 9d. per 1000 cubic feet of gas. Mr. Giveen, defendant's Counsel, said, if the contract was entered into in consequence of the misrepresentation of the plaintiffs' canvasser, he thought the Jury would set it aside. When Collins first called, Mr. Lambert refused to have anything to do with the electric light; but subsequently he told him that it would be very much cheaper than gas. Mr. Lambert said: "Why should I change?" Collins replied that electricity was so much cheaper; and he gave Mr. Lambert the Corporation's circular, which set forth that the cost would be but 3d. per unit after 1½ hours. What was the result? The gas bill for the previous year was £70, and the electricity bill from February to October was £120. After this, he had the fittings removed. Defendant bore out this statement, and said not only was the electric light much more expensive, but it was not so good as gas; and he spent £40 in going back to the older illuminant. He would never have entered into the agreement but for the fact that it was urged that electricity was so much cheaper. Plaintiffs' Solicitor pointed out that the circular of the Corporation stated that the cost per unit was 6d., and several months elapsed between the first call of Collins and the time the contract was entered into. The 3d. related to electricity supplied for motors; and the scale for light did not go beyond 5d. His Honour said he failed to see why the 3d. should be put in the circular. Everyone knew that the electric light was dearer than gas. People grumbled that the gas was not good, and that electric light was dear. He knew of no one who paid less than 6d. a unit. Mr. Giveen wished to call a number of traders to give evidence as to the great increase in the cost of electricity as compared with gas; but his Honour declined to allow him to do so. In addressing the Jury, he told them that if the contract was entered into in consequence of fraudulent statements made by Collins, it could be set aside. It was for them to say whether or not this had been proved to their satisfaction. The Jury found for the plaintiffs for £10, which was apparently for the alteration to the gaseliers.

A Decision Against the Brymbo Water Company for Refusing a Supply.

The Wrexham County Bench on Monday last week gave their decision in an action brought by Mr. E. S. Clark, of Oak Alyn, Gwersyllt, and proprietor of the Llay Hall Colliery, against the Brymbo Water Company for having refused to furnish him with a supply of water for thirty-four days during May and June, 1899, contrary to the provisions of the Water-Works Clauses Act, 1847, and the Company's Special Act, and claiming a penalty of £10, and £2 per day for the whole thirty-four days. The first hearing of the case was on the 5th inst., when Mr. S. Moss, M.P., appeared for the complainant, and Mr. J. H. Pierce for the Company. It was stated by Mr. Moss that the case was the result of a struggle between Mr. Clark and the Company commencing in 1893. The Company insisted that they were entitled to force upon Mr. Clark a domestic supply of water by meter, and not in accordance with the rateable value of the house he occupied. He (Mr. Moss) maintained that this was a high-handed proceeding on the part of the Company, and an illegal attempt at extortion. Counsel read a voluminous correspondence which had passed between the parties, showing that in 1894, although the meter was put in and the water passed through it, Mr. Clark was allowed to pay a rate upon the basis of his assessment. In September, 1896, there was again an attempt to force a water supply by meter upon Mr. Clark, followed by another lengthy correspondence; and in September, 1897, the Company cut off the Oak Alyn supply, as Mr. Clark declined to pay 1s. per 1000 gallons—the amount of the disputed account being £25 18s. In September, 1897, after the Company cut off the water, Mr. Clark coupled up the Oak Alyn pipes with the trade pipes to the colliery, and so obtained a supply for domestic and other purposes at Oak Alyn from that time until May 19, 1899. On behalf of the Company, Mr. Pierce argued that if they deprived Mr. Clark of water it was in 1897, from which time down to 1899 he got his domestic supply from his trade supply. The Company were not bound to supply the complainant with water for trade purposes, except by agreement. After an agreement had been made, the remedy was by civil action. As regards the meter, the Company decided upon installing that instrument owing to the great waste of water which was evidently going on at Mr. Clark's premises. The case was adjourned until yesterday week, when it transpired that the complainant had in the meantime died. This gave rise to a singular point which was urged by Mr. Pierce. He contended, in accordance with a maxim of law, that, personally, an action died with the person. He said he had laid the matter before Counsel, who was of opinion that the action ought to abate with the death of Mr. Clark. He (the Counsel) further said that the Magistrates should be asked to say that, owing to the death of Mr. Clark, the proceedings should come to an end, and that, instead of giving judgment, they should postpone the matter until probate had been taken out. The Chairman (Sir Robert Egerton) said the Bench were advised that the claim did not abate by the death of the claimant. They thought that the charge of continuing to refuse to furnish a water-supply had been proved, as from June 16, 1899, to June 24, both dates inclusive; and they imposed a penalty of £18, payable to the complainant's representatives, with costs. Mr. Pierce gave notice that he should apply for a case upon the points of law raised at the time the matter was argued, and upon the point raised on this occasion.

A Paltry Action Against the South Shields Gas Company.

At the South Shields Police Court last Wednesday, the South Shields Gas Company were summoned by the Corporation for opening up a street without giving the required three days' notice of their intention to do so, as required by statute. The Town Clerk (Mr. J. Moore Haytor) appeared for the Corporation; and Mr. C. W. Newlands for the Company. The Town Clerk stated that the Company opened up a pavement on Dec. 18 last, in Ocean Road, South Shields, without giving three days' notice, in accordance with the provisions of the statute. A foreman in the employ of the Corporation said he remembered seeing the pavement broken in Ocean Road on Monday morning, Dec. 18; and the Gas Company's workmen were there. Witness made a communication to the Borough Surveyor. Another witness stated that a notice was received from the defendants on the morning of Thursday, Dec. 21. Replying to Mr. Newlands, he said he did not think it was possible for the notice to have been delivered sooner, or overlooked in the office. Mr. S. E. Burgess, the Borough Surveyor, and other witnesses gave evidence, and they all were positive that the work was commenced on Dec. 18. Mr. Newlands said it had not been proved that the necessary notice had not been received at the office; and he adduced documentary evidence to prove that the work was commenced on Dec. 19. The Bench dismissed the case.

Charge of Falsifying Books and Embezzlement.

At the Lambeth Police Court last Wednesday, Frank Fairfield Norris, of Acacia Grove, West Dulwich, was summoned to answer the complaint of Howard Douglas Burn, that he, being an officer employed by the Directors of Frank Wright's Prepayment Gas-Meter Corporation, Limited, did, on various dates, "unlawfully and with intent to defraud, alter and falsify certain books of account belonging to his employers." There was a second summons against the defendant for embezzling money received by him on account of the Directors. Mr. Wontner appeared in support of the summonses; the defendant was represented by Mr. H. I. Sydney. In opening the case, Mr. Wontner said the complainants were a Company having offices in Glengall Road, Old Kent Road, and the defendant was the original Secretary, and was a man who enjoyed the fullest confidence of the Directors. In September or October last he went for a holiday; and while he was away it was determined to make an application to the Court of Chancery for an order for the reduction of the capital of the Company. The Auditors were called in for the purpose of this application; and, in consequence of what was then discovered, the defendant was asked for an explanation, and was eventually discharged. After dealing at some length with the details of the case, Mr. Wontner proceeded to call evidence in support of the summonses. The further hearing was adjourned for a week.

Embezzlements by a Gas Company's Manager and Clerk.

At Margate on Saturday, William Joseph Latchford, formerly Manager and Secretary of the Broadstairs Gas Company, appeared on remand, and pleaded guilty to embezzling £354, received on behalf of the Company. A remarkable feature of the case was that a clerk named Richard Henry Philpott came forward voluntarily and confessed to embezzling £100 of the Company's money without the knowledge of Latchford. The latter was sentenced to six months' and Philpott to one month's hard labour.

An Agreed Award under the Workmen's Compensation Act dealt with in the County Court.

At the sitting on the 14th inst. of the Ludlow County Court, before Judge Harris Lea, a claim under the Workmen's Compensation Act was settled. A man named Charles Smith met with an accident on the Birmingham Water-Works pipe-track at Ludlow, about five months ago, whereby he had to have his foot amputated; and as there was no dispute as to the facts, an arrangement had been arrived at. Messrs. Morrison and Mason, the contractors, were insured in the General Accident Insurance Corporation, Limited; the plaintiff had been paid 9s. 4d. per week; and an agreement had been signed by the Insurance Company and by Smith. There seemed, however, said Counsel appearing for the plaintiff, to be only two ways of dealing with the action. His Honour might make a formal award for the amount agreed upon, 9s. 4d. per week, or adjourn the case *sine die*. Having the Company's seal to the agreement, he was satisfied himself. His Honour said he could not make an award; and he would agree to the suggestion that the case be adjourned *sine die*. If the agreement failed, plaintiff could then come again to the Court.

MISCELLANEOUS NEWS.

THE DAMAGE TO GAS-MAINS THROUGH SEWERAGE OPERATIONS AT SHREWSBURY.

Arbitration Proceedings.

At the Shire Hall, Shrewsbury, last Tuesday, proceedings were opened in an arbitration with respect to a claim for the sum of £1583 made by the Shrewsbury Gas Company against the Shrewsbury Corporation as compensation for damage alleged to have been caused to the Company's mains, with consequent loss of gas, in carrying out the new system of sewerage in the town, to which reference was made in the "JOURNAL" last week (p. 486).

Mr. CORBET WOODALL was Arbitrator for the Company, for whom the Hon. A. LYTTELTON, Q.C., M.P., and Mr. SPEARMAN appeared. Mr. J. H. REDMAN was Arbitrator for the Corporation, who had retained Mr. F. A. BOSANQUET, Q.C., and Mr. A. GRAHAM to represent them. Mr. JAMES MANSERGH was Umpire.

Before the proceedings were opened,

Mr. GRAHAM said he had to make an application. His leader, Mr. Bosanquet, who arrived in Shrewsbury on the previous night, was unfortunately at that moment lying at his hotel dangerously ill; and therefore it was quite impossible for him to appear. Under these circumstances, he had to ask the Arbitrators to fall in with a suggestion made by Mr. Lyttelton that he (Mr. Lyttelton) should open the case, and call before them such artisan witnesses as would describe what they saw, and then adjourn the hearing to London, on a date to be fixed, when they could go more fully into the expert evidence with which they would have to deal.

Mr. LYTTELTON said he thought the course proposed by his friend was the best that could be adopted.

Mr. WOODALL having concurred,

A preliminary argument took place between Counsel on the subject of the inspection of plans, specifications, and account books.

Mr. LYTTELTON proceeded to open the case. He said the arbitration had been instituted, under section 308 of the Public Health Act, by the Shrewsbury Gas Company against the Corporation. The section specified that "where any person sustains any damage by reason of the exercise of any of the powers of this Act in relation to any matter as that to which he himself is not in default, full compensation shall be made to such person by the local authority exercising such powers; and any dispute as to the fact of damage or amount of compensation shall be settled by arbitration, in the manner provided by this Act." They would therefore have to determine whether damage had been caused to the Company's undertaking; and, if so, by whom, and what was its extent. These were the sole matters with which that tribunal was concerned. The Company was incorporated in 1820; and there had been two Private Acts passed since—one in 1878, which had added to their capital and increased their powers. During the past twenty years, he was informed by the Engineer of the Company, no subsidences or breakages had taken place in the mains, other than those caused by severe frosts and steam-rollers, until a rather recent date; and mains which were laid as far back as 1820 were found to be in remarkably good condition when inspected for contemplated improvements. It was a singular fact that the leakage of gas from 1879 to 1896, reckoning from June in each year, was only 5·125 per cent. of the entire quantity manufactured. In 1896, however, the Shrewsbury Corporation were empowered to carry out a sewerage system for the town; and from this period until the completion of it that uneventful history had unfortunately been changed. The result of the deep trenches which had been made for the sewerage had been the breaking of the Company's mains and services, the drawing of the pipes, sinkages, and so forth, entailing considerable cost in actual repairs, and a very large increase over the average leakage of the previous years. Particulars of the damage were furnished to the Corporation in 1898, after the works were completed, so far as they affected the claim; and the Contractor (Mr. Law) satisfied these to a certain extent. At that time (July, 1898), it was absolutely impossible for the Company to observe, or even estimate with any precision, what amount of damage and leakage had actually been caused. This was a matter which could only be ascertained after a considerable period. He did not propose at present to do more than give a summary of the matters of which the Company complained—leaving the details to be explained later on by the witnesses called. He would refer to only three conspicuous cases in which damage had been done. One was in the Berwick Road, where a 2-inch main sank laterally in consequence of the sewerage trenches; and it had to be raised and strengthened, and nearly every joint set up. No less than 116 joints had been more or less drawn. These pipes were 6 feet long. Then there was another case in Longden Coleham, in which, owing to frequent and bad breakages, no less than 170 yards of pipe had to be cut off for eight months; and so great was the subsidence, that the fronts of two adjacent cottages had to be propped up and subsequently rebuilt. Another similar case was in Castle Foregate, where the gas men had to investigate a leakage, and one of them actually sank into the ground up to his arm-pits. In the year 1895, the gas to be accounted for was 143,352,200 cubic feet, and the leakage was 8,282,617 cubic feet, or 5·8 per cent. In 1896 the quantity manufactured was 139,242,600 cubic feet, and the leakage was 8,034,004 cubic feet, or 5·75 per cent. In 1897 the make was 153,196,100 cubic feet, and the leakage 10,592,070 cubic feet—a percentage of 6·95. In 1898 the quantity manufactured was 154,254,700 cubic feet, and the leakage 12,819,746 cubic feet, or 8·34 per cent. In 1899 the make was 160,836,300 cubic feet, and the leakage 13,015,092 cubic feet, or 8·09 per cent. They would therefore see that the leakage had enormously increased since the sewerage works began. It was estimated that the Company had suffered damage to the amount of £1583 4s. 1d., and a claim was sent in for this sum; but the Council resisted it, and the Company now came before the Court and asked that it might be allowed.

Mr. MANSERGH: How much did Mr. Law pay for compensation?

Mr. GRAHAM: About £40.

Mr. LYTTELTON: That was for one place only. I am told it was a great deal more.

Mr. WOODALL: Was the amount paid by Mr. Law for damage to the pipes only, or was it for consequential loss as well?

Mr. LYTTELTON: So far as that part went, the claim was only for damage to pipes.

Mr. MANSERGH: Your claim for damage to the mains and for repairs is £178 15s. 1d. only?

Mr. LYTTELTON said that was so.

Evidence was then adduced.

Mr. *Charles Harris*, contractor, bore out substantially Counsel's statements with regard to the sinking of the Company's mains, the drawing of service-pipes, and other damage done during the years 1896, 1897, and 1898. These disturbances, he said, were clearly due to the sewerage operations. This was particularly the case at Porthill, Burton Street, Queen Street, and Berwick Road.

Mr. GRAHAM again raised the point as to what particulars he was entitled to receive from the Company, and contended that he had insufficient figures to enable him to check their claim. He said he should like to see the books, so as to ascertain the amount of capital expended during the last ten years, and the outlay on the repair and maintenance of pipes during the same period.

Mr. WOODALL: Might not that be confined to the distributing works?

Mr. LYTTELTON: Yes. We are willing to give that information; and surely it is sufficient for anybody.

Mr. GRAHAM said he understood the Company was one of those who paid maximum dividends, and also had a full reserve fund. Under these circumstances, he wished to know in what way they were spending their capital on the mains.

Mr. LYTTELTON said the accounts of the Company had nothing to do with the present inquiry. What did it matter whether they allocated capital to the extension of these mains or not?

Mr. GRAHAM: It is very easy to see the bearing of it.

Mr. LYTTELTON: It is for you to satisfy the Court, before they make the order, that it will assist them in making it instead of gratifying your own curiosity.

Mr. WOODALL: The Court is unanimous that it is unnecessary to furnish particulars beyond those in regard to the maintenance and extension of the distributing plant.

Mr. GRAHAM: But I am anxious to get particulars of the amount of coal consumed and the gas made per ton. It is obviously material that we should be able to test the Company's statements in that respect.

Mr. MANSERGH: Well, get it from the Engineer in cross-examination. We have already ruled as to what you are entitled to, and surely that is enough.

Henry Mansell said he had been in the service of the Company for 40 years, for 18 of which he had been outdoor inspector. He had to examine the men's books; and the time put in, and the material used, in the repairs in question were accurately stated. He supervised these repairs. At Porthill, there was considerable subsidence through the sewerage trench. The gas-main had sunk, the joints had been drawn, and there was considerable escape of gas. The main was from 2 to 3 feet deep. There was no such sinking of the main before. In Queen Street and Burton Street a similar state of things was found. The mains were very uneven and broken in places, and the services on one side of Burton Street had all gone down. At Coton Hill he found drawn joints, sinking, and so forth. There had been no difficulties before the sewerage operations; and these were plainly the cause of the damage. In Chester Street, where there had been no trouble before, they found sinking and loosened joints. The next place he inspected was Longden Coleham. There he found drawn joints, a broken main, and matters so bad that he had to cut off 120 yards of the main and provide a substitute in another part of the road. The subsidence was so great that two adjacent cottages had to be propped up and subsequently rebuilt; and on the opposite side the pavement of the footpath gave way. About 20 yards of 4-inch pipe had entirely disappeared. The same remarks applied generally to Castle Foregate and other places. Before the sewerage works began, they never had any trouble in any of the places referred to.

Witness was cross-examined at considerable length by Mr. GRAHAM. He admitted that the Company's mains had occasionally to be repaired before the sewerage operations commenced; but he adhered to his original statement that, generally speaking, they were in capital order, and needed very little attention. Some difficulty had been experienced with a new 15-inch main through the town, as well as with a specially constructed main, over the English Bridge, which was near the surface; but the leakage from these was comparatively small. He repudiated the idea that the Company's mains were so bad at one point, where there was no sewerage, that on the soil being thrown up and a light put against it a flame at once burst forth.

On the resumption of the proceedings next day,

Mr. *Henry Lyne*, Assistant-Manager at the Cork Gas-Works, and formerly of Shrewsbury, and *William Waite*, main and service layer in the employ of the Gas Company, gave corroborative evidence; as did also *Henry Gill*, another workman.

Mr. *W. Belton*, the Company's Engineer and Secretary, next gave evidence. He verified various items of account, including the charges made for the repairs, and also the statements as to the damage done by the sewerage operations. The sum of £178 had, he said, been claimed for repairs; and the remainder was for leakages and matters relating directly thereto. It was true that there were leakages before the sewerage works were commenced, and it would be impossible to have a gas-supply system in which there were not; but up to 1896 there were none of the special matters of complaint to which he had spoken. He had formed a decided opinion that the various damages had occurred in consequence of the subsidence arising from the sewerage operations. The statement of claim was based on the actual cost, without regard to what would be inevitable loss from the same causes in future.

In cross-examination by Mr. GRAHAM, witness said the Company declared maximum dividends, and these, with all arrears, had been paid up to date. They had a reserve fund, but this was disposed of; and the capital, so far as their powers to raise it went, had also been exhausted. He considered that the Company had been damaged. For the past ten years, the average amount spent on the works and mains per 1000 cubic feet of gas sold was 8·6d. This might appear very high, but considerable alterations had been carried out. They had charged the Corporation the same

price for the estimated leakage as they charged their ordinary customers for gas. But various points were taken into consideration, and it was thought that if the matter were settled amicably that price could be re-adjusted. The cost of manufacture per 1000 cubic feet was about 23·98d., without any deduction for residual products. These amounted from 5·61d. to 6·11d. in the last three or four years. There had been fluctuating leakages before the sewerage operations commenced; but they averaged only 5·125 per cent. From 1897 to 1899, however, the leakage went from 6·95 to 8·09 per cent. There was a slight decrease on the last half year. Their returns during the past few years showed a greater amount of production per ton of coal used; but this was due to improved works. A suggestion had been made that greater pressure had caused increased leakage in the new mains where the sewers did not run; but he denied that this was the case. The consumption had augmented in greater proportion to the extension of the mains; but though the pressure was greater in one place it was less in another, and this had a counterbalancing effect, and practically the whole pressure remained as before.

Mr. *H. E. Jones* said he had inspected the Company's mains at openings at the various places mentioned in the borough, and found them in good condition, and laid at a proper depth. The soil was mostly of such a nature as to need special precautions in carrying out sewerage works; and in some places in Shrewsbury which he had examined, he believed it was physically impossible to conduct such operations without disturbing the subsoil to such an extent as to affect the gas-pipes—not only those directly in the trench or close to it, but even those at some distance. He had not the slightest doubt that the damage which had been described was due to the sewerage works, and that further trouble would ensue from the same cause.

In cross-examination, witness said that, all things considered, he thought Mr. Belton had taken very moderate estimates in arriving at the amount he had claimed, although the price charged for the gas might be a matter of opinion. He agreed with Mr. Belton that, under the circumstances stated, the higher pressure would not cause increased leakage from the mains.

Mr. *G. F. L. Foulger*, Chief Distributing Engineer of the Gaslight and Coke Company, said he had visited several places in the town where the gas-pipes had been laid. At the parts where the sewerage work had not been in progress the pipes were very good, and not the slightest sign of escape, either past or present, was noticeable; but where sewerage operations had been going on, he observed that some of the mains had been recently repaired. The ground was particularly loose underneath the pipes, and it was a very easy matter to drive a bar down into the soil; but the pipes were in perfect condition. In Castle Foregate there was a slight escape from the 10-inch main, and the soil was particularly loose—due, no doubt, to the sewerage works. He thought it would be impossible to carry out an extensive system of sewerage without doing some damage to gas-pipes; but measures might be taken to reduce it.

Mr. *J. T. Wood*, of Liverpool, who had examined the places in dispute, said he found evidence of sinking and leakage which were clearly due to the sewerage works. The old pipes were in very good condition, and, if undisturbed, would be practically indestructible.

This concluded the evidence for the Company; and the inquiry was adjourned till the 5th prox., in London.

A question arose as to the furnishing of reciprocal plans showing both the gas-mains and the sewage-mains; and Mr. Mansergh said the parties must agree to provide these, as the expense involved would be quite incommensurate with the amount claimed. He added that he was almost ashamed to sit there with his two colleagues on such a paltry claim.

THE LEEDS CORPORATION GAS COMMITTEE AND CARBURETTED WATER GAS.

From a statement appearing in a local contemporary, it would appear that the members of the Leeds Corporation Gas Committee who have been visiting London and Brighton for the purpose of inspecting carburetted water-gas plants have returned home favourably impressed with the advantages of the system. It is therefore expected that the City Council will shortly be asked to sanction the erection of plant capable of making 2½ million cubic feet per day, at an estimated cost of £30,350. It is the rapid growth of Leeds that forces the Chairman of the Committee (Alderman Lowden) and his colleagues to look ahead. The present capacity of the gas-works collectively is equal to a production of 17½ million cubic feet a day. The maximum daily consumption last winter for the whole of the city was 15 million feet; and, consequently, the Committee possess a surplus producing power of 2½ millions, or 15 per cent. The new retort-house which is being erected at the York Street works will, however, make a substantial addition to the total power of production. As regards the future demand, it is difficult, owing to the competition of the electric light, to forecast the sales with any degree of certainty; but, making allowance for this rivalry, and taking into consideration the fact that the gas distribution system is being quickly improved, the General Manager (Mr. R. H. Townsley) anticipates an increase during the next three years of at least 5 per cent. With the additions now being made at York Street, he is of opinion that the works are fully equipped to meet the demands upon them for the next three winters. With respect to possible extensions, it is pointed out that, on the available land in the possession of the Committee in Meadow Lane, carburetted water-gas plant could be laid down equal to a daily output of 2½ million feet. It is also feasible, by making alterations and additions to some of the old retort-houses at the Meadow Lane and New Wortley works, to increase the producing power of these works by at least 2 million feet per day; making an additional total of 4½ million feet a day, which will last the city through the winter of 1905-6. Latterly, complaint has been made that the quality of Leeds gas has not been up to the usual standard; but this fault arises, according to an official explanation, from scarcity of cannel coal. All the stocks of this enriching fuel at the works were exhausted weeks ago; and the management have the greatest difficulty in obtaining even the smallest daily supply. A carburetted water-gas installation would, it is claimed, lessen, if not remove entirely, the anxiety of both the management and the Committee in maintaining a high and uniform quality of gas.

LIVERPOOL UNITED GASLIGHT COMPANY.

The Half-Yearly Meeting of this Company was held last Wednesday—Sir Edward Lawrence in the chair.

The Secretary (Mr. P. F. Garnett) read a formal report recommending a dividend at the rate of 5 per cent. on the "A" stock and of 3½ per cent. on the "B" stock, after providing for the debentures.

The Chairman, in moving the adoption of the report, said the payment of the dividends recommended was warranted by the working of the Company; and he thought he might venture to say this much—that rarely had they submitted a more favourable report than the one for the last six months. The increase in the consumption of gas for the half year ended Dec. 31 was about 3½ per cent. and the price received for residuals was very considerable—very much in excess of what the Directors had dared to estimate in preparing their figures in July last. This statement would be very satisfactory to the shareholders, especially when he added that so far during the present year these good results had been continued. In fact, the consumption of gas for the last six weeks had been something very large indeed. Perhaps it might suffice if he stated that the increase the previous week over the corresponding week of last year amounted to no less than about 15½ per cent., which was one of the largest increases, if not the very largest increase, of which the Company had any record. These things he mentioned in order that the shareholders might know the Company were doing well. They had, however, troubles, in spite of this prosperity—troubles which caused their Engineer a great deal of anxiety. These troubles were mainly connected with the delivery of coal. As the shareholders knew, great complaints had arisen in all parts of the country in reference to the inability of gas and other companies who had contracted for large quantities of coal to obtain its due delivery during the winter. Large colliery proprietors with whom this Company had extensive contracts had failed to regularly send in the coal which had been contracted for, and which was really required in order to keep up the supplies of gas. In spite of these anxious troubles, however, the Company had been enabled keep up the pressure and quality of their gas throughout the winter; the public never having had to suffer, either as regarded pressure or quality, in the slightest degree. Such results could not be claimed by all gas companies in the North of England, some of whom had been placed in rather difficult positions owing to failure in the supplies of coal. The Liverpool Gas Company did not take any special credit for having succeeded better than other companies; they might have been better treated, or have been more fortunate. But at any rate, they had been able to discharge their obligations without the slightest delay. The uncertainty about the delivery of coal had, however, given the Directors much cause for anxiety. As the shareholders knew, the Company were hampered for want of storage room for coal; and the absolute necessity for increasing the storage space had been so forced upon the attention of the Directors by recent events, that they had already secured an additional plot of land adjacent to one of their works. This would not make the Company altogether independent of the contracting colliery companies, but it would, at all events, relieve to some extent the anxiety always felt at the commencement of the winter, when through frost or fog the deliveries of coal began to fail. As to the next half year, of course, they could not hope that things would go on as satisfactorily as during the past six months; for it was only right to point out that the price of coal was higher than it was twelve months ago, while in the course of the next month or two the Directors would be advertising tenders for further supplies. It was impossible to forecast what the future price of coal would be; but it must be very considerably in excess of what the Company had been paying during the past few years. Therefore, although there was a very rosy side to the current working, he feared they would find a very adverse account during the succeeding year, for, whatever might be the course of events in the next few months, the price of coal could not be expected to reach nearly the level of last year. Already certain of the gas companies in England had raised their price for gas. Some were probably in small places—still, they afforded an indication of what was going on; and even in Durham, situated close to the coal-fields of the north, they had felt obliged to raise the price of gas by 3d. per 1000 cubic feet. So, while the Liverpool shareholders took the bright side of their Company's account, let them recollect that there was a darker side. All he could say was that the Directors would continue to give the best attention they could to the interests of the Company, both as regarded shareholders and consumers. Even if it became necessary to raise the price of gas, consumers might depend upon it that the Directors would only advance the price under very urgent necessity—not, indeed, until the necessity was absolutely forced upon them would the Directors wish to think of making any change in the present price. He had been in hopes at the beginning of the year that there was such a bright time coming as might lead them to see a fresh record in the price of gas in Liverpool; but the events of the past year were events which combined prosperity with a great deal of care and anxiety. These events had tended to raise the price of coal from which gas was mainly manufactured; and therefore the Company could not hope to work under the same favourable conditions as during the last few years. He moved that the report be adopted.

Mr. James Lister (the Deputy-Chairman) seconded the motion, which was unanimously adopted; and the dividends specified were declared.

Mr. Alfred Tyrer, in moving a vote of thanks to the Chairman and Directors, took an optimistic view of the future of gas companies, quoting figures to show the steady growth in the consumption of gas despite the competition of the electric light.

Mr. James Birkett seconded the motion; and the vote was accorded.

The Chairman, in reply, said: I hope no one will think we have the slightest intention now of raising the price of gas. I only thought it right that, having given you the bright side of the picture, I should put the dark side before you as well.

The workmen employed by the Shanklin Gas Company had their annual dinner (provided by the Directors) on the 15th inst., in the Board-room at the offices. The Vice-Chairman of the Company (Mr. R. Young) presided. After dinner, a long toast-list was gone through; and a very enjoyable evening was spent.

TOTTENHAM AND EDMONTON GAS COMPANY.

An Appreciation of the late Mr. W. H. H. Broadberry—Mr. Corbet Woodall on Current Gas Topics—Additional Capital to be Raised.

The Half-Yearly Meeting of this Company was held on Saturday last, at the Offices, Willoughby Lane, Tottenham—Mr. CORBET WOODALL in the chair.

The SECRETARY (Mr. James Randall) read the notice convening the meeting; and the Directors' report and the accounts, of which an abstract appeared last week, were taken as read.

The CHAIRMAN, in addressing the proprietors, said the report having been in their hands, they would not be surprised to find that he had again to open the proceedings by referring to a grave, personal loss which the Company had sustained since the last meeting. It was not this time a Director who was absent from his accustomed place; but they missed from among them the chief officer of the Company, who had been its guiding spirit to a large extent for 25 years. During the whole of that time, Mr. W. H. H. Broadberry was associated with their friend Mr. Randall, and during a large portion of it with his own son, in the management of the Company's affairs; but practically he was the active governing spirit of the concern for many years. Mr. Broadberry was of a class which he thought this nation produced more than any other. In spite of the deplorable absence of means of technical education in the days in which he was getting his training, he became fully and completely master of the business to which he gave himself—not simply as a good commercial Manager, but also acquainting himself thoroughly with the technical details of it, and, to a large extent, the more scientific applications of it; so that he was able not only to keep himself in line with the development of the gas industry, but also to help it forward in no small degree. In Mr. Broadberry's time the business of the Company increased sixfold. It was lifted from 91 million cubic feet, the amount distributed in the first year of his management, to 575 million cubic feet, the quantity sent out last year. Whatever the future of the Company might be, he (the Chairman) felt quite sure that the name of Broadberry would be honourably associated with the story of its prosperity. He suggested that the meeting should record its grateful sense of the indebtedness which they owed to Mr. Broadberry during his long service with the Company.

The proprietors endorsed the proposal by silently rising.

The CHAIRMAN (continuing) said, in succession to their late friend, the Directors had appointed his son (Mr. Arthur E. Broadberry). Their new Engineer had had many advantages that were denied to, or were beyond the reach of, his father at the outset of his career; and he had also had the benefit of being associated with his father during the years of his ripe experience. The Board therefore felt very confident that the work which the father had begun, and carried on for so many years, would be safe in the hands of his son. He had yet to prove himself; to win his spurs. But he (the Chairman) was sure Mr. Broadberry had the sympathy of the proprietors at the outset of his career, and he might have the confident expectation of the most sympathetic helpfulness on the part of the Directors. Proceeding to move that the report and the statement of accounts be received and adopted, the Chairman said there were a good many things he should like to say, but on the present occasion he preferred to restrain himself. As an industry, they were looking forward somewhat anxiously to the next six months. There would be proceedings in Parliament of a character that would possibly affect very seriously the future of many gas companies, especially those in London and its suburbs; and in view of this, possibly the less said the better at the present time. What he did sincerely hope was that the system of legislation under which the Company had so far worked, and under which it had done exceedingly good service, would not be lightly disturbed or altered. The report for the half year was, on the whole, satisfactory. The most gratifying item was the one which showed that, during the six months, they had had an increase of more than 28 million cubic feet in the quantity of gas supplied, or 10¾ per cent. At this rate, the business would double in something under seven years. This was not a one-sided matter for congratulation. It was very satisfactory to know that the business was growing; but they had to recognize the fact that a large amount of money had to be spent in order to keep in line with this rapidly increasing demand. It was, however, pleasing to know that, while the business was growing very fast, their capital was not growing in the same ratio—that the new business was being obtained at a less expenditure of capital than had to be spent upon the old business. This was the more gratifying when they remembered that the new business was made up to a large extent in a very costly way. He had on previous occasions referred to the heavy capital charge involved in the new business that was obtained through prepayment meters and the gratuitous fitting up of consumers' premises. He noticed that the number of slot consumers was now 8082; while the ordinary consumers numbered only 7901. So that this business—the growth of a comparatively few years—had now outrun the business that had taken half a century to build up on the ordinary lines. It would be palpable to all the shareholders that, while they had doubled the number of consumers, they had not doubled the amount of gas sold, because the new customers under the prepayment system were smaller consumers on the average than those who used ordinary meters. Upon these new consumers, however, there had been an expenditure larger than would have been made upon ordinary ones; but in spite of this, they were able to say that the amount of capital in proportion to the business done was less than it was in 1889. It so happened also that the past ten years had just seen the doubling of the business of the Company. Although these figures were met with so often, he could not get used to them. It was, indeed, very surprising to find that a period of ten years was sufficient, in a district like theirs, to double their whole output. The economy in the expenditure of capital, and the cheaper rate at which the capital was raised, was shown in the fact that, while in 1889 it cost 1s. per 1000 cubic feet to pay the dividends, in the past year, if the proprietors approved of the dividends recommended by the Directors, the whole charge against the price of gas would be only 8·7d. So that upon this item there was a saving of 3·3d. to the consumers. Dealing with the items of expenditure in the revenue account, he said the proprietors would possibly have noticed that there had been an increase of nearly £6000 in the cost of material from which the gas was made—that was, in the coal and in the oil and coke that was used in the manufacture of the carburetted water gas. As against this £6000, they had received, in the increased value of residual products sold, £2600; so that the net increase in the cost of materials was about £3300. Then there had been some economies. Slightly less had been spent on repairs of works; but the corresponding half year was a very heavy one in this respect. Some other economies had also been effected; the net result being that, after providing for the dividend upon the increased capital, they were able to carry forward some £700 more than at the end of the corresponding half of 1898. So much for the past. With regard to the future, it would be affectation to say the Board regarded it with perfectly easy minds. There was no doubt whatever that, judging by present appearances, they would have to pay more, under the new contracts, both for coal and oil, than they had been doing. He hoped the amount would not be so large as indications at and about Christmas time led them to expect. But whatever the additional cost might be, one thing the Directors were quite resolved upon, and that was they would exhaust all the resources they had before they proposed to increase the price of gas in order to meet it. The Directors would struggle, and they would ask their officers to struggle with them, to do everything possible to reduce expenditure. They would be very careful—as careful as they could be—as to the purchases they made; and if it should happen that an increase in the price of gas had to take place, it would only be as a last resort, which would be resisted as long as possible.

Mr. JAMES WARREN seconded the motion, which was unanimously carried.

Mr. D. FORD GODDARD, M.P., moved the declaration of a dividend at the rate of 6 and 4½ per cent. per annum respectively on the "A" and "B" consolidated stocks.

Mr. H. BAILEY seconded the motion, and it was carried unanimously.

An Extraordinary Meeting was then held to consider the question of the issue of further capital.

The CHAIRMAN moved that the Directors be authorized to raise, in accordance with section 17 of the Company's Act of 1898, all or any part (as they thought fit) of the money they were empowered to raise on mortgage by the creation and issue of £44,900 debenture stock. He remarked that it might be within the memory of some of the shareholders that, prior to the passing of the Act of 1898, they had borrowed, on account of the capital raised, the amount of £55,100. It would be remembered that the nominal capital of the Company was increased, and the rate of dividend was decreased. At the same time, they obtained from Parliament the right to issue one-third of the amount of the converted capital as debenture stock. There was some mild opposition to this proposal; but it arose entirely through ignorance of the operation of it. When a large amount of capital was raised at a low rate of interest, it was to the advantage of the Company and very much to the advantage of the consumers, because they had only to pay a low rate of interest upon it. The amount of increased money they were authorized to borrow by reason of the Act of 1898 upon the old capital—not upon the new—was £44,900; and his proposal was that the Directors be authorized to raise this. It was right he should justify the application for leave to raise more capital by showing what the Directors were going to do with it; but having already said that, if they continued to progress at the rate they had been doing, the business would be doubled in seven years or less, it went without saying that they would spend in this period a large amount of capital. He did not say they would have to double the capital, but they would have to raise a large sum—very much larger than they were asking authority to raise that day. In the present year, a new retort-house would have to be built; and they would have to take in hand the erection of a large new gasholder. Then with the increase in the demand for gas, many additional mains would have to be laid, new meters connected, and a large number of new houses fitted up. The Directors had decided to fix the minimum price of the 4 per cent. debenture stock at 115.

Mr. JAMES WARREN seconded the motion, which was agreed to.

Mr. GODDARD next proposed that the Directors be authorized to raise, in accordance with section 6 of the 1898 Act, the sum of £75,000, being a moiety of the additional "B" capital consolidated stock; and under section 18 of the same Act, to create the sum of £25,000 of additional stock, being one-third part of the borrowing powers in respect of the additional "B" capital.

Mr. H. BAILEY seconded the motion, which was at once unanimously carried.

The CHAIRMAN said he would remind the shareholders of the fact that the amount of debenture stock they were issuing was one-third of the amount of the ordinary stock, instead of only the one-quarter they were empowered to issue prior to the passing of the last Act.

Mr. J. L. CHAPMAN, proposing a vote of thanks to the Directors and officers, remarked that, in the few years that many of the proprietors had been connected with the Company, it had grown from a medium-sized concern to one of quite colossal size; and they could appreciate how great had been the difficulties and work of the Directors. While speaking, he should like to say how much he, with many of those who were connected with the gas profession, felt the loss of their friend Mr. Broadberry. He had known him, he might almost say, since he was a boy, had respected him highly, and had found in him a true friend.

Mr. W. B. RANDALL, in seconding the motion, also spoke of the estimation in which Mr. Broadberry was held in the gas profession.

The motion was unanimously agreed to.

The CHAIRMAN responded; and, referring to the officers, he remarked that, while every winter was a fairly trying time for the chief officers of a gas company, he did not think that ever in his experience he had known one that had been more trying than this. Throughout the country, there had been the greatest difficulty in getting materials to carry on the manufacture; and, in their own case, they had been reduced to—he would not say how many days' supply of coal, and how many (he might almost say) hours of oil. Mr. Arthur Broadberry had spent a Sunday promenading up and down the side of the canal, watching for a barge of oil that never came; and he felt that the proprietors owed him their full sympathy. The officers had met the requirements made upon them during this winter; and the proprietors might rely upon them to meet the contingencies in the days to come.

The proceedings then terminated.

BROMLEY GAS CONSUMERS' COMPANY.

The Half-Yearly Meeting of this Company was held on Thursday, at the Bell Hotel, Bromley—Mr. Alexander Dickson in the chair.

The Secretary (Mr. H. W. Amos) having read the notice convening the meeting, the report of the Directors, with the accounts for the six months ending Dec. 31, 1899, an abstract of which appeared in the "Journal" for the 13th inst., was presented.

The Chairman, in proposing the adoption of the report and accounts, remarked that the good progress of the Company was very satisfactorily shown by the increase in the make of gas, which, taken over the whole year, amounted to nearly 11 million cubic feet over 1898. In looking down the statement of accounts, they would see that, under the head of gas, the make for the past half year had been 125¼ million cubic feet; and this was something like 8 millions more than in the corresponding half of last year. Unaccounted-for gas was a little higher than in the previous half year; but he would remind them that this item covered variations in the gas in stock in the holders, which were not taken into account, and it also covered the variations, such as they were, in the dates of taking the different registers of the meters. Turning to the capital account, they would be, as he was, very pleased to notice that the expenditure there was comparatively very small. They would be glad to see that expenditure remain small—at any rate, until the capacity of the works which they had in reserve was actually required for the purposes of the Company. The revenue for the half year amounted to £24,921, as against £23,191 for the corresponding period of last year, which gave them an increase of £1730 on the half year. Of this £1730, about £789 was from the increase of gas-rental, £534 from coke, £221 from increased make and better price of sulphate of ammonia, £71 from tar, and £115 from sundries. On the expenditure side of the account, they had a total of £17,422, as against £15,914 last year, which was an increase of £1508. Dealing first with the items which were in excess as compared with last year, they had had to spend £1668 more in coals. They had laid out in repairs of mains and services an additional £156; on stoves, fittings, and purifying, £181; and there was also an increase in the wages item and small sundries of £2123. Against this, they had some diminished items. Works and retorts cost £198 less, and rates and taxes £414 less. The latter, however, was a matter of account, as the income-tax was now a charge on the profit and loss account, instead of on the revenue account, as it used to be. In the result, they had a profit on the revenue account of £7500; and this was subject to the net amount of interest to be paid, which was £644, and so left them £6856 available. Their dividends of 12 and 9 per cent., with the additional amount that they had to include for the full half-year's dividend on the new shares raised in the spring of the year, amounted to £6555; so that they closed the half-year's account with a surplus of some £300. Carrying this forward to the previous surplus, they had a balance of £2348, in addition to the reserve fund of £6450. In closing the accounts, they had taken the precaution to value their stocks at very low figures, and had also written off very fully every item upon which they felt that a depreciation charge ought to be made. In this sense the accounts were made out as favourably from the permanent point of view as they could possibly wish them to be. Of course, the principal item of interest in the accounts was the question of coals. The very trying conditions of the present coal market had apparently arisen from the unwonted, if not actually unprecedented, activity which had prevailed in every branch of the manufacturing metals market, and in all businesses where coal was required. Under their contracts, they had fortunately mitigated the hardship of the extreme exactions, unless they had to face anything in the future worse than they had experienced hitherto. Whether prices would tighten or whether they would slacken, it was at present almost impossible to say; and prophesying was a very dangerous practice, so he did not propose to follow it. There was one thing which he thought they would all concur in, and that was that an advance in prices of commodities which arose from, or was accompanied by, a general prosperity throughout the whole country, was not altogether undesirable or unwelcome, because when everybody had more to do and got more for doing it nobody grumbled, and if everybody's commodity went up in price and it should happen that gas would have to go up somewhat, it would not be regarded as in any way unreasonable. However, they had not contemplated any change of this kind; and they hoped to be able to weather the storm without having to contemplate it. They rather felt that in giving the public the improved public lighting which the town now possessed, and in giving the consumers a good and sufficient supply of gas at the same rates as were prevalent when coal was so much cheaper, they at least had not been unsuccessful in the principal object of the administration of the gas industry—namely, to accommodate the public at the lowest possible price. That a certain section of coal should within the last two or three years have increased in price something like 200 per cent., would have been thought almost incredible; but nevertheless it had happened. He did not know that they had had any more pleasant time of it than neighbouring gas companies. They had seen by their statements in public that most of them had been in a tight corner; and they had, of course, had their times of anxiety. In the dark days before Christmas, when the delay in the delivery of their coal was causing them some anxiety, they found themselves with three days' stock in hand. He need not say that they dealt with this emergency at once, and immediately purchased a fortnight's requirements at higher prices, over the heads of their contractors—being determined that they should not run any risk with regard to the town or district. He merely mentioned this fact as one perhaps of interest to the proprietors, as showing, with regard to the Directors' claim to their confidence in conducting the business for them, that they acted promptly, and succeeded in tiding through an emergency which had caused many others great inconvenience. Some of them might, perhaps, after having read the report, have the question on the tip of their tongue as to why they had made no mention of the matters which were *sub judice* between the Crays Company and themselves. The simple reason was that these matters were practically precisely where they were when he addressed them at the last half yearly meeting; and the reasons which then induced him to ask them to allow him not to say anything in public upon the points in dispute, were still applicable.

Mr. B. H. Latter seconded the resolution; and it was agreed to.

The Chairman proposed that the dividends, as recommended in the report, be declared; and this was seconded by Mr. Janson and carried.

Messrs. A. E. Willett and A. S. Gedge were then unanimously re-elected Directors; and Mr. W. W. Baynes was re-appointed Auditor.

Upon the proposition of the Chairman, seconded by Mr. Janson, it was agreed to increase the salary of the Secretary by £50.

The Chairman, in reply to a hearty vote of thanks, bore testimony to the admirable services of the chief officers and staff. They had, he said, recently made a recognition of Mr. Woodward's sterling services to the Board during the past year, and could only express their thanks to Mr. Woodward and Mr. Amos for their very great care and industry in protecting and promoting the best interests of the Company. He moved a cordial vote of thanks to all the officers and staff.

Mr. B. H. Latter seconded, and the vote was unanimously accorded.

Mr. Woodward, in reply, mentioned that the past year had not been a bed of roses for any gas engineer; they having experienced very trying times, as coal was almost impossible to get. They had now better materials; and the works were going on as well as possible.

Mr. Amos also returned thanks, on behalf of the staff, for the expression of confidence, which, he was sure, would be appreciated.

The proceedings then terminated.

ASCOT DISTRICT GAS COMPANY.

The Half-Yearly Ordinary General Meeting of this Company was held on Friday last, at the Offices, No. 46, Cannon Street, E.C.—Mr. Robert Berridge presiding.

The Secretary (Mr. W. A. Schultz, F.C.A.) having read the notice convening the meeting,

The Chairman moved the adoption of the report and accounts. He said the shareholders would see from the report that there was a profit of £1290, as against £984 for the corresponding half of the previous year. After providing for every charge against the half-year's working, there remained a balance of £1796 at the credit of profit and loss. Out of this, they recommended the payment of a dividend at the rate of 4½ per cent. per annum. This was a very great improvement; and they could easily have paid 5 per cent. The state of the coal market, and other considerations, however, made it inadvisable to divide more than the amount the Directors recommended. After payment of the dividend, there would remain to be carried forward a sum of £867, as compared with £654 in the corresponding half year. This result the Board considered very satisfactory; it was better than anything the Company had ever before experienced. The revenue showed an increase of 22¾ per cent. over the corresponding half of the previous year. The capital account had been slightly increased. It stood now at £49,161, as against £48,521 at Dec. 31, 1898. The capital expenditure per ton of coal carbonized was £21 6s. in the past half year, as compared with £22 15s. in the corresponding six months of the previous year; and per 1000 cubic feet of gas made, it was £2 1s. 5d., as against £2 4s. 6d. The gas made in the half year under review was 12,630,000 cubic feet, as compared with 11,559,000 feet in the December half of 1898; while the quantity sold was 11,488,100 cubic feet, as against 9,817,100 feet. This showed an increase in the quantity of gas sold of 1,671,000 cubic feet, or about 17 per cent., which was a very good result indeed. The gas sold per ton of coal carbonized had increased from 9000 cubic feet in 1898 to 9416 feet in the past half year; while the unaccounted-for gas had been reduced from 12·5 to 8·1 per cent. The amount received for coke per ton of coal carbonized was 7s. 6d. in the past six months, as compared with 4s. 10d. in the corresponding period; while the amount received per ton of coke sold (less expenses) was 15s. 9d., as against 12s. 7d. The ordinary consumers had increased from 361 in 1898 to 375 in the past half year, while the prepayment consumers had increased from 76 to 94. In 1898, there were 79 stoves on hire; now there were 123. The number of public lamps, too, had grown from 69 to 91. He thought it would be well to say a few words about the remuneration of the Secretary during the change of management. Their late Manager (Mr. Hicks) was obliged, owing to the death of his father, to leave them very suddenly. During the time that elapsed before they could find a suitable Manager, the Secretary had much additional work to perform; and for this, as would be seen from the accounts, the Board had paid him something extra. The item for stationery and printing (£43) might appear somewhat heavy; but he would like to explain that this was caused by the writing off of some old books in the office which were absolutely useless to the Company. Another very important matter which he wished to bring before the shareholders was the question of the gas-works at Bagshot. Bagshot was situated entirely within the district of their Company. The Ascot Company had power to lay their mains through Bagshot, which was an important place. The Bagshot works lit the whole of Bagshot Park, the Duke of Connaught's Estate; and they had a good amount of public and private lighting. The Directors made a special visit to Bagshot, and found the works very dilapidated. They had tried to ascertain what amount would be accepted for them, but up to the present had not been successful. It was announced that the works would be sold by auction by Mr. Alfred Richards on March 6. What the Directors would do, they did not know at present; and nothing final would be decided without consulting the shareholders. His view was that, so long as Mrs. Kemp (the widow of the late Manager and owner) continued to carry on the works, their Company ought not to interfere; but if they were disposed of to an outsider, then the Directors would be prepared to recommend that they should take their mains through Bagshot. By doing this, they would very much improve their position. They would be able to go through Windlesham, from there to Bagshot, and from Bagshot to the top of Bracknell. In this way, they would get a complete circuit, which was an advantage in the matter of economical working. Bagshot was about 2½ miles from Ascot.

Mr. Henry Woodall said it would be rather hard on the purchaser if the Company entered the Bagshot district after he had bought the works.

The Chairman replied that they had written to the Auctioneer, and were going to communicate with the lawyers. Another important question he had to bring forward was the Secretary's salary. When Mr. Schultz was appointed Secretary, the Company was only paying 3 per cent. dividend; but they were now able to pay 4½ per cent. The Board

therefore proposed that the salary of the Secretary should be increased from £75 to £150 per annum.

Mr. Alfred Kitt seconded the motion, which was carried unanimously.

The dividend recommended was then declared, and the increase of the Secretary's salary was agreed to.

The Secretary having briefly thanked the shareholders,

The retiring Director (Mr. Alfred Kitt) and the Auditors (Messrs. T. A. Welton and F. Bridges) were re-elected. It was stated that the remuneration of Mr. Welton would in future be at the rate of 20 guineas, and that of Mr. Bridges at the rate of 10 guineas, a year.

Dr. Strong proposed a vote of thanks to the Chairman, Directors, and staff.

Mr. Woodall, in seconding the motion, said he had looked carefully through the accounts, and thought they were of a most gratifying character. The increase in the number of consumers was not very great; but it was palpable that much had been done to improve the quality of the customers, which was better than getting new ones. The way in which the capital account was coming down in relation to the quantity of gas sold, was very gratifying indeed.

The resolution having been carried unanimously,

The Chairman, Manager (Mr. A. E. Brooks), and Secretary returned thanks.

This concluded the business of the meeting.

BARNET DISTRICT GAS AND WATER COMPANY.

The Half-Yearly Meeting of this Company was held last Friday, at the Albion Tavern, Aldersgate Street, E.C.—Mr. Charles Horsley, J.P., the Deputy-Chairman, presiding.

The Secretary (Mr. Ernest W. Drew, F.C.A.) having read the notice convening the meeting, it was agreed to take as read the report and accounts.

The Chairman, in the first place, explained that he was presiding that day because, he regretted very much to say, their Chairman (Mr. James Glaisher) had been suffering for some time from bronchitis. He also referred to the earnestness with which Mr. Glaisher devoted himself to the Company's interests, and to the genial manner in which he worked with his colleagues on the Board. He was certain the shareholders would join with him in sympathizing with their Chairman, and in an expression of hope that he would soon be with them again. (The shareholders cordially endorsed these remarks.) Turning to the accounts, he remarked that he considered the gas undertaking was in a very satisfactory state; and, when he informed the shareholders that the increase in the consumption of gas during the half year was equal to 7½ per cent., they would agree with him that the business was progressing at a very gratifying rate. The quantity of coal carbonized during the half year was 4754 tons, which was an increase of 356 tons compared with the corresponding half of 1898. The production of gas was equal to 10,951 cubic feet per ton of coal carbonized; and the quantity sold averaged 9942 cubic feet. This, he considered, was exceedingly good working, and reflected the greatest credit on the management of their Engineer (Mr. T. H. Martin, Assoc.M.Inst.C.E.). The coke made was equal to a chaldron per ton (of 21 cwt.) of coal; and the yield of tar was about 11½ gallons per ton. The net gas-rental amounted to £8833; and the expenses, less sales of residuals, &c., to £4825—leaving a profit of £4008. To this had to be added the profit on meters, £161, which gave them a gross profit of £4169. The plant was in good working order; and the new large gasholder which they had erected was working satisfactorily. Dealing with the figures of the water undertaking, he said the gross rental amounted to £11,494. A number of detailed charges, of which pumping was the largest item, made the total working expenditure £6748; leaving a profit of £4748. This, with the profit on the gas undertaking, gave them a total of £8917. If they declared the same dividend as last time, a larger sum than this would be required. Although they had not quite earned it, the Directors proposed to pay the same dividend. The deficiency in the profits was accounted for by some excessive charges which would not occur again—such as the extra cost of pumping by temporary machinery at the new wells during the drought. The Directors proposed to take £1100 from the undivided profits; and this would make up the amount required for the dividends. Regarding the water undertaking, he was happy to say that, during the severe drought of last year, they were enabled to supply the district perfectly, and only had to cease the road watering for two or three weeks. The new engines for the pumps at the East Barnet works were in hand; and the Engineer hoped to have them running this season. When they had them in operation, the pumping account would be brought down to its normal limits. Of course, the item for pumping on this occasion was higher than it should be, because they had not had proper and economical machinery to use; but the new engines would be the most economical now made in regard to fuel consumption. The £1100 which they were short of was accounted for by the extra cost of pumping during the half year. In order to keep the district well supplied, they made use of the contractors' pumps at the new wells from time to time. But the use of these would cease when they got their own engines to work; and the extra cost would then be saved. Taking the two undertakings together, they made a larger profit than in the corresponding period of 1898; so that altogether the report was not a bad one. He concluded by formally moving the adoption of the report and accounts.

Mr. A. H. Baynes seconded the motion.

Mr. R. Johnson pointed out that the Chairman had not said much regarding the work which was being carried out at Potters Bar, but he confined his remarks more directly to the work at East Barnet, which he presumed was a little more successful. According to the water capital account, they did not appear to have expended anything during the past half year. The item to which he referred was rather mixed up. It comprised reservoirs, premises, wells, shafts, conduit pipes, and works for the collection and impounding and storage of water. In 1897, £19,000 was spent in connection with those works; bringing up the total to £48,316. But nothing was shown as having been expended during the past half year; and he should like to know how the outlay at Potters Bar had been charged.

The Chairman replied that the work had not been charged to capital account yet, as it was not finished. The amount expended on works and not yet charged was £27,595. Asked also as to whether he expected the Potters Bar well would be a success, the Chairman answered that they did anticipate a sufficient supply of water to justify them in putting down permanent pumps.

The resolution was unanimously carried.

Dividends were next declared at the rates of 9 per cent. per annum on the "A" and "C" stocks, 8 per cent. on the "B" stock, and £6 6s. per cent. on the "D" capital gas and water stocks and shares.

The retiring Directors (Mr. James Glaisher and Mr. Alfred Lass) were both unanimously re-elected; reference being made to the assiduous manner in which both gentlemen had worked to bring the Company to its present prosperous condition.

The retiring Auditor (Mr. Frederick Lennard) was also re-appointed, on the proposition of Mr. J. L. Chapman.

On the motion of the Chairman, seconded by Mr. Johnson, the remuneration of the Secretary was fixed at £250 per annum.

The Chairman next proposed "that the 3792 fully paid-up shares of £10 each, forming part of the additional capital authorized to be raised by the Company's Act of 1883, be converted or consolidated into 'D' capital water stock, such stock to be divided amongst the holders entitled to the said shares according to their respective interests therein."

Mr. Dyer seconded the motion, which was unanimously carried.

The thanks of the shareholders were heartily accorded to the Chairman and Directors and the officials.

PROVINCIAL GAS AND WATER COMPANIES.

Gas Companies.

When moving the adoption of the report of the Directors of the Aldershot Gas and Water Company (*ante*, p. 347), at the recent half-yearly meeting, the Chairman (Mr. A. F. Wilson) remarked that, like the generals in South Africa, the Company had had to retrace their steps, and increase the price of gas to 2s. 9d. per 1000 cubic feet. He explained that this was due to the coal market, which had become so uncertain that they had to make up their minds to the probability of an increased expenditure of from £2000 to £3000 in the next half year. If during the past six months the price of gas had been 2s. 9d., as it would now be, they would have been £750 more in pocket. Now this would go as a set-off to the extra cost of coal. At the same time there had been a large profit from the fitting and plumbing business, for which the Secretary and the Manager must be credited. From about £50 in the half year the profit had risen to £241. The report was adopted, and the dividends recommended were declared.

The annual meeting of the shareholders of the Barnsley Gas Company was held yesterday week. The report (which was read by the Secretary and Manager, Mr. W. W. Hutchinson) recorded a total revenue of £28,417, against £26,414; the gross profit being £8429, or an increase of £239. In referring to the eminently satisfactory condition of the accounts, the Chairman (Mr. E. G. Lancaster) stated that last year it cost, broadly speaking, £19,910 to make 150 million cubic feet of gas, against £18,233 for 143 million cubic feet the previous year—the increased cost of coal (£1400) about making the difference. The cost averaged about £133 per million cubic feet last year, against £127 in the preceding year. The residual products, however, had given them about £1000 increase. Putting the matter in another way, the gross profit of the concern was £10,274, out of which they had returned to consumers £1845, or equal to 18 per cent. of the profits. With regard to the future, he must admit the Board looked forward with some degree of anxiety. They had two very important questions—the electric light and the price of coal. They carbonized 17,000 tons of coal per year; and if the increased price was only 2s. per ton, it represented £1700. But they were afraid the increase would mean £3000 or £4000. They did not intend to raise the price of gas if they could possibly help it; but the consumers might have to temporarily dispense with the discount, and the further loss would have to be borne by the shareholders. This arrangement, he thought, would be admitted to be reasonable. With regard to the electric light, it was now actually in use; and the shareholders would naturally want to know what effect it had had upon the consumption of gas. They would hardly credit it, but, since the installation had been at work, there had been a larger consumption of gas than had ever been experienced in the life of the Company. The report was adopted; and the maximum dividend declared. A vote of thanks was accorded to the Chairman, Directors, and Manager.

The recent annual meeting of the Barnstaple Gas Company was characterized by a somewhat acrimonious criticism on the part of one or two shareholders. In moving the adoption of the report and accounts, the Chairman (Mr. W. C. Rafarel) remarked that the inflated price of coal and the difficulty of getting delivery had caused the Directors anxiety. They had, however, managed to obtain sufficient coal to carry them on without restricting the supply of gas. The receipts for the year showed an improvement of £530 on residuals account; but, on the other hand, the payments were £975 in excess of those in 1898, partly owing to an over-estimate of the stock of coal and to the stock having been taken in 1897 at less than its full cost. The profit carried to the net revenue account was £1607; and the balance available for distribution was £1700. The gas made last year showed an increase of 1,268,300 cubic feet. The number of consumers was 1042. Since the last meeting, the Corporation had taken over the lighting of the public lamps. Mr. S. Berry, in seconding the motion, said that, notwithstanding the various difficulties which they had to contend with, the undertaking was in a satisfactory condition. Mr. F. W. Petter asked what were the difficulties which the Company had had to surmount. The Chairman said there were always difficulties in carrying on an extensive and complicated business. Mr. Petter asked a question as to the number of public lamps, and alleged that no record of the number was kept in the office. The Secretary (Mr. F. L. Schofield) said there were 292 public lamps, of which one was double and 23 were treble. In the course of further discussion, Mr. S. N. Petter remarked that they were £97 worse off than they were last year, and yet it was thought they had managed splendidly. Mr. H. Ashton complained of the tone of the discussion, and suggested that Mr. Petter should sell his holding. The report was

unanimously adopted; and the usual dividends of 10 and 7 per cent. were declared.

The annual report of the Cheltenham Gas Company shows that sufficient profit has been made to pay the statutory dividends, and leave a balance to the good of £500; the actual profit being £14,085. The consumption of gas was not only greater by 16 million cubic feet, but the largest in one year ever known. Despite this, the profit is nearly £200 less; and the explanation lies in the higher price of coal. The receipts from residual products increased from £11,200 in 1898 to £15,000 last year; the chief gain being for coke. The Directors record that a recent sale of £5000 of ordinary stock realized a premium of £1380 10s.

The revenue of the Colney Hatch Gas Company from the sale of gas in the half year ending Dec. 31 was £6779; being £6290 for 33,776,800 cubic feet used by private consumers, and £489 for 2,626,300 cubic feet used for public lighting. The sale of residuals produced £1593; and the total receipts were £9087. The expenditure being £6686, the balance carried to the profit and loss account was £2401. The amount available for distribution was £5012; and the Directors recommended dividends at the rate of 10 per cent. per annum upon the original shares, 7 per cent. per annum on the additional shares and stock, and 5 per cent. per annum upon the preference shares. The payment of these dividends will absorb £1868, and leave £3144 to be carried forward. The Directors reported continued growth of the Company's business. The quantity of gas sold was 9 per cent. more than in the half year ended Dec. 31, 1898; and a further increase also took place in the value of residuals. But against these improvements had to be set the higher cost of coal, wages, and material; and it was expected that a still larger advance in the cost of coal would probably have to be met during the present year. Additional manufacturing plant is in process of erection, and further additions will have to be made from time to time in the near future, to enable the Company to meet the constantly growing demand for gas.

In the report of the Eckington and Mosbro' Gas Company, it is stated that, owing to the increase in the price of coal and the installation of the electric light at the Holbrook Colliery, the price of gas has been raised from 3s. 4d. to 3s. 9d. per 1000 cubic feet. From the balance standing to the credit of profit and loss account, the Directors are able to declare a dividend of 7 per cent.

The half-yearly general meeting of the Farnworth and Kearsley Gas Company was held last Thursday—Mr. J. W. Watkinson, the Chairman, presiding. The Directors in their report stated that the profit on the revenue account amounted to £3019, and that a sum of £5333 was available for distribution. They recommended the payment of dividends at the rate of 10 per cent. per annum on the "A" stock and 7 per cent. per annum on the "B" stock and on the "D" shares (all less income-tax). In moving the adoption of the report, the Chairman said he was pleased once again to refer to the satisfactory condition of the Company. During the past half year, there had been a material increase in the quantity of gas sold, and also an improvement in the revenue derived from the sale of residuals. He was proud to state that the increased cost of coal and cannel, and the recent reduction in the price of gas, had not to any great extent affected the working results. Mr. J. Holland Watson, in seconding the motion, supplemented the remarks of the Chairman by referring to the accounts and the healthy financial condition of the Company. The report was adopted, and the dividends recommended were declared. Mr. W. Watson moved, and Dr. Walter Morris seconded, a hearty vote of thanks to the Directors and officers of the Company; and the motion was carried by acclamation. The Vice-Chairman (Mr. J. Fletcher) and the Manager (Mr. T. L. Sheppard) returned thanks; and the proceedings terminated.

Addressing the shareholders at the annual meeting of the Ipswich Gas Company on Monday last week, the Chairman (Mr. G. A. Biddell) alluded to the state of the coal market. So far as the Company were concerned, he remarked that their contracts had still a few months to run; and unless prices were very much increased, they hoped to get through without raising the price of gas. A shilling per ton increase in the cost of coal represented £1500 a year to the Company; but they were never in so good a position to meet a reasonable advance as they were this year. Referring to the capital account, he said that, notwithstanding the heavy expenditure, chiefly for new purifiers, the proportion of capital to coals carbonized had been reduced to the lowest figure it had ever been at—viz., £4 16s. 4d. per ton. Then, besides renewing half-a-mile of main, three miles of new mains had been laid; and arrangements had been made to at once put down some new arterial mains at considerable cost. There were now over 50 miles of mains, bringing in a revenue of nearly £800 per mile, with an average of 145 consumers per mile, out of a total of 7235 consumers; besides 1358 public burners. The quantity of coal carbonized during the year was 29,537 tons, which was 3585 tons more than in 1898. The increase in the make of gas had been 10·2 per cent., as against 5·88 per cent. in 1898. They had sold 277 million cubic feet; being an increase of 24¼ millions. Thirteen years ago, the consumption was just half this quantity. The receipts for gas were £40,284—an increase of £3162. About one-fifth of this total (£8252) was from slot meters. There were now 4000 of these popular instruments fixed—an increase of 583; while 140 more were on order at the end of the year. Residuals had produced £13,650—an increase of £3212. Coke brought in £10,034, rather more than half the cost of coals. The total revenue was £54,064, as against £47,673 in the previous year. He also directed attention to the expenditure of £7259 for repairs and maintenance; remarking that he liked big figures under this head, as they showed that the works were maintained in a state of good repair. The outcome of the year's earnings enabled the Directors to pay the full dividends on all stocks, and to carry forward £7079. He added that there were in Ipswich about 2150 domestic gas-fires, 680 cookers were used by ordinary consumers, and 600 were attached to slot meters. There were also upwards of 100 gas-engines fixed; being 14 more than last year. Mr. D. Ford Goddard, M.P., in seconding the motion for the adoption of the report and accounts (which were noticed last week), pointed out that the eleven largest gas companies whose accounts were available realized 90·74 per cent. of the gas made in 1898; while in Ipswich they realized 93 per cent. This, he thought, was evidence that great attention had been paid to this part of the business by their Engineer and Secretary (Mr. J. T. Jolliffe) and the Directors; and there were other features which served to illustrate the great care bestowed upon all the details of the work. The balance-sheet was so satisfactory that it would defy any serious criticism. It all came to this—and they, as Directors, gladly acknowledged it—that the Company had a Manager and staff who took the greatest possible pains to make the undertaking successful in every branch of its operations. The motion was carried unanimously. Dividends were declared at the rate of 12 per cent. per annum on the "A" stock, 9½ per cent. on the "B" stock, and 9 per cent. on the "C" stock.

The annual general meeting of the Leighton Buzzard Gas Company was held on Monday last week—Mr. R. Richmond presiding. The accounts presented showed a profit of £1396 for the past year; and the addition of the balance of £223 brought forward made a total of £1619 standing to the credit of the profit and loss account. Out of this sum, the Directors recommended the declaration of dividends at the rate of 8 per cent. per annum on the original stock, and £5 12s. on the new ordinary stock, free of income-tax. The payment of these dividends will absorb £1206, and leave a balance of £413 to be carried forward. Reference was made to the loss by death of the former Chairman (Mr. F. Bassett) and two other Directors (Dr. Lawford and Mr. W. S. Page). The Chairman, in moving the adoption of the report, said he had to record the death of three Directors within the year, which he hoped he should never have to do again. The loss of these gentlemen was a serious blow to so small a Company. The accounts showed that the concern had had a successful year, notwithstanding the adverse circumstances they had had to contend with; and there had been an increase in the consumption of gas. Of course, the expenses had been greater. Residuals, however, were satisfactory, and they had no law charges this year. From a shareholders' point of view, they might pay another ½ per cent.; but this would be unwise without some prospect of maintaining it. Mr. Willis seconded the motion; and it was carried. Subsequently, the Directors were authorized to issue an additional £2000 of new ordinary 7 per cent. stock, under the provisions of the Company's Act of 1891. The Chairman explained that their Manager (Mr. C. F. Ruggles) had been anxious about the working; and he did not feel justified in going through another year without more retorts. To provide these they required money; and they had already overdrawn their capital account. A vote of thanks having been accorded to the Chairman, Mr. Richmond, in replying, proposed a similar vote to the Manager and the staff for the way in which they had carried on their work. This having been passed, Mr. Ruggles, in acknowledging it, spoke of the pleasure it gave him to act under such Directors as those of the Company, and said he was proud to know that they had what were recognized in the gas world as works which were among the best in the country.

The total receipts of the Littleborough Gas Company in the six months ending Dec. 31 amounted to £4660; the expenditure, to £2980. The profits were £1680, against £1544 in the corresponding period of 1898. The amount available for distribution was £2789, including the balance brought forward; and the dividends absorbed £1450. The reserve fund now stands at £3000.

The annual accounts of the Matlock and District Gas Company show a profit amounting to £2772, which, with the unappropriated balance, gives an available sum of £3564. From this an interim dividend has been paid; and the Directors now propose the payment of the statutory dividends of 5 and 3½ per cent. on the respective stocks and shares for the past half year. This will leave £1419 to be carried forward. Notwithstanding the rise in the price of materials and the increase in wages, the Directors made a reduction in the price of gas of 2d. per 1000 cubic feet from Jan. 1 last.

The half-yearly report of the Mirfield Gas Company states that the profit for the past six months amounts to £3158; making the sum available for dividend £4234. The Directors recommend the usual dividend of 10 per cent. on the old shares, and 7 per cent. on the new shares, and that the balance of £1734 be carried forward.

Presiding at the annual meeting of the Newcastle and Gateshead Gas Company last Wednesday, the Chairman (Mr. L. W. Adamson) moved the adoption of the report and accounts, which were noticed in last week's issue. He said for the year 1898 the balance of undivided profits was £3579; this year £3406 was carried forward to next year's account. For 1898 the profits were £70,227, and for last year £80,616. The gross amount available for dividend for 1898 was £73,309, and now £84,195. Out of this, the Directors recommended a dividend at the rate of 5 per cent. per annum on the preference stock, 9¼ per cent. on the ordinary stock, and the appropriation of £8000 to the reserve fund. It was necessary to transfer this sum to reserve, in order to meet the increased cost of material, which was almost certain to rise, and to prepare for very large extensions of mains. The Directors were fortunate in making their contracts for coal during the past year. In June, they thought they were paying rather a high rate for coal; but if they had had to buy it in the market in December, it would have cost them considerably more. The contracts which they were fortunate enough to enter into enabled the Company to meet their obligations to the public without having to increase the price of gas. The profits derived from residuals had improved; and the quantity of gas delivered had increased. The lighting of the city had never been so good as it was now; and all the experiments in lamps and lights had been carried out at the expense of the Company. When the new works were completed, their facilities for producing cheap gas would be greater. It was quite true they had complaints; but everybody in business had them. The Company had used every exertion to remove all cause of complaint, and had paid no regard to expense in doing so. The motion was adopted; and it was also decided to make a grant of £250 out of the net profits to the Queen's Commemoration New Infirmary Fund.

At the recent annual general meeting of the Newmarket Gas Company, the accounts presented showed that the revenue from the sale of gas to private consumers in the year ending Dec. 31 amounted to £8020, and that the total receipts were £12,429. The expenditure having been £8912, there was a balance of £3517 to go to the profit and loss account, the sum standing to the credit of which was £4349. The Directors, in their report, recommended that out of this sum a dividend at the rate of 6¼ per cent. per annum should be paid (less income tax), amounting to £3770, and leaving a balance of £579 to be carried forward. Under the supervision of the Manager and Secretary (Mr. J. H. Troughton), the works and plant have been increased and improved, a sum of £1387 having been expended on capital account during the year—£357 for new lamps and fittings, £334 for new sulphate plant, and £381 for a new

washer-scrubber. In moving the adoption of the report, the Chairman (Mr. R. Stephenson) said the past year had been a rather trying one, because for the first time they had had the competition of the Electric Light Company. While coal had cost £587 more than in 1898, the amount received from the sale of gas was £92 less. With regard to residuals, however, they had done well, in consequence of the new sulphate plant, which had cost £334 and had realized a gain of £145. As to the competition of the electric light, they had taken £198 less, from 59 customers, in the past half year than they would have done had there been no Electric Light Company in Newmarket; and, of course, they could not say that they might not lose a few more. If the other side would only state what those 59 customers had paid for electric light during that period, it would be most interesting information for the public of Newmarket, as they would then be able to judge whether, in fact, the Gas Company were supplying light cheaper or dearer than their opponents. Of course, the only real way to ascertain exactly what one system of lighting cost as compared with the other, would be to have two rooms of precisely the same size equally lighted, one with gas and the other with electricity, and have a meter on each room. If this were done, he would undertake to say that it would be found that the Gas Company could give as much light for 1s. 6d. as the Electric Light Company could for £1. He would almost throw out a challenge to that Company, if they would accept it, to have two rooms lighted in the manner he had suggested; but he did not think it at all likely that it would be accepted, for the Engineers advising the Company knew very well the comparative cost of the two lights, and a challenge of that kind had never yet been taken up. In the matter of the public lighting, the two Companies tendered against each other; and the result was that the Gas Company showed that they could supply five or six times more light for a given sum of money than their competitors. With regard to other matters, he was afraid that next year there would be a further rise in the price of coal; but while he looked forward to this, he thought there would also be an increase in the quantity of gas sold. He took a very cheerful view of the position of the Company, and thought it would be quite as flourishing in the future as it had been in the past. Mr. Musk having seconded the motion, Mr. Rodrigo put some questions in regard to the Company's coal contracts, which were answered by the Chairman and Mr. Troughton; and the report and accounts were then unanimously adopted. It was subsequently decided to increase the remuneration of the Directors by 25 per cent.

The ordinary half-yearly meeting of the Portsea Island Gas Company took place last Saturday—Alderman Sir John Baker, M.P., in the chair. The accounts for the six months ending Dec. 31 last showed an available balance of £35,138, exclusive of the sum standing to the credit of the extraordinary renewals account (£3177), which enabled the Directors to recommend the payment of dividends at the rates of 13 per cent. per annum on the "A" and "B" shares, 12 per cent. per annum on the "C" shares, and 5 per cent. per annum on the stock, less income-tax, and left a balance of £22,946. The Directors reported that during the past half year 40,809 tons of coal had been carbonized, as compared with 38,672 tons in the corresponding period of the previous year; and 423,688,000 cubic feet of gas were manufactured (23,158,000 cubic feet in excess of the corresponding period), of which 390,965,200 cubic feet were sold. The residual products sold included 30,025 chaldrons of coke, 2339 chaldrons of breeze, 426,255 gallons of tar, and 692,428 gallons of ammoniacal liquor. The Chairman, in moving the adoption of the report, said the Directors had the keenest pleasure in again meeting the shareholders, owing to the very great success which still attended the undertaking. In order to strengthen and improve their position, their engineers had made great progress with the water-gas plant; and notwithstanding all the threats which had been made to them upon the subject of the introduction of electricity, they still found that they had an increasing revenue, while from the automatic prepayment meters there were receipts amounting to £400 per week. It was very satisfactory, too, that, in consequence of the contract they had made, they had avoided the "coal ring," and were still obtaining their coal at 10s. 11d. per ton. This, they trusted, would continue until the present very heavy extra prices were lowered. The Vice-Chairman (Alderman Sir W. D. King), in seconding the motion, said there was one item which the Chairman had not touched upon, and that was the large returns from the residuals. On the coke alone there was an extra revenue of about £4000 on the half year. The motion was carried unanimously; and the payment of the dividends recommended was authorized.

The half-yearly general meeting of the Reading Gas Company was held last Tuesday, when the Directors reported a continuous and considerable increase in the quantity of gas sold in the six months ending Dec. 31, together with a revenue from residuals largely in excess of that for the corresponding portion of 1898. The prevailing high price of coal added materially to the cost of gas manufacture in the period covered by the report; while its irregular delivery, especially about Christmas time, caused the Directors great anxiety. As, however, some improvement has already taken place, they hope to successfully cope with the difficulty. The accounts accompanying the report showed that the sale of gas for public and private lighting (10,937,000 and 169,695,500 cubic feet respectively) produced £25,123; the revenue from residuals was £9102; and the total receipts were £34,272. The expenditure on the manufacture of gas came to £23,078 (coals costing £16,927); on distribution, to £2374; and on management, to £1514—the total being £29,302. The balance carried to the profit and loss account was £4970; and the amount available for distribution was £19,057. The Directors recommended the payment of the full dividends for the half year on all the stocks and shares of the Company. Under the supervision of Mr. Herbert E. S. Baker, the Company's Engineer, 18,113 tons 13 cwt. of coals were carbonized; the residual products being: Coke 18,113 chaldrons, breeze 214 loads, and tar 183,626 gallons. There were 180 tons of sulphate of ammonia made during the half year, all of which was sold.

The annual general meeting of the Redhill Gas Company was held on the 15th inst.—Mr. H. Stenning in the chair. The Directors reported that the consumption of gas in the past twelve months showed a marked increase on previous years; and owing to the extra demand, it had been found necessary to extend the works. The new plant was in course of erection. The accounts showed that a sum of £5329 was available for distribution, out of which the Directors recommended the declaration of a dividend at the rate of 9½ per cent. per annum, less income-tax; leaving a balance of £279 to be carried forward. An interim dividend of 4½ per cent. was paid in September. The Directors referred with regret to the resignation, followed shortly afterwards by the death, of the late Chairman, Mr. John Lees. In moving the adoption of the report, the Chairman stated that the business of the Company had been highly satisfactory, for there had been an average increase of 12 per cent. over 1898. Their prepayment meters, of which they had 800 out, accounted for a certain proportion of this. Further enlargement of the works was absolutely necessary. They must have another holder and additional plant to keep pace with the growing demand for gas. With the object of obtaining more land for extensions, a Bill had been promoted which they hoped would be carried through satisfactorily. A good deal of credit was due to the Engineer (Mr. D. H. Helps), who had served them well. Mr. Hunt seconded the motion, which was carried; and the dividend recommended was declared.

The half-yearly general meeting of the Riddings District Gas Company was held last Friday, when the accounts presented showed that the revenue from the sale of gas in the six months ending Dec. 31 last was £1925, and that the total receipts were £2290. The expenditure being £1483, the balance carried to the profit and loss account was £807. The amount available for distribution was £2420; and the Directors recommended the declaration of a dividend at the rate of 6 per cent. per annum, free of income-tax.

At the meeting of the Rugby Gas Company yesterday, the Directors expressed their pleasure at again being in a position to report that the affairs of the Company are in a satisfactory condition and the works (under Mr. Charles Meiklejohn's supervision) in a high state of efficiency. The accounts for the past year showed that the sale of 64,672,800 cubic feet of gas in Rugby itself produced a revenue of £8249; the quantity sold in the out-districts (1,018,500 cubic feet) yielding £155, and that used for public lighting £3143—making a total of £11,547. Residuals returned £3378; and the total receipts were £15,839. The manufacture of gas cost £8500 (of which £5503 was for coals); distribution, £467; and management, £1097—the total expenses being £10,771. The balance carried to the profit and loss account was £5068; and the amount available for distribution, £6455. The Directors recommended the declaration of a dividend at the rate of 12½ per cent. per annum, amounting to £2178, free of income-tax; making, with the interim dividend, 12½ per cent. for the year. The working statements in the accounts showed that the bulk of coal and cannel carbonized last year weighed 8662 tons; the estimated quantities of residuals produced being: Coke, 5197 tons 15 cwt.; lime refuse, 192 tons; breeze, 216 tons 11 cwt.; tar, 504 tons; ammoniacal liquor, 969 tons.

At the half-yearly general meeting of the Scarborough Gas Company on the 17th inst., the Chairman (Mr. B. Fowler), in moving the adoption of the report, noticed in the "Journal" a fortnight ago, stated that the total quantity of gas sold in the six months ending Dec. 31 was 149,524,300 cubic feet—being an increase of nearly 6 millions, or slightly over 4 per cent., as compared with the corresponding period of 1898. The number of consumers had augmented by 329 during the twelve months; and there had been an addition of 71 cooking-stoves. The gross receipts were £25,420—being an increase of £1315; and the payments were £17,121, or £1328 more than in the corresponding half year. The extra expenditure was mainly due to the increased cost of coals—2s. per ton. Had the Company not been fortunate enough to possess a two years' coal contract, he did not know what they would have done. The balance carried to the profit and loss account was £8298, as compared with £8310; and the amount carried forward, after payment of the dividends, was £1665, as compared with £2110—a decrease of £445, which was accounted for by the increased amount required for the half year's dividend consequent on the increased capital. Mr. Butterfield seconded the motion. Mr. Whitfield pointed out that the Company were using 500 gallons of oil per day in the manufacture of water gas; and he remarked that, in the event of a coal famine, this would be a new power in their hands. The Chairman, in reply, agreed that it certainly would. He added that recently they had been very near the end of their coal, and if it had not been for water gas, things might have been serious. When they started making water gas, the cost of the oil was 3d. per gallon, and now it was 7d. Fortunately, the Company had a contract at the lower figure, which had not run out. In the course of the proceedings, several references were made to the ability displayed by Mr. Holliday, the Company's Engineer and Secretary, in carrying on the works, upon which the Chairman said a great deal had lately been spent—he believed wisely. The report was adopted, and the maximum dividends were declared.

At the annual general meeting of the South Shields Gas Company to-morrow, the Directors will present accounts which show that the sale of gas for public and private lighting last year brought in a revenue of £54,473; residuals producing £13,364, and the total receipts being £72,372. The expenditure on the manufacture of gas amounted to £46,260 (coals costing £27,613); on distribution, to £2324; and on management, to £2520—the total expenses being £56,420. The balance carried to the profit and loss account is £15,952; and the amount available for distribution is £6440. As the statutory dividend for the latter half of the year comes to £7817, there is a deficit of £1377, which it is proposed to take from the reserve fund. The dividend will be 4½ per cent., which, with the interim dividend, will make 8¾ per cent. for the year. In their report, the Directors state that the sale of gas last year exceeded by 15,547,015 cubic feet that of 1898, or at the rate of 3½ per cent.; and there was a net increase of £4727 in the rental. On the other hand, coals cost £5393, or 24½ per cent. more; and there was an increase in the wages account of £1356, or upwards of 7¼ per cent. Under the supervision of Mr. W. J. Warner, the Company's Engineer and Manager, 50,455 tons of coal and 2093 tons of cannel were carbonized last year; and of the total bulk of gas made, 392,730,100 cubic feet were sold for private consumption. The quantities of residual products were: Coke, 33,076 tons; tar, 519,695 gallons; and ammoniacal liquor, 525,280 gallons, which was used in the manufacture of sulphate of ammonia.

The half-yearly meeting of the Wakefield Gas Company was held on Monday last week, under the presidency of Mr. W. A. Statter, J.P., the Chairman. The notice convening the meeting having been read by the Secretary (Mr. W. H. Parker), the Chairman went through the various

items of the accounts (briefly referred to last week), and stated that the half year had been very satisfactory; the profit being £469 more than was required to pay the usual dividends, while the increased make of gas amounted to 7,199,000 cubic feet. They had, however, very great difficulty in getting coal, and this, added to the demand for gas, had made the period covered by the report a very anxious time. During the half year, some remarks had been made with reference to the quality of the gas. The shareholders would therefore be pleased to learn that in the years 1894-6, when Mr. T. Fairley tested the gas, the average of 34 tests showed that the quality equalled 16·75 candles, or 1·75 candles more than the parliamentary standard; while the average of 62 tests in the years 1896-9, made by Dr. Chaplin, showed 16·28 candles, or an excess of 1·28 candles beyond the standard. There had been 60 tests in the past three years, showing an average of 15·8 grains of sulphur—a result which would compare favourably with that of any other gas undertaking, although the Company had no parliamentary limit for sulphur compounds. As to the pressure, the Examiners reported an average of 2·75 inches when the pressure required by the Act was 8-10ths of an inch, or 343 per cent. above the parliamentary standard. These tests were all taken at the Town Hall, by the Gas Examiners appointed by the Corporation, at times quite unknown to the Company; and during the whole of the period from 1894 to 1899, no legal test was found below the standard. The new works were proceeding satisfactorily, notwithstanding the fact that the contractor had been delayed in putting the roof on the new retort-house owing to the difficulty in getting iron. Mr. Statter concluded by moving the adoption of the report and accounts. The motion was seconded by the Vice-Chairman (Mr. G. H. Roberts), and carried. The payment of the usual dividends at the rates of 11½, 9, and 8½ per cent. per annum on the various classes of shares, clear of income-tax, was then authorized. The best thanks of the meeting were next unanimously accorded to the Chairman for presiding, and to the Directors for their attention to the interests of the Company. In responding, the Chairman proposed in generous terms the usual vote of thanks to the staff, which was acknowledged by the Engineer (Mr. H. Townsend) and the Secretary.

The half-yearly general meeting of the Weymouth Consumers' Gas Company was held last Thursday, when the Directors congratulated the proprietors on the fact that the profit made in the six months ending Dec. 31 was sufficient to meet the fixed charges on the loan capital, pay the maximum dividend upon the ordinary stock, and carry forward £111. The disturbed state of the coal market caused the Directors considerable anxiety, and great difficulty was experienced in obtaining sufficient coal to keep up a full supply of gas. This object was only achieved by buying in districts other than that from which the Directors usually get their supplies, and at enhanced prices. There was, however, a good market for coke; and in this way the increased cost of coal was met. The accounts presented showed that for public and private lighting 36,738,000 cubic feet of gas were sold, realizing £7054; residuals produced £1395; and the total receipts were £8727. The manufacture of gas involved an expenditure of £5136 (coals costing £3342); and the total expenses were £6367. The balance carried to the profit and loss account was £2369; and the amount available for distribution, £4135. The Directors recommended the payment of a dividend at the rate of 5 per cent. per annum, less income-tax. Under the supervision of the Manager and Secretary (Mr. James Lowe) a portion of the works is being reconstructed. A vote of thanks was accorded to the Chairman, Directors, and Manager.

Water Companies.

At the meeting of the East Worcestershire Water Company on Thursday, the report which was noticed on the 13th inst. was adopted. The Directors were authorized at a subsequent extraordinary meeting to issue 3 per cent. debenture stock to the amount of £7000, and 617 new £10 shares at a premium of £2 10s. The money is required for extra works which are being carried out.

Proposing the adoption of the report and accounts of the Sunderland and South Shields Water Company at the annual general meeting held last Thursday, the Chairman (Mr. James Stokoe) stated that during the past year they had expended on various works £46,303; making the total expenditure on capital account £811,010. The balance to profit and loss account was £37,048, against £38,638 in the previous year. This decrease could be accounted for by the fact that there had been a good deal more rain last year than in the previous one; and consequently there had not been the same draft upon the Company. The balance-sheet showed £10,664 due to bankers, against £17,611 in 1898. The report was unanimously adopted; and dividends at the rates of 4½, £3 3s., and £2 5s. per cent. on the various classes of stock were declared.

Mr. F. James presided at the meeting of the South Staffordshire Water Company last Thursday; and in moving the adoption of the report (*ante*, p. 415), commented upon the considerable increases in expenditure during the past half year. Engine charges, he said, had gone up from £5085 in the corresponding period of 1898 to £7224; and he could hold out no hope that the item would be less rather than greater in the current half year. The cause of the increase in engine charges was that the cost of coal was greater; for, whereas in 1898 the average per ton was 5s. 5d., last year it was 6s. 7d. The contracts for coal did not run out till July this year. The increase in the amount of coal consumed was due to the greater quantity of water pumped; the total increase in the last half year amounting to 104½ million gallons. The cost of maintenance of works had gone up from £3616 to £6648. Of this large sum, £700 was spent in cleansing a reservoir; but this was not a recurring charge. There had been a satisfactory increase in the water-rates; and although in the half year the expenses had been so heavy, they had earned £1035 more than the sum required for the payment of the dividend. On capital account £11,381 had been expended, bringing the total expenditure on the works to £1,120,000. He recollected that, when they went to Parliament on the formation of the Company, it was anticipated that £200,000 would be the cost of supplying South Staffordshire with water. Now they had reached a sum of £1,120,000; and this was not to be the end of it. During the half year the Company had laid between 10 and 11 miles of mains, largely in old districts; and altogether they had between 600 and 700 miles of mains. The number of houses connected during the half year was 2483; making the total supplied 103,965. The report was adopted.

THE RECENT FLOOD AT GUILDFORD.

Interruption of the Lighting and Water Supply.

In the "Journal" last week, we briefly recorded the interruption in the gas and electric light supply at Guildford in consequence of the flooding of the town on the night of Friday, the 16th inst. The water in the Wey was higher than it has been since 1824; and about half-past six on the evening of the above-named day, the mass of timber which had been brought down the river, and had accumulated against the arches of the town bridge caused the latter to collapse, and fracture the gas and water mains laid upon it. There was, at first, naturally a large escape of gas; but fortunately the ends dropped into the water, and sealed themselves, so that the loss and danger were lessened. On it being ascertained that there was not such an escape as was at first thought, and it being dark when the bridge broke away, nothing was done on Friday night. On Saturday morning, however, as soon as it was daylight, part of the *débris* was cleared away, and the ends of the mains bared, and plugged with clay. They were afterwards cut off on either side of the bridge, and blocked up. The 5-inch and 4-inch mains were then connected on one side of the bridge, and that district was thus afforded a partial supply of gas on Saturday and Sunday. At the gas-works, a stop was put for a time to the making of carburetted water gas. The water found its way to the plant, and rose as high as the blowers, which prevented their working. The fires of two of the boilers had to be drawn; but there was no interference with the manufacture of coal gas. The substantial walls round the works kept the water out to a great extent; and, moreover, there was a good stock of gas in the holders.

The water caused considerable interference with the working of the electric lighting plant. In one building there are three 40-horse power generating machines. Two of these were running on the morning of the 16th; but as the water continued to rise their working was stopped, and the water was so deep that the coils were just under it. In the building adjoining are two 100-horse power machines, which stand considerably higher than those above referred to; and on the former being stopped, one of the latter was set to work. The water, however, about half-past three in the afternoon, reached such a height that sufficient draught could not be obtained to keep up the steam; and accordingly the plant had to be shut down. As a result, there was no electric light in the town between Friday afternoon and Saturday morning, when a portion of the machinery was started again. Some of it was not able to run last Thursday morning; and it must therefore be a matter of time before the actual extent of the damage can be ascertained.

At the water-works, the water in the well was within 12 inches of the cover at ten o'clock on the morning of the 16th; and the engine-house was inundated to a depth of 2 feet. All the auxiliary power, both steam and gas, was thus cut off, and the pumps were useless. According to a statement made to a Press representative by the Borough Surveyor (Mr. C. G. Mason), this state of things must have commenced about 2 a.m. When the Water Engineer (Mr. H. Smith) visited the works at 6 a.m., there was a foot of water in them. The high-service reservoirs, which contain 600,000 gallons when full, were 1 ft. 9 in. down; and about 100,000 gallons had gone out since the pumps stopped. The low-service reservoirs were 5 ft. 6 in. down, and contained approximately 300,000 to 350,000 gallons. The flood occurred at a most inopportune time, as the mains had been subjected to a very severe strain by the late frost, and some very bad leaks existed; thus allowing the water to get away much quicker than it would have done under ordinary circumstances. Several of the staff were very busy for a long time securing the loose fittings which were floating about at the works. In the emergency, Mr. Mason consulted with the Town Clerk and the members of the Water Committee, and it was decided to seek the assistance of the Woking Water Company; and Mr. Quick, their Consulting Engineer, was at once communicated with by telegraph. The following morning he went to Guildford, and had an interview with the Water Committee; and, as the result, Mr. Mason was instructed to couple up the Woking mains wherever he could. Fortunately, when the Company some time ago apprehended trouble in regard to their supply, connections were made with their mains at two points. These, therefore, were available for the assistance of Guildford by simply reversing the meters. This work was completed on Saturday, and a small section of the town at once enjoyed the benefits of a full supply from the Company. By eight o'clock on Sunday evening, a 3-inch connection was effected which gave a supply to the low-level districts. This assistance came just in time, as the low-service reservoirs had become exhausted. As soon as the floods abated from the engine-house steam was got up, and subsequently a connection was also made with the new 8-inch rising main laid nearly two years ago. The power thus obtained was employed to drive the water-pressure engine over the well, and pumping was commenced in earnest at eleven o'clock on Sunday morning. The mains in the town were all shut off, and the large quantities of water in the well and the adjoining tank were dealt with. There were twelve hours' continuous pumping; and it was resumed on Monday morning—water of the finest quality being sent into the river before pumping into the reservoirs was started. At eleven o'clock on Monday morning, instructions were given to lift the water to the high and low service reservoirs; and by Monday night the water supply had assumed its normal conditions, with the exception that, instead of having full reservoirs, they were only half full. At a special meeting of the Town Council held on Tuesday evening to consider the damage done by the flood, the Chairman of the Water Committee (Alderman Salsbury) made a statement in regard to the difficulty experienced at the water-works, and said he thought the Council should recognize Mr. Quick's kindness in so promptly coming to their assistance. The Woking Company had agreed to supply them with water at 1s. per 1000 gallons and the cost of altering the meters; and he moved the approval of this arrangement. The Mayor (Mr. H. Peak) in seconding the motion, said the thanks of the Council were due to Mr. Quick for the kindly manner in which he came down and met the Committee; and, as the members would recollect, he was willing to do anything they asked him that would help them. He should like also to point out that their own officers had worked splendidly, and their men too. Wherever the members of the Committee went, they found their officers and men working and trying to help them in every possible way. The motion was carried *nem. con.*

GAS v. ELECTRICITY AT NEWMARKET.

Readers of the "JOURNAL" are aware that Mr. J. H. Troughton, the Manager and Secretary of the Newmarket Gas Company, has laid before his fellow-townsmen and gas consumers generally, in a little pamphlet he has written, a very convincing statement as to the relative economical value of gas and electricity as illuminants. He finds nevertheless that, at all events in the sphere in which he labours, statements are industriously circulated by persons interested in the electric light which have to be combated. He has therefore inserted in a local paper a conspicuous advertisement, the principal portions of which are brought into prominence by the use of heavy type, in which he once more demonstrates the real worth of gas. He shows that when used with the Kern burner its cost is only one-fifteenth that of the incandescent electric light; while with the older type of incandescent burner it is one-eighth, and with the old-fashioned flat-flame burners one-half. With the Kern burner, the Company are now supplying 100-candle power gaslight for less than is being charged for 8-candle power electric light. It is well to put this fact clearly before the consumers, as canvassers for the electric light, as is pretty well known, quietly ignore the new burners, and make their comparisons with practically obsolete types; moreover, they are careful never to allude to the liability of their illuminant to sudden extinction. A system of free wiring is being pushed in Newmarket; the rental for the fittings being a halfpenny in addition to the 7d. per unit charged for the current. But the Gas Company guarantee to give, by means of the Kern burner, as much light for the odd halfpenny as the users of electricity get for their 7½d. Surely, unless the inhabitants are particularly desirous of indulging in needless extravagance, they will give this fact careful consideration.

ELECTRIC LIGHTING NOTES.

The working of the Huddersfield Corporation electric lighting undertaking during the past year has resulted in a surplus balance of £2829; and this is to be transferred to depreciation and contingencies account to meet future expenditure. The Electric Lighting Committee are considering a proposal to lease the Provisional Order of the Mirfield District Council.

On the application of Mr. B. C. Roberts, the Chairman of the Lighting Committee, the Chester Town Council last Wednesday authorized an application to the Local Government Board for sanction to borrow a further sum of £35,000 to defray the cost and provide for the extension in connection with the Electric Lighting Department. Mr. Roberts stated that the new plant would cost above £11,000, and the buildings about £7200. The borrowing of £35,000 would possibly preclude the necessity of the Council applying to the Board for the next two years.

The Bath Corporation have not so far made a financial success of their electric light undertaking, and the Electric Lighting Committee have required £1937—nearly equivalent to a 2d. rate—to pay off the deficit which has accrued since the works were purchased three years ago. The accounts for 1899 show a gross profit, when working expenses only are considered, of £2165; but adding interest and repayment charges, and bringing forward last year's adverse balance of £125, this is converted into a deficit of £1937. It is generally conceded, however, that the light has not yet had a fair trial.

The Yeadon District Council, having considered the report of the expert engaged to advise them on the best methods of carrying out their Electric Lighting Order obtained in 1894, have decided to visit a number of places where the light is in operation, and have also instructed their Clerk to ascertain whether the Leeds Corporation, who have been asked to carry out the suggested scheme of tramways, would supply Yeadon with electricity for lighting purposes, either in bulk or per light. In his report, the expert (Mr. Enright, of London), propounds a scheme entailing a capital expenditure of £12,600 for 4500 8-candle power lights, with an estimated annual expenditure of £1540, and an estimated income of £2035.

Mr. R. H. Bicknell conducted a Local Government Board inquiry at Grimsby yesterday week in reference to an application by the Corporation for permission to borrow an additional £11,500 for electrical purposes. The Deputy Town Clerk (Dr. Grange) stated that there was a deficiency of £551 upon the original estimate, and £10,949 was required for further works. The original sum authorized to be borrowed was £43,500; and the total, with the amount now required, would be £55,000. The Borough Engineer (Mr. M. Petree) said the additional expenditure included an engine of 350-horse power, which, with boilers, dynamos, &c., would cost £6000, and £1677 was required for Consulting Electrical Engineers' charges.

Mr. H. Percy Boulnois sat at Bradford last Wednesday to consider an application by the City Council to the Local Government Board for authority to borrow £10,000 for electrical extensions. The Town Clerk (Mr. F. Stevens) stated that the money was needed for the erection of additional buildings and for the provision of more machinery and plant. There was an increasing demand for electricity for lighting and motive power; and the works also supplied the two new tramways by the overhead trolley system. The buildings in connection with the generating works were estimated to cost £4700, and the machinery and plant proposed to be laid down would require £5100. The City Treasurer (Mr. G. Thorpe) gave evidence to the effect that, since the undertaking was commenced, the profits had amounted to £23,606, and £10,556 12s. 3d. had been written off for depreciation. The Town Clerk added that there was a loss during the first two years; but the undertaking was now making large profits. Mr. A. H. Gibbings (the Electrical Engineer) also declared that the proposed extensions were absolutely necessary.

A report submitted to the Exeter Town Council last Wednesday stated, on the authority of the Electrical Engineer, that the general results of the working of the undertaking in 1899 were of a most satisfactory character. As compared with the previous year, the consumers increased from 300 to 353; the number of 8-candle lamps, from 14,500 to 18,000; and the number of units sold, from 200,000 to 285,000. This increased business had been done without any appreciable addition to the working expenses of 1898; while an extra revenue of more than £1000 had been earned. This excellent result, the Engineer (Mr. H. D. Munro) explained, was partly due to the improved character of the demand; nearly one-sixth of the consumers being in private houses. Congratulatory speeches were, of course, made on the progress of the undertaking; but the enthusiasm was a little damped by the complaint of one of the members of the irregularity of the light, which on more than one occasion had failed altogether. He objected to it being said that the undertaking was working satisfactorily. Alderman Domville, Chairman of the Electric Light Committee, apologized for the "occasional discomfort" experienced of late, and said he did not anticipate anything of the kind in future.

The dangers attending the supply of electricity were exemplified once more at an inquiry which was held last Friday, by Mr. E. N. Wood, Deputy-Coroner, at Greenwich, into the circumstances attending the death of Samuel Robert Harvard, 30, which resulted from an electric shock received through touching the spring of the switch-board at the central station of the Blackheath and District Electric Lighting Company in Blackheath Lane on the previous Wednesday morning. Mr. J. A. Constable, the Assistant Engineer, said the duty of the deceased was to regulate the voltage, and it was not his business to touch the metallic parts of the switches. In answer to the District Inspector of Factories, witness said the voltage on the machine by which the deceased was killed was 2750. Extra protection would have been secured if the floor had been insulated. Either an india-rubber mat or a dry wood covering would have served. The Jury returned a verdict of "Accidental death," and expressed the opinion that the floor should have been properly insulated. The Deputy-Coroner rendered this as "Accidental death, due to the absence of proper protection by the employers." The Company's Solicitor protested against this; but the Jury agreed with the wording of the verdict.

FALMOUTH WATER SUPPLY AND THE PUBLIC HEALTH.

In consequence of the prevalence of cases of enteric fever at Falmouth last year, Dr. G. S. Buchanan, one of the Medical Inspectors of the Local Government Board, was sent down to make inquiries into the sanitary condition of the town. Much of his attention was directed to the water supply, respecting which there has been, as readers of the "JOURNAL" know, a great deal of controversy in recent years. With reference to the streams flowing into the reservoirs, he indicates several potential sources of dangerous pollution, including manure deposits on the land near the streams, and drainage from scattered farm buildings and dwellings, as well as from three small hamlets in the gathering area. In order to properly safeguard the purity of the water, systematic inspection of the gathering-ground can hardly be dispensed with. No such inspection, however, is made by the officials of the Water Company. Dr. Buchanan considers the arrangements for filtering the water inadequate; and though he hesitates, on the results of several analyses, to condemn the water as impure, he points out that the proportion of nitrates indicated in one of the reports is suggestive of organic pollution. He is not satisfied that the fever cases were due to any specific contamination of the supply at its sources or on the gathering-ground. He inclines, however, to the belief that it was due to the local contamination of the supply through insuction of infectious matter into the pipes. Water-mains in Falmouth are, he says, from one or another cause, interfered with unusually often; mains and domestic supply-pipes are frequently placed in positions liable to injury; joints of supply-pipes are commonly unsatisfactory, and there are many "dead ends" which receive no attention. Taking into consideration these circumstances of the water service, and recalling the fact that during the months preceding the epidemic opportunities of local soil pollution were specially numerous in the high-level central area, it is, he thinks, permissible to surmise that the occurrence of insuction of infectious matters into the water-mains at some point or points in the high-level service shortly before and during the epidemic period would go far to explain the local incidence of the fever during that period. Concluding his report with a series of recommendations, Dr. Buchanan advises, as to the water supply, frequent and systematic inspection of the gathering-ground, with a view to preventing opportunities of pollution; construction of sand filters, which will secure an efficiency of filtration conforming to modern standards; providing for the maintenance of greater pressure on the high-level service; discontinuing intermission of the supply; and, above all, a thorough overhaul and cleansing of the whole system of water-mains in the town. Careful search for leaks in the course of the mains and at their terminations, and also in domestic supply-pipes, seems particularly needful.

THE SUPPLY OF WATER BY METER AT BRADFORD.

A Substantial Loss on Metered Supplies.

A point of some importance bearing upon the question of the price charged for water supplied by meter for trade purposes, was raised at the meeting of the Bradford City Council last Tuesday week. It was stated by the Chairman of the Water Committee (Alderman Holdsworth) that in the past year the total receipts for water sold by meter were £75,182. This was an increase of £5678 on the previous year, in addition to the consideration that £1180 would also have been received had not the out-districts been taken into the city on Nov. 9. Mr. E. R. Hartley pertinently inquired the cost per 1000 gallons of the water now brought into Bradford, and the total loss on water sold by meter at 6½d. per 1000 gallons. Alderman Holdsworth, in reply, said the daily consumption was between 12 million and 13 million gallons; and the cost per 1000 gallons, taking into calculation interest and sinking fund, was probably 8d. per 1000 gallons. He could not give the total loss on the sale of water at 6½d. per 1000 gallons. It was a variable quantity; and in the past year the drought was responsible for a larger quantity of water being taken than usual.

Commenting upon the matter, the "Bradford Observer" remarks: "The interests of Bradford are so largely bound up in the existence of a plentiful supply of cheap and good water for the industries of the city, that the question with respect to the sale of water by meter at less than cost price is not altogether one to be decided upon ordinary business principles. But it certainly seems to demand consideration whether in

the interest of the ratepayers the loss is altogether justified. Alderman Holdsworth told the Council that the water supply cost about 8d. per 1000 gallons, when interest and sinking fund had been charged for. Since in 1899 no less a quantity than 1500 million gallons of water were sold at 6½d. per 1000 gallons, the loss which has been incurred in the transaction exceeds £9000—a by no means inconsiderable sum. It must also be remembered that while, of course, the advantage is great that dyehouses and woolcombers should be kept at work, the demands made by some of these establishments are practically limited to times of drought, when other sources of water supply have failed. In the drought of last year, when the ordinary domestic consumption of water in the city was almost more than the water-works could supply, three firms alone, who usually supplied themselves from other sources, took by meter a daily supply of 3 million gallons from the water-works. If, as is to be presumed, this unusual and untimely demand was fulfilled at a daily loss of 1½d. per 1000 gallons, or a daily loss for these three firms alone of £375, while the regular users of Corporation water were put on the shortest possible rations, the transaction was a doubly unprofitable one. Certainly, while it may perhaps be a wise practice on the part of the Corporation to encourage the regular patronage of large firms who give employment to considerable bodies of workpeople, it is not fair that a few large establishments, who, as a rule, compete with the Corporation by supplying themselves, should be able when their own supply fails to take town's water at the reduced rate."

Ilkeston Water Supply.—A public meeting of ratepayers and inhabitants of Ilkeston was held in the Town Hall, on Friday, the 16th inst., for the purpose of considering the unsatisfactory condition of the water supply, and the immediate necessity of procuring unpolluted water. There is a good deal of typhoid fever in the town; and as Dr. Wheaton, an Inspector of the Local Government Board, Dr. Willis, the Medical Officer of Health for Ilkeston, and Dr. Klein all condemn the town water as unfit for a public supply, there is a strong feeling that the Town Council should cut off the Stanley Brook, which is the main source of contamination, at the earliest possible moment. The following resolution was submitted to the meeting, and carried unanimously: "That this meeting of ratepayers and inhabitants of the borough of Ilkeston, being satisfied that the present water supply, which has been condemned by an Inspector from the Local Government Board and the Medical Officer of Health, is grossly polluted, and unfit to be used, hereby urges upon the Town Council the imperative and urgent necessity of obtaining a sufficient supply of pure water; that it is of the first importance that an opinion by a leading professional expert should be immediately obtained, dealing with the whole question of the water supply; and that copies of this resolution be communicated to the Town Council and to the Local Government Board." In the course of the proceedings, a suggestion was made that a Ratepayers' Association should be formed for the following purposes: (1) To prosecute the Council for damages in every case of enteric fever; (2) to promote drastic measures to get matters attended to without delay, by refusing to pay the water-rate; and (3), if necessary, after giving the Town Council reasonable time, to appeal to the Local Government Board to turn the Council out of office.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The resignation of Mr. S. Stewart of the post of Gas Engineer to the Corporation of Greenock, referred to in the "JOURNAL" last week, was submitted to the Police Board on Tuesday. In his letter, Mr. Stewart stated that he had had the control of the works for 35 years, and that he considered it advisable, in the interests of the Board, that the management should be put into the hands of a younger man—more especially in view of the large extensions which are now necessary to meet the increased demand for gas, and the plans for which he had prepared, or was preparing. Mr. Mitchell, who is Convener of the Gas Trust, Provost Black, and other members of the Board, testified to the high quality of the services Mr. Stewart had rendered; and on the motion of Mr. Mitchell, his resignation was allowed to lie on the table. A Committee was appointed to consult with Mr. Stewart, with instructions that, in the event of his resignation being adhered to, they proceed to consider what arrangements should be come to for filling up the vacancy, as well as what retiring allowance should be made to Mr. Stewart, who, it is proposed, should be retained as Consulting Engineer. Everyone must admit that Mr. Stewart has chosen an opportune moment for retiring. He has reached the top of his profession; he has built up a most prosperous business; he has superintended the erection and equipment of a gas-works which are as up-to date as any; the town of Greenock is apparently emerging from under a cloud of depression which has hung over it since the sugar industry was swamped by foreign bounties; and it is quite appropriate that the gentleman who is to manage the extended gas-works should have the superintendence of their erection. I daresay it is out of respect for Mr. Stewart that the proposal is made that he should be retained as Consulting Engineer. It is out of no disrespect to Mr. Stewart that I would venture to suggest that the proposal should not go any farther. It appears to me that it is better, on all occasions, that when a man gives up the active control of an undertaking he should go outside of it altogether. It is better for himself, because he would otherwise have responsibility without power; it is better for the new man, because he would be free to carry out his own ideas; and it is better for the undertaking, because they would have only one man to deal with. A liberal retiring allowance will show the esteem in which Mr. Stewart is held, as well as anything.

In furtherance of the threat that the Town Council of Glasgow would be made to ring with the demands of the workmen for the recognition of their Unions until it should be granted, a communication from the Glasgow Trades Council was laid before the Town Council on Monday. This contained a resolution by the Trades Council expressing their regret that the Town Council had refused to grant the reasonable request of the employees of the Cleansing Department for an increase of wages, protesting against the language of some members of the Town Council when referring to the right of employees to submit complaints through the officials of their Unions, and urging the Town Council to give their employees full liberty to make their representations through their duly elected officials, thereby guaranteeing the employees against being interfered with because of their making personal complaints to

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 527.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
690,000	10	Oct. 13	10½	Alliance & Dublin 10 p. c.	20½—21½	..	4 17 8
100,000	10	,,	7½	Do. 7 p. c.	14—15	..	5 0 0
800,000	100	Jan. 2	5	Australian 5 p. c. Deb.	100—102	..	4 18 0
200,000	5	Nov. 15	6	Bombay, Ltd.	5¾—6¼	..	4 8 11
40,000	5	,,	6	Do. New, £4 paid	4—4¼	..	5 6 8
880,000	Stk.	Feb. 23	12	Brentford Consolidated	267—272*	..	4 8 3
270,000	,,	,,	9	Do. New	203—208*	..	4 6 7
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145*	..	3 9 0
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb.	118—123	−5	3 5 1
220,000	Stk.	Sept. 15	11½	Brighton & Hove Orig.	255—260	..	4 8 6
226,320	,,	,,	8½	Do. A. Ord. Stk.	185—190	..	4 9 6
973,500	Stk.	Aug. 16	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Sept. 29	10	British	43—44	..	4 10 11
50,000	10	Feb. 23	12	Bromley, Ord. 10 p. c.	24—26*	..	4 12 4
75,000	10	,,	9	Do. 7 p. c.	19—21*	..	4 5 8
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd.	9¾—10¼	..	5 17 1
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	98—100	..	4 0 0
150,000	20	July 13	8½	Cagliari, Ltd.	28—29	..	5 13 10
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	13½—14½	..	5 10 4
50,000	50	Nov. 2	6	Do. 6 p. c. 1st Mort.	56—58	..	5 3 5
550,000	Stk.	Oct. 13	13½	Commercial Old Stock	305—310	..	4 7 1
200,750	,,	,,	10½	Do. New do.	240—245	..	4 5 9
200,750	,,	Dec. 14	4½	Do. 4½ p. c. Deb.	140—145	..	3 2 1
600,000	Stk.	Dec. 14	9	Continental Union, Ltd.	177—181	..	4 19 5
200,000	,,	,,	7	Do. 7 p. c. Pref.	178—183	..	3 16 6
51,000	Stk.	Aug. 31	14	Croydon A 10 p. c.	335—340	..	4 2 4
168,100	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
555,000	Stk.	Feb. 23	5½	Crystal Palace Ord. 5 p. c.	122—127*	..	4 2 8
60,000	,,	,,	5	Do. 5 p. c. Pref.	132—137*	..	3 13 0
486,000	10	Jan. 26	11	European, Ltd.	20½—21½	..	5 2 4
354,060	10	,,	11	Do. £7 10s. paid	15—16	..	5 3 2
14,999,975	Stk.	Feb. 9	4⅝	Gas-light and Coke	4 p. c. Ord.	105—107	..
2,800,000	,,	,,	3½		3½ p. c. max.	96—98	..
2,799,735	,,	,,	4		4 p. c. Con. Pref.	119—122	..
3,999,975	,,	Dec. 14	3		3 p. c. Con. Deb.	99—101	+1
70,000	10	Nov. 15	8	Hongkong & China, Ltd.		13½—14½	..
3,800,000	Stk.	Nov. 15	10	Imperial Continental		215—220	..
478,000	Stk.	Feb. 9	3½	Do. 3½ p. c. Deb. Red.		100—103	..
75,000	5	Dec. 14	6	Malta & Medn., Ltd.		4½—5½	..
560,000	100	Oct. 2	5	Met. of	5 p. c. Deb.	110—114	..
250,000	100	,,	4½	Melbourne and	4½ p. c. Deb.	107—109	..
541,220	20	Nov. 15	3	Monte Video, Ltd.		11—12	..
617,946	Stk.	Feb. 23	9½	Newcastle & Gateshd Con.		215—220*	..
264,856	Stk.	Dec. 29	3½	Do. 3½ p. c. Deb.		104—107	..
60,000	5	Feb. 23	7	Ottoman, Ltd.		4¼—4½*	..

* Ex div.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
150,000	5	Nov. 30	8	Oriental, Ltd.	7—7½	..	5 6 8
135,000	5	,,	8	Do. New, £4 10s. pd.	6½—6¾	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.	1½—1¾	..	4 11 5
500,000	100	Dec. 1	6	People's Gas of Chicago	2nd Mtg. Bonds	102—106	..
851,070	10	Oct. 13	7	River Plate Ord.		11—11½	+½
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.		99—101	..
250,000	10	Sept. 15	10	San Paulo, Ltd.		12—13	..
135,000	Stk.	Sept. 15	10	Sheffield A.		249—251	..
209,053	,,	,,	10	Do. B.		249—251	..
447,427	,,	,,	10	Do. C.		249—251	..
5,600,000	Stk.	Feb. 23	5⅝	South Metrop., 4 p. c. Cnd.		132—135*	..
1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb.		100—102	..
120,000	Stk.	Aug. 31	6	Tottenham and Edmonton	A. 5 p. c. B. 3½ p. c.	141—143	..
250,520	,,	,,	4½		4 p. c. Deb.	102—104	..
55,100	,,	Dec. 14	4			113—117	..
182,880	10	Jan. 12	5	Tuscan, Ltd.		8½—9½	..
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.		101—104	..
				WATER COMPANIES.			
780,399	Stk.	Dec. 29	11	Chelsea, Ord.		307—312	..
160,000	,,	,,	5	Do. 5 p. c. Pref.		157—162	..
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75		145—150	..
175,785	,,	Sept. 29	4½	Do. 4½ p. c. Deb.		148—153	..
1,720,560	Stk.	Oct. 13	7	East London, Ord.		203—208	..
554,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb.		145—150	..
890,000	,,	,,	3	Do. 3 p. c. Deb.		98—100	..
700,000	50	Dec. 14	7½	Grand Junction	10 p. c. max.	108—110	..
810,000	Stk.	Sept. 29	4		4 p. c. Deb.	131—136	..
708,000	Stk.	Feb. 23	14	Kent		330—340*	..
160,000	,,	,,	7	Do. New, 7 p. c. max.		200—210	..
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.		295—300	..
406,200	100	,,	8	Do. 7½ p. c. max.		215—220	..
1250,000	Stk.	Sept. 29	4	Do. 4 p. c. Deb.		135—138	..
500,000	100	Feb. 23	13½	New River, New Shares		420—425*	..
1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb.		132—137	+2
902,300	Stk.	Dec. 14	7½	South-wark and	Ord. 7½ p. c. max.	200—205	..
126,500	100	,,	7½			190—195	..
489,200	Stk.	,,	5		5 p. c. Pref.	160—165	..
1,019,585	,,	Oct. 13	4	Vauxhall	4 p. c. A Deb.	131—136	..
1,155,066	Stk.	Dec. 14	16	West Middlesex		290—296	+1
200,000	,,	,,	4½	Do. 4½ p. c. Deb.		147—152	..
200,000	,,	Sept. 15	8	Do. 3 p. c. Deb.		100—102	..

* Ex div.

their overseers. The Town Council decided to let the communication lie on the table; but the resolution was only carried by a majority of one, which is the nearest that the labour agitators have yet come to carrying their point. The Corporation may be caught napping some day; and then, though it should be by a snatch vote, Glasgow would be added to the list of places where Trades Unions were recognized.

A petition was presented to the Gas Committee of the Dundee Town Council this week, by the inspectors of gas-meters, asking for an increase of wages. They seem to hold the belief that unless they ask much, they are not likely to receive much. Their request is for an advance of 5s. per week. At present, they are paid 32s. a week. The reasons for making this large request is that gas collectors receive 37s. and water inspectors 38s. a week, and that their duties are somewhat similar. This is an assumption which, I anticipate, will not be readily accepted. Anyone can read a gas-meter; but a water inspector requires to be a man skilled in the matter of fittings—a plumber, in fact—while a collector has very responsible duties. The petitioners may be deserving of some advance; but 5s. a week is out of the question. The application was sent to a small Committee for consideration.

At this week's meeting of the Dundee Corporation Gas Committee, the subject was raised as to the valuation of the gas-works. At present the valuation is fixed by the Burgh Assessor; but in some other places—Glasgow and Stirling were mentioned—this is done by the Assessor of Canals and Railways. It is suggested (by whom is not stated) that the valuation of the Dundee Gas-Works should be by the Assessor of Canals and Railways, who at present values the Dundee Water-Works. This is a method of valuation provided for undertakings which extend into the territories of more than one local authority; the object being to have one assessing party instead of several, or many, who sometimes differ as to apportionment. Unless there be some such difficulty, it does not seem that there is any necessity for a change in Dundee. The total valuation is determined, according to a well-known rule, by the amount of the net profit; and I suppose that apportionment is usually made upon a rough estimate of the sums expended within the various jurisdictions. Were it made upon the profit derived from each locality, rural places would suffer, because the gas consumption there is less per mile of main than it is within cities.

The Gas Corporation of Forfar would appear to feel very heavily the remarks of Sheriff Johnston in making the appointment of Public Auditors, to which I referred last week. On Wednesday night, at a meeting of the Corporation, Provost M'Dougall made a long speech upon the Sheriff's opinion, in which he complained about the Corporation being held up in the way they were, upon such a small matter. For upwards of twenty years, he said, they had been in the habit of suggesting names for the post of Auditor; and every Sheriff, till now, had given effect to their wishes. He did not doubt the authority of the Sheriff; and he believed that the gentleman who had been appointed was a person of great ability. They found that local gentlemen of intelligence and ability were quite willing to do the work for the fees they paid, and would give them an audit as true and as thorough as they could get from a chartered accountant of Dundee. Bailie Adamson endorsed the views of the Provost upon the subject. Now, I cannot avoid the conclusion that the speakers would have acted a more dignified part if they had preserved silence. They cannot help themselves in the matter. Though Bailie Adamson hinted at there being a possibility of their "making a representation in another quarter, which would condemn this very foolish interlocutor," as a matter of fact the Corporation can do nothing. The House of Commons is the only place where they could make a representation. The Right Hon. Mr. John Morley is their representative in Parliament; and if the Corporation think that he has time to attend to such a paltry matter, or that the House would listen to him upon it, they are mistaken. But they altogether ignored the Sheriff's grounds for his action. The members of the Corporation had been quarrelling among themselves upon the subject of the audit, and had, in fact, gone the length of procuring an independent audit of the gas accounts—a step which I criticized at the time as foolish, and which the Sheriff seems also to have so regarded. Then the Sheriff says that he is convinced they have not been getting the kind of audit which the statute intends. This was sufficient justification for him. The Corporation have brought themselves into this undesirable position. The Sheriff is to see that a real audit is made. It may turn out that this will result in no more than a change in the form of keeping the accounts of the Corporation; but, on the other hand, the new Auditor may disallow certain entries—say, of outlay—requiring them to be placed to another account, which may alter the appearance of things. The knowledge of this possibility should make the Corporation particularly careful how they prepare their accounts for the audit, because, if occasion should arise to find fault, they may be certain that it will be taken advantage of. And they know now that Sheriff Johnston is a gentleman who, if he wishes to tread upon anyone's toes, does so in a manner which leaves no doubt in the mind of the person trodden upon that it was intended, as well as that it had taken place.

With reference to the statement in last week's "Notes" to the effect that the Gas Committee of the Glasgow Corporation had caused intimation to be made to Messrs. John Watson, Limited, that, on account of non-delivery of coal, they would exercise the option in their contract of purchasing coal as against the short deliveries, the contractors explain that the period of the contract was from July 1 to June 30, with power to the Corporation to call for increased quantities during the winter months; that down to Feb. 14, of 50,000 tons of coal there had been delivered 30,046 tons; and that the balance will be delivered well within the specified time. The Corporation have not bought coal against them. The explanation does not affect the situation, because the delivery is more than 1000 tons short of what would have been a delivery in equal monthly instalments. If the Corporation have required increased deliveries during the winter months, they either have not had them or the deliveries before the advent of winter must have been extremely light. The Corporation may yet purchase coal as against the Company, as to which they will no doubt be guided by the course of events; but the explanation makes it plain how such a step would be received, and shows how difficult it is to enforce any such provision.

Last Monday morning, an explosion of gas occurred in the office of the Ardrossan Harbour Company. A charwoman in the course of her

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WINDSOR STREET WORKS, BIRMINGHAM	2,000,000
SALTLEY WORKS, BIRMINGHAM	2,000,000
COLCHESTER	300,000
BIRKENHEAD	2,250,000
SWINDON (New Swindon Gas Co.)	120,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000
WINDSOR STREET WORKS, BIRMINGHAM (Second Contract)	2,000,000
HALIFAX	1,000,000
TORONTO	250,000
OTTAWA	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
TORONTO (Second Contract; Remodelled)	2,000,000
BELLEVILLE	250,000
OTTAWA (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000
BUFFALO, N.Y.	2,000,000
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.,	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
LEICESTER	2,000,000
ENSCHEDE (HOLLAND)	150,000
BUENOS AYRES (RIVER PLATE CO.)	700,000
BURNLEY	1,500,000

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duties lighted one of the arms of a gaselier in the Manager's room, and a violent explosion took place. Its force was such that two of the walls of the room were wrecked, nearly all the windows in the building were broken, and the door was blown outwards for several yards. The damage done will cost more than £200 to repair.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Feb.* 24.

Sulphate of Ammonia.—There has been more business doing for prompt and early delivery; and quotations have advanced to from £12 to £12 2s. 6d. per ton delivered f.o.b. at the ports. Supplies have been somewhat larger; but, although the bulk has again been taken for "covering" purposes, consumers have come more into line with the situation. Home consumption, too, has been appreciable; and everything offered has been readily disposed of. There has not been much interest in the forward position—makers being firm at last week's quotations for the near months; but they show more anxiety to sell over the last six months of the year, for which period a considerable discount on prompt values would be accepted.

Nitrate of Soda is firm at 8s. 9d. per cwt. for fine quality on spot, and 9s. for spring months.

LONDON, *Feb.* 24.

Tar Products.—There is more life in benzols; and 90's have in some instances realized more money. The London shipments of benzol are undoubtedly better than at other ports; and in this position it commands a somewhat better price. There exists as much as 1d. difference between the value in London and some of the country ports. A large accession of benzol is said to have come upon the market from German sources; but the price is evidently on the move upwards notwithstanding. For naphthalene there is also an increasing demand, especially for such qualities as show a fairly high melting-point, and are in a thoroughly dry condition. Tar oils are firm, although the recent stormy weather has interfered very much with deliveries. Carbolic acid has fluctuated somewhat during the week; but, on the whole, the prices quoted below represent its average value at the various points of delivery. There is no change in anthracene.

The average values obtaining during the week are: Tar, 17s. to 26s. Pitch, east coast, 35s. 6d.; west coast, 33s. 6d. Benzol, 90's, ordinary, 7d.; special qualities for gas, 8½d.; 50's, 9d. Toluol, 90's, 1s. 2d.; pure, 2s. Solvent naphtha, 1s. 2d. Crude, 30 per cent., naphtha, 4¾d. Heavy naphtha, 1s. 2d. Creosote, 3¼d. Heavy oils, 3¾d. Carbolic acid, 50's, 2s. 9d.; 60's, 3s. 2d. Crude naphthalene, 60s. Anthracene, nominal, "A," 4d.; "B," 2½d.

Sulphate of Ammonia is scarce and dearer. The advent of the spring and home demand has much strengthened the market. Producers hold small stocks; and the large makers are fully contracted. The general quotation throughout the country is £12 per ton, less 3½ per cent.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The position in the coal trade of this district, although it does not as yet represent any easing down whatever in prices so far as the Lancashire collieries are concerned, is scarcely so strong as it was a week or so back. In some outside districts prices have been giving way on the full rates that were quoted recently; and supplies from one or two quarters have been coming in more plentifully than for a considerable time past. Lancashire collieries continue pressed with orders more than sufficient to take away their output; and any relief in the difficulty they have so long experienced in meeting the requirements of their customers is mainly in some of the better qualities of round coal, which have not been in quite so keen demand since the change in the weather. In the house-fire coal trade supplies are now fairly ample, although here and there complaints are still made that merchants and consumers have not yet received the full deliveries of coal that have been ordered. Common round coals are in much the same active demand as reported recently for iron-making, steam, and general manufacturing purposes; and Lancashire collieries have no surplus supplies of these to offer in the open market, as they have all they can do to keep up with the wants of their customers. Where they have any coal at all to dispose of, it meets with a ready sale for shipment, at considerably above inland prices. Slack also continues short at the Lancashire collieries, with the demand fully maintained, though in some outside districts sellers are prepared to book orders more freely, and the supplies of engine fuel offering on the market have been rather more plentiful. Prices at Lancashire collieries are all round exceedingly firm at full list rates of 14s. 6d. to 15s. 6d. per ton at the pit for best house coals, 13s. to 14s. for mediums, 12s. to 12s. 6d. for steam and forge coal, and from 10s. up to 11s. for engine fuel. For shipment, although the pressure of demand is perhaps not quite so great as it has been, it is still in excess of supplies offering at the ports on the Mersey; and special prices continue to be paid. Ordinary steam coal fetches 15s. 6d. to 16s. per ton, and better qualities of round coal 16s. 6d. to 17s., delivered at the Mersey ports or the Manchester Ship Canal. With regard to furnace and foundry cokes, there is no further official advance in list rates; but makers have so little to offer in the open market that from new customers they are readily able to obtain special prices.

Northern Coal Trade.—There has been a little ease in the coal trade of this district in the last few days, due partly to the lack of steamers to carry away cargoes, and partly to the natural declension that is often found at this season of the year. Best Northumbrian steam coals are now quoted from 18s. to 18s. 6d. per ton f.o.b., and steam smalls are about 11s. In both cases there is fairly full work, and the collieries are well employed; but there is no pressure of moment. In the gas coal trade, one or two additional contracts have been settled, but not to any great extent; the larger southern tendering not having been touched yet. As far as is known, the prices of the lots that have been sold—chiefly for Continental ports—have been such as to leave from 14s. to 15s. per ton

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as the f.o.b. prices for Durham gas coals. For occasional cargoes, the price asked is 16s. per ton f.o.b. There is a good demand for manufacturing coals; and prices are unaltered. Coke is in brisk demand; and best foundry coke seems to advance in price. This should benefit the gas coke trade, in which business is fairly good.

Scotch Coal Trade.—There is little change to report in the coal trade. The demand continues strong. The prices quoted are: Main 15s. to 15s. 6d. per ton f.o.b. Glasgow, ell 15s. 9d. to 16s. 6d., splint 15s. 6d. to 16s. The shipments for the week amounted to 189,035 tons—a decrease of 5545 tons upon the preceding week, but an increase of 58,475 tons upon the corresponding week of last year. For the year to date, the total shipments have been 1,191,836 tons—an increase of 143,772 tons upon the same period of last year.

Increase in the Price of Gas.—The Kingsbridge Gas Company have given notice that the price of gas will be increased from the 1st prox. by 6d. per 1000 cubic feet; bringing it up to 3s. 10d.

Suffocation by Gas.—Mr. Alfred Wood, aged 35, a commercial traveller, of Leeds, died at the Belfast Royal Hospital last Thursday from suffocation by gas. On Monday last week he left Leeds for his Irish journey. On Wednesday morning he was found in his bedroom at a temperance hotel in Belfast unconscious, and evidently suffering from suffocation by gas. The gas was fully turned on. He was removed to the hospital, but all attempts to restore him were unsuccessful. There is every reason to believe that the disaster was accidental.

Hull Gas, Electricity, and Water Undertakings.—Mr. Alderman Jarman, Chairman of the Finance Committee, made some congratulatory remarks at the meeting of the Hull City Council on Monday last week, concerning the results of the management of the gas, electricity, and water undertakings. Regarding the first, he confessed that at one time he was opposed to the purchase of the Kingston-upon-Hull Gas Company's property, the cost of which was put down in the books at £96,300. But during the two years they had had the works, they had not only paid their way, but provided sufficient sums for the sinking fund and interest. The charge to the consumers had also been reduced by 2d. per 1000 cubic feet. The cost of the electric light undertaking stood at £130,000. The light was now in general use; and the concern was able not only to pay its way, but to provide money for sinking fund and interest, and also for the provision of a reserve fund. He hoped before long they would be able to have some relief from the undertaking. The water-works stood in the books at £475,980; and in regard to this undertaking, he questioned whether if a million sovereigns were laid on the table, the Council would accept them in exchange. This heritage they had not only maintained and increased, but had kept in perfect order, under the late Alderman Woodhouse and the present Chairman of the Committee (Alderman Massey). They congratulated the Chairman not only upon the able manner in which the works were being managed, but upon the splendid help the profits had been for several years past in relieving the rates.

The Dorking District Councils and the Water Company's Bill.—The Urban and Rural District Council of Dorking are opposing the Bill promoted by the Water Company, with the view of getting the insertion therein of a clause giving them power to purchase the undertaking within ten years. A Joint Committee of the above-named bodies had an interview with the Directors of the Company on the matter, and the latter expressed their willingness to insert a clause if the period were made twenty years; but this offer has not been accepted.

Wolverhampton Gas Company's Bill.—At the meeting of the Wolverhampton Town Council on Monday last week, the Town Clerk explained the provisions of the Bill by which the local Gas Company are applying for extended capital powers. He said that at the present time, the capital of the Company amounted to £260,861; and it was proposed to increase it by £175,000. The capital was increased seven years ago; and he contended that the dividends paid were too high. Another reason for opposing the Bill was that the illuminating power was not sufficiently high; and, further, the Corporation ought to have greater scope in regard to the breaking up of the streets. Some discussion followed; and it was decided to oppose the Bill—the Lighting Committee being entrusted with the necessary powers.

City of St. Petersburg New Water-Works Company, Limited.—At the ordinary general meeting of this Company to-day, the accounts to be submitted by the Directors, covering the year ending Dec. 31 last, will show that the instalments payable by the Municipality of St. Petersburg for 1899-1900 on account of the purchase-money of the Company's works amounted to £17,542, of which £6793 was applicable to capital; leaving a balance of £10,749. Interest and fees brought up this sum to £10,789. After payment of interest and expenses, there is a balance of £5558 available for distribution. An interim dividend of 5s. per share was paid in September last; and the Directors recommend that a further dividend of 5s. 6d. per share be paid, that £500 be placed to the reserve fund, and that the balance (£19 6s. 6d.) be carried forward. During the past year, £6600 of "A" debentures were paid off; leaving £5900 outstanding, the whole of which is repayable this year.

Gas and Electric Lighting at Coventry.—The following is the statement of the Gas Committee of the Coventry Corporation for the quarter ending Dec. 31: Gas made, 165,569,000 cubic feet; do., 1898, 151,172,000 cubic feet—increase, 14,397,000 cubic feet, or 9·52 per cent. (Gas made during the nine months ended Dec. 31, 1899, 373,430,000 cubic feet; do., 1898, 342,450,000 cubic feet—increase, 30,980,000 cubic feet, or 9·04 per cent.) Gas-rental, £18,658; do., 1898, £16,947—increase, £1711. Number of consumers, 8179; do., 1898, 7511—increase, 668 or 8·89 per cent. Stoves on hire, 2559; do., 1898, 2212—increase 347 or 15·68 per cent. Length of mains, 58 miles 131 yards; do., 1898, 56 miles 1006 yards—increase, 1 mile 885 yards. Average illuminating power, 17·35 candles; do., 1898, 17·70 candles. Average sulphur compounds, 19·45 grains, do., 1898, 13·34 grains. The quarterly statement of the Electric Light Committee shows the number of consumers on Dec. 31 last to have been 198, against 128 on the same day twelve months ago; and the rental for the past quarter to have been £1340, compared with £1042.



"Bringing his goose to be cooked."

Acetylene Lighting at Sydney (N.S.W.).—On Thursday, Dec. 21 last, the Cricket Ground at Sydney was experimentally lighted by acetylene; the plant having been arranged by Mr. W. Tyree, Managing-Director of the Acetylene Gas Company of Australasia, Limited. There were 3000 lights in use; and provision has been made for 2000 more if required. Suspended over the racing track were 163 shades, each containing a number of burners, and impervious to wind or rain. The shades were attached to light angle-iron supports 15 feet from the track and 16 feet apart. The trial was successful; and it was intended to start the lighting the following night.

The Budleigh Salterton Gas-Works Flooded.—Owing to heavy rain following upon a fall of snow, severe floods have lately prevailed in the western counties. The Budleigh Salterton Gas-Works were a few days ago invaded by the water from a stream which overflowed its banks. The water reached a depth of more than 2 feet in the retort-house; and a considerable amount of damage was done to the works generally. The Manager (Mr. W. S. Walker) took prompt measures to minimize the mischief; and the water was as quickly as possible diverted into another channel. Gas making was, however, seriously interrupted, and the public lamps could not be lighted on the day of the accident.

Incandescent Gas Lighting at Seaford.—The Seaford District Council have had before them a report by their Surveyor on the question of incandescent gas lighting which may interest other authorities of small towns who desire improved street lighting at low cost. The report stated that there were 68 lamps in the district, 48 of which were supplied with incandescent burners; and to 43 of the lamps meters were affixed—the others being averaged for payment. It was found that each incandescent lamp, on an average, consumed 9100 cubic feet of gas per annum; and those with ordinary burners 13,000 cubic feet. The quantity of gas consumed during the three years had decreased. In 1897 the total consumption was 734,000 cubic feet; in 1898, 712,000 feet; and in 1899, 688,000 feet. It was recommended that the whole of the lamps in the district be provided with incandescent burners, and that additional ones be fixed. The report was adopted.

A French Gas Lighting and Meter Making Company.—The Compagnie pour l'Eclairage des Villes et Fabrication des Compteurs et Appareils Divers, the offices of which are in Paris, although less well known in England than some of the other Continental undertakings, is a flourishing concern. The Company at the present time own 34 gas-works, supplying light to more than 40 towns of the adjacent communes, as well as seven water-works. This number may soon be augmented, because by a recent increase of capital, bringing it up to 4,000,000 frs. (£160,000), funds are available for fresh acquisitions. The Company manufacture the plant for their works, and have a considerable number of customers. These are rapidly increasing; and in order to be in a position to supply them at less expense, they have established agencies in provincial towns of France and in foreign countries. One was recently opened at Lille, another at Madrid, and more are to follow. In each of the past four years, the Company have paid a dividend of 25 frs. on their shares of 500 frs.

The Reigate Corporation and the Redhill Gas Company's Bill.—The Reigate Corporation have resolved to oppose the Bill promoted by the Redhill Gas Company to obtain further powers; and the resolution has been confirmed by the ratepayers.

Ashford and the Mid-Kent Water Bill.—It is stated that at an interview between Mr. William Whitaker, F.R.S., F.G.S., and the Ashford District Council, the former advised opposition to the Mid-Kent Water Company's Bill with the view of obtaining a clause which should prevent the Company from sinking wells within 4 miles of the Ashford town supply. The majority of the Council, however, declined to take any steps in the direction indicated. It is understood that the area from which the local supply is drawn is only about a square mile in extent; but many of the councillors seem to think this ample to afford an adequate supply.

Heysham and the Morecambe Gas Bill.—A meeting of ratepayers was held at Heysham on Monday last week to confirm a resolution of the District Council to oppose the Morecambe Gas Bill. The Chairman (the Rev. C. T. Royds), basing his remarks on a report presented to the Council by Mr. Silverthorne, said Morecambe had given an exorbitant price for their gas-works; and he calculated that there would be a deficit of £3000 per annum. This would either have to be met by an increase in the price of gas or out of the rates. He thought the former alternative would be selected, in which case consumers would be charged up to the limit of 5s. per 1000 cubic feet. Mr. Silverthorne advised them that for £10,000 they could erect gas-works of their own at Heysham to produce 11 million cubic feet per annum; and, allowing £2000 for the purchase of the existing mains and pipes from Morecambe, they could manufacture their own gas at 2s. 6d. per 1000 feet, and supply it to consumers at the very moderate sum of 3s. 7d. Heysham ought to command its supply of gas and water. The resolution to oppose the Morecambe Bill was carried unanimously.

Reconstruction of the Madrid Gas Company.—In the report presented by the Directors at a recent extraordinary general meeting of this Company, it was stated that the greatest advantage the undertaking could derive from the new contract which has been entered into with the Municipality would consist in the increased consumption of gas resulting from the reduction of the price. To profit by this circumstance, however, great expense would have to be incurred to extend the use of gas in Madrid, and bring it to a figure proportionate with the population. New mains would have to be laid, and gas cooking and heating appliances provided for the consumers. Most of the Company's capital having been exhausted, it has been decided to increase it from 11,400,000 to 17,000,000 pesetas, by the issue of 22,400 5 per cent. preference shares of 250 pesetas each. After payment of this dividend, one at the same rate will be paid on the ordinary shares; and the balance will be divided among all the shareholders. The Municipality of Madrid having relinquished their right to purchase the Company's works and mains, the assets remain the property of the shareholders. The Company have a substantial reserve fund composed of accumulation of the annual deduction of 5 per cent. from the profits realized.

Season 1899-1900.



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Copenhagen (Second)	2,500,000	Edinburgh	2,000,000	Utrecht	1,000,000
Belfast	1,700,000	Guildford	350,000	Deventer	150,000
Belfast (Second)	4,500,000	Brentford	1,200,000	Portsmouth	1,000,000
Brussels	700,000	Syracuse, N.Y.	850,000	Bournemouth	1,000,000
Brussels (Second)	700,000	Bridlington	125,000	Aylesbury	150,000
Liverpool	3,500,000	Middlesbrough	1,250,000	Hamburg	1,750,000
Liverpool (Second)	4,500,000	Croydon	1,250,000	Redhill	275,000
Tottenham	750,000	L. & N.W. Ry., Crewe	700,000	Dublin	2,000,000
Tottenham (Second)	750,000	Taunton	225,000	Posen	450,000
Santiago de Cuba	400,000	Lawrence, Mass.	400,000	Dunedin (N.Z.)	150,000
Swansea	750,000	Commercial Gas Co.	850,000	Lincoln	500,000
Manchester	3,000,000	Commercial (Second)	850,000	Antwerp	1,500,000
Brighton	1,750,000	Commercial (Third)	1,250,000	Brussels	1,000,000
Preston	1,500,000	Rotterdam	850,000	Brighton (Second)	1,850,000
New York	1,200,000	Dorking	125,000	Stockport (Second)	500,000
Southport	750,000	McKeesport, Pa.	500,000	Croydon (Second)	625,000
Bath	1,000,000	G.L.&C.Co., Bromley	3,750,000	Maidenhead (Second)	225,000
Newburg, N.Y.	350,000	G.L.&C.Co., Nine Elms	2,750,000	G.L.&C.Co., Beckton	2,250,000
Newburg (Second)	250,000	Durham	200,000	G.L.&C.Co., Fulham	1,750,000
Hoylake	125,000	New York	4,000,000	Tottenham (Third)	350,000
Coventry	600,000	Scarborough	800,000	Sydney (Harbour)	500,000
Coventry (Second)	600,000	Perth, W.A.	125,000	Sydney (Mortlake)	500,000
Bordentown, N.J.	125,000	Bremen	550,000	Manchester (Second)	3,500,000
Winchester	200,000	Maidenhead	225,000	Hull	1,500,000
Shanghai	225,000	Epsom	225,000	Longton	600,000
Stockport	500,000	North Middlesex	150,000	Staines	600,000
Norwich	1,000,000	Wandsworth	1,800,000	Commercial (Fourth)	2,000,000
Holyoke, Mass.	600,000	Aarhus	800,000	Dublin (Second)	2,000,000
St. Joseph, Mo.	750,000	Falmouth	150,000	Faversham	200,000
Lea Bridge	350,000	Southampton	800,000	Birmingham (Swan V'ge)	1,500,000
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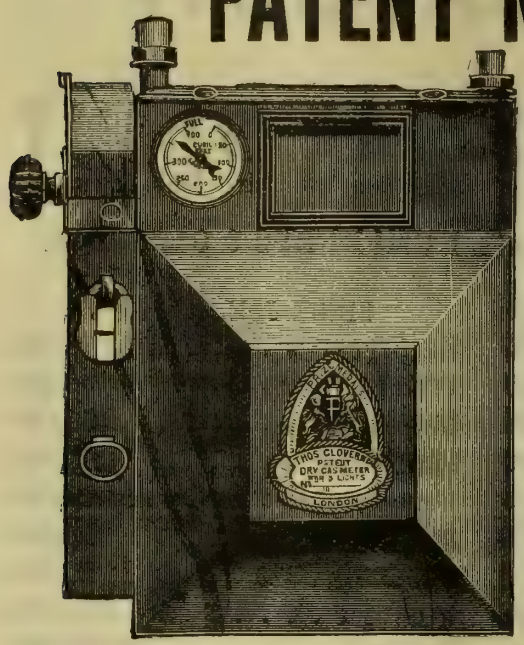
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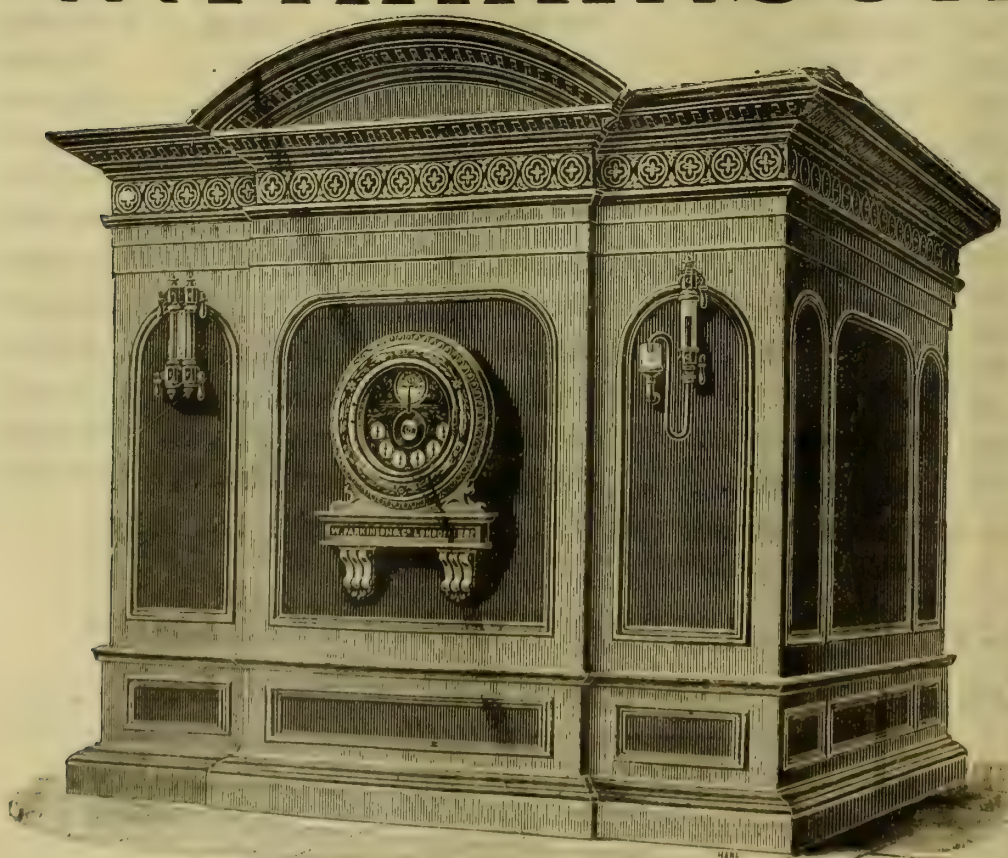
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[See also Advt. on last White Page

CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE.
London Gas Questions in Parliament 593
Questions Affecting the Coal Difficulty 594
The Spontaneous Combustion of Coal; and High-Pressure Gas Distribution 594
The Meeting of the Midland Association 595
Official Trade Union Performances of the Week 595
Private Members' Futilities 595
The Eight Hours for Miners Bill 596
WATER AND SANITARY AFFAIRS—
The London County Council and the Metropolitan Water Question 596
The Local Government Board and Typhoid Fever Epidemics . . 596
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market 597
Electric Lighting Memoranda. 597
Concerning the Science and Art of Public Street Lighting . . . 598
The Labour Market in 1899 599
A Veteran Scottish Gas Manager. 599
Recent Publications—"A Short History of the Progress of Scientific Chemistry in Our Own Times;" "The Municipal Year Book for 1900" 599
NOTES:—
Draughts in Houses 600
Testing Portland Cement for Soundness 601
Compressed Air Power Transmission 601
Coke Breeze for Fire Resisting 601
TECHNICAL RECORD:—
Midland Association of Gas Managers—Annual Meeting at Birmingham—
General Business 601
The Late Mr. J. Fryer 601
Inaugural Address by Mr. J. Ferguson Bell 602
Discussion on Retort Heating 606
The Inclined Retorts at Smethwick 608
Southern District Association of Gas Engineers and Managers—Annual Meeting in London—
General Business 609
Inaugural Address by Mr. D. Irving 610
REGISTER OF PATENTS:—
Manufacture of Water Gas—Boult, A. J. (Fleischer, E.) 613
Prepayment Meters—Green, H. 613
Gas-Stove with Water-Heater—Richmond, E. W. T. 614
Prepayment Gas-Meters—Pinchbeck, J. 614
Regenerative Furnaces—Drake, J. A. 615
Coin-Freed Gas-Meters—Pearce, G. W., and Whitbread, S. J. . . 615
Self-Lighting Gas-Burners—Kent, H. A. 616
Pressure-Regulator or Stop-Valve—Tobler, A. 616
Regenerative Furnaces for Gas-Retorts—Brearley, J. H. . . . 616
Washing Gas—Guillaume, N. A. 617
Patent Notices 617
PARLIAMENTARY INTELLIGENCE:—
House of Lords—Progress of Bills 618
House of Commons—Second Reading of the Gaslight and Coke Company Bill; Notices of Instructions relative to the Gaslight and Coke and South Metropolitan Gas Companies' Bills; Progress of Bills 618
LEGAL INTELLIGENCE:—
High Court of Justice—Chancery Division—The Welsbach Incandescent Gas-Light Company, Limited, *v.* The New Sunlight Incandescent Company, Limited 618
The Incandescent Gas-Light Litigation 618
Conviction for Assault on Welsbach Company's Inspectors . . 619
The Charge of Falsifying Books and Embezzlement 619
The Payment of Water-Rates for Small House Property . . . 619
MISCELLANEOUS:—
South London Local Authorities and the South Metropolitan Gas Bill—Conference at Camberwell 619
Acquisition of the Portland Gas-Works by the District Council—A Transfer Effected without Arbitration 620
Belfast Corporation Gas Affairs—How a Loan to the Electric Lighting Committee is being Dealt With; The Price of Coke . 621
Darlington Corporation Gas Supply—Increased Storage Required 621
Longton Corporation Gas Supply—The Half-Year's Working; The Coal Supply Difficulty 621
The Rothwell District Council and the Gas-Works—Local Government Board Inquiry 621
Meeting of the South Shields Gas Company 622
North Middlesex Gas Company 622
Provincial Gas and Water Companies 622
Gas and Water Companies' Stock and Share List. 625
Electric Lighting Notes 626
Lincoln Corporation Water Supply—Proposed Boring at Boultham 627
Notes from Scotland. 628
Current Sales of Gas Products 631
Coal Trade Reports 631
PARAGRAPHS:—
PERSONAL: Mr. Harold S. Williams; Mr. Frank Morris; Mr. T. May, Assoc.M.Inst.C.E.; Mr. E. P. Reilly; Mr. Arthur Easton. 600
OBITUARY: Ex-Bailie Gow; Mr. John M'Landsborough; Mr. Peter Schuyler Bruff; Mr. David Stiven. 600
Oil for Removing Boiler Incrustation 598
The Chemical Industry of Japan—Germany and the Metric System 613
Increased Consumption after Reduction in Price 619
Installation of Inclined Retorts and De Brouwer Plant at Wakefield 621
Compensation to an Injured Workman of the Manchester Gas Department—Sales of Shares—New Joint-Stock Companies—Carburetted Water-Gas Plant for the Oldbury Gas-Works—Increases in Price—Harrow and Stanmore Gas Company—The Sunlight Company and the Chimneyless Burner Patent—The Hemel Hempstead Corporation and the Water-Works—Cagliari Gas and Water Company, Limited 632
Lancaster Gas and Water Supply—Manchester Water Supply—The "Builder" on London Gas—Destruction of the Grand Theatre, Islington, through a Gas Explosion 633

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

EDITORIAL NOTES.

London Gas Questions in Parliament.

LONDON Gas Affairs have been to the fore in Parliament and on the platform during the past week. On the motion for the second reading of the Gaslight and Coke Company's Bill in the House of Commons last Tuesday, Mr. Pickersgill moved as an amendment that the Bill be read a second time that day six months. The amendment was seconded by Mr. Lough; but, after a brief debate, it was rejected, and the second reading carried by a majority of 78. It would have been outrageous for the House to have refused the second reading of a Private Bill which was not only perfectly in order, but also proposed to take powers that a Committee of the House agreed last session were such as ought to be given to the promoters in order that the Company's lawful business might be properly carried on. So much of the merits of the Company's Bill was before the House; and the committal of the Bill was clearly right and expedient. There, however, the strength of the promoters' position comes to an end. The greatest enemies of the Company's cause have been those of their own household. Not all the Pickersgills and Loughs, who—as Mr. Boulnois truly remarked—would not, in their insensate Progressivism, let Londoners have either gas or water by the practical ways open to such supplies, could to any purpose stand in the path of the Gaslight and Coke Company if the unfortunate counsels of the Horseferry Road did not paralyze the friends of private enterprise. It was no part of the Company's duty to voluntarily offer to embody the recommendations of the Powers of Charge Committee in their own Bill; but neither was it politic for the Horseferry Road to flout the Committees of Parliament as it has done. Parliament and the public appear to be firmly persuaded that the dear gas supply which the Horseferry Road magnates affect to regard as part of the scheme of things, is chiefly due to their mismanagement of the business, and especially to extravagant capital outlay. Ordinary people know that if a retail shopkeeper cannot sell his goods as cheaply as the man in the same line over the way, bankruptcy is his portion. There is, therefore, on the part of a good many people who do not own a single gas share and never drew a directorial fee in their lives, a feeling of impatience of all special legislation which tends to protect the proprietors of a commercially unsuccessful undertaking—as measured by the standard of competition—from the consequences which would assuredly overtake them in the open. That is the public opinion which the Gaslight and Coke Company have to reckon with; and those who pretend to believe that Parliament will willingly pass fresh Acts for the perpetuation of such an unnatural state of things as the public complain of in this connection, are living in a Fool's Paradise. The favour of the modern commercial world is given to the Liptons, the Coppens, the Whiteleys, whose prosperity is based upon what the old-fashioned tradespeople used to call "underselling." There is no mercy on this earth for a trader who cannot do business at dead low-level prices.

Notice of motion has been given for "Instructions" to the Committee on the Gaslight and Coke Company's Bill, to introduce into the Bill clauses embodying the recommendations of the Powers of Charge Committee. It is difficult for outsiders to divine the counsels of the authorities of the House in regard to particular examples of the modern fashion of instructing Private Bill Committees. But it would not be surprising to see these "Instructions" ruled out as too sweeping, or as being otherwise inadmissible. The Speaker is not disposed to allow the discretion of Committees of the House to be fettered without sound cause. Somewhat similar "Instructions" are put down for the South Metropolitan Bill Committee; and it will be interesting to follow the way in which the House disposes of this complicated business.

Meanwhile, the South London Local Authorities have been conferring upon the South Metropolitan Bill. The proceedings, which are reported in another column, are not without an element of amusement. Counsel's opinion had been taken on the proposals of the Bill, and proved to be favourable to them generally; but he seemed to be just a little fogged over the proposed sliding-scale of illuminating power. He appeared to be under the impression that the Company might supply gas of different illuminating power in different districts; but apart from this he could not find

any fault with the Bill. Several of the delegates to the Conference were rather hazy about the same point; but one gentleman at least displayed a competent grasp of the subject, and warmly supported the scheme. Indeed, he was found so well posted on the points, that his possession of so much information made him "suspect." It was considered almost "uncanny" that a Vestry delegate should know so well what he was talking about—always supposing that he had not been primed by the Company. The speaker, however, was able to say that he had never spoken to Mr. Livesey in his life; but he held up a number of the "JOURNAL," saying: "This is where I get my "information. I have studied this paper for years." It is a testimonial which we greatly appreciate. A motion was made that Mr. Livesey should be invited to attend an adjourned meeting of the Conference for the purpose of explaining the Bill; and the suggestion was not a baseless one, in view of the misunderstanding we have already mentioned. It created alarm in some of the Vestrymen, however; because, as one of them candidly stated, they were afraid that Mr. Livesey would be able to talk them into anything. Very naturally, they agreed to formally oppose the Bill in Parliament; but, from what has transpired, the opposition will not be very venomous.

Questions Affecting the Coal Difficulty.

ON Wednesday last in the House of Commons a second reading was refused, by 199 votes to 175, to that hardy annual, the Bill to restrict the hours of labour in mines to eight per day from bank to bank. The majority against the Bill would, we think, have been considerably greater had members not felt so sure that it had no chance of becoming law. The temptation to the representative of a working-class constituency to play to the gallery by voting for a measure of which he does not approve, because he is confident it will be rejected, is as obvious as is the inducement to introduce Bills for the achievement of impossibilities, which are destined, as they are intended, to find their way into the parliamentary waste-paper basket. The Mines (Eight Hours) Bill was introduced by Mr. Herbert Lewis, who, however, entirely failed to make out the "strong and overwhelming case" which, as Mr. Thomas Burt justly observed, must be presented in favour of any suggested interference by Parliament with the conditions under which any industry may be conducted. No arguments were, in fact, adduced in favour of compulsorily restricting the hours of labour in coal mines which would not apply with equal force (if such be the word to use in respect of that which is essentially weak) to the vast majority of other industries. It was, instead, shown clearly by the speakers against the Bill that considerable injustice would be done, as between one district and another, by the proposed legislation, in consequence of the distance of the coal-seams from the bank varying so greatly in different mines.

As we have said, no proof was forthcoming that the miners are in need of special protection from the tyranny of their employers; nor, indeed, was it shown that the miners of the country are insistent in their demand for the State regulation of their hours of labour. On the contrary, many of them, and particularly the miners of Northumberland and Durham, are strongly opposed thereto. It was, in fact, a remarkable and eloquent circumstance that, of the three principal speeches made against the Bill, two were delivered by representatives of mining constituencies, both of whom had at one time been actually engaged in the work of coal mining—Mr. John Wilson and Mr. Thomas Burt. The truth of the matter is that the demand for the State limitation of miners' working hours does not come from the miners themselves, but from politicians and Labour "leaders" with axes of their own to grind. If the miners really wanted to have, and meant to get, their hours restricted to "eight from bank to bank," they would have obtained it long ago—as, in fact, not a few of them have. As Mr. Wilson said, wherever negotiation has been fairly tried, the eight-hour day has been already obtained.

A more inopportune moment at which to introduce a measure the effect of which would of a certainty be to diminish the output of coal in this country, could scarcely have been found. The more one examines the present situation of affairs in the coal trade in particular and in the industrial world in general, the more certain is the conviction that a speedy return of the coal market to its normal condition is not to be hoped for. By the "normal "condition" of the coal market we mean a state of practical equilibrium between supply and demand, with the concomitant maintenance of prices at the level at which they yield only a moderate return upon the capital employed in the production of the coal. The approach of spring will, of course, see the price of house coal tumbling down from the unjustifiably high figure it has reached; and the general public will doubtless think that all the trouble is over. But it must never be forgotten that the real scarcity all the way through has not been to any extent in "household," but in the qualities of coal used for industrial purposes; and the future of the market for steam and gas coals depends upon the state of trade at home and abroad, and the relationship subsisting between the output and the demand in other countries as well as our own.

As to trade at home, no signs of any real check in its activity are discernible. The war is affecting certain industries adversely—more especially those dependent upon the patronage of the leisured and moneyed classes. But it is bringing very full work to many others; and the effect on the commercial world of the increased taxation involved (as to which more will be known when this week's "JOURNAL" is in our readers' hands) will not be felt for some time to come. Most of the iron and steel manufacturers now have their hands full; and if any slackening of orders is experienced by some, we believe it is due to the reluctance of buyers to come in at present prices; and the least weakening in the market will precipitate their orders. It is significant that the Admiralty themselves state that they are only refraining from putting more ships on the Estimates on account of the difficulty in getting the necessary armour, machinery, guns, &c., turned out by the contractors. Trade abroad—more particularly in Germany, Russia, and France—appears also to be flourishing; railway enterprise and increasing armaments playing a great part in its stimulation. With the question of how far these countries can supply their own coal requirements, and to what extent they are dependent upon our own mines for their supplies, we must deal some other time, and merely say that, whether we look at home or on the Continent, we can see no sign of any immediate slackening in the demand for coal. It is significant of a general agreement with this conclusion that very large contracts have already been entered into for supplies during the current year, at prices practically equal to those at present ruling.

The Spontaneous Combustion of Coal; and High-Pressure Gas Distribution.

THE members of the Southern District Gas Managers' Association met in London on Thursday last, under the presidency of Mr. D. Irving, of Bristol, whose Inaugural Address will be found duly reported elsewhere. Mr. Irving devoted the greater part of his address to a thoughtful and practical examination of the phenomena of the spontaneous combustion of coal; and his observations on this subject, although not conclusive, will be read with interest by gas managers at home and abroad. The spontaneous combustion of coal in bulk is one of those troublesome matters which cannot be dealt with along hard-and-fast lines, but is continually making the wisdom of men look foolish. Mr. Irving is exceptionally well situated for studying the subject, for the reason that much of the coal raised in the neighbourhood of Bristol is notoriously liable to take fire in store. And when it once gets well alight, nothing will put it out. A heap of coal out of doors may be turned over with shovels half-a-dozen times; but if it means to burn, it will go on doing so while half a hundredweight of it remains. Professor Lewes has sufficiently accounted for the phenomenon, which is nothing more nor less than a rapid oxidation of the small coal. Big, clean lumps do not take fire in this way. What puzzles the plain man is that there should be enough air inside heaped small coal to act as it does. The spontaneous ignition of greasy cotton waste or damp hay can be more easily understood. What proportion of air, however, can there be in small coal? To the best of our knowledge, this has never been determined by experiment. After all, the explanation does not really explain anything. At best, it can only be of use as a warning. Small coal, perfectly dry, does not burn spontaneously. Damped, it may, and probably will, do so if it has much good in it, and is not merely road

sweepings. When we have said this, we have said all that is really known about the matter.

It is rather a pity that Mr. Irving did not allow himself the time to deal with the subject of gas distribution under high pressure, which is undoubtedly one of the gas engineering questions of the future. It is purely a matter of accident and routine that illuminating gas is handled and distributed in our towns under pressures measured by tenths of inches of water. There is no reason at all in the nature of things why the main pressures should not be in pounds above the atmosphere. Every railway train that leaves a station after nightfall, and many others, carries gas at a pressure measured by atmospheres. In America, natural gas has for years been distributed at pressures of 100 lbs. per square inch and upwards, without any difficulty or danger. American steam and compressed-air power distribution is done every day at pressures that would make some of our fossilized engineers fairly shudder with reflecting on what "might happen" if anything were to go wrong! Common coal gas is perfectly stable at pressures far higher than anything yet contemplated by rational engineers, who nevertheless perceive that gas transmission and distributing plant will have to be very much harder worked in the near future than ever it has been in the past, if the public are to be served, room for pipes found in the streets, and capital economized.

The Meeting of the Midland Association.

The Midland Association of Gas Managers met in Birmingham last Thursday under the presidency of Mr. J. Ferguson Bell, of Stafford. There was a good attendance of members; and the proceedings were of an interesting character. The President's Address was of the high quality to be expected of the author. Mr. Bell heartily supported the proposal to unify the technical organizations of the gas industry. A very noteworthy passage of his address disclosed the fact that the Corporation of Stafford have become the pioneers of profit-sharing for the workpeople of their gas and electricity departments. Further information respecting this movement, hitherto held to be beyond the grasp of municipal undertakers, will be awaited with curiosity. Mr. Bell had a good word to say for the Workmen's Compensation Act. He dealt very lucidly and informingly with several of the chemical questions of gas manufacture, and ranged himself with those who hold that high candle power for gas is no security at all for the satisfaction of the public with the service. Altogether, Mr. Bell's address bore the imprint throughout of a keen and original mind; and it is on this account very good reading. The remainder of the business of the meeting consisted of an animated discussion of Mr. G. Helps's paper (read at the previous meeting) on the heating of gas-retorts; and an acknowledgment, rather than a discussion, of Mr. B. W. Smith's paper on the inclined retorts at Smethwick—also reserved from the previous meeting. Mr. Smith has every reason to be pleased with the warmth of the testimony given by his colleagues of the Midland Association to the excellence of this installation, which will probably make Smethwick a place of pilgrimage for those engineers who desire to learn what can be done in this respect.

Official Trade Union Performances of the Week.

The professional "leaders" of Trade Unionism have been trying their best to be somebodies during the past week. Like a good many other superfluous excrescences on the body politic, these persons have been relegated of late to an obscurity not at all to their taste; and they made a desperate effort to struggle into notoriety by means of a Conference on "Labour Representation" held in the Memorial Hall. The "Daily News" obligingly reported the proceedings, which were sustained by the stock company of "representatives from the British Trade Unions, "and a sprinkling of well-to-do delegates from the Fabian "Society, and a few of the sterner spokesmen of the "Social Democratic Federation." We know that galley. Still, the transactions of the Conference were marked by an accession of reasonableness which probably means more than appears on the surface. The hitherto prevailing idea that the cause of "Labour" was something essentially quite different from every other cause, was formally disowned. Some habitual speakers—one can scarcely call them workers—of the professional Labour party went over with all the usual enthusiasm to the side of those who have always urged that the working man was not an object for exclusive worship in the Commonwealth. Mr. John Burns and others professed their inability to understand why "working class" candidates for Parliament, or "working class" specialities in general, should be upheld in preference to subjects with broader recommendations. It was not even allowed that "members of the working "classes" should be credited with a better knowledge of the wants of "Labour" than other people. But is it not a fact that in times past—and not so long ago, either—the very contrary position was passionately maintained? When, during the strike in the engineering trades, Mr. George Barnes was told that it did not follow from his official position in the A.S.E. that he was the repositary of all wisdom and of perfect knowledge of what was best for workpeople, the reply was that working men preferred the leading of men of their own order. Many things have happened since then; among the rest, the professional wire-pullers of "Labour" have learnt that real victories are not won by manning the ship of State with a crew separated by water-tight compartments.

Before the end of the week, the same stock company of public performers appeared on successive days before the President of the Board of Trade and the Home Secretary, to communicate the views of "Labour" on a variety of matters. Mr. Ritchie had no hard task in disposing of the trivial suggestions offered by his deputation; and Sir M. W. Ridley was let off even more easily, inasmuch as one of the Trade Union grievances brought under his official notice was the existence of capital punishment! Very reasonably, the Home Secretary denied the competency of an association of Trade Unionists to give an opinion on such a subject. From this initial snub the Secretary of State proceeded to score off the deputation in the approved official style. He was looking into this matter; he was considering that subject; really, he could not agree with such a view of the work of the Department! And so the end came. "The deputation, having thanked the Home "Secretary for his courtesy in receiving them, withdrew." When will these self-styled practical men perceive that they are playing into the hands of the official element in Government, by carrying on this empty formalism? Court ceremonial is not more hollow than that which the working people of this country are taxed to support for the glorification of their representatives, in the blessed and sacred name of "organization."

Private Members' Futilities.

Parliamentary institutions are always open to attempts to abuse what is intended for the general good for the sake of particular interests. There are fair and above-board means of obtaining statutory protection for private concerns, in the Private Bill system. The constituencies are scarcely sufficiently alive to the extent to which the privilege enjoyed by private Members of Parliament of bringing in and backing Bills has been laid under contribution for the promotion of class legislation. Fortunately, the pressure of other business on the limited working time of Parliament is so great that it becomes more difficult every year for private members to get their little Bills passed through both Houses. There is a great outcry occasionally on this account; but, in reality, the practical blocking of this class of projects of legislation prevents much mischief. Of course, the knowledge that the backing of a Bill is generally a matter of form, is a temptation to many weak-kneed legislators to take this cheap means of currying favour with sections of their constituents. This is euphemistically styled "redeeming their election pledges;" but the whole thing is an undignified farce. Still, there is enough reality in the danger of undesirable legislation to compel the Government of the day to keep a tolerably sharp eye upon Private Members' Bills, so long as there is the remotest chance of their getting too far forward. After the back of the session is broken, the private members are left to one another's tender mercies, with the result of the House being counted out week after week, until the Administration mercifully appropriates every sitting for the finishing of the public business. We take the precaution every session of procuring copies of all the old and new Private Members' Bills that threaten interference with the trade and industries of the country, but rarely find it worth while to advert to them. Experience goes to indicate, however, that the quality of these Bills is deteriorating. Although ostensibly prepared by private members, many of them are plainly originated by certain classes and

organizations outside the House. A glaring example of this is a Boiler Registration and Inspection Bill, which proposes to make boiler inspection a monopoly for boiler makers. It is unnecessary to explain what this means. There are other Bills nearly as objectionable. It is difficult to think of a remedy for this abuse of the privilege of membership of the House, short of a general elevation of the sense of public duty in members themselves. So long, however, as the backing of all sorts of futilities of the kind is a useful political advertisement, it will continue to be perpetuated by men who ought to know better, who do know better, and would be the first to run away from their own Bills if there were the least prospect of their passing into law.

The Eight Hours for Miners Bill.

THE rejection by the House of Commons of the Eight Hours Bill for Miners (to which reference is made in another editorial paragraph to-day) is a matter for mild thankfulness, but more in respect of its being a check to a piece of mischievous faddism than by reason of its intrinsic importance. The debate on the Bill last Wednesday was redeemed largely by Sir James Joicey's common-sense speech. The curious thing about this proposed legislation for shortening the hours of labour of adult miners is that the North Countrymen reject it utterly. It is an outcome of the Miners' Federation, and a child of Mr. Ben Pickard. Originally the Welshmen objected to it as strongly as the Northerners; and it is a sign of their conquest by the Federation that they now profess to want it. What has become of the independence of the Welsh nation of which one occasionally hears in Parliament and elsewhere? Actually, the coal-mining population of Northumbria and Durham are standing out for the principle of Particularism, while the Welshmen have become absorbed. Of course, the Bill itself is nonsensical; and the arguments of Messrs. Pickard and Woods, who are its sponsors, are as illogical as their legislative proposal is baseless. Why do they invoke the aid of Parliament to limit the hours of adult male labour? What is the purpose to be served? We do not desire to bring the question of coal prices or the output into this question, but merely to endorse emphatically the contention that legislative interference with the freedom of male adult labour should only be resorted to when an overwhelming case can be made out upon sanitary grounds. We do not admit that a powerful popular demand should suffice to justify parliamentary interference with the liberty of the subject to work for his living. A nation that has known how to keep its Sunday off, and get a Saturday half-holiday as well, besides having generally a shorter week's labour than any other nation under the sun, does not want any coddling in this matter of working hours.

WATER AND SANITARY AFFAIRS.

THE Water Committee of the London County Council have at last completed their reply to the report of the Royal Commission on the Metropolitan Water Supply; but they regard it as of too much importance to appear upon the *agenda*, and therefore, in order to allow ample time for its consideration, it has been circulated to the members as a separate document. This we hope to deal with in an early issue. In the report of the Parliamentary Committee which is to come before the Council to-day, they make a long statement explanatory of the parliamentary procedure of the Council during the past few years in regard to the purchase of the undertakings of the Water Companies and the introduction of a supply of water from Wales. They point out that the preparation of the Purchase and Welsh Supply Bills of the present session was deferred as long as possible, in the hope that the report of the Royal Commission might be forthcoming. Ultimately, however, the Bills had to be settled and deposited before that document, or any information in regard to its tenor, was published. The Committee explain that the first-named measure has been framed substantially in the terms of the Bill discussed before Mr. Plunket's Committee of 1895, but so drafted as to admit of alteration in accordance with the recommendations of the Royal Commission. The Welsh Bill has been submitted this time with the full detailed plans of the scheme, embracing not only the works in Wales, but also the aqueducts to London. The whole project is thus now open for the consideration of Parliament and the public. The two Bills, as mentioned in the "JOURNAL" last week, are down for second reading next Tuesday. The Committee are impressed with the serious consequences of further delay in this matter; being convinced that "every year by which pur-"chase is postponed will tend to increase the cost." They consider that, if the facts of the case are "fully and fairly "stated to Her Majesty's Government," they can hardly now, in view of the report of the Commission, refuse to allow the Council's Bills to be referred to a Committee. It is proposed to ask the First Lord of the Treasury to receive a deputation on the subject from the Council. Should he consent to do so, use will in all probability be made of the somewhat alarmist letter of Mr. Shaw Lefevre, in yesterday's "Times," on the subject of the projected increase of reservoirs in the valleys of the Thames and Lea. Mr. Shaw Lefevre has visited Staines, and has come away "perfectly appalled" at the prospect of the multiplication of storage works such as those now in progress there. He endeavours to terrify Londoners by talking of "hideous "reservoirs towering above the country, and creating "what will almost be an artificial flood in the valleys of "the Thames and Lea;" and he contrasts this state of things with the beautiful placidity, combined with safety, of a Welsh lake. As a member of the County Council, Mr. Shaw Lefevre is, no doubt, greatly impressed with the superiority of their Welsh scheme to any system of storage reservoirs in the neighbourhood of the Metropolis, and is very desirous of having it sanctioned. Other people, however, venture to have different views on this matter. The writer raises in his letter some important engineering questions which there will be ample opportunity of discussing before any of the Bills dealing with this subject receive the Royal Assent.

While considerable difference of opinion exists, as was evidenced by the recent discussion at the meeting of the British Association of Water-Works Engineers, as to the desirability of forming a Central Board for controlling the water supply of the nation, most people are agreed that we have at present, in the Local Government Board, a Department of State capable of doing much good work of a supervisory character in connection with the above-mentioned branch of the public service. The operations of the Board are, no doubt, hampered to a certain extent by the routine inseparable from a Government office; but there is a very efficient staff of Medical and Engineering Inspectors, whose abilities are in constant requisition to guard the public against lavish expenditure on unnecessary works on the one hand, and on the other against the effects of too rigid economy in this direction. Moreover, at the head of the Department there is a Minister responsible to Parliament, and consequently liable to be questioned on any branch of the work of the permanent officials. This, in brief, is the machinery at the disposal of the public; and the bulky Blue-book issued every year bears witness to the extent of its operations. Referring here only to the work of the Board in connection with water supply, it may be remarked that, whether this is in the hands of Companies or Local Authorities, an investigation by an Inspector into any cause of complaint usually leads to prompt steps being taken to remove it. A case in which the Local Government Board have lately done some good work was mentioned in the "JOURNAL" last week, in the abstract of the report presented by Dr. G. S. Buchanan, one of their Medical Inspectors, on the results of his investigation into the outbreak of typhoid fever at Falmouth last year. Though the Water Company were in that case by no means blameless, neither were the Local Authority. The Inspector furnishes ample evidence that, in many important matters of public health, the administration by the authorities of the areas which are now comprised in the borough was in the past "regrettably "and conspicuously lax;" and he says it is to be feared that the present Town Council, who began work in 1892, have not very greatly improved matters. He advises the Council to consider not only the disposal of the sewage but the state of the drains and sewers; and he thinks the Water Company should frequently inspect their gathering-ground, improve their filters, and overhaul and cleanse their mains—taking care that leaks are stopped. This is good counsel to both offenders; and it is very wisely being followed.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 625.)

Owing to the more confident feeling inspired by the news from South Africa regarding the war, the tendency of the Stock Exchange was firmer during the greater part of the week. There has been, however, no indication that the public are inclined to abandon the cautious attitude they have maintained for some time past. It is generally recognized that, in spite of our recent successes, the struggle in South Africa is by no means over, unless the Boers see that it is hopeless to prolong the war. It is the fear that the campaign may degenerate into a guerilla war, and be prolonged for many months, that helps to check business upon the Stock Exchange. Investors are reported to be doing a little more in some markets, but not sufficient to encourage activity. Consols gradually improved; some purchases being induced by a conviction that no fresh creation will be made for some time to come. Other gilt-edged securities, though very inactive, have also presented a firm appearance. A complete change, however, came over the markets on Saturday, owing to the early introduction of the Budget. Money rates stiffened up; while the Stock Markets were very depressed. Consols declined to 100⅛. Gas stocks have also shared in the general quietude of other investment securities. But very few changes are recorded; and the market as a whole has shown steadiness. Gaslight ordinary was moderately active at times between 105 and 106; and a little business was also done in the secured stocks. The only alteration in the Metropolitan Companies was a rise of 1 in South Metropolitan ordinary to 133-136. The Suburban group was quite featureless. Brentford stocks have not recovered, though, as we mentioned last week, the proposed issue of debenture stock has been withdrawn. The most changes have been in the Foreign groups. Cagliari shares have fallen 1 to 26-28, and European ½ to 20-21; but, on the other hand, River Plate debentures rose 1 to 100-102, and Bombay shares ¼ to 6-6½. Imperial Continental shows a firmer tone, though there has been very little doing; but dealers have raised their buying price to 217. Water stocks were quite neglected; very little business being recorded throughout the week. The only alteration in values was a rise of 2 in East London ordinary and 1 in the 3 per cent. debentures.

Concerning the daily operations: Monday was a very quiet day; and no change was recorded in the value of gas stocks. A little business was done in Gaslight ordinary at 105 and 105½; while the 3 per cent. debentures changed hands at 99½. Dealings were also marked in South Metropolitan at 134½ and British at 43¼. On Tuesday, business was even more quiet; and values were unaltered. Some dealings were recorded in Gaslight ordinary at 105¼ and 105, South Metropolitan at 135, Imperial Continental at 218, and European at 20½. In Water stocks, East London ordinary rose 2. Renewed inactivity prevailed on Wednesday, though a little more was done in Gaslight ordinary between 105¼ and 106; while the 3 per cent. debentures changed hands at 101. South Metropolitan ordinary (which rose 1 to 133-136) was dealt in at 133, and the 3 per cent. debentures at 100¼. Tottenham "B" marked 103, and Bombay 6¼. Thursday was a very blank day; but some business was recorded in Gaslight ordinary at 106 and 105¼. On Friday, Southampton ordinary rose 2 to 117-122, Imperial Continental 1 to 217-220, River Plate debentures 1 to 100-102, and Bombay ¼ to 6-6½; but Cagliari declined 1 to 26-28. The feature, however, was the activity in Gaslight ordinary between 105¼ and 106, while some business was also done in the 4 per cent. preference at 120. Dealings were also recorded in South Metropolitan at 135 and 136, European at 20¾, San Paulo at 12$\frac{5}{16}$, and River Plate at 11½. Saturday was another inactive day; but a little business was done in Gaslight ordinary at 105 and 105¾; while Imperial Continental changed hands at 218, European at 20¼, Monte Video at 11¼, River Plate at 11⅜, and San Paulo at 12.

ELECTRIC LIGHTING MEMORANDA.

Electric Power Schemes in Parliament—The Municipal Dog-in-the-Manger—Sound Criticism—Check to Municipalism.

The subject of electricity-in-bulk generation and distribution came before Parliament last Wednesday, on the orders for the second reading of the Lancashire, Durham, and other electric power Bills. They were all read a second time, for the sake of the principle, on the understanding that they would be referred to a specially strong Committee, to be nominated later. This is satisfactory, as a salutary set-back to the inordinate pretensions of the municipalities to the monopoly of electricity supply. At the same time, the action of Parliament in accepting the principle of the Bills must not, and will not, be misunderstood as an expression of approval of the schemes involved. As we have already remarked in this column, these Bills are of various orders of merit; and it is even possible to go further and say that some of them have scarcely the remotest chance of becoming Acts of Parliament. This is purely on account of the character and quality of the promoters. It is inconceivable that Parliament should consent to hand over large areas to be exploited in the interest of enterprising "foreign" electricians—men who, however estimable, or even eminent, are known to have their hands full of general electrical business elsewhere. It appears to be incontestable that only local industrial enterprise can hope for the encouragement of Parliament in the effort to deliver national manufactures from the dead hand of municipal monopoly. The Electric Lighting Acts were never intended to mortgage the nascent interest of electricity supply to the municipalities. On the other hand, Parliament is not likely to permit private speculators to ride roughshod over local authorities.

This year, care has been taken in the drafting of the different Bills to disclaim any such ambition. The municipalities are indeed placed in a position of great power and influence; but the main issue is raised in every case of whether the facility of cheap and boundless electricity supply for industrial purposes over an extensive area should be denied to those who might be able to make good use of it, simply and solely because one or more local authorities occupying part of the region possess Electric Lighting Orders. Stated thus baldly, the question can only be answered in one sense. The crudity of the municipal position was displayed by Mr. Galloway, who declared that the opposition to the principle of the Bills was based on "the broad ground that, where municipalities had borrowed money on the security of the rates, with the consent and sanction of Parliament, they should not be subjected to the competition of private traders." This declaration, it is not surprising to hear, was greeted with cries of "Oh!" and "Why Not?" from the House. As a matter of fact, the municipalities went into electricity supply on exactly the same guarantee as that offered to any other undertakers. They knew what they were doing. Not one jot or tittle of the law of electric lighting has been changed; and now for them to arrogate to themselves a special and particular monopoly in the matter is only another way of stating a claim to do the business in their own way and for their own purposes. The claim of Manchester was endorsed by Huddersfield; but it was strongly contested by the representative of St. Helens, who argued that the supplying of electricity in bulk is far too big an enterprise for any municipal undertaking. He also alleged that the opposition to these Bills of the Association of Municipal Corporations is very largely a question of officialism.

Sir W. Harcourt, speaking with the authority of a long parliamentary experience, defended in respect of the Bills the old-fashioned principle of allowing private enterprise full scope. His remarks upon this head must have been as gall and wormwood to the modern Progressive mind. He desired the precedent of railway legislation to be followed in this regard, and condemned the existing electric lighting legislation as inadequate to the needs of the new industry. The Electric Lighting Acts treat electricity supply as an exclusively municipal concern, and make no provision for the doing of this kind of business by county areas. This is a defect of the law; but, according to Sir W. Harcourt, it is a defect which ought not to be remedied by Private Bills subject to no guiding principle. The point was well taken; and the President of the Board of Trade bowed to the criticism. All this, of course, was dead against the municipal claim. Mr. Ritchie went on to admit that the state of the electrical industries of this country is not on an equality with that found to prevail in other countries, for which backwardness the municipalizing spirit of the legislation of 1882 is responsible. Why should all the electrical supply business of South Lancashire pay the rates of the Corporation of Manchester? Nobody can say, except that the Corporation of Manchester like to have it so. On the other hand, everything connected with the higher development of electrical power has slipped out of British hands and been taken possession of by foreigners. It is not electrical machinery only that has largely to be imported, but also such things as steam-engines adapted to electrical work. Even Glasgow has been fain to go to America for its electric tramway engines.

If there is anything in electricity generation and supply in bulk—it is unnecessary to say for the moment whether there is or is not—municipalities should certainly not be permitted to stand in the way of it for their own selfish reasons. Local authorities cannot supply counties with electricity. Alderman Higginbotham, of Manchester, has undertaken to organize and inform parliamentary opposition to the Bills, indiscriminately "on the broad principle that this is an attempt to upset the now settled policy of Parliament that municipalities shall not allow competitors with the local authority in their own district when the power cannot be exercised without interfering with the streets of the municipality." This is moonshine. The use of overhead wires would circumvent the terms of the resolution. But why did not its framers mention the word "rates?" And what has Manchester to do with South Wales? The fears of the municipalities are not to be allayed by the engagement of the promoters of the Bills not to sell cheap electricity within their boundaries without permission. Naturally; for assuming the manufacturers just outside the Corporation boundary to be rejoicing in cheap electricity, it would be small gratification to those inside to know that they were supporting a maternal municipality who would carefully protect them from being supplied on the same terms. Hence the opposition of the organized municipalities to the Bills is an opposition to cheapened electricity, as such. This the House of Commons saw on Wednesday; and the knowledge so far paralyzed the opponents of the Bills that they dared not go to a division. It was a sweeping demolition of the fabric of Municipalism.

CONCERNING THE SCIENCE AND ART OF PUBLIC STREET LIGHTING.

In the numbers of the "Electrical Review" for the 22nd and 29th of December last there was published an essay by Mr. F. W. Carter, M.A., on "The Scientific Principles of Public Lighting by Arc Lamps," which resumes a study already opened out by Mr. A. P. Trotter in this country, and M. Maréchal in France. If we mistake not, Mr. Carter has also done some earlier mathematical work in the same field. In any case, the study of artificial lighting effects by the application of the principles of the science of Optics is still novel enough to warrant our paying particular attention to any addition to the scientific literature of the subject. As usual, the science has lagged behind the practice in this matter. Mr. Carter admits that public lighting by arc lamps has long passed its experimental stage, so that it may be questioned whether any further study of its underlying principles can be useful at this period, when anyone wishing to plan an installation need do no more than look up particulars of similar installations already in existence. He allows that hard-bought experience will remain the chief guide in this matter; for it alone will take account of all the circumstances of the case. But he nevertheless contends that knowledge of the principles of light distribution may tend to the improvement of systems. Of course, what is true of arc lighting is equally true of other kinds.

Mr. Carter begins by pointing out that artificial lighting differs so enormously from daylight, that it becomes a debatable question as to how it should be done. The ideal of lighting any place, particularly out of doors, like day, being unattainable, what had better be done in the circumstances and with the means available for the purpose? Daylight has two ideal qualities—quantity and uniformity. The former is beyond our imitation; but the latter is not wholly unapproachable, in its kind. Consequently, some maintain that artificial illumination should be as uniform as possible; while others contend that patches of bright artificial light, even with intervening stretches of comparative darkness, correspond better with the requirements of certain cases. Again, the circumstance of all artificial light proceeding from what Mr. Carter calls "discrete sources" has to be duly considered. The effective illumination derivable from an artificial source of light depends upon how it bears upon the object lighted. This has given rise to some differences as to how we should judge of the value of a system of lights—whether by their illumination of horizontal objects, of vertical objects, or of objects otherwise inclined. "While it is necessary to be able to see the roadway or ground as plainly as possible, it is also useful to be capable of easily distinguishing persons and objects standing vertically on the ground. So that a light that is too high up may illuminate the ground well, but be unsatisfactory on account of its nearly vertical rays only just grazing vertical objects. Again, one wishing to examine anything by artificial light naturally turns the object so that it shall be as highly illuminated as possible; so that, from this point of view, the maximum illumination is important." Since the lighting effects of lamps are additive, the effects of one supply a minimum upon which that of the whole is reared. Mr. Carter notes that in street lighting the effect of reflection from the frontages may be considerable. He also admits that the dazzling effect of electric arcs is a grave objection. What with one consideration and another, he willingly concedes that the scientific method alone cannot be trusted to solve the problem of finding a system of lights to satisfy specified conditions.

Nothing daunted, however, Mr. Carter proceeds to define the scientific terminology of lighting. It is unnecessary to repeat what he has to say about the unit of intensity, the candle power; but it is not very exact to describe the value of this unit as an amount of light "which does not differ very much from an ordinary paraffin or tallow candle." What make of tallow candle would satisfy this specification? Next, as is natural, Mr. Carter proceeds to explain the "law of inverse squares." This leads up to the case of light-sources which are not symmetrical—that is, which radiate different amounts of light in different directions; and also to the effect of the angle of presentation on the amount of light received by a surface. This is stated as follows: "The illumination of a surface at any point is proportional to the quantity of light falling on unit area at the point. It is measured in terms of the 'candle-foot,' which is the illumination of a surface facing a standard candle, and at a distance of 1 foot from it. . . Hence, if the intensity in a particular direction is 1 candle power, the illumination of a surface situated in that direction, distant r feet from the source, and facing it, is $\frac{1}{r^2}$ candle-feet. If the surface does not face the source, we have to multiply by the cosine of the angle through which it is turned from its position facing the source."

Thus started, Mr. Carter plunges into a thicket of mathematical expressions from which he triumphantly emerges with a handful of "Cartesian curves," showing the particulars of the illumination at any point due to a single lamp. It is difficult to resist the suspicion that it is scarcely worth while to go through so much to gain so little. However, the exercise is bracing to the mathematical faculty; and having found the lines once, a cardboard curve might be cut to enable the distribution of light to be drawn for other examples. Mr. Carter remarks that the datum of the minimum illumination between two lamps is "a suitable specification for street lighting." It is, however, a perilously small multiplicand to start with, if, as he states, it is usually, in England, "about 0·04 candle-foot for the principal streets." The minimum illumination of gas-lit side streets is stated on the same authority to be "only of the order 0·001 candle-foot." It should be observed in regard to this, however, that public lights in side streets are no more to be classified as "illumination" than the solitary policeman should be judged as a Lord Mayor's Show.

Mr. Carter does not admit any consideration to mar the symmetry of his calculations. Thus he speaks of lamps ranged along a street, and says that with such a disposition "some of their light will be wasted on the bordering buildings." Wasted! What then, it may be asked, constitutes a street, if the frontages are to be left out? Mr. Carter, in concluding his exercise, gives up the hope of uniformity of illumination when such intense sources of light as arc lamps are used; but he qualifies his despair by suggesting that higher lamp-posts, or the use of lanterns and reflectors sending out the greater part of the light "but little below the horizontal," will palliate the evil.

The truth of the matter is that in practice these matters are arranged without the smallest regard for the dictates of optical science. The early electricians, with their "tower lights," set all science and common sense at defiance; but they were not devoid of a glimmering of reason. They were followed by the more cunning impostors who, discovering that the term "candle-power" was something wherewith to charm public lighting authorities, invented "French measurement," and returned their arc lamps as of fourfold the average photometric intensity measured in one direction. Now the lighting of the public streets by arc lamps has come down to the prosaic setting of such lamps on posts 20 feet high, at intervals of from 50 to 60 yards. Even these are only too frequently put in the wrong place—that is, in the middle of the roadway, when they would be far more useful in the line of the kerb. We have pointed this out repeatedly, and are content to maintain that, for the convenience of people using cabs, omnibuses, and tramcars, street lights of any kind are far better fixed on the kerb. One would think it stands to reason that it is better to have the light on the mounting and dismounting side of vehicles; but this consideration belongs to the art of public lighting, not to its science, with which alone Mr. Carter is concerned.

In truth, the art of this matter is of vastly greater importance than the science. Latterly, by dint of sheer experiment, it has been discovered that, for spectacular effect, public lighting should not be limited to one plane. This truth was enunciated in the "Journal" very many years ago. We showed, in connection with the early attempts at lighting the Crystal Palace Nave by electricity, that it is impossible for the vision to penetrate through a plane of powerful overhead lighting and see anything beyond. In this connection, the Crystal Palace is so huge that the problems of its effective lighting are the same as those of streets and open spaces. Nowadays, the meaning of our contention has been grasped by those who never heard of it; and the frontages of theatres, public halls, and important buildings are lit up by lights at different heights. Only in this way is it possible to see the architecture. This is not photometrical science, it is scenic art. So, we maintain, should all problems of public lighting be approached. Unfortunately, when a public body get bemused by so-called scientific advisers in this matter, whose minds are clogged with statistics of candle power—and utterly meaningless at that—they lose sight of the artistic aspect of the question; and the consideration of public convenience is also forgotten. In this connection, we have to refer to the Editorial "Note" in the issue of the "Journal" for the 13th ult. (p. 393).

It is perhaps only to be expected that, in a business which involves so many unconnected objects, and is swayed by such diverse interests, as this of public street lighting, glaring inconsistencies of treatment should be exhibited in various localities. Such is the fact, at any rate. The use of the electric arc light at all for this purpose is actually only being attempted in some places, whereas other towns have been through the experience and given it up. The truth is that, in the hap-hazard British way of doing these things, such a problem is rarely, if ever, stated for solution strictly on its merits. There is usually some ulterior, and not always divulged, end to be subserved—revenue must be found for the electric lighting undertaking, or the gas company are to be snubbed, or the neighbourhood must be "in the fashion," or somebody's vanity must be flattered. This is neither science nor art, nor is it business; but it is more influential than all of them put together, in some places.

Oil for Removing Boiler Incrustation.—The use of petroleum for preventing incrustation in boilers is now adopted in a great many places. For this purpose petroleum injectors are used, by which means oil is supplied to the boiler in small drops. Generally the petroleum injected collects in small mineral deposits, and the light parts of the petroleum evaporate with the steam, while the heavy part, together with the deposits, forms an amorphous powder, which is very easily removed from the sides of the boiler. The quantity of petroleum used for the purpose is not more than half-a-pint per 24 hours.

THE LABOUR MARKET IN 1899.

A SUMMARY of the returns received by the Board of Trade each month relating to the state of employment during the past year has just been issued; and, as was certain to be the case, it shows that 1899 was a period of exceptionally good employment in almost all the principal branches of industry.

The returns received from Trade Unions connected with the engineering, shipbuilding, metal, building, and miscellaneous trades show that, of a total membership of some 500,000, only 2·4 per cent. were, on the average, unemployed during 1899; this being a lower percentage than in any of the seven preceding years, and hardly more than half the mean for that period—namely, 4·6 per cent. In respect of the coal trade, returns were received, chiefly from employers, relating to about two-thirds of the total number employed in and about coal mines. They show that the pits at which these persons were employed worked, on an average, 5·46 days per week throughout the year, or about one-fifth of a day more than the average for 1898, which was itself higher than in any of the preceding years. These returns only profess to state the number of days (allowance being made in all the calculations for short days) on which coal was hewn and wound at the collieries concerned. It does not necessarily follow that all the persons employed at these collieries worked the whole number of days. The statistics, however, are plainly indicative of unusual activity in the trade last year—an activity that was especially in evidence during the usually slack summer months.

The monthly returns received relating to the pig-iron trade are very complete, covering the great majority of the blast-furnaces of the kingdom. The statistics compiled therefrom show that a remarkable improvement in employment took place in that industry during 1899. At the works to which the returns relate, the number of furnaces in blast at the end of every month in the year was greater than the maximum recorded in 1898. A similarly marked improvement was witnessed in the manufactured iron and steel trades. The number of hands employed therein was higher by over 5 per cent.; while in the tinplate trade an even greater increase of employment was recorded. The number of mills at work rose from 349 at the end of April, 1899, to as many as 411 by the end of September; and the average number of workpeople employed during the year was higher by 15 per cent. than in 1898. As a result of this greatly increased activity in manufacturing industries, the scarcity of labour in agricultural districts—rapidly becoming the normal condition—was more marked than in former years. The casual harvest labourers being the class from which gas-works customarily draw a number of their winter hands, some considerable difficulty has undoubtedly been experienced this season in obtaining sufficient labourers. The problem of the unemployed has, for the present, solved itself.

A YETERAN SCOTTISH GAS MANAGER.

IT is with feelings of the deepest sincerity that we offer our hearty congratulations to-day to one of Scotland's veteran gas managers. Mr. Jesse Hall, Manager of the St. Andrews Gas-Works, entered his 81st year on the 10th of January last, and in the present month he will have held for half-a-century the position he now fills. Mr. Hall's association with St. Andrews extends over a longer period than this, as in 1845 he was engaged in superintending an addition to the College buildings and other works there. When these were finished, he removed to Edinburgh, and was employed in Her Majesty's Office of Works. Official duties causing his health to fail, he sought outdoor occupation. In 1849, the gas managership at St. Andrews became vacant by the removal of Mr. W. Foulis to Paisley; and Mr. Hall was selected, out of a leet of four, as his successor. In March, 1850, he entered the gate of the St. Andrews Gas-Works to take the superintendence of a very primitive concern. The price of gas was 8s. 4d. per 1000 cubic feet, with a charge for meters; and the annual make was 3½ million cubic feet, calculated from the bulk of coal carbonized, for there was no station meter. The first result of Mr. Hall's appointment was a reduction of the price to 7s. 6d. in 1851; and since then it has been further lowered from time to time until it is now only 3s. 4d.—or 5s. less than when Mr. Hall entered upon his duties—while the yearly make is more than 36 millions. The original capital of the Company was £2500, in £10 shares; but it was increased by a second issue of 198 £12 shares—making together 448 shares. These were reduced by purchase in 1869 to 424, valued at £20 each, owing to additions made to the works. In 1850, the dividend was 12s. per share; but in 1851 it was increased to 15s., and it has since gradually risen to 50s. Half-a-century ago the shares fetched £12 10s. each; now they are readily purchased for £40 apiece.

Reference has been made above to additions to the works. The latter were erected in 1835, from the plans of Mr. Russell, Engineer and Manager of the Dundee Gas-Works; but during the past fifty years they have been so improved that hardly a trace of the original works is left. As the make of gas increased, Mr. Hall had to design and superintend the carrying out of the extensions, besides discharging the various duties of Treasurer, Secretary, and Collector; the meters being inspected four times a year. In 1862, he was allowed an assistant; and since then several young men have learned from him the rudiments of their profession, and are now filling responsible positions. Among them were two of his sons—Mr. T. Douglas Hall, of Montrose, and Mr. Robert Hall, of St. Andrews. Mr. Jesse Hall was President of the North British Association of Gas Managers in 1878, when the members met in St. Andrews, and his son Douglas in 1893. Mr. Hall's services were at one time not devoted exclusively to the Gas Company, as up till 1884 he had a large practice as an architect, to which his Directors did not object—in fact, his relations with them have all along been very cordial; and they have from time to time recognized in a tangible way their appreciation of their Manager's value. In 1892, they relieved him of some of his duties by appointing his youngest son his assistant; and he will eventually succeed to the management of an undertaking with which the larger portion of his respected father's varied and useful life-work has been associated.

RECENT PUBLICATIONS.

A Short History of the Progress of Scientific Chemistry in Our Own Times. By W. A. Tilden, D.Sc.Lond., &c. (Longmans, Green, and Co.).

This most interesting little book is the outcome of a course of "Lectures to Working Men," delivered by Professor Tilden in the spring of 1898, on the progress made in the science and practice of chemistry in the preceding sixty years—that is to say, during the Queen's reign. Professor Tilden was, he tells us, desirous of assisting his audience—most of whom possessed at least an elementary knowledge of physical science—by referring them to some book by the aid of which they could verify and amplify their notes of his lectures. But he could find no single book of moderate size and cost which afforded a historical survey of the succession of events which has led up to the system of theory in chemistry accepted at the present day. The book before us is intended to supply the deficiency; and the author is to be congratulated upon the admirable manner in which he has performed his task—not only in regard to the quality of the subject matter, but also in regard to the style which characterizes the writing, and the excellent arrangement of the various branches of the subject.

The period selected by Professor Tilden for his survey—from the commencement of the Queen's reign up to her Diamond Jubilee—appears at first sight to be purely arbitrary; but its justification from the scientific point of view is provided by recalling the fact that it was in the thirties that the influence of Liebig's teaching, which marked an epoch in the development of chemical research, began to make itself widely felt. It is, moreover, a fact that a revival and quickening of learning in its every branch characterized the period immediately preceding and succeeding the year of the Queen's succession. The author, in his introduction, disclaims having attempted to expound with fulness the present state of knowledge and of theory, but rather to show by what principal roads we have arrived at that state in regard to questions of general and fundamental importance. Professor Tilden, however, is better than his word; and no one can fail to more fully understand and appreciate the stores of knowledge now available to the student of chemical science, after a careful reading of this thoughtful survey of the means by which these stores were accumulated.

One thing that is brought clearly home to us in considering the advance that has been made in every branch of scientific knowledge during the past fifty and more years, is the impenetrability of the veil that hides from our human intelligence the solution of the fundamental problems of the universe. We know—that is, we think we know; every method of inductive reason proves—that atoms combine together. The atomic theory assumes that, since two elements combining in the same proportion may yet produce several distinct compounds, these compounds are produced by a different arrangement of the same number of atoms. But why, and by what impulsion, do atoms combine together at all? This has been, and, Professor Tilden says, probably wil always remain, "one of the fundamental but unsolved problems of chemistry." What, again, is the essential nature of gravitation, of magnetic attraction, of electrical induction? We can use these forces—we can even measure them—but do we understand them? The more we take count of what we do know, the more fully we appreciate the truth that at present we see but as in a glass, darkly.

Investigators are none the less, but rather the more, strongly drawn towards these realms of the unknown, the boundaries of which are steadily, if but infinitesimally, being contracted; and in no direction is the attraction more strong than towards the mysteries of the ultimate sources and properties of matter—not the least among which mysteries is the true nature of chemical affinity. "We not only do not yet know why substances unite together, but there is at present no measure of the law as to the distance through which particles of uniting substances may act upon each other. Nevertheless, speculation has, of course, not been wanting; and among the several hypotheses concerning the nature of chemical affinity, none has attracted more attention, or shown signs of greater vitality, than the one which

attributing chemical combination to the existence upon the atoms of charges of electricity of opposite kinds, in virtue of which they unite to form more or less completely neutral products." Another source of much speculation and discussion is the numerical relations among the atomic weights. "A large part of the interest attaching to this subject arises from its association with the question as to the probable nature and origin of the chemical elements. On the one hand, each of the elementary bodies may represent a separate creation independent of all the rest, and having nothing in common with them. On the other hand, supposing a relation can be traced between the masses of the atoms of which different elements are composed, then it is open to inquiry whether they may not have had a common origin; whether they may not represent several stages in a formative or evolutionary process, operating upon a primitive simple material; and whether, in that case, it may not be possible to transform one into another by the operation of agencies within the range of practicable experiment." The interesting theories of Newlands, and his "Law of Octaves," in respect of the numerical relations of the atomic weights of the elements, are fully discussed by Professor Tilden. We must not, however, be tempted into touching at any length upon this or any other of the subjects dealt with. The chapters on the origin and development of the ideas of valency and the linking of atoms, on the development of synthetical chemistry, and on electricity and chemical affinity, are of especial interest. The liquefaction of gases is considered in a much more judicial spirit than is to be observed in the writings of American enthusiasts. The chapter thereon forms a condensed, but sufficient, account of the progress made in this field of discovery.

In his conclusion, the Professor defends British chemists from the charge of having fallen behind in the race for pre-eminence in the advancement of knowledge, by reason of "inactivity, indolence, ignorance, and neglect," and speaks with hope of the future. "In the ancient Universities of Great Britain, where chemistry has not flourished with the vigour shown by the older studies, the spirit of mediævalism is no longer wholly predominant. We may therefore look forward hopefully to the day, not far distant, when Science and Letters, no longer fierce competitors for academic vantage, may walk hand in hand, each conscious of her own dignity, but ready to yield to the other her due share of honour."

The book is to be heartily commended to all students of the science of chemistry. Its value is increased by the addition of a table of important events in the history of that science since 1800 arranged in chronological order, an index of subjects, and an index of persons.

The Municipal Year Book for 1900. (Edward Lloyd, Limited.)

This publication, which grows more bulky each year, contains a vast amount of information relating to the municipal bodies of the United Kingdom, and the main features of the work they undertake. Separate sections are devoted to the principal municipal industries—the supply of gas, water, and electricity, the management of tramways, and the erection of artisans' dwellings and municipal lodging-houses. The subject-matter and statistics have, in many cases, been revised by officials of the various public bodies, and should therefore be reliable. Use is, of course, the only possible test of the accuracy of such a work. The intention is certainly excellent, and the arrangement good; but a scanning of the pages indicates that the proof-reading has not been up to the highest standard—which is a fatal observation to make in glancing through a book of reference, for it shakes one's faith in the absolute reliability of the figures. Would a careful "reader" have passed "Municipal Legislation in 1900," as a heading for pages devoted to a summary of the Acts obtained by public authorities in 1899? The error occurs on four pages out of seven. The writing is also somewhat slip-shod. For example, in the summary of the report of the Metropolitan Water Commission, the past and present tenses are used quite indiscriminately, even in the same sentence. If a work like the Stock Exchange Year Book, with ten times the amount of matter, can be issued without a single blunder throughout its text, why cannot publications of more modest dimensions be equally accurate? If it be a question of money, we can only say that a work of reference which bears the mark of carelessness in its compilation is dear at any price.

The Editor asks for suggestions for improvements in new editions. We therefore mention one point, in respect of which a change for the better might, we think, be adopted with advantage. In the summary of the population, area, work, &c., of each municipality which is engaged in any of the industries to which separate sections are devoted (gas, water, &c.), a reference is made to such section or sections. The number given in the reference is, however, only that of the first page of the section. It would be much more useful if the reader were referred instead to the actual page on which is to be found the information respecting the particular municipality concerned. We may add that it would also be an improvement if the references were given in all cases, instead of only in some. Instances of the omission are numerous.

The production of coal last year by the collieries comprised in the German Coal Syndicate was 48,024,014 tons. The corresponding output in 1898 was 44,865,536 tons; so that the production increased last year to the extent of 3,158,478 tons.

PERSONAL.

Mr. Harold S. Williams has been appointed Assistant Gas Manager to the Lancaster Corporation.

Mr. Frank Morris, formerly Engineer and Manager of the Brentford Gas Company, has been elected a Director of the Uxbridge and Hillingdon Gas Company.

After thirty years' service, the Engineer and Manager of the Canterbury Gas and Water Company, Mr. T. May, Assoc.M. Inst.C.E., intends to retire very shortly. The Directors have offered him the appointment of Consulting Manager.

Mr. E. P. Reilly, who, as was recently announced in the "Journal," has relinquished the position of Manager of the Guildford Gaslight Company, has been appointed Manager of the Cape Town and District Gas Company, in succession to Mr. Sidney E. Stevenson; and he will sail for the Cape about the end of the month.

[It was Mr. Arthur Easton, not Alfred, who was recently appointed Manager of the Faversham Gas-Works, as mentioned in last week's "Journal."]

OBITUARY.

Ex-Bailie Gow, of Perth, who was for a number of years Convener of the Works Committee of the Perth Gas Commission, died at Perth last Thursday. He had been in office on one or more of the public boards in the city for thirty years. Only last year he retired into private life.

Mr. John M'Landsborough, of Bradford, whose name is associated with the water undertakings at Shipley, Horsforth, and Clitheroe, as well as with drainage works at Burley, Yeadon, and elsewhere, died on the 24th ult., at the advanced age of eighty. He began practice as a civil engineer at Bradford in 1850, and retired in 1882.

The death occurred on Saturday, the 24th ult., in his 89th year, of Mr. Peter Schuyler Bruff, of Handford Lodge, Ipswich. Deceased was one of the founders of the Tendring Hundred Water Company, of which he was Managing-Director, and for some time Chairman. He was the oldest member of the Institution of Civil Engineers, having been elected in 1840.

We regret to record the death, on the 6th ult., of Mr. David Stiven, Engineer and Manager of the St. Thomas (Danish West Indies) Gas-Works. About nine months ago, Mr. Stiven had a stroke of paralysis which affected his right side. This was followed four months later by a second attack, which rendered him unfit for his duties; and his son, Mr. David D. Stiven, who was then with Mr. Herring, in Edinburgh, was sent for to undertake them. Mr. Stiven, junr., arrived in October and relieved his father; but, though the latter's health improved, it had really broken down, and he passed away on the above-named day. He had held his position for 31 years. When he went to St. Thomas, the Company were in a sad condition; but after a few years he not only brought the undertaking out of debt, but enabled the Directors to declare dividends of 10 and 12 per cent. The place has, however, gone down; and the Company are now paying only 7½ per cent. to the preference, and 2 per cent. to the ordinary shareholders. Mr. Stiven was a member of the Gas Institute; having been elected in 1877.

NOTES.

Draughts in Houses.

The necessity for knowing with tolerable accuracy how much heat is required for keeping up the inside temperature of an inhabited house to any given average, has been forced upon American heating and ventilating engineers by the conditions of steam heating practice. Mr. W. S. Munroe states that in any heating system it is necessary, first, to replace the heat lost by convection and radiation from the windows and walls of the building to the colder surroundings outside; secondly, to heat to the required temperature any air that may be intentionally admitted for ventilation; and thirdly, to heat also the air admitted unintentionally through cracks of window frames, porous walls, and opening doors. He remarks that the amount of heat required for the last cause is much greater than is generally supposed. The quantity of air that will pass through the walls of an apparently tight room is incredible to those who have not familiarized themselves with the phenomenon by actual experiment. Mr. Munroe does not know of any experimental data on this subject; but he knows that when the wind is blowing hard and the weather is cold, it is always possible to find a decided current of air flowing through any building in the same direction as the wind out of doors. Sealing up windows and doors will not prevent this effect, which is most noticeable along the floors. Mr. Munroe argues that buildings should be made much tighter than they are, making proper provision for ventilation; because the current of cold air along the floor, which is the inevitable product of the ordinary no-system, is about the worst and most comfortless method of "natural" ventilation conceivable. Wooden floors with concrete filling are good to start with; and the walls around the joists should be painted with a heavy coat of asphalt

paint. It is largely due to the uncertainty introduced by this element of air leakage that heating calculations for interiors are so often wrong. Rooms which seem to quickly get "stuffy" at ordinary temperatures, are discovered to be like sieves when the outside temperature is below 20° Fahr. with a brisk wind.

Testing Portland Cement for Soundness.

A Committee of the Associated German Portland Cement Manufacturers, in conjunction with the Mechanical Testing Laboratory at Charlottenburg, has been engaged investigating the trustworthiness of various quick tests for the soundness (constancy of volume) of portland cement. It is acknowledged that this quality of soundness is of cardinal importance in portland cement; and it is also admitted that it has no necessary connection with other qualities of the material—as strength, fineness, or weight. Mr. Gary had charge of the experiments designed to elucidate this matter of soundness, which is the same thing as constancy of volume; and he attempted to systematize the signs of cracking, warping, and other movements of the test pats and balls referable to this character. Soundness or the opposite is inferred from the behaviour of flat cakes, and in particular from the result of the boiling test of Michaelis and others. The latter is greatly affected by the age of the cement. The general result of the investigation was to show that there is no quick and easy test to be relied upon for showing whether a sample of cement will stand all requirements of practical use. Still the boiling test for soundness will be provisionally retained at Charlottenburg. The Committee offer the hint that the tests of cement may sometimes bear some relation to the use to which it is to be put—as, for example, cement work which is to be kept hot and dry may not be suited for the same make of the material that would be proper for a breakwater.

Compressed Air Power Transmission.

In connection with what is so often heard nowadays in praise of the electrical driving of machine tools, it is interesting to note that, for other purposes besides the mechanical stoking of gas-retorts, pneumatic power continues to hold its own. It is seriously maintained by some American authorities that the mechanical power traction of tramcars in busy localities is better done by the agency of strongly compressed air than by any other means. Recently, "Engineering" had occasion to chronicle the fact that revival of interest in pneumatically operated machinery has been a marked feature of the last few years. It is remarked that pneumatic engineering underwent a considerable development during the first half of the century; but vacuum rather than pressure plant was fashionable in those days. Pneumatic pressure tubes for the despatch of parcels are familiar conveniences; and there is at least a possibility that the system may be extensively developed in coming years. Referring to the driving of workshop tools, where electricity had the start, this agency is already being superseded for many purposes by pneumatic driving. The pneumatic riveter is a most useful tool. The pneumatic hoist or lift is capable of doing much service. True, the enterprise of Popp in distributing pneumatic power in Paris came to the end of its possibilities some time ago; but the great point to be made is that those who use pneumatic power for gas-retort stoking machinery—for which purpose it is admirably adapted—need be under no misapprehension as regards the class and modernity of this order of machinery. It is far more advanced than many more showy secondary movers.

Coke-Breeze for Fire Resisting.

In a paper on the construction of industrial block dwellings in towns, Mr. T. Blashill lays it down that the floors of rooms should at least be made "fire resisting." He thinks that pugging between the wood joists would be sufficient; but all the floors in the dwellings put up by the London County Council are made of coke-breeze and cement carried by steel joists. They are thinner than wood floors, saving a course of brickwork in all walls, and they have been found somewhat cheaper; but this must depend upon the price of steel. Care is required in mixing the coke-breeze concrete, and in applying it so as to be firmly held by the flanges of the joists, which should be rather wide. Mr. Blashill recommends these fire-resisting floors for convenience of construction as well as cheapness. All floors have thin floor boards nailed down close on the coke breeze after this is quite dry. It has been elsewhere stated that, for the sake of rigidity, steel floor joists should never be used for a greater span than twenty or twenty-two times their depth. As bearing on this subject of fire resisting floor construction, it has been a matter of remark that the London building by-laws permit of the construction mentioned by Mr. Blashill, of wood joists pugged in between. Mr. Ellis Marsland has written to the "Builder" describing a test of the slightest construction of floor permitted by the schedule, which he says has set his mind at rest on this point. The experimental floor was constructed of 7 in. by 2 in. fir joists, placed 12 inches apart. Coke breeze cement concrete, gauged 5 to 1, was filled in between the joists to a depth of 5 inches from the top level, upon temporary wooden centering. When the centering was removed, a ⅜-inch match-lined ceiling was nailed up underneath the joists, and a ⅞-inch deal flooring was nailed on top of them. The floor was then loaded with 100 lbs. to the foot super, and a fire made up under it, raising the temperature to 2000° Fahr., which it successfully withstood for an hour and twenty minutes. Mr. Marsland is loud in praise of coke-breeze concrete as a fire-resisting material. He knows nothing better for the purpose.

TECHNICAL RECORD.

MIDLAND ASSOCIATION OF GAS MANAGERS.

The Annual Meeting of this Association was held on Thursday at the Grand Hotel, Birmingham. The PRESIDENT (Mr. J. Ferguson Bell, of Stafford) occupied the chair; and there was an excellent attendance of members.

CONFIRMATION OF MINUTES.

The HON. SECRETARY (Mr. Charles Meiklejohn, of Rugby) read the minutes of the meeting held on Oct. 26 last; and they were confirmed.

ANNUAL REPORT AND STATEMENT OF ACCOUNTS.

On the motion of Mr. B. W. SMITH (Smethwick), seconded by Mr. A. COOKE (Oldbury), the annual report of the Committee and the statement of accounts, which had been circulated among the members, were taken as read. The former reviewed the proceedings of the past year; and in one of the concluding paragraphs, the Committee regretted that during the year three members had died—viz., Mr. W. Parsons, of Atherstone; Mr. J. Fryer, of Market Harborough; and Mr. J. Ward, of Brierley Hill. It was also mentioned that three new members had joined, one had resigned, and three had ceased to be members under rule 15. With regard to the financial statement, it was shown that the balance in hand was £97 11s. 11d.

ADDITIONS TO THE ROLL.

The HON. SECRETARY then submitted the following nominations for membership: Mr. Edward Onions, of Loughborough; Mr. C. E. Parsons, of Atherstone; Mr. H. G. Harrison, of Derby; Mr. F. A. Winstanley, of Rotherham; Mr. W. Gorse, of Walsall; Mr. A. T. Harris, of Market Harborough; and Mr. H. H. Everest, of Whittington, near Chesterfield.

The PRESIDENT remarked that he thought it was a matter for congratulation that they had so many nominations at this meeting.

Mr. SMITH moved, and Mr. J. S. REEVES (Bilston) seconded, that the gentlemen named be elected members of the Association; and this was unanimously agreed to.

THE LATE MR. J. FRYER.

The PRESIDENT said that, before he delivered his address, he would ask the Secretary to make a few remarks with reference to a matter that had been before the Committee and also before the members. He referred to the death of Mr. J. Fryer, of Market Harborough.

The HON. SECRETARY said, as the result of the appeal circulated among the members, the sum subscribed up to date was £64 9s. 6d.; and as the result of the appeal through the technical journals, he had received £39 17s. from sympathizers outside the Association—making a total of £104 6s. 6d. In addition to this, £4 4s. had been promised, but had not yet come to hand. These amounts would together give a total of above 100 guineas. He might also add that one of the boys had been practically assured for election to the Royal Masonic Institution for Boys, which would provide for him for the next eight years or so; and, by the kindness of a member of the Association, some efforts had been made to get one of the girls into a local orphanage. But this was not quite settled yet. In regard to the local fund which had been raised by the people of Market Harborough, he (Mr. Meiklejohn) saw the Chairman of the Gas Committee the previous day, and was informed that they had raised a total of £180 from among the old shareholders of the Gas Company and the members of the District Council, under whom Mr. Fryer served. It had been agreed by the promoters of the local fund, and by the Committee of the Association, that representatives of each should meet, in order to agree to some joint method of distributing the money so that there might not be any overlapping.

The PRESIDENT said he thought the statement of the Secretary would be considered eminently satisfactory.

Mr. THOMAS GLOVER (West Bromwich) said he did not know whether there would be a further report on this matter; but in case there should not be, he would like to say that he thought every member felt the Association were indebted to Mr. Meiklejohn for the way in which he had carried the matter through. He had been at some considerable trouble—he (Mr. Glover) thought it had been a pleasure to him; but at the same time he had done the work very well. He did not think the matter would have been taken up as it was, had it not been for the initiative of Mr. Meiklejohn.

Mr. J. A. HARRIS (Wigston) said he was delighted with the result of the appeal which had been made. Living in the same neighbourhood as the late Mr. Fryer, he knew him well. About three years ago, he lost his wife, and since then he had had to battle along with five children, two of whom were very weak and sickly; and so no one really knew what Mr. Fryer had had to contend with. He (Mr. Harris) knew the family circumstances perhaps better than anyone present; and he could say that what had been done was highly appreciated by Mr. Fryer's parents, and by his brothers and sister.

The PRESIDENT then delivered the following

INAUGURAL ADDRESS.

Permit me to commence my address with an expression of cordial thanks for the honour you have conferred upon me by electing me your President. I am conscious I cannot in many ways equal the able men who have preceded me. But the duties of the office shall have my fullest and best attention; and I hope, with the assistance of the members, to maintain the interests and usefulness of our Association, so that we may continue to prosper both individually and collectively, and accomplish useful work for the gas industry.

It is now 23 years since the Association was formed, in order that those united by mutual interests might know each other better, and bring to the notice of members any modern improvements effected, and the results of investigations which from time to time occupy their attention; and as past records contain some of the most important advances and achievements connected with our industry, so we must endeavour to keep in the van of progress, and lay the foundations deeper and broader every year.

During the past year we welcomed three new members; but unfortunately we lost, by death, Mr. W. Parsons, of Atherstone, Mr. J. Fryer, of Market Harborough, and Mr. J. Ward, of Brierley Hill—all men of worth, and whose places will not be readily filled. Also our friend Mr. Tindall, of Walsall, has retired from his more active duties—full of honour—and I trust we may for many years continue to see him among us. The numerical strength of the Association remains the same—85 members; and I am happy to say that the Association, which year by year has gradually risen by continued steady progress to its present prosperous condition, is a united and flourishing society.

The introduction of coal gas for lighting and other purposes only dates from the commencement of the present century, which has now entered upon its closing year. From that time to the present, there has been a continuous and amazing increase in its use, notwithstanding the rapid spread of the electric light and other artificial means of illumination. The increase continues; and as gas is now used for so many purposes in addition to lighting, we may reasonably conclude that future developments will continue to be made, and it is our business to see that the rate of progress is maintained, so far as improved conditions and circumstances permit of the introduction of the best and most modern appliances, in order that gas in the future may be supplied still cheaper and better. One step in this direction, in these days of rapid progress and keen competition, is to consolidate our forces. Hence the desirability of greater unity; and evidence is fortunately not wanting of an approaching fusion of the two Institutions, which is a matter for congratulation. It is now nine years since the Institution of Gas Engineers was formed by members of the profession who believed that changes involving grave issues were necessary in the constitution of the Gas Institute; and it was thought these could best be obtained by means of a new Association.

Altogether, from whatever aspect we regard either Society, it is felt that the welfare, harmony, and prestige of the profession will be best served by the amalgamation of both bodies. I hope this year to see both the Gas Institute and the Institution of Gas Engineers dissolved and re-formed into one Institute worthy of the gas industry. There should be nothing insuperable in the way of re-union; and by a full recognition of the just claims of the members of both Associations, a permanent and advantageous settlement should be easily attainable. Further, I hope to see the various District Associations affiliated to the new Institution by some scheme which will be acceptable to the district members, and thereby add to their dignity and be a source of strength to both. It only requires the active co-operation of the various members to unite our divided forces, and to thereby carry into effect what most members will agree is both desirable and expedient—a united National Gas Engineers' Association.

An endeavour to cultivate friendly relations between capital and labour by the introduction of profit-sharing, whereby those actually employed may have some share in the prosperity that is created by their labour, over and above the remuneration agreed upon, is well worth the serious consideration of those who desire to see established a bond of union between employer and employed; and greater unity and harmony are absolutely necessary between capital and labour if this country is to maintain its industrial supremacy. I am persuaded that a system of profit-sharing on the lines so successfully introduced by Mr. George Livesey, who has done so much for the gas industry, is a means whereby industrial peace may be preserved, and mutual trust established between employers and employed, and hence cause a more zealous performance of duties which must eventually lead to better results. More than twelve months since, I suggested to my Committee that the introduction of profit-sharing in our gas and electricity works would be to the advantage of the undertaking; and, after some consideration, it was unanimously passed by the Council, and I hope we shall have our first division of profits next May. At some future time, I will gladly avail myself of an opportunity to lay before the members full details of our profit-sharing scheme, and give the results. I can only say that never were the relations more pleasant and harmonious than at the present time.

It is now eighteen months since the Workmen's Compensation Act of 1897 came into operation. It marked a new departure in the law relating to the liability of employers for injuries to their workpeople. The new Act is a direct tax upon certain industries for the accidents that occur from time to time; and now a large number of industrial employments are liable to pay compensation for all accidents, and are only exempt upon the serious and wilful misconduct of the injured. Previously, in whatever way a workman sustained injury, unless negligence could be sustained upon the part of the employer, the workman had no remedy. This, in most cases, was a great hardship. Under the new Act, compensation is not payable until after the first fortnight, and is limited to half the average weekly wage up to £1 per week; and in case of a fatal accident, the amount of compensation payable is fixed at three years' wages—the total amount not to be less than £150, nor more than £300. Such is a brief summary of the Act, which created such an outcry, and caused the Insurance Companies to ask premiums for this class of risk at excessively high rates; so that, if employers had been obliged to pay the premiums asked, it would have meant a serious additional tax.

I think all members of this Association will agree that the Workmen's Compensation Act of 1897 is a beneficent one, as it seems only fair and reasonable that the products of any industry should bear the risks connected therewith. This being my opinion, we have for many years insured all our employees against all accidents; the premiums being 9s. 6d. per cent. upon the wages paid each year. The limit of compensation was half wages up to 26 weeks, and in case of a fatal accident one year's wage. But compensation was payable from the date of the accident. Now, taking five years prior to the Workmen's Compensation Act of 1897 coming into force, I find we received for accident claims 2s. 8d. per cent. per annum upon the wages; but had compensation not commenced until fourteen days after the date of the accident, the amount received would only have been 2s. per cent. In other words, if no compensation is payable during the first fortnight, the claims are reduced about one-third. Seeing we had insured all employees against all accidents at 9s. 6d. per cent. upon the wages paid, we were not inclined to have our premiums increased from 9s. 6d. to 25s. per cent., but took the additional liability under the new Act ourselves, until the Insurance Companies were prepared to quote rates commensurate with the risks.

I am glad to find the Insurance Companies are at last quoting more reasonable premiums; and gas-works can now cover their employees at 3s. 3d. per cent. upon the wages paid—to include the Workmen's Compensation Act of 1897, the Employers' Liability Act of 1880, and claims at common law. If payments are to be made during the first fortnight, and the policies endorsed to cover all accidents, the risk may be met by a premium of 7s. per cent. An increase in the wages account of little more than one-third of 1 per cent. cannot entail any hardship; and insurance against all accidents is undoubtedly the best plan, and a great boon to the employees. If insurance is effected, it is best to cover all accidents; otherwise, in the event of an accident happening, payment will only be made where a clear legal liability exists, which may be a cause of friction.

It is not my intention to describe the works which for a number of years have been under my control, as I hope to have the pleasure of seeing the members at Stafford in May next, when your criticism will be welcomed.

The present time is one of great activity; and within the last few years marked improvements have been effected, by the introduction of machinery for drawing and charging retorts. There is also a rapid increase in installations of inclined retorts; a noticeable feature being the adoption of conveyors for coal and coke—all of which tend to economy. A judicious capital expenditure in retort-house improvements will be found a profitable investment, as it does not pay to work with old and antiquated plant which should be consigned to the scrap heap, especially when capital may be obtained at a comparatively low rate of interest. My experience is that with simple regenerator furnaces, with air and spent-gas flues on each side, built of fire-bricks with cross baffle bricks, there being one furnace to each setting of nine 22 inch by 16 inch oval ⌂ through retorts, a make of 144,000 cubic feet per diem may be reckoned on with any ordinary quality of gas coal, and a fuel consumption of from 15 to 20 per cent. of the coke made. The best way to check the working of the furnaces is not only to note the temperature in the flues, but to make a periodical test of the spent gases for carbonic acid, which may be simply and expeditiously done in an Orsat-Muncke apparatus.

The efficient condensation of gas is of much greater importance than is often attached to this operation; and much of the naphthalene troubles arise from defective condensation. The higher temperature of carbonization increases the percentage of benzene and naphthalene at the expense of the methane and other series of hydrocarbons, and the gas becomes saturated with naphthalene vapour precisely as aqueous vapour occurs in the atmosphere, with the result that a reduction of temperature means that naphthalene is deposited.

An erroneous opinion at one time existed that the production of naphthalene was influenced by physical and mechanical action, such as sudden cooling, friction, &c. But practical researches prove that it is formed in the retorts by the decomposition of other hydrocarbons which are split up upon being

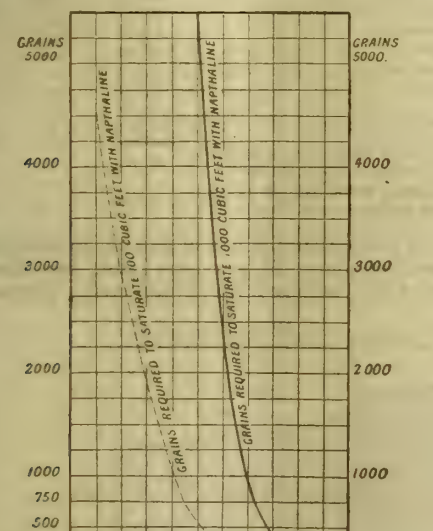
exposed to a high temperature, and that it cannot be produced by the cooled constituents of crude gas after it leaves the retort.

The amount of naphthalene produced from a ton of coal carbonized varies very considerably; but it is always sufficient to saturate the gas produced many times over. Fortunately, nearly the whole of the naphthalene produced is dissolved out, along with the other condensable hydrocarbons; and hence it passes into the tar—the solvent powers of the constituents of coal tar having a great affinity for naphthalene.

Mr. Malam in 1874, and Herr Fleischer in 1875, found that sprinkling the purifying material in the purifiers with coal-tar naphtha, was a means of preventing the deposit of naphthalene. This is one method of making up the deficiency of the lighter hydrocarbon vapours, which are capable of dissolving the naphthalene; and many have found it useful. Mr. W. Young, who has made the naphthalene question a special study, devised a process for dissolving it out of the gas by washing with ordinary heavy coal-tar oil. Dr. Bueb, of Dessau, carried out this process on a limited scale, which proved successful. He added 3 per cent. of benzol (so that the oil might not deteriorate the illuminating power), and found the creosote oil continued to absorb naphthalene until it contained as much as 15 per cent., when it was found to be saturated and unfit for further use. The naphthalene eliminated was about 200 grains per 1000 cubic feet; and the cost of this process is given as 0·045d. per 1000 cubic feet.

There are many cures for this troublesome deposit; but I think the best remedy is to aim at preventing the evil arising, which may be done by good and abundant condensation—the cheapest, and probably the most effective, means of avoiding naphthalene stoppages. The deposits generally take place in late summer and autumn, when there are wide differences between the day and night temperatures. I have plotted on a diagram

CURVE *showing Weight in Grains of Naphthalene required to Saturate* 100 *Cubic Feet of Gas from* 32° *to* 212° *Fahr. Compiled from Experiments made by Mr.* R. W. ALLEN, M.A.



the figures given by Mr. R. W. Allen, M.A., of the weight of naphthalene, in grains, required to saturate 1000 cubic feet of coal gas as the temperature rises from 32° to 212° Fahr. Although different qualities of coal gas contain a great many hydrocarbons of variable vapour tensions, the data are valuable and show at a glance the great difference in carrying power due to increase of temperature. At 32° Fahr., the naphthalene vapour required to saturate 1000 cubic feet is only 32·8 grains; whereas at 59° Fahr. it is 210 grains, and at 77° Fahr. no less than 341 grains. These figures show the important part temperature plays, and that it is of the utmost importance to cool the gas down to as low a temperature as that to which it will fall during distribution.

Ordinary illuminating coal gas will not carry more than from 150 to 200 grains before saturation; and with this quantity will give serious trouble. The reduction in illuminating power due to the removal of this comparatively small amount of naphthalene will generally be found to be not more than from 0·1 to 0·2 candles; and we may therefore ignore the idea of utilizing it as an enricher.

My opinion is that a system of condensation whereby the gas is very gradually cooled, and the hydrocarbon vapours kept in contact with the gas and allowed time to dissolve the naphthalene, will dispel the trouble arising from naphthalene deposits; but the gas must be sufficiently cooled before it leaves the condensing plant.

It has been truly said that the man who makes two blades of grass grow where one grew before is a benefactor to his kind; and seeing the fertilizing value that nitrogen possesses, it is inexcusable not to eliminate all the ammonia from the crude gas before passing it forward to the purifiers, especially as there are now so many really good washers and scrubbers available. I have found that the washer invented by one of our most distinguished members, Mr. Charles Hunt, is admirably adapted for this purpose; and by its use a large percentage of the carbon dioxide and hydrogen sulphide may be removed, along with the ammonia, from the crude gas, thereby considerably reducing the cost of purification.

According to Sir William Crookes, F.R.S., we are threatened with a shortage of wheat, and that within measurable distance, which would mean starvation. The only hope held out to us that this terrible fate may be averted, is by the copious use of nitrogen, whereby we may considerably increase the growth of natural food. So please remember that in the use of ammonia as a fertilizer is the hope of mankind's delivery from famine. The guano deposits of South America are becoming rapidly exhausted. Hence it is necessary to utilize as far as possible all the available sources of combined nitrogen, as the great achievement to which chemists look forward—to fix by some cheap process the nitrogen in the atmosphere, and make it available for plant growth—appears at present out of the question.

Crude ammoniacal liquor can be readily either concentrated or worked up into ammonium sulphate by any of the modern continuous working stills; and with a well-arranged plant of ample capacity the ammonia in the spent liquor may be reduced to 0·003 per cent. The waste liquor is sometimes troublesome, as it contains lime in suspension, besides traces of ammonia, sulphide, sulphate, cyanide, tarry acids, &c., and is of a brown colour, with an unpleasant tarry smell. Hence local authorities object to it going into water-courses, and even into the sewers, although its disinfecting action is to a certain extent beneficial. I find that by allowing it to flow into tanks, and thereby precipitating the lime, it may then be used for quenching hot coke without in any way deteriorating the coke or causing little or any inconvenience. The water from the condensers and scrubbers, which contains sulphuretted hydrogen, is most objectionable, and should be kept separate. One means of getting rid of it, is to work it through the still.

The legislative penalties for sulphur impurities, which were at one time strongly opposed, have been beneficial rather than otherwise, as they were the means of directing more attention to the better purification of gas, thereby making it more acceptable to the consumer. It is an obligation on those supplying gas to reduce the sulphur to as low a limit as possible; and gas companies, as a rule, are limited not to exceed a prescribed quantity of about 20 grains per 100 cubic feet. Although corporations who carry on gas-works are not generally so restricted, the time cannot be far distant when the law in this matter will be made to apply equally to companies and local authorities, as the presence of from 30 to 40 grains of sulphur in the gas is not only noticeable, but harmful when used for lighting purposes in rooms badly ventilated—and unfortunately most rooms are defective in this respect. Gas containing 30 grains of sulphur per 100 cubic feet will evolve upon combustion about three times this quantity of sulphurous acid, which no doubt is a very small quantity, especially if comparison be made by volume with the cubic contents of an ordinary room. It may appear almost unappreciable. But, as the late Professor Tyndall remarked, "No chemist ever weighed the perfume of a rose;" yet we notice the difference when a bunch is brought into a room. Hence, although the difference between 20, 30, or 40 grains of sulphur in 100 cubic feet of gas (which weigh 22,500 grains) may appear imperceptible, yet they have an appreciable effect; and if the interests of consumers are studied, the sulphur impurities will be reduced from 10 to 20 grains per 100 cubic feet, which may be effected at a cost for purification (leaving out interest on capital charges) varying from ½d. to 1d. per 1000 cubic feet of gas sold.

The carbonic acid present as the coal gas leaves the scrubbers or washers varies from 1·2 to 1·8 per cent. by volume; and if the sulphur compounds are to be dealt with, it is well known that this carbon dioxide must first be eliminated. But it generally pays to take it out, as 1 per cent. of carbonic acid means a reduction in the illuminating power of at least half-a-candle in 17-candle power gas. The poorer the quality, so the lowering effect increases; and, further, gas containing much carbonic acid burns with a dull-red flame.

I am of opinion that gas of about 16-candle power, free from sulphur impurities and carbonic acid, will generally be found to answer all the requirements of consumers better than richer gas not equally purified. I believe there are as many complaints about the quality of the gas in towns where 20-candle power gas and upwards is supplied as in those districts where the quality is only 16-candle power.

The suppliers of gas should not be content to afford an efficient supply at the outlet of the meter, but see that the supply is efficient right up to the burner, and that the gas is being used with some regard to economy and efficiency. Hence I advocate the desirability of a gas-fittings department, in order to furnish and supply gas-fittings, cooking-stoves, fires, and engines, and all the various domestic labour-saving gas appliances, as a branch of the business. I have found it a great advantage to have such a department, with a show-room where all the best and most modern appliances for the economical use of gas may be seen and purchased at a reasonable trade profit. It is an absolute fact that nine-tenths of the complaints of bad gas, &c.,

arise from either defective fittings or else insufficient supply on account of the internal pipes being much too small, or antiquated burners being used which have done duty for many years. The small cost of replacing them would soon be amply repaid.

It appears time that a standard set of rules for gas-fitting work was issued, and adopted with the necessary local modifications, by the various gas companies and corporations, so that houses, &c., may be fitted up under authorized inspection, and unless the work is carried out in accordance with the regulations issued, the supply be not connected. Too long have the best minds in our profession devoted themselves unsparingly to reduce the cost of the gas at the meter—neglecting the equally important question of how to most efficiently use gas for light, heat, or power purposes by the consumer.

The expiration should be noted of the Welsbach master-patent in December last, which in 1885 was granted to Dr. Auer von Welsbach for the discovery of a practical and simple method of arranging certain refractory and rare earths so that a hood made of a fabric impregnated with a solution of these nitrates, when burnt away, left a skeleton of itself—the nitrates of the impregnated fluid being converted into oxides, and this hood on being heated to incandescence by a bunsen burner radiating light. This month, the Welsbach 1886 patent expires—being the one in which thoria is claimed. This leaves only the 1893 ceria patent; so that the field of competition will be widened, and we may shortly expect such reductions in the prices of gas-burners and mantles as will bring them within the reach of all consumers. The weak part of incandescent gas-burners is the mantle being so fragile, and its deterioration of lighting power after use for 100 hours and upwards. Also the light might be improved by the addition of more bright yellow and orange rays; but these disadvantages will no doubt in time be overcome, along with the abolition of the glass chimney.

I look forward to the time when self-lighting incandescent burners will come into general use; and I may mention, from experiments carried out by me, that there appears to be very little difference in illuminating power between 16 and 20 candle power gas when used with incandescent burners.

There is much to be said in favour of differential prices for gas; as it appears to me that the price charged should be in accordance with the service rendered. This means taking into account not only the quantity, but also the time during which it is used; so that those consumers who are the most profitable may have special consideration. Now, most gas undertakings charge different prices to quarterly and prepayment consumers, because the conditions of supply are not equal. In the latter case, additional expenses are incurred for fittings, &c., over quarterly consumers; and hence the increased charges for gas. Those, therefore, whose consumption is large during the day-time, or period of minimum demand, should be charged at a somewhat lower rate.

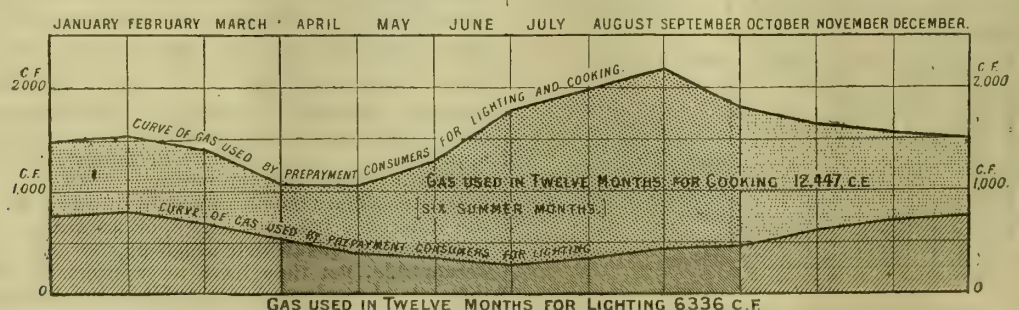
Referring to prepayment consumers, taking a large number with and without gas cooking-stoves, you will see from the diagram that those who have cooking-stoves use about three times as much per annum as those who use gas for lighting only; and, further (what is of more importance), the average gas consumption during the summer, where stoves are in use, is considerably over four times that where there are none. In the months of June, July, and August, when the demand for artificial light is comparatively small, those customers who have cooking-stoves use about six times the quantity of gas that those without do; and it is worthy of note that their maximum consumption is during these months.

An inspection of the diagram, giving the consumption each month, will show at once the advantage of affording every facility and encouragement to use gas cooking-stoves. It will be found that in houses of £20 rental, the quantity of gas used by cooking-stoves is about twice that used for lighting purposes; in houses of £30 rental, the quantity is about equal; and for houses of much higher rental, the relative quantity used for cooking as compared with lighting decreases to about one-half. But, of course, the figures in individual cases will vary considerably. The above are the averages obtained by separate metering of stoves.

TABLE *showing the Average Gas Consumption, for Each Month during the Year, of Prepayment Gas Consumers With and Without Gas Cooking-Stoves.*

1899.	With Gas Cooking-Stove. Cub. Ft.	Without Gas Cooking-Stove. Cub. Ft.
January	1,507	751
February	1,413	702
March	1,065	553
April	1,053	408
May	1,281	355
June	1,772	302
July	1,985	323
August	2,168	405
September	1,796	437
October	1,639	603
November	1,572	707
December	1,532	790
Total for the year	18,783	6336
Total used from the 1st of April to the 30th of September	10,055	2230
Total used from the 1st of October to the 31st of March	8,728	4106

In order to encourage the use of gas for cooking, heating, or motive power, we charge 4d. per 1000 cubic feet less than our ordinary price of gas used for illuminating purposes. This



brings the price down to from 2s. 3d. to 2s. 5d. per 1000 cubic feet, according to the quantity used; and if consumers agree to use 6000 cubic feet and upwards per quarter, we fix an additional meter free of charge. This small concession often induces consumers to have cooking-stoves and gas-fires fixed; and we find it an advantage for consumers to be able to accurately check the quantity used for lighting and heating purposes. The two accounts, when rendered at the quarter's end, enable them to do this, and ascertain the cost of each service.

One hears a good deal about the benefits to be conferred upon small industries when large central electric power schemes are established and are able to distribute electrical energy at 1d. per unit, or less when used for motive power. Without in any way deprecating the use of electricity for power (which has a great future before it), I may perhaps be allowed to point out that, in most districts, cheap power is already available. We are only waiting for users of power to avail themselves of one of the cheapest sources of energy—ordinary illuminating gas; the calorific value being, for 16-candle power coal gas, about 650 British thermal units per cubic foot. It may be conveniently utilized for power by means of gas-engines, which during the past few years have been greatly improved—chiefly in the direction of increased efficiency and size, rather than in the production of new types. At the present time, the consumption of gas per brake-horse power per hour, at full load, varies from 17 to 25 cubic feet, according to the size of the engine and the heating value of the gas used. The most modern make of medium-sized gas engines (10 to 30 horse power) use about 20 cubic feet per brake-horse power; and this, at 2s. 3d. per 1000 cubic feet, means just over ½d. per brake-horse power per hour.

The most profitable consumers are those who use gas for motive power—the load-factor being nine hours per day, summer and winter, as compared with two hours per day in summer and six hours per day in winter when used for illuminating purposes. It will, therefore, pay gas suppliers well to make specially liberal concessions for the gas used for motive power, as not only have we electrical energy, which is now generally charged at one-half the lighting rate per unit if used for mechanical power, and for which it is specially adapted, but, in addition, there are oil, producer gas, and steam all competing. The three last-named perhaps are not, for small power, formidable competitors; but for larger power, unless the gas is sold when so used at about 2s. per 1000 cubic feet or less, they are much cheaper.

The present enhanced price of gas coals is due in a measure to advances in miners' wages and greater cost of all materials, but chiefly because at the present time the demand is greater than the supply. This being so, colliery owners have not hesitated to very considerably advance prices—unfortunately, to such an extent as to make the increase a very serious tax upon gas-works, and compel in many cases an advance in the price of gas. The long-continued rise in the price of coal shows no sign of declining; but further advances for this year's contracts are being discussed. A considerable additional rise in prices appears inevitable for some time to come. Unfortunately, the scarcity is such that gas-works have great difficulty in getting the necessary supplies; and the same applies to most industrial concerns where much fuel is required. If the scarcity continues, I think the export of coal should be taxed, as every ton sent abroad means so much decrease in our potential resources—more

especially as the export of coal has doubled during the last 25 years, and now reaches about one-fifth of the total output. The great scarcity, and consequent increase in prices, of all gas coals, will cause many engineers to look favourably upon carburetted water gas as an auxiliary; so colliery proprietors would do well not to raise prices to an inordinate extent.

During the last nine years, carburetted water-gas plants have been erected at upwards of fifty gas-works in the United Kingdom, and their total plant capacity is now about 100 million cubic feet per diem. According to the last Board of Trade returns, the total quantity of carburetted water gas sold in 1898 was 7404 million cubic feet, or just over 6 per cent. of the total gas sold. The figure for last year will, however, be considerably increased.

The Home Office inquiry that was held last year, to ascertain the suitability of water gas for general distribution in connection with coal gas, will be the means of allaying the fears of those—myself among the number—who somewhat doubted the suitability of the gas for general distribution on account of the much greater quantity of carbon monoxide present, as compared with coal gas. So far, no legislation has followed the report of the Departmental Committee, which at least shows the matter is not one of urgency. If legislation follows, no doubt a limit will be placed on the percentage of carbon monoxide permissible in the mixed gases; and the consensus of opinion seems to place this limit between 12 and 20 per cent. The recommendation of the Committee is to limit the proportion of carbon monoxide in the public gas supply at night to 12 per cent., or such greater amount as the Department may consider desirable.

It may be expected from me that, having the management of both gas and electricity works, I should say a few words on their respective provinces. Their attitude towards each other should be that of generous, and not hostile rivals; for there is more than room enough for both. In many towns, the municipality own both the gas and electricity undertakings, upon both of which large sums have been expended; and so a community of interests exists, which should not be ignored to the detriment of one or the other.

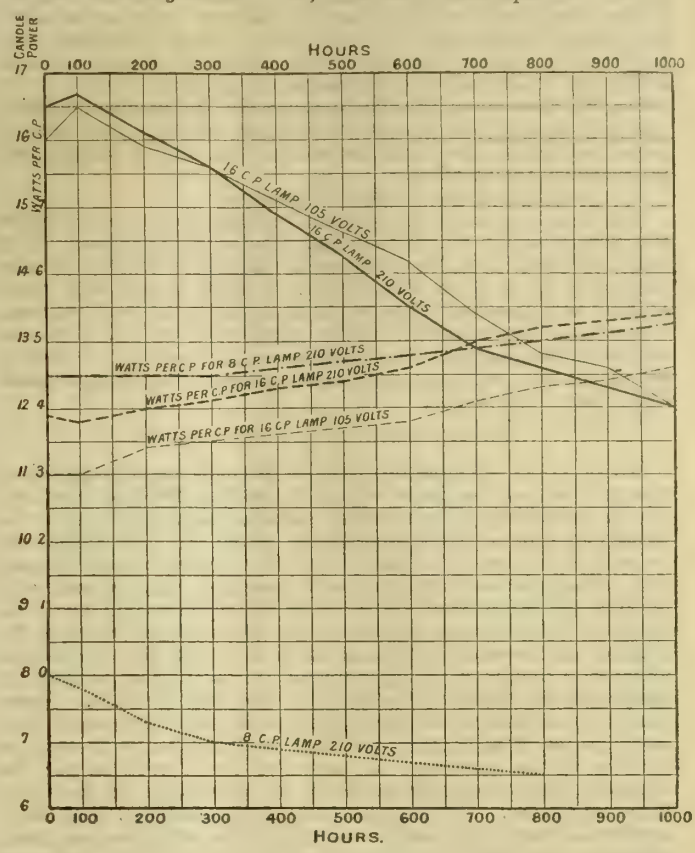
During the last few years, the electric light has made rapid strides; and we may expect this progress to continue, so far without being detrimental to the gas industry. A glance at the Board of Trade returns for the last five years will give some indication of the increase in the gas consumption over the same period. In the year 1898 (the last published returns), the total quantity of gas made was nearly 138¼ thousand million cubic feet, as compared with 114¼ thousand millions for the year 1894—being an increase of no less than 24 thousand millions, or over 21 per cent., during the last five years. In our own case, the electricity works have been running just over four years; and the increase in the gas consumption for the last nine months has been nearly 10 per cent. upon last year.

I am often asked how the cost of electricity compares with gas; but unless the exact conditions are known, it is almost impossible to give a correct estimate. For instance, gas may be used so as to develop 25 candles per cubic foot, or only 3 candles or even less per cubic foot. Again, electrical energy may be used in glow or arc lamps. Also there are high and low efficiency glow-lamps. So, unless the particular circumstances be taken into account, it is impossible to give an impartial estimate. The late Dr. John Hopkinson, F.R.S., was of opinion that generally if the price of electricity per Board of Trade unit be multiplied by 8, it would equal the price of gas, when efficient glow-lamps and good ordinary flat-flame burners are used. However, so that anyone may make his own calculations, I have plotted on a diagram the efficiency of 105 to 210 volts ordinary glow-lamps during their life of from 1 to 1000 hours.

During the next few years we shall see a very large increase in the use of electric energy for power, and especially for tramways by overhead conductors on the trolley system, with rail return; and it is of the utmost importance to those who have underground iron mains to see that the Board of Trade regulations for electric traction are strictly adhered to—more especially with reference to the difference of potential during the working of the tramway between the points of the uninsulated return furthest from and nearest to the generating station. This should not exceed a maximum drop of 7 volts. Also the line insulators of the feeders and conductors should be so maintained that the leakage currents shall not exceed 1-100th of an ampère per mile of tramway. Unless these conditions are closely observed, we shall have serious troubles caused by leakage currents affecting the neighbouring gas and water pipes by electrolytic action, which is singularly insidious—the effect being to render the pipes soft and spongy. In America, the gas and water companies have already experienced very serious trouble and heavy loss, through the rapid corrosion of their mains and service-pipes, due to the destructive effects of these stray currents by electrolytic corrosion; and considering the immense capital invested in underground gas-mains, and the dangerous effects that may result from the destruction of these pipes, it appears to me that all reasonable precautions against leakage should be adopted, and rigid inspections (along with careful tests) made from time to time, so as to minimize the danger. It is incumbent that we, on our part, do everything possible to keep our underground mains and services free from leakage; so that we may insist on all others who use the subsoil doing so without injury to their neighbours.

Allow me, in conclusion, to draw attention to what may be

Candle Power and Efficiency Curves of 8 and 16 Candle power, 105 and 210 Volt, Electric Glow-Lamps.



Arc lamps for a given energy show about six times the candle power of incandescent lamps.

A Board of Trade unit is 1000 volt-ampère-hours or 1000 watt hours. 10 ampères at 100 volts for one hour = One B.T. unit.

well known—that in the production of light by the combustion of coal gas, in which the hydrocarbons are raised to incandescence, a large amount of heat is generated, only a small proportion of which is utilized in the production of light. By heating to incandescence a mantle composed of certain refractory and rare earths, we obtain a somewhat higher efficiency; but a comparison between the energy required to fully incandesce a 16-candle power electric glow-lamp (which may be taken at 60 watts, or in heat energy about 200 British thermal units), and to maintain a 16-candle power gas-lamp, using an incandescent burner developing 16 candles per cubic foot, required about 650 British thermal units, or more than three times the heat-energy expended in maintaining an electric glow-lamp. This shows the possibilities of incandescent lighting by means of gas-burners. Especially remembering that Dr. Siemens estimated that in arc lamps of 3000-candle power one-third of the energy became luminous, and that incandescent glow-lamps utilize only about 5 per cent., he would be rash who prescribed a limit to the progress that is being made in the development of converting heat energy into light; and I look forward to the overcoming of the chemical and mechanical difficulties for the accomplishment of very much higher illuminating efficiency per cubic foot of gas used.

I have touched lightly—perhaps in too general a way—upon various topics that seemed likely to be of interest; and I trust you will not deem the time occupied as unprofitably spent.

At the conclusion of the address,

Mr. Charles Hunt (Birmingham) congratulated the President upon having produced such an interesting address. He hoped that the aspirations he had indulged in, at the commencement of it, as to the fusion of the Gas Institute and the Institution of Gas Engineers, might be fulfilled. He also congratulated him upon his Corporation having been the first among corporations to adopt the profit-sharing system, and upon the success of his initiative. They were not permitted to discuss the matter contained in the President's address; and he (Mr. Hunt) was not going in the least to transgress this wholesome rule. He wished, however, to observe on one point that he was entirely in accord with Mr. Bell in his opinion as to the effect of condensation upon the reduction of naphthalene; and this was no new opinion of his own. He gave it fully ten years ago; and, later than that, he mentioned the same thing in the paper he read before the Institution of Civil Engineers. He did not regard condensation as the thing to be aimed at—he regarded it more as a cure for naphthalene rather than the prevention. It seemed to him they should aim at prevention quite as much as a cure. But where the conditions were such as to produce naphthalene in the retorts, then he entirely agreed with the President that efficient condensation was a practical cure. He was glad to say that quite recently it had been decided

that he should try to put his opinions into practice; and he hoped that good results would follow. There were other matters in the President's address that he did not quite agree with; but putting them aside, he was sure all were of opinion that their hearty thanks were due to him for his intelligent address, which would be read with interest when printed.

Mr. W. R. Cooper (Banbury) seconded the proposition with much pleasure. He remarked that the address had been a most instructive one; and he wished Mr. Bell a happy and prosperous year of office.

The proposition was cordially agreed to.

The President said he was much obliged to the members for the hearty way in which they had received the address. If it had interested them, he might say it had interested him also in preparing it; and he was pleased to know it met with some amount of approval. They would now pass to the next business, which was the discussion on the paper read by Mr. G. Helps, at the last meeting, on "The Heating of Gas-Retorts."* Before the discussion commenced, however, perhaps Mr. Helps would like to say a few words.

THE HEATING OF GAS-RETORTS.

Mr. G. Helps (Nuneaton) said he did not come prepared to give a *résumé* of the paper which he read at the last meeting; but he would try to put before the members briefly what he wished to prove. His propositions were: (1) That there was no real advantage to be gained in fuel consumption by heating the primary or secondary air with so-called waste gases; and (2) that all the advantages claimed for regeneration could be obtained by generator settings. He endeavoured to give the grounds for these propositions, which were that the theoretical advantage in favour of regeneration, under perfect conditions, could only be about 20 per cent. on the fuel account. These perfect conditions would mean that the whole of the waste heat was capable of utilization, and that no direct heat was used for heating up the secondary air, and also that there was not the slightest short-circuiting between the secondary-air flues and the waste gases. He thought it would be conceded that these conditions were impossible of realization with recuperators; whereas they could be more nearly obtained with ordinary generators, where the secondary air was almost entirely heated by direct conduction. With coal giving 13 cwt. of coke per ton, the small theoretical advantage would only be ½ cwt. of coke per ton of coal carbonized in favour of recuperation; and this must be somewhat reduced in practice, if not altogether lost. With regard to the results obtained in practice by simple generators, he had not personally had any very great experience; but in the paper read by Mr. C. C. Carpenter before the Southern Association in 1886, to which he (Mr. Helps) alluded in his paper, reference was made to a very elaborate test which the author had undertaken to prove that the advantage in favour of recuperation was very small—that it came out to less than 1 lb. of coke per 100 lbs. of coal carbonized, which would be about 13·39 per cent. of the total fuel, taking the coal he used as giving 15 cwt. of coke per ton. In his (Mr. Helps's) paper, he also had drawn attention to the fact that Mr. Carpenter was selling from Newcastle coal 10½ cwt. of coke and 1¼ cwt. of breeze, which made a total of 11¾ cwt. of coke and breeze sold per ton of coal carbonized. This, on the same basis, would work out to about 10·62 lbs. per 100 lbs. of coal carbonized. Again, and this entirely accorded with his contention, he (Mr. Helps) knew of several works with shallow generators, and settings of six small retorts, where just upon 10 cwt. of coke was sold per ton of mixed coal —half Staffordshire and half Yorkshire. In addition to this, he took his own tests, as given in the paper. These extended over some time, and with several different settings; and they tended to prove his propositions were correct. If there was no difference in the fuel account of two settings, one having the division-wall between the waste gases and the secondary-air flues ⅜ inch thick, and three times the area of the division-wall of the other set, which was 4½ inches thick, surely it must point to one of two conclusions: Either (1) that there was a lot more waste heat in the regenerator with the thin wall of large area than was required to heat the secondary air, or (2) that the quantity of really waste heat entering the recuperator that could be utilized by the secondary air was a very small matter indeed. If the former conclusion were correct, the heating of the primary air to 1500°, as well as the secondary air, should have made some difference in the fuel account. As it did not do so, the only inference he could draw was that there was very little waste heat available for heating the secondary air in the recuperator under proper conditions of damper adjustment, &c. Under theoretically perfect conditions, and conceding to recuperation more than its due, it was clear that the difference in the fuel account could only be between 28 and 56 lbs. per ton of coal carbonized; and a very little defect in the working, or in the recuperator itself, would counteract this. He was of opinion that the extra expenditure necessary to heat the secondary air by waste heat, instead of direct heat, could not be justified.

The President said the members had heard the few remarks by Mr. Helps with reference to his paper. He had enunciated the proposition (which the members ought to be able to discuss) that no real advantage was to be gained in heating the primary and secondary air supply over that obtained in practice with ordinary generator furnaces. He (the President) did not propose to enter into the discussion himself; but he might say that the proposition did not agree with his own practice. He found that there was considerable advantage; and he should like to hear an expression of opinion on the subject from various members.

Mr. Henry Hack (Birmingham) said that, after carefully reading Mr. Helps's "Notes" on this subject, he had seen nothing whatever to lead him to change the opinion he expressed at the last meeting. The author's proposition was altogether contrary to his own experience; and he had had a large experience in regenerative furnaces. He noted that Mr. Helps had discarded altogether the question of ordinary furnaces; and therefore the whole thing resolved itself into a question whether it was beneficial and economical to go to the expense of heating the primary air as well as the secondary air. He (Mr. Hack) had lately looked up tests that he had made in past years on various furnaces at his works, and the results there showed that there was considerable benefit in heating the secondary air, and also a further benefit by heating the primary air. Even if the saving in fuel was small, it was an advantage, and was worthy of adoption. With regard to the claims 1 to 4 propounded in the paper, he thought it would be a feather in the cap of Mr. Helps if he proved his case; but he was afraid he would have a hard job to do it. To his (Mr. Hack's) mind it was a prominent case of Theory *v.* Practice—a lot of the former, and comparatively little of the latter; for Mr. Helps candidly told them that some of the practical tests he had intended to make at Hinckley had to be abandoned by him on his leaving those works. It would, however, be interesting to know whether his successor took up the matter; and, if so, whether he would let them have the results from the furnaces with which Mr. Helps started his experiments. He (Mr. Hack) had often protested, and he protested now, against the method adopted for arriving at the fuel consumption—that was, the method of stating the coke and breeze sold per ton of coal carbonized. There were various things that cropped up in the method of dealing with the coke—the screening, and so on—which would affect the result. His opinion was that the only satisfactory way of getting the true results was to take settings for a week or a longer period, and actually weigh in the coke and the coal—letting the coal be of the same quality in all the tests made—and then see what the percentage of coke used was to the coal carbonized. He repeated that stating the coke sold per ton of coal was misleading altogether; and it was a method he should never adopt himself. Looking through the author's "Notes," he might say that he regarded them as a good theoretical exposition; and, as they stood, he could find no fault whatever with the figures given. But he thought Mr. Helps had overlooked the fact that the specific heats of gases varied with the temperature, and that he had taken the specific heats at ordinary temperatures. He (Mr. Hack) was told by one who had studied the matter more than he had done himself, that at 4000° Fahr., the specific heat was at least double; consequently the temperature of combustion was very much lower. Therefore, the calculations that Mr. Helps had put before them should, he thought, be corrected to the specific heats of the gases at the different points in the settings where he dealt with them, and not at ordinary temperatures. He was convinced most strongly that Mr. Helps was wrong in his conclusions; and he did not simply assert this, but he was backed up by his own numerous experiments at his own works. This was a case to which they might apply the statement that a pound of practice was worth about 10,000 units of theory. (Laughter.)

Mr. Thomas Glover (West Bromwich) said he remembered some time ago watching what Mr. Helps was doing; and he persuaded him at that time to promise to give a paper to the Association embodying the results of his experiments. He was not, however, prepared for the right-about-face attitude which Mr. Helps had taken in his paper. At that time he was enthusiastic about recuperation; but when Mr. Helps's "Notes" came out, he found he had discarded it altogether. It seemed to him (Mr. Glover), when reading the paper, that Mr. Helps had started by trying to eat his cake and to have it at the same time, and yet he finished off by throwing the cake away. The previous night he (Mr. Glover) had spent one or two fairly stiff hours over the paper; and, in going through the calculations, he fancied he took them in rather a different way to the author He took the fuel consumption for a setting from actual experience, and worked it out, on Mr. Helps's data as to the weight of air required for the secondary combustion, and the units of heat absorbed in heating the secondary air up to 2000°. Using his data, a theoretical saving was shown for recuperation of 20 per cent. over generators. They knew this was a figure that did not at all come out in practice; and therefore he should be inclined to agree with what Mr. Hack had suggested, that there was something wanting or not quite correct in the paper, or the figure would come out nearer actual practice. There was a saving, but it did not work out to 20 per cent. for regenerators as compared with generators. But there was a saving; and he had had ample opportunities for testing it. He had a distinct liking for a simple generator furnace; but he was bound to say there was a saving in the use of regenerators. To tell the truth about the matter, regenerators would use as fuel 20 per cent. of the coke made; and with simple generator heating, 24 to 25 per cent. would be used—showing a saving of from 4 to 5 per cent. in favour of regeneration. Now it seemed to him to be a question for consideration whether the capital expenditure

* See "Journal," Vol. LXXIV., p. 1055.

was not out of all proportion to the saving effected. He took a regenerator setting of 16 mouthpieces at £40 per mouthpiece, which equalled £640. He assumed that a generator setting, without recuperation, could be built for £25 per mouthpiece. This would come out to £400 per setting. Now taking 273 working days per year, and a coal consumption of 2730 tons, he found that the saving in coke for regenerators as compared with generators would be 68 tons. If they took this at 10s. per ton, it worked out to £34 for one setting. If they then took 10 per cent. (£24) on the difference in cost for installing generators and regenerators, they had a saving of £10 per set per year for regenerators as compared with generators. This was how he had been bound to look at the question. He had both generators and regenerators working side by side at his works; and so he had had ample opportunities for testing the matter. What he had therefore stated was his actual experience; and he was not in entire agreement with Mr. Helps when he stated that no real advantage was to be gained in fuel consumption by heating the secondary air with the so-called waste gases, nor that all the advantages claimed for recuperation could be obtained by generation. He (Mr. Glover) quite admired Mr. Carpenter's arrangement, and thought his furnace practice excellent. But he did not agree that the best method of heating retorts, horizontal or inclined, was by having one producer for several beds, except in large works. It might be the best for the South Metropolitan Gas-Works; but he did not think it was capable of universal application. Mr. Helps asked the question in his paper, "What can truly be designated waste gases in this connection?" The waste gases were those that left the bottom retort, and either entered the main flue or passed into the regenerators. He (Mr. Glover) should say that the waste gases were carbonic acid, nitrogen, and a very slight excess of oxygen. If the gases were tested there, and about 0·05 of oxygen were found, then they knew that all the carbonic oxide was burnt, and the best results were being obtained. It was not a very elaborate experiment to find out the composition of the gases at this point; and it was a most useful guide in proportioning the primary and secondary air—if there was a very slight excess of oxygen present, the whole of the carbonic oxide was being burnt. He thought he had said enough to show that, while he believed what Mr. Helps had said, that the bulk of the advantages might be obtained by a good generator, there were other advantages over and above those obtained by a generator that could be obtained by a regenerator.

Mr. Charles Hunt (Birmingham), on being called upon by the President, said that Mr. Glover had clearly put before them the difference in fuel economy between generators and regenerators; and he did not think he could add anything to what had been said on this point. He quite agreed with Mr. Glover that, to a large extent, the advantages of gaseous firing were secured by the simpler arrangement; but the full advantages could only be obtained by recuperation, more or less elaborate. There was, however, one point that was generally missed in the discussion of this question. He did not see that fuel economy was the one thing by which the merits of a system were to be determined. Their aim was to provide themselves with an efficient furnace to suit their own circumstances. Which then was the most efficient furnace—that in which recuperation was employed to its fullest extent, or that in which the generator was the prominent feature? Very early in his study of this subject, he had tried both, and had to give up the latter. He had applied Mr. Carpenter's plan to his setting of nine retorts—heating two from one generator; and it was not successful. He could not properly heat their settings with it, and had to return to the so-called elaborate regenerative arrangement. Probably the reason why Mr. Carpenter succeeded where others might fail was to be found in the setting itself. Mr. Carpenter's original setting was one of six retorts, arranged in two vertical rows, with a fairly wide space between them. This gave plenty of room for slow combustion, and the secondary air became heated up in the bed itself. But where the retorts were packed more closely, there was little opportunity for this to take place. The work of heating up the air must be done, either below the setting, or within the latter. If below, they were able to heat more retorts in the same area. The alternative to this was to increase the number of tiers of retorts, as was done at the South Metropolitan Gas-Works, where a setting of ten retorts arranged in five tiers had now been generally adopted. He did not doubt the economy of this setting, but it did not seem to him to be so convenient as one in which the whole of the retorts could be worked from the same stage or floor. He himself preferred a setting of not more than three tiers, and although the retorts might in that case have to be placed closer together, so as to economize space, he regarded this as a matter of more importance, although seldom referred to in discussions of this kind. The question generally turned upon how many pounds of fuel could be saved by a particular furnace. But they wanted an efficient furnace; and the most efficient furnace was that which was adaptable to the greatest variety of conditions and requirements. This, in his opinion, was an accurate description of the regenerative system which was now so largely employed.

Mr. B. W. Smith (Smethwick) said he had not had the experience with generators that Mr. Hunt had; but he could judge pretty well, compared with the regenerator furnace, as to their duty power. He quite agreed with what Mr. Hunt had said, that it was a most essential thing for them to obtain an efficient heater, or to obtain the greatest duty power irrespective of the small extra cost likely to occur in the lower furnace. Now with regard to the fuel account, that was a very sore point with him. He had had many contentions as to the amount of fuel he used, or the amount of fuel that somebody else used as compared with himself. He thought it was a great mistake for anybody to attempt to give a statement as to the amount of fuel used, because it varied in accordance with the quality of the coal, the amount of coke that had to be stacked during the winter, as well as the method employed in handling the coke from the retorts. These were three very important factors. If he had not to stack a large quantity of coke, his fuel account would be reduced considerably. It was not fair to take the amount of fuel based upon the amount of coke sold.

Mr. T. Berridge (Leamington) said he would suggest that a small Committee be formed to go to Nuneaton and inspect the settings which he understood were about to be built, and make a practical trial of them. They could only come there and talk of their personal experience; but if they had a Committee of two or three gentlemen, who could go and see what was actually being done at Nuneaton, they could report to a meeting. A great deal more good would be derived from this than by giving their individual oinions. He moved that a small Committee be formed for this purpose.

The President remarked that they had had a most interesting and instructive discussion; and they were much obliged to Mr. Helps for having brought this question forward, though the bulk of the members did not agree with his deductions. There was a great deal in what Mr. Hunt had said with reference to the number of retorts in a bed. Mr. Carpenter had worked with ten retorts; while probably all the members of the Association worked with six, seven, or eight, and perhaps some of them with nine. Another speaker pointed out that the quality of the coal and the method of handling the coke should be considered. If conveyors were used, the coke was broken much less, and less breeze was made. All these were points that were worthy of attention in discussing this question. Personally he found that modern regeneration was an advantage.

Mr. Helps, in reply, said Mr. Hack had made some remarks with regard to the paper containing a great deal of theory that was not backed up with much practice. But he should like to ask Mr. Hack whether he correctly understood him in regard to the heating of the secondary air. In some of his remarks, he thought Mr. Hack assumed that he did not favour the heating of the secondary air in the case of generator furnaces. It was just the contrary; he was strongly in favour of heating the secondary air as much as was possible.

Mr. Hack said he clearly understood from Mr. Helps's paper that he did not approve of the secondary air being heated by the waste gases, but by radiation or conduction.

Mr. Helps (proceeding) said Mr. Hack stated that he felt sure he (Mr. Helps) was wrong, and that his statements were all based on theory; but with all deference, he should like to point out that Mr. Hack did not favour him by telling him where he was wrong. When he submitted his "Notes" to the members, he distinctly stated that they were written with the object of obtaining information; and if anyone would tell him where he was wrong, he should be particularly obliged to him. Certainly at the present time he could not himself see where it was. Mr. Hack told them that he had made several tests; but he did not give them any indication of the line he took in making them. In the paper, he (Mr. Helps) suggested certain definite lines on which, in his opinion, tests should be made; and if Mr. Hack had made tests on these lines, and would say that he had proved that recuperation was an advantage, then he should have no doubt that Mr. Hack was right.

Mr. Hack remarked that he had made tests on proper lines; and it was upon these tests that he based the statement that he found the heating of the secondary and primary air was an advantage.

Mr. Helps: Can Mr. Hack say what the advantage was?

Mr. Hack said he mentioned in his remarks that the advantage of heating the secondary air was considerable, and there was a further advantage, but not to the same extent, with regard to the primary air.

Mr. Helps said that all he was anxious to know was where he was wrong; and he would give in immediately if anyone could show him. But he was a bad one to acknowledge he was in the wrong, until someone proved that he was. Perhaps Mr. Hack would tell him why he did not secure any advantage when he heated up the primary air, as well as the secondary air. He had heated it up to considerably over 1500°; but he found he did not get the slightest advantage from it. This was where he came to a stop. He could not at all see why there should not be an advantage in heating up the primary air if an advantage could be obtained by heating up the secondary air. He tested the matter for seven or eight months; and he arranged the setting so that he could heat up both the primary and secondary air at the same time, or separately. This was the test he referred to in the paper. With regard to the correction which it was stated should be made in connection with the temperature of the gases, that was no doubt quite correct; but he did not think the correction was necessary. It would not amount to a great deal even if made; and the lines of the argument would not be the least affected. He quite agreed with Mr. Hack that a pound of practice was worth 10,000 units of theory. And in his paper he thought he had given the pound of practice; in

other words, he had endeavoured to set forth in it only what he had actually done, and had not assumed all kinds of things. Mr. Glover got somewhat nearer his ideas than Mr. Hack had done, but not very much. Mr. Glover thought there was a difference of 4 or 5 per cent. This was on the right road; and if he would really put the matter to the test, he would find that it was very easy to lose this 4 or 5 per cent. under imperfect or ordinary working conditions. Mr. Glover, like many others, had not made a test under any special conditions to arrive at the conclusion he had formed.

Mr. GLOVER: My tests were made under ordinary conditions.

Mr. HELPS: In my paper, I set out certain conditions that are absolutely necessary for arriving at correct results.

Mr. GLOVER: I regard everyday work as the best possible condition that one can get, if the settings are exactly alike from week to week.

Mr. HELPS: The settings must all be constructed on exactly the same lines.

Mr. GLOVER: I give way on that point.

Mr. HELPS: If there is (say) a ton of bricks in one setting, and only ½ ton in another, there will be a lot of difference in the fuel account. Mr. Glover says I am wrong; but he has not shown me where.

Mr. GLOVER: I have left that for another occasion. (Laughter.)

Mr. HELPS (continuing) said Mr. Hunt had remarked that fuel economy was not everything; and he (Mr. Helps) was quite in accord with this observation, because there was so little difference in the fuel account between a generator and an ordinary regenerator that he did not think it worth consideration. He did not know whether Mr. Hunt, when he made his tests, heated the secondary air to any great extent, because he (Mr. Helps) found that generally a comparison was made with a generator in which the secondary air was only heated to a low temperature with a regenerator in which the air was heated to a high temperature. Of course, in such a case the comparison was not on proper lines. Although Mr. Hunt had kindly made some remarks, he, like the other speakers, had not shown him where he was wrong. (Laughter.)

Mr. HUNT: I have not really read the paper.

Mr. HELPS was sorry that Mr. Hunt had not. Mr. Smith had touched upon the question of the fuel used, and said he considered it was not a good method to base the fuel consumption on the amount of coke that was sold. They all knew the difficulties there were in the way of making a reliable comparison between the fuel accounts at different works. Some people adopted the system of stating the fuel account per 100 lbs. of coal carbonized; but this could be made to suit the fancy of anyone. One had only to "adjust" the quantity of coke made from a ton of the coal he was using, and the thing was done. It seemed to him that the coke sold per ton of coal over twelve months was a fairly reliable method. [No, no.]

Mr. SMITH: Stack 2000 tons, and you will see.

Mr. HELPS said it appealed to him as being the most reliable method, although even then there were many different circumstances. For instance, one works might sell all the coke forked, and not take into account the breeze. Another might sell all the coke by shovel; and even the clinker ashes from the fires were sometimes weighed out, and credited to the fuel account. Again the coke made from a ton of coal was generally taken as weighed hot; and the coke sold per ton of coal was the coke after it had been quenched. They knew that, if coke was weighed and sold just after quenching, it had fully 15 per cent. of moisture in it; but after it had been stacked some time, it was supposed to retain only about 3 per cent. So that those people who sold the coke as it was made, had a distinct advantage over those who had to stack it. These varying circumstances alone—and there were plenty of others—made it, to his mind, almost impossible to discover the 28 or 56 lbs. per ton of coal carbonized advantage, one way or the other, with the regenerator setting over the generator, or *vice versâ*. Most of the members seemed to think there was no doubt whatever that recuperation was the very best thing, and that ordinary generation was "not in it;" but he did not gather that any specific tests had been made of this matter. However, considering the enormous expenditure incurred in the adoption of recuperator furnaces over and above that required for ordinary generator settings, would it not be well, he asked, for the members of the Association to thoroughly investigate the matter, and for a Committee to make systematic tests. It appeared to him that such a test would be far more reliable than any number made by individuals. If this suggestion should meet with the approval of the members, his Directors permitted him to offer, on their behalf, three arches, in which could be set three beds in such a manner as a Committee of the Association approved. It occurred to him that two of the beds might be fired from one generator, and the other by any recuperator the members might wish. In this way, a thorough test of the matter might be made. If the Association could favourably entertain this offer, he trusted it would prove conclusively the relative value of the two systems. He could not say that the discussion had altered his convictions one bit. However, he trusted that the remarks he had perhaps somewhat bluntly made in his reply would not be misunderstood.

The PRESIDENT said they were indebted to Mr. Helps for bringing this paper before the members, and for giving them his opinion. It was only by difference of opinion that they arrived at the truth of the matter. He did not know what the members thought of the suggestion Mr. Helps had made, to put three arches at their disposal for the purpose of testing the question. It seemed to him the matter required some consideration before they committed themselves to proceed with it. Most of the members had made the subject one of experiment; and some of them had carried out somewhat extensive experiments. He did not therefore know that the matter would be forwarded by conducting an investigation with the three settings as proposed.

Mr. HELPS remarked that they had these three arches empty at the present time, and they would have to put three settings into them under any circumstances; and as his Directors had kindly offered to put in, at their own expense, such settings as might be considered by a Committee best calculated to prove the question—which he considered still at issue—he thought it a very favourable opportunity to carry out such a test as he had indicated.

Mr. T. BERRIDGE (Leamington) considered the suggestion a very good one. They had often thought about experimental work; and now that they had an opportunity to do something in this direction, it ought not to be thrown away. He, therefore, moved that the offer be accepted.

Mr. HUNT suggested that it should be referred to the Committee for consideration.

Mr. A. COOKE (Oldbury) seconded Mr. Berridge's proposition, and Mr. W. NORTH (Stourbridge) that of Mr. Hunt.

On being put to the vote, the amendment was carried.

[Since the meeting, Mr. Helps has forwarded for publication a few supplementary comments on a point which he overlooked in his reply upon the discussion. He writes: "Mr. Hunt made some remarks as to the particular setting adopted by Mr. Carpenter, stating that such a setting—two tiers of five retorts each—was not applicable to many works; that most engineers, owing to structural conditions, had to set their retorts in beds of eight or nine, in three tiers; and that a regenerative furnace for heating such had especial advantages over an ordinary generator. Mr. Hunt further said that Mr. Carpenter's setting gave him a distinct fuel advantage on account of the combustion space he had. I should like to be allowed to remark, that I quite admit there is a fuel advantage in having only two tiers of retorts in a bed, whether they are two tiers of threes, fours, or fives, as such settings are the simplest, and offer most facilities for heating; cramping and local heating being avoided. Plenty of combustion head-space being essential for an even and economical distribution of heat, settings of three tiers cannot be favourably compared with them. One great advantage, however, of Mr. Carpenter's system is that, by his arrangements, he thoroughly mixes all the gases from his producer before the second combustion takes place; whereas in ordinary recuperative settings you have producer gases of varying quality from the front to the back of the setting. The thorough mixing of producer gases effects a very considerable saving in fuel—a fact which it is important should be borne in mind in this discussion, as by Mr. Carpenter's system the gases are mixed by the very manner of their distribution; whereas to mix them in an ordinary recuperative setting is a very elaborate business. No doubt, Mr. Hunt is fully aware of this advantage; but as there are some members of the Association who might overlook it, I have ventured to call attention to it."]

THE INCLINED RETORTS AT SMETHWICK.*

The PRESIDENT said the next item on the *agenda* was the discussion of Mr. B. W. Smith's paper on "Inclined Retorts," which was also read at the last meeting. Perhaps Mr. Smith would like to make a few remarks before the discussion commenced. After the paper was read on the last occasion, a number of the members had the pleasure of seeing the very excellent installation at Smethwick. They took advantage of the opportunity to ask Mr. Smith a number of questions during the inspection; and they were answered in the most satisfactory manner. For himself, he could only say that the installation was one of the best and most complete that he had yet had the pleasure of inspecting.

Mr. B. W. SMITH (Smethwick) said he could only repeat the great pleasure it had afforded him to have the members visit his works to see the little he had been doing in the way of improvement. He could add nothing further to the remarks he made in his paper; but he should be pleased to answer any question upon any point in connection with the installation that might have cropped up in the minds of members since their visit. The inclined retorts had been working continuously from the time they were started; and there had been no interruption or mishap, or anything to cause them to regret the step they took in adopting the system.

Mr. T. GLOVER (West Bromwich) said he thought they discussed Mr. Smith's paper very well on the spot; and they felt at the time that it was the best place to discuss it. He believed Mr. Smith went to a lot of trouble in explaining the method of working, and the construction of the inclined retort settings, to the members individually; and they came away from Smethwick feeling that they had seen a good installation, and many of them understood considerably more about inclined retorts than they

*See "JOURNAL," Vol. LXXIV., p. 1057.

had done hitherto. Therefore, he did not think there was a great deal they could now say. They admired very much the way the work had been done; and they admired the way the retorts were behaving themselves now they were at work. The installation reflected credit on Mr. Smith's design, on his choice of contractors, and on the way in which the latter had done their work.

Mr. H. HACK (Birmingham) said it was his misfortune not to have been able to visit the Smethwick works with the members; but through the kindness of Mr. Smith, he had had the opportunity of seeing the installation since then. He had great pleasure in supporting the statement made by Mr. Paterson in the course of the proceedings, that this was one of the finest installations of inclined retorts—it was second to none, possibly even in regard to Salford. For a very considerable time he (Mr. Hack) had his doubts as to the working of inclined retorts; and it was only on seeing the splendid installation at Salford, that he recommended his Committee to put up such an enormous installation as they were erecting at Saltley. Since then, he had not at all lost faith in the system; but he had been much encouraged by what he saw at Smethwick. The heats—he believed the settings were on the regenerative system, with both the primary and secondary air heated (laughter, in which Mr. Helps joined)—were uniform throughout; nothing could have been better. Then with regard to the coke. In some places, when first starting these inclined retort installations, they had noticed trouble in getting out the coke; but in this case he observed, as he also did at Salford, that, simply with one touch of the bar, the coke came out beautifully. When Mr. Smith started his coke-conveyor, he thought the installation—taking the retorts and conveyor together—would be second to none in the kingdom. He took this opportunity of publicly offering his congratulations to Mr. Smith on his successful installation. There was one other point. Mr. Smith had no hydraulic main in this installation. He (Mr. Hack) had not yet gone quite so far as that; and he was a little anxious about it. A good many managers, he knew, had done away with hydraulic mains, and were getting splendid results; but he as yet was fearful of doing away with them. However, he was open to conviction that it was the right thing to do.

Mr. H. P. MAYBURY (Great Malvern) wished to join in the expression of congratulation to Mr. Smith. He might say that what he saw of the installation before it was lighted up, and subsequently, had led him to adopt the same principle.

VOTES OF THANKS.

The PRESIDENT thought the members could not separate without giving expression to their thanks to Mr. Helps for his interesting paper, and also to Mr. Smith for his contribution to the proceedings. They had had a very instructive discussion; and he had to propose that the best thanks of the members be accorded to both Mr. Helps and Mr. Smith.

Mr. J. GOULD (Stourport) seconded the motion.

Mr. HELPS, in acknowledging the vote, said he felt somewhat for the members in having to listen to his discursive remarks that afternoon. If some other gentleman who was more capable than he was of expressing himself, had had the *facts* which he had at his (Mr. Helps's) disposal, he would, no doubt, have been able to handle them in a better way, and have convinced every member present that they were right. (Laughter.)

Mr. SMITH, in also acknowledging the vote, said it had afforded him, as it had always done in the past, great pleasure in contributing a small matter of interest to the Association. His duties did not permit him to devote so much time to preparing papers as some other members were able to do. Still there was the satisfaction of knowing that, however hard one had to work, it was a recreation to treat upon subjects which imparted information to others, and in knowing that, in doing so, the thanks of such an Association as this had been earned and received.

THE ASSOCIATION REPORTS.

The action of the Committee in sending to each member a copy of the volume of the "District Association Reports for 1899" was confirmed.

DECEASED MEMBERS.

The PRESIDENT remarked that, with reference to the members whom the Association had unfortunately lost by death during the year, a vote of condolence was passed by the Committee; and he would ask the Secretary to state what had been done in the matter.

The HON. SECRETARY said he did not know that he had anything to say, beyond the fact that votes of condolence were conveyed to the families of the deceased members, and that he had replies acknowledging the same, except in the case of Mr. Parsons. In this instance, the matter was somehow unfortunately overlooked; the death of Mr. Parsons having occurred in the early part of the year.

This ended the business before the meeting; and the members subsequently had high-tea together.

The Bakerian Lecture of the Royal Society will be delivered next Thursday, by Professor Tilden, F.R.S., on "The Specific Heat of Metals, and the Relation of Specific Heat to Atomic Weight."

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

The Annual Meeting of this Association was held last Thursday, at the Holborn Restaurant. At the commencement of the proceedings,

Mr. A. E. BROADBERRY (Tottenham), the retiring President, said his duty that afternoon was of a very simple character; but it was fraught on his part with a certain amount of sorrow, involving as it did his vacation of the chair. He felt that during his presidency of the Association he had left undone a good many things he had hoped to have done. On the other hand, it afforded him a great deal of pleasure to instal his friend Mr. D. Irving. It needed no words of his to introduce or recommend Mr. Irving to the members; he was already well known and highly appreciated by them. For the past 25 years, the Association had held an important position and done good work. He was sure they all united in wishing Mr. Irving a good year of office, and in hoping that the Association, under his care, would continue to flourish as it had done in the past.

Mr. Irving then took the chair, and was cordially received by the members.

The minutes of the previous meeting were next confirmed.

ANNUAL REPORT OF THE COMMITTEE.

The HON. SECRETARY (Mr. J. W. Helps, of Croydon) read the annual report of the Committee, which was as follows:—

The Committee have pleasure in presenting their twenty-fifth annual report on the working of the Association during the presidency of Mr. A. E. Broadberry.

They regret that during the year four members have been removed by death—viz., Messrs. F. Livesey, W. H. H. Broadberry, H. Legg, and W. Faulkner. Mr. F. Livesey, although frequently invited to do so, never occupied any prominent official position in the Association. He was, however, for many years a regular attendant at the meetings, and freely contributed both to the reading of papers and to their subsequent discussion. Mr. W. H. H. Broadberry was one of the original members of the Association, and in the year 1881 occupied the presidential chair. Mr. H. Legg was elected a member in the year 1899; while Mr. Faulkner joined the Association on its amalgamation with the South-Western District Association.

These losses, together with the resignation of three members, and the removal of two others under Rule 20, represent a total decrease of nine, and as only six new members have been added during the year, the present number of members upon the list has been reduced from 155 to 152.

The Committee regret that the attendance at the various meetings has not been as satisfactory as they have a reasonable right to expect, considering the number of members belonging to the Association. They desire, therefore, to emphasize the importance of special efforts being made to attend, as they feel certain that the papers and discussions, and the means afforded for the mutual interchange of ideas, cannot fail to be of advantage to the members and to the companies they represent.

The finances of the Association are in a prosperous condition. Commencing the year with a balance of £92 6s. 11d., the receipts have been £79 16s.; and the expenses, including £36 15s. expended on presentation copies of the "Reports of the District Associations," amounted to £64 11s. 7d.—leaving a balance to carry forward of £107 11s. 4d.

The Committee, in conclusion, earnestly request that members will do all in their power to support their President, and to assist the Honorary Secretary and Committee, by regular attendance, by contributing papers, and by taking their fair share in the discussions which follow.

On the motion of Mr. F. E. LINGING (London), seconded by Mr. T. A. GUYATT (Ely), the report was adopted.

CONTRIBUTION TO THE TRANSVAAL WAR FUND.

The HON. SECRETARY said there was one other matter he would like to bring forward. The members would have seen from the report of the Committee which he had just read that the funds of the Association were in a particularly prosperous state. There was a balance of more than £107 to carry forward. He was sure that all the members present felt in a very happy frame of mind, on account of the good news that had just reached them from the seat of war. He did not know whether they would be acting *ultra vires*, but he thought it would be the wish of every member that they should show their gratitude for the blessing vouchsafed to them by the great victory that had been achieved, by doing a little to alleviate the sufferings of those who had been afflicted through the war. If they had power to do it, he would propose that the sum of ten guineas be sent by the Association to the Lord Mayor's fund.

Mr. J. D. ASHWORTH (Portsmouth) seconded the motion.

The PRESIDENT said he did not know how they could better show their appreciation of the good news just received than by contributing from their very large balance towards the object named.

The proposition was carried unanimously.

THANKS TO THE EX-PRESIDENT.

The PRESIDENT proposed that the very best thanks of the Association be given to Mr. A. E. Broadberry for his conduct in the chair during the past year. He was sure they would all agree that Mr. Broadberry had rendered the Association very excellent service; and they deeply regretted and sympathized with him and his family in the great bereavement they had sustained during his year of office. He would like to congratulate Mr. Broadberry on his appointment as Engineer to the important Company in whose service he believed he was trained. He thought it spoke volumes for Mr. Broadberry's ability, and the confidence the Directors had in him, that he should have been chosen to fill the position. He had great pleasure in

proposing that the best thanks of the Association be tendered to Mr. Broadberry for his services, and to his Company for the very hospitable way in which they had entertained the members on their visit to Tottenham last May.

Mr. A. F. Browne (Vauxhall), in seconding the resolution, remarked that it was not necessary for him to add much to what had been said. Mr. Broadberry was a man who held decided views on gas matters; and he had in the public Press proved his ability to maintain these views against those who differed from him. He thought Mr. Broadberry might retire from the chair with a sense of great satisfaction, and that the members would feel that his name was not the least worthy in the list of Presidents of the Association.

The motion having been unanimously carried,

Mr. Broadberry briefly returned thanks. He said he felt a certain amount of disappointment at not having done all that he had hoped to do during his year of office. He realized that some part of his duty had been left undone; but if in the years to come he should be able to make up for this in any way, he would always be at the service of the members of the Association. He thanked the President and Mr. Browne for the very kind sentiments they had expressed, and the members generally for the way in which they had re-echoed these sentiments.

New Members.

The Hon. Secretary read the following nominations for membership: Mr. G. P. Lewis, of Lower Sydenham; Mr. Frederick Hoult, of Horley; and Mr. W. B. Reidie, of Barking.

Mr. J. Tysoe (East Greenwich) proposed, and Mr. D. H. Helps (Redhill) seconded, the motion, which was agreed to.

The President then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—Permit me to offer you my sincere thanks for the confidence you have shown and the great honour you have conferred in electing me to the position of President. I am very conscious of the many able and experienced gentlemen who have preceded me in this chair; some of them occupying, and deservedly occupying, the very highest positions in the gas profession. With your kind indulgence and assistance, it will be my earnest endeavour to uphold the dignity of the chair, and promote, in every way I am able, the usefulness and interest of our Association.

The past history of the Southern Association has been one of marked success. The contributions have attained a high degree of merit and usefulness; and good feeling, confidence, and sympathy have characterized all the meetings it has been my privilege to attend. But no society can live long upon its past history, however brilliant or successful; and if the Association is to maintain its reputation, it can only be by each member contributing to, and taking a practical interest in, its work and meetings.

The work and duties of engineers and managers of gas-works are yearly becoming more onerous and trying. The progress of the gas industry in the face of keen competition, entails on the responsible officials of gas undertakings a growing load of responsibility and incessant and close personal attention. I can well understand, and sympathize with, members residing at a considerable distance finding it at times difficult, or even impossible, to attend our meetings, however desirous they may be of being present or taking part in the work of the Association. No member can take part in our meetings, and thus be brought into intimate public or private contact—taking part in its discussions or privately comparing notes, explaining difficulties or successes, and visiting progressive works, &c.—without being amply rewarded and better fitted to perform his duties to his employers. The most successful men in the gas profession to-day have been those who have taken an active part, generously contributing of their experience, and doubtless profiting from the experience and results contributed by other members of their respective Associations. It would be difficult to find a gas undertaking in the van of progress, where its responsible managers have followed a course of isolation and seclusion. Where is the engineer who has not found assistance, and the undertaking that has not profited by the experience, experiments, and results that are recorded in the "Transactions" of the various Gas Associations?

The past season has been one of unexampled activity. Never before have there been such demands upon the resources of gas undertakings; and never before has there been, in my experience, such difficulty in obtaining the necessary supply of raw material. With the continuing reduction in the price, and the ever increasing use of gas for motive, cooking, and heating purposes, it follows as a matter of course that, with any scarcity in the coal supply, there will be increased demands for gas; and when dear coal acts in conjunction with cold weather, such as was experienced last December, undertakings not provided with some stock, and a fair margin of manufacturing power, cannot expect to meet their obligations.

It became evident early last season that there was an active and unusual demand for coal; and scarcely any works received their proper monthly quantities as contracted for. Even the most influential and responsible concerns had to draw upon their reserve stores to an alarming extent; many being reduced to two or three days' supply. Unfortunately, oil users were, in many cases, in no better position. It is, however, satisfactory to know that most undertakings were able to fulfil their obligations to the public, and some to maintain full pressures right through this season of exceptional demand.

It is at such times as these through which we are now passing, that the advantage is experienced of doing business with coal proprietors and merchants who honourably consider their obligations before their profits. With such a demand for coal as now exists, it is naturally trying and disappointing to coalowners to have to fulfil their contracts at a price perhaps 100 per cent. less than they could obtain in the market. Contracts, of course, have their advantages and disadvantages to each contracting party. Coal contracts should be carefully drawn and executed in each case. But no contract, however carefully drawn, can meet every contingency that may arise; and it is impossible to be constantly carrying on business in these matters at the point of the legal bayonet. I am not sure how far it is reasonable for gas people to draw up specifications which, after setting forth in detail the quantities of coal to be delivered month by month, then proceed, as is usually the case, to state that the coal contractor must be prepared to make such increases, reductions, easements, or suspension of deliveries as the gas undertaking may from time to time deem necessary, and the gas authority shall have the right to require the coal contractor to make up any arrears which may be so caused.

It is, of course, very necessary to keep a fair stock of coal at the works; and what is a reasonable stock depends upon the geographical position and the particular circumstances of each case. Works depending on seaborne coal have greater risk than works depending on land carriage; and works depending upon one railway for carriage, or upon one coal district for supplies, have greater risks than those having connections with two railway companies, or those which derive their coal supplies from more than one coal-field. I am no advocate of great stocks which are often maintained for the convenience and profit of other people. Under present-day circumstances, with a growing consumption and a prospect of still further expansion in the future, coal purchases should err on the large side; and as far as is possible, nothing should be allowed to interfere with the regular delivery of the monthly quantity as specified in the contract.

With regard to the present extraordinary demand for coal, it would be difficult to assign the true cause. It is probably due to a large number of causes, which, united, and acting together, produce these excessive recurring demands which seem to baffle all known commercial law. It is evident from colliery returns that the scarcity is not due to a diminished output; though it has been suggested that, by the scarcity of labour on the one hand, and the indifference of the labourer who was at work on the other, the output of coal in the country has been restricted. How far this restricted output is the arrangement of the colliers or the colliery proprietors and merchants, it would perhaps be difficult to say. The railway companies have been to blame to a considerable extent by their inability to deal with the mineral traffic in certain districts. It has also been suggested that making good the depletion of stocks, both at home and at foreign coaling-stations, caused by the great strike in South Wales, together with the activity in the iron and steel trades, have produced an abnormal demand for coal. On the Continent, there is something approaching a coal famine. The details of the Board of Trade returns for last month, which are here appended, do not show any considerable increase in the coal exported; yet the amount is, nevertheless, about 20 per cent. of the total output of the kingdom. But you will note the greatly increased value of the coal exported in 1900 compared with the corresponding period of the last two years, which amounts to just 60 per cent. over the value of 1898. There is, however, a very large increase in the tonnage of iron and steel exported, as compared with 1898 and 1899. When it is remembered that every ton of iron is equivalent to two or three tons of coal, the significance of these figures will be seen.

The development of American coal-fields is remarkable. The production of the United States is now nearly five times as much as in 1870; and its proportion to the world's production has risen from 17 to 23 per cent. No other country can show such rapid increase. America is now the largest coal producer of the world. Prices have, of course, risen in America, but (on the authority of the "Economist") not nearly so much as that indicated by the prices now ruling in this country; and the fact that first-class American steam coal can at present be shipped and delivered at Genoa and other places in Europe at 7s. or 8s. per ton less than Cardiff coal, or 3s. to 4s. less than Newcastle coal, cannot fail to bring about a reduction of our exports, and a corresponding reduction in the current prices.

The rise in the price of coal, should it be maintained, will be a serious matter for the country. Can it be that we are beginning to feel the approach of the time foretold by Professor Jevons, over a quarter-of-a-century ago, who then suggested, in his great work on the "Coal Question," that if our consumption of coal continued to multiply for 110 years at the same rate as hitherto, the total amount consumed in the interval would be one hundred thousand million tons? Happily, these figures have not been attained. Otherwise all the available coal in the country would have disappeared, as this quantity exceeds the estimated coal in the country that was available, if working at a depth of 5000 feet was practicable. But it was not suggested that any approach to exhaustion would be reached in any such period as

BOARD OF TRADE RETURNS.

Coal, Coke, Iron, and Steel Exports in January.

COAL.

Place.	Quantities.			Values.		
	1898.	1899.	1900.	1898.	1899.	1900.
	Tons.	Tons.	Tons.	£	£	£
Russia	33,311	35,319	47,071	13,987	16,995	35,650
Sweden and Norway	222,106	267,635	293,929	97,284	131,662	183,319
Denmark	157,482	160,288	144,394	65,999	76,542	88,741
Germany	270,114	278,888	287 050	111,959	126,951	163,761
Holland	68,532	82,100	85,017	30,410	36,504	43,367
France	545,905	515,833	668,761	227,792	236,256	471,828
Portugal, Azores, and Madeira	71,735	44,770	65,089	31,514	22,479	55,311
Spain and Canaries	226,751	210,392	230,913	108,675	112,305	200,922
Italy	394,776	477,544	390,016	163,934	237,707	289,268
Turkey	64,577	47,400	34,981	29,934	25,285	27,599
Egypt	169,408	198,347	147,275	83,456	102,495	120,671
Brazil	99,127	105,312	55,941	54,512	65,376	45,858
Gibraltar	35,411	22,534	22,476	17,266	11,680	20,862
Malta	42,319	51,731	31,837	21,024	28,919	31,816
British East Indies	83,780	81,041	57,677	42,274	44,507	47,722
Other countries	424,475	453,459	525,105	220,747	251,532	411,637
Total	2,909,809	3,032,343	3,087,532	1,320,767	1,527,195	2,238,332

IRON AND STEEL.

	1898.	1899.	1900.
	Tons.	Tons.	Tons.
Iron: Pig	62,910	49,871	130,246
Bar, angle, bolt, and rod	14,806	11,591	13,383
Railroad of all sorts	79,283	44,975	49,781
Wire of iron or steel and manufactures thereof (except telegraph wire)	3,698	3,228	3,531
Galvanized sheets	18,969	16,162	21,796
Cast and wrought iron and all other manufactures (except ordnance)	29,976	26,268	28,922
Old for remanufacture	7,288	6,677	14,576
Steel unwrought	23,583	20,836	29,859
Black plates for tinning (iron and steel)	4,600	4,635	4,540
Manufactures of steel or of steel and iron combined	2,276	4,001	3,538
Total of iron and steel	284,189	207,965	331,183

that named. It was contended that, as the workings of the collieries attained an average depth of less than one-half of the depth estimated—viz., 2000 feet—the cost of working would be such that manufacturers in this country would have to pay a double price for coal.

Jevons, in concluding his remarkable work, says: "The alternatives before us are simple. Our Empire and race already comprise one-fifth of the world's population; and by our plantation of new states, by our guardianship of the seas, by our penetrating commerce, by the example of our just laws and firm constitution, and, above all, by the dissemination of our new arts, we stimulate the progress of mankind to a degree not to be measured. If we lavishly and boldly push forward in the creation and distribution of our riches, it is hard to over-estimate the pitch of beneficent influence to which we may attain in the present. But the maintenance of such a position is physically impossible. We have to make the momentous choice between brief greatness and longer continued mediocrity." While giving all due appreciation to these eloquent and carefully reasoned remarks of Jevons on this subject, I am afraid you will, like Colonel Makins, require further evidence to convince you that the present prices of coal are to be taken as the true price, and real value of the mineral in the open market.

The question of safely storing coal in ships for transport and at railway depots, iron, gas, and other works, is one of no mean importance in these days of strikes and lock-outs. Threatened on the one hand with combinations of labour, and on the other with combinations of capital, it is a matter of serious importance to all who have the responsibility for the conduct of large public or private undertakings to maintain a reserve or stock of coal that shall secure them against any emergency at the colliery, in transit, or at their own works. To safely store coal in large quantities, especially if coals from various collieries are to be mixed together, is not by any means so simple a matter as may at first sight appear.

At the Stapleton works of the Bristol Gas Company all coal is stored in the open. The stores are 450 feet long and 72 feet wide, paved with blue brindle bricks and thoroughly drained. Coal is delivered into the stores by two sets of overhead rails, carried on steel girders, which are supported by iron columns. The coal is dropped from hopper-bottomed railway trucks to the ground, and is stored to a depth of about 20 feet. During the past few years, and more especially last year, we have been troubled with recurring cases of spontaneous combustion. Great care has always been taken with our coal stocks, especially with those coals that were known to have any tendency to heating. A number of 1-inch pipes, to each of which a letter or number is attached, were usually inserted throughout the stock of coal, into which a thermometer could be lowered, and the temperature observed and daily recorded; and when any part of the stock gave indications of heating, that portion was worked out as soon as possible. It has rarely been found, even with the most active coals, that the rise of temperature would exceed from 3° to 5° C. in 24 hours—that is, in the first stage of heating. But after a certain degree is attained, the action is much more rapid; and where air is available, it is destructive.

Various theories have been put forward to account for the spontaneous combustion of coal; and they may be summed up under two heads—viz., (1) the decomposition of iron pyrites, and (2) the oxidization of the coal. In the case of coal mines, there is a third theory—that of friction. An authority has stated: "In mines there are certain mechanical conditions which cause heat, which in a coal containing favourable conditions may be the initial cause of giving rise to a fire. In such cases, it has been suspected that the friction of the moving parts gives rise to a temperature sufficient to start the heating of the mineral. Air slowly circulates through the interstices formed by the roof and pillars which offer a large area of coal surface to its action, and the oxygen of the atmosphere, or the heating may commence in the cracks of the coal seam itself, and then extend to the goaf." However this friction may operate in coal mines, with regard to the cases under consideration, friction, as a cause of heating, may be dismissed.

In considering the decomposition of iron pyrites as a cause of heating, it will be noted that the two coals which experience has proved to have a tendency to heating, and which are marked on the table of analyses as "C" and "E," do not contain a large quantity of volatile sulphur—indeed, all the coals in the Bristol district are comparatively free from sulphur. It is very generally admitted that in the presence of moisture, pyrites undergoes oxidization and disintegration, furnishing additional fresh-cut surfaces of coal to absorb oxygen, the chemical action develops heat and the further oxodization of the coal. Great differences of opinion have existed, and do still exist, as regards the influence of iron pyrites and its affinities when found in coal. Spontaneous combustion has long been known in connection with other organic substances besides coal. Coal, as you know, varies considerably in chemical composition and also in physical structure. The ultimate analysis of coal does not show very great differences, yet the physical features vary very much. Given a number of fine coal particles containing rich hydrocarbons in the presence of moisture and atmospheric oxygen, and you have all the elements required.

Analyses of Coals Stored at the Stapleton Gas-Works.

Class.	Volatile Matter.	Fixed Matter.	Moisture at (100° C.)	Ash in Fixed Matter.	Total Sulphur in Coal.	Volatile Sulphur. ($S=FeS_2$)	Fixed Sulphur, in Ash. ($S=CaS_4$)
FROM MIDLAND COAL-FIELDS—							
Screened "A"	39·85	60·15	4·83	7·54	1·75	1·56	0·19
Nuts "B"	44·50	55·50	6·63	6·58	1·30	1·23	0·07
" "C"	38·75	61·25	4·58	4·04	1·27	0·62	0·65
FROM LOCAL COAL-FIELDS—							
Through "D"	32·45	67·55	1·78	9·45	1·22	0·32	0·90
Small "E"	33·80	66·20	2·83	17·89	1·04	0·77	0·27
" "F"	34·00	66·00	2·28	13·75	1·02	0·79	0·23
Through "G"	30·85	69·15	1·63	9·26	0·97	0·94	0·03
Small "H"	31·80	68·20	2·03	14·15	0·80	0·05	0·75
" "I"	34·90	65·10	2·13	15·54	0·70	0·60	0·10
Screened "J"	37·30	62·70	2·63	10·30	0·62	0·55	0·07

Professor Lewes some years ago pointed out that newly-won coal will take in, or absorb, one-and-a-half times its own volume of oxygen, and in some coals as much as three times its volume. A recent article contributed to the German Chemical Society by Professor Fischer says: "Thorough investigation has established the fact that various coals behaved very differently regarding spontaneous combustion; a great deal depends upon the size of the pieces, as well as upon the dampness. A loss during storage, or self-ignition of coal, is nothing more than manifestations of oxidization." If this represents the total knowledge of German chemists upon this subject, I can only add that the general facts given have long been known to every observer who has taken any interest in the subject.

Heating always takes place in the small coal; but I have come

across cases where large coal, and also nuts, lying against small, or covered by small, have developed spontaneous combustion. It would seem in some cases that the interstices or air-spaces formed between the large and nut coal provided the necessary atmospheric oxygen, which, acting upon the hydrocarbon particles of the small coal, chemical action was set up; and the heat produced develops a certain peculiar chemical change in the coal. One of the first indications of heating is the steam, or vapour, which usually escapes from the stack by the course of least resistance, which may be far removed from the seat of the cause. As the heat develops, certain gases are evolved, of the acetylene series, which give a distinctive and peculiar odour, exactly the same as that found in coal-mines. The odour is characteristic, and exclusive to the gases evolved from spontaneous combustion. No one could mistake this odour, which can be detected even at a considerable distance.

I have been led to suspect that there is some kind of chemical action induced when coals from different collieries are mixed together, differing to some extent from simple oxidization. I have known cases where spontaneous combustion has taken place in coal that had not been six weeks in stock. In a number of instances, the chemical action has just produced enough heat to congeal the whole of the surrounding coal into one compact mass. So long as these affected portions of the stock were kept free from atmospheric oxygen, which was done by battering it well down with small coal; and, under these circumstances, very little further harm was done. In all these cases, the coal was used up as soon as possible.

An instance was recently brought under my notice of a coal that was only subject to spontaneous combustion when stacked in one particular part of the colliery grounds. Upon investigation, it was found that a drain passed underneath this particular part. Into the drain, the exhaust steam from the engine was passed; and thus heat was conveyed through the ground to the coal above, raising it to the necessary degree of temperature to induce chemical action which, in other circumstances, would have remained dormant. In another case, a large stack of dry coal was fired by spontaneous combustion induced by moisture, caused by the slight leakage from a steam-pipe passing over the stack. Yet in a colliery in the Bristol district, the workings of which are said by the Engineer to be as dry as snuff, there have been repeated cases of spontaneous combustion that could not possibly be due to the presence of moisture. Probably the combustion in this case was due to oxidization pure and simple. It is thus evident that no one theory can be applied to all cases. Friction cannot apply to the hold of a ship or coal stored on land. Oxidization is certainly one cause, if not the chief cause, of spontaneous combustion.

Mr. Stokes, one of H.M. Inspectors of Mines, in a recent communication to the Board of Trade on the subject of spontaneous combustion, says: "Fires appear under the most peculiar and erratic conditions; one part of the mine being subject to their generation, whereas another part of the same mine is never troubled. Under whatever conditions they occur, the premonitory symptoms, as a rule, are the same—a rise in temperature, a sweating of the roof near the place, and the peculiar characteristic smell, the result of decomposition of the mineral." Our observations at Stapleton fully confirm this regular order of procedure in the course of spontaneous combustion. The rise of temperature followed by the "sweating of the roof" is, however, evidence of the presence of moisture in the coal in those cases referred to by Mr. Stokes; and I have also observed instances where there has been a considerable rise of temperature and visible evidence of vapour, and yet little or no decomposition of the mineral, which would doubtless have ultimately followed had the coal remained. A German writer has recently stated that sufficient light has not been thrown on this question. There still remain a great many important points to be cleared up; and he expresses his regret that the chemistry of coal has been dealt with to so slight an extent, even in Germany.

I had observed some years ago that coals stacked not more than 6 or 7 feet deep never showed any tendency to heating. In this case, it is evident that the heat of oxidization is carried off into the atmosphere, without raising the coal to the temperature necessary to induce active or destructive chemical change, and little or no damage is done to the coal. Attempts have also been made to ventilate by running air-shafts through the coal-stack; but the latter state of that coal has been worse than the first, because the air, instead of keeping the coal cool, supplied the necessary oxygen, and greatly facilitated the destruction of the coal. Several suggestions or recommendations have been made to prevent the heating of, or to cool the already heated, coal in ships. The application of steam-pipes, I understand, is compulsory in vessels carrying coal under the American flag; and Professor Lewes some time ago suggested the distribution of cylinders of compressed carbonic acid gas, secured with fusible plugs, throughout the coal cargo.

Water and steam have always, in my experience, contributed to the spread of combustion; but I have had no practical knowledge of their application to coal in a ship's hold. To maintain large stocks of coal, and periodically or regularly work them through, to prevent heating, &c., is inconvenient, and entails considerable cost. Under such circumstances, it is impossible to receive the daily deliveries of coal at the most convenient place for working—viz., the breakers or elevators—or even at the most convenient place for handwork.

To provide a reserve of coal that should only be used in cases of real emergency, I would suggest that, where practical, a quantity of special coal should be bought—large, entirely free from small, and of a hard and close texture—and carefully stacked apart. Such a coal would stand for years without any very serious loss. There would, of course, be the interest on the outlay and cost of stacking. With such a reserve, the ordinary stores could be used for receiving, and conveniently dealing with, the ordinary monthly deliveries, with the least possible handling of material. Coal should, of course, in all cases be received as dry as possible, and care taken so that no damp coal is covered up with dry. The receiving stores should in all cases, where possible, be covered in, both in the interests of the workmen and the material.

It is painfully evident in many places throughout the country that the attitude of labour in the larger gas-works is anything but satisfactory. The workmen are being taught by the modern Socialistic agitator that they are the sole producers of all the wealth of the country, and that they are robbed of their labour by the grasping capitalists. How few of our workmen or gas consumers really know that the shareholders of nearly all the leading gas companies of the kingdom are not, and have not for years been, receiving more than about 4 per cent. upon their investments.

No class of labour in this country is better paid, or has generally received more kindly treatment, than that of gas workers. In most cases, eight-hour shifts and an annual free week's holiday have been granted. Every case of accident, in many works, has been granted compensation, even years before the Workmen's Compensation Act came into force; and the old-age pension problem has, in many instances, been solved by granting to workmen incapable of further service a pension of from one-third to one-half of their weekly wages, computed upon their years of service, to which grant in some cases the men are not even required to contribute a penny.

Unfortunately it is not in the interests, or in the nature of this class of Unionism, to be peaceful; and not only are the relationships existing between employer and employed thus often strained, but where such Unionism dominates, the general quality and quantity of work deteriorate. Individual freedom is banished, as far as the Union is concerned; and men are compelled, by subtle and relentless petty persecution, to join the Union or to leave the work. There is also reason to believe that it is one of the deliberate aims and objects of modern Unionism to establish a rule or system that men shall come on and go off at the beginning and end of the season in strict accordance with a blind rule that the last to come shall be the first to go. This is what is termed securing every man his "place and turn."

Foremen or managers are thus able to exercise, under these circumstances, little or no discrimination in taking on or sending off men. Skill, careful attention, and industry go unrewarded; and the inevitable consequences follow. In all such works, the standard of workmanship must be, and is, reduced to that of a declining average mean. I am informed that there are works where this rule is carried to such an extent that, once given employment, the workman practically secures a vested right of place and position in the works, so long as he can anyhow perform the duties; and the Union will claim to be judges equal with, if not superior to, those of the employers' representatives as to their fellow workmen's fitness or capacity. What could be more disheartening than to witness—as could be witnessed, in some large gas-works under such conditions—the scandalous waste, the utter disregard for the time and property of the employer, and the repeated violation of the most elementary principles and rules necessary to the successful operations of modern gas-works?

Compare this with the careful German, Belgian, or French workmen, to whom no detail seems to be too small to be overlooked. Recently the Bristol Gas Company received from a firm in London who possess manufacturing works in Scotland a quantity of steel work. After the material had been partly fixed, it was quite accidentally discovered that it had been manufactured in, and was imported from, Belgium; and I am compelled to admit that better material, or more perfect workmanship, could not have been produced. This is, unfortunately, by no means a solitary instance of the kind. How is it that we are thus beaten in our own markets, possessed as we are in such an exceptionable degree with rich mineral deposits of iron and fuel, and the immense advantages such possessions should give us in competition? How much is due to our excessive royalties, or how much of it is due to our out-of-date manufacturing plant, it would perhaps be difficult to say. But there can be no doubt much is due to the short-sighted, and ultimately destructive policy, that binds our artisans to one common level of execution and reward—the intelligent, industrious, and capable workman binding himself to, and making himself responsible for, the idle and incapable; both relying on their trade organization to keep them in employment, and to maintain their wages, irrespective of the workmanship, the cost of production, or the demand existing for that production in the open market. Workmen have an undoubted right to combine for the legitimate purpose of protection, or for the sale of their labour; but it must be admitted, however much we may sympathize with the legitimate objects of Unionism in theory, the practical results of such combinations as those named are in most cases detrimental to the best interest of both workman and employer.

It is important, and necessary, that all employers should treat

their workpeople with justice and consideration, and, in a prosperous industry like that of gas, even with generosity. That this has been done in all cases, is doubtful. Injustice and arbitrary treatment afford the opportunity of the agitator, and do more for the cause of Unionism than all the stump oratory of the demagogue. Much of the labour in a gas-works is of a very trying and arduous nature; and the intermittent nature of a considerable portion of that employment renders it necessary that it should be paid fully up to, if not a little over, the standard rate of wages in the district. High wages need not mean increased cost of production. Good pay is economical in well-managed works.

There can be no success in any undertaking without a close and real sympathy with the workmen and appreciation for their many individual fine qualities. Those responsible for the control of workmen should see that even-handed justice is done to every man; but, at the same time, it must be remembered that strict discipline and rule are indispensable, and are more calculated to produce harmony and comfort in an establishment than any policy of weakness and vacillation in passing over repeated breaches of rule and discipline.

The British workman, taking him all round, and if left to himself, is loyal, capable, and industrious, and at times heroic, because much of our work can only be done by men of skill and courage; and it is because of respect and admiration for his many good qualities, that it is desired to secure his perfect freedom and liberation from such a system as that described.

It was my intention to have alluded to the subject of water gas, and also to the growing deficiency of the initial pressure of gas obtained from modern gasholders for the purposes of distribution, and the assistance of exhausters and fans for this purpose. These subjects presented so much debatable matter, and knowing that many of you feel the keenest interest, especially in the subject of water-gas, it appeared unfair for me to take advantage of the chair and advance opinions and views where there would be no opportunity of reply. Gentlemen, I am afraid that I have already trespassed too long upon your time, and can only conclude by thanking you for the kind and patient hearing you have given my remarks.

At the conclusion of the address,

Mr. W. B. Randall (Waltham Cross) moved that a vote of thanks be awarded to the President for his extremely interesting address. One of the most important of the matters he had dealt with was the spontaneous combustion of coal—a trouble which perhaps was a little difficult to account for.

Mr. F. G. Cockey (Newport, I. of W.), in seconding the proposition, said the President had introduced some very interesting subjects, which he (the speaker) had no doubt the members would, in the course of the year, give them an opportunity of discussing.

The motion having been carried by acclamation,

The President thanked the members for the vote, and the business proceedings then terminated.

At the conclusion of the meeting, the members dined together, under the chairmanship of Mr. Irving.

The Chemical Industry of Japan.—The present position of the chemical industry in Japan is referred to in the "Board of Trade Journal." Near Osaka, the Yuso Kwaisha alkali works and the Nippon Yuso Kwaisha sulphuric acid plant are both in steady operation. It is stated that the first-named plant was started in 1893 by English engineers, who fitted it up on the most approved principles; but it is now entirely under Japanese management. At the latter works, sulphuric acid is concentrated in porcelain vessels in terraced succession. The acid, packed in earthenware carboys, has been exported in small quantities as far as Bombay.

Germany and the Metric System.—A report on the commercial value of the metric system, with special reference to the classification of German iron manufactures, was recently forwarded to the Wolverhampton Chamber of Commerce by the British Consul at Amsterdam. He states that the iron and steel manufacturers' unions of Germany have adopted a uniform system of dimensions for articles of universal consumption at home and abroad. Angle-iron of all descriptions, flanged boiler ends or fronts for Cornish or Lancashire boilers, the boilers themselves, and iron and steel tubes and all fittings connected with them (such as valves, cocks, and T-pieces), are made, so far as flange, diameter, and working lengths are concerned, in normal standard sizes, in order that every part of one work may be procured at once to fit every corresponding part of another construction. The normal standards are all fixed by the free co-operation of the combined German Engineers' Associations, and are adopted by the various manufacturers all over Germany. At present, a Committee of the Engineers' Associations are occupied in endeavouring to fix a metric thread for bolts and screws, nuts, bolt-heads, &c., as the present universal normal standard (the Whitworth) is so differently constructed by different works that the parts are not so interchangeable as should be the case. The Consul points out that Germany and the Continent generally will have a constantly increasing advantage over British manufactures in future in foreign countries, unless the metric system be fully and entirely adopted by Great Britain.

REGISTER OF PATENTS.

Manufacture of Water Gas.—Boult, A. J.; a communication from E. Fleischer, of Dresden. No. 4495; March 1, 1899.

This invention (the specification of which is not illustrated) relates to the production of water gas in twin generators, by first heating the generators to different temperatures, adding coal to the less highly heated generator, and then passing steam through this generator in the same direction as the blast used for heating it—the gases evolved thereby then passing through the second generator in the opposite direction to that of the air-blast previously driven through it, for the purpose of heating it. It has been found, says the patentee, that not only coke and anthracite, but also bituminous coals, are very well adapted for such an arrangement of two generators; the special difficulties of using such coal being overcome by distilling it, and converting it into coke after it has been charged.

The process is preferably so carried out that the steam is caused to enter from below into one of two generators, and that the products produced in this generator pass over to the second generator and enter into it at the top. The gas formed in the first generator passes into the second, through the upper colder strata to the hottest strata below. Thus the heat is, it is said, advantageously employed, and all the carbonic acid is changed into carbonic oxide. Further, gas is also distilled from a charge of fresh coal by means of the heated gases passing through the charge—such "new gas being also changed into permanent water gas in the second generator as it passes from the top to the bottom through the gradually increasing degrees of heat, by which the formation of tar is avoided."

A "practical arrangement of the whole process, which is independent of any specially constructed generator," is described as follows: Coke is placed in two generators, and one of the generators (A) is heated to a lesser temperature—say, 900° C.; while the other (B) is heated to, say, 1100° C. The colder generator is charged with a stratum of coal; and steam is admitted into it. This steam is decomposed, and the evolved gases, carbonic acid and hydrogen, as well as the particles of non-decomposed steam or of carbonic oxide, pass through the fresh charge, evolving from it new products of distillation. The mixed gases then enter Generator B, and pass through it from top to bottom. In this passage, the carbonic acid is reduced, and the products of distillation decomposed, whereby water gas issues from the bottom of the generator. During this operation, Generator A is cooling down—say, to 700° C.; while Generator B will hardly have cooled below 900° C. The steam and water gas conduits are closed as soon as it is found that the issuing gas does not correspond to the required conditions; the connecting channel between the two generators being also closed. Generator A is then again heated by a blast to a temperature of, say, 1100° C.; and the same conditions are re-established as at the beginning, only that Generator A has changed places with Generator B as regards temperature. After having charged the second generator with coal, steam is caused to pass through it, and the production of water gas is carried on as before.

As will be understood, the patentee points out, it is possible to charge the first generator with coal sooner than has been indicated above—that is to say, before or at the same time that it is heated by means of the blast. This arrangement can also be advantageously combined with the Dellwik gas process, described in patent No. 29,863 of 1896. According to this invention, such a quantity of air (calculated according to the height of the layer of burning material) is made to pass from below into the generator, that the products of combustion may result in as much carbonic acid gas as possible—at any rate, more carbonic acid than carbonic oxide.

Prepayment Meters.—Green, H., of Preston. No. 4738; March 3, 1899.

This invention has particular reference to prepayment fluid-meters of the kind described in a patent granted to the same inventor in 1896—No. 19,067; one object being to provide price-changing mechanism whereby the quantity of gas permitted to flow through the meter in exchange for a given coin "can be readily and definitely varied, in accordance with the current price, without substituting for one or more existing parts of the meter others of a similar kind but differing therefrom in their relative proportions, or otherwise." Other objects are to provide means for preventing a second coin being inserted in the coin-shoot until the coin previously inserted has performed its function—thus preventing the jamming of the coins in the shoot; and for preventing coins beyond a certain number being inserted and used, thus permitting the operation of the prepayment mechanism before gas is delivered.

Figs. 1 to 4 (see p. 614) illustrate the price-changing mechanism according to this invention applied to a dry gas-meter having prepayment apparatus of the kind described in the earlier patent. Fig. 1 is a plan, partly in section, of so much of the meter as is necessary to illustrate the improvements (the casing being removed); fig. 2, a section on the line X of fig. 1; and figs. 3 and 4, detail views of the gear-wheels.

A worm A, driven by the meter proper, gears with a mutilated worm-wheel B, and is connected with a worm-spindle C that gears with a worm-wheel D fixed to one of the hollow plugs of a compound cock (described in the 1896 patent), and which controls the passage of gas through the meter. The other plug is actuated by hand through any appropriate coin-freed mechanism. The two hollow plugs are so arranged one within the other that, in certain relative positions, they close the gas-passage; and then, if a coin be inserted through the coin-slot E of the meter and a handle F be actuated, the second hollow plug may be actuated to a given extent. Thereupon the gas-passage through the compound cock will be opened; and, as gas flows, the first hollow plug will be actuated by the meter proper so as, by the time the quantity of gas paid for has been delivered, to again close the gas-passage through the compound cock.

The worm A also gears with a second mutilated worm-wheel G (shown separately in fig. 4), and is loosely mounted on a fixed tubular stud H, the axis of which is in line with the spindle C. Frictional contact between the two wheels B and G is prevented by a collar or flange on the stud H. The two mutilated wheels together constitute what is designated a compound toothed wheel. The peripheral portion of the wheel B is shown connected to its boss by arms; and the wheel G is adapted to receive two pins I and J screwed through it so as to project laterally into the opening in the

body of the wheel B. The former pin may be fixed, and the latter one moveable and screwed through any one of a series of holes arranged in a part circle at equal distances apart. The position of the fixed pin in relation to the arms must be such that the gaps of the mutilated wheels can never overlap each other.

When the pins (as shown in fig. 2) abut respectively against the arms

Fig. 1.

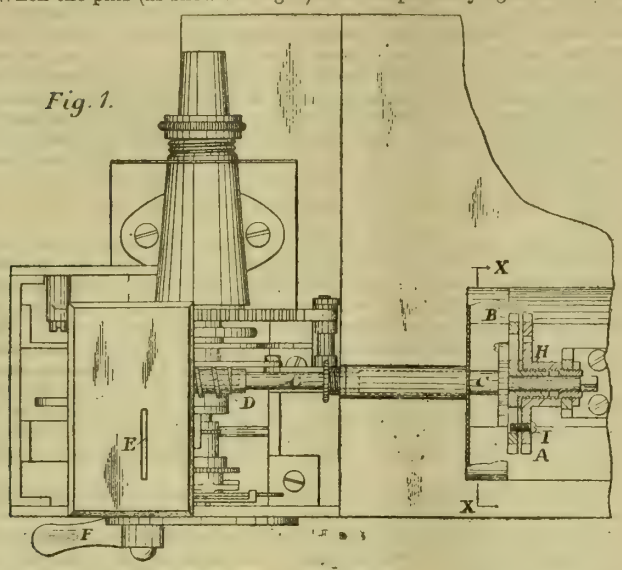


Fig. 2.

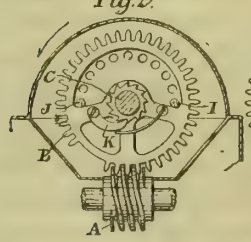


Fig. 3.

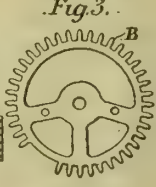
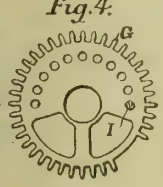


Fig. 4.



of the wheel B, both wheels will be coupled together so as to form a complete wheel having, say, forty teeth. The teeth of each wheel overlapping the gap in the other wheel, and relative or independent movement between them being prevented by the pins, the two wheels will be continuously driven as one wheel so long as the worm is in motion—that is to say, as long as the gas-passage of the compound cock remains open, and consumption of gas occurs. The gearing may, for example, be so proportioned that, when the wheels are thus coupled, 20 cubic feet of gas can pass through the meter between the opening of the gas-passage by means of, say, a penny and the closing of the same by the meter. When, however, the pin J is shifted to the next hole, both wheels will, if the arm abuts against the pin I and the wheel B gears with the worm A, travel together until the gap in the wheel B is over or against the worm A, when the wheel will become disengaged from the worm and will stop rotating. The wheel G, however, being in gear with the worm, will then be moved relatively to, or independently of, the wheel B, until the pin J abuts against the arm, whereupon the wheel G will drive the wheel B forward until it again gears into the worm. Both wheels then again travel together until the gap in the wheel G is over the worm A, whereupon the wheel G becomes disengaged from the worm, and will stop rotating; but the wheel B will continue to rotate, and will thus bring its arm into contact with the pin I, and then drive forward the wheel G until it again gears with the worm. With the pin J in the second hole, such an amount of relative movement is permitted when the gap of the wheel B is over the worm, that the wheel and the inner plug of the compound cock cease to move, while the wheel G is moved idly for a distance equal to two teeth. The wheel thus transmits the motion of the worm in the ratio of 1 to 42 instead of 1 to 40, as is the case when the wheels are coupled, and thus allows 21 cubic feet of gas to pass through the meter between the opening and closing of the gas-passage of the compound cock, instead of 20 cubic feet. If the pin J be removed altogether, then the wheel B and the inner plug of the cock will cease working while the wheel G is moved forward a distance equal to (say) 20 teeth, thus making the wheel B transmit the motion of the worm in the ratio of 1 to 60, and permitting 30 cubic feet of gas to pass for each penny.

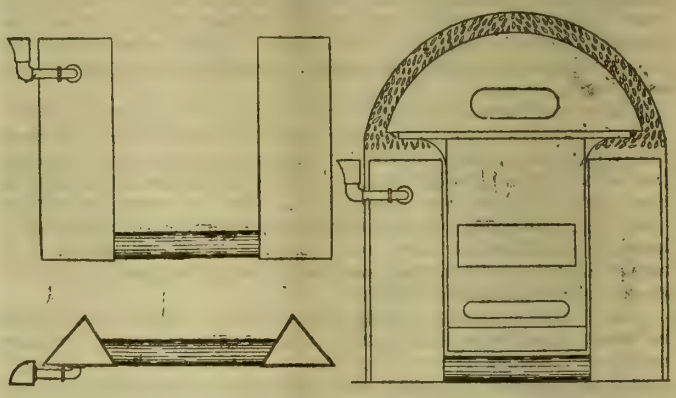
Thus, by removing or varying the position of the pin J, the meter can be adjusted to deliver 20 or any greater number of cubic feet of gas, up to (say) 30 cubic feet, in exchange for each penny inserted; and, as will be understood, the limits of adjustment may vary, and the shifting of the pin from one hole to the next may be arranged to cause a variation of the supply of more or less gas for each penny.

The motion of the worm may be conveyed to the worm-spindle C by a spring pawl K and a ratchet-wheel carried respectively by the wheel B and the worm-spindle C; the object being to enable the latter to be moved forward by hand independently of the action of the meter mechanism, so as to re-set the indicator to zero when the meter is to be used by a new customer.

Gas-Stove with Water-Heater.—Richmond, E. W. T., of Warrington. No. 5192; March 9, 1899.

The patentee proposes to provide within the space enclosed by the perforated or openwork case of a gas fire-place, at each side, a vessel adapted to contain water—the two vessels being connected together by a pipe, so as to be in communication with each other; while at a suitable part a pipe extends from one or both of these vessels, through the casing of the fire-place, and by its means they may be charged with water from outside. The vessels extend up from the lower part of the fire-place to above the level of the grate or combustion space, and are open at the top. The effect is that the water vapour given off does not mix with the gases of combustion, and pass away with them up the chimney flue, but issues with the air heated by the fire-place out through the perforations or spaces in the outer case, and so "humidifies" the warm air discharged from the fire-place into the room.

As shown in the illustrations, there are two vessels placed in the casing of the gas-fire on each side of the fire-place proper. These vessels

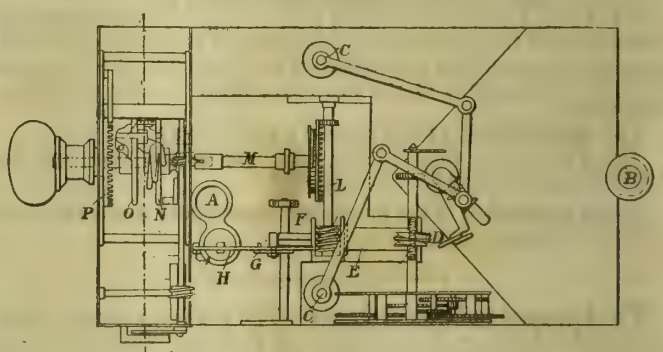


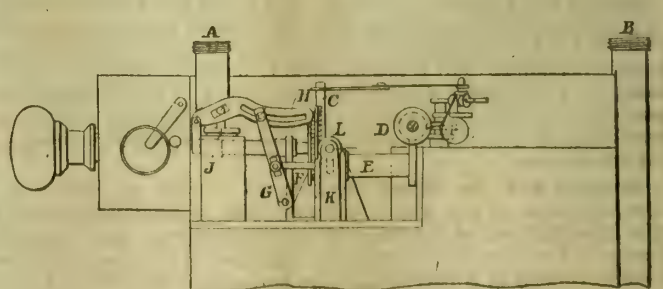
are filled with water, and are open at the top, and connected below by a pipe, so that the water-level in each is equal. They are filled by one filling-device, consisting of a pipe connected with one of the vessels at the back, and with a filling-mouth outside the casing of the fire. In action, the water in these vessels becomes warmed by the heat of the fire, conduction, &c.; and the vapour given off at the free surface in them mixes with the heated air produced in the fire-place, and passes out through the perforated casing above.

Prepayment Gas-Meters.—Pinchbeck, J., of Clerkenwell, E.C. No. 5656; March 15, 1899.

The mechanism of this prepayment meter consists of a nut moved longitudinally on a screw on the spindle of the meter in one direction proportionally to the consumption of gas, and in the other direction proportionally to the number of coins introduced. Towards the end of its travel in the former direction, the nut actuates an arm or lever connected to the gas-supply valve; and its further travel cuts off the gas until it is moved back again by the introduction of more coins.

The illustrations are a plan and side elevation (with the case removed) of an ordinary gas-meter to which apparatus has been added to make it a prepaid meter in accordance with this invention.





A is the gas-inlet pipe, and B the outlet. C are splindles caused to oscillate by the passage of the gas, and which, by means of links, rotate a spindle, which has fixed to it a worm gearing with the worm-wheel fixed to the shaft by which the counting and recording mechanism is actuated. The worm D is fixed on a shaft gearing with a worm-wheel forming part of a sleeve E, which has an internal screw-thread and contains a screw-plug fixed to a square rod F. The end of this rod carries a pin working in a slot of the lever G, which has one end pivoted, and whose other end carries a pin working in a slot in the lever H. J is the rod of a valve on the gas-supply pipe, and carrying a pin working in a second slot in the lever H. As gas is consumed, the rod F is moved from right to left; and when the nut on it approaches the end of the sleeve E, the lever H is pulled down—closing the valve—and the gas is cut off. K is a sleeve through which the rod F passes, but which is prevented from moving longitudinally by the framing. There is a worm-wheel fixed to the sleeve K and gearing with a worm on the shaft L, which carries a pinion gearing with a crown-wheel mounted loose on the shaft M—being driven in one direction by a pawl gearing with the ratchet wheel fixed on the shaft. This shaft is turned on the introduction of a coin, thereby rotating the rod F and nut; screwing the latter into the sleeve E, and thus moving them from left to right. On the shaft M is fixed a disc N having a slot in it. O is a second slotted disc

worked by a handle. P is a crown ratchet-wheel; and there is a pawl operated by a spring engaging with it. Q is the coin-slot.

On a coin being introduced into the slot Q (the parts being in the position shown in the plan), it falls into the slot between the jaws on the disc O, and also engages with the slot in the disc N, and with the teeth of the ratchet-wheel P. On the handle being turned, the discs and ratchet-wheel all rotate together—being connected by the coin; and the shaft M is therefore rotated, moving the nut on F from left to right. So long as the coin remains in place, the handle cannot be turned back again—being prevented by the pawl which engages with the ratchet-wheel P. But when the coin drops out, the handle is disconnected from the ratchet-wheel, and can be turned back freely, carrying with it the disc O and also the disc N—a lug on the one engaging with a lug on the other. The shaft M shares the backward motion, but not the wheel, which is retained by its pawl. The angle through which the handle and other parts can be rotated for each coin is limited and properly regulated.

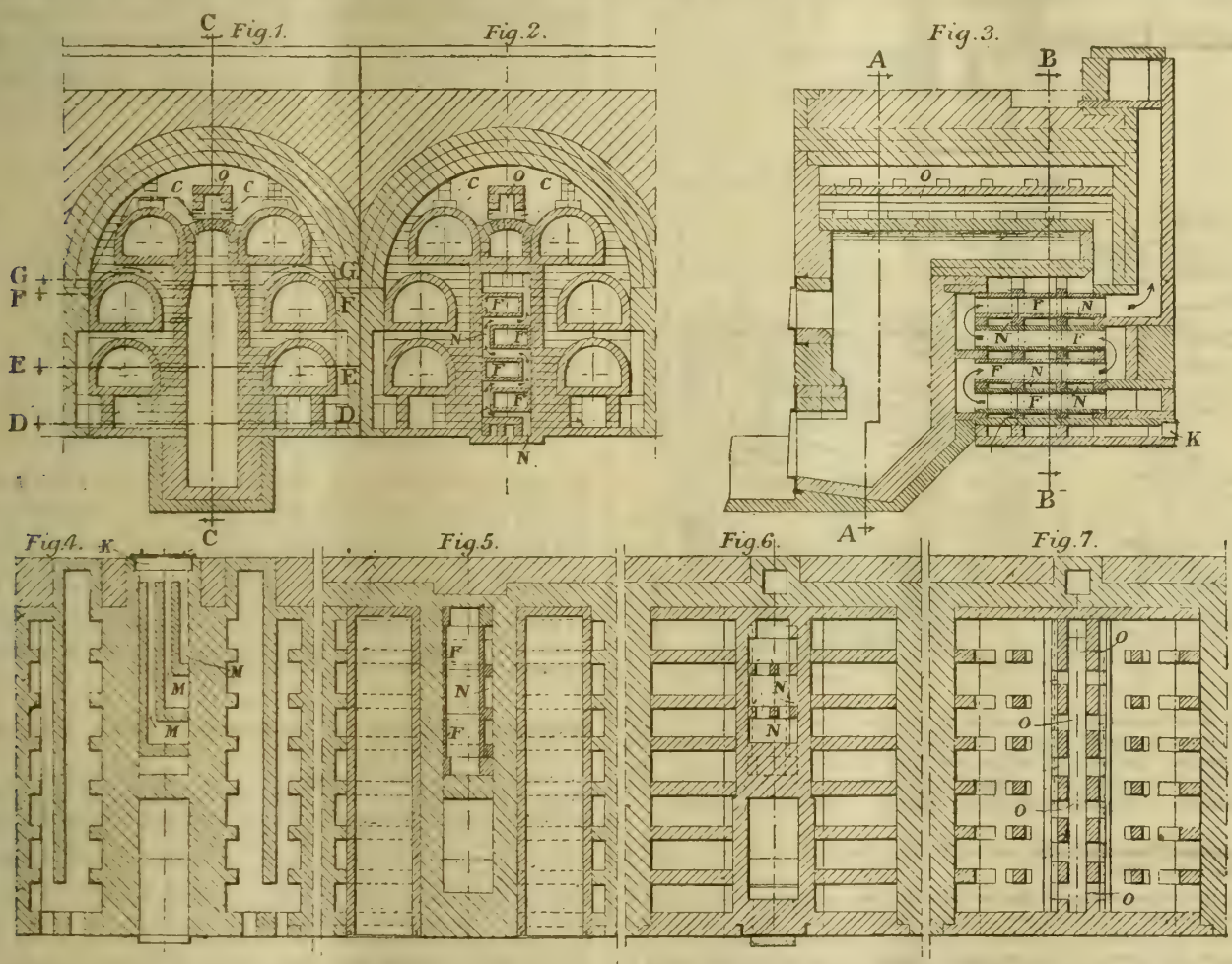
Regenerative Furnaces.—Drake, J. A., of Halifax. No. 5710. March 16, 1899.

According to this invention, the producer is placed between the retorts to be heated (so as to avoid the necessity of sinking a deep substructure), and wholly inside the front line of the structure. The sides of the division-walls are recessed, so as to allow for the passage of furnace gases from the combustion chamber on the top of the producer arch in a ziz-zag manner in, round, and about the retorts, while the gases are on their way to the main or exit-place, which is preferably arranged either on the top or at the bottom of the setting, as may be most convenient. In the space formed between the inner back wall of the producer and the external wall of the structure, provision is made for the introduction of a supply of secondary air to pass through or around a series of tubes arranged longitudinally from front to back or crosswise, so that the air is "very highly heated."

Fig. 1 is a sectional front elevation of the furnace taken on the line A of fig. 3. Fig. 2 is a sectional front elevation on the line B. Fig. 3 is a longitudinal section on the line C of fig. 1. Figs. 4, 5, 6, and 7 are sectional plan views taken respectively on the lines D, E, F, and G of fig. 1.

The details of construction are shown so fully that no description of the arrangement is needful.

The secondary air is shown as being drawn in at the rear of the structure—passing, firstly, into a chamber or box K, admission to which is controlled by sliding doors or valves, and thence along channels or conduits M, each of which opens at its inner end into a separate and independent air-passage N, up which the secondary air passes in a zig-zag manner around the recuperative tubes F in the direction of the arrows, until, in a highly heated condition, it finally reaches the chamber O built in the crown of the producer arch, whence it passes through lateral openings or passages into the combustion chamber C, where it



meets the furnace gases emerging from the producer through openings, and combustion ensues. The separate air-passages are formed by the supporting walls, which are made solid from side to side of the recuperative chamber. Wedge-shaped blocks may be employed to control the area of the channels, or each of them may be continued to the back of the structure, and provided with a separate sliding door or valve to control its area, and consequently the admission of secondary air to its corresponding air-passage. "By this means, a regulated supply of secondary air is obtained from front to back of the recuperator tubes, whereby local heating of the parts is prevented."

Coin-Freed Gas-Meters.—Pearce, G. W., and Whitbread, S. J., of Bishopsgate Street, E.C. No. 5756; March 16, 1899.

This invention relates to the construction and arrangement of several appliances affixable to any gas-meter, "in or by which a weighted push-back rod can be operated by coins forced from a receiving slot to open a gas-valve due to the slip of a finger from a pin to the tail of a hook, and from thence to the next pin of a series projecting from a disc during the return motion of such rod."

Fig. 1 (p. 616) is a plan of coin mechanism operating parts within the upper casing of the meter; the appliances being in the position of rest, and the gas-inlet valve fully open. A block-bar is then across the path of the coin-receiver, to prevent the fresh entry of coin until some portion of the gas already paid for has been consumed. Fig. 2 is a side elevation of the coin-operative mechanism in the same positions; the gas-valve being open. Fig. 3 is a side elevation of the coin-operative mechanism, with the gas-inlet valve returned to a closing position, and showing the varied positions each inserted coin has to follow after being passed into the coin-receiving slot, until it finally falls into the cash-box. Fig. 4 is a face view of the disc with the head of the gas-valve in position when open. Fig. 5 is a corresponding view, showing the position of the head of the gas-valve when lifted and the valve closed.

Bearings B support a back-throw or end-on motioned rod C, carrying on its back end a weight D. Between the bearings, the rod C has a projecting lip-plate E, and the front end a collar, against which a coin-discharger pressed forward by a spring has a bearing. The front of the rod C terminates in a rounded head, which each coin has to bear against, so as to force the rod C back to the position shown by the dotted lines in fig. 3. The rod also carries a cranked guard I, which, when the full number of coins has been inserted for opening to its fullest extent the gas-valve J, comes across the bottom of the coin-slot, and prevents their passage, should any additional coins be inserted, until some consumption of gas has taken place, when the guard will be removed automatically and the passage freed.

The rod has affixed to it a pointer or finger normally in contact with the inner face of an otherwise loose disc L. This disc remains stationary during the push-in action of the rod C by the coins, in which case the finger which bears against one of the pins projecting from the back face of the disc, is pushed rearwardly when the rod is forced back; and as the finger is pushed from the end of the pin, it falls on the tail of a hook-like projection N. During the return motion of the rod under the action of the spring, the finger drops from the tail-end of this hook, and lodges on the next lower pin; the two motions corresponding to the quantity of gas to be given in exchange for the inserted coin.

The disc L, although free of the rod C, is supported by a collar and separate bearing; and any back-action is prevented by a ratchet-wheel and stop-pawl.

The foregoing explains the opening of the gas-valve proportionate to the number of coins inserted through the slot S, and successively passed by a moon-shaped plate or a star-wheel, which receives the coins singly, and forces them when the handle is operated—each coin, as it finishes the pressing back of the rod C by falling on a lug of the tilting cradle G, becomes shot therefrom by the return motion of the rod due to the tension put upon the spring, and from thence falls into the cash-box.

Now, supposing consumption of gas commences, the meter mechanism

of the usual construction and arrangement operates the index-shaft W, by and from which the quantity consumed becomes registered; and by the addition of an extra gear-wheel, or of a series of gear-wheels at X, a cranked-shaft Y is rotated, to the crank of which is attached a draw-

Fig. 1.

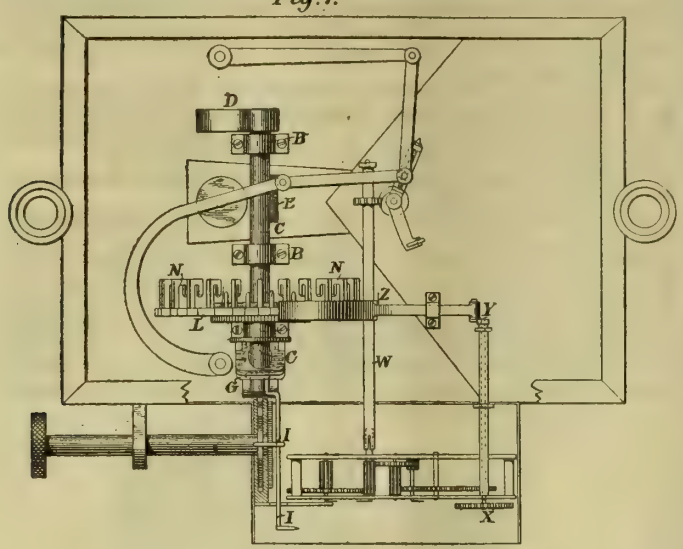


Fig. 2.

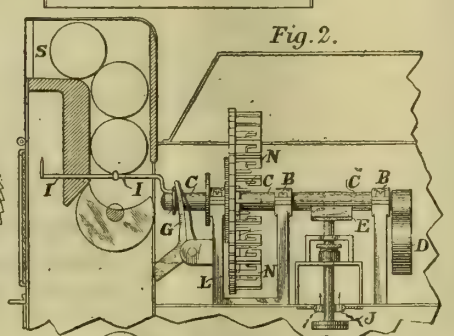


Fig. 4

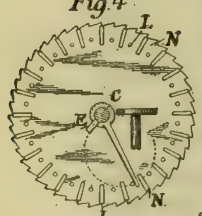


Fig. 5.

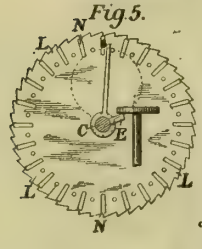
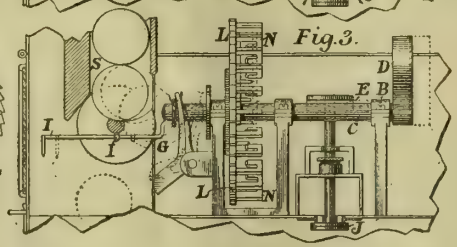


Fig. 3.

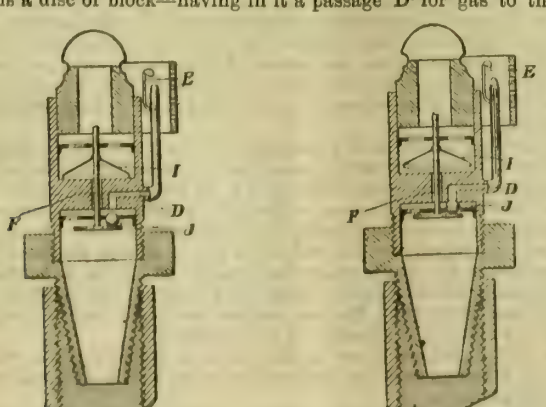


pawl Z, to engage teeth on the edge of the disc L, or it may be pins projecting from the front face of the disc, which, in its turn, draws the finger resting against one of the pins with it, and this by turning the rod C lifts the weight D a proportionate distance, and so on until the lip E lifts the head, and closes the gas-valve J to shut off the supply.

Self-Lighting Gas-Burners.—Kent, H. A., of Bowes Park, N. No. 6051; March 20, 1899.

This invention relates to the combination of a gas-tube, a passage for gas from the tube to the burner, a pilot-jet, a passage for gas from the gas-tube to the pilot-jet, a hollow conical valve normally closing the gas-passage to the burner, a rod or spindle connected to the conical valve, a disc or arm on the rod or spindle, and a valve carried by the disc or arm to close the gas-passage to the pilot-jet when the conical valve is moved by the pressure of the gas to admit gas to the burner.

The illustration shows the position of the parts, when the gas is unlighted and lighted respectively. In the gas-way between the tap and burner is a disc or block—having in it a passage D for gas to the pipe

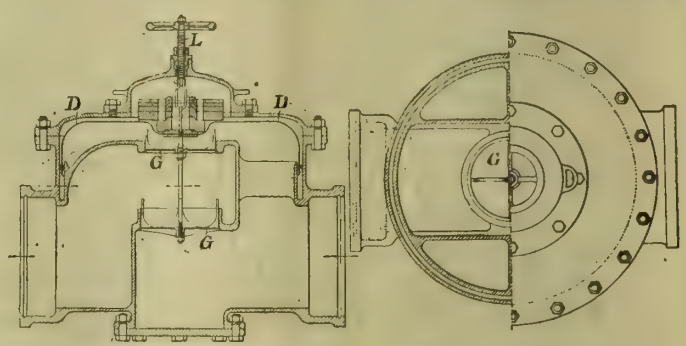


leading to the igniter E, and another (central) passage F for gas to the burner. Carried by a vertical spindle, mounted so as to be capable of moving up and down in guides (shown as discs, perforated for the passage of the gas), is a valve or hood I, presenting a comparatively large surface to the gas, and (when the gas is not turned on sufficiently to raise it) closing the passage for gas to the burner. When the gas tap is first turned on to a small extent (which may be indicated by a spring-catch entering a recess, or by a pointer), the pressure is not sufficient to raise the valve or hood I to open the passage for gas to the burner; but gas passes by the passage D (which is open) to the igniter E, and is there ignited. When the tap is further turned, the pressure exerted by the additional quantity of gas admitted is sufficient to open the passage F for gas to the burner by acting on the valve or hood I, and so gas passes to the burner, and is there ignited by the igniter. The movement of the valve I thus effected acts by means of a disc (secured to the vertical spindle) on a valve J (mounted in the lower guide-disc), so as to close the passage for gas to the igniter, as shown in the right-hand figure; and the parts remain in this position as long as the lamp is burning. When the main tap is turned to extinguish the light, the valve or hood I descends, and closes the passage F for gas to the burner; and as the disc descends with the valve I, the valve J also descends and opens the passage D for gas to the igniter, ready for gas to pass to the igniter when the gas-tap is again operated.

Pressure-Regulator or Stop-Valve.—Tobler, A., of Paris. No. 6056; March 20, 1899.

This invention relates to apparatus adapted to act either as a pressure-regulator or as a stop-valve for gas-mains. It consists essentially of the combination with a floating bell-chamber and double-beat valve controlling the admission of gas to the bell (whereby to obtain a constant pressure) of a device for enabling the regulator to act as a stop-valve.

In the illustration—a vertical section of the apparatus, and a half plan, half longitudinal section—the bell D dips into a bath of mercury contained in an annular channel within the casing. The bell is fixed to the stem of a double-beat valve G, and is loaded with weights for regulating



the outflow pressure of the gas. The stem is connected by a link at its upper end with a shackle attached to a regulating-screw L, turning in a nut mounted in the cover, and operated by a hand-wheel. When the screw is in the lowest position, the valves will be removed from their seats and give passage to the gas, in which position the bell floats, and is free to rise and fall under variations of pressure; the links permitting freedom of vertical movement sufficient in extent to allow the valve to pass from the closed to the full-open position. By raising the screw until the valve is closed (as shown), the bell, which is also raised, will be rendered immoveable, and the flow of gas to the main shut off.

Regenerative Furnaces for Gas-Retorts.—Brearley, J. H., of Longwood. No. 7210; April 6, 1899.

These improvements in regenerative furnaces for heating gas-retorts comprise principally a new or improved construction of brick for building the dividing walls or partitions between contiguous flues or passages in the setting on each side of the furnace—one set of passages or flues being for the admission of secondary air to the combustion chamber of the furnace, for admixture with the furnace or producer gases to secure complete combustion; and the other set being for the discharge of the products of combustion, after circulation around the retorts, to the main-flue outlet—the secondary air entering and passing upward through the first set of passages, and being heated by the hot gases descending through the second set of passages.

The special construction of brick for building the walls which divide the flues is "for the purpose of effectually preventing the contamination of the air and gases, or other elements or fluids passing through adjacent or contiguous passages by leakage from one to the other, whether resulting from cracks in the bricks, from defective joints between them, or from contraction or other causes." It consists in forming, near each longitudinal edge of each brick, a groove or recess of half circular or other suitable shape, which extends completely around the brick; while intermediate of the groove is formed on one face of the brick a V or other shaped longitudinal rib or projection, and on the opposite face a corresponding countersunk recess or opening. When laid, therefore, there is formed between each layer of bricks, and centrally thereof, a "baffle or dovetailed joint, which will prevent the passage of air or gases between the bricks." But in addition to this, fire-clay or other fire-resisting cement is applied between the faces and ends of the bricks, to fill in the half-circular grooves in each adjacent brick, thereby forming circular beads or ropes of fire-clay or cement completely around each brick on both sides of the centre, and presenting two additional sealed joints or baffles to resist the passage of air or gases through the joints of the walls.

The ends of the bricks are cut out or recessed on opposing sides, to form overlapping or rebated joints with the ends of adjacent bricks—thus providing a third baffle to each end of the brick.

The heated secondary air is conducted from the secondary-air passages to the combustion chamber of the furnace through channels or U-shaped bricks, which are arched to the radius required to fit the producer arch; one end of the bricks or channels being preferably contracted to check the air sufficiently to admit of its being heated to the desired temperature in the air-inlet passages or flues. The combustion chamber for a portion of its height is also divided with a central wall or bridge, which "ensures a more thorough mixing of the air and gases in the

crown of the chamber, and gives better equalization of heat throughout the setting."

Fig. 1 is a transverse sectional elevation of so much of a regenerator furnace as is essential to show the application of these improvements. Fig. 2 is a part longitudinal section taken on line A B of fig. 1. Fig. 3 is an enlarged elevation of the improved bricks, illustrating the manner

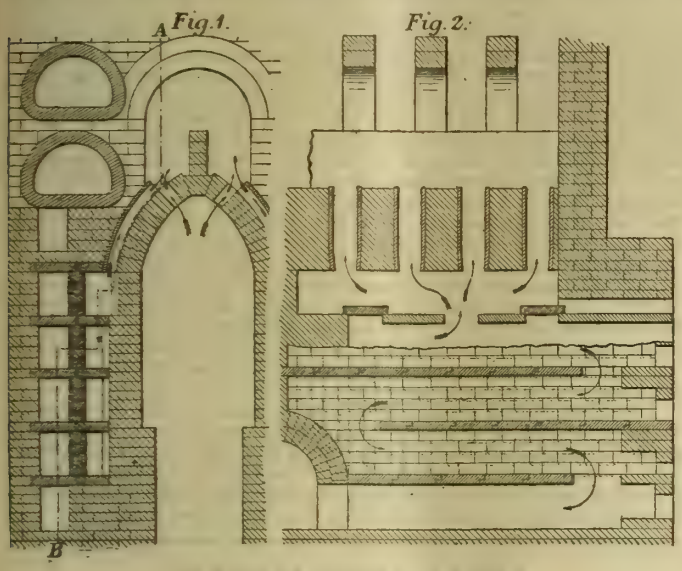


Fig. 1.

Fig. 2.

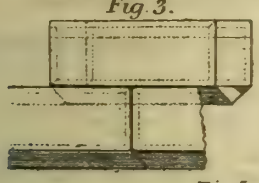
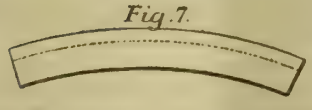

Fig. 3.


Fig. 4.


Fig. 5.


Fig. 6.


Fig. 7.

of building them one upon the other. Fig. 4 is an end elevation of fig. 3. Fig. 5 is a plan view of the upper face of the bricks shown at fig. 3, illustrating how the bricks are laid and joined end to end. Fig. 6 is a plan view of the opposite or under-face of the brick. Fig. 7 is an elevation of the channel or U-shaped brick communicating between the secondary-air passages and the combustion chamber.

Washing Gas.—Guillaume, N. A., of Paris. No. 11,868; June 7, 1899.

This invention is more especially applicable to gas-washers working under suction. The gas enters in the form of a thin sheet in proximity to water falling as it is about to leave the apparatus; the gas subsequently rising and traversing the apparatus, down through which the water flows—the gas being directed into contact with the water by serrated hoods dipping into the water in troughs, "so that the gas is repeatedly washed as it passes upwards by water which passes downwards."

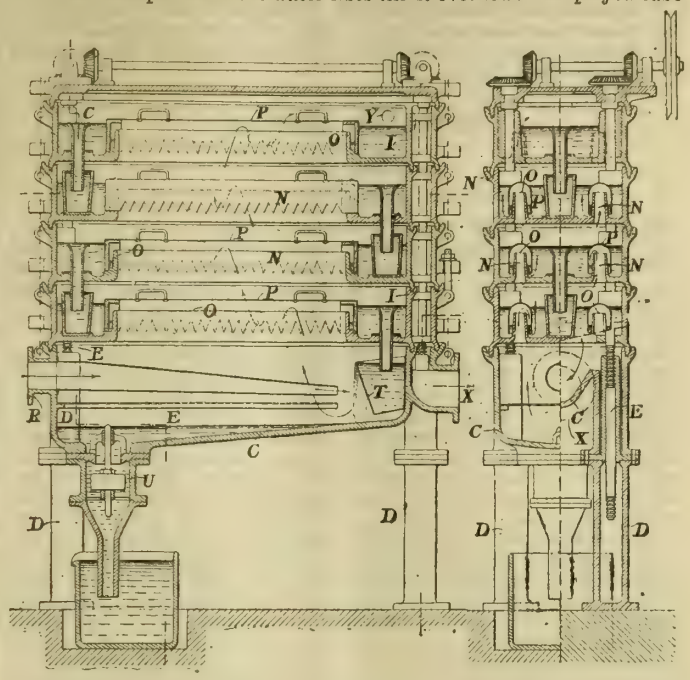
The apparatus (as shown) is constructed of a series of superposed rectangular troughs, fitting into each other by ribs on the one engaging with grooves on the other, and secured together by vertical bolts, or by joints giving a sufficiently tight closure. The lowermost trough C is mounted on columns D, extending up beside the troughs, and provided internally with screws E, the movement of which is controlled by bevel-wheels and a pulley at the top of the apparatus. In this way, the several troughs can be lifted or lowered so as to secure a uniform tightening of the joints.

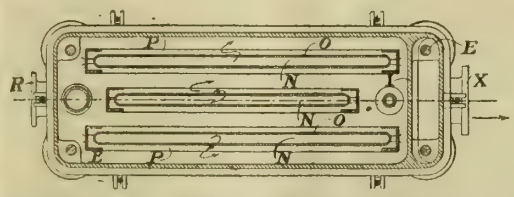
Each trough is divided by a partition I into two compartments, the smaller of which, when the troughs are superposed, constitutes a vertical conduit for the outlet of the washed gases, while the larger compartment is the trough in which the washing takes place. The troughs have each a splayed tube passing through the bottom, and a cup so arranged that the lower end of the tube is immersed in the water contained in the cup of the trough beneath. The gas enters each trough by several long and narrow openings N at bottom, with sides O rising into the trough; and over these hoods P are placed. These hoods have serrated lower edges, and are supported at their ends so that the serrations dip into the water in the troughs, and offer a gradual increase of area for the passage of the gas when the water-level in the hoods falls.

The lowermost trough is provided with a tubular entrance conduit R for the gas, extending into the trough, and being flattened out towards its end so that the gas passes from the conduit in the form of a horizontal sheet to meet the water which has served for washing the gas, and which overflows in a thin sheet from a box T situated before the incoming stream of gas. This lower trough has a sloping bottom; and the washing-water passes off at the lowest part through an outlet U provided with a float-valve. When the suction by which the gas is drawn in becomes too strong, this float-valve closes.

The water enters through a pipe Y in the upper trough—made flexible in order not to loosen the joint. The entrance for water to it is controlled by a float.

In each compartment the water rises till it overflows the splayed tube





already referred to, and passes through it into the cup beneath, which it overflows and passes into the next trough, and so from trough to trough till it overflows the box in the lowest trough in front of the incoming gas. The gas impinges against the water, and then passes through the openings in the trough and under the hood, and between the serrations and through the water that surrounds the hood. The gas thus successively passes through the water in each trough, and then descends in a washed condition through the vertical conduit formed by the smaller compartments constituting the gas-outlet—leaving the apparatus at X in the lowest trough.

APPLICATIONS FOR LETTERS PATENT.

2814.—Beak, W., "Gas or other engines." Feb. 13.
2834.—Hilliard, J. B., "Gas or air pump." Feb. 13.
2837.—Murrie, J., "Exhausters." Feb. 13.
2855.—Forbes, Sir C. S., "Acetylene gas-generators." Feb. 13.
2858.—Lake, H. H., "Fluid-meters." A communication from W. de Hertburne Washington and F. C. Goodwin. Feb. 13.
2888.—Naef, P., "Producing gas and bye-products." Feb. 13.
2917.—Naef, P., "Producing coke, gas, and bye-products, in part applicable for other purposes." Feb. 13.
2989.—Oehme, R., "Gas-stoves." Feb. 14.
3009.—Kemp, C. W., "Gas and other lamps." A communication from W. Fahndrich. Feb. 15.
3014.—Newark, J. E., "Sieves or grids used in gas-purifiers." Feb. 15.
3061.—Tuckfield, C., "Governor." Feb. 15.
3071.—Woodman, A. F., "Oil and gas engines." Feb. 16.
3093.—Lister, F., "Gas and like motor engines." Feb. 16.
3140.—Wynne, W. R., "Inlet and outlet valves of compound gas-engines." Feb. 16.
3181.—Sand, E. I., "Generating acetylene gas." Feb. 17.
3217.—Delin, G., "Obtaining intense heat by means of gas." Feb. 17.
3278.—Titchett, J., "Gas-stoves." Feb. 19.
3284.—Farmer, J. P., "Gas-burners." Feb. 19.
3312.—Richmond, E. W. T., "Gas culinary apparatus." Feb. 20.
3323.—Radclyffe, D. E., "Manufacture of fabric for illuminating mantles." Feb. 20.
3332.—Hicks, W. G., "Incandescent gas-burners." Feb. 20.
3385.—Linden, H. J. V., "Gas stoves or other apparatus." Feb. 20.
3391.—Stephens, R., "Gas-motors." Feb. 21.
3429.—Harrison, R., "Production of combustible gases from peat and similar substances." Feb. 21.
3465.—Jeffery, F. W., "Incandescent gas-burners." Feb. 22.
3509.—Gilman, J. T., "Gas-burner." Feb. 22.
3530.—Janz, J., "Incandescent bodies for illuminating purposes." Feb. 22.
3555.—Taig, J. B., T., & R., and Robertson, J., "Lighting street and other gas-lamps." Feb. 23.
3561.—Crossley, W. J., and Atkinson, J., "Internal combustion motors." Feb. 23.
3631.—Duff, E. J., "Gas-producers." Feb. 24.
3636.—Reid, W. W. D., "Gas and like cooking-stoves." Feb. 24.
3674.—Legge, J. St. C., "Incandescent lighting." Feb. 24.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress was made with Private Bills last week:—

Bills read a second time: Bristol Water Bill, Dorking Water Bill, South Essex Water Board Bill.

Petitions were presented against the following Bills: Cleethorpes Gas Bill, Exmouth and District Water Bill, Exmouth Urban District Water Bill, Great Berkhampstead Water Bill, Kingston-upon-Thames Gas Bill, Newport (Mon.) Gas Bill, Walsall Corporation Bill, Westgate and Birchington Water Bill.

HOUSE OF COMMONS.

Tuesday, Feb. 27.

THE GASLIGHT AND COKE COMPANY BILL.

On the motion for the second reading of this Bill,

Mr. PICKERSGILL moved, as an amendment, that the Bill be read a second time that day six months. He explained that the Bill was to enable the Gaslight and Coke Company to increase their capital by £2,500,000; and it was identical with that of last session as amended in Committee. He opposed that Bill, and in the House of Lords it was rejected. He complained that the charges made by the Company for gas were excessive as compared with those of other Gas Companies; their rates having been constantly increased during the last ten years, notwithstanding the fact that the natural conditions were all in their favour. This was the largest Gas Company in the world; they had the most extensive and the richest district of supply; the quantity of gas they sold per mile of main was greater than that of any other Company in the Metropolis; and yet they were practising upon a very large number of working-class consumers something like a fraud, and at the same time avoiding their statutory obligations. He further opposed the Bill on the ground that the Company were showing something like contempt towards the House in having ignored every one of the five recommendations made by the Select Committee who last year inquired into the charges of the London Gas Companies. There was no necessity to give the Company power to increase their capital; and it would be a public advantage if they were empowered to sell their property on the south side of the Thames to the South Metropolitan Gas Company, so that the latter could, as they proposed in a Bill now before Parliament, undertake the whole of the gas supply in South London. In these circumstances, it was very desirable that the House should reject the present Bill.

Mr. LOUGH, in seconding the amendment, said that if ever there was a Bill which ought to be rejected before second reading, it was the present one. Through mismanagement and over-capitalization, the Company promoting it had imposed a great burden upon the whole population north of the Thames in respect of their charge for gas. As a matter of fact, the Company already had £1,000,000 of unexhausted capital, and this would be sufficient for the next two years at least. With regard to the proposed purchase by the South Metropolitan Company of the property of the Gaslight and Coke Company in South London, the former Company were willing to buy, and the latter willing to sell; the only question in dispute being as to the price to be paid.

Mr. BOULNOIS said if the honourable member for Bethnal Green (Mr. Pickersgill) had his way, he would not let Londoners have any gas, electricity, or water. He (Mr. Boulnois) maintained that it was impossible for the House itself to decide whether or not the charges made for gas by the Gaslight and Coke Company were fair; such a question could only be determined by a Select Committee after hearing evidence. He had no interest whatever in the Company; but he asked the House not to depart from the practice it had always observed in regard to industrial undertakings.

Mr. BANBURY said that neither he nor his constituents were interested in the Company. He hoped, however, that the House would pause before it rejected a Private Bill before second reading unless it contravened—which he understood this Bill did not—some well-recognized principle on which the House proceeded.

Mr. BUXTON pointed out that the promoters of the Bill had deliberately ignored the five recommendations made by the Committee of last year. Under the circumstances, if Committees were to be of any value at all, the second reading of the Bill ought to be rejected.

Sir J. BLUNDELL MAPLE, as a large consumer of gas, supported the second reading. Consumers were in want of more gas, and unless the Company had more capital they could not supply it.

Mr. COHEN said he had no interest in the Company, but he advocated the second reading entirely for the benefit of the consumers, who had been too long sufferers by the management, or the absence of management, of the Company.

Mr. T. P. O'CONNOR supported the rejection of the Bill. He said that when the Committee of the House of Lords, who always extended the utmost consideration to commercial companies, felt compelled to reject a similar Bill last year, the argument against it must have been unanswerable. That Committee also recommended that if the Company came again to Parliament they should be compelled to reduce their price to that charged on the south side of the Thames—viz., from 2s. 11d. to 2s. 1d. per 1000 cubic feet. If the Company came before the House of Commons and said that if they received this power of enlarging their capital they would reduce their charge to that of the South Metropolitan Company, the House would willingly pass the Bill; but, in the circumstances, he hoped it would be rejected.

The House divided, with the following result: For the second reading, 184; against, 106—majority, 78.

The Bill was then read a second time and committed.

The following further progress was made with Private Bills last week:—

Bills read a second time and committed: Glastonbury and Street Gas Bill, Maidenhead Gas Bill, Mid-Kent Water Bill, South Metropolitan Gas Bill, Wandsworth and Putney Gas Bill.

Mr. Lough and Mr. Marks placed upon the paper for yesterday the following notice of motion in regard to the Gaslight and Coke Company Bill: "That it be an Instruction to the Committee to introduce clauses into the Bill to carry into effect the recommendations of the Select Committee on Metropolitan Gas Companies Charges (1899), as follows: (1) That the standard price should be reduced to 3s. 3d. to carry the standard dividend of 10 per cent., and that the existing scale of increase and decrease for dividend of ¼ per cent. for every penny of decrease or increase of price below or above 3s. 3d. be maintained, and that a secondary or additional scale be imposed which should permit of an increase or decrease of dividend over and above that regulated by the present scale of ¼ per cent. for every complete 3d. of decrease or increase below or above the standard price of 3s. 3d. (2) That the area south of the River Thames, at present part of the district of the Gaslight and Coke Company, should be transferred from the Gaslight and Coke Company to the South Metropolitan Gas Company; fair and reasonable price being paid. (3) That the charge made by the Gaslight and Coke Company for the rents of automatic meters and stoves should be the same to consumers north and south of the Thames for fittings of the same quality and capacity. (4) That capital powers should not be granted to any Gas Company for more than five years, if and when new capital is required. (5) That an effort should be made by any Company having obsolete or unproductive capital to redeem such capital by sinking fund or otherwise." The same honourable members also placed upon the paper for to-day a somewhat similar notice of motion in regard to the South Metropolitan Gas Bill—viz., to instruct the Committee on the Bill to insert such clauses therein as may be required to give effect to the first and second recommendations of the Select Committee of 1899, as above set forth.

A petition having been presented (after time) for the Llandrindod Wells Water Bill, the Examiner reported non-compliance with Standing Orders; and his report has been referred to the Standing Orders Committee. A petition was presented too late against the London Water (Welsh Supply) Bill, by the Duke of Beaufort; but application has been made for a suspension of the Standing Orders in regard to it.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Wednesday, Feb. 28.

(*Before Mr. Justice* BUCKLEY.)

The Welsbach Incandescent Gas-Light Company, Limited, v. The New Sunlight Incandescent Company, Limited.

This was the motion opened before Mr. Justice Byrne on the 23rd ult., and adjourned by him to be heard by Mr. Justice Buckley, who had tried the action in which practically the same parties were concerned (*ante*, p. 547).

Mr. MOULTON, Q.C., Mr. T. TERRELL, Q.C., and Mr. WALTER appeared for the plaintiffs; Mr. BOUSFIELD, Q.C., and Mr. NEILL represented the defendants.

Mr. MOULTON having stated that the motion was for an interim injunction against the successors in business of the Company against whom he had recently succeeded in establishing the validity of the plaintiffs' 1886 patent,

Justice BUCKLEY asked when the patent would expire.

Mr. MOULTON: On the 12th of March.

Justice BUCKLEY asked if Counsel could seriously apply for an interim injunction for twelve days. Why did plaintiffs not join defendants in the original action?

Mr. MOULTON said they were not in existence when the writ was issued. If they had been joined afterwards, when full information was given, it might have delayed the trial.

Justice BUCKLEY said that was merely formal. He did not suppose it would have delayed the trial a day. He must hear the motion, if it was pressed; but he had no expectation that Counsel would persuade him to grant an injunction for twelve days.

Mr. BOUSFIELD remarked that the plaintiffs began an action against the New Sunlight Company in respect of the same mantles in July last; but they chose to confine it to their later patent.

Mr. MOULTON said defendants were still selling these mantles.

Justice BUCKLEY said they would be entitled to make and sell them in a few days, so far as the 1886 patent was concerned. It was only a question of damages. One of the grounds on which he declined to grant an injunction in the other case was that it would, in effect, have been against the present Company, who were not parties to that action, though individuals connected with it were defendants. If Counsel insisted, of course he would hear it.

Mr. MOULTON said at any rate the defendants ought to undertake to keep an account.

Mr. BOUSFIELD said that an undertaking had already been given in the other action.

Justice BUCKLEY said, on the defendants undertaking to keep an account, there would be no order on the motion, except that the costs should be costs in the action.

The Incandescent Gas-Light Litigation.

In the Court of Appeal, on the 26th ult., before Lords Justices Smith, Collins, and Romer, the Voelker Incandescent Mantle Company, Limited, appealed from an order made by Mr. Justice Day, in Chambers, on Dec. 21 last, granting an injunction restraining them from infringing the 1886 patent of the Incandescent Gas Light Company, Limited. Mr. Bousfield, Q.C., and Mr. Neill appeared for the appellants; Mr. Moulton, Q.C., Mr. T. Terrell, Q.C., and Mr. Walter represented the respondents. Mr. Bousfield had scarcely opened the case—submitting that it was not usual to grant an injunction on a summons without any opportunity of going into the matter, and stating that the appeal was made immediately, though the action had not come into the paper until now—when their Lordships suggested that, as the patent in question had only about a fortnight to run, it was hardly worth while to interfere now, even assuming the appellants were right, as the mischief had practically been done. What might happen during the coming fortnight would only add to the damages they would be entitled to recover if they succeeded at the

trial. Mr. Bousfield said he felt the force of this suggestion; but as his clients were not present, he could hardly consent. Lord Justice Smith said the Court would order the appeal to stand over until after the trial; the costs of the injunction and of the appeal to be reserved.

Conviction for Assault on Welsbach Company's Inspectors.

At the Thames Police Court, on Saturday, the 24th ult., Benjamin Benjamin, who refused to give any address, was charged with assault upon, and threatening to shoot, Daniel William Barnett and James Cox inspectors in the service of the Welsbach Incandescent Gas-Light Company, and also with assaulting two police constables. From the facts of the case as narrated by the Solicitor for the prosecution, an injunction was granted on Dec. 16, 1897, against certain persons trading as the Excelsior Incandescent Light Company, of 166, Mile End Road, E.; the accused and his son (Isaac Benjamin) being two of the defendants to that action. Evidence was given that, Barnett having served on Isaac Benjamin an order of the High Court appointing a Receiver to take possession of all mantles and appliances infringing the patents of the Welsbach Company, and also giving the Company possession of all documents relating to any such infringements, the prisoner Benjamin Benjamin violently assaulted Barnett and Cox, and threatened to shoot them. The constables who were called were also assaulted by the prisoner, and a revolver loaded with two ball and two shot cartridges was taken from him after a severe struggle. Having heard the evidence, Mr. Dickinson fined the prisoner £3, or one month's hard labour, in each instance, for the assaults upon Barnett and Cox, and £2, or one month's hard labour, for the assault upon each of the constables; making in the aggregate a £10 fine, or four months' hard labour—the sentences of imprisonment being ordered to run consecutively. Prisoner was also bound over in the sum of £25 to keep the peace for twelve months.

The Charge of Falsifying Books and Embezzlement.

At the Lambeth Police Court last Wednesday, before Mr. Hopkins, Mr. F. F. Norris appeared to further answer the complaint that he, being an officer employed by the Directors of Frank Wright's Prepayment Gas-Meter Corporation, Limited, did on various dates "unlawfully, wilfully, and with intent to defraud, alter and falsify certain books of account belonging to his employers." There was also a summons against the defendant, who was formerly the Secretary of the Company, for embezzling money received by him on account of the Directors. Mr. Wontner appeared in support of the summonses; the defendant was represented by Mr. H. I. Sydney. The case on behalf of the Company was opened on the 21st ult. (*ante*, p. 548); and the evidence of one of their clerks was now taken at some length. It had reference to the Company's accounts, and was directed to showing the manner in which the defendant was alleged to have dealt with moneys received by him on the Company's behalf. At the close of the examination-in-chief of the witness, Mr. Hopkins said he should on this occasion require the defendant to find bail. Mr. Sydney expressed the hope that his Worship would not insist upon bail being furnished at this hearing. The defendant, he pointed out, was not required to find bail upon the last occasion, and had not anticipated being called upon to provide it that day. He reminded his Worship that all the issues in the case were raised in an action which had been commenced in the High Court of Justice at the instance of the defendant's wife. Mr. Hopkins, however, said he must adhere to his decision, and, in adjourning the further hearing for a week, said the defendant would have to find a surety in £250, or two sureties in £125 each, for his appearance.

The Payment of Water-Rates for Small House Property.

At the Stockport County Court last Friday, before his Honour Judge Yate Lee, an estate agent named Joseph Albiston sued Edward Dixon for £3 12s. 6d., money alleged to be due by defendant to plaintiff in respect of the water-rate of the premises No. 275, Heaton Lane, Stockport. It was mentioned that the case would be a test one in regard to the other tenants of the plaintiff, who were in a similar position to Dixon. It appeared that in 1893, up to which time the tenants had paid the water-rate, the Water Company gave the plaintiff notice that he must himself pay the rate for the whole of his houses, instead of the money being collected from individual tenants. The plaintiff did so, and it was submitted that he was entitled to get the money from the tenants. It was mentioned that he had not claimed before because he had asked Dixon for the amount from time to time. The rates had accumulated against Dixon from 1893 to 1899, until they reached the sum claimed. For the defence, it was argued that, under the Act of Parliament, the landlord was liable to pay the rates of £10 houses; being, of course, entitled to recoup himself by placing a proportionate increase upon the rent. His Honour agreed with the defence set up, and gave a verdict for the defendant; awarding increased costs on the ground that the case was one of interest to the general public.

Increased Consumption after Reduction in Price.—Two years ago, a proposal was adopted in Berne to reduce the price of gas 12 per cent. Some of the residents regarded this step as being financially dangerous, and they predicted a heavy deficit. The result proved them to be wrong. After the decrease in prices, the consumption of gas increased 13½ million cubic feet in 1897, and 14 millions in 1898. Moreover, the financial equilibrium, temporarily disturbed, was speedily restored; and now there is an increase in the revenue. The same happened in the case of the supply of electricity. After reducing the prices, the communal electric light works had an increase of business. The profits in 1892 were 10,120 frs.; whereas in 1898 they were 38,882 frs. There was also a rise in the receipts for water. At present, gas, electricity, and water are the most important sources of revenue for Berne.

MISCELLANEOUS NEWS.

SOUTH LONDON LOCAL AUTHORITIES AND THE SOUTH METROPOLITAN GAS BILL.

Conference at Camberwell.

A few weeks ago, the Camberwell Vestry convened a conference of South London Local Authorities to consider the advisability of taking joint action with respect to the Bill promoted by the South Metropolitan Gas Company in the present session. The conference took place in the Vestry Hall, Peckham, on Monday evening last week, under the presidency of Mr. E. P. Phillips, J.P., Chairman of the Vestry. The following Local Authorities sent delegates: Battersea, Bermondsey, Camberwell, Newington, Rotherhithe, St. George-the-Martyr, and Wandsworth. Invitations were sent to Greenwich, Lambeth, Lee and Lewisham, St. Olave's, and St. Saviour's; but these parishes did not appoint delegates. The documents submitted to the conference included the statement prepared by Mr. George Livesey, which was published in the "JOURNAL" for the 20th ult. (p. 482), and the following opinion of Mr. G. M. Freeman, the Counsel employed by the Camberwell Vestry:—

My opinion is asked as to whether consumers south of the Thames will be prejudiced by the Company obtaining the powers asked for, and also whether local authorities can be affected in regard to the charges for street lighting. It is therefore necessary to consider the various parts of the Bill separately. First, as to varying the standard of illuminating power. The opinions expressed by the Chairman of the Company, that the reduction or increase of illuminating power within a certain range is immaterial because the control really rests with the consumer, and depends mainly upon the burner used, and also that all enrichment of gas is done at the expense of the consumer, are held by many gas experts, and are, in my opinion, true. This seems a good reason for allowing a reduction of power by one, or possibly two, candles, as has been frequently done by Parliamentary Committees. But I think the proposal to have varying charges in the same district is objectionable in the interests of consumers, because it would leave it in the hands of the Company to supply such quality as they chose at varying times and in different parts of their district, and, moreover, as presumably consumers would be charged on an average, persons only receiving 14-candle gas might be contributing to the payment of persons receiving 16-candle gas. I think the clause should be amended either by simply reducing the illuminating power to 15 candles, with a standard price of 3s. 2d., or providing that the illuminating power shall be the same for all parts of the district. I do not think this affects the local authority in respect of their public lamps, as they can determine at which power and price they will take the gas, providing that a condition is put in the Bill that the Company shall at all times furnish for the public lamps gas of such illuminating power, not exceeding 17 candles, as the local authority require, and such supply shall be separately tested. I do not think the corresponding variations of dividend are objectionable. Secondly, as to the purchase by the Company of part of the undertaking of the Gaslight and Coke Company. It is important that the Company should not be entitled to charge higher prices, whether to private consumers or local authorities, than they are entitled to charge in their present district. I think that this is practically provided for by clause 25 (2) of the Bill, but that it would be desirable, after the words "supply of gas" in clause 25, line 31, to insert the words "and to the charges to be made for such supply, whether for public lighting or private consumption." The only other way in which the proposed sale could affect the local authority would be in case they had any intention of themselves becoming purchasers of the portion of the Gaslight and Coke Company's undertaking south of the Thames; but I do not understand that this is contemplated. Otherwise the sale would be for the benefit of all consumers, as the charge for supply would be lower.

Mr. SETH COWARD (Camberwell) moved the following resolutions:—

(*a*) That, in the opinion of this conference, it is desirable, in the interests of the authorities whose areas are affected by the Bill, that the Bill should be opposed, in order that necessary amendments may be obtained.

(*b*) That Parliamentary Agents and Counsel be engaged against the Bill, and that the cost of the opposition be shared by the authorities represented at this conference.

(*c*) That the several authorities whose areas are affected by the Bill be requested to urge the local Members of Parliament to support the amendments desired by the conference.

(*d*) That a copy of the resolutions passed by the conference be forwarded to the Board of Trade, the London County Council, the Metropolitan Vestries and District Boards south of the Thames, and the London Members of Parliament for the district affected by the Bill.

He argued that these resolutions were necessary in the interests of the consumers.

Mr. W. WESTCOTT (Newington) seconded the motion.

Mr. H. G. HILLS (Vestry Clerk of Wandsworth) said that, in his opinion, the most important clause in the petition which had been drafted was the following: "That your petitioners humbly submit that the proposal to have varying charges in the same districts is objectionable in the interests of consumers." He moved, as an amendment, that the clause should be altered so as to read: "That, in the opinion of this conference, the proposal to have various charges in the same districts is objectionable in the interests of consumers."

Mr. J. H. GIBSON (Wandsworth) seconded the amendment.

Mr. J. SOMERVILLE (Camberwell) said the kernel of the Bill was contained in the clause to which attention had been drawn. The Bill did not propose varying charges. The main object of the Company was to enable them to use for gas making Newcastle coal alone, without any enrichment. The gas supplied by the Company was the cheapest in London. If the Bill were not permitted to go through, the inevitable result would be that the Company would be compelled to raise the price of their gas in order to meet the increased cost of production. They were now in such a financial position that they could take many thousands a year out of the pockets of the people of South London without depriving the shareholders of a single penny of dividend. He could not imagine how Counsel had fallen into the error that the Bill intended to introduce varying charges in different districts. Such a thing was manifestly absurd. It was also an error to imagine that the Company desired to adulterate their gas. What they really wanted to do was to supply unenriched gas. Why did consumers want enrichment? The incandescent gas system had been introduced into their streets; while, as far as

private consumers went, the illuminating power, within a range of two or three candles, was practically of no importance. It was all a question of burners, over which the Gas Company had no control. Of course, all experts agreed that the enrichment of gas used for power or manufacturing purposes, or for cooking or heating in any form, was waste of money. In South London, there were in operation an enormous number of gas-stoves; and if the cheapest form of enrichment—namely, by the admixture of carburetted water gas—were resorted to, the effect would be to reduce the heating power of the gas. This was a matter to be seriously considered in the interest of the consumers. It must not be imagined that he "held a brief" for the Company; he had never seen Mr. Livesey, the Chairman, in his life.

Mr. W. Matthews (Battersea) said he did not desire to throw any imputation upon Mr. Somerville; but if he did not "hold a brief" for the Company, and had not been "coached" by anyone, he seemed to have got a very large amount of information upon the subject.

Mr. Somerville [holding up a number of the "Journal"]: This is where I get my information. I have studied this paper for years. He went on to say that what was required in South London, with its 50,000 ordinary gas-stoves, was not an illuminating, but a heating gas, with a higher incandescent power. Instead of opposing the Bill, they should support it, not only in the interests of the people on the south side of the river, but for the whole community. If the Bill passed, the Companies in North London would be obliged to follow suit.

Mr. A. Purser (Rotherhithe) said what they wanted in his district was more efficient testing-stations. Within the small area of Rotherhithe they had different illuminating powers.

Mr. Matthews said the Company ought to supply private consumers with good burners.

Mr. Somerville: Perhaps they will.

Rev. J. H. Anderson (Wandsworth) advocated caution in coming to a conclusion.

Mr. C. E. Hearson (Camberwell) followed on the same lines as Mr. Somerville, and strongly argued that the local authorities should support the Bill in the interests of the consumers.

The delegates from Bermondsey, Newington, Battersea, and St. George-the-Martyr advocated that a petition should be lodged, in order that the local authorities might secure *locus standi*. In the result, Mr. Coward temporarily withdrew his series of resolutions. Mr. Hills's amendment was then put in the form of a motion, and carried with one dissentient (Mr. Somerville).

Mr. Somerville explained that he had only voted against the motion because there was not in the Bill any proposal to have varying charges in the same districts.

Mr. Coward's series of resolutions were then taken *seriatim*; and the first was adopted.

Mr. Coward moved that the conference adjourn, and that Mr. Livesey be invited to attend the adjourned sitting, in order to see if any arrangement could be come to.

Mr. Gibson seconded the proposal.

Mr. Matthews strongly objected. If they invited Mr. Livesey, he was such an exceedingly able man that he would talk them into agreeing to what he wanted them to do. (Laughter.) He was perfectly serious; and, in the interests of weak-kneed delegates, he wished to save them from the risk of being induced to give their countenance to a Bill which, in his opinion, was nothing less than an attempt to exploit the people.

Mr. T. Haynes (St. George-the-Martyr) mentioned that his Vestry had already petitioned against the Bill.

Mr. Somerville said he wished earnestly to support Mr. Coward's proposal. It was to be observed that there was a great deal of misapprehension about the matter; and it was most desirable that Mr. Livesey should be afforded an opportunity of dissipating it. Nothing could be more absurd than to describe the Bill as "an attempt to exploit the people." A good many of those present did not know what they were opposing.

The motion was negatived.

After some discussion, the three remaining resolutions were adopted; and it was decided to instruct Parliamentary Agents.

Rev. J. H. Anderson moved—"That this conference is of opinion that the Metropolis should be provided with gas of a uniform quality and price throughout." He said that in his district (Wandsworth) there were several Companies, some of whom the residents did not consider treated the public fairly.

The Chairman ruled the motion out of order.

Mr. Somerville dre wattention to the London County Council Gas Bill, and said he thought the conference should express some opposition to the proposed introduction of a moveable photometer.

The Chairman ruled that the conference had no power to discuss any Bill other than that of the South Metropolitan Gas Company.

A vote of thanks was accorded to the Chairman; and the proceedings closed.

ACQUISITION OF THE PORTLAND GAS-WORKS BY THE DISTRICT COUNCIL.

A Transfer Effected Without Arbitration.

The Urban District Council of Portland have within the past five months accomplished a feat which we believe to be unique in the history of the municipalization of gas undertakings. They have acquired from a private owner the gas-works supplying the Island, and have done this without an expensive contest in Parliament or the assistance of two arbitrators and an umpire. The circumstances under which the transfer has taken place are as follows.

At a meeting of the District Council on the 11th of October last, the following resolution was proposed by the Chairman (Mr. J. Lano), seconded by the Vice-Chairman (Mr. B. Combon), and carried unanimously: "That it is the opinion of this Council that they should control the supply of gas and electricity on the Island; and that a Committee be appointed to negotiate with the Portland Gas Company with the view of ascertaining upon what terms the Portland Gas Works can be acquired." It was then resolved that the Committee should consist of the Chairman, Vice-Chairman, and Chairman of the Finance Committee (Mr. G. H. Smith). These gentlemen had an interview with Sir Richard Howard, the owner of the works, and informed him that the Council were anxious to acquire them, if they could do so on reasonable terms, as they believed it would be of advantage to the inhabitants to have the public lighting of the district under their management. Sir Richard informed the Committee that he believed in public authorities having control over the gas and water works within their district; and therefore he should be prepared to favourably consider any proposition which the Committee might put forward for acquiring his works. The Committee asked Sir Richard whether, having regard to his experience, as the former Clerk to the Council and as the present Town Clerk of Weymouth, in matters of municipal finance, he considered the price he would be prepared to accept would be of such a reasonable character that it would be unnecessary to come on the rates for any portion of the annual instalments of principal and interest. He informed them that he would be willing to accept such a sum as would render it unnecessary to do so; and that he believed the present net income to be derived from the works would be sufficient to meet all those instalments—in other words, that the works would pay for themselves. In answer to a further question, he informed the Committee that he was quite prepared for an expert gas engineer to examine the works and investigate his books, &c.; and that, if a reasonable report were made by such valuer on behalf of the Council, he would probably accept it, and in that event it might be unnecessary for him to call in a valuer. The Committee considered that their interview with Sir Richard was of a very satisfactory character; and therefore, on the 13th of December last, in their report on the result, they recommended the Council to at once appoint an engineer to examine the works and accounts, and state what would be a proper sum to offer for the undertaking. With the view of assisting the Council in the matter, the Committee requested the Clerk (Mr. J. Howard Bowen) to communicate with their Parliamentary Agents (Messrs. Baker, Lees, and Co.), and request them to submit the names of some gentlemen qualified to make the valuation. In the result, the Committee advised that Mr. W. A. Valon should be appointed, and be requested to visit Portland at once, so that an agreement might, if possible, be come to by the end of January. The report was adopted, with one dissentient.

Mr. Valon promptly paid a visit to Portland, and, in company with the Council's Surveyor (Mr. E. J. Elford), examined the works, inspected the district, and subsequently presented his report and valuation. On the 10th of January, the Committee informed the Council that there were certain matters upon which they required further information; and they were therefore authorized to meet Mr. Valon. This they did, and on the 2nd ult. they presented another report. Mr. Valon also sent in a long report dealing fully with the structural condition of the gas-works and the character of the district to be supplied. It closed as follows: "The conclusion I have arrived at with regard to the works is that they are generally well built and substantial; that the retort-house is in excess of present requirements; that the gasholders (when the new one is completed) will be considerably in excess; that the condenser, scrubber, and washer require adding to; and that, while the purifiers are sufficiently large for the present make, it would be decidedly economical to put up an additional one. Further, that it would be good business to erect sulphate works for the manufacture of sulphate of ammonia on the premises; this article being now in fair demand for agricultural purposes, and likely to continue so. In other words, the excess plant, together with the site on which it stands, is more than a set-off against the deficiencies in scrubbing, condensing, and washing power; while the sulphate works will pay for erection. As regards the district, the mains require an expenditure to give them a proper overhauling and lay them deeper in the ground, which would considerably reduce the leakage, and at the same time render them safe for the future. The pipes themselves, I think, are in good condition; and nothing more than I have stated will be necessary to put them in good order. For the year ending Sept. 30, 1899, the quantity of coal carbonized was 1700 tons; the quantity of gas made, 16,204,100 cubic feet; the gas accounted for, 13,943,300 feet; the gas sold, 13,568,300 feet. From the accounts for receipts and expenditure furnished by the Manager, which have been verified, and after adjusting the various items as between capital and revenue, I am of opinion that the undertaking of the Portland Gas Company—including works, plant, buildings, mains, meters, gas-stoves, stock-in-trade, tools, implements, and goodwill, and all and every the interest of the proprietors (excepting coal in the stock or gas manufactured and stored in the gasholders), is to be valued at the inclusive sum of twenty-eight thousand six hundred and fifty-six pounds (£28,656), this sum to include the amount to be expended by the proprietors for the erection and completion of the new gasholder; the holder, tank foundations, connections, &c., to be completed to the satisfaction of the Council's Engineer, and subject to his certificate."

The two reports were discussed together by the Council at a meeting held on the 9th ult., and the matter adjourned till the 12th ult. Mr. Valon was unable to attend on that day; but he sent certain details of income required by the Council, accompanied by the following explanatory remarks: "The gross income is £3826 0s. 9d.; while the expenditure, adjusted for the repair and maintenance of works, &c., is £2388 9s. 11d.—leaving a gross profit of £1437 10s. 10d. My valuation of the above is £28,656 10s. The annual amount to be invested at 3 per cent., together with sinking fund, to reproduce the principal of £28,656 in 40 years would be £1241 15s. 2d., or in 50 years (which I think it is more likely the Local Government Board might be induced to grant) £1114 14s. 4d. If for 40 years, the balance of profit on the adjusted accounts as they stand would be £195 15s. 8d.; and if for 50 years, on the second amount of £1114 14s. 4d., £322 16s. 6d. The carbonizing accounts show, however, that the gas sold per ton of coal carbonized is only 8000 cubic feet. This, as I pointed out to the members I had the pleasure of seeing when at Portland, should be considerably over 9000 cubic feet. Taking it, however, at 9000 feet, it means 1000 cubic feet per ton of coals carbonized, or an additional profit of £250. There should also be made from the manufacture of sulphate of ammonia a profit of £85. These two sums together give £335. If this be added to the balance of profit in the case of 40 years, it means a balance on the right side of £530 15s. 8d. per annum; and if for 50 years, £657 16s. 6d. per annum. This amount of profit, therefore, would fully justify the Council, as I have already recommended the

Committee, in reducing the price of gas 6d. per 1000 cubic feet, which would still leave them a balance on the right side, without calculating the increase of consumption which would be the natural result of the reduction made."

A special meeting of the Council was held on the 20th ult., at which Mr. Valon was present. After a long consultation, it was resolved, with one dissentient—"That the Committee be instructed to make Sir Richard Howard an offer of not exceeding £28,656 for the Portland Gas-Works, and, if accepted, to arrange with him the details of an agreement for the purchase of such works, to be sealed by the Council at their next meeting; such agreement being in all respects subject to the consent of the ratepayers being obtained." The Committee met Sir Richard on the 22nd, finally agreed with him for the purchase of the works for the amount stated by Mr. Valon, and provisionally settled the terms of the contract for purchase. A full representative meeting of the ratepayers was held last Tuesday (Mr. Valon being present as adviser to the Chairman); and it was unanimously resolved to endorse the policy of the Council and the offer they had made. The Council will now be able, by promoting a late Bill, to obtain parliamentary sanction to the agreement this session; Lord Morley having already promised to give permission for the introduction of the Bill, which will pass through its various stages in both Houses as an unopposed measure.

BELFAST CORPORATION GAS AFFAIRS.

How a Loan to the Electric Lighting Committee is being Dealt with—The Price of Coke.

There seems to be a little juggling going on at Belfast with money which the Corporation Gas Committee advanced to the Electric Lighting Committee in the hour of need; and the cool manner in which the loan is being dealt with by the Electric Lighting and Finance Committees was exposed by Mr. Young at the meeting of the Council on Thursday during the consideration of the estimates for the year. Mr. Young said that in the estimate of the Finance Committee there was an item: "Deduct contribution from Electric Light Committee, £5090." In the Electric Light Committee's report, they found the explanation of that which he thought the public should be put in possession of: "Resolved—That the principal Committee be recommended to transfer to the Finance Committee in aid of the rates the sum of £5090 16s. 3d., being the equivalent of the interest and sinking fund to Dec. 31, 1899, on £32,500 capital expended on which this Committee has not heretofore contributed the interest or sinking fund." Not a word so far about the Gas Committee; and, said Mr. Young, to find out how the Committee got hold of the money, they had to turn to the gas accounts. There it was found that the money was advanced out of the surplus profits of the Gas Committee a great many years ago; and up to the present they had obtained neither interest nor anything else for it. What he complained of was that this £5090 was going to the Finance Committee to the relief of the rates of the city, whereas, if it had been given back to the Gas Committee, it would have gone to the relief of the gas consumers, who should receive the benefit in the form of a reduction in the price of gas. He strongly advised the Gas Committee to be very slow in future to advance any more money to any of the Committees; and, if they had a surplus, to use it in a legitimate way by reducing the price of gas and coke.

On the same occasion, the minutes submitted by the Gas Committee contained a report by Mr. J. Stelfox, the Manager of the gas-works, in regard to the price of coke, and also a resolution of the Committee adhering to a previous determination to fix the price at 5d. per bushel. Mr. Young, in moving the confirmation of the minutes, said at the last meeting of the Council a question was raised regarding an increase of 1d. in the price of coke. It was decided that Mr. Stelfox should report on the matter; and this he had done. The report showed that this year they were paying for coal £8500 in excess of what they paid last year, and it was estimated that, owing to the increased price of coal, if they had now to make a contract, they would have to pay from £27,000 to £38,000 in excess of last year's rates, in addition to the £8500. There was no increase put on the price of coke until November, when the stock was thoroughly exhausted; and it was then raised to 4d., and still they had not sufficient coke to supply the demand, so that they raised the price another penny. This penny meant to the ratepayers a sum of £10,000 a year if they took that off. It was said that this was depriving the poor of the coke. Before the Committee increased the price, they issued 150 circulars to the consumers of coke, and only one consumer—and a very small one—objected to the price charged. Every one of the large consumers agreed to it, and asked to be supplied with as much coke as they could give. The coke sold for the week ended Feb. 13 amounted to 49,626 bushels. Of this, there was disposed of to large consumers on credit 30,548 bushels, and of the remaining 19,078 bushels 16,142 were sold to private consumers occupying large houses. The persons of the humbler classes who applied only took 2936 bushels out of the 49,626 bushels. No person who went to the gas-works to get coke was refused; and the poor consumers obtained it in preference to the large ones. They had stopped the sale of coke to any person outside the city. Mr. Liddell moved, as an amendment, that the portion of the minutes referring to the price of coke be sent back to the Committee; but this was defeated by seven votes to nineteen.

Installation of Inclined Retorts and De Brouwer Plant at Wakefield.—The Directors of the Wakefield Gas Company have decided to adopt a complete installation of the De Brouwer coke-conveying plant in connection with the settings of inclined retorts now in course of erection at their works; and they have placed the order with Messrs. W. J. Jenkins and Co., Limited, of Retford. The Directors are having nine beds of these retorts put up, each consisting of eight retorts 26 in. to 22 in. by 16 in., and 20 feet long, the contract for which has been let to Messrs. Jonas Drake and Son, of Halifax. When finished, the whole will form one of the most complete installations of inclined retorts in the country. It has been designed by, and is being erected under the supervision of, Mr. H. Townsend, the Company's Engineer and Manager.

DARLINGTON CORPORATION GAS SUPPLY.

Increased Storage Required.

At the Meeting of the Darlington Town Council last Thursday, the Gas and Electric Light Committee presented a report in which they recommended that Mr. Charles Hawksley be requested to ascertain if the various firms who submitted, during the year 1897, tenders to erect the proposed gasholder were now willing to undertake the work at the prices quoted in the respective tenders, or, if not, what was the amount of increase. In moving the adoption of the report, Alderman Barron said the Council would probably remember that some years ago he ventured to point out that their storage was not sufficient to cope with the demand for gas. Two or three years ago the matter came up, and the Council decided that it should be deferred. He should like to tell the gentlemen who were responsible for the decision that they were now close upon a possible short supply of gas for their customers, and that the gasholder, the erection of which they were compelled to take into serious consideration, would cost from £6000 to £10,000 more than it would have done if the contract had been let when the Committee recommended it to the Council. They felt the time had arrived when the gasholder should be erected; and this was the meaning of the recommendation. Mr. Bartlet inquired as to the approximate date on which the electric light would be supplied to the town. It would be a serious thing for the Council to spend a large sum of money if it could be staved off for a couple of years till prices returned to their normal condition. Alderman Sedgwick said it seemed to him that if they had been able to get along for the last two years, they might do so until they saw how far the electric light would affect the gas supply. Mr. Gunter opposed. They might wait, he said, till they saw the effect of the electric light. Mr. Harbottle characterized the recommendation as somewhat of a joke, for if the Committee knew of the vast increase in the price of material, why were they going to the tendering firms to see if they would do the work at the prices they had stated? They were now told the same story as before—that the work was imperative; and this on the eve of the electric lighting plant being put down. Alderman Barron, in reply, mentioned that since June, 1897, when the subject was before the Council, they had put two or three miles of mains in the streets. Certainly, £30,000 was a large expenditure, and they would shrink from it were it not absolutely necessary. Up to the end of last year, the augmentation in the consumption of gas was between 9 and 10 per cent. Three days in succession, in the present year, the increase over the corresponding period of last year was more than 30 per cent. The Committee placed the responsibility on the Council. They must not look to the electric light as a panacea. Their storage at present was not more than half-a-day's supply; and they knew what this meant. If the manufacturing plant broke down, the town would be without gas. As to the electric light, their contracts were made for the provision of a supply of current about August or September—at any rate before next winter. The report was adopted.

LONGTON CORPORATION GAS SUPPLY.

The Past Half-Year's Working—The Coal Supply Difficulty.

At the Meeting of the Longton Town Council last Thursday, the half-yearly accounts of the gas undertaking were submitted in the minutes of the Gas and Electricity Committee. They showed a net profit of £1014, after payment of instalments of the principal and the interest on loans. The output of gas for the previous four weeks showed an increase of 2,506,000 cubic feet over the corresponding period of last year; while 106 slot meters and 21 stoves were fixed—making a total of 2777 slot meters and 863 stoves now in use. In moving the adoption of the minutes, Alderman Bakewell, referring to the profit on the half year, said it reflected great credit on their Manager (Mr. W. Langford), considering the very high price of coal, and the many difficulties he had to contend with. Alderman Leak concurred. Personally, he wished to say how pleased he was to observe the realization of a profit on the gas-works. Mr. Preece spoke in a similar strain, and went on to say that at a recent meeting of the Council it was stated that the contractors were not fulfilling the terms of their contract in regard to the quantity and quality of the coal, and reference was made to penalties. Certainly something ought to be done to make the contractors keep to their contract. Further, he had noticed an employee from the gas-works travelling by rail nearly every morning; and, on inquiring as to the nature of his business, he was informed that this man had to go and look for coal, or the works would not go on, the supply was so unsatisfactory. They should at least make the defaulting contractors pay that man's wages and expenses. In reply, Alderman Bakewell said it was quite an open question as yet what they were going to do; but it might be left to the Gas Committee, who were endeavouring to do the best they could in the matter.

THE ROTHWELL DISTRICT COUNCIL AND THE GAS-WORKS.

Local Government Board Inquiry.

At the Council Chamber, Rothwell, on the 23rd ult., Mr. H. P. Boulnois, M.Inst.C.E., held an inquiry relative to an application by the District Council for a Provisional Order to acquire the undertaking of the Rothwell Gas Company and to maintain, continue, enlarge, and improve the works when acquired; and for permission to borrow a sum of £13,000 to defray the cost, and a further sum of £2000 for necessary extensions. The Clerk to the Council (Mr. F. W. Bull) stated that when the Gas Company were approached, it was found that they were not unwilling to transfer the undertaking if satisfactory terms could be arranged. The Council then called in an expert to value the property and to advise them whether or not it would be desirable to proceed further with the matter. Mr. Corbet Woodall therefore inspected the works on the 24th of April last, examined the books, and interviewed the officials. Mr. Evan Barlow, the Company's Solicitor, who watched the case on their behalf, pointed out that they had no part in the engagement of Mr. Woodall, but when that gentleman arrived it was arranged that he should act for both sides. Mr. Bull went on to say that Mr. Woodall made his report on

June 5, 1899; and it was upon it that further proceedings were taken. He gave it as his opinion that the undertaking was worth £10,800. After discussing the report, the Gas Committee recommended the Council to proceed with the negotiations; and a provisional agreement was entered into with the Gas Company on Oct. 11, 1899, and sealed by the Council. Steps were then taken to obtain a Provisional Order for the transfer of the works; and at a meeting of shareholders held on Dec. 22, 1899, a resolution was unanimously passed assenting to the provisional agreement. Owing to the development of the town, it would be necessary for the gas-works to be enlarged before next winter. The value of the existing works was put at £10,800, compensation at £400, produce and coal at £300, the probable cost of the Order at £250, and extensions to the works at £2000. The last item would be divided into £350 for enlargement of the retort-house; for new retorts, £500; for additional purifiers, £350; for 1200 yards of mains, £300; and £500 to carry on the undertaking. Mr. F. Barlow said the present gasholders had capacities of 10,000 and 27,000 cubic feet respectively; while there were between two and three miles of mains in the streets. He pointed out that the growth of Rothwell had taken place mainly during the past six years; but he did not think there was any chance of electrical competition. Mr. Evan Barlow said that at a meeting of the shareholders it was unanimously decided not to raise any opposition to the proposal. The inquiry closed with a vote of thanks to the Inspector.

SOUTH SHIELDS GAS COMPANY.

The Annual General Meeting of this Company was held last Wednesday—Dr. J. F. Armstrong in the chair.

The notice convening the meeting having been read, the report and accounts for the past year, the principal items in which were given in the "Journal" last week (p. 555), were presented.

The Chairman, in moving the adoption of the report, said the past year had been a very anxious one for the Directors. The two chief items affecting the Company's profits were coal and labour. Coal cost £5393, or 24¼ per cent., more than in the previous year; and wages came to £1356, or over 7½ per cent., more. These two items amounted to the large sum of £6749, or equal to 3·88 per cent.—or they might say 4 per cent.—of dividend. The most important item was coal; and had the price of this material come down, it would have made a great deal of difference. The reserve fund amounted to £3973; and the insurance fund to £3156—the two together making £7129. After deducting £1377 which they had to take to make up the half-yearly dividend, they would still have £2596 left in the reserve, or £5752 in the two funds. Their available balance was £6440, as compared with £6098 this time last year; so that they were £342 better under this head than in 1898, notwithstanding the large increase in coal and labour. The sale of gas had exceeded that of the year 1898 by 15,547,015 cubic feet, or 3½ per cent. There had been an improvement in the sale of residual products to the extent of £2250, or 20½ per cent.; and the net increase in the meter-rentals was £4725.

Alderman W. R. Smith seconded the motion.

Mr. W. Duncan expressed regret that the Company had been compelled to draw £1300 from the reserve fund in order to maintain their statutory dividend of 8¾ per cent. for the year. He was prepared to admit, however, that circumstances had been much against them. He thought the Directors had made a mistake in raising the price of gas by 2d. per 1000 cubic feet. If they looked at the Gas Companies in the North of England, they would find that not one of them had been content with a rise of 2d.; and therefore they in South Shields had made a present to the consumers of 1d. per 1000 feet. He was inclined, however, to believe that the people would not have objected if they had raised it by 3d. He was sorry to part with the 10 per cent. dividend, because it was a charming rate; but they had had 9¼ per cent., and he hoped that this time next year they would get back to it.

Alderman Bowman said he, too, was sorry the Directors had had to draw upon the reserve fund to pay the dividend; but it evidently could not be avoided.

The Chairman said the rise in price of coal and labour was equal to a 4 per cent. dividend. The price of coal just now was causing the Directors in South Shields, Sunderland, and other places, to give the matter very serious consideration. Coals were 50 per cent. dearer this year than they were last.

The report was adopted.

Votes of thanks having been accorded to the Directors and to the Chairman for presiding,

Alderman Bowman inquired whether the Directors had considered the penny-in-the-slot business, which he thought was well worth attention. It was evident, from the report of the Tynemouth Gas Company, that it had succeeded in that town and district; and he did not see why it should not do so in South Shields, Jarrow, and Hebburn.

The Chairman said the matter had been under the Directors' consideration; but it would entail a large expenditure before they started the meters, and they were now building a retort-house.

The retiring Directors and Auditors were then re-elected, and the proceedings closed.

NORTH MIDDLESEX GAS COMPANY.

The accounts of the above-named Company for the half year ending the 31st of December last, which were presented at the ordinary general meeting of shareholders yesterday, exhibited a considerable improvement in the business of the undertaking. The sale of 40,960,200 cubic feet of gas for private, and 3,029,000 cubic feet for public lighting, produced a revenue of £8797—being £1117 more than in the second half of 1898; the extra bulk of gas sold having been 5,587,200 cubic feet, or 14·5 per cent. The total receipts were £10,643; and the expenditure was £7158—leaving a balance of £3485 to go to the profit and loss account. The amount available for distribution was £3828; and the Directors recommended that dividends for the past half year be declared as follows: On the original capital at the rate of 10 per cent. per annum, and on the ordinary capital at the rate of 7 per cent. per annum. The payment of these would absorb £2153; leaving £1675 to be carried forward.

PROVINCIAL GAS AND WATER COMPANIES.

Gas Companies.

At the annual general meeting of the Abingdon Gas Company next Tuesday, the accounts presented will show that the revenue from the sale of gas last year amounted to £3978, and that the total receipts were £5616. As the expenses were £3697, there was a balance of £1919. The amount available for distribution is £1370; and the Directors will recommend that £500 of this sum should be placed to the credit of the capital account, and a dividend declared of 10s. per share on the original and "A" shares, and of 7s. per share on the "B" shares. This will absorb, after deducting income-tax, £684, and leave £186 to be carried forward. The bulk of gas sold for private consumption was 14,321,900 cubic feet; the entire quantity sold being 17,445,600 cubic feet—an increase of 2,599,100 cubic feet, or 14·87 per cent., on the previous twelve months' sale, which was a record one. Early last year, the Directors had a most successful exhibition of gas stoves and fittings in the Corn Exchange, Abingdon. This, no doubt, accounts for a considerable portion of the increased sales; 55 cookers and stoves having been sold or hired during, or shortly after, the exhibition. The experiment of fitting up the houses of small consumers free of charge, and allowing a special discount to those customers who use gas for other than illuminating purposes, has more than justified the policy followed by the Board in this direction. During the past year, the whole of the Company's mains were thoroughly examined and repaired where necessary, with the result that the waste from leakage has been brought down from 16·70 to 7·58 per cent.; and it is hoped that even this percentage will be still further reduced during the current year. Appended to the accounts is the certificate of the Manager (Mr. S. Crossland) that the buildings, machinery, and plant have been maintained in good working order, and that the stocks of coal, residuals, stores, &c., are of the values stated.

At the annual general meeting of the Armagh Gas Company on the 19th inst., the Directors will report that, notwithstanding the continued advance in the price of coal, the usual dividend has been earned. The revenue from the sale of gas last year was £3723, the prepayment meter supplies and the rental of gas-stoves bringing this amount up to £3810; residual products brought in £1478; and the total receipts were £5558. The expenditure on the manufacture of gas amounted to £3491 (coal costing £2706); and the total expenses were £4161—leaving £1397 to go to the profit and loss account. The net balance for the year amounts to £1111, which is £31 more than the sum required to pay the dividend. The Directors say that an extra valuation was put upon the Company last year under the head of "Right to lay main and service pipes in streets," the assessment on which for the past half year amounted to £20 12s. 6d. This claim the Directors decided to dispute; but on being sued in the County Court, they find that it must be paid. This will have the effect of leaving practically no balance to carry forward. They intend to appeal to the Valuation Commissioners for a re-valuation. In the meantime, they recommend the payment of the usual dividend of 2s. per share, free of income-tax. The Engineer and Manager (Mr. J. Whimster) reports that there was no exceptional expenditure on repairs, either within or outside the works, last year; but for the current twelve months the outlay on repairs to the manufacturing plant may, he says, be expected to be rather heavier than usual.

At the recent half-yearly meeting of the Bedford Gas Company, an increased balance from revenue of £450 was reported; this being mainly due to the larger quantity of residual products disposed of. Owing to advance contracts, the Company were unaffected by the rise in the price of coal. The draft of the Bill to raise £40,000 of additional capital for extensions to meet the demands of increasing population was approved.

The half-yearly meeting of the Brighton and Hove General Gas Company will be held next Friday, when the accounts presented will show that there was an increase in the revenue from the sale of both gas and residuals in the six months ending Dec. 31 last as compared with the latter half of 1898—the quantity of gas sold having been 7¾ per cent. greater. The charges for coal and wages, however, augmented in a larger ratio than the revenue; and in their report, the Directors express the opinion that the enhanced value of coal and materials will be felt still further during the current year. The revenue from the sale of 534,933,600 cubic feet of gas for public and private lighting was £74,823; the rental of meters, fittings, and stoves, £5198; residuals produced £20,073; and the total receipts were £100,367. The expenditure on the manufacture of gas amounted to £55,924 (coals, coke, and oil costing £38,718); on distribution, to £8826; and on management, to £4274—the total expenses being £73,138. The balance carried to the profit and loss account was £27,229; and the amount available for distribution, £30,888. The Directors recommend the declaration of dividends for the past half year at the rate of 11½ per cent. per annum on the original ordinary consolidated stock, 8½ per cent. per annum on the "A" ordinary consolidated stock, and 6 per cent. per annum on the "B" preference consolidated stock. For the payment of these dividends, £23,769 will be required; leaving a balance of £7119 to be carried forward. Under the supervision of Mr. Joseph Cash, the Company's Engineer, 42,759 tons of coal, 185 tons of cannel, and 358,427 gallons of enriching oils were employed in the manufacture of gas; the estimated quantities of residuals being: Coke, 26,521 tons; breeze, 2111 tons; tar, 583,743 gallons; and ammoniacal liquor, 922,514 gallons.

The annual meeting of the Canterbury Gas and Water Company was held yesterday week, when the Directors reported that the sale of gas continued to increase, and the income therefrom, as well as from residual products, was satisfactory. Notwithstanding another year's drought, there had been, and still was, an undiminished supply of water at the works. The increased demand for water, however, rendered it desirable to add to the plant at the pumping-station; and the subject was receiving attention. After defraying the interest on the loan capital and the transfer to the dividend account of the sums authorized by the Company's Act of 1890, there remained a credit balance of £4671 to carry forward to the profit and loss account. After payment of the interim dividend, there was a sum of £5175 standing to the credit of the dividend account; and the Directors recommended that a dividend of 4¾ per cent. should be declared—making, with the interim payment, 9 per cent. for the year. Reference was made to the approaching retirement of the Engineer and Manager, Mr. T. May (as noticed elsewhere) and to the loss sustained by the death of the late Vice-Chairman, Mr. F. Flint.

At the recent annual general meeting of the Chelmsford Gas Company—Mr. W. W. Duffield in the chair—the report presented showed a balance available for distribution of £2747, against £2869 in 1898. The Directors recommended the payment of dividends of 9 per cent. on the original capital, and £6 6s. per cent. on the additional capital. This would leave a balance of £107 16s. to be carried forward. The Chairman, in moving the adoption of the report, drew attention to the fact that, notwithstanding the reduction in the price of gas, the net amount earned by the Company was in excess of that of the previous year. They had also been able to carry a further sum to the reserve fund, and to wipe out £425, which was really the cost of obtaining an Act of Parliament some years ago, and which was charged to a particular account. They were a little alarmed at one time by the competition from the Electric Lighting Company; but they found that gas was required for purposes for which it was not used some time ago. In 1898 there were 164 penny-in-the-slot meters in the borough; whereas last year there were 223. In 1898 there were 68 gas-stoves in use; while last year there were 168. The report was adopted. The working statements in the accounts accompanying the report showed that, under the supervision of Mr. Er W. Smith, the Company's Engineer and Manager, 3713 tons of coal and 5 tons of cannel were carbonized last year. The make of gas was 39,330,100 cubic feet, of which 36,721,900 cubic feet were sold or used on the works; leaving 2,608,200 cubic feet unaccounted for, or 6·63 per cent. of the make. The present rate of increase in the output of gas is about 20 per cent. as compared with last year. With regard to residuals, the quantity of coke produced was 2417 tons, of which 1713 tons were sold, or at the rate of 9·20 cwt. per ton of coal carbonized. There were 38,345 gallons of tar; and the treatment of ammoniacal liquor yielded 20 tons of sulphate.

The shareholders of the Cork Gas Consumers' Company held their 62nd ordinary general meeting last Tuesday, when the Directors reported a small decrease in the rental for the six months ending Dec. 31 last, as compared with the corresponding period of the previous year. It amounted to £21,468; the residuals produced £7356; and the total revenue was £28,832. The expenditure was £22,033 (coals costing £11,376); so that a sum of £6799 was carried to the profit and loss account, the balance on which was £5146. As the usual dividend amounted to £5652, it was necessary to take £506 from the reserve fund to pay it. The price of gas supplied outside the public lighting district has been reduced to the rate charged in the city. There was a considerable improvement in the receipts for residuals in the past half year; and all the products realized higher prices. This compensated for the greater cost of coal. The Company's Resident Engineer (Mr. T. P. Travers) reported that the plant and buildings had been maintained in good working order. There was a large increase in the production of sulphate of ammonia as the result of the erection of new washers; and the manufacturing plant will shortly be extended by the completion of ovens in course of construction in the new retort-house.

Last Wednesday, the annual meeting of the Cradley Heath Gas Company was held, under the presidency of Sir Benjamin Hingley. The statement of accounts showed that the quantity of gas sold last year was 7 per cent. more than in 1898; and that a profit of £3236 had been made. The Chairman moved the adoption of the report, and congratulated the shareholders upon the continued prosperity of the Company. Dividends of 10, 7, and 4 per cent. were declared on the different classes of capital.

At the recent half-yearly meeting of the Douglas Gas Company, it was reported that the profits for the past six months amounted to £4638—an increase of £500 over the corresponding half of 1898. Adding the balance brought forward, made an available sum of £7088; and from this a dividend of 35s. per share has been declared. Though there is a credit balance of £4672 lodged in Dumbell's Bank—as to which there is doubt regarding the amount that will be realized—the Directors consider the position of the Company justifies the usual dividend. Regretful references were made to the recent disaster at the works; and it was mentioned that the Directors had made ample provision for the widows and orphans.

The half-yearly meeting of the Dover Gas Company was held yesterday, when the Directors reported an increase at the rate of 14·25 per cent. in the sales of gas for the six months ending Dec. 31, as compared with the corresponding period of 1898. This was mainly owing to the general expansion of the town and the adoption of prepayment meters, of which the Company now have 1192 in use. The coal supply necessarily caused the Directors great anxiety. They made very favourable contracts for the year; but, owing to an accident at the colliery and labour troubles, they were compelled to buy outside their contracts at current prices, in consequence of which the cost of coals was somewhat increased. The due supply of gas was, however, maintained. The accounts presented showed that the sale of 110,666,300 cubic feet of gas for public and private lighting produced a net revenue of £14,064; the rental of meters and stoves, £1291; and the sale of residual products, £4732—making a total of £20,087. The expenditure on the manufacture of gas was £12,981 (coals and oil costing £8453, and the town dues amounting to £836); on distribution, £2253; and on management, £963—the total expenses being £17,320. The amount carried to the profit and loss account was therefore £2767; and the balance on that account available for distribution was £5750. The Directors recommended the declaration of the usual dividend at the rate of 7½ per cent. per annum (less income-tax), amounting to £2870, and leaving a balance of £2880.

The half-yearly general meeting of the Eastbourne Gas Company was held on Monday last week—Dr. G. A. Jeffery in the chair. The report presented showed that the profit for the six months ending Dec. 31 was £7139, which, added to the balance of £10,888 brought forward, made a total of £18,027 standing to the credit of the profit and loss account. The Directors therefore recommended that dividends for the past half year be declared at the rate of 14½ per cent. per annum on the original capital and on the £12,490 raised on the "C" shares; and at the rate of 11½ per cent. per annum on the £77,000 raised on the "B" shares. These payments would absorb £6323, and leave a balance of £11,704 to be carried forward. In moving the adoption of the report, the Chairman said the profit for the past half year was £7139, as compared with £6328 in the corresponding half of 1898. Coals had cost £1573 more; and manufacture and repairs an excess of £1174. On the other hand, the residuals had produced an increased sum of £1576, and gas-rentals £2058 more. Greater profits on the sale of coke had to a large extent counteracted the effect of the enhanced price of coal. They had also received help from the sale of sulphate of ammonia and other products; but if coals continued to go up, they would, he was afraid, be unable to neutralize the rise by any extra profits from residuals. The sale of gas in the half year had been 142,557,000 cubic feet, against 127,630,000 cubic feet in the corresponding period, which represented a substantial advance. The coals used were 15,239 tons; and the gas made was 154,531,000 cubic feet, which was rather less than in the corresponding half of last year, owing chiefly to the poor quality of the coals, although the latter had been bought at an increased price. The leakage had been only 4 per cent. for the year, which was quite satisfactory. He was pleased to say that the whole of the works were in good condition. This, however, was the bright side of the picture. They had had great difficulties, and things had gone none too smoothly and regularly for the management. They had been greatly put to it of late to get the requisite quantity of coal, and both the Directors and the Manager had felt considerably harassed by the failure of the contractors to keep them fully supplied. However, they had pulled through all right; and he thought they might look forward to the future with every confidence and satisfaction. Alderman Farncombe seconded the motion; and it was carried unanimously. A vote of thanks having been accorded to the Chairman and Directors, it was briefly acknowledged by Dr. Jeffery, who proposed a similar compliment to the Consulting Engineer (Mr. H. E. Jones) and the Manager (Mr. J. Hammond), whose services he warmly eulogized. The proposition having been unanimously agreed to, Mr. Jones, in responding, said he could bear out the Chairman's remark that the last few months had been a most harassing time, especially for the Manager. Those responsible for their coal supply had, he thought, given them unnecessary trouble, though it was only fair to add that other gas companies all over the kingdom had been treated similarly; even the two great London Companies having been driven to within a few days' supply. The fact was that all the surplus stock had been required in the making of coke for the manufacture of steel, which, as the price had gone up 100 per cent., could easily pay a largely increased rate for coal, and so starve the gas companies. These had, however, a prior claim, owing to the contracts having been long made; and managers ought not to have been caused all the nervous anxiety they had had to endure. They were not wholly out of the wood yet; and considering the satisfactory way in which Mr. Hammond had overcome the difficulties that had stood in his way, he was certainly entitled to the shareholders' thanks. In the course of some general remarks, Mr. Jones alluded appreciably to the liberal and enlightened policy of the Directors, and expressed an opinion that ere long the price of gas in Eastbourne would be lower than it was in any other town in the South of England. The proceedings then terminated.

The report presented at the recent annual meeting of the East Grinstead Gas and Water Company showed that the receipts from the sale of gas, &c., in 1899 were £4047, as compared with £3634 in 1898; from residuals, £933, against £725; and from water, £1707, against £1664. The Directors thought the increase in the revenue from gas might be considered satisfactory, especially as the present price of 4s. compared with the higher price of 4s. 4d. for the early part of 1898. The accounts showed an available balance of £2364, from which the Directors recommended a dividend of 8 per cent. per annum on the "A" shares, and of £5 12s. per cent. on the "B" and "C" shares, free of income-tax. This would absorb £1746. In moving the adoption of the report, the Chairman (Mr. Stenning) said he thought the progress with the gas was gratifying, as it showed an increase in money of 11 per cent. The price of coal, and the difficulty in obtaining it, had been the causes of much anxiety, and he hoped they would not have to raise the price of gas. The water showed a very poor result—an increase of only 2½ per cent.—and they were carrying on the service almost, as it were, as a charity. Nothing had proved of such benefit to the district as the water, and yet the return was so small. The report was adopted. Votes of thanks were accorded the Directors, the Auditors, the Clerk (Mr. Evelyn Head), the Gas Manager (Mr. D. T. Livesey), and the Water Manager (Mr. R. G. Payne).

The annual meeting of the Elland-cum-Greetland Gas Company was held on the 23rd ult.—the Rev. G. E. Aspinall presiding. In moving the adoption of the report and accounts (noticed in the "JOURNAL" for the 13th ult.), and that a dividend be declared of 14s. per share on the ordinary shares for the half year, making, with the interim dividend paid six months ago, 13 per cent. per annum (1 per cent. more than last year), the Chairman dealt at some length with the position of the Company's affairs. He said the total increase in the consumption had been 7,696,000 cubic feet, equal to 8·85 per cent.; the additional consumption through prepayment meters being 42·85 per cent. The ordinary consumers had increased by 101; and the prepayment consumers by 180. They had now a total of 690 prepayment meters in use. During the year there had been 130 cookers and 44 washing-boilers let out on hire. There had been a satisfactory rise in the income derived from residual products to the extent of £742. The motion was carried.

The half-yearly meeting of the Harrogate Gas Company was held last Wednesday—Mr. S. Hornby, the Chairman, presiding. In the course of his remarks in moving the adoption of the report, he referred to the satisfactory result of the past year's work. Although it had, he said, been a year of anxious care for the Directors and officials, it had been a "record" one in several respects; the make of gas being 222,734,000 cubic feet, against 202,365,200 cubic feet in 1898. The maximum daily output 1,006,000 was cubic feet; while that of 1898 was 922,000 cubic feet. The receipts, expenditure, and profits were the heaviest in the history of the Company. He characterized the development of the Company's business as phenomenal, and submitted an interesting table of comparison between the years 1890 and 1899. Turning to the accounts, he lucidly dealt with every item; congratulating the proprietors upon an additional consumption of 15,183,000 cubic feet—an increase which he believed was equal to about 75 per cent. of the total units of electricity sold by their competitors. Owing to the improved condition of the coke, tar, and sulphate markets, residuals figured favourably. He was sorry the expenditure had been so heavy that the profits for the year were not so large as the Directors hoped they would be. They were, notwithstanding, £772 in excess of those for 1898; and this placed the net revenue in the satisfactory position of meeting all preferential charges and the usual dividends, and added £351 to the balance carried forward to the year 1900. Leaving the accounts, the Chairman proceeded to refer to the outlook. He said that, though the resources of the Company were taxed to meet the present demand, there

were difficulties to be encountered, such as the large increase in the price of coal, which would so seriously affect the revenue that he feared an advance in the price of gas would be necessary. He, however, assured the proprietors that such a step would not be taken except as the result of deliberate consideration by the Board. He alluded to the election of a Director in the place of Mr. P. H. Wilkinson, and expressed his regret that Mr. Wilkinson's continued infirmity rendered an appointment necessary. The adoption of the report and accounts, the declaration of the dividends, and the election of Directors and Auditors having been proposed, seconded, and carried, a vote of thanks to the Directors and officials closed the ordinary meeting. Immediately thereafter, an extraordinary meeting of the shareholders was held, at which the Directors were authorized to raise additional capital by the issue of a sum of £20,000 of new stock.

At the recent meeting of the Hertford Gas Company, the Directors reported that the profit on the revenue account for the year ending Dec. 31 last, after charging the balance of the suspense account (£433) for the renewal of the retort-house and coal-store, amounted to £1749. The sum standing to the credit of the profit and loss account, and available for distribution, was £1770, out of which the Directors recommended that, after paying the dividend of 5½ per cent., less income-tax, on the new preference shares, dividends for the year should be paid at the rate of 8½ per cent. per annum on the original shares and 7½ per cent. on the new shares, both less income-tax. Owing to the increasing output of gas, additions have been required to the plant, as well as extensions of the mains. The Chairman (Mr. J. R. Cocks), in moving the adoption of the report, stated that there was a gross profit of £2182 on the revenue account, against £1867 last year. The dividends recommended would absorb £1483 out of the £1770 at the shareholders' disposal; leaving a balance of £287 to be carried forward, as against £125 last year. Altogether, therefore, they started much more favourably than they did in the previous year. The increased output of gas was 3½ million cubic feet, or at the rate of 13½ per cent. This was due to the increased number of consumers; and, moreover, the reduction in price had stimulated consumption. After carefully studying their position, the Directors had decided to reduce the charge from 3s. 11d. to 3s. 9d. per 1000 cubic feet as from the 1st prox. The motion was carried unanimously; and the dividends recommended were declared. A vote of thanks was accorded to the Manager (Mr. R. Watson), who, in acknowledging the compliment, stated that during the past four years there had been an increase of 25 per cent. in the consumption of gas. It seemed rather risky, he added, to reduce the price in the face of the increase in the cost of coal; but, under all the circumstances, he thought the Directors were justified in the course they had taken. At the close of the business of the ordinary meeting, the Directors were authorized to raise a sum not exceeding £3000 on mortgage, at the maximum rate of 4 per cent.

The 72nd half-yearly meeting of the Leominster Gas and Coke Company, Limited, was held last Saturday, when the accounts presented showed that the sale of 18,274,100 cubic feet of gas for private consumption produced £3045, and that used for public lighting £310—together, £3355. The total revenue was £4384; and the expenditure, £3412. The balance carried to the profit and loss account was £972; and the amount available for distribution was £403. The Directors recommended the payment of dividends at the usual maximum rates on both classes of shares. In their report, they recorded an increase of 1,042,000 cubic feet, or at the rate of upwards of 6 per cent., in the sale of gas, largely owing to the introduction of prepayment meters and to an exhibition of cooking-stoves held in the summer. The Company's Manager (Mr. C. Eastment) requires additional retorts and a new station-meter; and for these and other works further capital is to be raised.

The annual meeting of the Matlock and District Gas Company, Limited, was held on Monday last week. The profits for the past year amounted to £2772, and the addition of £792 brought forward made a sum of £3564 available for distribution. Dividends of 10 per cent. on the original capital and 7 per cent. on the new shares were declared.

At the recent half-yearly meeting of the Normanton Gas Company, the report presented showed that the profits in the six months ending Dec. 31 amounted to £1203; making the fund available for dividend (after providing interest on mortgages) £3161. Out of this, dividends of 5½ per cent. on the original, and 4 per cent. on the additional stock were recommended; leaving £1981 to be carried forward. The Chairman (Mr. E. Mitchell, J.P.) moved the adoption of the report. He said, notwithstanding the advance in the price of coal, they had been able to maintain the dividend. The sale of gas through ordinary meters produced £2588, an increase of £220; and that through prepayment meters, £439, an increase of £21. The sale of coke had increased by £221, and tar £47. One unfavourable feature was the increased leakage, which was 20·28 per cent., against 18 per cent. last half year. The report was adopted, and the dividends recommended were declared.

At the half-yearly meeting of the Pontefract Gas Company held a few days ago under the presidency of Mr. J. Taylor, the Chairman, the report, which was adopted, showed that the amount divisible among the shareholders was £1508, out of which the Directors recommended the payment of the usual maximum dividends of 10 per cent. on the original shares, and 7 per cent. on the new ordinary shares. The reserve fund now amounts to £2676.

The annual meeting of the Rowley Regis and Blackheath Gas Company was held last Wednesday—Mr. W. North presiding. The report showed that the receipts for the year were, on the whole, satisfactory. The gas-rental had increased by £65, and the prepayment meter rental by £52. The balance on the profit and loss account being £1319, the Directors recommended the payment of a dividend of 7½ per cent. (free of income-tax), amounting to £712 10s.; the placing to the reserve fund of £100, and to renewals fund of £100; and the carrying forward of the balance. The report was adopted.

The annual meeting of the Tunbridge Wells Gas Company was held last Wednesday, under the presidency of Alderman W. H. Delves. In moving the adoption of the report, the Chairman congratulated the shareholders upon the satisfactory progress made during the year. The capital account, which was overdrawn to the extent of £1269, remained practically the same as last year, except that they had spent a net amount of £1868 in laying new mains, making extensions, &c. The revenue account showed that £2944 more had been expended for coals than in former years. The total increase in expenditure for the manufacture of gas was £3470. The distribution of gas and all other items came to exactly the same amount as in 1898. On the other hand, the gas-rentals had risen from £30,081 to £31,890—an increase of £1809. The rental of meters also showed a satisfactory improvement, as did also the automatic meters, from £2053 to £2126 in the year; and the gas consumed was about equal to 22 million feet. The rise in residuals was £1954. So that, after paying dividends, interest charges, debentures, and temporary loans, the balance would be augmented by £2200. This was very satisfactory, considering the great difference in the price of coal. The extra sale of gas amounted to rather more than 7½ per cent. Dividends were declared of 11½ per cent. on the consolidated ordinary shares, 9 per cent. on the "B" shares, and 8½ per cent on the "C" and "D" shares.

At the annual general meeting of the Tynemouth Gas Company on Thursday next, the accounts to be presented will show that the revenue from the sale of gas amounted last year to £29,396—the rental of meters, stoves, and Bray's lamps (£1679) bringing up this amount to £31,075; the sale of residuals produced £10,421; and the total receipts were £41,757. The expenditure on the manufacture of gas came to £23,040 (coals and enrichment costing £12,324); on distribution, to £4975; and on management, to £2060—the total expenses being £32,468. The balance on the year's working was therefore £9289. Adding the balance of undivided profit, £978, a total of £10,267 is produced. Of this the interim dividend to the 30th of June, at the rate of 5 per cent. per annum, absorbed £3111 13s., and a dividend at a like rate for the second half of the year will leave a balance of £4044 to be carried forward, in addition to the reserve fund of £7500 brought from 1898. In the report, the Directors express their pleasure in recording an increase of 19,572,100 cubic feet, or 6·14 per cent., in the make of gas, and a larger sale to the extent of 22,995,000 cubic feet, or 8·9 per cent., as compared with the preceding year. The number of ordinary meters in use on Dec. 31 last, was 5500; being an increase of 200, or 3·77 per cent., for the year. The number of automatic prepayment meters in operation at that date was 890; being 511, or 134·82 per cent., more than on the corresponding date in 1898. The number of gas cooking-stoves was 791—an increase of 131, or 19·85 per cent. In common with their colleagues in other parts of the country, the Directors regard with apprehension the serious rise in the price of coal and all other gas-manufacturing materials; but they state that the market for residuals showed a distinct improvement last year. The Company's Engineer (Mr. W. Hardie) reports that the works and plant are efficient, and maintained in excellent order. Under his supervision, 29,608 tons 13 cwt. of coal and 20 tons 17 cwt. of cannel were used last year in the production of 305,596,000 cubic feet of gas, of which 281,106,000 cubic feet were sold and 285,046,000 cubic feet accounted for. The estimated quantities of residuals were: Coke, 17,783 tons; tar, 299,175 gallons; while from the ammoniacal liquor produced, 245 tons of sulphate of ammonia were manufactured.

The 39th annual meeting of the Uxbridge and Hillingdon Gas Consumers' Company was held on the 20th ult.—Mr. W. Fassnidge in the chair. In moving the adoption of the report and accounts, he said that, as compared with the year ending Dec. 31, 1898, the receipts for gas sold, for meter and stove rentals, and for residual products, &c., were more by £1343. The quantity of gas brought into charge in 1898 was 42,649,200 cubic feet, while for 1899 it was 46,233,400 cubic feet; showing an increase in the consumption of a little over 3½ millions—actually 3,584,200 cubic feet. The account for residuals was more favourable than in the previous year. The gross expenditure for 1899 was more than for 1898 by £1327, accounted for by the increase in the quantity of gas sold, the enlargement and renewal of services, and other improvements. The profit and loss account showed that, after paying debenture interest, &c., there remained £2677, which, with the surplus from the previous year, made £2841 at the disposal of the shareholders, which was sufficient to pay the statutory dividends, amounting to £2651, and leave a balance of £190 to carry forward. This statement was looked upon by the Directors as favourable; and he trusted it would be received in the same manner by the shareholders. At the previous meeting, he mentioned an increase in gas consumption for the year 1898 over the year 1897 of nearly 7 million cubic feet. He was now pleased to state that there was a further increase in the year 1899 of upwards of 3½ millions over 1898. Their Engineer and Manager (Mr. A. R. Burch), when they last met, was somewhat new to them. They had now seen more of him, and were of opinion that he had the interest of the Company at heart; and the extra consumption of gas in the year was to a great extent due to his energy and desire to please all their customers. The motion was carried unanimously; and dividends of 10, 7½, and 7 per cent. were declared.

The half-yearly general meeting of the Wellingborough Gas Company was held on Monday last week, when the Directors had the gratification of submitting accounts for the six months ending Dec. 31 which showed a continued increase of business; the quantity of gas sold being more than 11½ per cent. greater than in the corresponding period of 1898. The total revenue from this source amounted to £6853; the sale of residuals produced £1823; and the total receipts were £9486. The expenditure on the manufacture of gas came to £5833 (coals costing £3501); and the total expenses amounted to £7269. The balance carried to the profit and loss account was £2217; and the sum available for distribution was £3895. The Directors recommended the declaration of dividends of 6 per cent. on the "A" and "B" shares, and 4½ per cent. on the "C" shares (free of income-tax), for the half year. They reported that, under Mr. John T. Lewis, the Engineer and Manager, the works were being maintained in a full state of efficiency; and that to meet the increased demand for gas, further alterations and extensions were in progress. The 110-feet gasholder is to be telescoped during the coming summer to provide additional storage capacity. The Directors added that, though there had been a considerable advance in the cost of coal, it had been practically covered by the increased price obtained for residuals, and had not affected the Company's profits. The report was adopted, and the dividends recommended were declared. The working statements in the accounts showed that 4715 tons of coal were carbonized, and 51,150,000 cubic feet of gas made, or at the rate of 10,848 feet per ton. Of this quantity, 49,152,000 cubic feet, or 10,424 feet per ton, were accounted for; 48,734,000 cubic feet, or 10,336 feet per ton, being sold. The unaccounted-for gas in the half year was 3·9 per cent. The quantity of coke for sale per ton of coal carbonized was 11 cwt. 0 qr. 15 lbs.

At the recent half-yearly meeting of the Winchester Water and Gas Company, the Directors reported that the receipts on revenue account for the six months ending Dec. 31 last amounted to £11,318, and the expenditure to £7134; leaving a balance to be carried to the profit and loss account of £4183, and making the balance on this account £6783. Dividends for the half year, at the rate of 10 per cent. per annum on the original shares, and of 7 per cent. per annum on the new shares, both less income-tax, were declared.

The half-yearly meeting of the Wolverhampton Gas Company was held last Tuesday—Mr. S. Loveridge presiding. The Directors recommended dividends for the half year of 3 per cent. on the preference stock, 5 per cent. on the consolidated stock, and 3 per cent. on the new ordinary stock, less income-tax. The Chairman, in moving the adoption of the report, congratulated the shareholders on the usual dividends having been earned. Higher prices had been obtained for residuals, and favourable contracts had been made for the supply of coal; and these contracts extended up to Midsummer. Large amounts were being spent to increase the size of the mains, and also to meet the wants of the suburban consumers. Owing to the capital of the Company being nearly exhausted, they were applying to Parliament for power to increase it and to meet other requirements, in order that they might put themselves in a position to supply an adequate volume of gas to all the consumers. The new works were practically completed, and a considerable amount was now being saved in working expenses. The report was adopted, and the dividends recommended were approved. A special meeting was held to consider the Bill above referred to, which is to authorize the construction of further works, the purchase of land, and the raising of additional capital to the amount of £140,000. The resolution sanctioning its promotion was approved.

Water Companies.

The receipts of the Dorking Water Company in the six months ending Dec. 31 last were £1657; and the expenditure was £758. With the balance brought forward, the sum available for distribution was £1621. At the recent half-yearly meeting, a dividend at the rate of 5 per cent. per annum was declared. This absorbed £1100, and left a balance of £521. The expenses for fuel and wages were higher than in the corresponding half of last year.

Steady and continuous prosperity was reported by the Directors of the Exmouth Water Company, at the recent half-yearly meeting, to be characteristic of the undertaking. Upwards of 2180 dwelling-houses are now supplied with water, and the half-year's accounts showed that a balance of £1165 was available for distribution. The usual dividends were declared.

At the annual meeting of the Faversham Water Company, a dividend of 9 per cent. was declared on the original, and 6½ per cent. on the additional capital. The report stated that there had been an increase of 76 services during the year; the receipts from the water-rates being £2198. It was agreed to issue £1300 of additional share capital, and also debentures to the amount of £4500, in order to complete a new reservoir and deep well.

The annual general meeting of the Felixstowe and Walton Water Company was held last Tuesday. The report showed that the balance standing to the credit of dividend and interest account amounted to £1563. The Directors recommended that a dividend of 5 per cent. be paid for the year on the original capital, and of £4 13s. 4d. per cent. on the additional capital. The Felixstowe and Walton Urban District Council had informed the Company that they did not intend to purchase the undertaking under the Act obtained by them for that purpose in 1898. In order to protect the interests of the Company, the Directors had proceeded to arbitration; and unless the Council purchased within six months of the date of the award, they would have no further opportunity of doing so. In order to meet the increasing requirements of the district, the Directors had decided to erect a new tower and service-tank, as well as cottages for workmen. The report and accounts were adopted.

The half-yearly meeting of the Leatherhead and District Water Company was held last Thursday. Mr. John Boustead presided in the absence, through illness, of the Chairman of the Company. The report stated that the receipts for the half year amounted to £2366, and the working expenses to £1300—leaving a profit of £1066. To this had to be added the sum of £857 brought forward, making a total of £1923. Deducting from this £158 interest on debenture stock, there remained £1765 available for distribution. Out of this, the Directors recommended a dividend at the rate of 5½ per cent. per annum, which would absorb £882, and leave a balance of £883 to be carried forward. During the half year 52 new services had been laid on, making a total for the year of 105. Appended to the Directors' report was the report of the Engineer (Mr. F. S. Cripps). In it he said that the water supply during the six months had been satisfactory, and the quality perfectly pure. A new 12-inch main had been laid across the river, which greatly facilitated the pumping to the reservoirs, and was a protection against any possible breakdown of the old 7-inch main. The Chairman, moving the adoption of the report, said that the Company continued to make very satisfactory progress. There had been a large increase in the supply of water during the past half year; and the receipts had also increased. The working expenses had been slightly more, owing to the drought of last summer. There had, however, been no failure in the supply; and had they been in the Metropolitan area, they would have been able to assist those of the London Water Companies who were not in so good a position as themselves. He would quote a few figures to show the progress made by the Company during the last four years. In 1895, the quantity of water pumped was 28 million gallons, whereas last year it was 57 millions. In the same period the water-rates had increased from £1432 to £2218; the profit showed an increase of £558; and the dividend, instead of being 2½ per cent., was now 5½ per cent. In reply to questions, the Chairman said, with regard to the hardness of the water, that it would be desirable to soften it, though he believed that hard spring water was better for many purposes than soft water. Their limits of charge were defined, so that even if they incurred an additional outlay in supplying their customers with what people called a better article, they would not be in a position to charge a higher price for it. The matter, however, was constantly kept in mind by the Board; and if at any time they saw their way to carry out a water-softening scheme without loss to the Company, it should be done. The report was adopted.

The 64th half-yearly meeting of the Luton Water Company was held last Wednesday—Mr. B. Seebohm presiding. The balance-sheet showed

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 597.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
530,000	10	Oct. 13	10½	Alliance & Dublin 10 p. c.	20½—21½	..	4 17 8
100,000	10	,,	7½	Do. 7 p. c.	14—15	..	5 0 0
200,000	100	Jan. 2	5	Australian 5 p. c. Deb. .	100—102	..	4 18 0
200,000	5	Nov. 15	6	Bombay, Ltd. . . .	6—6½	+½	4 12 4
40,000	5	,,	6	Do. New, £4 paid .	4—4½	..	5 6 8
380,000	Stk.	Feb. 23	12	Brentford Consolidated	267—272*	..	4 8 3
270,000	,,	,,	9	Do. New . . .	203—208*	..	4 6 7
80,000	,,	,,	5	Do. 5 p. c. Pref. .	140—145*	..	3 9 0
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb.. .	118—123	..	3 5 1
220,000	Stk.	Sept. 15	11½	Brighton & Hove Orig..	255—260	..	4 8 6
226,320	,,	,,	8½	Do. A. Ord. Stk. .	185—190	..	4 9 6
973,500	Stk.	Aug. 16	5	Bristol, 5 p. c. max. .	125—130	..	3 16 11
420,000	20	Sept. 29	10	British	43—44	..	4 10 11
50,000	10	Feb. 23	12	Bromley, Ord. 10 p. c. .	24—26*	..	4 12 4
75,000	10	,,	9	Do. 7 p. c. . . .	19—21*	..	4 5 8
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd.	9½—10½	..	5 17 1
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb. .	98—100	..	4 0 0
150,000	20	July 13	8½	Cagliari, Ltd. . . .	26—28	−1	5 17 10
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	13½—14½	..	5 10 4
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	56—58	..	5 3 5
550,000	Stk.	Oct. 13	13½	Commercial Old Stock.	305—310	..	4 7 1
200,750	,,	,,	10½	Do. New do. .	240—245	..	4 5 9
200,750	,,	Dec. 14	4½	Do. 4½ p. c. Deb. .	140—145	..	3 2 1
800,000	Stk.	Dec. 14	9	Continental Union, Ltd.	177—181	..	4 19 5
200,000	,,	,,	7	Do. 7 p. c. Pref. .	178—183	..	3 16 6
51,600	Stk.	Aug. 31	14	Croydon A 10 p. c. . .	335—340	..	4 2 4
168,400	,,	,,	11	Do. B 7 p. c. . .	265—270	..	4 1 5
555,000	Stk.	Feb. 23	5½	Crystal Palace Ord. 5 p. c.	122—127*	..	4 2 8
60,000	,,	,,	5	Do. 5 p. c. Pref. .	132—137*	..	3 13 0
486,090	15	Jan. 26	11	European, Ltd. . . .	20—21	−½	5 4 9
234,650	10	,,	11	Do. £7 10s. paid .	15—16	..	5 3 2
14,993,075	Stk.	Feb. 9	4⅞	Gas- 4 p. c. Ord. . .	105—107	..	4 13 5
2,600,000	,,	,,	3½	light 3½ p. c. max. .	96—98	..	3 11 5
3,799,725	,,	,,	4	and 4 p. c. Con. Pref.	119—122	..	3 5 7
3,993,975	,,	Dec. 14	3	Coke 3 p. c. Con. Deb.	99—101	..	2 19 5
70,000	10	Nov. 15	8	Hongkong & China, Ltd.	13½—14½	..	5 10 4
3,800,000	Stk.	Nov. 15	10	Imperial Continental .	217—220	+1	4 10 11
473,600	Stk.	Feb. 9	3½	Do. 3½ p. c. Deb. Red.	100—103	..	3 8 0
75,000	5	Dec. 14	6	Malta & Medn., Ltd. .	4½—5½	..	5 9 1
560,000	100	Oct. 2	5	Met. of 5 p. c. Deb.	110—114	..	4 7 9
250,000	100	,,	4½	Melbourne 4½ p. c. Deb.	107—109	..	4 2 7
541,920	20	Nov. 15	3	Monte Video, Ltd. . .	11—12	..	5 0 0
617,946	Stk.	Feb. 23	9½	Newc'tle & Gateshd Con.	215—220*	..	4 4 1
264,855	Stk.	Dec. 29	8½	Do. 8½ p. c. Deb. .	104—107	..	3 5 5
60,000	5	Feb. 23	7	Ottoman, Ltd. . . .	4⅞—5½*	..	6 13 4
				* Ex div.			

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
150,000	5	Nov. 30	8	Oriental, Ltd. . . .	7—7½	..	5 6 8
135,000	5	,,	8	Do. New, £4 10s. pd.	6½—6¾	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.	1½—1¾	..	4 11 5
500,000	100	Dec. 1	6	People's Gas 2nd Mtg. of Chicago Bonds .	102—106	..	5 13 2
851,070	10	Oct. 13	7	River Plate Ord.. . .	11—11½	..	6 1 9
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb. .	100—102	+1	3 18 5
250,000	10	Sept. 15	10	San Paulo, Ltd. . . .	12—13	..	7 13 10
135,000	Stk.	Sept. 15	10	Sheffield A.	249—251	..	3 19 8
209,053	,,	,,	10	Do. B.	249—251	..	3 19 8
447,427	,,	,,	10	Do. C.	249—251	..	3 19 8
5,600,000	Stk.	Feb. 23	5½	South Metrop., 4 p. c. Cr'd.	133—135	+1	3 18 4
1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb. . .	100—102	..	2 18 10
120,000	Stk.	Aug. 31	6	Tottenham A. 5 p.c. and B. 3½ p.c.	141—143	..	4 3 11
250,520	,,	,,	4½		102—104	..	4 6 6
55,100	,,	Dec. 14	4	Edmonton 4 p. c. Deb..	113—117	..	3 8 5
182,380	10	Jan. 12	5	Tuscan, Ltd.	8½—9½	..	5 5 3
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.	101—104	..	4 16 2
				WATER COMPANIES.			
780,399	Stk.	Dec. 29	11	Chelsea, Ord.	307—312	..	3 10 6
150,000	,,	,,	5	Do. 5 p. c. Pref. .	157—162	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	145—150	..	3 0 0
175,785	,,	Sept. 29	4½	Do. 4½ p. c. Deb. .	148—153	..	2 18 10
1,720,560	Stk.	Oct. 18	7	East London, Ord. . .	205—210	+2	3 6 8
654,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb. .	145—150	..	3 0 0
890,000	,,	,,	3	Do. 3 p. c. Deb. .	99—101	+1	2 19 5
700,000	50	Dec. 14	7½	Grand 10 p. c. max. .	108—110	..	3 8 2
310,000	Stk.	Sept. 29	4	Junction 4 p. c. Deb. .	131—136	..	2 18 10
708,000	Stk.	Feb. 23	13½	Kent	330—340*	..	4 2 4
160,000	,,	,,	7	Do. New, 7 p. c. max. .	200—210	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max..	295—300	..	3 10 0
406,200	100	,,	8	Do. 7½ p. c. max..	215—220	..	3 12 9
350,000	Stk.	Sept. 29	4	Do. 4 p. c. Deb..	135—138	..	2 18 0
500,000	100	Feb. 23	13½	New River, New Shares	420—425*	..	3 2 0
1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb..	132—137	..	2 18 5
902,300	Stk.	Dec. 14	7½	South-wark Ord. . . .	200—205	..	3 13 2
126,500	100	,,	7½	7½ p. c. max..	190—195	..	3 16 11
489,200	Stk.	,,	5	and 5 p. c. Pref.	160—165	..	3 0 7
1,019,585	,,	Oct. 13	4	Vauxhall 4 p. c. A Deb.	131—136	..	2 18 10
1,155,066	Stk.	Dec. 14	10	West Middlesex . . .	290—296	..	3 7 7
200,000	,,	,,	4½	Do. 4½ p. c. Deb. .	147—152	..	2 19 3
200,000	,,	Sept. 15	8	Do. 8 p. c. Deb. .	100—102	..	2 18 10
				*Ex div.			

a profit of £2739, out of which the Directors proposed to pay the maximum dividend of 4 per cent. and carry forward £438 to the renewal and contingency fund, which now stands at £5529. The receipts from water-rates and sales showed an increase of £270 as compared with the corresponding period of 1898; but the balance, after deducting maintenance and working expenses, was about £400 less, owing to the thorough overhaul and repair of one of the engines. In briefly commenting on the report, the Chairman said that the outlay for engine repairs was quite exceptional. It was owing to an accident, and was not likely to occur again; the engine being now made as good as new. The report was unanimously adopted.

It was announced at the half-yearly meeting of the Maidstone Water Company that the water-rents for the past six months amounted to £5917; being an increase of £336 over the corresponding period of 1898. The accounts showed a balance of £2176 at the credit of profit and loss account. Dividends at the rates of 5 and 3½ per cent. per annum on the two classes of shares would, it was stated, absorb £1120; leaving £1056 to be carried forward. The dividends for the previous half year were £4 6s. 8d. and £3 1s. 8d. respectively. The total receipts for the half year were £6133, and the expenditure £3786; leaving £2347 to be carried to the profit and loss account. At his own request, Alderman George Marsham has been relieved of the duties of the chairmanship; but the Company will continue to receive the benefit of his services on the Board. He took the head of affairs at the time the concern was in a critical position owing to the epidemic in the town; and since then he has ungrudgingly given to the work an immense amount of time and labour. Mr. H. W. T. Drake succeeds to the chair, and Mr. W. H. Bensted to the vice-chair.

The recent annual meeting of the South Hants Water Company, held at Southampton, was a very harmonious gathering; the most striking feature being the resolution to write off at once the £3089 of law and parliamentary charges in connection with the opposition to the Bill of the Southampton Corporation last year. The receipts amounted to £18,074, and £11,381 had been carried to profit and loss account. The dividends declared were 10 per cent. on the ordinary and 7 per cent. on the new ordinary shares. During the year, the new engine and boiler house at Twyford was completed, and a softening-tank and reservoir erected. An additional well is being sunk there, which will be a valuable auxiliary to the works. The net increase in the year's rental was £1338. At an extraordinary meeting, the proprietors authorized the raising of additional capital to the amount of £25,000.

The half-yearly general meeting of the West Surrey Water Company was held on the 27th ult.—Mr. A. T. Simpson presiding. The accounts for the half year ended the 31st of December last showed that the income, after making provision for empty houses, irrecoverable rates, &c., amounted to £5110, and the expenditure to £1849; being an increase of £629 of income and £132 of expenditure as compared with the latter half of 1898. There were 176 additional supplies connected to the Company's mains—representing a future rental of £329 19s. 8d. per annum; and 2460 yards of cast-iron pipes were laid in the parish of Shepperton. The Engineer and Manager (Mr. J. K. Hill) reported that the whole of the Company's works were in good order. After transferring from revenue £300 to the contingency fund, the amount available for distribution was £4031, which the Directors recommended should be applied as follows: In payment of dividends upon the preference shares (5 and 6 per cent.), amounting to £536 10s.; and of a dividend at the rate of 6½ per cent. per annum upon the ordinary shares, amounting to £1824—leaving a balance of £1670 to be carried forward. The report and accounts were approved and adopted, and the dividends recommended were declared. A vote of thanks to the Chairman, Directors, and officers of the Company concluded the meeting.

ELECTRIC LIGHTING NOTES.

Great consternation was caused at Spital Hill, Sheffield, last Tuesday, by the occurrence of a double explosion in an open street. The first report was heard about 40 minutes past twelve; and the second almost immediately afterwards. There had been an accumulation of gas in two of the underground boxes through which are carried the electric current cables of the tramway system, and the near proximity of burning coal caused an explosion in one box, which fired the gas in the other. The pavement plate over the second box was blown high into the air. The two boxes were about 30 yards apart. Fortunately no one was seriously injured.

With befitting ceremony, the electric lighting works which have been erected by the York Corporation, at a cost of £20,000, were inaugurated yesterday week. This is the realization of an idea which it has taken ten years to develop; but perhaps the City Council have been a bit uneasy as to its ultimate success, seeing that this is the first trading enterprise they have entered upon. The scheme is the work of Professor Kennedy; and the present installation is capable of supplying at one time 6600 lamps of 8-candle power each. The undertaking starts on its career with about 100 customers; and the Corporation require alone something like 3000 lights on their premises.

At the meeting of the Southampton County Council last Wednesday, the Electricity Committee reported that two serious failures of the light had occurred, both due to short-circuits on the mains in the old part of the system—the cause being explained; and it was stated that steps were being taken to minimize the possibility of the recurrence of such a breakdown. A letter was read from Messrs. G. J. Tilling and Sons, Limited, stating that when their men arrived at the Sail Works, Town Quay, recently, they were unable to obtain any electric light, and consequently were from six to eight o'clock without being able to do any work, and claiming the wages paid the men during this time—viz., 23 men, two hours each at 8d., £1 10s. 8d. The letter was referred to the Engineer (Mr. F. H. Chaplin) to report upon.

The "Electrician" remarks that the experience of the residents of St. Louis must be absolutely unique in the history of the electric lighting industry. That the streets and public places of a large city should be left in utter darkness, because of a difference as regards the price to be paid for these lights, is a circumstance which has probably not had a

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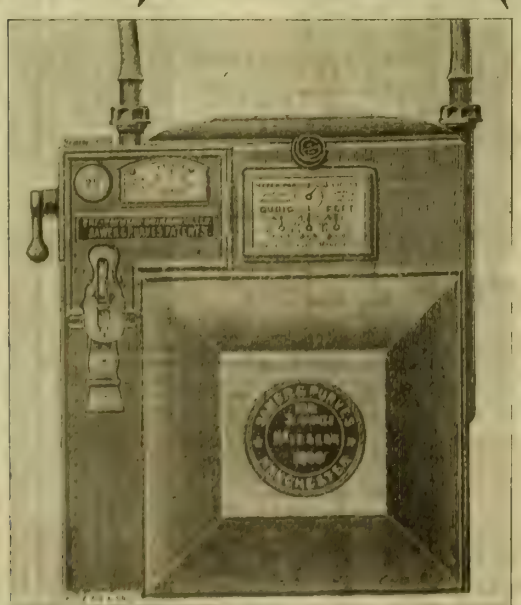
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parallel in cities of the same size. According to a Chicago paper, the St. Louis Board of Delegates desired, mainly because of the low state of the city's finances, that the price previously paid to the local Lighting Company should be considerably reduced. This reduction the Company refused to accept; and accordingly, as soon as the existing contracts had expired, they cut off all the public lights, leaving the official buildings and public institutions to fare as best they could.

The fifth annual statement of accounts of the electric light undertaking of the Bedford Corporation shows a decided improvement; but the ratepayers have to provide a deficit of £288. Out of £105,050 sanctioned, £64,000 has been borrowed and £7000 repaid. Last year the working expenses, &c., amounted to £4881, and the receipts were £8797; leaving a balance of £3916. However, interest and instalments of principal came to £4204, and left £288, as above mentioned, to be provided from the rates. In moving the adoption of the report, Alderman Richards, the Chairman of the Electric Light Committee, said he did so with great satisfaction and pardonable pride. They would have had a profit but for reducing the price of the current by 1½d., to 4½d. per unit. The Committee were fortunate in having made their coal contracts last summer; for during the dark days of winter they used 100 tons a week. They had reduced the cost of output, and worked with great economy. In 1898, the output was 360,000 units; but last year it rose to 550,000 units. They had now 600 consumers—an increase of 174. The total number of 8-candle lamps in use was 27,000; there were 530 public lamps charged for at 3d. per unit; cables were laid in 13 miles of streets for private consumers; and there were 200 miles of cables in all. Reference was made to the satisfactory working of electric motors in pumping sewage at the sewage works. The Chairman, Committee, and Town Clerk were thanked for their labours in connection with the development of the works.

At the invitation of the Directors, a large party, including Lord Kelvin and other distinguished electrical engineers, last Thursday inspected the new works of the Metropolitan Electric Supply Company, which are situated about a mile from Willesden Junction. The site upon which they stand is about 8½ acres in extent, and is well located with regard to facilities for the cheap and rapid delivery of the necessary coal supply. The works as they now exist cover only a small part of the area over which they will ultimately extend. When finished they will occupy more than 2½ acres, and will consist of two parallel boiler-houses, each 384 feet long by 88 feet wide, with a two-bay engine-house between, measuring 384 feet by 112 feet, and four large chimney-shafts. This engine-house will contain 18 1500-kilowatt alternators, arranged in two rows of nine each, and capable of providing for the requirements of a connection of 1,620,000 lamps, or of actually lighting about 810,000 8-candle lamps. At present only three of these alternators, with a proportional extent of the boiler-house, have been erected; but a second section of equal size is now under construction. The boiler-house as it now stands measures 164 feet by 88 feet, and contains 16 Babcock water-tube boilers, disposed in two rows, and having a heating surface of 3500 square feet each. The three engines now at work are of the Westinghouse vertical compound type, each of 2500 indicated horse power, and fitted with automatic expansion governors. Each is coupled direct to an alternator standing on the same foundation (a mass of concrete 19 feet thick), and is provided with its own circulating and air pumps and condenser. The revolving armature of the alternators, whose field magnets have 62 poles, is about 17 feet in diameter; and at a speed of 116 revolutions a minute each generates a two-phase alternating current of 3000 ampères at a potential of 500 volts. From the alternators the current is conveyed to the switchboard, placed in a gallery above the engine-room, and thence to the transformer-house, where its potential is raised to 10,000 volts to enable it to be economically transmitted to the various transformer sub-stations in London, where it is again reduced as required by the circumstances of the districts served. The transformers are 14 in number, each of 250-kilowatt capacity. From the transformer-house the current is conveyed to London by five concentric cables, so arranged that one acts as a reserve to the other four. These are laid in five-way cast-iron conduits, in which there is space to put five more mains when required; and they are insulated with paper and covered with lead.

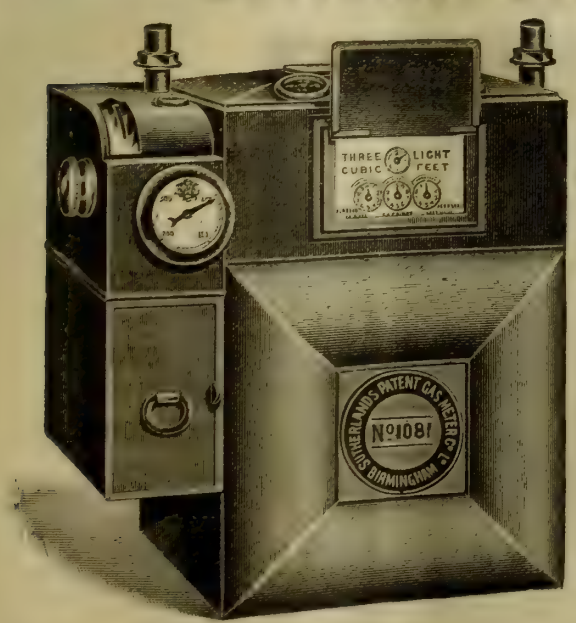
LINCOLN CORPORATION WATER SUPPLY.

Proposed Boring at Boultham.

During the past ten years, the Corporation of Lincoln have from time to time had their attention directed to the water supply of the city. As far back as September, 1891, Mr. C. E. De Rance reported on the matter; and in the following January a Special Water Committee, appointed for the purpose, put the Corporation in possession of all the information on the subject then available. But they did not feel justified in advising an extension of the supply. In October, 1898, however, Professor Hull recommended that this should be done by means of a deep boring at Boultham. Several estimates and reports were obtained by the late Water Engineer (Mr. H. Teague) from various well sinkers; but no definite steps were taken in the matter till July last year, when the Corporation called in Mr. Percy Griffith, Assoc.M.Inst.C.E., F.G.S., of Westminster, to advise them as to the best detailed plan of "boring for water from the red sandstone on or near the site of the water-works at Boultham." Mr. Griffith was peculiarly fitted, from the experience he has gained in connection with the boring operations in progress at Gainsborough, to undertake the duty entrusted to him; and he has now presented his report.

Commencing with the present supply, it appears that in April last 1,358,500 gallons of water were being supplied daily to a population of 55,000, or at the rate of 24·7 gallons per day. The capacity of the pumping machinery was 2,200,000 gallons; and as during the drought of last summer no difficulty was experienced in maintaining an adequate supply, it may be concluded that, for the present at least, the quantity of water available is sufficient for the demand. But it is the future requirements which have to be considered. During the past ten years, the population has increased, on an average, 2·36 per cent. Assuming this rate to be maintained, in 1909 it will be about 70,000, and, on the basis of 25 gallons per head, they would require 1,750,000 gallons of water per

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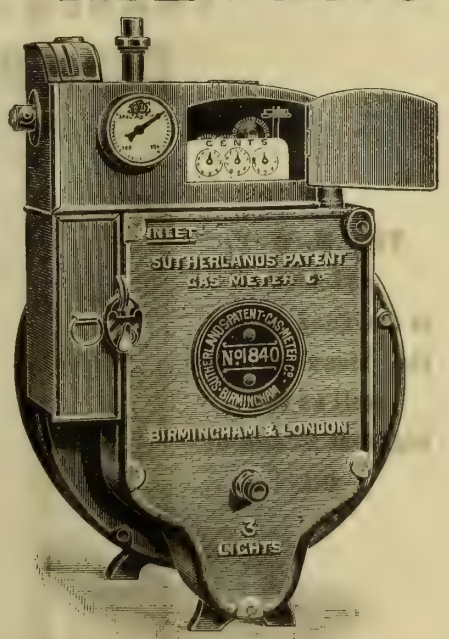
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diem; while in 1919 it will be 88,400, and 2,210,000 gallons will be needed. Mr. Griffith points out that these figures were obtained from averages over periods of twelve months; and the maximum day's demand during a dry season might very possibly exceed his estimate by as much as 100 per cent. The result would be that unless the Corporation had ample storage capacity to enable the pumping machinery to be kept constantly at work, the demand would exceed the supply in a much shorter period than the twenty years indicated—in fact, within the next ten years. Mr. Griffith therefore recommends the Committee not to put any arbitrary limit to the bulk of water to be sought from the proposed boring, but, on the contrary, to spare no expense to obtain the maximum quantity available.

Professor Hull estimated that from a boring 12 to 14 inches in diameter at a depth of 1200 feet from the bottom of the well, or 1400 feet from the surface, a supply amounting to about a million gallons per day of 24 hours would be obtained. Mr. Griffith has examined the data furnished by various borings, and does not feel justified in assuming any definite "rest level" at Boultham, as this would, he says, probably be considerably affected by the nature and condition of the sandstone in the immediate neighbourhood of the boring, and between its site and the outcrop of the sandstone. A trial boring would have to be carried to the base of the sandstone, and it should not be less than 6 inches in diameter at the bottom. It would cost about £4500, which would be in addition to the permanent boring; but he unhesitatingly recommends such a boring. As he estimates this to be about 2200 feet below the surface, he advises that the depth of the boring provided for in the contract should be based upon this figure; the minimum diameter at the bottom to be 12 inches. He estimates the probable section as follows: Mud and sand, with water (drift), 20 feet; lias, 533 feet; rhoetic shales, 22 feet; keuper marls, 810 feet; new red sandstone, 791 feet—total depth, 2176 feet. Although Mr. Griffith has arrived at the above figures after a careful study of all the available information upon the subject, he ventures to suggest that the opinion of Mr. De Rance should be obtained as to the accuracy or otherwise of his conclusions before the specification of the boring contract is prepared.

In the next section of the report, Mr. Griffith deals *seriatim* with the several strata indicated above, points out their characteristics, and suggests the best method of carrying out the boring with the view to overcoming the particular difficulties presented. In order to give the Water Committee a general view of his recommendations, he submits with his report a section showing the strata expected to be met with, and the construction of the work at the various depths; also a plan, indicating roughly the proposed arrangement of the boring and the engine and boiler house. He gives the time required to carry out the well and boring as from four to five years from the commencement; and his original estimate of the cost, inclusive of the Engineer's Commission and expenses (£300), was £15,500. But in a supplementary report he states that recent experience at Gainsborough makes it advisable to extend the tubing 400 feet, instead of 50 feet, into the sandstone, as he originally proposed; and that this alteration will add roughly about £850 to his figures.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

There was more than the usual tale of business at the monthly meeting of the Edinburgh and Leith Gas Commission this week. The first item had reference to an arrangement which has been come to, in respect of which the burgh assessment upon the new gas-works at Granton is to be restricted, and the Gas Commissioners are not to oppose the extension of the city boundaries of Edinburgh so as to include the works. A Sub-Committee had been appointed to attend to the interests of the Commissioners under the Bill of the Edinburgh Corporation. This Sub-Committee ascertained that the Edinburgh burgh assessment was 1s. 3d. per pound higher than is the county assessment, which the Commissioners would have to pay were the works not taken into the city. They resolved not to oppose the Bill if the Corporation of Edinburgh would agree to restrict their assessment upon the works, for 21 years, to the amount which would be payable to the county. A conference with representatives of the Edinburgh Corporation was held, at which the representatives stated that the concession could not be granted, but that the Corporation were prepared to restrict their assessment by one-third for a period of 15 years. This offer was rejected by the Sub-Committee, who despatched their Convener (Bailie Manclark, of Leith), the Engineer, and the Clerk to London, where they had a meeting with Mr. Kennedy, the Parliamentary Agent of the Commission, and a petition against the Bill was drafted. This was done post-haste; for a meeting of the Commissioners had been summoned, by desire of the Lord Provost of Edinburgh, for the following day. This meeting was held; and at it the Lord Provost explained that the Corporation were prepared to restrict the assessment to one-half for 17 years—dwelling-houses and subjects not forming part of the gas-works to pay full rates. The Commissioners unanimously accepted this proposal. At this week's meeting, a letter from the Town Clerk of Edinburgh was read, confirming the arrangement, but inserting Whitsunday, 1900, as the date of its coming into force, instead of, as had been agreed upon, the date of the passing of the Bill. The point was a matter of book-keeping; but it created some discussion—more than, presumably, would have taken place had there not been a little soreness over the fact that the Sub-Committee had been able, by their promptitude, to force the hands of the Corporation. Bailie Manclark remarked that the cost of the deputation to London was the best investment the Commissioners had ever made; and Mr. Kinloch Anderson said he thought the Commissioners were to be congratulated upon having the matter settled without going before a Committee in London. It was agreed that the arrangement should come into effect at Whitsunday. I hear of no other opposition to the Bill, which will most probably now pass as an unopposed measure. No one can yet say what the valuation of the new gas-works will be; but at present the Edinburgh works are valued at £42,000. As the Granton works are to supersede the Leith and Portobello works, as well as the Edinburgh ones, it is

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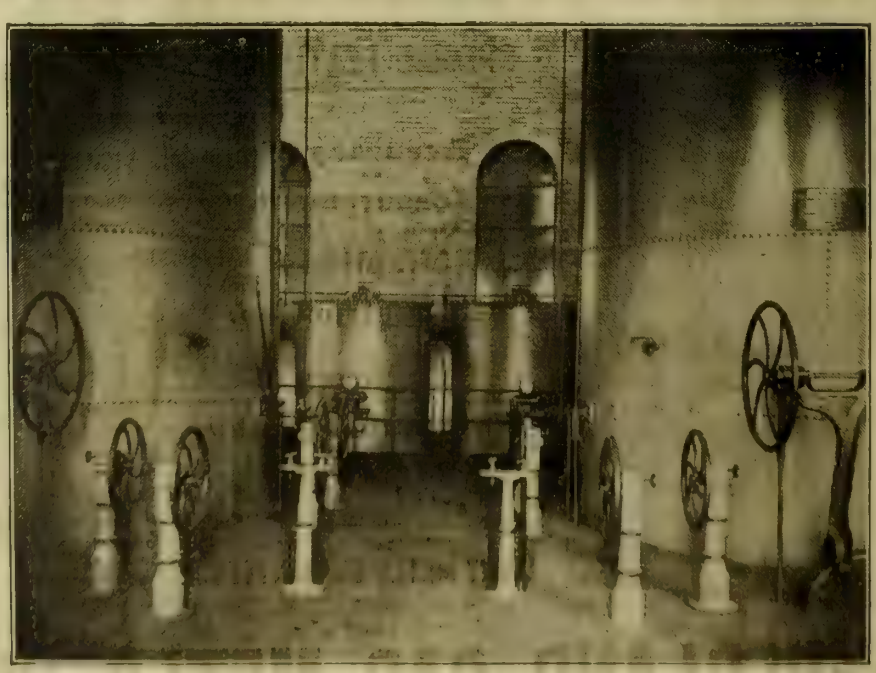
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reasonable to assume that they will soon be a considerable way over the present valuation in Edinburgh. The rate now in Edinburgh is 2s. 5½d. per pound. The saving, consequently, to the Gas Commission will be not less than £2500 a year, which is a matter of some importance.

The report by the Engineer (Mr. W. R. Herring) showed that the output of gas during January was 246 million cubic feet—an increase of 1,728,400 cubic feet over the corresponding month. The Commission have now 3922 cookers on hire—an increase of 972. Mr. Kinloch Anderson said it would be observed that, for the first time for many months, there had been a slight decrease in Edinburgh—945,000 cubic feet. The cause of this was not that there was any lack of demand; but, owing to the difficulty in getting coal, the Engineer was under the necessity of reducing the pressure as much as was prudent. It was a loss to them, but they had to take care of their coal. He did not wish to create an alarm about the coal-stores running down, because the Engineer had received supplies now, and there was no danger of their being short. The increase in the output of gas since May 16, had been 67,679,000 cubic feet, which he considered was wonderful. He heard that a good many people were cutting off the electric light, so that there was a prospect of this increase going on.

The Works Committee, Mr. Kinloch Anderson said, had considered an application by their yard labourers for a revision of wages. They recommended that the Commissioners should continue to recognize a differential rate of pay—the maximum being the standard rate (at present 5½d. an hour) payable to competent men, the wages being due for actual work only; that time-and-a-third should continue to be paid for Sunday labour; and that extra holidays be given after ten months' service. The recommendation was adopted.

It was reported by the Works Committee that arrangements had been made with defaulting coal contractors; and that there had been recently bought 1000 tons of Newbattle Parrot bottoms at 14s. 1d. to Edinburgh and Leith and 13s. 8d. to Portebello; 1000 tons of Carberry splint at 14s. 10d.; 500 tons of Pelton splint at 14s. 9d.; 1000 tons of Milton gas coal at 13s. to Edinburgh and Portobello and 13s. 3d. to Leith; 1000 tons of Balbardie gas coal at 15s. 3d. and 500 tons of Belhaven splint at 15s. 11d. to Edinburgh and Portobello, and 16s. 1d. to Leith. I understand that some of these prices are 50 per cent. higher than they were a year ago.

Then arose an incident which deserves more than a passing notice. Mr. Kinnaird, of Leith, said, seeing that the period for contracting was coming on, he wished to ask whether the self-denying ordinance applied to members of the Commission who were financially interested in limited liability companies supplying materials to the Commission. Mr. Steel said the subject had been raised often in the Commission. Mr. Kinnaird said he had been seven years in the Commission; and he had looked over the minutes, but could see no reference to it. The Clerk (Mr. J. M'G. Jack) replied that there was a section in the Commissioners' Clauses Act of 1847, which had been incorporated in their Act, and which provided that limited liability companies might contract with the Commissioners; but no Commissioner who was interested in such a company was entitled to take part in the fixing of the contract. The Chairman (Provost Mackie, of Leith) remarked that this had always been observed. Mr. Kinnaird said there was a gentleman present who was a director of a company who were supplying material to the Commission. This gentleman was asked to go out of the room when the contract was being fixed; and the whole of the contract fell to his company. He thought that if a member of the Gas Commission were there, and using influence on the members, it was contrary to the spirit of the Act. He should not be there at all, or even be a Commissioner. Mr. Kinloch Anderson said he was sure that if a contract had ever been given to a company in which any Commissioner was interested, it was because they were the lowest tenderers; he was perfectly certain that no consideration was ever given to any Commissioner. Mr. Kinnaird pointed to an instance in the minutes before them, where, a Commissioner having acquired the business of a limited liability company, this company had been paid for goods supplied to the Commission; and he asked if it was right that this should take place. He wished the principle to be settled. Mr. Kinloch Anderson said that if a Commissioner were the sole owner of a business, the self-denying ordinance would certainly apply. But in this instance, the gentleman had purchased the business as an investment, and did not manage it himself; and it was quite likely that he knew nothing about the supplying of goods to the Gas Commission. It was agreed that the Clerk should look into the law upon the subject, and inform the Commission whether it forbade only directors of companies, or shareholders as well, from taking part in business in which their company was interested. The late Professor Blackie said it was a misfortune to be possessed of too tender a conscience. I am afraid that Mr. Kinnaird labours under this misfortune. I do not think that the laying down of any general principle which would have the effect of excluding the best business men in the country from public boards would be serving the public interests. General principles, no matter how well they may look upon paper, cannot be made applicable to every case. It is, in such matters as this, the duty of those who wish to preserve purity to watch each particular case. Had Mr. Kinnaird challenged a contract at the time it was being entered into, his position would have been unassailable. But he did not do so; and it is to be assumed that he saw nothing wrong. If for seven years he has been unable to detect a corrupt contract, it is inexplicable why he should begin to fear them now. At least, he gave no reason; and it can only be concluded that he acted without reflecting that the consequences, were he to secure what he seemed to be aiming at, might carry him further than he desired, and would, of a certainty, not be to the benefit of the gas undertaking.

The ground upon which the gas-works at Hamilton are erected is held by the Corporation on a long lease, of which there is still about 30 years to run. The Gas Committee have been considering the desirability of acquiring the land; and this week they have recommended the Town Council that negotiations should be entered into to this effect. Mr. Tainsh, who is not one of the most advanced public men in Hamilton, thought the matter was one for their successors to settle, nearer the end of the lease; and he moved that the recommendation be not adopted. He did not find a seconder; and the negotiations will proceed. It is

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most certainly a wise step to come to some understanding in good time. Were the Corporation to wait till near the end of the lease, the proprietor could make his own terms; but if they begin in time, the Corporation will have it in their power to play off the possibility of removing against any unduly heavy conditions. Of course, on the other hand, it might pay the proprietor to get the gas-works cleared away from his land; but such questions will be considered in the negotiations.

Cross petitions have been presented to Parliament with reference to the Bills affecting the Falkirk district which are being promoted. The County Council of Stirlingshire petition against both the Bill of the Falkirk and District Water Trustees and that of the Falkirk Corporation for the extension of the burgh boundaries. With reference to the Water Bill, they object to the Falkirk Water Trustees being allowed to appropriate the more populous areas in the neighbourhood of the burgh—leaving to be supplied by the County Council the more sparsely peopled localities. They oppose the proposals of the Corporation for the extension of the burgh boundaries, on the grounds that the extension would entail loss of revenue to them, and would dislocate their arrangements for the administration of the Public Health and other Acts. The proposed extensions include the two sites which are suggested for the new Corporation gas-works. On the other hand, the Town Council petition against the Bill of the County Council for the supply of water to villages and populous areas in the eastern district of the county, and contend that it is desirable that there should be included within the burgh all the areas which are at present supplied with water or gas from the town undertakings. These Falkirk measures are likely to be the most stubbornly contested of all the Scotch Bills in Parliament this session.

A little episode in the working out of electric lighting problems, which I suppose has now closed, may be given. On the 13th ult., speaking in the Edinburgh Town Council, Bailie Mackenzie, who is Convener of the Electric Lighting Committee of the Corporation, said that the Treasurer and other members of the Corporation had expressed a fear that undue capital expenditure was going on in the electric light undertaking of Edinburgh. He had prepared a statement of comparison with other similar large undertakings, which might be interesting. The latest published accounts showed that up to May last Edinburgh had expended £395,356 on the electric light undertaking, and had connected with its system equivalent to 226,740 8-candle power lamps—thus giving a capital expenditure of £1 15s. per lamp. Glasgow at the same time had spent £339,782, with 139,772 lamps joined on—giving a capital expenditure of £2 8s. per lamp. Dundee shows an expenditure of £1 13s. per lamp, Aberdeen £1 14s. 6d., Manchester £2, Liverpool £3 4s., Leeds £2 18s., Birmingham £2 10s., Sheffield £3, Dublin £2 14s., Belfast £2 8s., and Brighton £2 4s. The large London Companies show an expenditure as follows: The City Company (the largest in the country) has a capital expenditure of £3 18s. per lamp, the Metropolitan Company (the next largest) £2 12s., and the Westminster Company £2 6s. None have a smaller expenditure per lamp than Edinburgh. He hoped this would reassure the members of Council that the work in Edinburgh had been done economically, and, notwithstanding a few slight interruptions, efficiently carried out. This statement was called attention to in the Glasgow Town Council; and Bailie M'Lay, the Convener of the Electricity Committee, pointed out that a comparison between the two cities was scarcely possible. For one thing, the public lamps in Glasgow were kept lighted all night; whereas in Edinburgh they were not. This week Bailie Mackenzie was asked what the capital expenditure per lamp was as at the 15th ult.; and in reply he said that since May last about £100,000 had been expended upon the new station at M'Donald Road. The total capital expenditure was, at the 15th ult., £545,981. This brought out the cost per lamp at the present time to £1 18s. 4d. He pointed out that 20,000 lamps were waiting to be attached; and that during the year ending May 15 next the number of lamps joined on would be 70,000—a number never heard of in connection with any other undertaking of the kind in the country. The cost per lamp would thus go down after May. The closing scene came in the Glasgow Town Council on Thursday of this week, when a member conveniently asked if Bailie M'Lay was in a position to give any explanation of the recently published comparison between Glasgow and Edinburgh. Bailie M'Lay's reply was that the figures of Bailie Mackenzie were not accurate; he gave the number of lamps in Glasgow as 137,772; whereas the correct number was 191,062—a difference in favour of Glasgow of 53,290. This correction made all the difference in the world. It reduced the capital cost from £2 8s. to £1 15s. 1d. In Edinburgh, according to its own figures, the cost was £1 14s. 10d.—a difference of 3d. in favour of Edinburgh, which was not worth speaking about. Apart from this, he found that Bailie Mackenzie had revised his figures, and now he made the cost of each lamp in Edinburgh £1 18s. 4d.; whereas the cost in Glasgow was £1 15s. 1d.—a difference in favour of Glasgow of 3s. 3d. Bailie M'Lay went on to say that the comparison made between the two cities was unfair and unreliable, because, particularly in Glasgow, and in Edinburgh to some extent, they were in a state of transition. They were in the stage of development, and they were spending capital freely. This statement has given nearly as much satisfaction in Glasgow as did the information about the relief of Ladysmith. With the question as between the two cities I have no concern; but a comparison with gas lighting brings out how costly a matter lighting by electricity is, after all is said in its favour. And, first, it has to be observed that the electricians make their calculations at per 8-candle lamp. There is, in practice, no such lamp in gas lighting. As a matter of fact, it is seldom indeed that a gas-lamp is to be met with which is of less capacity than 16 candles. Thus, at once, in a comparison of cost per lamp, as between gas and electricity, the cost of the electric lamps as given, must be doubled. But even taking the figures as they are given, I find that gas lighting is less than the electricians claim for theirs. The published accounts of the Glasgow Corporation give the total expenditure upon works, including workshops, offices, chemical works, and dwelling-houses, at £1,315,610; and the parliamentary return gives the number of consumers as 186,327. This does not take public lamps into account, as the electricians do. The number of private lamps is not given; but if five be taken as an average per consumer (which is probably under the mark), it is found that the capital cost per lamp is £1 8s. In Edinburgh (excluding the cost of the Granton works in course of construction), the outlay upon works has been £767,620, and the number of consumers is 74,964;

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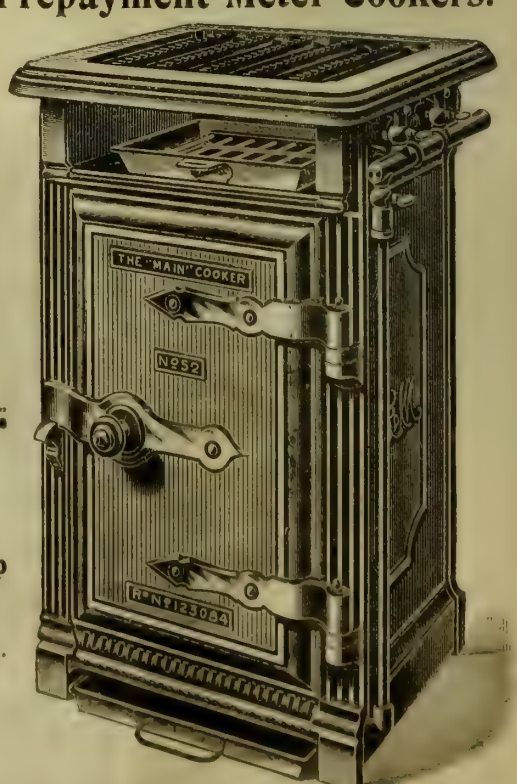
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giving the number of lamps as 374,820, and the capital cost per lamp £1 14s. In the case of gas, too, the whole area of supplies, to their most outlying and most thinly peopled limits, are served; while with electricity only the central districts—the best revenue producing ones—have yet been served. When, if ever, the outlying districts are supplied with electricity, the capital account will be of huge proportions; and the cost per lamp will certainly not be anything like the figures which both electrical conveners look upon as being so small.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *March* 3.

Sulphate of Ammonia.—There has been a firm market, and values have hardened slightly; the closing quotations being £12 1s. 3d. to £12 3s. 9d. per ton, delivered f.o.b. at the ports. Consumers have bought sparingly; there being still a disposition to wait a better opportunity. Purchasing has consequently again been for "cover" purposes; but it has been sufficient to absorb available supplies, and February closed with bare stocks. There has been a considerable speculative interest in the forward position; and £12 per ton March-May, and £11 12s. 6d. October-March, has been paid, ordinary terms, f.o.b. Leith. London quotation for delivery over the spring months is £12 per ton, Beckton terms; but so far this price has not been paid.

Nitrate of Soda is firmer; and the spot quotations have been advanced to 8s. 10½d. per cwt. for ordinary, and 9s. for fine quality. The visible supply is considerably less than at the same date last year; and a further advance seems probable.

LONDON, *March* 3.

Tar Products.—There is not such a keen rush for carbolic acid; but it is believed that many dealers have orders up their sleeves, and are in the meantime attempting to depress the market value. Distillers have no stocks of carbolic in any form; and many of them oversold have been tempted to do so by the higher prices recently obtaining. Benzols are dull; but larger shipments to the Continent are taking place. There is a better demand for 50's than 90's—doubtless due to the enlarging consumption of toluol for indigo manufacture. Solvent naphtha is not quite so strong; while heavy naphtha is quoted less money. Good business exists for creosote and other tar oils. There is no change in value. Anthracene is in better inquiry. The average values are: Tar, 17s. to 26s. Pitch, east coast, 35s. 6d.; west coast, 33s. 6d. Benzol, 90's, ordinary, 7d.; special qualities for gas, 8½d.; 50's, 9½d. Toluol, 90's, 1s. 2d.; pure, 2s. Solvent naphtha, 1s. 2d. Crude, 30 per cent., naphtha, 4¾d. Heavy naphtha, 1s. Creosote, 3¼d. Heavy oils, 3¾d. Carbolic acid, 50's, 2s. 8d.; 60's, 3s. 1d. Crude naphthalene, 60s. Anthracene, nominal, "A," 4d.; "B," 2½d.

Sulphate of Ammonia still enjoys a steady market. The position of stocks in this country are such as to warrant the belief that values will be maintained during the spring. Indeed, there are numerous offers at to-day's price for forward delivery, without finding sellers. Makers would probably accept £12 5s. per ton for the spring months; but for spot delivery £12, less 3½ per cent, is the price at all points.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—No really material change can be reported in the position of the coal trade here. An active demand still comes forward for practically all descriptions of fuel; any falling off—and this is not appreciably felt—being simply in the better qualities of round coal suitable for house-fire purposes. There is, however, a continued easing down from the special prices that have recently been ruling in the market; and it is now exceptional where buyers are prepared to pay anything above the normal list rates to secure supplies. The best house-fire varieties are, if anything, rather more plentiful; but all the lower qualities of round coal that can be used for steam and general manufacturing purposes are meeting with a ready sale, with supplies only barely sufficient for requirements. Much the same also applies to engine fuel, in which, though there is perhaps not the scarcity reported recently, the output of the pits is still short to meet full demands. From outside districts there is a larger quantity of fuel coming forward, which is enabling consumers who are in the open market to meet their wants without having to pay special prices, or to purchase house-fire qualities at full rates for steam and forge consumption. Taking the position all through, although it is strong at the full list rates, there is a disappearance of the special prices which collieries have been securing in the outside markets. At the pit, average rates are about 14s. 6d. to 15s. 6d. per ton for best house coal, 13s. to 14s. for medium qualities, 12s. to 12s. 6d. for steam and forge coals, and from 10s. for medium to 11s. for best slack. For shipping, there is still a pressure of demand; and with only limited supplies obtainable, prices above those ruling for inland sale are still being secured without difficulty. Delivered at the ports on the Mersey, ordinary steam coals are fetching 15s. 6d. to 16s. per ton; and better qualities of round coal 17s. per ton. There is still more inquiry for coke than makers can entertain; but there is no official change in prices, which remain at about 23s. to 23s. 6d. per ton at the ovens for furnace, and 30s. for best foundry cokes. There is apparently a disinclination to make any further upward move on list rates.

Northern Coal Trade.—There has been some ease in the coal trade, and prices are occasionally lower than a week ago. Best Northumbrian steam coals are now quoted from 17s. 6d. to 18s. 6d. per ton f.o.b., second-class steam are about 9d. lower, and steam smalls are 11s. In the gas coal trade, the deliveries are still heavy, though less than they were, except where the making-up of the quantities that were deficient is being effected. Prices for occasional cargoes vary from 16s. to 16s. 6d. per ton f.o.b.; but there is comparatively little being sold that way. Very little has been done in regard to contracts this week; and as far as is known, the negotiations for the renewal of the large contracts for the South have not yet been entered upon. In coke, the market is brisk, and the prices are firm, with an upward tendency. Gas coke is steady; and the output is well taken up. Prices show little alteration.

Scotch Coal Trade.—The demand is getting bigger—as the opening of the Baltic ports draws near. Forward contracting is actively sought

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for; quite satisfactory prices being offered. Current rates remain firm. In some places, the miners are not working steadily, which is interfering with the output. The prices quoted are: Main 14s. 6d. to 14s. 9d. per ton f.o.b. Glasgow, ell 15s. 9d. to 16s. 6d., and splint 15s. 3d. to 15s. 6d. The shipments for the week amounted to 198,076 tons—an increase of 9041 tons upon the previous week, and of 59,038 tons upon the corresponding week of last year. For the year to date, shipments have been 1,400,520 tons—an increase of 313,151 tons upon the same period.

Compensation to an Injured Workman of the Manchester Gas Department.—At the meeting of the Manchester Corporation Gas Committee last Friday, the question of granting some compensation to William Wall, a workman at the Bradford Road station, who recently lost the sight of one of his eyes owing to a piece of cannel flying into it, was considered; and it was ultimately decided to pay him £150 in settlement of all claims.

Sales of Shares.—A few additional shares in the Plymouth and Stonehouse Gas Company were lately sold by auction at from £21 10s. to £22 15s. each. The fourth batch of 1500 £5 shares in the Portsmouth Water Company, authorized by the Act of 1898, were recently sold by Messrs. Hall and Paine, at Landport. They were put up in 300 lots, 280 of which were sold at £6 15s. per share. The next three lots were sold at an advance of 2s. 6d. per share; but the price realized for the remainder was £6 15s. per share. The sale produced £10,128 15s.; being a premium of £2628.

New Joint Stock Companies.—The Portable Gaslight Company, Limited, has been formed, with a capital of £12,000, in £1 shares, for carrying on business of the nature indicated in the title. The Flameless Gaslight Company, the registration of which is announced, consists of 20 members, each liable for £1, who purpose carrying on the business of gas engineers, &c. The National Gas-Engine Company (1900), Limited, has been registered with a capital of £200,000, in £1 shares, to acquire and take over, as a going concern, the business now carried on at Ashton-under-Lyne by the National Gas-Engine Company, Limited.

Carburetted Water-Gas Plant for the Oldbury Gas-Works.—At the meeting of the Oldbury District Council last Friday, the Gas Committee presented a report in which they recommended that water-gas plant should be laid down in accordance with plans, specifications, &c., approved by them, and that the estimate of the Economical Gas Apparatus Construction Company, Limited, amounting to £5663, be accepted for carrying out the work to the satisfaction of the Gas Engineer and Manager (Mr. A. Cooke). The Committee considered such plant would best fulfil the present needs of Oldbury, and would avoid heavy expenditure on additional holders, &c. The Chairman of the Committee (Mr. J. W. Wilson, M.P.), in moving the adoption of the report, explained that the Committee felt they would not be prepared to face another winter unless steps were taken to increase the productive capacity of the gas-works. The report was adopted.

Increases in Price.—The Milton Urban District Council have resolved to raise the price of gas by 3d. per 1000 cubic feet. The Welshpool Gas Company are about to raise the price of gas from 3s. 9d. to 4s. 2d. per 1000 cubic feet.

Harrow and Stanmore Gas Company.—At the half-yearly general meeting of this Company yesterday, the accounts presented showed a balance of £3121 available for distribution. The Directors recommended a dividend for the past six months at the following rates per annum: 8 per cent. on the "A" capital, 7 per cent. on the "B" capital, £5 12s. per cent. on the "C" capital, and 6 per cent. on the guaranteed shares—all less income-tax. This was agreed to.

The Sunlight Company and the Chimneyless Burner Patent.—We learn that the Law Officer last Thursday dismissed the Welsbach Company's appeal from the decision of the Comptroller of Patents, by which he allowed the Sunlight Company to amend the De Mare patent for their chimneyless burner. That Company, who claim that the Law Officer's action gives them the master-patent for the principle of a chimneyless burner, have commenced proceedings against the Welsbach Company for infringement of the De Mare patent by the manufacture and sale of the new Welsbach (Kern) burner.

The Hemel Hempstead Corporation and the Water-Works.—At a special meeting of the Hemel Hempstead Town Council held last Wednesday, it was decided to undertake all necessary expenses and steps for promoting a Bill to secure the purchase of the property of the Hemel Hempstead Water-Works and Laundry Company, Limited. A cheque for £200 was ordered to be paid to the Parliamentary Agents for fees at the different stages of the Bill in the House of Lords. The expenses of the poll of owners and ratepayers came to £58, and were ordered to be paid. Mr. Fisher said the majority in favour of the purchase was only 17; but if it had been on the basis of "one man one vote," they would have had a majority of 115. Still, they did not employ any paid canvassers, and had to contend against tremendous odds. The Council sealed a petition against the Great Berkhamsted Water Bill.

Cagliari Gas and Water Company, Limited.—At the ordinary general meeting of this Company to-day, the Directors will report that the receipts on revenue account amounted last year to £25,138, and the expenditure to £14,843; leaving, after the usual deduction for sinking fund, a net revenue of £10,295. The amount available for distribution, including the balance brought forward, is £14,523, out of which an interim dividend at the rate of 6 per cent. per annum was paid for the six months ending the 30th of June, and the Directors recommend one at the rate of 8 per cent. per annum for the past half year (making 7 per cent. for the year), together with a bonus of 2s. 6d. per share. These payments will absorb £11,437, and leave £3086 to be carried forward. The water revenue shows an increase over the year 1898; but the expenditure was greater by £596. There was a considerable rise in the gas revenue—£883—as compared with the preceding year; while the expenditure was only £630 more. The unaccounted-for gas averaged 4·9 per cent. of the make over the whole year. The electric lighting undertaken by the Company produced a larger profit last year than it did in 1898.



No. 590 (Khaki) . . . 90s.

RICHMOND

To meet the demand for Khaki coloured articles, Messrs. Richmond & Co. beg to announce that they are now prepared to supply this powerful White-Light Heating-Stove, beautifully Enamelled in

KHAKI.

Lancaster Gas and Water Supply.—At the meeting of the Lancaster Town Council last Wednesday, it was stated that the gas profits applicable in aid of the rates were expected to be £1000, and the water profits £3417—in both cases exceeding the estimates of the departments.

Manchester Water Supply.—The Manchester Corporation Water Committee, at their meeting last Thursday, presided over by Alderman Sir John J. Harwood, again discussed the question of laying a second pipe from Thirlmere. They passed a resolution expressing the opinion that the time has arrived for the matter to receive serious attention, and referring it to the Thirlmere Sub-Committee for the purpose of investigation, with the view of bringing the scheme before the Council, and also with authority to carry out the engineering arrangements. The consumption of water supplied by the department is still very high. In the week ending the 24th ult., the daily average was 33¾ million gallons. The stock is deemed to be sufficient for 122 days; seven days' supply having been gained during the last fortnight. At the corresponding date last year, the stock was less; but the consumption also was less. The daily need for the year is now estimated at 32½ million gallons.

The "Builder" on London Gas.—In the course of some editorial remarks on the approaching contest between the London County Council and the Metropolitan Gas Companies concerning the official recognition of the portable photometer, our contemporary points out that the legalization of this instrument with the retention of the 16-candle standard would necessitate the supply of a more highly enriched gas, which in turn would result in an immediate rise in the price charged; while the consumer who obtained the richer gas at a higher figure would not get a proportionate increase in lighting or heating value for his extra expenditure. As an aid to smoke abatement, and in the interests of manufacturers and gas consumers generally, our contemporary expresses the opinion that "the supply of a low-grade gas—say of 14½-candle power—at a minimum pressure of 1½ inches of water, and possessing a minimum calorific value to be fixed by Act of Parliament, would be of more utility than the supply of a higher grade gas of uncertain heating value at a higher price."

Destruction of the Grand Theatre, Islington, through a Gas Explosion.—On Monday last week, the Grand Theatre, situated close to the Angel, Islington, was almost totally destroyed by fire. It broke out about eleven o'clock in the morning, and was attributed by Commander Wells to the gas arrangements on the stage. For the purpose of scenic effect, a series of gas "battens," supplied by pilot lights, were fixed at various heights in the "flies." On the previous Saturday night, in accordance with the usual custom, the whole of the pilot lights were shut off, to be relighted on Monday morning in preparation for the evening performance. It was when the workmen were engaged in this operation that the fire broke out. It is believed that the gas was turned on for the "battens," and not immediately lighted; the result being an escape. The "long arm" of the operator came in contact with the escaped gas, and the result was a report, which was heard all over the building. The explosion is believed to have shattered a stage "avalanche" used in the piece, and the inflammable material of which it was composed caught fire. The curtain having been raised shortly before, and the windows and doors on the stage and the skylights in the roof being open, there was a strong draught, which quickly spread the fire to the scenery. The result was that the stage was in a few moments a mass of flames. The scenery and the back part of the building were burnt out, and part of the roof was destroyed, with the rest of the auditorium, refreshment-rooms, &c.; and the contents were severely damaged by fire, water, and breakage. Fortunately no personal injurieswere sustained.

The "London Gazette" last Tuesday contained an announcement that the Malvern Link Gas Company had been wound up voluntarily.

At St. Bartholomew's Parish Room, Bristol, last week, an exhibition of gas appliances was held by Messrs. Fletcher, Russell, and Co., Limited, with lectures by Miss Helen Edden.

The Directors of the Abingdon Gas Company have entered into a contract with Messrs. Gibbons Bros., of Dudley, for the erection, during the coming summer, of their system of regenerative furnaces.

The Directors of the British Gaslight Company, Limited, propose to recommend at their half-yearly meeting on the 21st inst., a dividend at the rate of 10 per cent. per annum for the six months ended Dec. 31, free of income-tax.

Messrs. Wilsons and Mathiesons, Limited, of Leeds, held an exhibition of their gas cooking and heating appliances at the Denison Hall, Armley, last week. Miss Holroyd delivered a series of cookery lectures, with practical illustrations.

Messrs. Hooker and Webb announce the sale by auction, at the Greyhound Hotel, Croydon, on the 15th inst., of £5000 of consolidated "B" ordinary stock and £2500 perpetual debenture stock (5 per cent.) of the Croydon Gas Company. The dividend paid on the "B" stock for some years has been at the rate of 11 per cent. per annum. The stock will be offered in 85 lots, divided into parcels of £100 and £50 each for the convenience of purchasers.

The Patent Paraffin Gas Lighting Company, Limited, of Glasgow, have lately put down a considerable number of installations of their oil-gas lighting plant for mills and mansion houses. Among the places fitted up during last summer and autumn outside Scotland were Powerscourt Castle and Hollybrooke House (Co. Wicklow), Lyons House (Co. Kildare), and the Calver Mills, Derbyshire. At present they have an order from His Grace the Duke of Sutherland, for Dunrobin Castle, Sutherlandshire. In this case the plant is to supply gas for the cooking as well as for the lighting of the castle.

At the meeting of John Wright and Co., Limited, next Thursday, the Directors will report that the profit for the past year, after further strengthening the internal reserves and charging debenture interest, Directors' fees, and Managing Directors' salaries and commission, amounts to £20,432. After adding the balance brought forward (£5759), and deducting the interim dividends paid in July last, there remains for disposal £21,451. The Directors have had brought under their notice the appeal to local manufacturing firms and companies for contributions towards the endowment fund of a University for Birmingham; and they suggest that a sum of £500 be given as a donation in aid of the scheme. The Directors recommend that the balance standing to the credit of the profit and loss account be appropriated as follows: Dividend at the rate of 6 per cent. per annum on the preference shares (less income-tax), £1740; dividend at the rate of 10 per cent. per annum on the ordinary shares (free of income-tax), £3000; a bonus of 10s. per share on the ordinary shares, £6000; addition to reserve, raising the fund to £15,000, £5000; endowment fund of the proposed University, £500—leaving £5211 to be carried forward. Surplus funds (£10,514) were invested during the year in debentures of the Company and first-class securities.

The annual general meeting of Richmond and Co., Limited, was held last Tuesday, at the Company's works at Stratford—Mr. E. W. T. Richmond, the Chairman and Managing Director, presiding. In moving the adoption of the report, noticed last week (p. 564) the Chairman expressed his pleasure at being able to inform the shareholders that the Company's sales for 1899 were 50 per cent. more than those for 1898. At the last meeting, he announced that the Plymouth and Stonehouse Gas Company had entered into a contract with the Company; and he was now pleased to state that in the past year they had secured a large contract at Dublin, and that the premises were open and doing an increasing business. He had only that morning come from Bournemouth, where they had obtained another important contract. The increase in the Company's business had been something phenomenal. Ten years ago they had very small works; and now they were paying over £50,000 a year in wages and salaries. The report and accounts were unanimously adopted; and dividends of 6 per cent. on the preference shares and 10 per cent. on the ordinary shares were declared. An extraordinary meeting was afterwards held at which a further increase of share capital was unanimously sanctioned.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale than all other Oxides combined. Purity and uniformity of quality guaranteed.
JOHN WM. O'NEILL, Managing Director,
160, 161, & 162, Palmerston Buildings,
Old Broad Street,
London, E.C.

Andrew Stephenson, Agent. All communications re Oxide to the Company as above.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for use in GAS-WORKS.
Andrew Stephenson,
182, Palmerston Buildings,
Old Broad Street,
"Volcanism, London." London, E.C.

EVESON Coal and Coke Company Limited. See Advertisement, p. 637.

BROTHERTON & CO.
Offices: Commercial Buildings, Leeds. Correspondence invited.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, Oldham; and 45 & 47, Westminster Bridge Road, London, S.E.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Addresses:
"Braddock, Oldham." "Metrique, London."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PRACTICAL RETORT SETTERS.

GEORGE NUTTALL & CO., 32, Havelock Road, Saltley, Birmingham.
Regenerator or other Furnaces erected to Engineers' own Designs. Best Work Guaranteed. Please write for Estimates.

GAS CARBON Wanted, not less than 4-Ton Loads.
Apply to the Brimington Carbon Company, Sowerby Bridge, Yorks.

AMMONIACAL LIQUOR wanted.
Brotherton and Co., Ammonia Distillers. Works: Birmingham, Leeds, and Wakefield.

SADLER & CO., Ltd., Middlesbrough, Tar Distillers and Tar Colour Manufacturers. BENZOL specially prepared for Gas Enrichment free from Sulphur. Pure Hydrated OXIDE OF IRON for Purifying Gas either for Sale or Lent on Hire. Always Buyers of GAS TAR and AMMONIACAL LIQUOR.

CANNEL, COAL, ETC.

JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application
No. 80, St. Andrew Square, Edinburgh, } Scotland.
Newton Grange, Newbattle, Dalkeith, }

SULPHURIC ACID for Sale.
Brotherton and Co., Chemical Manufacturers. Works: Birmingham, Leeds, and Wakefield.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "Porter, Lincoln."
[For Illustrated Advertisement, See p. 640.]

GAS TAR wanted.
Brotherton and Co., Tar Distillers. Works: Birmingham, Leeds, and Wakefield.

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c., CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special attention to Repairs.
Before placing Orders, please write for Estimate.
Telegraphic Address: "SATURATORS, BOLTON."

ENRICH your Gas with cheap Benzol. Specially prepared, free from sulphur. At to-day's Price of Benzol, ILLUMINATING POWER costs less than ONE-THIRD OF A PENNY PER CANDLE.
Apply to SADLER AND CO., MIDDLESBROUGH.

PATENTS FOR INVENTIONS. Messrs. J. C. CHAPMAN & CO., Chartered Patent Agents, ADVISE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

NEW GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

BENZOL, specially made for the Enrichment of Gas.
ELLISON AND MITCHELL, LIMITED, Kilnhurst, near ROTHERHAM.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

TO GAS AND WATER OFFICIALS.

HIGH-CLASS Cycles at reasonable and low Prices. Guaranteed for Twelve Months. Sent on approval. For Cash or Gradual Payment System. Send for Catalogue, Post Free.
MELROSE CYCLE COMPANY, COVENTRY.

WANTED, a Situation as Manager of Small Works or FOREMAN of Medium-sized Works. Good experience of modern Works, and excellent Testimonials.
R. ELLERSHAW, Gas Manager, SOLIHULL.

WANTED, a Situation as Assistant GAS MANAGER. Could undertake erection and working of Tar-Distilling Plant; also Ammonia and Sulphate Making.
Address No. 3442, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ADVERTISER (aged 30), experienced, and well connected in Inland and Export Gas Coal Trade, &c., desires APPOINTMENT. Chartering, French and Spanish, accustomed to Travelling, &c. Highest References.
Address No. 3446, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Advertiser, a Situation as MANAGER of a Small Gas-Works or FOREMAN of Medium-Sized Works. Thoroughly understands Retort-House Work. Can read and fix Meters, lay Services, and do inside Fitting, and is well up in the working, &c., of Slot Meters.
Address No. 3443, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a competent Gas-Fitter. Wages 30s. per week.
Send full Particulars as to Experience, Age, &c., to Mr. P. H. FLETCHER, Engineer, Gas-Works, EVESHAM.

WANTED, a first-class Sulphate MAKER. Must have experience with Schwab's Sulphate Plant. Must be steady and reliable. Wages 35s. per week.
Apply, by letter, to No. 3447, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a first-class Man as General FOREMAN at important Gas-Works. One with Mechanical training and knowledge of modern Gas Plant and Manufacture preferred.
Apply, by letter, stating Age, Wages required, and References, to No. 3444, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, at once, for a Small Gas- Works, a steady Man as STOKER. Must be used to Shovel Charging and Engine and Exhauster. Wages in Summer 25s.; in Winter 28s. A permanency to a good Man. Reference required.
Apply, by letter, to No. 3445, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ASSISTANT Manager wanted for the Manufacturing and Trading Departments. It is requested that only those will apply who possess a thorough practical knowledge, and have had experience in a similar appointment.
Applications, which must be made by letter (marked "Private"), must state full details of Experience, References, and Salary expected, and be addressed to the MANAGING DIRECTOR, the Welsbach Incandescent Gaslight Company, Limited, York Street, Westminster, LONDON, S.W.

WANTED, a Young Gas-Fitter of good address to act as METER INSPECTOR and SLOT METER COLLECTOR, filling up spare time in fixing Cookers, attending to Incandescent Lamps, and general House Fitting. An Abstainer preferred.
Apply, with Testimonials, and stating Wages required, to No. 3441, care of Mr. King, 11, Bolt Court FLEET STREET, E.C.

NEWPORT (MON.) GAS COMPANY.

WANTED, a Junior Draughtsman.
Apply to the undersigned, stating Age, Experience, and Salary required, with *copies* of not more than three recent Testimonials, on or before the 17th of March next.
THOMAS CANNING,
Engineer and Manager.
Engineer's Office, Newport, Mon.,
March 2, 1900.

NEWPORT (MON.) GAS COMPANY.

WANTED, at once, a Ledger Clerk, not over 30 Years of Age (one accustomed to Gas Ledgers preferred). Progressive Salary, commencing £90.
Applications, stating Age, and enclosing *copies* of Testimonials, to be sent, endorsed "Application for Ledger Clerk," not later than the 12th of March, 1900.
EDWARD F. MARFLEET,
Secretary.

BROADSTAIRS GAS COMPANY.

WANTED, at once, by the Directors of this Company, an Experienced and Competent GAS MANAGER and SECRETARY, to take immediate charge of their Works. He must have a practical knowledge of the Manufacture of Coal Gas, Sulphate of Ammonia, and the Laying of Mains and Services, and to have entire control of the same. Salary £200 per annum. Residence, Rates, Coal, and Gas free.
Applications must be made in Candidates' own handwriting, accompanied by three Testimonials of recent date, and addressed to the Chairman of the Broadstairs Gas Company, not later than March 13, 1900.

URBAN DISTRICT COUNCIL OF PONTYPRIDD.
(GAS DEPARTMENT.)

THE Urban District Council of Ponty- pridd are prepared to receive APPLICATIONS for the position of ENGINEER and MANAGER of their Gas-Works. Candidates must possess a thorough knowledge of the Manufacture and Distribution of Gas on the most modern principles. The person appointed must devote the whole of his time to the duties, which will include the preparation of all Books appertaining to the Management. Age not to be under 25 years, or over 45 years.
Salary at the rate of £3 10s. per week, with House, Coal, Gas, and Rates and Taxes free.
Applications, in Candidates' own Handwriting, accompanied by *copies* of three recent Testimonials, to be forwarded to me, the undersigned, marked "Manager," not later than Monday, the 19th day of March, 1900.
Canvassing will be deemed a disqualification.
MONTAGUE H. GROVER,
Clerk to the Council.
Council Offices, Pontypridd,
March 2, 1900.

THE DERWENT VALLEY WATER BOARD.

APPOINTMENT OF ENGINEER.

BY the Derwent Valley Water Act, 1899, the Derwent Valley Water Board are authorized to construct six large Reservoirs in the Valleys of the Derwent and the Ashop in Derbyshire, together with important subsidiary Works in connection therewith to deal with an estimated flow of Fifty Million Gallons of Water per day. The Reservoirs will be constructed successively; and the execution of these and the other authorized Works is expected to occupy many Years.
Applications are now desired for the position of ENGINEER to the Board. The Engineer will be responsible for the Designing and Construction of the Works. He will be required to reside in the neighbourhood of the Works, and to devote the whole of his time to his duties under the Board, and to have daily personal charge of the work in hand. The staff of Assistants, Inspectors, Draughtsmen, Clerks, and others necessary in the carrying out of the work will be provided by the Board, and be under the direction of the Engineer.
The engagement will (subject to the services rendered being satisfactory) be certainly until the first two Reservoirs are completed (this work it is estimated will take some Ten Years to carry out), and may be a permanent one. The Engineer on his part will be required to enter into an agreement to remain in the exclusive service of the Board until the first two Reservoirs are completed. The Board reserve the power of determining the engagement with the Engineer on giving him Six Months' Notice, in case his services are not considered satisfactory.
It is indispensable that Candidates for the appointment should have had considerable experience in designing and constructing Reservoirs and Gravitation Water-Works.
The Board reserve the right (which they will probably exercise) to appoint, or take the opinion of, a Consulting Engineer or Consulting Engineers on the Works, when and as desired.
Each Applicant must furnish at least two References and *copies* of Testimonials (which cannot be returned, and which preferably should be printed); the Board having the right to call for the production of the originals.
Applicants must state Age, Experience, Present Position, Salary required, when at Liberty, and general state of Health. Personal Canvassing will be a disqualification.
Communications to be sent to me not later than the 10th day of March, 1900, marked on the outside "Derwent Valley Engineer."
JAMES BELL,
Clerk to the Board.
Rowton Buildings, Bowling Green Street,
Leicester, Jan. 17, 1900.

DRAUGHTSMAN Wanted, for General and Constructional Engineering work.
State Age, Experience, and Salary required to WEST'S GAS IMPROVEMENT COMPANY, LIMITED, Albion Iron-Works, Miles Platting, MANCHESTER.

WANTED, a good steady Man as RETORT-HOUSE FOREMAN, accustomed to the control of Men, and with an Experience of Generative Settings.
Wages £2 2s. per week.
Make of Gas 350 millions per annum.
References (not Testimonials) only required.
Apply, by letter, to No. 3437, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a 30,000 cubic feet per hour EXHAUSTER, with Engine combined. New or good second-hand.
Apply, with full Particulars, to W. SMITH, Gas-Works, AYR, N.B.

FOR SALE—A 60-inch Letheby-Bunsen PHOTOMETER, and complete TESTING APPARATUS for Sulphur and Ammonia. All new in 1895.
Apply to H. MATTHEWS, Gas Examiner, CHELTENHAM.

ENGINES and Exhausters, from 1500 to 30,000 cubic feet per hour, in Stock, ready for delivery. No reasonable offer refused.
J. F. BLAKELEY, Thornhill, DEWSBURY.

LIVESEY Washer, 1 Million per diem, 18-inch Valves. MORRIS & CUTLER'S CONDENSER, 18-inch Valves. All in perfect order, and cheap.
J. F. BLAKELEY, Thornhill, DEWSBURY.

BOILER Tanks, several good ones. CAST SCRUBBER, 10 feet diameter by 20 feet (would make splendid Tank); also others. Two VERTICAL ENGINES. ROTARY EXHAUSTERS. Cheap to clear.
FIRTH BLAKELEY, Thornhill, DEWSBURY.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

FOR SALE — A Washer by Cockey. Size 10 ft. by 4 ft. 9 in. by 3 ft. 9 in., in four Compartments, with Manholes, Water-Supply Pipes, and 6-inch Gas Connections. All in good condition. Suitable for a Gas-Works making 12 millions a Year and under.
For Particulars, apply to the MANAGER, Gas-Works, Whittington, near Chesterfield.

YEADON GAS COMPANY

FOR SALE — Two second-hand Gas- HOLDERS of about 60,000 and 36,000 cubic feet capacity, with Columns and Guide-Framing complete. Can be seen at the Yeadon Gas-Works. Contractor must cut out and remove at his own risk.
Offers for one or both to be sent to
EDWARD LISTER,
Secretary and Manager.
Gas Office, Yeadon,
Feb. 28, 1900.

TENDERS FOR GAS COAL.

THE Corporation Gas Committee of Stoke-upon-Trent invite TENDERS for the supply of GAS COAL.
Specification and Form of Tender may be obtained on application to the undersigned, or at the Gas Offices.
Tenders to be sent in not later than Twelve o'clock noon, the 15th of March, 1900, addressed to the Chairman, F. Geen, Esq., J.P., Stoke-upon-Trent, and endorsed "Tender for Gas Coal."
WM. PRINCE,
Engineer and Manager.
Gas-Works, Stoke-upon-Trent.

STOKE-UPON-TRENT CORPORATION GAS-WORKS.

TENDERS FOR TAR AND LIQUOR.

THE Gas Committee are prepared to receive TENDERS for the purchase of the SURPLUS TAR and the whole of the AMMONIACAL LIQUOR made at their Gas-Works from the 1st of April next to the 31st of March, 1901.
Any further Information may be obtained at the Gas-Works.
Sealed Tenders, addressed to the Chairman, F. Geen, Esq., J.P., and endorsed "Tender for Tar and Liquor," to be delivered not later than March 15, 1900.
WM. PRINCE,
Engineer and Manager.

NELSON CORPORATION.
(GAS DEPARTMENT.)

TENDERS FOR ENGINE AND EXHAUSTER.

THE Gas Committee invite Tenders for the supply and erection of an ENGINE and EXHAUSTER at their Brierfield Works.
Full Particulars may be obtained on application to Mr. A. Allan, Gas Engineer, Nelson.
Sealed Tenders, marked "Tender for Engine and Exhauster," to be sent to me, the undersigned, on or before the 13th of March, 1900.
R. M. PRESCOTT,
Town Clerk.
Town Hall, Nelson,
Feb. 28, 1900.

CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE.
The Budget—An Injustice 663
London Gas Bills in Parliament 664
The "Policy" of the London County Council 664
A Lesson from Darlington 665
The Legal Discouragement of Strikes 665
WATER AND SANITARY AFFAIRS—
The London County Council and the Water Question—The Water Committee's Reply to the Report of the Royal Commission . . 665
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market 667
Electric Lighting Memoranda. 667
A New Aspect of the Naphthalene Question 668
Retort-Settings of 1850 and 1900 669
The Board of Trade Returns for February 669
American Coal in Europe 670
The Liability of Auditors 670
COMMUNICATED ARTICLE:—
Gas Companies and Peripatetic Gas Testing. By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S. 671
TECHNICAL RECORD:—
Society of Chemical Industry—Mr. R. W. Allen, M.A., on the Presence of Naphthalene in Coal Gas: A Novel Theory . . . 673
New England Association of Gas Engineers—Mr. F. H. Shelton on Pumping Gas Five Miles at 20 lbs. Pressure 676
The Production of Liquor Ammoniæ from Gas Liquor 678
Retort-Settings of 1850 and 1900 679
Sugg's Increased Pressure and Christiania Incandescent Burner Systems 680
REGISTER OF PATENTS:—
Making Gas for Heating Purposes—James, R. W. (The American Stoker Company) 681
Lanterns for Incandescent Gas Lighting—Talbot, H. 681
Generator and Regenerator Furnaces for Gas-Retorts—Drake, J. A. 681
Purifying Gas—Guillaume, N. A. 682
Fluid-Meters—Chesley, S. A. 682
Patent Notices 683
CORRESPONDENCE:—
The Presence of Naphthalene in Coal Gas 683
The Low Price of Benzol and Creosote 683
PARLIAMENTARY INTELLIGENCE:—
House of Lords—Progress of Bills 684
House of Commons—An Instruction in Reference to the South Metropolitan and Gaslight and Coke Company Bills; Progress of Bills 684
LEGAL INTELLIGENCE:—
High Court of Justice—Queen's Bench Division—Jones and Attwood *v.* Laindon Gas and Water Company and Others . . 684
Stealing the Plymouth Gas Company's Coal 685
Committal for Selling Infringing Mantles 685
Payment of Water-Rates for Small House Property 685
The Charge of Falsifying Books and Embezzlement 685
MISCELLANEOUS:—
The Damage to Gas-Mains through Sewerage Operations at Shrewsbury—Arbitration Proceedings 685
Incandescent Gas Lighting at Plymouth 687
The Scarcity and High Price of Coal from a German Point of View 688
Manchester Corporation Gas and Water Supply 688
Provincial Gas and Water Companies 689
Australian Gaslight Company. 691
Meeting of the Gas, Water, and General Investment Trust, Limited 691
Meeting of the Harrow and Stanmore Gas Company. 691
Meeting of the Hornsey Gas Company 692
Meeting of the Cagliari Gas and Water Company, Limited. . . 692
Electric Lighting Notes 692
The London County Council and the Water Question—Reply to the Report of the Royal Commission; The Government to be Approached 694
Gas and Water Companies' Stock and Share List. 695
Notes from Scotland. 696
Current Sales of Gas Products 697
Coal Trade Reports 697
PARAGRAPHS:—
PERSONAL: Mr. T. Jowett; Mr. Brooke Gibson; Mr. W. Lister; Mr. R. Porter; Mr. F. W. Ward Holland, Assoc.M.Inst.C.E.; Mr. John Chalmers; Mr. James Lyon 671
OBITUARY: Mr. William Brown; Alderman John White, J.P.; Alderman J. Maltby, J.P.; Mr. John W. Buckley 671
The Prevention of Electrolysis—The Value of Cyanogen—A Laboratory Note-Book—The Safety of the Staines Reservoirs . 666
Some Deep Borings for Water. 672
Preventing Waste of Water 679
Preventing Gas-Pipes from Freezing—Gas from Town Refuse . . 681
A Large Improvement in the Distribution System of the British Gaslight Company at Hull—Acetylene *v.* Electric Lighting at Sydney (N.S.W.)—The Gas Supply of Salford Out-Districts . . 683
Increases in Price 685
The Honley District Council and the Gas-Works—Reductions in Price—The Heckmondwike District Council and the Gas-Works—The Price of Gas and Workmen's Hours and Wages at Morley—A Gas-Works Offered for Sale by Auction 688
West Bromwich Gas Company—The Morley Corporation and their Gas-Workers 693
Heswall and Acetylene Gas—The Management and Development of the Birkenhead Gas and Water Undertakings 695
The Sale of Gas in Newcastle—Wellington (Salop) Water Supply—The Newport (I.W.) Town Council and the Gas-Works—Metropolitan of Melbourne Gas Company—The New Issue of Brentford Gas Stock—A Traction Engine Causes a Gas Explosion in Dublin—Coventry and the North Warwickshire Water Bill . . 698
Prepayment Gas-Meters at Nottingham—The Mutual Gas, Water, and Electricity Supply Company—Wallasey Water Supply—Failure of the Deep Boring for Water at Margate—Faringdon Water Supply—Compensation for Water at Leeds—Proposed Extension of the Walsall Corporation Gas-Works—The Water Supply of Castle Rising, Norfolk—Gas Discounts at Bradford—Southport Corporation and the Water-Works 699
The Blackbrook Water Scheme of the Loughborough Corporation—The Exmouth District Council and the Water Company—Visit of the Birmingham Association of Mechanical Engineers to the Saltley Gas-Works—Sevenoaks Water Company's Application for a New Provisional Order—Newhaven and Seaford Water Supply—Newquay District Council and the Water Company . . 700

EDITORIAL NOTES.

The Budget—An Injustice.

THE introduction of this year's Budget by the Chancellor of the Exchequer was signalized by a good deal of that kind of anticipatory movement described by Shakspeare as "alarums and excursions." Parliamentary tradition prescribes the giving of adequate notice of the introduction of the financial statement of the Administration of the day, in order that the Opposition may be prepared for an event which has sometimes determined the fate of a Government. Unfortunately, this candid practice has its drawbacks. The amenities of parliamentary conflict are dearly purchased at the cost of what it would perhaps be harsh to characterize as an illegitimate financial and business use of the usual notification. The circumstances count for everything in this connection. Our Imperial taxation is now based on so exceedingly narrow a foundation, that it is only too easy to forecast the direction in which a Chancellor of the Exchequer must proceed either to put taxes on or to take them off. Join to this knowledge the equally certain expectation of the financial necessities of the year which every educated citizen must possess, and it follows that men of business, and the Chancellor of the Exchequer, are obliged to play a more or less deep game whenever Budget day comes round. In ordinary times, the stakes played for are not large. When national income and expenditure are nearly balanced, Budgets are perforce uninteresting; the age of heroic experiments in taxation being past. This year, however, everybody knew that the Chancellor of the Exchequer would want very much more money than usual to pay for national defence, national justification, and national insurance. The "man in the street" had fully resigned himself to the conviction that a capital sum of one hundred millions sterling, or thereabouts, would have to be laid out on the British Empire. To do him justice, he thought that the investment was called for, and was prepared to find his proper share. But naturally, human nature being what it is, the Scriptural injunction to "bear one another's burdens" does not hold good in business. Income-tax payers, of course, knew they were in for it; they always are. The seat of political power has shifted since the memorable period when Mr. Gladstone promised to abolish this impost if he were returned to office. Income-tax payers may then have had the making and unmaking of parliamentary majorities; but this glory has departed from them. For many years the middle classes, the heaviest payers of income-tax, have paid into the revenue more than the share corresponding to their political power. This year, therefore, the income-tax was bound to go up, whatever else was done to raise the wind so heavily drawn upon in shouting "Rule Britannia." But there was also the indirect taxation to be thought of. An increase all round was recognized as inevitable. The only question for the general public was, "How much?" while for the alert and highly astute gentlemen trading in excisable articles the more pressing question was added, "When?"

What happened is history. Short as the notice of the Budget night was, the owners of excisable goods in bond trod one another under foot in their desperate endeavour to clear their property at the old duties. This temporary excitement over, the country finds itself laid under another fourpence in the pound income-tax, which consequently stands at one-twentieth of all dutiable annual values, profits, and emoluments. Well and good. The charge is not so much as our forefathers had to pay on occasions of emergency; and of course it will be paid now. But what of the other sources of revenue already alluded to? and what of the whole bearing of the national taxation? We venture to hold that it is high time the consciences of our statesmen were pricked by the reminder that they are one and all, irrespective of Party, following the dangerous practice of separating political power from liability to taxation. The new Budget is a particularly bad example of this evil. It makes a great parade of financial virtue, whereas it is really sunk in the depths of political profligacy. We say nothing about the much-debated questions of the proportions in which the cost of the war should be divided as between the Transvaal and the United Kingdom, or as between capital and revenue. There is something in the financial propositions of the Government of far deeper import than these passing problems. It is the principle—

implicit, though not avowed—that as much as possible of the indirect taxation raised by the Excise should be levied on the same classes of people as already pay income-tax; while the mass of the population shall be spared any additional impost. That this is the fact, a glance at the increased duties on excisable commodities clearly shows. Who will have to pay the shilling per barrel extra on beer, and the similarly heightened duty on spirits, tobacco, and other articles? Who but the purchasers of these goods in quantities sufficiently large to allow of an aliquot part of the higher duty being charged in the bill? Income-tax payers, to a man. The purchaser of beer by the pint, or of tobacco by the ounce, will not suffer. The merchant pays for him—another income-tax payer!

Of course, we do not deny that, in principle, indirect taxation is bad, and also admit that where it is prevalent the poorest of the community suffer most. The "Daily News" puts it that "to indirect taxation a man contributes in the "inverse ratio of his means." This is true; but the sting of the truth is taken out when the indirect taxation is levied almost exclusively upon articles which men can mostly go without. Besides, there is a fine art in adjusting wholesale costs to retail prices, which we suspect the advisers of the Chancellor of the Exchequer know, or imagine they know, something about. The value of the units of currency chiefly employed in small marketing transactions, the corresponding subdivision of weights and measures, are among the things that determine when and how far variations of wholesale costs, including taxation, shall come down to the retail purchaser. Raise a shopkeeper's rent by any amount, he cannot charge more over the counter for his wares. Increase the expenses of commerce in some ways, and up go retail prices directly—and at times with advantages to the dealer. Not to labour the point, we contend that it is well within this margin, in which the merchant pays the difference of duty, that the exercises of our Chancellors of the Exchequer in search of additional revenue are conducted. The dumb income-tax payer pays for all, or very nearly all, that the Government profess to put upon other men's shoulders. This may be prudent politics, but it cannot be sound statesmanship.

London Gas Bills in Parliament.

The House of Commons have committed the Bills of the Gaslight and Coke Company and South Metropolitan Gas Company, subject to modifications of the "Instructions" mentioned last week as awaiting the judgment of the House. Almost for a wonder, these instructions were not ruled out of order; but when they were moved, Sir James Rankin, who was Chairman of the Powers of Charge Committee, brought forward as an amendment words which converted the mandatory direction to the Committee into an optional matter. This was quite right and proper, if only because the House has never had an opportunity of hearing the Companies interested, or of expressing its judgment on the Committee's recommendations. As the instructions stood, they were tantamount to acceptance of some of the recommendations picked out from the others. The President of the Board of Trade approved of Sir James's suggestion, and remarked that he thought the two Bills would go before the same Committee. The case of the Gaslight and Coke Company's Bill was distinctly more difficult for the House to leave open than that of the South Metropolitan, for a particular reason stated in the short debate. However, in the event, all went satisfactorily. There is every prospect of the Bills getting into Committee by an early date, as the House is ploughing through its Private Bill business at a brisk rate. The constitution of the Committee on the London Companies' Bills will be a serious consideration, to which we may be sure that ample attention will be given by the authorities. There is no reason to expect, however, that the proceedings of the Committee when the Bills come before them will be protracted by the hearing of many witnesses. Very little expert testimony will be needed to put the Committee in possession of the merits of the Bills; and Counsel will probably abstain from superfluous rhetoric.

The "Policy" of the London County Council.

It was imperative that the Water Committee of the London County Council should without delay set about preparing a rejoinder to the strong report of the Royal Commission on the Water Supply of the Metropolis. The particular subject-matter of this statement, which was adopted by the County Council as a thing of course, is dealt with in another part of the "Journal;" but the general character of the spirit and manner in which the work of the Royal Commission is received by the County Council is worth noticing here. Having assumed the part of prosecutors of the Water Companies from the first moment of their corporate existence, the County Council continue in the same way; and their rejoinder—it is not to be called an answer—to the Commissioners' report is strictly analogous to the closing speech of Counsel for the prosecution before the issue is put to the Jury. Thus, the registered pious opinion, which was fully formed and expressed years before the County Council came into being, that the water supply of London ought on theoretical grounds to be in the hands of a public authority, is coolly appropriated by the County Council as "its policy of purchase and public ownership." The formal acceptance of this opinion by the Royal Commission, not as proved, but as something they could put behind them, is also taken possession of in the same sense. With regard to the practical questions of how the expropriation of the Companies might be effected, what kind of public authority should take over the undertakings and be responsible for the supply present and future, and what might be expected to follow upon the transfer financially and otherwise, the report of the Royal Commission, it will be remembered, was dead against the pretensions of the London County Council. Upon the whole of this part of the case, the County Council can, therefore, only say that they still retain their old opinion. Of course; but, happily for the population of London, the final decision in the matter does not rest with the present majority of the Council. The Council want to buy up the Companies, on special terms to be prescribed by a Special Act of Parliament. They set at naught the objections of other involved Authorities, as honourable as they, to the realization of this desire, with the lofty remark that "we cannot help "thinking that when once purchase is effected, the future "arrangement for the Metropolitan Water Supply would "not be difficult of settlement as between the various "Authorities." Cannot one hear Mr. Littler, the Chairman of the Middlesex County Council, and a man of considerable experience in these matters, murmuring thanks on behalf of the county to the authors of these generous sentiments? It is a fact, as true as it is painful, that not a single public Authority or private Corporation concerned in the question has a good word to say for that part of the water policy of the London County Council which is its very own.

An aspect of the general question with which we are specially concerned is the way in which the London County Council have endeavoured to impose their views upon the public Press. There are some newspapers conducted by men who keep a level head in regard to municipal politics; but others, who ought to know better, are making a sad mess of their task of helping to form public opinion upon the subject. Take the following, for a specimen of ineptitude dashed with prejudice: "The majority of the Council "demand the same right to provide and control the supply "of water as every other municipal body in the United "Kingdom possesses." This is about as correct a definition of the issue as the celebrated French description of a crab as "a red fish which walks backwards;" to which it was objected that it was only wrong in that a crab is not red, is not a fish, and does not walk backwards. So here, the London County Council is not a Municipality; and only those Municipal Corporations who have obtained special and particular statutory powers for the purpose enjoy the "right" to provide and control the water supply of their districts. It is grotesquely untrue to say that every municipal body possesses this "right." Moreover, the claim of the London County Council in this respect is characterized as being "modest." Modesty, like morality, is perhaps a question of latitude. What is perfectly certain is that, if the London County Council were a Municipal Corporation with exclusive powers of local government over a district approximately coterminous with the water-supply area, and if they were content to approach the problem of municipalizing the existing undertakings in the same way as Municipal Corporations and Local Authorities throughout the country have had to do it, Parliament would be able to determine the question of the expediency of transfer on its merits.

This, however, is precisely what the London County Council cannot and will not do in the circumstances. The fate that now attends their actual proposals in this regard

is of enormous moment for the owners of all properties of similar character to the London water undertakings. They want to ride roughshod over all opposition from public authorities as good as themselves. They want the Legislature to accommodate them with special terms of purchase, such as no other Local Authority with similar desires has ever enjoyed. Meanwhile, before negotiations for the purchase have been originated, they want statutory permission to attack the Water Companies in the rear by bringing in an independent supply which none but their own paid officers affects to consider necessary or expedient. And all this is a "modest" programme! The County Council should approach the London School Board, and get a new dictionary put into circulation for the use of young Progressives.

A Lesson from Darlington.

A BEAUTIFUL illustration of the advantages of Municipalism as applied to gas supply was reported in the "JOURNAL" last week from Darlington. It is always taken for granted, whenever the comparison is made between the public and private ownership and control of such a business as that of gas supply, that the quality of the administration is the same in each instance. This assumption, of course, underlies the whole case for municipalizing such undertakings. Now, it is not necessary to argue that Gas Companies are always well administered, and Municipal Gas Departments never, in order to show that, all things being equal, the probability is that the average Gas Director will understand his business better than the average Gas Committeeman. If this only means that the former knows how to take advice better than the latter, this is no small recommendation. The truth is that the Director has a sense of undivided interest and responsibility, which the "scratch" Town Councilman lacks. This is the true lesson of the Darlington example. Here, three years ago, the necessity of enlarging the gasholder room became urgent; but the Town Council did not see it. Three years have passed; and the urgency has become feverish. The additional accommodation is to be provided; but meanwhile prices have risen, and the delay will cost the town a fine of from £6000 to £10,000. Still, the amateur gas administrator of Darlington babbles of the growth of the electric light, and other matters. How did he get elected on the Town Council? Certainly not for his ability to carry on business in a businesslike way. Is every shoedealer to shut up shop because another man "opens" over the way? So long as trade increases, does it matter one jot how many try to profit thereby? Truly, the marvel grows, whence do they get these Town Councillors? A man who has it in him to manage an apple-stall might be a more eligible Gas Committeeman than nine out of ten of the self-styled "practical men" who undertake the duty. Gas administration, like most other industrial affairs, requires soberness of judgment and a power of appreciating evidence. A Gas Director knows that he is responsible for providing all things needful for keeping up the service. When he is told what the rule for the proportion of gas storage to daily output is, he has common sense enough to know that the rule must be correct. Not so, apparently, some Gas Committeemen. There may be too many of them, or their tenure of power is too short, or something—the fact still remains that at Darlington they have been trying to rub along with half the normal amount of gasholder room, with the inevitable results of dear working. Now it is dear gasholders as well.

The Legal Discouragement of Strikes.

THE unrecognized, but most powerful, of the practical resources of militant Trade Unionism are now one by one coming under the repressive power of the law of the land. It was noticed in these columns some time ago that the Associated Trade Unions had abandoned their idea of appealing against the legal decision which made picketing unlawful, by putting it upon the same footing as besetting. This intelligence has lately been circulated officially by the Employers' Parliamentary Council. In view of this, what all the Federations of Trade Unions of which one hears occasionally are good for, if it is not for trying fundamental issues such as that to the last extremity, it would be really hard to say. Picketing in force has always been regarded, justly, as part of the tactics of a strike in action. Without it, there must be the greatest possible difficulty in differentiating a strike, from a desertion in mass. Strikers will henceforward have to rely upon the moral strength of their cause to gain their end. A strike ought consequently to be called in future by some other name. Last week the long-pending question of the legal right of strikers to go upon the poor-rates for relief was also decided in the negative. It will be remembered that the question arose out of the South Wales colliers' strike in 1898, when the men sought to make amends for having omitted to provide themselves with a strike fund, by going on the rates. It has been delicately said in this connection that the Guardians found themselves confronted with a problem of considerable difficulty. But inasmuch as they might conceivably have been elected from the same order as the strikers, whereas the largest ratepayers were the very colliery owners against whom the men were striking, the difficulty may have been theoretical only. At any rate, the Guardians relieved the strikers; and the ratepayers brought them to book. Lord Justice Romer, who heard the case first, held that Guardians need only satisfy themselves of the fact of destitution in dispensing poor-law relief. The Appeal Court have now decided differently. They allow the right to relief of the families of strikers, and also of outside workmen prevented from earning their living by a strike not of their making. Strikers, however, who can have work for the asking are not entitled to be supported in idleness at the expense of the ratepayers. The judgment will perhaps be a little difficult to work in practice; but it is a salutary pronouncement bearing the impress of common sense. It now remains to be seen what the Local Government Board will do concerning the surcharging of the £25,000 that was illegally spent in this way by the Guardians of the Merthyr Tydvil Union. It is a serious amount in any case; but in the circumstances a crushing liability.

WATER AND SANITARY AFFAIRS.

THE meeting of the London County Council last Tuesday was made specially interesting by the presentation by the Water Committee of their views on the report of the Royal Commission on the Metropolitan Water Supply. The Committee devoted four weeks to the study of that document; and the result is embodied in the report which they laid before the Council, and of which an abstract appears in another column. The Committee, as is not surprising, agree and disagree with the Commissioners. When the Council came into existence eleven years ago, they immediately proceeded to press forward their policy of "purchase and public ownership of the Metropolitan Water Supply;" and the Committee claim that in the expression by the Commissioners of the opinion that it is desirable that the undertakings of the Water Companies should be acquired and managed by a public authority, they affirm the main principles for which the Council have contended, and use the very arguments which have been employed in support of their policy during the progress of the controversy. But when the Council talked of "public ownership," they, of course, meant possession and management by themselves; whereas when the Commissioners speak of a "public authority," they have in their minds a specially constituted body. This is the point on which there is difference of opinion. However, the Committee recognize in the Commissioners' recommendation as to purchase a distinct appreciation of its advantages. The question then arises as to the terms upon which it is to take place. The Committee submit that the London Water Companies have been established by Parliament on the basis of competition, and are still liable to it. This fact, which the Commissioners admitted, they consider differentiates their position from that of the water undertakings in the Provinces which possess an absolute monopoly, and justifies the Council's claim that they should be brought specially under the notice of the arbitrator. The liability to competition may possibly still exist; but surely it is very remote. The Companies, if not monopolists, are in possession of privileges which have been conferred by Parliament; and these will have to be taken into account when the worth of their undertakings comes to be appraised. The fair value of these, the Committee frankly acknowledge, will have to be ascertained by a court of arbitration of the highest standing, and armed with the fullest authority to inquire into all the circumstances of each individual case. In other words, the arbitrator must have a perfectly free hand.

The Committee naturally object to the proposed Water

Board. The Council thought they ought to be the Water Authority for London; and the Commission held a different opinion, on the ground of the Council being pledged to sever the undertakings and carry out their Welsh scheme. The Committee think that if the Board were created, one of their earliest acts would be to bring about a "dissolu- "tion of partnership," if the outside Local Authorities were bent on severance. Moreover, as several of them are anxious that no more water should be drawn from their areas, which the Committee say are "already depleted," they consider it not inconceivable that the new Board would arrive at the conclusions come to by the Council in regard to resorting to Wales. We think they would be far more likely to utilize to the utmost the sources of supply lying close at hand. But when the purchase of the undertakings has been effected, the Committee think a settlement with the various authorities will be easy; and they suggest that the Council might be authorized to supply them in bulk, as proposed in the Bill now before Parliament. There is something in this idea, assuming that the authorities are willing to be dependent upon the Council for their water supply. We are inclined to think they would prefer taking it from a body upon which they were directly represented. This matter of representation on the proposed Board is another point on which the Committee and the Commission are at variance. It must be acknowledged that the Council's representation to the extent of 33 per cent. of the total number of members is lower than that contained in previous proposals; Lord James, in 1896, giving them nearly twice this proportion—18 out of 30. The Committee think the Council would, on the ordinary basis of population or rateable value, be justified in claiming at least 21 out of 28 seats allotted to various representative bodies; and the Commissioners' proposal of 10 appears to them to be one which can never be fairly imposed upon London. Their suggestion would, of course, give London a permanent majority. This, however, is, to a certain extent, a detail which could be dealt with later on. The first thing to be done towards settling the Metropolitan Water Question is, as the Committee remark, to obtain some decision by Parliament upon the method and principle of purchase, quite apart from the question of management; and they think this could be done in the present session. We agree with them that, in the public interest —and, it may be added, in that of the Water Companies also—this matter should be settled at once. The report closes with some remarks on the future supply of water to the Metropolis and the comparative cost of the Welsh and Thames supplies. These are dealt with elsewhere.

The presentation of the report did not give rise to a very angry debate, though it was prolonged; a spirit of conciliation seeming to pervade the Council. Mr. Dickinson, the Chairman of the Water Committee, warned the Conservative members that they had taken upon themselves a very grave responsibility in deciding to ask for the rejection of the Council's Bills. The Council must, he said, either go forward with their purchase policy or they must drop it; and to enable them to do the former, he would not say that they would not be justified in accepting something less than they had asked for. He charged the Commission with looking on the matter of the price to be paid for the water undertakings from the worst point of view, as far as the public were concerned; and he was sanguine enough to believe that, when the settlement came, they would find they had made a better bargain than that which the Commissioners had forecast. He, of course, upheld the carrying out of the Welsh scheme in preference to the construction of "hideous reservoirs" in the Thames Valley. He characterized the proposed allocation of seats on the Water Board as a gross injustice to London. However, though his Committee did not agree with some of the suggestions of the Commissioners, they were willing to "effect a compromise;" and they thought that, as a first step, the Government should be approached with reference to the Council's Bills. Mr. Harris, as leader of the Moderate party, could not understand upon what lines they were to go to the Government. He pointed out that the Commission had condemned the policy of the majority of the Council. How, then, could they ask the Government who had appointed the Commission to sanction the carrying out of that policy? He thought the object of the deputation should be to endeavour to obtain some definite action on the broad lines laid down in the report of the Commission, rather than to discuss the Council's Bills. He moved an amendment to this effect, and Mr. Beachcroft gave support to it. Mr. Whitmore, while expressing satisfaction at the conciliatory tone of Mr. Dickinson's speech, denied that the London Conservative members were acting as obstructives on the water question. He, however, appeared desirous of holding out the olive-branch; for he invited the Progressives and the Moderates to join hands in trying to get the Government to deal with the water question on the basis of the conclusions come to by the Royal Commission. The suggestion was a good one. There has assuredly been enough wrangling and waste of money over this matter. The present may, as Mr. Whitmore suggested, be an opportune time for sinking all differences on a question which should never have been made a party one, and obtaining a satisfactory settlement of it. Sir Arthur Arnold, who has already figured as a conciliator in this connection, offered his congratulations to the Council on their remarkable unanimity on the subject of approaching the Government. Mr. Stuart followed in the same strain; suggesting an addition to the Committee's recommendation which would connect the report of the Commission with the object of the deputation. An appeal was then made to Mr. Harris to withdraw his amendment; but he stubbornly declined to make any answer. His silence was, however, not taken to mean assent; for there was a division on his amendment, which was rejected, and that of Mr. Stuart carried. The Council will now endeavour to have an interview with the First Lord of the Treasury. In the meantime, their Bills, which were down for second reading to-day, will not at present be pressed forward.

The Prevention of Electrolysis is the object of a Bill introduced into the Washington House of Representatives a short time ago by Mr. Joseph A. Babcock. It provides that within 60 days of the passing of the Act all the electric railways in the District of Columbia must file plans for equipping their systems with the double-trolley "or other equally good insulated metallic-circuit system." Within 30 days of the passing of the Act, all electric light, heat, and power companies must file plans to prevent any grounding of their circuits.

The Value of Cyanogen.—At the meeting of the Rochdale Literary and Scientific Society on the 16th ult., Mr. T. Stenhouse, F.I.C., F.C.S., delivered a lecture on "Cyanogen, the Latest Gas-Works Residual." Having shown how cyanogen is obtained from gas, he pointed out that compounds of the substance are required in increasing quantities, owing to the fact that a dilute solution of potassium cyanide is now employed for extracting gold from poor ores and from refuse heaps of previous extractions. After explaining the process by which the compound is used for this purpose, he went on to say that from Rochdale gas about 50 grains of cyanogen are extracted from 100 cubic feet, equal to 2 lbs. of potassium ferrocyanide per ton of coal carbonized. In the course of his remarks, Mr. Stenhouse mentioned that he had devised a method whereby the amount of cyanogen in a small quantity of gas could be readily determined.

A Laboratory Note-Book.—We have received a copy of a useful "Laboratory Note-Book for Chemical Students," prepared by Professor Vivian B. Lewes, of the Royal Naval College, Greenwich, and Mr. J. S. S. Brame, the Demonstrator in Chemistry at the College, and Assistant-Examiner in Chemistry to the Science and Art Department. The authors state in their preface that the book has been prepared without reference to any particular syllabus or examination, and is intended to cover such practical work as a student should be familiar with if he is to have a good groundwork in the subject of practical chemistry. It is essentially for the laboratory bench; and the primary object of the compilers has been to place in the student's hands a note-book which shall contain all necessary working directions—leaving to him, as far as possible, the theoretical explanation of the chemical reactions which ensue. The book is published by Constable and Co., Whitehall Gardens.

The Safety of the Staines Reservoirs.—In the "JOURNAL" last week (p. 596), reference was made to the alarmist letter on the above subject by Mr. Shaw Lefevre which appeared in "The Times" on the previous day. The object of the letter was perfectly obvious. Our readers are aware that the Staines works are being carried out by Messrs. John Aird and Sons, for the Reservoirs Joint Committee, in accordance with plans prepared by Messrs. Hunter and Middleton, the Joint Engineers to the Committee; and in a letter in yesterday's "Times" the eminent firm of Contractors, who have in hand the gigantic works on the Nile, expressed themselves as follows on the Staines scheme: "We have no hesitation in saying that the works when constructed will be complete in all respects, and amply sufficient, both as regards the strength of the banks and the puddle wall, to stand against any pressure they may have to carry. For the last forty years we have been constructing reservoirs, not only in the Metropolitan district, but throughout the country, and cannot call to mind any engineering work of a similar kind which in all details is more complete."

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 695.)

Business on the Stock Exchange last week was on a very limited scale, taking the markets all round. The public are still holding their hands, and doing next to nothing. The general tendency was steady, though at the opening some little anxiety prevailed lest the cancellation of the Queen's visit to the Continent should have any political significance. This was soon allayed, and a better feeling set in, especially over the Budget developments. Thenceforward to the close extreme quietude ruled; the issue of the new War Loan being awaited with much interest, and several dealings in it at fair premiums being effected before its exact terms were published. Votaries of the golden calf worshipping the unknown god! Prices are not uniformly higher by any means; but Consols had a nice rise. The other gilt-edged securities were much neglected; being quite overshadowed by the War Loan. This came out on the closing day, and made a very busy Saturday. The premium advanced considerably; and there is every prospect of an immense subscription, with the inevitable result that many applicants will be disappointed. The Money Market has been extremely brisk, affected not only by the Loan, but by large operations in produce clearance to anticipate the new Budget imposts. Business in the Gas Market was brisk; and some of the leading issues were quite active. There was no settled tendency; movements being irregular, and there being almost as many in one direction as in the other. In Gaslight issues, the ordinary opened at 106; and after a little hesitation began to give way, gradually falling to 103⅝, but the closing mark was 104½. The attempt made in the House of Commons to burke the Company's Bill happily failed; and the measure will receive fair consideration in Committee. The secured issues were quiet and strong. South Metropolitan showed renewed animation, and, after changing hands at 134¼ on the opening day, commanded 137 on Thursday, with a rise of two points in the quotation. A few bargains in Commercial old were marked at good figures; and the debenture stock advanced a point. Hardly any business was done in the Suburban and Provincial group, except in British; and prices were left standing. In the Continental Companies, transactions were only limited; and things ruled flat—Imperial receding, and Union doing the same in a greater degree. Slight changes for the better in Bombay and River Plate were the feature among the remoter undertakings. In Water, business was quite as limited as usual; and there were no movements, except in Kent, which was set back considerably. It is believed this was owing to some misgiving (probably unfounded) as to the continuation of payments in respect of back-dividends.

The daily operations were: Gas opened fairly active, and movements were favourable. South Metropolitan rose 1, and Bombay ¼. Tuesday was brisk; but prices moved the other way. Continental Union fell 4, Imperial 2, and Gaslight ordinary 1. Wednesday's doings were almost wholly in Gaslight ordinary; prices remaining unchanged. In Water, Kent fell 5. Thursday was rather quieter; and only River Plate gained ¼. Friday was but moderately active; and movements were irregular. South Metropolitan advanced 1, and Gaslight ordinary receded 1. In Water, Kent fell 15. Transactions on Saturday were largely in Gaslight secured issues at good figures. Commercial debenture rose 1, and Bombay new ¼.

ELECTRIC LIGHTING MEMORANDA.

The Fire in Maiden Lane—The Facts of the Case—Reflections and Questionings.

The event of the week in electric lighting circles has been the fire at the Maiden Lane Station of the Charing Cross and Strand Electricity Supply Corporation. Possibly, the sufferers from this conflagration and their friends will modestly disclaim for their trouble anything like the importance that some people might be disposed to assign to it. The official account of the occurrence, which was promptly circulated among the shareholders in order to prevent a panic, merely acknowledges the fact that "considerable damage was done to the works, which, however, is substantially covered by insurance." The lighting of the southern district of the Company's area was "prejudicially affected" for some hours; but by the same afternoon the supply was resumed to the theatres and several other large buildings, and the rest was restored about three days afterwards. The highest praise is given to the Company's Engineer, Mr. W. H. Patchell, to the Secretary, Mr. Wilmot Seale, and to the staff generally for the celerity with which the damage was repaired. The consumers, also, seem to have taken the interruption very good humouredly; and the circumstance of the Company having been able to keep the theatres going, by means of temporary connections with other stations, saved the situation. So far, good; but the incident is full of "morals" for those who would fain persuade themselves that a reasonable degree of immunity from risk of breakdown is among the gains of electric lighting progress. We have committed ourselves so completely to the opinion that reliability of the service is not one of these gains, that we must take leave to discuss the Maiden Lane case from this standpoint, without desiring in the least to reflect upon the Company in any particular sense.

What are the facts of the case, put as briefly as possible? On the night of the 2nd inst., the Maiden Lane station was running as usual, and as it has done for ten years—this being the oldest of the Company's stations. For the information of those who only know the principal thoroughfares of London, it may be remarked that Maiden Lane lies at the back of the Strand (to the north); and that the generating station is opposite to the Hotel Cecil, and in the very heart of the amusement quarter of the town. The work of the night had been done; for by 1.40 a.m. even the Strand district is getting quiet. All was in order, when the night-shift engineer "noticed a smell of burning coming from the vaults below the station, where the cables enter." The machinery still working was going well; and there was no sign of any short-circuit. The pressure on the mains was 100 volts; and the cables were insulated in different ways. Some were covered with vulcanized "bitite"—whatever this may be; others were lead covered, or protected by armoured jute. All the same, scarcely had smoke been seen and smelt before flames burst out, and ran up through the brick channel in which the cables lay to the switchboard in the engine-room, which is of slate mounted on an iron frame. The fire had such hold, and burnt so fiercely, that the men could do nothing but shut down the machines and quit the premises "in haste." Then the Fire Brigade came; and the whole thing was over in a couple of hours. The Engineer, summoned by telephone, was next to arrive; and a cheerful prospect met his eyes. Regarded as a fire, it was only a very small affair—the building being little damaged. Inside, however, the switchboard was completely demolished; the cables were rendered absolutely useless; the generating plant (seventeen motor generators and five steam dynamos) was all damaged; and the leads from the accumulators to the switchboard all fell together, so that presumably the battery will have been considerably injured. Says the "Electrician," in continuing the story of the wreck: "All the cables leading into the Maiden Lane station had first to be disconnected, as they were short-circuiting the network; and the stations at Lambeth and Short's Gardens then took all the load until the evening, when it was found possible to start two of the steam dynamos." Another account states that "there was not a vestige of insulation left anywhere—the wire being perfectly clean;" and that the work of testing and adding the machines to the system occupied all the week. What has not been said, however, until this present, is that indispensable assistance was rendered to the distracted engineers at the station by the district officers of the Gaslight and Coke Company, who, being appealed to, lent lamps and gave all the help in their power to Mr. Patchell in his emergency.

The origin of the fire is unknown. The "Electrical Review" says, on this head, that "there is not one iota of evidence that the fire was an electrical one." If our contemporary imagines that there is any comfort in making a mystery of the matter, it is very greatly mistaken. "A fault confessed, is half redressed." So long as the origin of the mishap now in question remains in doubt, uneasiness and mistrust will exist and spread. Let us know what was wrong, and confidence will be in a measure restored. It will be far better for the Company, if they know the cause, whether it was of an electrical nature or not, to make a clean breast of it. Otherwise, it must be concluded that a bundle of insulated cables charged with a low-pressure current may burst into flames at any moment; and where is the security then? And this is the Company that wants to supply the City of London with a better service of electricity! The example of Maiden Lane is not calculated to inspire confidence in the system identified with the mysterious fire.

There is yet another thing to be considered as a lesson of this fire. Where would the undertaking have been without the supplementary stations at Lambeth and in the Holborn district? An electrical journal remarks that Mr. Patchell had cause to bless his stars for this resource, "as it has enabled a supply to be given to all consumers when some at least might reasonably have expected to have to do without it for a few days." It must be remembered, in order to appreciate the full gravity of this reflection, that the Maiden Lane fire was a small one—not extending to the battery room, boilers, or offices. Yet without the help of the other stations, the district might have been without electricity for a week! It is tolerably safe to say, it would not have been in darkness all this while. Thirty theatres and music halls, and supper-rooms without number, would have suited themselves with light long before the end of the week; and the Electric Lighting Company would have been at a very loose end. This being the prospect, if all the Company's eggs had been in one basket—what is to be said for the wisdom of the new electricity-in-bulk plan of action which the Metropolitan and other London electricity supply undertakings have now in hand? Supposing Maiden Lane to have been at Willesden, or at Rotherhithe, or even in the middle of the nearest coal-field, and assuming it to have been a hundredfold bigger—would the circumstances have been different?

Professor Rücker, one of the Secretaries of the Royal Society, has been elected President of the British Association for next year. He is a physicist of European reputation, and was for a time one of the Metropolitan Gas Referees.

A NEW ASPECT OF THE NAPHTHALENE QUESTION.

In the "Journal" for Sept. 5 last year, we were able to point to the good work done by Mr. R. W. Allen, M.A., in adding to our store of scientific data bearing on the naphthalene question. Elsewhere to-day (p. 673) we publish the substance of a paper read before the Society of Chemical Industry, in which Mr. Allen supplements the account we had already given of his researches. Moreover, he is now no longer content merely to collect trustworthy data for the common weal; he advances a theory of the cause of naphthalene deposits in mains which has at least the merit of novelty. As the discussion which followed the reading of Mr. Allen's paper was considerably hampered by the fact that the speakers had had no opportunity of ascertaining previously the trend of his researches, we hope that others will follow the example of Mr. R. Forbes Carpenter, and take an opportunity to renew it in our "Correspondence" columns.

The experimental data, which supplement and correct the table given on Sept. 5 last (p. 595), cannot fail to be of great service. Incidentally, we may point out that they indicate conclusively that the mixture which we know as coal gas, behaves, in so far as capacity for carrying naphthalene vapour is concerned, exactly as air or a simple gas, such as hydrogen. Now, though theoretical considerations would have led us to anticipate this fact, as Dr. Hehner pointed out to Mr. Allen, yet some gas engineers have endeavoured to explain depositions of naphthalene on the assumption that coal gas could not retain so much naphthalene as would saturate a simple gas at the same temperature, because it contained also vapours of other hydrocarbons. It has been shown experimentally by Mr. Allen that the presence of these vapours does not diminish the amount of naphthalene vapour which a gas can retain. Experimental proof of such a point will convince many who would be inclined to doubt the validity of a theoretical deduction from well established general laws; and Mr. Allen has done the gas industry good service in furnishing such proof. We know now, at least, how much naphthalene vapour coal gas under normal conditions is capable of retaining at given temperatures.

Mr. Allen incidentally referred to the fact, already pointed out by us, on Sept. 5 (p. 591), that at about 60° Fahr. his figures coincide with the quantity of naphthalene recovered from coal gas by Dr. Bueb, by washing the gas, as it leaves the tar-extractor, with heavy oil. Consequently, we may draw the inference that at this point on the works coal gas is normally saturated with naphthalene vapour. Therefore, if at any point in the distributing system the gas is found at the same or a lower temperature to be not completely saturated with naphthalene vapour, it is evident that the naphthalene must have dropped out at some intermediate point. If it had been absorbed by tar or by hydrocarbons condensed as liquid from the gas, it would have been removed with the tar or condensation products from the system. But failing absorption by such agents, it must have been deposited in the solid state at some point where a lower temperature or much friction induced the deposition.

Now Mr. Allen, according to his method of investigation, found gas delivered from the service-pipes very nearly free from naphthalene. He has therefore to account for the disappearance of the naphthalene, which undoubtedly occurs in freshly manufactured gas in quantity nearly approaching, if not attaining, the limit of saturation of the gas at ordinary temperatures. Mr. J. W. Helps offered Mr. Allen one explanation of the disappearance of naphthalene—viz., prolonged contact of the gas with the tar; but this explanation was coupled with the information that gas thus treated did not produce naphthalene deposits in the distributing system. The gas which Mr. Allen found to be nearly free from naphthalene was, however, stated to produce such deposits. Here are anomalies, which will need reconciliation before gas engineers can seriously entertain Mr. Allen's hypothesis of the synthesis of naphthalene in the mains. Briefly, unless the records of the oil-washing processes are incorrect, gas under ordinary circumstances leaves the works charged with naphthalene vapour. Because at some point in the distributing system Mr. Allen was unable to trace the presence of much naphthalene, while deposits were found at other points, it is not reasonable to assume that there is no connection between the naphthalene originally present in the gas and the deposits found in the mains. Let us examine the grounds on which Mr. Allen would have us discard so probable a connection in favour of an independent synthesis in the mains of the naphthalene which constitutes the deposits.

According to Mr. Allen, a formation of naphthalene in the pipes themselves would satisfactorily account, among other things, for such facts as the following: (1) That deposits generally occur locally, and in those pipes where the temperature, &c., fulfilled the conditions necessary for the formation of naphthalene. (2) That no naphthalene could be detected in the gas employed in the researches, for that gas may be assumed never to have passed through pipes where the conditions were favourable for the formation of naphthalene. (3) That gas proved to contain less naphthalene as it enters the mains than can ever saturate it at the temperatures to which it will be subjected in the course of distribution, nevertheless causes great trouble from naphthalene deposits.

Perhaps it would have been better if the third of Mr. Allen's facts had been stated before the first and second, as the above order of precedence raises a suspicion that the discovery of conditions under which naphthalene might conceivably be formed in gas-mains preluded the researches which made it appear necessary to explain the occurrence of deposits by such formation. In reality, however, we gather that Mr. Allen first made the latter researches. Therefore, considering the third of his facts first, we are fain to ask if he really did prove that gas *as it enters the mains* contains much less naphthalene than suffices to saturate it at ordinary temperature. We understand that he made his experiments at some distance from the works; and we do not learn that he ascertained that the gas had not deposited naphthalene in the mains traversed by it. Far more convincing proof than Mr. Allen has yet offered must be adduced in support of this statement.

The first and second of the facts set forth above are both made to depend on the existence in the mains of conditions favourable to the formation of naphthalene. We may therefore suppose that Mr. Allen is acquainted with these conditions, and that they do not necessarily comprise the prevalence of a higher temperature than frequently occurs in gas-mains. Hitherto naphthalene has been regarded as a condensation product obtainable from hydrocarbons of less complex structure at high temperatures only. Mr. Allen leads us to infer that a high temperature is not essential in the synthesis of naphthalene from the other constituents of coal gas. Moreover, he hints that one of the reacting substances in the synthesis may not exist in the gas as it leaves the works, but perhaps is formed in the mains. Beyond this he is reticent; and we cannot blame him for keeping silence regarding what may prove to be a discovery of great commercial value to him. But he has whetted the curiosity of all interested in the naphthalene question—both theorists and practical men—and they naturally seek to divine his views.

Mr. Allen's allusion to one of the reacting substances as possibly being formed in the mains, implies either that it is a product of prolonged contact of two or more constituents of the gas, or that the mains themselves play a part in the formation. If prolonged contact of constituents matters, then the formation of naphthalene would be greatest where the rate of flow of gas was not rapid and the distance traversed was great. We have not heard that such conditions always prevail where naphthalene deposits occur. If, on the other hand, the mains themselves have any influence, we recall at once the peculiar volatile compound of iron which is produced when a gas containing carbonic oxide passes through iron mains. Now as carbonic oxide occurs in larger proportion in water gas than in coal gas, this compound—iron carbonyl—is produced in greater quantity during the distribution of water gas than of coal gas.

Mr. Allen nowhere speaks of water gas; and many gas engineers—though not all—find that with the introduction of carburetted water gas naphthalene deposits disappear from the distributing system. Iron carbonyl, however, comes very near to fulfilling one condition of the synthesis of naphthalene in mains—viz., that it is decomposed at a comparatively low temperature, though we do not recollect that the precise temperature of its dissociation has been determined. Neither have we heard that it reacts with hydrocarbons or other bodies present in coal gas, though, if any such reaction did occur, it is likely that it would happen at a temperature lower than that of the simple dissociation of the carbonyl. But iron carbonyl has been so little studied that it would be impossible to deny that it might react with some other body in coal gas at temperatures which might prevail in the mains. Even though it plays no part in the synthesis of naphthalene, which takes place, according to Mr. Allen, in gas-mains, it is worthy of further study at the hands of gas engineers and chemists; for it is believed to be responsible for mineral-like deposits within the tips of steatite gas-burners, which deposits become more prevalent wherever carburetted water gas is introduced. That iron carbonyl can, however, affect the formation of deposits of naphthalene is at present mere conjecture. We must regard all the three facts set forth above as requiring substantiation.

Mr. R. Forbes Carpenter, in our "Correspondence" columns to-day, asks the pertinent question whether naphthalene deposits have been found to occur in mains fed only with gas previously freed from naphthalene. If they do occur, Mr. Allen's views have substantial support; if they do not, his theory loses its practical importance. Perhaps someone acquainted with the Burnley and Dessau trials will be kind enough to give definite information in regard to this point.

Mr. Allen deserves the thanks of the gas industry for a highly suggestive paper, for valuable scientific data, and for a useful method of estimating naphthalene in coal gas. His views will certainly meet with more severe criticism than was accorded them in the discussion which followed the reading of the paper; but we sincerely trust that he will be encouraged to pursue his researches on the subject, even though a discovery of immense commercial value be not yet within his grasp.

MM. Léo Vignon and Louis Meunier have communicated to the Paris Academy of Sciences a rapid method for determining the carbonic acid contained in various gaseous mixtures. It is only applicable to gases which can be obtained in unlimited quantities, such as air or coal gas; and it consists of a titration with lime water tinted with phenolphthalein.

RETORT-SETTINGS OF 1850 AND 1900.

Whatever else of all the long and expanding array of gas-works plant and machinery may captivate for the time being the interest of the thorough gas engineer, retort-settings must remain his chief attraction, if he is to be true to his salt. The retort is the elemental force of every gas-works, large or small; and, all other things being equal, those gas managers who feel this truth most, and best appreciate all its consequences, are the most efficient in their calling. There is, besides, this unique distinction in the retort—that it is the technical atom to which coal carbonizing plant of every size is reducible. No gas-works can have less than one retort; and it matters very little how many retorts there are in a works, as regards the standard of efficient carbonization. One retort may be worked to better purpose, having regard to the circumstances, than a thousand. Consequently, all gas managers stand upon common ground when it is a question of retorts and retort-settings. If there is any difference, the palm of mastery could most often be awarded to the man of moderate means in this respect. Many of the acknowledged experts in retort-setting and management have come out of small works, where everything has necessarily been done under their own eye. There is, of course, no rule for this; and both bad and good retort-setting can be—or used to be—found in works of all sizes. We relegate this reproach of inequality to the past advisedly; because there has of late years been a marked levelling-up of retort-setting practice, in connection with the universal adoption of gas-fired settings. This general result has followed from the fact of gas-firing being a strictly rational proceeding. There could be no "rule-of-thumb" about a gas-fired setting. Neither could there be in designing it any blind faith in the elementary science of text-books upon "Heat." Success had to be felt for, step by step, after its possibility was known; and incidentally the whole practice of retort-setting was resettled on a truly scientific system, which consisted simply of recognizing the needs of particular cases.

At the present time, it is not saying too much to declare that there exists a body of science centering in the gas-retort which has grown into being during the last twenty years. When a young student of gas manufacture is first confronted with a particular example of carbonizing practice, it takes him much time and hard study to ascertain and understand the reasons for it all. Hardly, perhaps, has he succeeded in obtaining a dim mental picture of the course of evolution of the retort-house patterns he sees before him, when a visit to another works threatens to upset his reflections altogether, by showing how differently the same problem may be worked out in other places. But is it really the same problem? That is another question, the very existence of which the neophyte did not suspect. And how is a mere student to make proper allowances for the various factors of local talent, or stupidity; of financial pressure, or the opposite; of the score of influences which, avowedly or beneath the surface, mould the development of this branch of gas engineering practice in different localities?

An interesting relic of a bygone stage of this development has reached us in the shape of an original pen-and-ink drawing, dated 1850, of "Crosthwaite's system" of setting three retorts, the chief characteristic of which is the use of moulded fire-clay blocks for supporting the retorts. The reduced reproduction of this sketch appearing in another part of the "Journal" (p. 679), shows the simple retort-settings of those days, and how little went to make a "system" of the period. Mr. John Crosthwaite, the designer, was Engineer of the Carlisle Gas-Works, and the gas was made here by means of such settings. It is stated, in a letter accompanying the sketch, that the furnace is seven fire-bars wide, and 2 ft. 6 in. long. It was very shallow, and must have needed continual stoking. The fire must have been very fierce, and the local heat intense, as Mr. Crosthwaite says, "the more supports the better, especially at the fire-place." His reason for preferring block supports to brick-piers was the liability of the mortar to be burnt out of the joints of the latter, when they would give way. This also shows how strong a heat was kept up. These retorts were 7 ft. 3 in. long, by 16 in., by 14 in. Out of the 13 cwt. of coke made per ton of coal carbonized, there was used 5 cwt. for fuel, or 38½ per cent., as Mr. Crosthwaite put it. The retorts were probably of cast iron, although nothing is said on the subject. It is, however, a typical iron retort-setting, though the usual seating of fire-tiles running the whole length of the retorts is absent. There was a reason for this omission; Mr. Crosthwaite remarking that he had tried the tiles and found them crack and fall down into the fire. On the whole, therefore, it does not seem extravagant to classify this particular setting of retorts as marking the high-water line of practice in this connection, which occurred, as is natural, just before the new fashion of fire-clay retorts became established, and the iron retort was definitely relegated to use in the decent obscurity of private gas-works of country houses.

Mr. Crosthwaite's sketch and descriptive letter have been religiously preserved; and an opportunity now offers of comparison with Drake's system, pattern of 1900, for setting three clay retorts with a regenerative furnace. No detailed description of this system is needed, inasmuch as the sectional elevation exhibits it all to the practised eye. We do not put this system forward as the best of its kind, still less as representing the ultimate possibility of retort-setting on a small scale. It happens, however, to be a setting of threes, like Mr. Crosthwaite's; and it is conspicuous that, except for the number of the retorts and the circumstance of their being enclosed in an arch with side piers, the two beds of retorts have nothing in common. It is such contrasts as these that enable one to perceive the fact and the course of technical development, which is oftener taken for granted than completely understood. It is unnecessary for us to dwell upon the differences in detail. This exercise may well be left to students. Expert readers will, of course, see the distinctions, as well as the differences, at a glance; but it will be no bad exercise for learners to pick them out for themselves. An essay of handsome proportions might be written on the character and purpose of these changes.

There is good reason for the belief that the gas-retort is likely to remain the cynosure of gas engineering attention for a period as long as any practical man need think about. This being the case, it would seem to follow that the study of it should be followed up to the limits of ascertainable knowledge. The gas-retort is to the gas manufacturer what the dynamo is to the electrician, or the steam-boiler to the mechanical engineer. Yet it may be doubted whether it is treated with equal respect. The electrician should know all about his dynamo. He knows at any rate how much duty he can expect from it; and the machine will not disappoint its makers, unless it should be called upon to do utter impossibilities. Similarly with the steam-boiler. Sir Frederick Bramwell long ago, and workers like Mr. Bryan Donkin in later years, have taught the world how to gauge the value of this rude means of turning fuel into a source of power. But nobody has much to say for the gas-retort as a tool. Granted that the experimental study of the performances of gas-retorts in action is not easy, nor pleasant; still, this is no justification for tacitly neglecting it. Take, for example, the thoughtful disquisition upon retorts and retort settings in "King's Treatise," Vol. I., Chapter 5. How much more is really known concerning the data of heat utilization in coal carbonization than was accepted when this chapter was written? Consider these simple questions alone: Should a gas-retort be made of heat-conducting material, or not? If this is of no consequence, from what proceeds the superior efficiency, if any, of thin retorts? It is impossible to read the chapter in question without perceiving how purely empirical retort-setting practice still is.

We do not forget that we have already called the gains of modern carbonizing practice a body of science; and so it is. How, then, can the practice itself be empirical? Very easily; for there is no incompatibility between science, which is systematized knowledge, and the method of trial-and-error, which gives us the knowledge to be systematized. It is matter of common knowledge, for example, that in practice it is impossible to carbonize coal in externally-heated retorts without burning a certain amount of fuel in doing the work. A good deal of both theory and experiment have gone to the hammering out of the answer to the question that follows upon this general statement—the query, how much? But when one comes to ask further, why it is necessary to burn this rated quantity of fuel, there is no answer. Several attempts have been made to draw up the balance-sheet of a retort setting. So much of the heat of the fuel gone in conduction, so much in convection, so much gone up the chimney, so much to roasting the coal—but is there any such estimate that is really trustworthy? Let us put the question on the simplest possible basis, by way of showing the way of beginning. Will any student of gas manufacture send to the "Journal" a certified statement, based on experimental proof collected by himself, of the relation between the fuel consumption of a retort-setting and the weight of coal carbonized by it, *de die in diem*?

It is an old criticism that the pyrometer is not employed in gas retort-houses as much as it should be. The same may be said of the various appliances now so readily available for determining the quality of the combustion in the furnaces by the composition of the waste gases. The freest employment of all these means of instruction may not teach us much; but where nothing of the kind is used, there is no truly scientific knowledge of what is being done. Without systematic checks and investigation of results, the most artful devising of regenerative retort-settings is as much guess-work as the unwritten rules that were followed, half blindly, by the old retort-setters of a past generation. Before we smile at the simplicity of Mr. Crosthwaite's "system" of 1850, therefore, let us be quite sure that we know why that which has come after it is to be preferred.

THE BOARD OF TRADE RETURNS FOR FEBRUARY.

The Board of Trade returns of exports and imports during the month of February show an increase in the foreign commerce of the country that—taking into account the fact that we are now comparing with a period that was itself noteworthy for the improvement witnessed in trade—is very remarkable.

The value of the imports for the month was nearly 8 per cent. higher than in 1899; while the exports showed the striking increase of 19·8 per cent. over the corresponding month last year, although the exports then were close upon 10 per cent. more than in 1898. The total estimated value of trade with other countries for the month was 66·4 millions, compared with 60·8 millions last year. The great increase in the value of exports was mainly

under the headings of raw materials and metals. The estimated value of metals and articles manufactured therefrom (except ships) exported was 5·30 millions, as against 3·96 millions in 1899. No small part of this rise was due to the prevailing high prices of iron and steel goods; but the tonnage figures, especially those for pig, bar, angle, and cast iron, also continue to increase. If, as seems most probable, the orders already in hand, together with those that must of necessity be placed from time to time, should carry on the iron and steel trades in their present state of activity until the development of industry in South Africa, consequent upon the cessation of the war (which is now, happily, possible at a much earlier date than seemed probable a month since), shall give that activity a fresh lease of life, the duration of the season of high prosperity in these industries will have exceeded all precedent. The increase of the value of raw materials exported is due almost entirely to the coal trade with the Continent; the high prices not having as yet checked the flow of coal out of this country. The quantity of fuel exported for the month was 3,333,664 tons, valued at £2,680,608, as against 3,196,848 tons in 1899 and 2,518,751 tons in 1898, valued at £1,629,426 and £1,165,939 respectively. The heavier demand came from France, Germany, Holland, and Russia—naming them in the order of tonnage imported. The value of the coal sent to France was rather more than double that of her imports in February last year. It is noticeable that there is a falling off in the quantity sent to most of the countries not affected by the special conditions of trade and the labour market existing in three out of the four countries named above. The chief source of the enhanced imports was the increase in the shipments to this country of raw materials for the manufacture of textile goods—an industry that always displays great activity during seasons of prosperity and high wages.

Altogether the trade returns are, from a patriotic point of view, most satisfactory, especially taking into account the additional burdens which the country will have to bear, as the cost of the war, during this and next year. Whether coal buyers can regard them with enthusiasm, is quite another question.

AMERICAN COAL IN EUROPE.

In recent articles dealing with the coal resources of this country, it was pointed out that our commercial prosperity depends, not merely upon our ability to produce coal sufficient for our requirements, but, further, upon the production of that coal at a reasonable cost. The extreme penalty we should have to pay were the price of coal increased (by the cost of raising) to a figure much in excess of past averages, would, as was said, be the importation of coal from America. The earlier and more imminent penalty would, however, be the serious blow to our iron and steel industries entailed by the displacement of English by American goods—not merely in foreign, but in our own markets—on a much vaster scale than hitherto. It is already the case that iron and steel can be produced in America at a lower cost per ton than in England, and that the cost of freight is the only protection of our home industries other than the superiority of British workmanship—a fact which renders the present state of the coal market, and of technical instruction in this country, matters of vital importance to the community.

It is a point of great significance for the future that the coalfields of the United States are practically inexhaustible, having an area estimated at 196,650 square miles, as compared with somewhere about 5500 square miles in the United Kingdom; and, further, it must not be forgotten that, thanks to the short-sighted folly of our own coal miners—and of not a few of our coalowners—coal can be raised at less cost per ton in America than here, other conditions being equal, owing to the adoption there of coal-cutting machinery. In this country, such employers as have sought to introduce these machines have failed in the attempt, owing to the determination of the men that they should not be successful. It is the old fallacy over again, that limitation of trade is of ultimate advantage to the labourer.

We must not be misunderstood as prophesying the actual competition of American coal with English in our home markets within measurable distance of time. The point we wish to make is that any lengthened maintenance of prices at their present level must give our great competitor an opportunity, which he will not be slow to seize, of ousting English coal out of foreign markets. The process has, in fact, begun; for, in spite of the difference in freight, large quantities of best steam coal from the United States are now being delivered at Italian and Austrian ports at much lower prices than those at which Cardiff or Durham coal can be there imported.

It is, indeed, in this influx of American coal into Europe, and its displacement of Welsh coal at many foreign coaling stations, that we see the earliest promise of an easement of the English market. For it must be remembered that the hardness of that market is due as much to the large increase in our exports of coal as to the increased consumption at home. Every ton, therefore, of American coal imported into Europe, tends to release a ton of our output for the home market. Herein lies the radical difference between the present situation and that of 27 years ago, when coal was as dear as it is now. Then the scarcity was due very largely to the demand for iron from America, and neither the coal nor the iron output of the States was a third of our own. Now the demand is at home and on the Continent; and not only are the outputs of both coal and iron in the States greater than those of this country, but America is now (what she was not then) an exporter of metal goods and of coal.

The condition of the European market is both interesting and peculiar, and would have received much greater notice at the hands of the general Press had not attention been so much preoccupied with African affairs. France, Germany, and Austria have all been seriously handicapped by labour troubles in the coal trade, at the same time that industrial activity, not unconnected with warlike preparations, has increased the demand for fuel. The Austrian production has, indeed, been almost brought to a standstill by a strike of miners in Bohemia and Moravia, with the result that she is drawing heavily from Germany. The consequence of this is that Germany is importing more and more coal from this country, and that an agitation is on foot there to prohibit the export of fuel entirely. Russia needs so much coal for the purposes of her vast railway projects, that it has been necessary to suspend the import duties; and she is now a pressing buyer in English markets. All this has led to a panic cry in some circles here for the placing of an embargo upon exporting coal—a step which, as Mr. Goschen said in his speech on the Admiralty programme, it is "entirely impossible" to consider until war breaks out with a naval power, or "until an emergency of a totally different character from the present, one arises." The check on our exports, when it comes, will come from without, not from within; and as reports from the American pig-iron markets point to production overlapping consumption, and the output of coal there is rapidly increasing this check may come sooner than some people now think. It is chiefly the difficulty of chartering the necessary shipping that is delaying the importation of American coal into Europe by the million, instead of by the thousand, tons.

THE LIABILITY OF AUDITORS.

On Jan. 26 last, judgment was given in the Irish Court of Appeal in the case of *The Irish Woollen Company, Limited, v. Tyson and Others*, which was mentioned in these columns last August (in reference to the original trial in the Court of Chancery) as being of much importance to auditors and the investing public.

The history of the Company in question is, unfortunately, only too familiar, in its main features, to that of many other joint-stock enterprises. It was formed in 1887 for the purpose of promoting the woollen industry in Ireland. Two years later it was announced that it had been decided to extend the business; and for this purpose fresh capital was required. The prospectus then issued alluded to the success that had attended the operations of the Company up to that time, and foreshadowed more brilliant prospects for the future. The accuracy of the prospectus may be gathered from the fact that the whole of the additional capital was required to make good previous deficiencies, and to pay dividends which, from 1888 to 1895, never fell so low as 5 per cent. In 1895, the bubble burst; and the Company was ordered to be compulsorily wound up. It was then found that, although the business was just solvent as regards its creditors, the capital had entirely disappeared. It was sought to make the Auditor—a Mr. Kevans—liable for damages to the shareholders, for having failed to detect the system of incorrect book-keeping by which the fraud was made possible. The Irish Master of the Rolls found against the Auditor, who appealed; but the judgment has now been upheld by the Court of Appeal.

The fraud in this case is of a nature by no means uncommon at the present time; it is, indeed, very similar to that practised by the officials of the Millwall Dock Company. That is to say, the purpose of the manipulation of the accounts was not simple robbery—it was not misappropriation of monies to the personal use of the defrauder, but it was done for the purpose of giving an appearance of prosperity to a losing concern. It was a case of "living on capital"—a course of procedure always dangerous, and sooner or later calamitous, but for a small company (such as that in point) bound to be speedily fatal. The method by which the true state of affairs was concealed was mainly that of "carrying-over" to the accounts of one year invoices for goods supplied during a preceding year. This the Auditor would have discovered had he examined the creditors' ledger accounts with the invoices rendered. The question for the Court was whether, in not detecting this "cooking" of the books, the Auditor had so far failed in his duty as to render himself liable for damages.

Lord Justice Holmes, in giving judgment against the Auditor, said that he "did not understand how the carrying-over of the invoices could have escaped detection by the accountant, who should have used due care and skill, and who was not a mere machine. . . . He considered that not only were Mr. Kevans and his assistants not free from blame for this, but also for the mechanical way the audit was carried out." Lord Justice Fitzgibbon, in concurring, quoted, from the well-known judgment in the case of the London and General Bank, the definition of an auditor's duty as being "to ascertain and state the true financial position of the company at the time of the audit." He is to ascertain that position by examining the books of the company; but he does not discharge his duty by doing this without inquiry, and without taking the common trouble to see

that the books show the company's true position. "Otherwise the audit reduces itself to an idle farce." The most important point in Lord Justice Fitzgibbon's judgment lies in his conclusion, where he sums up the case by saying that the Auditor and his assistants were deceived, "not by any glaring or probable fraud such as they might be on the watch against, but by a thing done for the purpose of giving an appearance of fictitious prosperity to the company. . . That, however, cannot alter the legal liability if it is based, as I am satisfied it is, upon the failure to have suspicion aroused."

This declaration that an auditor is not only bound to investigate anything that arouses his suspicion, but is negligent if he do not suspect what a careful examination of the books would lead an intelligent man to suspect, is very satisfactory to the investing public. We have frequently urged that no auditor adequately discharges his duty unless he goes below the surface of the books and vouchers put before him, and satisfies himself of their genuine character. The fact that auditors are legally, as well as morally, bound so to do, and run a risk of being cast in damages if they content themselves with a less thorough scrutiny, should serve to arouse to an increased sense of their duty, and to the possible consequences of its neglect, those auditors (and they are many) who conduct their audits in a mechanical, an uninquiring, and an unintelligent manner. Companies who are anxious to keep up "an appearance of fictitious prosperity" by the gentle art of living on capital are not as scarce as Auks' eggs.

PERSONAL.

Mr. T. Jowett, of Milton, Gravesend, has been appointed Manager of the Solihull Gas-Works.

Mr. Brooke Gibson has resigned the position of Engineer and Manager of the Sittingbourne District Gas Company.

Mr. W. Lister, of East Ardsley, has been appointed Manager of the Llanrwst works of the Holyhead and North Wales Gas and Water Corporation.

Mr. R. Porter, of Elland, who was Consulting Engineer to the Skipton Gas Company, has been retained by the District Council, who have acquired the undertaking of the Company, to act in a similar capacity for them.

Mr. F. W. Ward Holland, Assoc.M.Inst.C.E., has been appointed Water Engineer to the Cape Town Corporation. He was formerly Engineer of the Brighton Corporation Water Works, and has practised privately in England.

The Gas Committee of the Greenock Corporation on Tuesday agreed, by eight votes to four, to recommend the appointment of Mr. John Chalmers, collector in the burgh, for the post of Manager of the Corporation gas-works which is being vacated by Mr. S. Stewart.

Mr. James Lyon, who fills an important post under the Glasgow Corporation Gas Committee, was last night entertained to supper, and made the recipient of valuable presents, including a purse of sovereigns and a piece of silver plate, the total value of which was upwards of £120, in celebration of his completion of fifty years' service; he having commenced with the Glasgow Gaslight Company on Feb. 13, 1850. The amount named was collected chiefly from the workmen in the employ of the Gas Commissioners and from the Gas Committee (£10). Mr. Lyon is paymaster to the employees in the various departments; and a large number of them met in the saloon of the City Hall last night, with great rejoicing. Bailie Fife presided, and there were present several members of the Corporation Gas Committee, as well as Mr. Foulis.

OBITUARY.

Mr. William Brown, the Chairman of the Chester and Hawarden Water Companies, died somewhat suddenly from heart disease last Wednesday. He held a very prominent position in Chester, and had been twice Mayor.

The death is announced of Alderman John White, J.P., the "father" of the Hartlepool Town Council. Deceased, who was upwards of eighty years of age, was first elected to the Council in 1860; and in 1874 he filled the office of Mayor. He was Vice-Chairman of the Hartlepool Gas and Water Company.

The death is announced of Alderman J. Maltby, J.P., of Lincoln. Deceased was one of the prime-movers in the purchase of the water-works by the Corporation; and when the undertaking was transferred he became Chairman of the Water Committee. He was 69 years of age, and had ungrudgingly devoted 40 of them to the service of the city.

We regret to record the death, after a few months' illness, of Mr. John W. Buckley, Engineer and Manager of the Formby Gas-Works. Deceased had been connected with the gas industry for upwards of fifty years, seventeen of which had been passed at Formby. Prior to going there, he was for many years in the Gas Department of the Southport Corporation. He joined the Gas Institute in 1885, and the Manchester District Institution in 1891. He leaves a widow, three daughters, and four sons, three of whom are in the gas profession. The funeral takes place to-day.

COMMUNICATED ARTICLE.

GAS COMPANIES AND PERIPATETIC GAS-TESTING.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

Although the use of the portable photometer has been recognized from time to time in connection with the work carried on by the Metropolitan Gas Referees, and has met with some degree of support, I am not aware that a case has ever been distinctly stated on behalf of the instrument and the system identified with it, the principal feature of which is that no testing-room, as generally understood, is required. Under the present arrangements, gas can only be officially tested in certain specified rooms fitted up for the purpose. But with the portable photometer, the specified testing-place becomes a superfluity, as any locality within a yard of a pipe charged with gas supplied by the company whose product is to be examined may be utilized for that purpose. I say supplied by the "company" advisedly, because the benefits attainable by the use of the photometer on wheels do not appear to have attracted attention in districts where the gas-works are the property of the municipality. Many gas engineers have been looking for some authoritative pronouncement, showing not only the deficiencies of the present system, as regards a fair presentment of the interests of the consumers, but also the advantages of the new one in assisting the gas examiner towards a fair and impartial discharge of his duty, which is simply that of holding the balances fairly as between buyer and seller. Neither of the parties concerned requires more or less than this. While they do not wish the scales to be tipped in their favour, they would equally resist a stroke in the other direction.

But a great deal more hangs on the present arrangements for examining the illuminating power of the gas supply, than a mere adjustment of quality as between one side of the counter and the other. It has been adopted as an integral factor in the bargain between the sellers of gas on the one hand and Parliament as representing the public on the other, which is known in well-informed circles as a "Special Act" or "Provisional Order," but to the majority of the public under the incorrect and misleading title of a "monopoly." Important questions relating to price and dividend are dependent upon it. The *status quo* of the present system must be maintained, if justice is to be adhered to. Sixteen-candle gas is not a mere nonentity or will-of-the-wisp, but a tangible article that can be accurately defined, not only by the test of the photometer, but by the aid of chemical analysis, and by the materials and processes concerned in its manufacture. I do not wish to do any injustice to the peripatetic system. But high authorities have repeatedly asserted that the object of introducing it is to score strongly at the expense of the gas companies, by forcing them to supply gas at least 20 per cent. above the standard, in order to guard against its irregularities; and I do not know that this impeachment has been contradicted. At present, the nominal 16-candle gas is actually 17½ to 18 candles; but with the portable photometer on the war path, the company would not be safe at even 19 candles. The gas companies are, in effect, to be compelled to supply a more costly article, while all other conditions of the bargain remain as before. Even if we grant that the present arrangements are inefficient, and that the portable photometer is perfectly fair as between buyer and seller, it is still a fact that the introduction of a not necessarily more rigorous, but a more uncertain, method of testing would be an injury and an injustice to the gas companies, as amounting to a breach of the parliamentary bargain.

While it has never been proved that the present arrangements for examining the gas supply are unduly favourable to the seller, and therefore prejudicial to the interests of the buyer, it is by no means uncertain that the portable photometer has a strong leaning in the other direction. One might almost add that this is its most favourable feature, in the eyes of its supporters. Any competitive photometrist, armed with a portable photometer and strict instructions to prove a conviction against the gas company under pain of the gallows, could save his neck, even if the quality of the gas was not less than 10 per cent. over the standard. These remarks are justified, because one claim in favour of the new plan is that the results obtained by its means are always below the indications recorded in the official testing room. But this is capable of two interpretations. It may, as assumed, be so much the worse for the gas; but, with at least equal probability, it may be so much the worse for the wheelbarrow photometer. Such a conclusion is favoured by the irregular and widely varying readings obtained, because gas manufacturers, whatever their other faults may be, find it necessary to maintain uniformity of quality. If they sent out 14-candle gas on Monday, 17-candle gas on Tuesday, and 15-candle gas on Wednesday, the manager and his staff would find that life was not worth living on Thursday. If the portable photometer could be depended upon to trot along at a regular distance—say, 10 per cent.—behind its stationary relative, it might be possible to make something of it. When Mr. Sugg improved the standard argand burner, the parliamentary standard was raised in proportion. It was stated to get 2 candles more out of the gas; and so the standard was lifted from 14 to 16 candles—not as a means of scoring at the expense of the gas companies or increasing their responsibilities, but simply to preserve the position unaltered, and secure a gas in all respects equal to that

previously supplied. But it is impossible to base a fair and square bargain on the indications of an instrument that runs at anything between neck and neck and a 25 per cent. deficit; and an adjustment of this nature could not be applied to the portable photometer. If the "portable" standard was put at 14, as compared with the "stationary" 16 candles, there would still be the element of uncertainty, due to the fact that the peripatetic system is intrinsically unfair as against the seller, and contrary to the spirit of similar legal enactments.

The statutory enactments which govern the testing of gas are an example of the class commonly known as the Adulteration Acts, which are framed with the object of securing that the free and independent, but ignorant (in a technical sense), Briton shall get full value for his money, and that the goods supplied to him shall be equal in value to a known standard. Gas is compared with the standard sperm candle, bread is put into the balances against an avoirdupois pound weight, whisky is tested for percentage of alcohol, butter is examined for the presence of inferior animal fats, coffee for chicory, &c.—all for the purpose of securing to the purchaser, when he spends a shilling, a fair shilling's worth in exchange. They do this and no more. He pays his shilling, and gets twelve pence value, and cannot claim anything between twelve and fifteen pence. Obviously the whole of the gas, bread, butter, whisky, coffee, &c., supplied to the public cannot be examined, just as the whole contents of a steam cargo boat may be passed through a custom-house. So the first step in drafting any Adulteration Act is to arrange for obtaining some small samples as a representation of the whole; and elaborate precautions must be taken to secure a fair sample. The true intent and meaning of the Acts is that the sample should be taken in a manner that is just to both parties, the seller as well as the buyer.

As regards gas, the photometer must be connected by a short service to one of the principal main-pipes, and the gas must be lighted at least 15 minutes before the test is taken—which, in effect, means that the service-pipe, meter, governor, &c., must be flushed out, and the test conducted upon a sample of the gas that is piping-hot from the main itself, and therefore a fair sample of the bulk. The gas company are entitled to have a representative present at the test, which means that they have a right to see this important condition fairly carried out, and generally that their interests are not prejudiced—inadvertently or otherwise—by any action on the part of the operator. With a similar object, the samples of bread, whisky, or butter are taken in a manner calculated to secure fair play all round. They must be purchased over the counter or from the delivery van in the ordinary way of business; the seller must be informed at the time that the sample will be analyzed, and he can if he chooses retain a portion of the same; the selected portion must be examined with the least possible delay; and so on—all with the view of guarding against a tip of the scales either one way or the other.

So far gas companies, as well as other traders, have been satisfied as to the taking of the sample. But bakers, publicans, and grocers would all very strongly object if, as a so-called improvement on the obviously fair methods of performing this operation, the inspector was allowed a free hand, and could go to any customer, and take samples of bread, whisky, or butter, without regard to the period of time that had elapsed since they left the tradesman's establishment, or to the treatment accorded to the commodities subsequent to their delivery. The baker would point out, with good show of reason, that the bread might have been placed in a warm corner, or otherwise so treated that it had lost weight considerably; the publican would suggest that the whisky bottle might not have been properly corked, with the result that its strength had been reduced by evaporation; and the grocer would ask for proof that the butter had not been tampered with, or exposed to dust or moisture, after leaving his shop. Strong objection would also be raised if the inspector was accompanied by an analyst and a trundling laboratory, prepared to make essays and write out a report on the spot. It would be said that the operations incidental to analysis were of a delicate and elaborate character, and could not be properly conducted except in a suitably fitted room.

All these objections can, and should, be urged by the sellers of gas. The portable photometer system leaves the method of taking the sample entirely to the discretion, not only of the examiner, but also of the individual consumer, who may be hostile to the company, or for personal reasons may wish to score a point against them. There are those who seek to obtain or to retain the public favour and confidence by striking the attitude of a doughty champion on their behalf, and who are occasionally driven to the necessity of dressing up a bogey antagonist. Failing other things, the gas supply can be utilized for this purpose. One admirable feature of the present systems, both for the testing of meters and the illuminating power of gas, is that the item of personal discretion is reduced to a minimum. All that is necessary is to follow the prescribed regulations with accuracy and conscientiousness. Care has also been taken to reduce the necessary corrections for error to the lowest possible limits. It is admitted that the corrections for rate of consumption of gas and of candles, and for variations in temperature and in barometrical pressure, are purely arbitrary and empirical; and therefore, where it is impracticable to reduce them to an insignificant quantity, they are curtailed in every possible way. As soon as the necessity for care in this direction was recognized and put into practice, the limits of error as between one operator and another—formerly so flagrant as to bring discredit on the whole system—were reduced within practical bounds; and the days when the gas company made the quality 20 candles, and the gas examiner brought it out as 14 candles, have long passed away. The portable photometer system not only returns to these conditions, but goes a long step farther back, and promises a last state of things that will be worse than the first. Its use must, among other matters, entail considerable corrections for temperature; and probably this has something to do with the variations in results above noted, as it may be employed in and out of doors.

But what would be the practical outcome of the adoption of the system? As soon as the novelty of the thing had passed away, the customers would get tired of giving the use of their living or business apartments for the purpose of a temporary testing-place. Unless actuated by such motives as above indicated, they have very little interest in the question. So the gas examiner would find himself and his outfit practically put out on the streets, and called upon to take snap-shots at the street-lamps. Here he would encounter difficulties due to weather and to exigencies of traffic. As in the case of indoor tests, after the novelty had passed away, his paraphenalia would be regarded as a nuisance. He could not work under the gloom of a London fog, or while exposed to heavy rain, snow, or wind. Gradually he would gravitate down to a few sheltered localities—such as the ends of blind-alleys—where he could pursue his investigations undisturbed by rumbling vehicles or jostling passengers, and be partially at any rate protected from the severity of the weather.

Under such circumstances, there is no guarantee whatever or provision for securing a fair sample by flushing out the service and other pipes between the bulk of the supply and the apparatus; nor would it always be possible to do so. There should be no misunderstanding on this point. Coal gas is not an unstable compound that commences to deteriorate as soon as it leaves the works. In earlier days, when the importance of slow and gradual condensation was not thoroughly understood, it is quite possible that it may have lost a candle or two while travelling a few miles. But, as produced under modern conditions of condensation and purification, it is a fairly hardy article, not affected by ordinary conditions of supply. The bulk of the consumers get as good value as those living close to the gas-works; and the supply to the official testing-rooms is a fair sample of the whole. Yet it is quite possible that certain portions, representing an insignificant percentage of the whole supply, are subjected to particularly unfavourable circumstances. There may be such a thing as a half mile length of 3-inch pipe, originally laid for the supply of a large consumer, but now only utilized for a few lamps. Railway companies often lay several hundred yards of pipe on their own premises, for the supply of distant signal-boxes. These pipes may, at particular points, be more or less exposed to the weather. A sample of gas drawn from the extreme end may have entered at the other perhaps 24, perhaps 30, hours previously, during which time it has been subject to the operations of exosmose and endosmose, to variations of temperature, and to the solvent action of hydrocarbons previously accumulated on the interior surface of the pipe.

If no other method than the portable photometer was available, some of these disadvantages could be minimized by restrictions limiting the length of service between a sufficiently representative main in regular use—say, not less than 8 inches in diameter—and the testing apparatus, and for securing a proper flush-out of the whole before testing. Maximum and minimum limits for pressure and temperature could be set, on the lines of those adopted for the sperm candle. But at best, the portable system would introduce a state of things far less satisfactory than the earliest attempts at a photometer room; and gas companies cannot regard it in any other attitude than that of uncompromising opposition, as contrary to the spirit of the Adulteration Acts, and as leaving no possible security for safety against conviction.

Some Deep Borings for Water.—In the "JOURNAL" last week we published particulars of the deep boring for water which the Lincoln Corporation are about to undertake, under the advice of their Consulting Engineer, Mr. Percy Griffith, Assoc.M.Inst. C.E., of Westminster. As the proposed boring is of unusual depth, it may be of interest to give the following measurements of others, which appeared in a popular weekly illustrated periodical on the 3rd inst.: The well at Sperenberg, near Berlin, is 4190 feet deep; that at Pesth, 3182 feet; that at La Chapelle, Paris, 2950 feet; that at Neusalwark, near Minden, 2000 feet; that at Passy, Paris, 2000 feet; that at Grenelle, Paris, 1798 feet; that at Kissinberg, Bavaria, 1787 feet. The foregoing particulars were reproduced in the "Lincolnshire Chronicle" in conjunction with the following, furnished by a correspondent. The Cambridge Downs borehole is 542 feet deep, and furnishes 700,000 gallons per day. The Charleville borehole, 1371 feet deep, gives 3,000,000 gallons per day, with a pressure of 104 lbs. The Engonia borehole is 1666 feet deep, and produces 320,000 gallons per day. The Claverton Downs, at 1777 feet deep, sends up no less than 1,500,000 gallons per day, with a pressure of 167 lbs. The Thurlagoona bore is 6 inches in diameter and 1710 feet deep, and produces 3,000,000 gallons per day. The deepest completed borehole in the world is at Schadebach, in Prussia; it being nearly one mile deep.

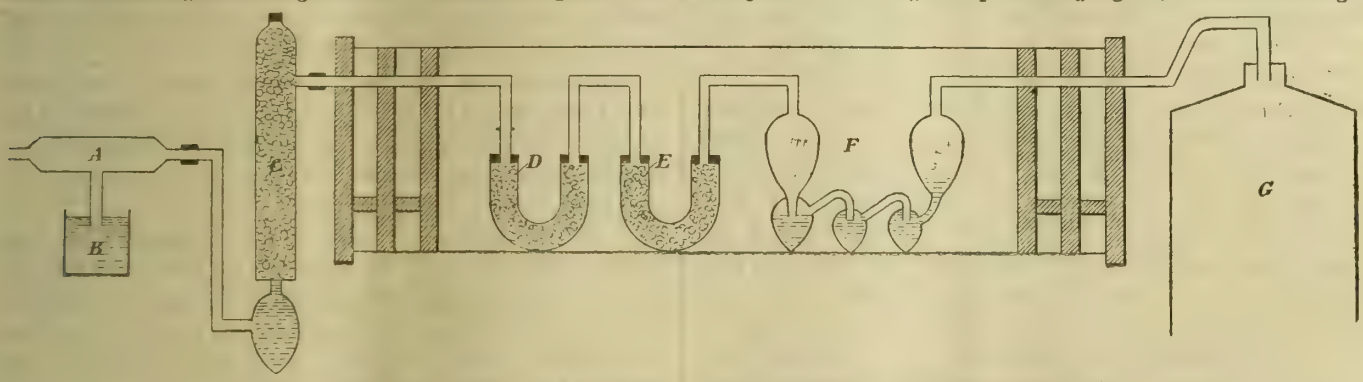
TECHNICAL RECORD.

THE PRESENCE OF NAPHTHALENE IN COAL GAS: A NOVEL THEORY.

At the Meeting of the London Section of the Society of Chemical Industry on Monday evening last week—Mr. Boverton Redwood in the chair—a paper was read by Mr. R. W. Allen, M.A., on "The Presence of Naphthalene in Coal Gas." As the text of the paper is not available previous to its publication in the Society's own "Journal," we have prepared the following account of its contents from notes taken at the meeting.

In commencing his paper, Mr. Allen said the discussion as to the amount of naphthalene ordinarily present in coal gas, and the prevention of its deposition therefrom, having been somewhat revived of late, he thought the result of some experiments made by him in the laboratory of University College, Auckland, New Zealand, about eighteen months ago, might perhaps be of some interest. The most plausible explanation of the deposition of naphthalene in gas-pipes was based on the supposed saturation of the gas, and the consequent supersaturation when the temperature fell, and deposition of some of the naphthalene. In order to ascertain whether this was really the case, he first determined the amount of naphthalene required to saturate a given volume of such gases as air, hydrogen, and carbon dioxide, which might be designated as "indifferent" gases, and then ascertained the amount of naphthalene required to saturate the same volume of coal gas carefully purified from any naphthalene that it might already contain. In this manner one might ascertain whether the coal gas really differed from an indifferent gas, at the same temperature, as to the amount of naphthalene required to saturate it. If there was a difference, and if it was due to the presence of the lighter hydrocarbon vapours in the coal gas, then he thought the presence of the vapours of such powerful solvents of naphthalene as ether, carbon bisulphide, benzene, chloroform, and ethyl alcohol in air ought to emphasize the difference. If any difference could be detected, then comparing the amounts of naphthalene required to saturate equal volumes of air and coal gas at the same temperatures, the exact amount of that substance in the gas could be ascertained.

By two totally different methods, the author determined the amount of naphthalene, in grains, required to saturate 100 cubic feet of air, hydrogen, and carbon dioxide at temperatures varying from 32° to 212° Fahr. The methods employed were: The direct evaporation method, wherein a known volume of each gas was passed through U-tubes containing dry powdered naphthalene, and the amount of naphthalene carried over estimated by the loss of weight of the U-tubes. Secondly, by the determination of the vapour pressure by the barometrical method. The author, referring to a blackboard sketch of the apparatus employed in carrying out the experiments under the first method, said the gas—hydrogen, carbon dioxide, or air—was passed in through the pressure-gauge A, which was charged



[*Drawn from the Rough Blackboard Sketch of the Experimental Apparatus Employed.*]

with oil B in place of mercury, because oil, on account of its lower specific gravity, showed slight changes of pressure very much better. It was then passed through a tower C filled with pumice saturated with sulphuric acid. Then it was passed on to a zinc water-bath about 3 ft. 6 in. by 2 ft. 6 in. long, and 2 ft. broad, comprising a number of compartments designed to prevent any air-currents passing into the apparatus. The gas, already partially dried, passed over into a drying-tube packed with calcium chloride D. A sulphuric acid bulb F, following the naphthalene tube E, was inserted to absorb the bulk of the naphthalene carried over at the higher temperatures, so that it might not clog up the exit-pipes. From the sulphuric acid bulb the gas passed into the aspirator G. The volume in the aspirator being carefully determined, and the temperature—viz., that of the air—and the pressure being known, the corrected volume of the gas in the aspirator represented the volume that had passed over the naphthalene. By weighing the naphthalene tube before and after the experiments, the amount of naphthalene carried over was easily found.

The duration of the experiments varied very greatly. The shortest ones lasted only 1½ hours. Those were with hydrogen. The longest ones were 135 hours; and they were with air. The volume of gas passed over was only 1·27 cubic feet; so that the rate, even in the fastest experiment, was only 1 cubic foot per hour. A rather remarkable agreement might be observed between the various values. The rate at which the hydrogen seemed to saturate itself was exactly the same as that at which the much heavier air or coal gas saturated itself, and at corresponding times the weights carried over were practically identical. The difference between experiments of 1½ hours' and 135 hours' duration amounted to only (in that particular case the temperature was over 86° Fahr.) 7 per cent. The close approximation of the values at (say) 24 hours and 110 hours, showed that the gas at 24 hours was practically saturated.

The foregoing, the author said, was briefly the method employed for determining directly the amount of naphthalene that was required to saturate 1·27 cubic feet of gas; and Table II. contained the results (calculated, and checked from curves) as to the amount of naphthalene required to saturate 100 cubic feet of gas at temperatures varying between 32° and 212° Fahr. The author here called special attention to the close correspondence there was between the weight of naphthalene required to saturate 100 cubic feet of gas at 59° Fahr.—viz., 19 grains—and the weight extracted by Dr. Bueb by his washing process from the same volume of coal gas—viz., 20 grains, at a temperature of 60° Fahr.

The author next determined the amount of naphthalene required to saturate the same volume of coal gas, carefully freed from any trace of naphthalene, at the same temperatures; and he obtained results identical with those for the indifferent gases. Hence it would appear, he said, that the vapours of the heavier hydrocarbons present in coal gas exerted no influence on the power of the gas for saturating itself with naphthalene. To confirm this, experiments were made with air containing the most powerful solvents of naphthalene—viz., ether, carbon bisulphide, benzene, chloroform, and ethyl alcohol. Quoting

Table I.

Temperature 86° Fahr. Volume of Gas Employed = 1·27 cub. ft.

Gas Employed.	Length of Experiments. Hours.	Weight of Naphthalene Carried over. Grain.
Air	2½	·4907
,,	3½	·4923
,,	4	·4938
,,	7	·4969
,,	9½	·5000
,,	11	·5047
,,	17	·5092
,,	30	·5123
,,	39	·5170
,,	135	·5293
Hydrogen	1½	·4815
,,	4½	·4830
,,	6½	·4861
,,	11	·5092
,,	24	·5200
,,	110	·5278
Coal gas	3	·4861
,,	6	·4938
,,	15	·4969
,,	20	·5015
,,	55	·5231

Table II.

Temp. Degrees Fahr.	Weight in Grains of Naphthalene Saturating 100 c. ft. of Gas.	Temp. Degrees Fahr.	Weight in Grains of Naphthalene Saturating 100 c. ft. of Gas.
32	6·0	131	317·0
41	9·8	140	482·0
50	14·1	149	723·0
59	19·0	158	1050·0
68	24·6	167	1430·0
77	30·9	176	1898·0
86	39·5	185	2426·0
95	57·5	194	3035·0
104	83·5	203	3727·0
113	132·0	212	4420·0
122	208·0		

from a table giving the values, at 140° Fahr., obtained from various gases, he said that 1·27 cubic feet of air, at 140° Fahr., carried over 537 grains, the same volume of hydrogen 537 grains, of coal gas 538 grains, of acetylene 538 grains, of marsh gas 536 grains; of air saturated, at 60° Fahr., with the following vapours—viz., of ether 548 grains, of carbon bisulphide 537 grains, of chloroform 542 grains, of benzene 547 grains, of ethyl alcohol 549 grains. From this it would appear that the presence of solvent vapours in quantities insufficient to saturate the gas exerted no influence on the amount of naphthalene vapour the gas could hold in diffusion.

The gas was next saturated at the temperature of 140° with the vapours of benzene and petroleum oils. So great was the increase in the amount of naphthalene carried over that the cooler parts of the apparatus almost immediately blocked up, the naphthalene in the U-tube completely liquefied, and the experiment stopped. Having thus established the fact that the coal gas could not, unless saturated with solvent vapour, hold in diffusion more than the same volume of naphthalene, and having found the gas employed was not saturated with benzene or petroleum vapours, it was clear that the amount of naphthalene present in the gas could be determined by observing how much additional naphthalene was required to saturate it. To diminish the errors as far as possible, the amount of naphthalene required to saturate the same volumes of gas from which all traces of naphthalene had been first removed, was also simultaneously determined. The temperature of the experiment was 130° Fahr.; and a sample of ordinary coal gas was used, carefully dried in calcium chloride tubes. The sulphuric acid tower was removed when using coal gas, so that the sulphuric acid should not act on the hydrocarbons, and remove them from the gas. The weight carried over by 1·27 cubic feet, the temperature being 130° Fahr., was 153 grains. When the gas had been carefully purified from all naphthalene by passage through tubes immersed in freezing mixtures, the weight carried over was 152 grains. When the gas was not only passed through the freezing mixtures, but through the drying-tower, and then through two bulbs of sulphuric acid at the temperature of the bath, the weight carried over was still 152 grains. From this it would appear that the coal gas which was supposed to be very nearly saturated with naphthalene, and which actually did form bad deposits, in reality contained none of the vapour of that body. This was confirmed by a long series of experiments. A little air saturated with naphthalene at the atmospheric temperature, by passage through a U-tube in a freezing mixture of ice and salt, deposited out practically the whole of the naphthalene at this temperature. In this way the small quantity of naphthalene could be detected. A considerable volume of coal gas was next similarly treated; but no trace of naphthalene was to be seen in the U-tube—only benzene and oily substances. This he took at the time to be conclusive proof that the gas itself contained no naphthalene. In truth, it did not clear up this; it only showed the possible amount of naphthalene was very small.

Subsequently Professor Brown experimented with large volumes of gas on the gas-works; but whether he did this before it entered the mains, or shortly after, he (Mr. Allen) was unable to say. At all events, he was unable to detect anything but a limited trace of naphthalene present; and yet the trouble from deposits was very great indeed. The truth of these observations had since been confirmed by passing the coal gas through a series of U-tubes, immersed in the freezing mixture of ice and salt, treating the frozen out product with a mixture of nitric and acetic acids, evaporating off any excess of acid and much of the nitro-benzene that was formed simultaneously with any nitro-naphthalene, and converting any naphthalene present into nitro-phthalic acid by means of an oxidizing mixture of potassium bichromate and sulphuric acid. No naphthalene could thus be found, although a small amount of the vapour of that body if introduced into the gas could be readily detected in this way. The experiments extended over a period of ten months, during which time the coal gas, proved to be free from naphthalene as it left the pipes, was continually forming deposits in the services. It would thus appear that they had this anomaly—that coal gas free from naphthalene would form deposits of that body in its passage through the pipes. The only possible explanation seemed to be that, under certain conditions, naphthalene was formed in the pipes themselves, and continued to deposit itself there. That this was always the case when naphthalene deposits were formed, the author did not wish to assert. However, it would satisfactorily account for the formation of deposits from gas containing less naphthalene than was sufficient to saturate it at any such temperature as it was likely to be subjected to in the pipes. The usual explanation "fall of temperature" would hardly suffice; for an ordinary sample of gas saturated with naphthalene at 60° would form no deposit of the solid if cooled to 50°. He had repeatedly tried this, and had found that, even on cooling the gas to − 20° Fahr., no deposits were formed.

The question arose as to the way in which this was brought about. Was there some unstable substance present in the gas, or formed under certain conditions in the pipes, which, under new conditions, spontaneously decomposed or combined with the hydrocarbons to form naphthalene? This question he was unable at present to answer definitely. His belief was that such an unstable body was already present in the gas, or was formed by the gas as it traversed the mains, and, under suitable conditions, combined with the hydrocarbons in the gas to form naphthalene.

In summarizing his conclusions, the author called attention to these points: (1) The very small amount of naphthalene required to saturate a given volume of gas at ordinary temperatures. (2) The fact that the presence of benzene or hydrocarbon vapours in quantities insufficient to saturate the gas did not affect the amount of naphthalene that a given volume of gas could hold in diffusion. (3) The easy detection of naphthalene by the formation of nitro-phthalic acid. (4) That gas which contained little or no naphthalene as it left the gasholders would, under certain conditions, form deposits in the distribution pipes. (5) Consequently, the necessity arose of looking elsewhere than to changes of temperature for an explanation of the formation of deposits.

Discussion.

Dr. F. Clowes, called upon by the Chairman, said he was glad he had been asked to say a few words, because he was responsible in the first place for the paper being brought before the Section; he was the first to suggest to the Committee that Mr. Allen should be allowed to bring it before them. He must say that it was a paper of a somewhat startling character. Gentlemen present would feel that in some sense a mine had been sprung among them. They had all held—and perhaps they could hardly give any reason for holding—that naphthalene was carried over by coal gas in larger quantity than it would be by any of the simple gases. Now Mr. Allen had given them figures which he (Dr. Clowes) thought incontestably proved that their notions on the subject had little foundation in fact. He could not see how they could get out of the conclusion that air and hydrogen carried over the vapour of naphthalene at least to the same extent as coal gas itself; and Mr. Allen had supported the experiments made by one method by experiments made by another. He (Dr. Clowes) might say that this work had been carried out by a young chemist of the greatest care and integrity; and those present who remembered Professor F. D. Brown's work when he was in England would know that any work done in his laboratory, even if not conducted by the Professor himself, would be certain to be performed with the greatest possible carefulness of manipulation. He knew that Professor Brown had had oversight of this work, and had in some sense mixed himself up with it; and work with which he had identified himself was work about which they could not question the scientific accuracy. Mr. Allen had certainly gone against all their prepossessions on this question. In regard to the latter part of the paper, they were assured that in some experiments on coal gas naphthalene had not been present, or its presence had never been detected in any quantity, but that from the gas naphthalene had been afterwards deposited. Here they had a "facer;" and he did not know what to say about it. He had made no experiments; but he could not doubt the experiments which Mr. Allen had brought before them. He thought some of the gentlemen present would be itching to repeat Mr. Allen's work; and repeating it with equal care, they would possibly find that they arrived at similar conclusions. But he (Dr. Clowes) could not help feeling that Mr. Allen had shown, as far as his work had gone, that naphthalene must, under certain conditions, be formed in gas in which it did not pre-exist. He himself had only had limited experience; and he should like to know what those conditions were. It would be interesting to learn what were the substances from which the naphthalene had been formed (they must assume) by chemical condensation. He sincerely hoped that Mr. Allen, who had shown himself to be an adept experimentalist, would be induced, by the reception of the paper that night, to continue his experimental work. Mr. Allen could not feel that he had finished his work; and if they could induce him to continue it, and bring the subject as to the formation of the naphthalene again before the Society, he (Dr. Clowes) would feel that what he did in recommending the paper to the consideration of the Committee had not been thrown away. There was food for contemplation of the most varied character in the paper.

Mr. T. S. Lacey (of the Pimlico station of the Gaslight and Coke Company) said it seemed to him that the chief interest in the paper to gas manufacturers was that it appeared, so far as he could see, to give them a method of estimating the amount of naphthalene in coal gas. The question of naphthalene deposits was, as they all knew, a very difficult one; and the first thing they required, before they could form any opinion as to the causes of the deposits, was that they should be able to measure the amount of naphthalene in the gas. It was certainly more important for them to be able to estimate these substances before forming an opinion as to the causes of the deposits than to simply make a guess as to what was going on. There was one circumstance that differed slightly from these experiments, and that was the presence of water vapour. He did not know, but he thought it quite possible that the effect of water vapour on the gas might considerably alter its behaviour in relation to the deposition of naphthalene. He fancied these experiments had all been made with dry gas. They did know this, that, when gas was passed through a wet meter containing a large quantity of water, it very frequently occurred that deposits of naphthalene were found immediately after the gas had passed through that vessel. This certainly would go to show that saturation of the gases with water vapour

had some effect in causing a very rapid deposit of the naphthalene. From this, one might be inclined to judge that the experiments made on dry gas might not be a direct guide to what might occur with a gas containing water vapour. However, another method had been shown them for estimating naphthalene. Possibly others might pursue these investigations; and then they would be able to arrive at, if not the solution of the problem, some information that would possibly set them on the right path.

Mr. J. W. Helps (Croydon) said it was difficult to discuss a somewhat scientific paper such as the one Mr. Allen had submitted without having first had the opportunity of reading it; and therefore the remarks he had to make would only be on general principles. As Dr. Clowes had observed, Mr. Allen had given them a "facer." The theory which he had brought before them was one which he (Mr. Helps) must say did not coincide with the general ideas of gas engineers, nor did it coincide with the facts that their experience from day to day presented to them. They had been brought up in the idea that coal gas, being exposed throughout the works to deposits of naphthalene, left the works saturated. He was inclined to believe with Mr. William Young, who had done a great deal in investigating this matter, that the gas was saturated at the particular temperature at which it left the works. He should like to ask Mr. Allen one or two questions, and to inquire how his theory would coincide with two or three conditions and facts which he (Mr. Helps) had noticed in his own experience. He would take, for instance, the case of gas, say, at a temperature of 50° or 60° as it went into the holders on a hot summer's day—saturated with naphthalene at that particular temperature. In the holders, it was exposed to the hot sun; and the temperature was considerably raised. He was speaking now of a works where naphthalene was generally found both on the works and in the district; and the gas left the works at a higher temperature than it went into the holders. He found on that hot day that the naphthalene deposits were very much greater in the district than in the winter. If the gas did not pick up naphthalene at that particularly high temperature and drop it in the town afterwards, he should like to know where the naphthalene came from. He should like to mention another case. In two works almost side by side, and working under almost absolutely similar conditions (he referred to his own works at Croydon, which were very near those managed by his brother), the same coal was used, the same conditions of carbonization, and, with one exception, the same treatment after carbonization; and, notwithstanding, in his brother's town, naphthalene had never yet been seen, while in his own it was seen far too frequently. If this condition of affairs existed in the mains, and naphthalene was, as was assumed, synthetically built up in the mains, how was it that it was not built up in the town which he mentioned, while it was at Croydon? He agreed with Mr. Lacey, that, if Mr. Allen had not done anything else, he had shown them a method whereby they would be able to estimate the amount of naphthalene in coal gas; and until they could do this, they were working in the dark. Naphthalene was generally known as the gas managers' bugbear; and if Mr. Allen or some other chemist could only find out a means of ridding them of it, he would earn the thanks of the gas industry and profit himself. Gas managers had allowed this subject to slide in the most absurd way; and they were indebted to chemists for looking into the question for them. They did hope that Mr. Allen and others who might follow would go carefully into the matter, and give the gas industry the benefit of their researches, and try to rid gas managers of this bugbear which troubled them day and night, summer and winter.

Mr. Watson Smith (London) asked whether Mr. Allen had made an examination, under the conditions described, in connection with gas as it was produced, and also of the coal tar deposited previous to obtaining the gas. In several cases he (Mr. Watson Smith) had examined both; and he had been perfectly conversant with the condition of the gas. When the gas had been highly charged with naphthalene, he had always found the coal tar deposited—that was, previous to the gas entering the mains—had also been rich in naphthalene too. He also happened to know that gas manufacturers who used Wigan cannel coal, if they dared to use it exclusively, would obtain a gas which was free of naphthalene and would give little or no trouble, and the coal tar also would be free from naphthalene, but that the tar would contain anthracene in such a condition that it would be of no use to the alizarin manufacturer. They had therefore to manipulate their coal mixtures. There was no doubt some relation between the character of the coal and the products subsequently produced in the tar and the gas.

Mr. Helps asked to be allowed to offer a slight explanation. In comparing the two works, he stated that the mode of treatment after carbonization was similar in either case. He should have said that, in the one where no naphthalene was found, the gas and tar passed away together; and this would make it appear that the naphthalene which existed in the gas was washed out by the tar, and so did not appear in the district.

Mr. Watson Smith said he should also like to know how the author managed to completely free his coal gas from naphthalene without the benzene vapours being also removed. He understood that Mr. Allen took a quantity of coal gas and completely freed it from naphthalene. How was that done without the benzene vapours being removed? If the benzene vapours were absent, he should not consider it a proper coal gas. It would scarcely be of an illuminating charater.

Mr. W. J. A. Butterfield said he had little to add to what Mr. Lacey and Mr. Helps had said. He was very interested and gratified to see that Mr. Allen had shown experimentally that the quantity of naphthalene taken up by all gases—at least, by air, hydrogen, and coal gas, was identical, as he thought statements had been very common to the effect that coal gas in containing large quantities of vapours of other hydrocarbons, could not therefore retain naphthalene to the saturating limit. One point he was not quite clear about, and perhaps Mr. Allen could give him some information. It was as to the point in the distributing system, or on the works, from which he took the gas in which he found there was no naphthalene. He noticed that Mr. Allen stated, in support of his figures as to the amount of naphthalene that gas could retain at various temperatures, that whereas he had found 19 grains per 100 cubic feet, at 59° Fahr., Dr. Bueb had, by the washing process, actually removed practically the same amount—20 grains he (Mr. Butterfield) thought it was—from coal gas on the works. He believed that the point where Dr. Bueb was working was immediately after the condensers; but he was not quite sure it was not after the scrubbers. It seemed to prove at any rate that at this point the coal gas was saturated with naphthalene, or something like saturated, at that temperature. Had Mr. Allen any idea where the naphthalene got out of the gas when he found it at some other point free from naphthalene? It seemed to him that getting a liquid condensation product from the gas by freezing, and saying that because it was free from naphthalene, the gas could not deposit it, would not apply to gas as it was distributed. To say that thereafter the gas could contain no naphthalene, and that therefore no deposition could take place in the mains, was going too far, because although, in the first instance, they got a liquid condensation product in which the naphthalene, if it was there at all, was dissolved, after a time they had gases passing over that were not fully saturated with the liquid hydrocarbons which had been deposited, and this gas carried off the condensed liquid, and, if it was already saturated with naphthalene, it left the naphthalene which had been dissolved in that liquid behind. Under different conditions of manufacture, it was quite conceivable that gas at one time was more nearly saturated with readily condensable liquid hydrocarbons such as benzene, and that at other times it was far more nearly saturated with naphthalene, and not so nearly saturated with liquids. Under these conditions, he thought it conceivable that the naphthalene might be left behind in certain parts of the mains where there was no liquid deposit at the same time to carry it into the syphons. One interesting point in regard to naphthalene in gas supplies was that he had heard it asserted that naphthalene deposits in mains considerably diminished the illuminating power of the gas. It was inconceivable that the small amount of naphthalene in the gas would make much difference to the illuminating power whether it were retained in it or not. At 59° Fahr., if the gas was saturated with naphthalene, it would probably make a difference of 0·15 candle. Well, if the gas passed through mains containing a deposit of naphthalene, one would expect it to arrive at the burner saturated with naphthalene; but, on the other hand, gas engineers would tell them that gas which had passed through services containing a deposit of naphthalene had its illuminating power reduced by its passage through them. This was conceivable on the assumption that the naphthalene exerted a scrubbing action on the gas, and scrubbed from it some of the hydrocarbons that were readily condensed as liquids—such as benzene—and thus reduced the illuminating power. He might say that he attempted only that afternoon, on seeing the subject of the paper, to ascertain what the effect on ordinary London gas would be of passing it over naphthalene, and thus making sure that it was saturated with it; his object being to see whether there was any definite scrubbing action, or whether the gas had its illuminating power increased by taking up naphthalene. He was working on the ordinary gas supply to his office; and he was sorry to say the Gas Company for some reason (he was working for about three hours) varied the illuminating power of the gas by 1¼ candles. This upset all his comparisons. The illuminating power varied when the gas was not passing through any material. He was passing the gas through naphthalene, intending to observe if the illuminating power was affected thereby; then omitting the naphthalene-tube, and passing the gas through a tube packed with sawdust to see whether there was any scrubbing effect due simply to passage through finely divided material. But the variation in the illuminating power of the gas at the time quite upset his experiments. But he might say that he thought it just possible there was a slight increase due to the naphthalene; and certainly the sawdust caused no increase, but perhaps a slight decrease. The experiments, however, were quite inconclusive, and needed to be resumed under more favourable conditions.

Dr. Otto Hehner said that, while listening to Mr. Allen's paper and to the experiments on which Dr. Clowes had passed such high encomiums, it seemed to him there was little connection between the author's careful experiments showing the saturation of gas by naphthalene at different temperatures and the fact that naphthalene was deposited in pipes from gas in which there was originally no naphthalene. He should have thought this curious point required some judicial inquiry; but he could not see that there had been any efforts in that direction to

ascertain whether any naphthalene really was deposited. He assumed that it was on hearsay evidence that the author made the statement that pipes were blocked up with naphthalene from gas which had not contained any, as all the time he was busy in his laboratory carrying out investigations intrinsically and scientifically interesting, but which were not altogether conformable with ordinary practice. Not a scintilla of evidence had been brought before the Society to show that the gas did deposit naphthalene while it contained none. The question as to the solubility of naphthalene had received the most able attention of Mr. Allen; but regarding what actually took place in gas-pipes underground they knew nothing. Mr. Allen had constructed a theory which, if ingenious, did require a little proof; and he (Dr. Hehner) had very grave doubts about it. Again, he did not think there was anything very astonishing that naphthalene dissolved in air, hydrogen, and coal gas in the same ratio. He endorsed what had been said as to the high manipulative skill which Mr. Allen had shown in his experiments; and he admitted that he had brought before them a very simple and pretty means of ascertaining whether there was naphthalene in gas. But another method of determining naphthalene in coal gas had quite lately been brought before another Section of the Society by Dr. Colman;* and it seemed to him, with great respect to Mr. Allen, that it was a better idea to make a definite compound of the naphthalene direct with picric acid, and then determine it, than to arbitrarily freeze the volatile substances, and then determine it. Whether a short passing of gas saturated with substances like naphthalene through a freezing mixture was sufficient to deposit it all, might be open to some doubt. Probably, however, Mr. Allen had given attention to this point. When one made experiments of this kind, dealing with extremely small quantities, a very precise method of determination was required. In 100 cubic feet of gas, at 32° Fahr., the author showed there were 6 grains of naphthalene; so that, when he worked with 1 cubic foot—and that took a precious long time—he would only get, at 32°, $\frac{1}{100}$ of the 6 grains (which was a small quantity to weigh with precision). However, he valued the experiments of Mr. Allen, and he appreciated the great care and accuracy he had bestowed upon his work; but he (Dr. Hehner) did think he had hardly given sufficient foundation for the revolutionary theory he had propounded.

Mr. R. Forbes Carpenter pointed out that Mr. J. P. Leather, of Burnley, had had some experience of washing gas with oil for the removal of naphthalene;† and if anyone could contribute any real knowledge as to what Mr. Leather had done, it would be interesting. He should like to know whether since Mr. Leather had had his method in use, he had experienced deposits in any new main? Mr. Helps had indicated how in summer time, and not only in winter, gas managers were troubled with naphthalene. He himself had also been told by gas managers that the trouble occurred not only in winter but in summer; and he could quite understand how, with a change in the temperature, a previous deposit of naphthalene might be moved, so as to choke up some local service. [A letter from Mr. Carpenter supplementing his remarks at the meeting will be found in our "Correspondence" columns.]

Mr. H. Leicester Greville said it was universally known that naphthalene was a special bugbear to gas companies. It had a peculiar tendency to accumulate in bends and angles of pipes—a fact probably largely due to friction. He believed that moisture had much influence on the formation of naphthalene deposits. With regard to the paper, it would require much corroboration before it could be accepted as a fact that gas normally left the works free from naphthalene vapour, considering that the presence of naphthalene in quantity was so evident at all points of the manufacture. That naphthalene—a substance always regarded as essentially a product of high temperature—could be absolutely produced in the gas at the ordinary temperature of the air would also require a large amount of confirmation. If naphthalene could possibly be permanently retained in the gas, instead of being deposited, it would be a great boon to gas companies, on the ground of its great value as an illuminant.

Mr. Allen, replying on the discussion, said he had dealt with his subject purely from the point of view of the scientist; his practical knowledge was absolutely *nil*. For the statement he made as to the deposition of naphthalene in gas-mains, he had the authority of his own Professor (who was the Chairman of Directors of the local Gas Company), and also that of the Chief Engineer of the works, who was continually at the University [Auckland, N.Z.] where he (Mr. Allen) performed the work. He should also like to point out that the work extended over a year; and this to a great extent eliminated any variations that might have otherwise existed in the amounts of naphthalene in the gas if he had only worked at the subject a few times, and with widely differing intervals, instead of working at it continuously for nearly ten months. Reference had been made to Mr. Leather; and he (Mr. Allen) was very nearly quoting him in support of some of his statements. In the "Journal of Gas Lighting" for Sept. 26 last [p. 755], there was a reference to Mr. Leather's experience, which showed that, with gas containing an amount of naphthalene utterly insufficient to saturate it, he had trouble from deposits in the mains. In reply to Mr. Watson Smith's question, as to how he prevented the benzene being removed from the gas along with the naphthalene, he made no effort to prevent the benzene being removed. He wished it removed in fact; but, on the other hand, he experimented afterwards with gas from which the naphthalene had been carefully removed and carefully dried, and the benzene was reintroduced, but in quantity insufficient to saturate it at the temperature of the bath. Dr. Hehner asked why he did not convert the naphthalene into a picrate. He did not convert it into a picrate of naphthalene because the benzene at the same time would have been converted into a picrate, and would have formed a solid; whereas, by first converting it into nitro-benzene and nitro-naphthalene, and then oxidizing it with chromic acid, nitro-phthalic acid was alone formed. There was certainly no such compound of benzene formed. He therefore thought that it was much better to form nitro-phthalic acid and effectively get rid of the benzene. Dr. Hehner also remarked upon the fact that he had worked on small quantities of air. He did; but he (Mr. Allen) had the utmost confidence that his weighings were correct in every instance to (say) the 50th of a milligramme. Dr. Hehner also had no doubt that the weight of naphthalene required to saturate hydrogen, coal gas, carbon dioxide, &c., was exactly the same. Without wishing to disparage his opinion, he (Mr. Allen) might say that Professor Brown had very grave doubts whether coal gas or carbonic acid would load itself up with naphthalene at the same rate as the lighter hydrogen would load itself up. With regard to Mr. Helps's question, he was sorry he could throw no light upon it, as he (Mr. Allen) was not a practical man. But it seemed to him that Mr. Helps's statement that a hot summer's day had some effect on the gas, rather supported his own view. A hot summer's day was just the day when the benzene was not going to condense out—when it was not going to prevent the deposition of naphthalene at all by solution. But still, as he had said, he bowed to their opinion, being himself utterly unpractical and scientific only. Reference had also been made to the way abrupt bends seemed to facilitate the deposition of naphthalene. He had tried to imitate this in a great number of ways; but he did not succeed at all. He had electrified the gas, treating it with high alternating currents, but could not imitate the deposition in any way.

The Chairman remarked that the subject they had been discussing was of the highest importance to gas manufacturers; and it only remained for him, as Chairman, to tender to Mr. Allen the thanks of the meeting, and to endorse the suggestion which Dr. Clowes had made that the author would follow up his investigations, and place before the Society, on a future occasion, some experimental proof of the rather revolutionary view of the genesis of naphthalene in coal gas which they had had submitted to them.

* See *ante*, pp. 330, 405. † See "Journal," Vol. LXXIII., p. 1734.

PUMPING GAS FIVE MILES AT 20 LBS. PRESSURE.

By F. H. Shelton, of Philadelphia, U.S.A.

[A Paper read before the New England Association of Gas Engineers, at the Thirtieth Annual Meeting, Feb. 21, 1900.]

Last June, I read a paper before the Western Gas Association, at their twenty-second annual meeting, in Milwaukee, entitled and advocating "Distributing Gas under High Pressure."* I pointed out that steam, ammonia, air, oil, water, Pintsch gas, natural gas, and other fluids are daily safely distributed and handled in public places at many pounds pressure, in contrast with illuminating gas at but a few inches pressure (or but the fraction of one pound); and that the traditional practice of using but a zephyr-like pressure, involving large and costly pipes to send gas some distance, is relatively wasteful of energy and expensive, and, when analyzed, but little short of ridiculous. I contended that mechanical appliances, as well as precedents, were now sufficient to warrant distributing illuminating gas at several pounds pressure; and that such a plan of working should be, and could be, made to be entirely satisfactory, and would save enormously in the investment required. Since reading that paper, considerable further thought upon the matter has brought the settled conviction that transferring or distributing artificial gas at high pressure involves neither any great experiment nor any particular risk. An opportunity a short time ago presenting itself to demonstrate my belief, despite the solicitous concern of several pessimistic friends, I assumed the responsibility of constructing a high-pressure system. It has worked perfectly satisfactorily from the start. I have the pleasure of describing it herewith.

Phœnixville, Pennsylvania, 28 miles above Philadelphia, on the Schuylkill River, is a manufacturing town of 10,000 population. Spring City and Royersford, some 5 miles above it, are smaller towns adjoining, on opposite sides of the river, and together form a gas district of 6000 people. In the intervening distance between it and Phœnixville, there are a few farm houses, and a county almshouse about midway. Each district has had a Gas Company for many years. The plant at Phœnixville was fair; that at Royersford was wretched. The Consolidated Schuylkill Gas Company, organized by myself and associates, acquired, on Oct. 1, possession of both plants. It was decided to lay a high-pressure connecting main from

* See "Journal," Vol. LXXIV., p. 372.

Phœnixville to Royersford, shut down the plant at the latter point, and make all gas at Phœnixville. Work on the pipe-line was started on Oct. 27. Gas was pumped through within 64 days —on Dec. 29. Since that date, the Royersford district has continuously procured its gas from Phœnixville, without either trouble or the suggestion of trouble.

The connecting pipe-line is 23,015 feet—or about 4⅓ miles—in length, 3-inch size, and, of course, of wrought iron. To protect against corrosion, it was suitably coated after being strung along the road, and recoated in part after joining in the trench. The pipe is heavier than the ordinary. Special threaded connecting sockets were used; and provision was made for protecting the threads in shipment from the pipe-mills to the ditch. It is bedded 3½ to 4 feet deep in natural earth from end to end. Two thousand feet of the run was through rock, requiring blasting; 10,000 feet was through more or less shale and surface rock. Midway, it passes through an old-fashioned covered, three-span, wooden bridge, 600 feet long, crossing the Schuylkill River; being attached to the trusses 7 feet above the drive level. Certain weather casing was here provided. At one point, over a stone arch road bridge, the pipe has but 15 inches covering for a distance of 60 feet. It runs along a public highway throughout, excepting one stretch of 1200 feet through fields—private ground. In its run, it crosses under a three-track trunk-line railroad. Valves are inserted at intervals, and adjoining the bridge, for use in the event of freshet or fire affecting the latter, and to facilitate the locating of any possible future leaks. Drips are provided. The run is fairly hilly. Some provision was made for contraction and expansion. As each 1000 or 1500 feet of pipe were added, the line was tested throughout with air pressure, from a power compressor at the works, to 60 lbs. Despite all foresight and care, leaks were usually found. These were corrected, and a second test made; and until the line stayed tight for hours was final filling in of the ditch permitted. When the line was finished, it was bottle-tight, from end to end, as proved by a 60 lbs. test for hours. A wire was laid alongside in the trench from end to end, to enable the use in the future of any desired electric alarm, call bell, or recording or signalling apparatus. A number of other constructional details and adjuncts were incorporated, not necessary to here take up at length.

The pumping machinery at the starting point is a straight line, steam driven, air-compressor, of the usual type, but altered for handling gas. The steam and gas cylinders are each 8 in. by 12 in.; and the listed capacity, at 140 revolutions, or free air at atmospheric pressure is 5820 cubic feet per hour, with a duty of about 20 indicated horse power. The compressor draws gas at ordinary pressure from the holder; a station-meter with bye-pass intervening. It is located near the water-gas apparatus, and is attended to by the gas-maker. No extra labour is employed. The space occupied is about 2 ft. by 8 ft.; and its weight is slightly over 1 ton. Its cost, including governor, gauges, setting, freight, foundation, &c., was about $1000. It is so run as to maintain from 10 to 20 lbs. pressure on the pipe-line. Provision was made for adding a duplicate compressor. Gauges and other minor appurtenances were provided.

Principally because of quick delivery, two regulators or governors were used at the far end, to reduce the pressure from the pipe-line to the customary 2 or 3 inches. The first, with 3-inch connections, is built to reduce from 50 to 2 lbs. The second, with 6-inch connections, from 2 lbs. to 2 inches. They are of the dry, non-freezing diaphragm type. They are relatively inexpensive, and seemingly perfect in action. The gas, after being reduced in pressure at the gas premises in Royersford, goes into a gasholder of 10,000 cubic feet capacity, from whence it passes into the street-mains in the usual fashion. Connections are made, however, so as to enable bye-passing the holder, and the throwing of the governors directly on the town. The low-pressure 6-inch connections are sufficient for the present; but 8-inch will be a later size, and are partly in place. Suitable gauges, safety appliances, and other features are covered in the valve-room at the terminus of the line. The equipment within the room represents a cost of about $500. Taking this figure, and the cost of a compressor, as about the sum already stated, *plus* the outlay on any given size pipe-line laid per mile, one can approximate the cost of a complete high-pressure installation.

As to operation. The gas handled is a straight illuminating water gas of from 20 to 22 candle power, made from naphtha on a machine of the Lowe type, but of bad design. The single superheater is smaller in diameter than the generator, and the fixing surface scant. This will ultimately be corrected; but observations so far have been upon gas made on the machine as above. Each morning the gas-maker at Phœnixville runs the compressor for about two hours, and pumps enough gas up the valley to fill the holder at the Royersford works. Pumping then ceases; and the Royersford and Spring City supply is maintained from the local holder. About 5 o'clock, it is nearly emptied; and pumping is resumed, and continued until perhaps 8 o'clock, when the holder is left full for the night. Royersford signals Phœnixville when to start and when to stop pumping. The compressor is run at a rate 25 per cent. less than its listed speed, and handles thus in practice about 4000 feet per hour, which means a capacity of about 100,000 feet per day. This is at relatively low pressure. By increasing the speed and pressure, and the alteration of governor adjustments, the pipe-line can deliver much more in the future, when necessary. While pumping, there is a loss of 2 to 3 lbs. pressure at the far end, due to friction. Between periods of pumping, the pressure equalizes, and is left on the pipe-line; and in eight to twelve hours over night it drops from 1 to 3 lbs. This is not pipe-line leakage, but is due to the consumption of customers so far taken off the line, changes in temperature, slight condensation, difference in gauges, leakage around valve-stems, &c. The cubic capacity of the line is about 1200 feet.

The sceptics as to the success of the plan of handling, as herein described, illuminating gas at 20 lbs. pressure, told me there would be considerable loss of candle power from the compression; that the governors would not be reliable; that condensation would trouble us; that the high pressure in the pipe would be dangerous; that corrosion and leakage would shortly follow; and that breakdowns of the pumping machinery would imperil the general supply. We have been working now for nearly two months; and we do not find the trouble predicted. There is no visible difference in the candle power because of the compression and long-distance delivery. The regulators have not misbehaved a particle. We find them to be entirely reliable and dependable. The condensation is slight, is mostly caught at the beginning, and involves no trouble to take care of. There are no signs of probable breakdowns. The compressor works as smoothly as could be desired. Duplicate parts in stock, at moderate cost, will enable the quick replacement of anything that is likely to break, as the holder at the far end gives at present a storage capacity sufficient to permit of changes, alterations, &c. When it is done away with, as is the expectation before long, a duplicate compressor will first be added, which can be started up in thirty seconds, in the event of a breakdown of the one operating. We have no leakage on the pipe-line; and its construction is such that we are certain it will last for many years before any occurs, or repairs or renewals of moment prove necessary. We are satisfied with it; we have not aimed to satisfy others.

The following points may be noted in connection with the general operation. The amount of drip-liquor taken out daily at the compressor and at the first drip or two out on the line, is about 2 gallons, combustible and largely oil, but with some water in it. Drips examined half way along the line so far are practically dry. The amount of drip recovered is about 2 per cent. of the volume of the oil used in gas making. The temperature of the gas after compression and a couple of hours' operation, with 15 lbs. pressure in the pipe-line, was noted as 106°. At 20 lbs. pressure, it was 114°. The outside temperature was 40°. The temperature of the gas, after emerging from the earth and passing through the regulators, was from 54° to 58°. It will be noted that no tank or cushion chamber is used at the outlet of the compressor. There is some pulsation while pumping at the beginning of the line; but no customers exist at this point. Services along the pipe line, where expected, were provided for by tees. Additional services can, if desired, be put in without shutting off the gas.

In a second high-pressure line that will probably be installed shortly elsewhere, there will most likely be used—for the sake of compactness—a single governor, instead of two as on the line herein described, including increased provision for the occasional cleaning of same, as well as a line-meter that will measure gas at 50 lbs. pressure.

No photometrical observations have yet been made. We have been too busy with the completion of the line and other construction work to do aught else than get things finished and going in general. All of the figures mentioned in this paper are general, and those so far observed; but they are felt to be practically correct.

We have just added midway a branch run of 2000 feet of smaller high-pressure pipe, to the County Almshouse mentioned, with which we shall handle a business expected to amount to 500,000 cubic feet of gas a year. Two house-regulators at the far end of this run reduce the gas to the ordinary pressure, and control the supply in the buildings; while a third regulator at the entrance to the Almshouse grounds controls a single lamp-post. Each and all of these individual customers' service-regulators are working as well as the main-line regulators. They cost but a few dollars each, and show the ease with which business can be taken care of *en route* on a high-pressure line. A fire-house was also served by such a regulator for some few weeks; and seventeen houses on a cross street of 800 feet length are now being connected.

It will be noted that the work done by the above pipe-line and compressor is substantially the economical transfer of gas from one holder to another a few miles apart. The two months' operation has satisfactorily demonstrated to me that we can pump gas at high pressure long distances, dependably as to both pumping and regulating mechanism, without trouble as to condensation, at low operating cost, without visible loss of candle power, and on a very low investment outlay. I am expecting to further demonstrate that we can serve a town some miles distant with such an equipment, *and without the use of a holder*. The regulators have so far worked perfectly on varying supplies and pressures, in taking care of the gas passing through them into the holder; and there is no reason why they should not equally well handle and control the gas passing into the town direct. In fact, we have already so operated (tentatively, but continuously for two or three days) in preliminary trials, and entirely successfully, with the holder bye-passed and entirely shut off; and we are expecting shortly, by a lengthy trial, to fully prove the last point

to be covered—namely, that a high-pressure line, with continuous pumping at a moderate rate and duplicate compressors, will safely and dependably supply a town direct, and that no holder is necessary.

The long-distance, high-pressure delivery here described was started during a cold snap, and involved a plan of working entirely new to the men in charge. The gas was made with an indifferent machine, and was not over well fixed. The reconstruction of the works at large to some extent interfered with attention to, and concentration upon, the pumping department. No station-meters were then in use; and the steam supply for the entire works, water-gas making, heating, and all, depended upon but a 30-horse power boiler. Despite the above, everything worked as smoothly as could be desired; and that this should be so under such conditions is confirmation of my belief that pumping at high pressure can be readily done.

In view of the uniformly smooth working, and the satisfactory results experienced, there is no question in my mind that in most instances the cheapest way to transmit gas long distances will be found to be by several pounds pressure through a very carefully laid small screw-pipe. I and my associates are entirely satisfied with what we have done at Phœnixville on the lines described, and are expecting to shortly repeat it on a much larger scale in another, perhaps two other places.

While the pipe-line here described is the first of which I have knowledge anywhere in which ordinary 22-candle power illuminating gas is handled at 20 lbs. pressure, or thereabouts, it should be remembered that its successful working is but a confirmation of a closely similar operation that has for a long time been conducted by Mr. H. H. Edgerton, in Danbury, Conn., but which has practically been steadily overlooked or ignored by gas men at large. Mr. Edgerton, in pumping for nearly ten years a 35-candle power oil-water gas three miles through a 2-inch main, and up to 40 lbs. pressure, has long since shown the feasibility and low investment cost of supplying a town at a distance by high pressure. Credit for being the first to operate such a system should go to him.

The successful operation of a high-pressure line, I am well satisfied, will be closely dependent upon the attention paid to details. It may be thought that anyone can buy a pump, run a line of pipe, attach a regulator, and in this way deliver gas at a distance. Anyone can try it; but I am certain that, unless from twenty to thirty specific, definite details, of both construction and operation, are sufficiently foreseen and provided for, the result will be but partially satisfactory.

THE PRODUCTION OF LIQUOR AMMONIÆ FROM GAS LIQUOR.

Dr. Otto Pfeiffer, of Magdeburg, has recently published in the "Journal für Gasbeleuchtung" an account of improvements he has made in the process of manufacturing liquor ammoniæ direct from gas liquor. He claims that they have resulted in a considerable reduction in the cost of production. We propose to indicate briefly the outlines of Dr. Pfeiffer's recent work on the matter.

The old method of producing liquor ammoniæ from gas liquor consisted in heating the latter with sufficient lime to retain the acid radicles of both the fixed and the volatile ammonia. The amount of lime required was therefore very large—especially as the salts in the liquor are not wholly the normal compounds, but partially the acid salts. The large quantity of lime used produced incrustations on the liquor in the still, which adhered to the walls of the latter and proved troublesome. It was found that preliminary heating of the liquor removed a large proportion of the sulphuretted hydrogen and carbonic acid, leaving a quantity of free ammonia in the liquor. Actually, the free ammonia in liquor which has been thus subjected to a preliminary heating amounts to about two-thirds of the total ammonia; and consequently lime about equivalent to only the remaining third need be added when such liquor is worked up to liquor ammoniæ. The quantity of lime required is in practice deduced from the total amount of the acid radicles in the heated liquor, in the following manner: A given quantity of milk of lime, of known degree of alkalinity, is boiled with a given quantity of the heated gas liquor, until ammonia ceases to be evolved. The excess of lime remaining is then ascertained by titration with standard acid, using phenolphthalein as the indicator. The quantity of lime theoretically required is thus readily found; and a slight excess is added to the liquor in practical working. At the Magdeburg Gas-Works, the adoption of preliminary heating of the liquor, and the addition of the lime according to this rule, resulted in a saving of 50 to 60 per cent. of the lime which was used when the addition was made according to the amount of ammonia in the crude gas liquor. The method of working adopted was the following.

About 650 gallons of gas liquor was gradually heated in the still by indirect steam, to about 212° Fahr. This heating occupied two hours. The gases evolved consisted chiefly of carbonic acid and sulphuretted hydrogen, but also contained appreciable quantities of ammonia. In order to recover the latter, the gases were led into a vessel, in which they passed through crude gas liquor. At the conclusion of the preliminary heating, milk of lime containing the proper amount of lime was pumped into the still, and distillation was commenced by means of live steam. The gaseous ammonia which distilled off, accompanied by steam and small quantities of carbonic acid, sulphuretted hydrogen, and empyreumatic products, passed through a system of three washers or condensers charged with milk of lime, a reflux condenser, and four charcoal filters. This train of apparatus abstracted the steam and impurities; and the ammonia passed on to the absorption vessels, in which it was absorbed in distilled water kept at a low temperature. The distillation occupied about eight hours; and its conclusion was determined by the cessation of the noise of the bubbles of gas escaping under the water. The residual liquor in the still then contained only 0·03 per cent. of ammonia—*i.e.*, was of 0·14 "ounce" strength—and further treatment of it would have proved unremunerative.

The amount of lime used might be restricted to the quantity theoretically needed, and yet the whole of the ammonia (apart from the aforesaid residual 0·03 per cent.) could be recovered. But in this case distillation had to be continued for ten, instead of only eight, hours. When only the theoretical amount of lime was employed, the liquor after eight hours' distillation contained, on the average, 0·071 per cent. of ammonia; and after ten hours' distillation, the percentage dropped to 0·027. The additional two hours' distillation, therefore, produced an increased yield of ammonia equivalent to 8·2 lbs. of liquor ammoniæ, sp. gr. 0·890, per charge of 615 gallons of liquor put into the still. The cost of production of high-grade liquor ammoniæ, however, is about 10s. per cwt. This total comprises cost of lime 7½d., steam 4s. 6d., and wages 1s. 3d. So that clearly two hours' expenditure of steam and wages for the recovery of 8·2 lbs. of liquor ammoniæ cannot be remunerative, as the prime cost of this quantity is less than 9d. It would thus pay to stop the distillation at eight hours.

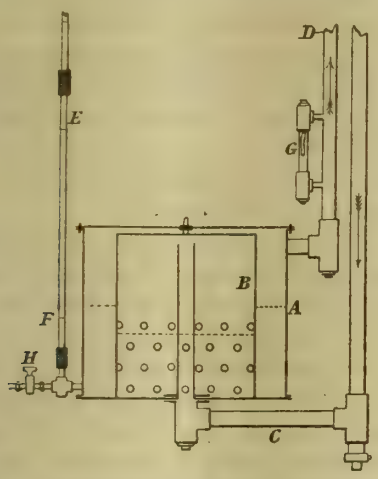
It was, however, far more economical to employ an excess of lime. Practically, it was found that, each time the still was recharged, about 44 lbs. more lime than the theoretically required quantity gave a satisfactory result. For instance, with eight hours' distillation, 132 lbs. of lime brought the ammonia in the gas liquor down to 0·07 per cent.; 165 lbs. of lime reduced it to 0·05 per cent.; while 176 lbs. of lime in all cases brought it below the normal residual percentage of 0·03. Even when only the theoretical amount of lime was employed, sulphuretted hydrogen was never found to pass forward to the absorption vessels. The reflux condenser retained traces of sulphuretted hydrogen, which escaped absorption by the milk of lime washers. If, however, there were some defect in the working of the plant, the use of only the theoretically needed amount of lime might have very serious ill results. For instance, the pipe leading the gases evolved during the preliminary heating process into the vessel containing gas liquor might have become choked by incrustations of ammonium carbonate, or the valve on the dip-pipe might not have opened at once.

In either instance, the acid gases would have been retained under pressure in the still, and the preliminary heating would not have sufficed to expel them. In such a case, undecomposed gas liquor would have distilled over if only the theoretical quantity of lime had been put in the still; and many hours would then be spent in cleansing by steam the whole train of apparatus contaminated by the sulphuretted hydrogen. The walls of the iron vessels would have suffered corrosion; and the liquor ammoniæ would for many days be discoloured by traces of iron. Such ill effects of faulty working of the plant could be entirely avoided by the interposition in the purifying system of a washer charged with a solution of caustic alkali. Two sets of apparatus at the Magdeburg Gas-Works have been provided with such washers for one-and-a-half years; and notwithstanding inadequate preliminary heating, or addition of too little lime to the still on several occasions, the liquor ammoniæ obtained suffered no contamination. The washer was placed between the charcoal filters and the absorption vessels; and consequently the gas was cool when it entered the washer. Soda lye, made by dissolving commercial caustic soda in ten times its weight of water, was the agent employed in these washers.

The washer at the Magdeburg Gas-Works was made by the Berlin-Anhalt Engineering Company. It consists (p. 679) of a cylindrical casing A of sheet iron, 0·2 inch thick, about 26 inches high, and 32 inches in diameter, closed at top and bottom. Within this cylinder is a cylindrical bell B, reaching nearly to its top, and attached by a bolt thereto. The diameter of the bell, which rests on the bottom of the outer casing, is about 22 inches. The lower half of the bell is perforated in rows of holes about 0·6 inch in diameter. The gaseous ammonia from the charcoal filters passes into the washer through a pipe C, which enters the bottom of the casing and extends to within a short distance of the top of the bell. The soda lye stands in the apparatus at a level about 1·6 inches above the topmost row of perforations in the bell. The gaseous ammonia, therefore, can only escape from the bell to the outer casing by depressing the level of the soda lye within the bell, and passing through the perforations and lye to the space between the bell and the casing. In the upper part of the wall of the casing, is the outlet-tube D by which the gaseous ammonia which has been washed by the soda lye passes on to the absorption vessels.

The dimensions of the parts of the washer are so co-ordinated that it throws very little back-pressure. The soda lye is run into the washer through a cock H in the lower part of the casing. A vertical glass tube E, communicating with the interior of the casing, shows the level of the lye within; and a mark F on the

tube serves to indicate the height to which the apparatus should be filled when it is recharged with lye. This tube is extended upwards for about 6 feet with ¼-inch gas-piping, open at the top, so that in the event of great back-pressure the gaseous ammonia will not pass back from the absorption vessels to the washers.



When the washer is filled with fresh soda lye, the latter absorbs much ammonia, and increases in volume. After saturation, the surplus liquid may be run off and kept for subsequent use. Or, in place of simple soda lye, the washer may be charged with equal volumes of soda lye and liquor ammoniæ. Very little increase of volume then ensues.

In regular working, the soda lye remains active for a long period—sometimes for a year. Its life is, of course, dependent on the number of times when the gas liquor is not subjected to an adequate preliminary heating. The soda lye, after it has been in use for a short time, should be tested at intervals for the purpose of ascertaining the amount of available caustic soda in it. Or, an even simpler means of finding out the exhaustion of the soda lye is to test the gaseous ammonia as it leaves the washer for traces of sulphuretted hydrogen, by means of lead papers, just as coal gas is tested for the same impurity. It is convenient to have a short glass tube, G, affixed to, and communicating at both ends with, the pipe by which the gaseous ammonia leaves the soda-washer. A strip of lead paper is suspended in this tube; and as a portion of the stream of gas passes through the tube, the lead paper becomes discoloured as soon as sulphuretted hydrogen begins to escape from the soda-washer. The lye must then be renewed. The spent lye is removed to the still, in order that the dissolved ammonia may be recovered.

For small works, the soda-washer affords a great advantage in that the smallest quantity of lime may be used in the distillation of the gas liquor, and expert chemical control of the working is rendered superfluous. For instance, starting with the ordinary allowance of about 330 lbs. of lime for each refilling of the still, the amount may be reduced in successive distillations by 20 to 40 lbs., until the completion of the distillation is observed to be retarded. From such trials, it is easy to deduce the smallest amount of lime which serves for working off the average charge; and thereafter that amount may be used without fear of faulty operation of the plant.

The advantages of the soda-washer in the manufacture of liquor ammoniæ are briefly—

1.—It enables the minimum amount of lime which may be employed to be found without analysis, and without causing contamination of the product with sulphuretted hydrogen.

2.—It avoids the necessity for frequently replenishing the hot washer in front of the still with lime.

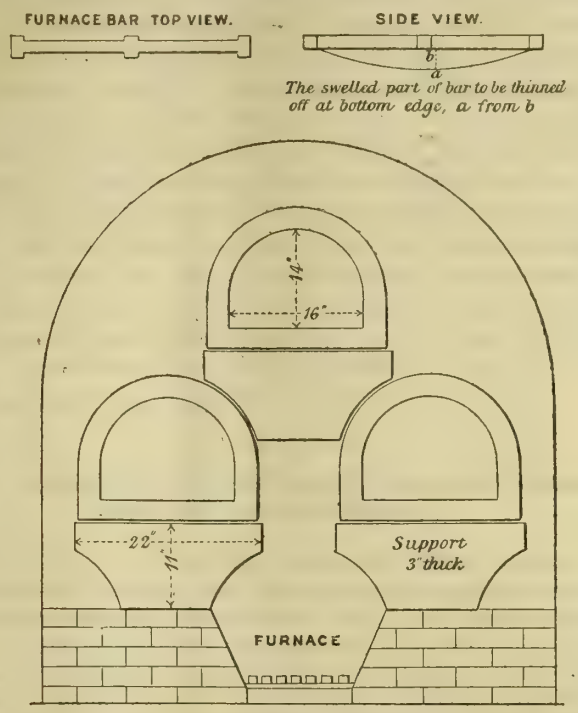
3.—Irregularities in the preliminary heating of the liquor do not affect the liquor ammoniæ made.

4.—Such irregularities are discovered by the prolongation they cause of the period of distillation with a restricted use of lime; and hence they can rapidly be rectified.

Preventing Waste of Water.—We learn from the "Engineering Record" that the prevention of the waste of water has become a serious problem in Schenectady (N.Y.). The quantity of water pumped daily is 162·5 gallons per head; and if this continues, additional pumping plants will be required. This will necessarily entail the expenditure of a large sum of money; and the question before the inhabitants is whether they will submit to additional taxation or make an effort to stop the waste. Reporting upon this matter, Mr. G. T. Ingersoll says: "The use of water-meters for stopping the waste of water is at the present time receiving the attention of water-works managers the world over; and from information and data received from cities having them in use, there can be no doubt that they accomplish the desired results. I am well aware that to instal a meter system over the entire city means the expenditure of many thousand dollars; but I am satisfied it is the only practicable and satisfactory method to all parties to prevent water waste."

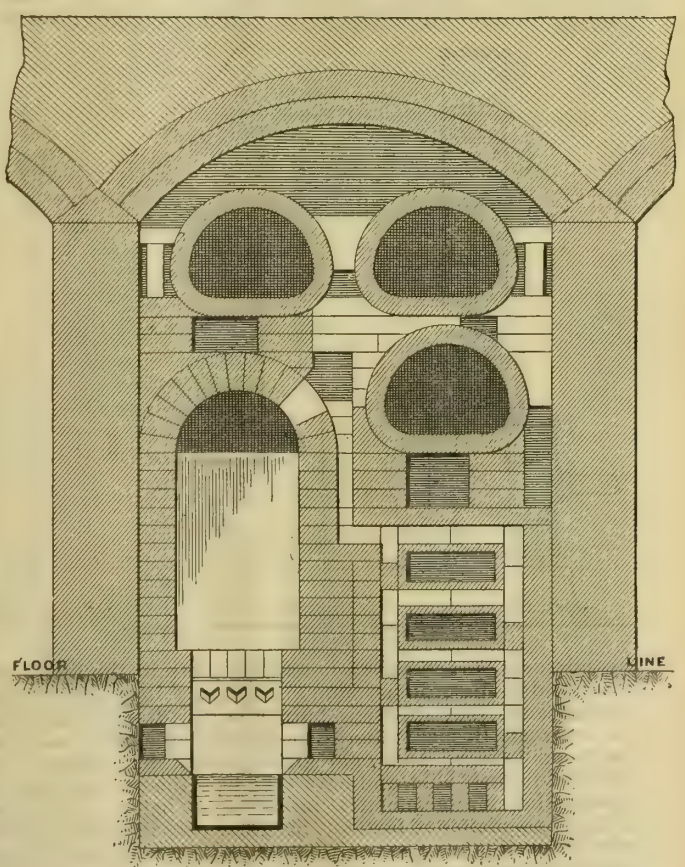
RETORT-SETTINGS IN 1850 AND 1900.

Mr. J. Armitage Drake (Messrs. Jonas Drake and Son), of Halifax, recently sent for publication a very interesting sketch, and the autograph letter by which it was accompanied, of a setting of three clay retorts suggested in the year 1850 by Mr. Crosthwaite, the then Gas Engineer at Carlisle, for erection at the



Scale ½ inch to a Foot.

CROSTHWAITE'S SYSTEM—1850.



DRAKE'S PATENT SYSTEM—1900.

Douglas (Isle of Man) Gas-Works. This, which was evidently one of the best settings of clay retorts in use at the time, forms a great contrast to a gaseous-fired setting of the present day. In order to bring out this contrast, Mr. Drake at the same time forwarded a drawing of his latest type of such retort-furnace; and the two are reproduced below, together with the letter of explanation by which Mr. Crosthwaite accompanied the sketch he sent to Mr. Corteen, of Douglas. This matter is referred to in an essay appearing to-day (see p. 669).

Gas-Works, Carlisle, May 30, 1850.

Mr. R. CORTEEN, Douglas Gas-Works, Isle of Man.

Dear Sir,—In reply to yours of the 27th inst., I beg to hand you a rough elevational sketch of our oven and retorts, with the

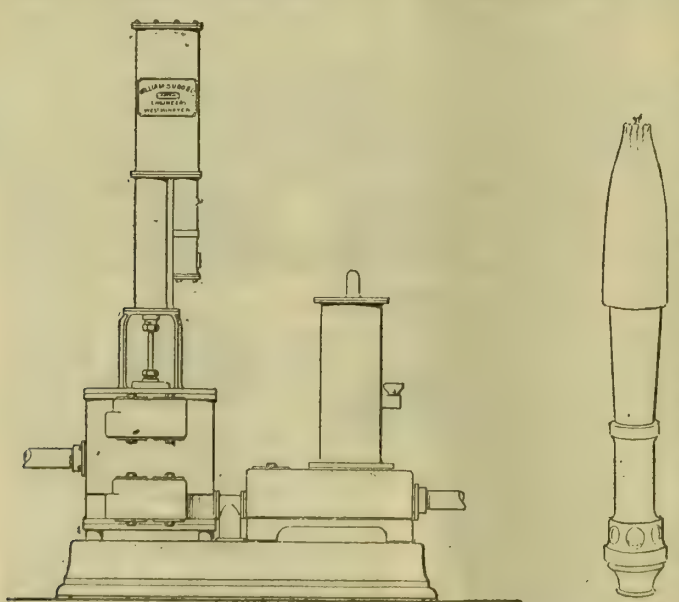
front wall removed, from which you will have no difficulty in conceiving the principle upon which they are set. Instead of brick pillars, we use fire-lumps for supports, to the shape as sketched, and 3 inches thick. There does not appear to be a great deal of difference between your mode of setting and our own, except in the size of the fireplace. We have seven bars in width, which are 2 ft. 6 in. long. The sides of the furnace are sloped as shown, and the front part of it is contracted to 1 foot wide, to fit the opening of the furnace-frame, which is 1 foot square. We generally put four supports under each retort, the back end of which rests on a 4½-inch brick wall—the more support the better, especially at the fireplace. I prefer supports in *one piece* to brick-built pillars, as the fireclay will be liable to be burned out of the joints, and thence the pillar will give way. I take in the "Gas Journal," and have seen the plan you refer to. I had some thoughts of trying the arch last year, but found we had not sufficient height without placing the bars considerably lower. As a substitute for the inner arch, I put fire-tiles 3 inches thick the whole length of the two lower retorts, but these I found cracked and fell down adjoining the fire. Our retorts, which are Ω's, are 7 ft. 3 in. long by 16 in. wide and 14 in. deep. Out of the 13 cwt. of coke produced per ton of coal, we use about 5 cwt. 38½ per cent.) as fuel. We frequently use small coal and coke mixed for fuel. Trusting the above may be useful,

I remain, &c.,

(Signed) John Crosthwaite.

SUGG'S INCREASED PRESSURE AND CHRISTIANIA INCANDESCENT BURNER SYSTEMS.

Another proof of the strong hold that the incandescent system of gas lighting has taken upon gas consumers the world over, and a further help to the development of the system on scientific and popular lines, is the improved arrangement now being introduced by Messrs. W. Sugg and Co., and actually on view at their Westminster establishment. The accompanying illustration shows the outward appearance of Mr. W. Sugg's patent pressure increaser and water-power and gas regulating apparatus for use in high-power incandescent gas lighting; and the larger-scale figure represents his new and improved pattern of



incandescent burner, which is adapted both to the high-power lights and to the ordinary kind of lighting. It is an interesting circumstance that this new burner is called the "Christiania Incandescent Burner," after the well-known scientific and artistic flat-flame burners and opal globes which have never been equalled in their kind, and have even held their ground gallantly against the more economical incandescent lights. The reason is that, as a matter of fact, Mr. Sugg has now made an incandescent burner that can not only be used with a Christiania-shaped globe, but really looks very well in it. There is no chimney, nor flash-light; but the burner stands on a governor exactly like that familiarized by the old favourite flat-flame system of domestic lighting. All the elegance of the old system is preserved; and, unless we are greatly mistaken, gas consumers in general will be thankful to have the Christiania style of fitting placed in their hands again, with all the added advantages of the incandescent method of producing the light. This success has removed one of the most real objections commonly entertained to the general household adoption of gas lighting by incandescence. It is stated that the mantles last even better in the Christiania-shaped globes than they do in chimneys. The appearance of the light is all that could be desired. The mantle is entirely screened from direct vision, unless one takes the trouble to get underneath the globe and look up into it; and even then the highly-reflecting inner surface of the opal globe cheats the eye. It is unnecessary to say anything for the efficiency of the downward reflection from these light-sources.

To return, however, to the apparatus illustrated. After much experience of attempts to realize the mechanical conditions of the reliable, cheap, and safe supply of gas at the heightened pressure of 9 inches of water at the high-power incandescent burner, Mr. Sugg has produced the device now shown. This arrangement possesses the following characteristics: Water power, obtained from the ordinary town's supply, is the motive force; the whole thing is self-contained, and automatic; the regulation of the supply to the demand is effected by a mercury-sealed gasholder-governor; there are no cocks or taps to jam or leak; any escape of gas or water is practically impossible; and the gas and the water do everything by themselves subject only to the turning off and on of the lights.

The operation of the apparatus is as follows: The upper portion of the combination is a small hydraulic ram, which is in rigid connection, by a vertical prolongation, with a lower gas-cylinder and piston of much larger dimensions. The ram is supplied with water, which may be at any pressure from 20 lbs. to 60 lbs. per square inch; and its reciprocating motion is determined by a very simple piston valve motion, which changes the direction of the flow to the top or bottom of the ram-cylinder on the completion of its stroke. This motion is very quiet, and the ram works with great smoothness. It pumps the gas at once to the required working pressure of 9 inches, or more. The gas at this increased pressure passes into the base of the apparatus, which is made to serve as a reservoir and is capable of holding about twice the contents of the pump. From here the gas flows into the regulating part of the arrangement—seen to the right of the figure—which is, as already stated, a mercury-sealed gasholder in a casing. It will withstand a pressure of 120 inches of water before breaking the seal. The holder carries a central rod, which actuates a lever in the base. The arms of this lever are of unequal length; and at the end of each is a valve taking a bearing on a seat. These valves respectively control the flow of gas from the reservoir, and the discharge at the pressure to which the holder is weighted—say, 9 inches—irrespective of what the pressure in the reservoir may be. No pressure greater than that of the holder can pass into the distributing system. There is provision in the side of the cylinder for filling up the level of the mercury, after which it is screwed up. The double cut-off is automatic in its action; and when the lights are shut off, the accumulated pressure of the gas in the reservoir stops the pump, and consequently the ram. It is like a spring which is always in place and ready to act. Turning on the burner cocks releases the gas pressure; and the ram forthwith starts, running as fast or as slow as the number of lights on may determine. Absolutely no attendance is required, beyond an occasional oiling, or the setting-up of a gland. It must be difficult to surpass the simplicity and economy of working parts in this arrangement.

The next essential of the new improvement, as constituting a Sugg combination, is the atmospheric burner for the high-power lights and others. Of course, Messrs. Sugg and Co. have nothing to do with the manufacture of the mantles. It argues a degree of hardihood on their part, however, to have made one more attempt to improve the bunsen burner for the purpose of incandescent lighting. Yet this they have done, with what success time will show. It is possible meanwhile to direct attention to the salient features of the Sugg lighting bunsen. In the first place, it is a stout, strongly-made article, comparing favourably in this respect with many of the flimsy foreign makes of bunsen, which can be crumpled by the hand with small effort. It is a longish affair, with a central gas-jet formed of steatite, made to send a jet of gas, of the rated quantity for the pressure, vertically upwards through the upper part of the fitting. The holes for the admission of air are in the periphery of the burner-tube, just below the gas-nipple, and are not adjustable. It is contended, indeed, that this burner will work equally well with gas of all qualities usually sold, and within a considerable range of pressure variation. It is not intended that the gas and air should mix in the burner tube. On the contrary, when the top of the burner is away, and the gas-jet allowed to light-back, the flame burns as strongly and straight as that of a jet photometer. The top of the burner is the mixer. It is a simple disc, or button, of unbaked steatite, fitting easily in the metal burner-tube, having a double row of round holes pointing outwards on its upper side, at the rim. In the middle it is solid, with a socket for the foot of the usual mantle carrier. Thus the gas and air strike against the under side of this piece of steatite, and are ignited at the upper holes, the direction of which is adapted to the requirements of enfolding the mantle in the atmospheric flame. The high-power burners are rated to consume 10 cubic feet of gas per hour, at the standard 9 inches water pressure. The duty of nominal 16-candle gas in this case is 30 candles per cubic foot per hour—say, 300 candles per burner. Three of these in a lantern with a semi-translucent top reflector give an actual lighting effect of 1000 candles for 30 cubic feet of gas per hour—in most places costing not more than a penny.

With respect to the smaller Christiania incandescent burners, it should be remarked that, as an old practitioner in this business, Mr. Sugg is no believer in gas-burners consuming less than 3 cubic feet per hour. He has no quarrel with those who like these tiny burners, with their necessarily minute dimensions and small adjustments; but he is no "baby farmer" himself. For

long-continued steady work, year in year out, a burner which can be relied upon to stand to its 3 cubic feet per hour is his ideal; and for this consumption the best useful effect with the Christiana globe is 80 candles. What strikes the eye when looking directly at such a light-source is perhaps 50 candles, spread over a moonlike surface of considerable area, and consequently not dazzling. And, it must not be forgotten, this result is absolutely the same whether the nominal illuminating power of the gas burnt is 14 or 20 candles. Moreover—and this is another important consideration for the consumer—variations of gas pressure from that at which the burner is on the point of "lighting-back," to the highest permitted by the governor, which is 15-10ths, do not make any appreciable difference in the lighting effect of the burner; while the lower working pressures actually enable the gas to score a higher duty. The reason for this is plain. It is the maximum pressure that the burner maker has to prepare for. He must make sure that at the highest pressure of gas at the foot of the burner there shall be enough air drawn in to burn it to proper advantage. When the gas pressure falls below the maximum, less gas passes and the resulting mixture is poorer. But the flame is also hotter, as is well understood. As the pressure of gas falls, the blue flame of the bunsen becomes green, until, just before the explosive proportions are reached, the holes whence the mixture escapes are crowned with emerald dots. Then the sheath of flame is at its hottest; but there is plenty of margin between the minimum and the rated pressures to ensure that the burner shall go on working. Consequently, the gas consumer is in far happier position than the user of incandescent electric lamps of the latest brand; for in this case a reduction of 5 per cent. of the normal voltage will reduce the carbon filaments to the appearance of "red hot hairpins." Sugg's high-power incandescent burners will bear a reduction of from 9 inches to 2 inches gas pressure before firing-back; and the same elasticity, in degree, is enjoyed by the small burners.

Experienced gas engineers will be interested in the restoration of the non-conducting steatite for gas-burner tips to the same place in the bunsen burner as it has occupied for so many years in the luminous flame burner. It is unnecessary to go over the old grounds on which the employment of this useful substance for such a purpose was based. It is sufficient to say they have never been shaken. In the case of the bunsen burner, they hold good equally, up to a point; and the point is certainly far enough advanced to be secure. Lastly, the position occupied by the firm of Messrs. W. Sugg and Co. in the gas industry is so exceptional, and the history of the work of the firm for gas engineers and consumers so remarkable, that we may be permitted to heartily congratulate them on this attempt to recover the lead in gas-lighting appliances of which they were deprived by the partial eclipse of the argand and flat-flame gas-burners by the insistent incandescent lights. Conversely, it is the best possible testimonial to the completeness of the triumph of the latter system that it has conquered the strongholds of the older dispensation, and has practically no rival in its universal domain.

Preventing Gas-Pipes from Freezing.—The Manager of the Cracow Gas-Works has described in the "Praktische Maschinen Constructeur" a method which he has devised for preventing the gas as it leaves the purifiers from causing the pipes to freeze owing to the water contained in the gas. The device consists of a cylindrical box made of brass, and soldered on the gas-pipe; the box containing a wire gauze basket filled with calcium chloride. In passing the basket, the water in the gas is absorbed by the chloride, which gradually becomes deliquescent and falls to the bottom of the box. The liquid can be run off from time to time by the aid of a cock, and then evaporated in the oven to recover the chloride. It would perhaps be preferable to dry the gas just before it enters the mains for distribution. In this way all the inconveniences due to the presence of water in the gas could be prevented.

Gas from Town Refuse.—Steam raising from town refuse is a comparatively old topic; and the fuel value, from this point of view, of all that is implied by the words "town refuse" has been discussed on many occasions, and has been practically illustrated as well in several instances. "It is, therefore, somewhat refreshing," says a writer in the current number of "Cassier's Magazine," "to read of the latest proposed refuse disposal scheme, which is simply to convert the stuff into fuel gas. This, later, is to be used in gas-engines for electric generator driving for power and lighting, leading eventually to an energy system beside which all present and immediately prospective steam-power plants would appear hopelessly antiquated. With the gas generated, of course, at one large producer station, and utilized permanently on the spot, and that spot located on the water front of such cities as have any, the question of power-station coal would be satisfactorily disposed of at once, and that of water as well, for the only water that would be needed would be that for cooling the gas-engine cylinders, and this could be pumped from the river and again discharged into it later. The scheme is decidedly an attractive one. It would solve some municipal difficulties as well as some encountered by private corporations; but, for the present, unfortunately, matter-of-fact figures to give a substantial practical base of operations are entirely lacking."

REGISTER OF PATENTS.

Making Gas for Heating Purposes.—James, R. W.; a communication from the American Stoker Company, of New York. No. 2506; Feb. 3, 1899.

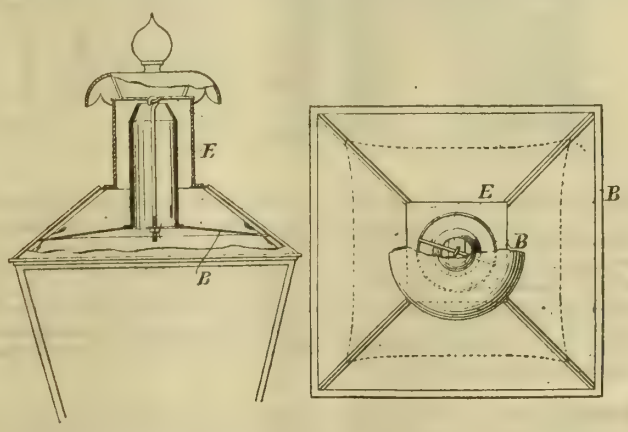
The patentee describes a method of making fuel gas from coal, consisting in distilling and decomposing the hydrocarbons, and passing the products resulting from the distillation and combustion of the hydrocarbons, as well as the products of the combustion of the carbon, over, or in contact with, incandescent carbon; and he points out that his method of making fuel gas is not dependent on the use of the arrangement shown in the drawing accompanying the specification, or, indeed, in any special mechanism.

Up to the present time, it has been, as far as he knows, the universal practice in generators of producer gas, to apply the fresh coal on the top of the incandescent coke; the result being that the gases produced are charged with the water expelled from the green coal, and, under certain conditions, with vaporized liquid hydrocarbons—such as tar. These form unstable gases, which it is the common practice to remove when a stable gas is needed.

One of the principal features of the present invention, therefore, consists in reversing this practice, by the introduction of the green fuel below the incandescent body of coke, instead of above it. The result of this change is said to be marked. In the first place, the water expelled from the green coal, in passing up through the incandescent body of coke, is converted into hydrogen and carbonic oxide gases, which are stable; in the second place, the liquid hydrocarbons are oxidized, and also converted into hydrogen and carbonic oxide gases; and, in the third place—since the distillation of the hydrocarbons takes place in a zone in which free oxygen is present—they are decomposed and converted into carbonic acid gas, which, in its passage through the incandescent coke on its way to the exit-flue, is changed into carbonic oxide, in precisely the same way that the carbonic acid resulting from the combustion of the coke is, on its way to the flue, converted into carbonic oxide. As a result, the gas produced is more nearly pure carbonic oxide and hydrogen, free from moisture and volatilized liquid hydrocarbons; and therefore a stable gas generated as such, and not made stable by any subsequent process—such as washing or scrubbing, or draining-off of the non-stable and deposited constituents. Various difficulties, arising from the unstability of producer gas as now made, are therefore avoided; and a gas is produced which is suitable for general heating purposes. In the manufacture of the gas, steam is introduced, as is the common practice in the making of producer gas, to supplement the combustible gases produced.

Lanterns for Incandescent Gas Lighting.—Talbot, H., of East Dulwich, S.E. No. 5867; March 17, 1899.

This invention consists in means for preventing down-currents of air acting on the flames of incandescent gas-mantles, when used in public lamps. This is attained by the use of a deflector, supported in the roof of the lantern, formed so as to allow the air to pass round its edges, and



also with a central hole having a bar across it, and a contracted chimney extending upwards into the ventilator of the lantern. As in such a type of lantern as that shown the bottom of the lantern would be so far air-tight as to prevent the necessary quantity of air required to support combustion from entering, air for the purpose would enter by the cylindrical ventilator E, and be deflected by the plate B. It would thus be directed down the sides of the lantern, keeping them cool, and would not blow upon the mantle, and render the flame unsteady. An article dealing with this invention appeared in the "Journal" for Oct. 3 last (p. 821).

Generator and Regenerator Furnaces for Gas-Retorts.—Drake, J. A. of Halifax. No. 6092; March 21, 1899.

This invention relates to means for controlling the secondary air in generator and regenerator furnaces and producers where coal, coke, or other combustible material is used.

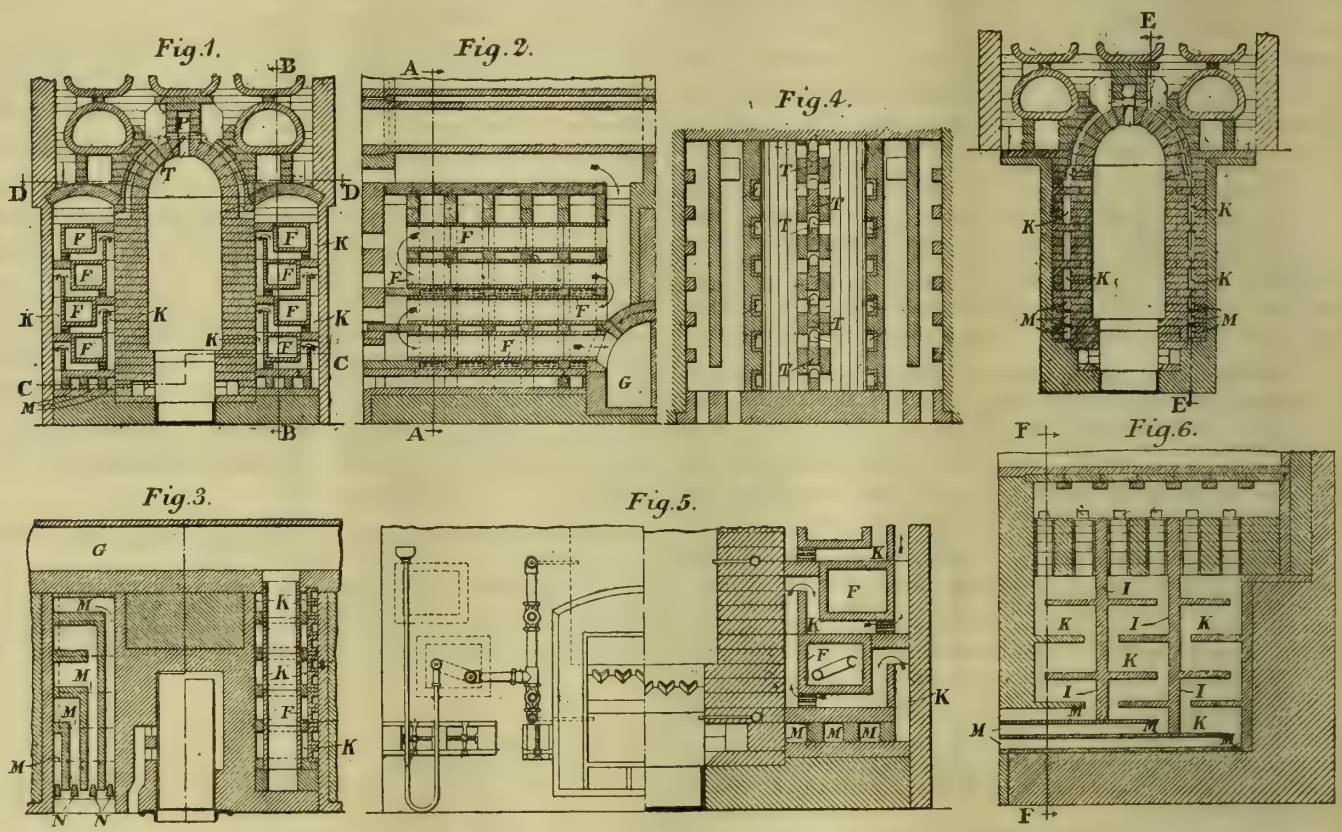
Fig. 1 (p. 682) is a sectional elevation, on the line A of fig. 2, of a producer and recuperator having these improvements applied thereto. Fig. 2 is a longitudinal sectional elevation on the line B of fig. 1. Fig. 3 is a sectional plan on the line C of fig. 1. Fig. 4 is another sectional plan on the line D of fig. 1. Fig. 5 is an enlarged front elevation, partly in section, of the lower portion of the oven or furnace. These drawings show the improvements applied to a recuperative or regenerative furnace of the type described in the inventor's patent of 1898, No. 6160.

After performing their work in heating the retorts, the waste gases pass, by way of channels, to the recuperator-tubes F, which convey them downwards in a zig-zag course from back to front and front to back alternately, in a direction lengthwise of the furnace, as many times as may be desired, and finally deliver them into the main flue or uptake G, for discharge into the atmosphere. Transverse fire-brick walls cover the joints of the tubes F, to prevent leakage arising from shrinkage or settling

down of the foundation work. These walls are made solid from side to side of the recuperative chambers, so as to divide the passages K, up or through which the secondary air passes and circulates around the recuperator-tubes, into several sections longitudinally—such sections having no communication with each other, and therefore differing in this respect from other constructions of recuperators. Leading to the lower or inlet ends of each section of secondary-air passages, are air-channels M, extending longitudinally from their respective secondary-air passages to near the front of the furnace, and terminating in a box provided with sliding doors or valves (see fig. 5), for primarily controlling the admission of air. In addition to the sliding doors or valves, loose wedge-shaped blocks N (fig. 3) are adapted to be moved into, or withdrawn from, the mouths of the air-channels, and so contract or increase the area through which air can pass into the channels. By adjusting these doors or valves, the quantity of secondary air supplied to the recuperator, and therefore to the combustion chambers, can be governed to the greatest nicety to suit requirements. The quantity of secondary air admitted to each of the several sections of the air-passages K can also be regulated as necessary by the wedge-shaped blocks; consequently it is possible "to supply a properly distributed supply of heated air to the combustion chambers from front to back to meet the producer or furnace gases, and ensure perfect combustion."

The means adopted for controlling the supply of producer gases admitted to the combustion chamber consists of a chamber P, into which all the furnace gases pass from the producer chamber, and from which the gases emerge through lateral openings into the combustion chamber, to meet the heated secondary-air supplies. The width of the chamber is rather more than the width of the openings leading thereto from the producer chamber, in order to receive bricks or blocks T of suitable size and shape, which lie flat upon the floor of the chamber P, and are adapted to be moved over or away from the openings as required to effectually check the passage of the producer or furnace gases to the combustion chamber at any point longitudinally, in order to prevent local or unequal heating of the parts of the combustion chamber.

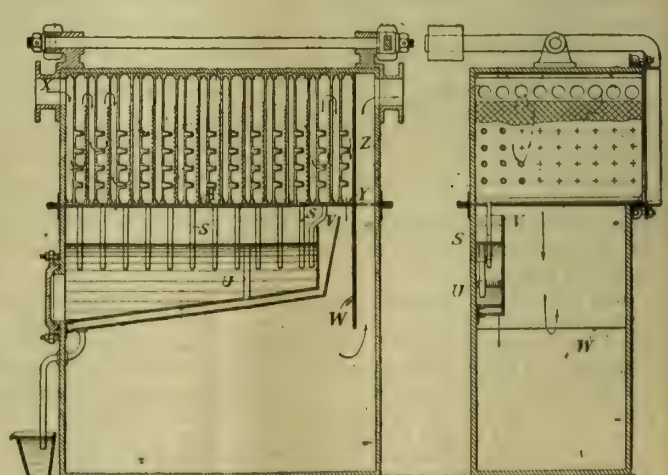
Fig. 6 shows the application of the improvements to a generator furnace, where the waste products of combustion, after heating the retorts, are not employed to heat the incoming supply of secondary air, but are allowed to pass away into the main or exit flue. In this class of furnace, the secondary air is heated by causing it to travel zig-zag over the surface of the heated side-walls of the producer. The transverse walls I are



made solid from side to side of the secondary-air chamber—thus forming a series of separate and independent air-passages K, each of which opens respectively at its inlet end into an air-conduit M. The admission of air to these conduits is controlled by a sliding door or valve at the inlet-end of each channel, or, if desired, the conduits may open at their inlet-ends into a box or chamber having sliding doors or valves, to regulate the total quantity of secondary air supplied to the furnace; and the admission of air to each individual air-channel may be regulated by the wedge-shaped blocks already referred to.

Purifying Gas.—Guillaume, N. A., of Paris. No. 12,295; June 13, 1899.

This apparatus is more especially intended for use in connection with gas-generators working by suction under the action of a pump or motor. It is constructed (as shown) with two chambers, one above the other, and separated by a horizontal partition. The upper chamber is divided into compartments by plates, preferably arranged to slide between guides or angle-irons. The partitions are provided with conical openings and nozzles. The partitions also have corrugated surfaces or reticulated or perforated plates on the side presented to the nozzles, so as to provide a large surface against which the gas on issuing impinges. At the upper part of each of the partitions, are openings for the passage of gas into the adjacent compartment. The upper chamber is provided at one side with a cover fixed (gas-tight) to levers mounted on a shaft, and balanced by counterweights. The liquid and impurities entering with the gas are arrested in each compartment of the chamber by the corrugated partitions or perforated plates, and pass downwards and through pipes S into a reservoir arranged on one side of the lower chamber. These pipes close the direct passage of the gas from one chamber to the other; and to secure this, they dip into a sufficient quantity of liquid. U is an overflow-pipe for regulating the level of liquid in the reservoir, and conducting any excess outside the apparatus. V is an auxiliary passage, to regulate the outflow of the liquid. The gas enters the apparatus at X to the first compartment of the upper chamber, and passes successively through the several compartments, as indicated by the arrows. As it passes through the nozzles of the partitions of one set, it strikes against the corrugated partitions of the other set. This intercepts the liquid and impurities; while the gas flows from compartment to compartment, and after repeated impacts "reaches the last compartment completely purified." In the bottom of the compartment are openings Y, forming direct communication between the top and bottom chambers. The gas passes into the lower chamber (which constitutes a reservoir, and is provided with a depending and elastic partition W, and is drawn off by the supply-passage Z), formed by the walls on one side and the depending

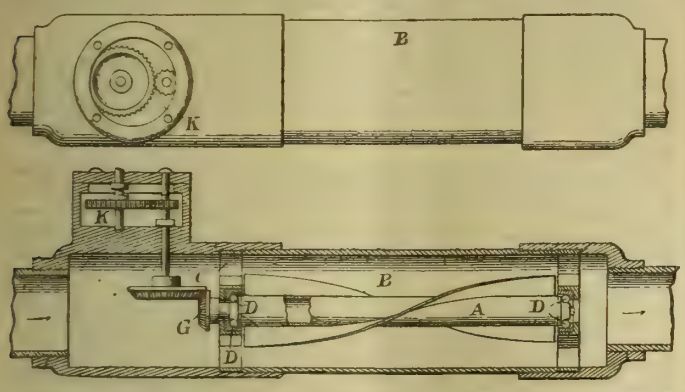


elastic partition W on the other. If from any cause the gas is taken off too rapidly, the increased suction causes this elastic partition to approach the wall, and so reduce the section of the gas-passage. The partition thus regulates the supply of gas; the lower chamber with its moving partition acting to a certain extent as a gas pocket or bag.

Fluid-Meters.—Chesley, S. A., of Lunenburg, Nova Scotia. No. 24,192; Dec. 5, 1899.

This invention relates to a water-meter which will allow the free, practically straight, and unobstructed flow of water through it, with no abstraction from the force of the current beyond the bare minimum amount necessary to actuate the registering clockwork; is free from liability to become choked or clogged; and in which the end-thrust on the rotating shaft or spindle is reduced to a minimum.

The rotary part of the meter consists of a spindle or shaft A, having thereon two opposite helical fins or flanges of long pitch, with an angular relation with the shaft of about 30°. The shaft is journaled in a tubular casing, composed of a main section B, an end section, and a cap-section, united by screw joints. The contracted orifice in the end section is internally threaded for connection with the pipe from which the water enters the meter; while the contracted orifice in the cap-section is similarly threaded for connection with the outlet from the meter to the



point of consumption. The two openings *b* *b*1 are in axial alignment with the shaft. C are the bearings for the journals of the shaft. They consist each of a spider, whose hub-portion is formed with a cup to receive a series of balls D. The journals of the shaft are provided with cones, which co-operate with the cups and balls so as to provide ball bearings for it. On the further end of the shaft is a bevel gear-wheel G, which meshes with a similar wheel on a vertical shaft at right angles to the spindle, and which passes into a chamber K (formed by a tubular projection), where it actuates a dial train of any suitable character.

APPLICATIONS FOR LETTERS PATENT.

3703.—Goodman, G. O., "Gas-stove water-container." Feb. 26.
3721.—Impey, G. D., "Automatic gas-tap." Feb. 26.
3735.—Heinroth, P., and Tresenreuter, G., "Incandescent gas-burners." Feb. 26.
3745.—Messer, A., "Acetylene gas-generators." Feb. 26.
3776.—Brown, A. E., "Coke-pusher machines." Feb. 27.
3839.—Martini, A., "Gas-mixing apparatus." Feb. 27.
3840.—Duncan, J. H. H., "Manufacture of incandescence bodies." Feb. 27.
3844.—Lancaster, E. W., "Acetylene generators." Feb. 27.
3850.—Willey, E., "Gas-engines." Feb. 28.
3860.—Leaver, J. R., "Gas-brackets." Feb. 28.
3874.—Bradshaw, T. P. R., "Artificial lighting." Feb. 28.
3925.—Helmecke, H., "Mantles for incandescent gas lighting." Feb. 28.
3970.—Millar, F. J. M., and Eede, C., "Gas-stoves." March 1.
3987.—Scott, E. G., "Manufacture of sulphate of ammonia." March 1.
3995.—Place, J., "Mantles for incandescent gas-light." March 1.
4010.—Drinker, R. C., "Apparatus for measuring intensity of light." March 2.
4062.—Brown, A. E., "Hoisting and conveying machines." March 3.
4098.—Walker, J. H., and Welch, W. H., "Gas-burners." March 3.

A Large Improvement in the Distribution System of the British Gaslight Company at Hull.—For the purpose of improving the gas supply to the Newington portion of their area of supply at Hull, the British Gaslight Company have undertaken the laying of new mains for a distance of 4½ miles, at a cost of something like £13,000. The Contractors are Messrs. John Aird and Sons.

Acetylene v. Electric Lighting at Sydney (N.S.W.).—In the "Journal" for the 27th ult., reference was made to the installation of acetylene lighting on the Cricket Ground at Sydney by the Acetylene Gas Company of Australasia, Limited, who hold the acetylene and carbide of calcium patents for the whole of Australasia. The object in lighting the ground was to allow of evening bicycle races; and according to the local papers the track is as well illuminated for racing purposes as if the sun were shining. The "New South Wales Cyclist" says the acetylene light has been "acknowledged on all sides to be superior to the electric light previously in use;" while a rider states that, compared with the latter light, acetylene is "brighter, steadier, and more pleasant to ride under."

The Gas Supply of Salford Out-Districts.—Questioned with regard to the alleged unsatisfactory quality of the gas supplied to Higher Broughton, Alderman Phillips, at the meeting of the Salford Borough Council last Wednesday, stated that the Gas Committee could not, even if they wished, give Higher Broughton a lower quality of gas than other parts of the area of supply. He, however, admitted that, owing to the immense increase in house-building in the lower part of the district, the present main was insufficient; but the Council were about to be asked to approve of the construction of a new one which would be 36 inches in diameter, instead of 24 inches as at present. The Mayor intimated that he had a communication from a number of gentlemen at Higher Broughton, requesting that a public meeting should be called to consider the matter. Alderman Phillips said his Committee would take great care to investigate the cases of all the signatories to the requisition. After this investigation had taken place, he would put himself in communication with the Mayor, who might then exercise his judgment as to whether or not a meeting should be called. Subsequently, the Council accepted a tender for the supply of 900 yards of cast-iron mains, 36 inches in diameter, at £6 10s. per ton, and the requisite connections at £9 10s. per ton. Alderman Phillips said the effect of this resolution would be to increase the supply to the Lower Broughton, Higher Broughton, and Prestwich districts, where the Gas Committee were not now able to supply as much gas as was required.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Presence of Naphthalene in Coal Gas.

Sir,—The paper read last night by Mr. R. W. Allen on this subject, at the London Section of the Society of Chemical Industry, proved of altogether absorbing and unexpected interest—both to those of our members concerned in the more purely scientific aspect of the question, as well as to the members of the gas profession who have only too intimate an acquaintance with the difficulties suggested by the mere mention of the word "naphthalene." Some of Mr. Allen's work has already received notice in your columns (see Vol. LXXIV., pp. 590, 595, 755); and the absence last night of Mr. W. Young, of Peebles, and, may I add, of Mr. Lewis T. Wright, formerly a member of the London Section, was a distinct loss to our discussion.

The hour was too late—there being another paper still on our programme—for me to be able to do more than indicate in the discussion that followed one of the points in the paper affecting the new processes of removal of naphthalene in gas by passage through mechanical washers; heavy oils already saturated with light hydrocarbons being the solvents. Mr. Lacey, Mr. Helps, of Croydon, and Mr. Butterfield, who contributed so much to our discussion, had not dealt with this particular point. Nor had the author, in his extreme modesty, and his anxiety not to pad his paper, done more than allude to the practical advances made by Dr. Bueb, of Dessau, and Mr. Leather, of Burnley; as he approached the subject from the laboratory point of view, disclaiming possession of any knowledge acquired by personal experience outside in practice.

Mr. Allen distinctly stated that coal gas, deprived of naphthalene by his elaborate provisions for this end, might still deposit naphthalene on travelling underground through mains and service-pipes. If this is actually the case, of what avail are the washing processes? Hence I asked the gas engineers and chemists present if, in the absence of Mr. Leather, any information was available from Burnley experience of the absence or presence of naphthalene in any newly-laid mains and service-pipes, if such existed in direct connection with the distributing centre. Mr. Butterfield had already cautioned the meeting as to inferences to be drawn from the presence of solid deposits of naphthalene at any particular point in the distributing system. These might have come down in solution in liquid form at one time, and then the solvent be removed if—as might easily happen—gas unsaturated with that particular hydrocarbon followed on at a subsequent time. I ventured also to add that transferences of deposits might occur through the alternation of periods of gas supply saturated and unsaturated, *quâ* the lighter hydrocarbons and *quâ* naphthalene, with varying atmospheric conditions. It was therefore necessary to appeal to Mr. Leather's experience, if he could supply it; and I would now add, as the meeting could vouchsafe no further light, that deposit of naphthalene in such ideal conditions of clean mains, &c., as I have indicated would only support Mr. Allen's theory—or, rather, I will call it, working hypothesis (it is quite right that he should frame one)—if Mr. Leather could assure us that continuous tests of the gas supplied to such a main contained no naphthalene. Mr. Allen's hypothesis certainly upsets all one's preconceived notions of naphthalene as only formed at high temperatures; but let us keep an open mind, and not despise a working hypothesis merely on that account.

I have always felt the advantage to our sectional meetings of papers affecting the gas industry, as we are far more likely to get a frank and complete discussion of knotty points from members of the profession; the conditions of the industry varying from those of any other chemical industry known to me. Discussion is not hampered by the fear of a possible unpleasant interview with a director next morning, for having let technical zeal outrun business discretion. Unless a patent is in view, a gas chemist or engineer can help his *confrère* without fear. Too often, from the very necessities of business competition, our discussions have had to cease at the point where the listeners would acquire really informing facts. The gas industry must, as time goes on, become increasingly dependent on chemical as well as engineering skill; the newer processes discussed year by year at the meetings of the Institution of Gas Engineers and of the Gas Institute, and the weekly contents of your valuable paper, bear testimony to this.

You have, Sir, devoted space to the notice of one of the most valuable contributions of our late President (Mr. George Beilby) to the Society's "Journal" (his address as President, at Newcastle, in July, 1899); but you did not notice the very thoughtful and valuable paper read at the London Section in April of the same year, on "The Relations of the Society to Chemical Engineering and Industrial Research." The first branch of this paper concerns me most; and it is to the national importance of this subject that I desire to direct the attention of members of the gas profession. No better exponent of it could be chosen than Mr. Beilby; and I commend to the notice of all his paper (see "Journal of the Society of Chemical Industry," Vol. XVIII., pp. 333-340).

March 6, 1900. R. Forbes Carpenter.

The Low Price of Benzol and Creosote.

A correspondent has called attention to a matter which appears to him to be a little puzzling, and which he thinks is of considerable interest to the gas producing and consuming world. He remarks that when 90's benzol was at 1s. 6d. per gallon, considerable quantities were used for the purpose of enrichment; but now that it has dropped to about one-third of this price, there appears to be no inclination on the part of gas managers to make use of this most valuable, and at the present time extremely cheap, enriching agent. He thinks there must surely be some excellent reason for this; and he asks if any of our readers are able to clear up the mystery. Writing on the subject of the price of creosote, a large firm of tar distillers point out that this product is now very much lower in value than it has been for a considerable time. They say that though the latest quotation given in the "Journal" is 3½d. per gallon, sales have, to their knowledge, recently taken place at 2½d.; and they have themselves offered creosote at 2⅝d. per gallon without finding a buyer.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress was made with Private Bills last week:—

The Barnsley Corporation Bill was read a second time.

The East Shropshire Water Bill, the East Stirlingshire Water Bill, the Falkirk and District Water Bill, the Falkirk Corporation Bill, the Great Berkhampstead Water Bill, the Hemel Hempstead Corporation (Water) Bill, and the Motherwell Water Bill were referred to a Select Committee, consisting of the Earl of Camperdown (Chairman), Earl Grey, the Earl of Dartry, Lord Saltoun, and Lord Sinclair; to meet on Tuesday, March 13.

The Higham Ferrers Water Bill, the Menstone Water (Transfer) Bill, and the Newport (Mon.) Gas Bill were referred to a Select Committee, consisting of Lord Windsor (Chairman), the Earl of Lucan, the Earl of Verulam, Lord Manners of Haddon, and Lord Newton; to meet on Tuesday, March 13.

A large number of petitions were presented against the South Essex Water Bill.

HOUSE OF COMMONS.

Tuesday, March 6.

SOUTH METROPOLITAN GAS BILL.

Mr. Lough moved, in reference to the above-named Bill—"That it be an instruction to the Committee to insert such clauses in the Bill as may be required to give effect to the first and second recommendations of the Select Committee on the Metropolitan Gas Companies, as follows: '(1) That the standard price should be reduced to 3s. 3d. to carry the standard dividend of 10 per cent., and that the existing scale of increase and decrease for dividend of ¼ per cent. for every penny of decrease or increase of price below or above 3s. 3d. be maintained, and that a secondary or additional scale be imposed which should permit of an increase or decrease of dividend over and above that regulated by the present scale of ¼ per cent. for every complete 3d. of decrease or increase below or above the standard price of 3s. 3d. (2) That the area south of the River Thames, at present part of the district of the Gaslight and Coke Company, should be transferred from the Gaslight and Coke Company to the South Metropolitan Gas Company, at a fair and reasonable price.'" The honourable member explained that, though the instruction looked complicated and technical, it dealt with only two principles—it reduced the standard price of gas by 3d. per 1000 cubic feet, and it provided a new sliding-scale, the effect of which was that if the price was less than 2s. 4d. it allowed a rather higher dividend than at present—thus affording a great inducement to the Company to reduce their price.

Mr. Mares, who had placed upon the paper a notice in similar terms, in seconding the motion, pointed out that the recommendations embodied in the instruction had been arrived at by the Select Committee of last session after a very careful and exhaustive inquiry.

Sir J. Rankin (the Chairman of the Committee referred to) moved, as an amendment, to insert after the word "Committee," in the introductory portion of the instruction, the words, "to consider whether it would be desirable." He explained that the alteration would deprive the instruction of its mandatory character, and it was the more desirable to take this course because the instruction, if carried, would affect the Gaslight and Coke Company equally with the South Metropolitan Company.

Mr. Ritchie suggested that the honourable member (Mr. Lough) should accept the amendment, because the Companies had not been heard upon the recommendations of the Committee of last session. He added that he thought the Bills of the two Companies specially concerned would go before the same Committee.

Mr. Lough thereupon accepted the amendment; and the instruction, as altered, was agreed to without a division.

Thursday, March 8.

GASLIGHT AND COKE COMPANY BILL.

Mr. Lough moved, with respect to the above-named Bill, an instruction to the Committee by whom it will be considered in the terms of the one he submitted to the House on Monday in reference to the South Metropolitan Gas Bill, but with the addition of the third recommendation of the Select Committee of last session on the Metropolitan Gas Companies' Charges—viz., "That the charge made by the Gaslight and Coke Company for the rents of automatic meters and stoves should be the same to consumers north and south of the Thames for fittings of the same quality and capacity."

Mr. Marks, who had placed upon the paper a notice to move a similar instruction, seconded the motion.

Sir J. Rankin proposed to amend the instruction by inserting after "Committee" (see above) the words "to consider whether it is desirable," to which the House agreed in regard to the South Metropolitan Bill.

Mr. Bousfield expressed the hope that the House would accept the amendment, coming as it did from the honourable member who presided over the Select Committee who considered the subject last year.

Mr. Pickersgill said the effect of the amendment was simply to reopen the whole question. As the House did not adopt the suggestion he made last year that the Committee should inquire whether or not it was desirable that the statutory provisions with regard to the price of gas and to the dividend should be revised, he felt bound to vote for the amendment.

Mr. Ritchie said it would be most unwise for the House to commit itself to the *ipsissima verba* of the instruction without hearing evidence. He therefore hoped the honourable member for Islington (Mr. Lough) would assent to the amendment, so that the instruction might not go to the Committee in a mandatory form.

Mr. Brynmor Jones and Mr. Cohen, both of whom were members of the Select Committee of last year, appealed to the honourable member to accept the amendment.

Mr. Lowles said he hoped nothing would be left undone to secure that consumers on the north side of the Thames should have their gas on the same terms as those on the south of the river.

The amendment was agreed to; and the instruction, as amended, was adopted.

The following further progress was made with Private Bills last week:—

Bills read a second time and committed: British Gaslight Company (Staffordshire Potteries) Bill, Ossett Gas Bill.

Bill reported with amendments: Rugeley Gas Bill.

The North Warwickshire Water Bill, the Ossett Corporation Gas Bill, the Ossett Gas Bill, and the Woodbridge District Water Bill were referred to a Select Committee, consisting of Mr. Lewis Fry (Chairman), Sir John Kinloch, Mr. Cornwallis, and Mr. C. P. Trevelyan; to meet on Tuesday, March 13.

The Airdrie, Coatbridge, and District Water Trust Bill, the Hartlepool Gas and Water Bill, the Morecambe Urban District Council (Gas) Bill, the Southport Water Bill, and the Wetherby District Water Bill were referred to a Select Committee, consisting of Sir T. Gibson-Carmichael (Chairman), Sir C. Gull, Mr. Carlile, and Mr. Horniman; to meet on Tuesday, March 13.

The Bedford Gas Bill, the Glastonbury and Street Gas Bill, the Glastonbury Corporation Gas Bill, the Mid-Kent Water Bill, the Rickmansworth and Uxbridge Valley Water Bill, and the St. Albans Water Bill were referred to a Select Committee, consisting of Mr. Schwann (Chairman), Captain Bethell, Mr. Doogan, Mr. Moon, and Mr. Bonham Carter (Referee); to meet on Thursday, March 15.

The Southwark and Vauxhall Water Company have petitioned against alterations in the East London Water Bill; and the Reigate Corporation have sent in a requisition to withdraw their petition against the Redhill Gas Bill.

On Saturday, the Portland Urban District Council applied for leave to present a petition for a Bill to enable them to acquire the gas-works supplying their district, in accordance with the arrangement referred to in the "Journal" last Tuesday (p. 620).

The Battersea Vestry petitioned in favour of the London Water (Welsh Supply) Bill.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Thursday, March 8.

(*Before Mr. Justice* Mathew, *without a Jury.*)

Jones and Attwood v. Laindon Gas and Water Company and Others.

This was a claim by the plaintiffs, who are Contracting Engineers at Stourbridge, against the defendants for £73 odd, the price of a quantity of 4-inch iron piping supplied to them for the purpose of providing water in the Laindon district in Essex.

Mr. Amphlett, Q.C., and Mr. Newsom appeared for the plaintiffs; Mr. Atkin represented the Company; and Mr. Willes Chitty and Mr. Newbolt, the second defendants, Messrs. Usill, Browne, and Usill.

Mr. Amphlett, in opening the case, stated that in December, 1898, the plaintiffs' London Agent, Mr. Newton, had an interview with Mr. Tarbett, who appeared to be acting for the defendant Company, and who represented that Messrs. Usill, Browne, and Usill were acting as Engineers for the Company for the purpose of carrying out the works to be executed. Plaintiffs' case was that in January, 1899, Mr. Usill gave Mr. Newton a verbal order for the goods in question, in the presence of Mr. Tarbett, and on behalf of the Company. One consignment was then sent to Laindon, and taken away by Mr. Usill and laid along the road where the pipes were supposed to be wanted. When plaintiffs sent the invoice, however, the Company repudiated any liability, and said the plaintiffs must look to the Engineers who ordered them. But Messrs. Usill, Browne, and Usill also repudiated any liability, and said that they were only acting as Engineers for the Company, and had ordered the goods on their behalf. Mr. Newton said Mr. Usill had stated that he had the Company's written authority to give the order; but plaintiffs had never been able to see it. Two other consignments of pipes had been sent in the meanwhile, and these were lying at Laindon station awaiting defendants' instructions. The question therefore was, which of the defendants was liable, as the Company denied that the Engineers had any authority to order the goods on their behalf.

Evidence having been given in support of the plaintiffs' case,

Mr. *Usill* was called, and denied liability.

Cross-examined by Mr. Atkin, for the Company, he admitted that at one time he was interested in the business, and was prepared to find persons to furnish capital for extending it. On the water being analyzed, however, he found he could not conscientiously recommend anyone to invest his money. The gas powers had also lapsed; and it was necessary to get them revived before the Company could continue business. To do this, it was necessary to have a Board of Trade inquiry, and show some signs of activity; but he denied that he ordered the pipes on his own authority for this purpose, and also that he had ever stated he had the Company's authority to order them.

Mr. *Holmes*, the Chairman, and one of the Company's Directors denied that the Company had ordered the goods, or that they authorized Mr. Usill to do so on their behalf. The capital of the Company was £3000, in £1 shares, which were all allotted to the vendors. The only business they had done was to supply one hotel and two cottages with gas. He did not admit that the water when analyzed turned out to be bad. The Company did not want the pipes, and had not used them. It must have been a pure speculation on Mr. Usill's part when he was hoping to carry through a scheme of reconstruction of the Company with his financial friends.

Justice Mathew said he was clearly of opinion that the Company was not liable and that the Engineers were. The Company came into existence in 1896, and had failed to continue the business for which it

was formed. The concern was in an utterly inanimate condition in 1898—the gas powers having lapsed. He knew nothing about the shares, except that they were all held by the vendors and none by the public. Who the vendors were he did not know, nor did he know anything else about them or the debentures which were said to exist. Mr. Tarbett and Mr. Usill seemed to be of opinion that the Company might be resuscitated; and for this purpose it was necessary that the gas powers should be revived and the water powers extended. To get this done, it was necessary that there should be a Board of Trade inquiry; and it was hopeless to expect a satisfactory report from an Inspector unless there was some show of activity. For this purpose, Mr. Usill appeared to have ordered these pipes; and as he had no authority from the Company to do so, his firm must be held liable for them. There would be judgment for the plaintiffs for certain damages to be assessed against the Engineers in consequence of the defendants' non-acceptance of the goods, and judgment for the Company, but without costs.

Committal for Selling Infringing Mantles.

In the Chancery Division of the High Court of Justice last Friday, before Mr. Justice Kekewich, Mr. Walter applied, in the case of *The Incandescent Gas-Light Company, Limited, v. Collins*, for the committal of the defendant for breach of an injunction which had been granted restraining him from selling mantles which were infringements of the plaintiffs' patent of 1886. It was explained that the defendant had already been sent to prison twice for a similar offence; the last occasion being on the 17th of November last. The defendant appeared in person, and contended that the plaintiffs' patent had expired. They had refused to supply him with their mantles on any terms. His Lordship made the usual committal order; and the defendant was taken into custody.

The Payment of Water-Rates for Small House Property.

At the Thames Police Court, on Monday last week, an applicant told Mr. Mead that he was a weekly tenant, and that his landlord had refused to pay the water-rate. The East London Water Company had attached his rent under the Water Companies (Regulation of Powers) Act until the amount due to them by the landlord had been paid. He was now threatened with the brokers by his landlord because he had paid a week's rent to the Company and not to him. Mr. Mead remarked that if the landlord distrained wrongfully, the applicant would be able to bring an action against him. A representative of the Company said it was very hard on the tenant. He was bound to pay the rent to them under their attachment; and because he had done so, the landlord had given him notice to quit. Mr. Mead said if the Company sympathized so much with the tenant, they should proceed against the landlord by summons in the ordinary way, instead of getting the money from the tenant under the Act mentioned.

The Charge of Falsifying Books and Embezzlement.

At the Lambeth Police Court last Wednesday, before Mr. Hopkins, Frank Fairfield Norris was brought up in custody, he having failed to find the bail demanded on the last occasion (*ante*, p. 619), to further answer a summons complaining that he, being an officer employed by the Directors of Frank Wright's Prepayment Gas-Meter Corporation, Limited, did on various dates unlawfully, wilfully, and with intent to defraud, alter and falsify certain books of account belonging to his employers. There was a second summons against the accused for embezzling money received by him on account of the Directors. Mr. Wontner appeared in support of the summonses; but the prisoner was not legally represented. Evidence in support of the charge advanced by the Company had previously been taken at some length. It had reference mainly to the accounts, and was directed to showing the manner in which the defendant was alleged to have dealt with payments received by him on behalf of the Corporation. He now questioned one of the clerks as to payments of particular sums by way of commission, which were stated to have been made to certain officials of gas companies. At this point Mr. Hopkins intervened, and said he could not imagine how it could be material, upon a question of embezzlement, to show that the Corporation had paid what might be illegal commissions. The further hearing of the case was adjourned; his Worship offering to accept the same bail as that fixed on the last occasion—viz., one surety in £250, or two sureties in £125 each.

Stealing the Plymouth Gas Company's Coal.

For systematically pilfering coal belonging to the Plymouth and Stonehouse Gas Company, a youth named Edward Avent was last week committed to prison for a month. The accused and other boys had been making it a practice to take coal from the carts passing along the quay during the discharging of cargoes. He had been repeatedly warned, and had previously been imprisoned for the same offence. It was stated that the loss of coal was considerable, and that boys were tempted to steal it because people were always prepared to purchase it from them.

Increases in Price.—The Morley Town Council have decided to raise the price of gas from 2s. 4d. to 2s. 7d. per 1000 cubic feet as from the 1st prox. The Totnes Gas Company, who recently sent out a notice to the consumers of an immediate advance of 6d. per 1000 cubic feet in the price of gas, have withdrawn that, and have substituted for it one to the effect that the price will be increased by 1s. per 1000 cubic feet from the 25th inst. The price will then be 4s. 6d. per 1000 cubic feet. The Gas Committee of the Walsall Corporation recommend that, owing to the high price of fuel and labour, an advance of 3d. per 1000 cubic feet in the charge for gas should take place from the 1st prox. The Newtown Gas Company have announced an increase of 2d. per 1000 cubic feet; making the price 4s. 5d. where the consumption does not exceed 100,000 cubic feet, and 4s. 3d. where it is above this quantity.

MISCELLANEOUS NEWS.

THE DAMAGE TO GAS-MAINS THROUGH SEWERAGE OPERATIONS AT SHREWSBURY.

Arbitration Proceedings.—Monday, March 5.

At the Westminster Palace Hotel, London, the proceedings were to-day resumed in an arbitration (part heard at Shrewsbury—see *ante*, p. 549) with respect to a claim for £1583 made by the Shrewsbury Gas Company against the Shrewsbury Corporation, as compensation for damage alleged to have been caused to their mains, with consequent loss of gas, in carrying out the new system of sewerage in the town.

Mr. James Mansergh was Umpire. Mr. Corbet Woodall was the Arbitrator for the Company, for whom the Hon A. Lyttelton, Q.C., M.P., and Mr. Spearman appeared. Mr. J. H. Redman was Arbitrator for the Corporation, who were represented by Mr. F. A. Bosanquet, Q.C., and Mr. A. Graham.

The case for the Company having been concluded at the previous sitting, evidence was at once called for the Corporation; Mr. Bosanquet intimating that he did not propose to make an opening speech in a case of this kind.

Mr. *Midgley Taylor*, of Messrs. John Taylor and Son, said he was responsible for carrying out the main drainage system in Shrewsbury, which was an intercepting scheme to prevent the outfall of sewage into the River Severn. Witness proceeded to explain in detail the course of the sewers constructed. With regard to the gas-pipe nearly opposite the entrance to the Old Brewery, it was not disputed that the pipe was drawn there. Considerable damage was done at the time of constructing the sewer; and the contractor paid a large sum to the Gas Company in consequence. At this point, they got into a sort of running sand; and every piece of timber here was left in. At the Red Lion public house in Castle Foregate, they had three gas-mains, three water-mains, and an old sewer to contend with. A gas-main crossed the trench, and the timber was all left in. There was considerable trouble near Queen Street. The only place where he saw a gas-pipe actually in the trench was at Argyll Street. The ground there was fairly good; but the upper portion of the road was made of tipped material, which was in a very loose condition. It was in this loose material that the gas-pipe was laid. A fracture was said to have taken place at or near the manhole opposite the Boat-house Inn. Here the sewer which came down from Post Hill, until it reached the manhole, was shallow; but the one which ran along the river bank adjacent, being a gravitation sewer, was at great depth. The sewer from Frankwell to the Boat-house Inn was all in tunnel, in a hard sand like a soft rock; so that it was impossible for any settlement to have taken place on that side of the manhole. The shallow sewer did not pass over, but joined, the deep sewer at the manhole. He could not say where the break occurred in this pipe. Speaking of the sewer pipes generally, he said they were nearly all of cast iron, varying in diameter from 9 to 30 inches. The work was commenced in July, 1896; and the sewers took about two years to construct. Being cast-iron pipes, they were able to ram the ground more than if they had been of stoneware. With regard to timbering, it was the uniform practice of his firm to include in the quantities a certain sum for timber which would have to be left in the ground. In this case, they allowed £250 for the purpose. The timber paid for amounted to £1570, for which there was obtained and used 21,438 cubic feet of walings, struts, and runners, and 35,639 superficial feet of poling boards. In addition to the timber, wherever they considered it necessary they supported the pipes with concrete. He had been over the trenches many times. Generally speaking, they had settled extremely little. The maintenance that the contractor had had to do on the trenches was very small. Witness had never seen anything other than a slight vertical settlement—nothing approaching a lateral movement. It was impossible to open any trench without occasionally interfering with the water or gas services or mains; but when damage of this kind occurred, the men at once repaired it—in the case of the gas-mains, by putting on a piece of clay or wrapping it round, and then giving notice to the Company. The leakage which would take place under these circumstances would be exceedingly small.

Mr. Bosanquet: Now as to the escape. If the roadway is consolidated above the gas-pipes and untouched, had that any effect in preventing escapes from the gas-mains?

Witness: Yes; the road surface practically forms a seal to the gas, and it is restrained from free escape by the soil surrounding the pipe, and by the road surface.

When the road surface is opened, apart from opening the pipes, what effect would that have on the gas?—It gives the leakage, if it already exists, a very much freer vent; and it is in this way that many escapes have, in my own knowledge, been pointed out to the Gas Company—not alone in connection with this scheme, but in many similar schemes.

In course of further examination, witness handed in a diagram, based on figures supplied by the Company, showing the lines of leakage claimed by the Company, and also what he considered to be the true line. He suggested that the extra leakage was accounted for by the increased consumption, the new main, and the increased pressure. The diagram showed that the percentage of leakage and amount of consumption varied in opposite directions in certain cases, but not in others.

Cross-examined by Mr. Lyttelton: There was no leakage before 1898 amounting to 8 per cent.

Mr. Lyttelton: Do you not draw any inference from the fact that the leakage in 1897, 1898, and 1899 had reached points higher than it had ever attained in the preceding 16 years.

Witness: Yes; I have drawn the inference that you laid a new 15-inch main; that you increased the pressure in a very large portion of the area over the English Bridge; that your supply and gas to account for went up in an abnormal way; and that therefore you get an abnormal amount of leakage. That the increase of leakage was entirely due to the 15-inch main is quite as good an inference as that it was due to anything connected with the system of drainage. I have seen three places opened on the 15-inch main, and have smelt leakage from that pipe on the English

Bridge; but I am not alleging that the leakage was only from the 15-inch main.

Are you aware that the 15-inch main is not on the English Bridge?—It is true you have a box-pipe over there. The joint I saw there leaked. With reference to the allegation of 116 drawn joints in Berwick Road, I cannot dispute that, because I do not know. At Castle Foregate, every precaution was taken. There was considerable difficulty there; but the trenches were well rammed.

Mr. *Alfred Bard*, examined by Mr. GRAHAM, said he was the Resident Engineer to the Shrewsbury main-drainage scheme. Particular attention was given to ensure that the filling in of the trenches and excavations was well done. Four inspectors were employed by the Corporation; and witness was satisfied that the work had been properly carried out.

Mr. GRAHAM: Generally speaking, as regards the sinking of the ground in the trenches, what do you say?

Witness: There has been the sinking you always get in trenches; but if anything, it has been rather less than usual, and the repair done to the road was remarkably small. I think the contractor, in that respect, has had a very easy job. We have not had a case of settlement in the road adjoining the trenches. We made a point of avoiding the gas-mains where possible.

Do you corroborate the evidence given by Mr. Taylor, that where you approached the gas-mains you left in large quantities of timber?—Timber in large quantities; and, in points of special difficulty, concrete. In nearly all the places where complaints have arisen, almost the whole, if not the whole, of the timber was left in. I have had numerous opportunities of inspecting the nature and quality of the joints in the gas-mains, and have never found any which I would have accepted or been responsible for. The caulking and yarning was very slight; and the caulking of the lead itself in some cases absolutely nothing, and in others very trivial. The joints would be sufficient to stop gas; but there was no stability beyond that to hold the pipes together. In the joint on a 5-inch main there was less than ¾ inch of lead.

Have you found, in opening down to the gas-mains, that there has been considerable leakage?—We found that very generally. There has been large leakage.

Have you found anything in the angle at which the pipes have been laid?—In several instances we have noticed that the pipes, where it was necessary, or where the Gas Company thought it necessary, to go round a curve, instead of curved pipes being used, two straight ones had been put in at an angle. You could get a joint in that way with very good workmanship, but not with the work the Company obtain from their men. In most of these cases we found the joint leaky.

Speaking generally, were there many instances in which you found the mains defective before any sewer work had been carried out which could possibly have affected them?—We have found that again and again.

Further examined: In Barton Street and Queen Street the sewer operations were started in mistake, owing to their not knowing the position of the gas-main; and chiefly on account of the condition of the gas-main, they moved their line of sewer. The gas-pipe was found to have dropped; and some of the joints were drawn, and others badly set up. There was considerable leakage from the main, and from one or two services. In excavating, an old sewer was found which witness thought was the cause of the leakage and of the dropping of the main. Following this main along, he only saw small lengths exposed; but there were a number of leaks, as they could tell by the smell. In Argyll Street, the main was composed of short lengths of 3, 4, or 5 feet; so that, instead of four joints as usual in 19 feet, there would be six, and five lengths instead of three. These joints were defective. The soil here was very loose, and seemed as if it was made-ground. There was a great deal of leakage; and, before the contractor had in any way disturbed the gas-pipe, his foreman would not go on working until the Company had sent down to put the pipe in order—so great was the escape of gas. If this main had ever been laid straight, it must have moved or twisted before sewering work started, and must have required re-laying long before any of the sewer work was commenced. At Berwick Road and Castle Foregate, as soon as work was started, and long before the gas-mains were reached, considerable evidences of leakage were found; the men being obliged in some cases to leave the trenches, as the smell was too strong for them. Even the soil was greatly discoloured. Forty loads of pea gravel were removed and deposited in the street. It remained there for some time; and so full of gas was it that it ignited on a match being applied. Witness himself saw that. In the case of the new 15-inch main, the joints of it which he had seen were in the same condition as those he had described on the old mains. At one place, the lead was driven in ¾ inch when the Company were stopping a leak. Witness was then examined in detail in regard to the claim for overhauling and repairing; his evidence being a general denial that there was any foundation for it. He was not aware of the subsidences alleged to have taken place; and generally he asserted that the movement said to have occurred, if it did occur, could not have resulted from the sewerage works. In one case of subsidence, the Company themselves removed the timber from below their pipes.

Cross-examined by Mr. LYTTELTON: All the joints he had seen were defective.

Mr. LYTTELTON: This phrase escaped you: "The joints were defective, but sufficient to contain the gas." Is that accurate?

Witness: Yes.

The UMPIRE: In all cases you said there was a smell of gas where you opened a trench?

Witness: Yes; I think I can say that without exception.

Mr. LYTTELTON: Can you point to a single written complaint or notice that you made o his fact to the Company?

Witness: No.

Do you, or do you not, say that these gas-mains were in bad condition wherever you saw them?—I do say they were in bad condition.

How do you reconcile your opinion with the fact that there was only 5 per cent. leakage before you came there?—Of course, I do not know whether that is the leakage.

Then take it from me that it was?—I am not sufficiently a gas expert to say whether or not that is a considerable leakage. The mains leaked largely and the joints were defective.

Mr. *E. H. Stevenson* said he had inspected the mains of the Company. At St. Mary Street, he saw a 15 inch and a 6 inch main, which appeared to be in good condition; but the lead in the joints of the 15-inch main was, in at least one joint, ¼ inch below the end of the socket, and in another ⅛ inch below the end of the socket. He should not have allowed that if he had been laying the mains. Close to the main at Port Hill (which was only 14 inches deep), he saw large stones. This was certainly not a proper way to lay a main. At Coton Hill, the soil around a 6-inch pipe was heavily charged with gas. At Berwick Road, a 2-inch pipe was joined to a 4-inch one by a 3-inch pipe being inserted in the 4-inch, and the 2-inch in the 3-inch pipe. No proper diminishing piece was used. There the mains had only 15 inches cover. The steel pipe at English Bridge appeared to be in such a form that it was a practical impossibility to make it gas-tight. He did not see how it was possible to caulk a flat joint tight—in fact, the more it was caulked, the less likely it was to be tight, because the instant pressure was put on one point, the pipe would bend inwards and the socket would go outwards. Generally speaking, the pipes were laid at very shallow depths. The charge of the Company for overhauling appeared to be very excessive, even for the amount of damage it was alleged the Corporation had done to the mains. Allowing full prices, £50 should have sufficed for the work claimed for. The claim for gas was improper, because it was based on the selling price—even supposing the loss alleged was the result of the action of the Corporation. The charge to the Corporation should be the actual cost to the Company for the manufacture of the gas. Mr. Belton put it on the average of three years at 17·94d. But the quantity in question would never have required more than two retorts for its production; and in a Company like this, the use of two retorts would be managed without the setting down of a retort of any kind, because a manager could always make a little more or a little less, as required, from the retorts in use. No more retorts, purifiers, or gasholders would have been needed whether the gas claimed for had been made or not; and therefore the same repairs would have been executed upon them as if the gas had not been made. There was a difference in the labour of working the retorts and purifiers, which he allowed for; and also the cost of coal. These items he calculated amounted to 13·5d. per 1000 cubic feet. The Company ought to prove the actual loss from leakage. There was admittedly loss from the new main; yet the Corporation were to be charged with the whole of the loss. According to the returns to Parliament, the proportion of gas not sold to the quantity made was less in 1897 than in the three or four preceding years; yet the Company, in their statement handed to the Corporation, made it out more. The figures, therefore, were not reliable; and it appeared as if the Company did not know exactly where they were. According to a table he put in, the production of gas rose from 10,545 cubic feet per ton in 1896, to 11,034 feet in 1897, and 11,338 feet in 1898; and then it fell. This was a very unusual make per ton. He could not go beyond that; they did not know whether the meter was correct or not. A slight alteration in the retorts would not give this result. The contention regarding the damage to the mains was all surmise. The Corporation could not prove that they had not damaged the mains; and he did not see how the Company could prove that they had. The effect of raising pressure in mains was to cause the quantity passing through any given orifice to increase; double the pressure would increase the escape by about 50 per cent. The increase of pressure in one district would not diminish it in another.

Cross-examined by Mr. LYTTELTON: Is your position this—that a corporation might damage as much as they please a gas company paying maximum dividends?

Witness: Oh, no; I do not take up any legal position whatever. The figure of 13·5d. is based on evidence given by Mr. Belton; but the deduction for repairs and maintenance of works is my figure.

Other things being equal, would not the leakage in 1899 be less proportionately than the leakage in 1880?—Other things being equal, what you say is correct; but we have it in evidence from witnesses that they have never had to attend to the mains—that they never had a bad joint. But mains will not last for ever. The mains are 19 years older; and if they have not been thoroughly overhauled, they must by this time be in bad condition.

Do you say the increase of loss in 1898 is due to the age of the mains and defective joints?—It may be due to the old mains; it may be due to the new mains; it may be due to anything.

In re-examination, witness put in another table showing that the cost of repairs and renewals of mains per 1000 cubic feet of gas sold was not the same from year to year; the figure being 0·93d. in 1893, 1·75d. in 1896, and 1·99d. in 1897.

Mr. WOODALL: If you have a large consumption of gas per mile of main, would you expect a larger or a smaller leakage in proportion?

Witness: I should expect a smaller leakage in proportion to the increase of consumption; but that is under normal conditions.

Mr. *W. C. Eddowes*, Borough Surveyor and Water Engineer at Shrewsbury, gave evidence that whenever he opened the streets he found them full of gas; the defects being in both mains and services. Cases had occurred of water getting in the pipes and stopping them entirely.

Mr. *C. W. Griffiths* said he was employed as Water Inspector by the Corporation. He had worked in Shrewsbury as a plumber for ten years, and had opened water-pipes and connections all through the streets. When the ground was broken up, he generally found a leakage in the gas-mains; and from time to time he had reported these cases to the Company. Whatever the reason, he had found as a fact that gas would come up in the sluice-boxes and fire-plug chambers; and most of the instances he had known could not have been affected by the sewerage operations.

Tuesday, March 6.

Mr. *George Reece* said he acted on behalf of the Corporation through the sewerage contract, as one of their inspectors of works. In December, 1896, when laying the new sewer from the riverside to the Queen Street manhole, excavations were made; and though the gas-main was not exposed, when the level of the main was reached, there was such a considerable escape of gas that the men complained. There was a large quantity of timber left in the trench. In another case, the line of trench was started in error; it being found that the gas-main came into it. He saw, however, that gas was escaping freely; and the main was very irregular. He noticed no settlement in the channel during the whole time. When they opened a trench in Argyll Street, they found the main consisted of odds and ends pieces ranging from 2½ to 6 feet. The joints were very badly set up. The whole of the timber was left in there.

He saw the Company laying the new 15-inch main; and in his opinion the bed was not sufficient to ensure its safety. The ground was not made up level for the pipe to lay on it; so that the bed did not receive the weight. The ground was strong enough to bear the pipe. The joints were made sufficiently well to stop air, provided they were never moved, but not well enough to stand any strain. He tested some joints in St. Mary Street—the principal street of the town—with a small set and light hammer; and he found the lead only went back ¼ inch. In another instance, the lead went back $\frac{5}{16}$ inch. In many cases the mains were laid so shallow that they would be affected by ordinary traffic; and the services were often so close under the kerb that heavy traffic might easily affect them. Whenever trenches were opened, gas escaped freely.

William Hirst said he worked as a jointer under Mr. Law, the contractor, for two years. He gave corroborative evidence as to the defectiveness of the joints and the leakiness of the mains. In Castle Foregate, before reaching the new main, the men smelt the gas; and so strong was the smell, that the men were taken away from the trench. Witness complained twice that day to the Company; but it was not till the next day that a man came, and then he caulked the joints cold. In three or four joints witness was able to get his knife between the lead and the socket. The 12-inch main in Castle Foregate was leaking so badly that he was unable to bring a light near it. Generally, while working in the trenches, when the gas-mains were not exposed, the men could smell gas. Some soil thrown up opposite the Britannia was set alight by a match, there was so much gas in it; and this was after it had been exposed to the air for a day or two.

John Farley, foreman of works to Mr. Law, said that when working in trenches in Castle Foregate, before exposing the gas-pipes, two or three men, including witness, were made ill by the gas. Several men left Mr. Law because of the smell of the gas in the trenches. The trenches Mr. Law opened were all well-rammed.

Mr. *Stevenson*, replying to a question from Mr. Redman, said the cost of distribution, on the average of the three years, was 2·84d. per 1000 cubic feet of gas made.

Frederick Pryce said he had seen the soil discoloured by gas, and had smelt gas very strongly before uncovering the gas-mains.

Joshua Boyce, ganger to Mr. Law, gave confirmatory evidence.

Richard Bywater, employed by the Corporation at the conduit-head, said that for a time after the main to the conduit-head was laid in 1897, sufficient gas was obtained to work the engine; but a short while after they had to relay a portion of the main owing to the defectiveness of the supply. He had had to communicate with the Company many times regarding the pressure. He had seen places in the fields adjoining the conduit-head where the grass was discoloured owing to the escape of gas. He knew that since Feb. 25 last the Company had stripped the main for 200 yards and re-set the joints.

William Bright, a turncock employed by the Corporation, said he had on several occasions called the attention of the Company to leaking gas mains and services he had met with when working at openings. At the bottom of Wild Copse, while he was searching for a pipe, the Gas Company were also looking for one. The Company found a main cut in two, with a wooden plug in one end wrapped round with bagging. The Company searched further, and set a joint on the 15-inch main.

Charles Griffiths, general labourer, said that while working at Coton Crescent, in consequence of a complaint as to an escape of gas, he put a bag of shavings on the road and lit them, with the result that there was an explosion like a gun going off. The Corporation had not been putting sewers in there. At different places between the stones in the road there were little jets of gas which continued burning on being lighted.

This closed the evidence.

Mr. Bosanquet, in addressing the Court for the Corporation, said the claim consisted of two parts. First, the Company claimed for work done in reinstating gas-mains which they alleged the Corporation had destroyed or injured. This claim was very small. Then the Company claimed—and this was the more important—for the loss they had suffered from consequent escape of gas. In the latter part of 1898, the Company overhauled their mains; and wherever they found any damaged, they made a claim against the Corporation, not only for the repairs, but for the investigation. But if anything was clear in a compensation case, it was that a claim must not be made for investigations undertaken to see if there was a claim. The Company, although they gave notice up to August, 1897, of their intention to open streets and attend to mains alleged to be damaged by sewerage works, did not after that date give any such notice until April, 1899; the overhauling having taken place in the interval, without any representative of the Corporation being present to watch. The case of the Company with regard to the consequential damage was that the Corporation had done them an injury; that the Company made a certain amount of gas; that they sold a certain amount; that the difference was loss; that the loss was greater during the time the sewerage work was going on than previously; and that therefore this extra loss was due to damage done to the mains. In support of this, they said that their gas-mains were in good condition before, and therefore everything that had since taken place was due to the Corporation, because no other cause was apparent. But when the loss by leakage was alleged to be greater, the Company showed a much larger production of gas per ton of coal carbonized than formerly. This they said was due to new furnaces, which would give a better yield; but the bulk of the improvement in the furnaces took place prior to the middle or beginning of 1897—before the sewer work was begun. Then they said the mains were in generally good condition, and there was no reason to suppose they would allow any substantial amount of gas to escape; but was it not marvellous that, having undertaken this overhauling, the Company gave no evidence of public complaints or evidence as to great escapes of gas at the places where the sewer work was alleged to have damaged the mains? There was no evidence of any material escape at any of the places where it was said the sewerage works broke up the mains. The evidence of Mr. Bard showed that the escapes occurred through the joints not being sufficient to keep the gas inside the mains; and the leakage arose long before the Corporation removed any support from the pipes. With regard to Castle Foregate, where it was said a man sank into the ground, the Gas Company were there after the Corporation; so that it was the Company, and certainly not the Corporation, who were responsible. At Conduit Head, beyond any sewerage works, the Company seemed to have put in a new main to supply gas for the engine to pump water. The said they laid it at a time of flood, because the Corporation clamoured for it; and suggested that therefore when it broke down the fault rested with the Corporation. It was also suggested that the Corporation were to be blamed because carts going to the water-works broke the mains as they passed over the road. But the Company should have seen that the mains were laid at a proper depth to resist the carting; and if the carting caused the damage, they had a claim against the man who did it. Certainly that had nothing to do with the sewerage works. As to the gas which was lost, the Company claimed 3s. per 1000 cubic feet, the selling profit price, out of which all shareholders' and debenture holders' dividends had to be paid. But the question was what loss they sustained—not the price which what was lost would have realized. What they had lost was the extra make of gas. This cost was 18d. per 1000 cubic feet; but deductions had to be made for general establishment expenses, which would be the same whether the make was 11 or 12 million feet. The net figure suggested by the Corporation witnesses was 13½d. It would be for the Court to fix the figure—which should be not more than 18d., and not less than 13½d.—to apply to the loss (if any) which they might attribute to the action of the Corporation.

Mr. Spearman said, having heard his friend's speech, he thought he was right in the inference he had drawn that this was an absolutely undefended case—that there was no answer to the claim the Company had made out. The Corporation had not called a single witness to contradict the witnesses for the Company, or to show that there was not this slipping of the soil, or even to show that the trenches were properly filled in. Mr. Bosanquet got hold of a complete mare's nest with regard to the increased production per ton. He seemed to doubt whether there was an increase. There must have been an increase years before it was said to have taken place; and Counsel went on to point out that Mr. Belton, the Company's Manager, attributed the increased production in recent years, not to the furnaces put in from 1892 to 1894, but to those of an improved type which were erected yearly from 1894 onwards. Up to the time the sewerage works were started, the percentage of loss was 5·8; but after that, it sprang up till it became 8 or 9 per cent. There was no ground for disputing these figures, because the earlier ones were prepared year by year, long before the sewerage works were thought of; and there was nothing to throw doubt on the later ones in respect of the years when the works were in operation. The evidence called by the Corporation went to show that long before the works were commenced there was a great escape of gas—that the mains were bad, and that the joints were faulty and leaky. If this were so, how was it that the admitted averages of loss were so good? He suggested that the evidence was unreliable, because if it was true there must have been an enormous escape of gas going on, and the average of loss should have been very much higher than it was. The gentleman who was responsible, in the first instance, for any damage that was done to the gas-pipes was Mr. Law, the Contractor. Why was he not called? He could have stated what really went on in the trenches. The evidence given, if true, only showed that some of the mains were in bad condition; and, if they were in bad condition, this was entirely irreconcilable with the low average loss. On the other hand, whether or not they were in bad condition, there was the startling increase of leakage which occurred at the end of the sewerage operations. The Company said it was due to the works; Mr. Taylor said it was in consequence of the 15-inch main; while Mr. Stevenson would not accept the figures. This was all the evidence. On the question of future damage, the learned Counsel said it was quite true the percentage of loss of gas had fallen somewhat in the past year. But the evidence went to show that, since the Contractor finished, there had been some filling up of holes; that the damage had not yet ceased; and that some leakage was still going on. Figures were quite unnecessary to support a claim for future damage; and all that was done was to put the facts before the tribunal, for them to judge how long that which had been going on over the past three years was likely to continue. In conclusion, Counsel referred to the question of costs. He detailed the steps the Company had taken in formulating and sending in their claim to the Corporation, who met it with an absolute denial of any liability whatever. Therefore the Company were in the position that, if the Court thought they were entitled to anything, they could not get it without the present proceedings. Under these circumstances, he submitted that, there being no offer on the other side—and not only so, but no offer to negotiate for a compromise—if the Company did recover anything, they were entitled to their costs as in the ordinary course. If there was no offer, the claimant, if he had an award, was entitled to his costs under the Lands Clauses Act; and he asked the Court to adopt the same practice here.

Mr. Bosanquet agreed that the costs were at the discretion of the Arbitrators.

The proceedings then terminated; the award being reserved.

INCANDESCENT GAS LIGHTING AT PLYMOUTH.

Proposed Large Extension of the System.

The Borough Electrical Engineer of Plymouth (Mr. J. H. Rider) has presented to the Electricity and Street Lighting Committee of the Corporation a report recommending the adoption of incandescent gas lighting in all the streets not now lighted on this system or by electric arc lamps. He states that since September last, some 90 incandescent gas-lamps of different types and power have been in use in the streets of the town. Speaking generally, the results have been very satisfactory. The amount of light has been increased, there has been a reduction in the quantity of gas consumed, and the renewals of mantles have been less than was anticipated. Improved lighting in the principal thoroughfares by means of the electric arc lamps and the incandescent gas-lamps has caused great dissatisfaction to be expressed at the comparatively inferior illumination of the other streets. This was only to be expected; and the time, he thinks, has arrived when the lighting of the whole town must be improved. At the end of last year, there were 1924 gas-lamps in use. Of these, 1708 were ordinary lamps of 12-candle power, consuming 4 cubic feet of gas per hour; 21 were of 30-candle power, consuming 10 cubic feet of gas; 84 were of 40-candle power, consuming 13 cubic feet; 9 were of 60-candle power,

consuming 18 cubic feet; and 15 were of 80-candle power, consuming 23 cubic feet. The rest were incandescent lamps—30 of 40 to 50 candle power, consuming 3¾ cubic feet of gas per hour; 39 of 80 to 100 candle power, consuming 4½ cubic feet; 12 of 80 to 100 candle power, consuming 7½ cubic feet; and 6 of 120 to 150 candle power, consuming 11¼ cubic feet. These give a total nominal illuminating power of something like 32,226 candles, at an annual cost of about £2784 for gas alone. He suggests that the whole of the ordinary gas-lamps should be altered to the incandescent system. The totals then will be 1685 of 40 to 50 candle power, consuming 2½ cubic feet of gas per hour; 30 of 40 to 50 candle power, consuming 3¾ cubic feet; 167 of 80 to 100 candle power, consuming 4½ cubic feet; 12 of 80 to 100 candle power, consuming 7½ cubic feet; 24 of 160 to 200 candle power, consuming 9 cubic feet; and 6 of 120 to 150 candle power, consuming 11¼ cubic feet. These would give a total nominal illuminating power of approximately 87,480 candles, at an annual cost of about £2090 for gas, or a saving on the gas account of nearly £700 per annum. To carry out the conversion, Mr. Rider explains that it will be necessary to purchase not only new burners and accessories, but also to fit new lanterns to the posts; the ordinary lanterns not being sufficiently wind and storm proof to shield the mantles. In any case, new ones must be obtained by next September, as those at present in use belong to the Gas Company, and, under the agreement, have to be returned by that date, or a rental paid for them. The capital outlay on new lanterns and burners is estimated at £4000. After allowing the necessary additional maintenance charges, there will be an annual saving of about £300. The interest and sinking fund charges on the outlay of £4000, taken at 3 per cent. and ten years for repayment, will, however, come to £469; so that about £169 will have to be added to the lighting estimates. But for this small sum, the illumination of the gas-lighted streets will be increased by two-and-a-half or three times. The Committee have decided, subject to the approval of the Council, to invite tenders for the burners and lanterns forthwith.

THE SCARCITY AND HIGH PRICE OF COAL FROM A GERMAN POINT OF VIEW.

[From the "Yossische Zeitung" of March 6.]

When, a few weeks ago, an enormous increase took place in the price of coal at Cardiff and in the other coal markets of England, it was given out by the English coalowners that the rise was chiefly due to the fact that the pitmen were winning less coal per head than formerly. We published at the time a declaration by the President of the Union of Miners in Great Britain in which he denied this allegation, and pointed out that if there was a scarcity of coal it was caused by a combination of owners with a view to effecting an artificial rise in price. His words have been verified only too soon by subsequent events. The coal famine has disappeared, and prices have fallen 25 per cent. in London and Cardiff, and rather less elsewhere, without inducing buyers to in any way depart from their attitude of reserve. It may now be assumed with confidence that the market has been "rigged" by the parties interested detaining many thousand trucks loaded with coal in the inland districts—thus causing an extreme scarcity of available trucks—and preferring to pay expensive truck-rent rather than allow supplies to go forward.

The combination of owners appear to have directed their efforts chiefly against two parties—firstly, against two Cardiff dealers who it was said had contracted to export 500,000 tons (some say even 700,000 tons) without sufficiently covering themselves, and who consequently could not supply; and, secondly, against the British Government, with the view of forcing them to pay fancy prices for the coal required for the transports to the Cape. The dealers referred to had to declare themselves unable to fulfil their contracts. The British Government, however, escaped by inviting tenders from Newcastle (instead of buying Cardiff coal at 30s. a ton) for the year's requirements, and also purchased, it is said, a quantity of 40,000 tons of Northumberland coal at 17s. 6d. or 18s. a ton f.o.b.

At the same time American coal came into the market at prices which were 7s. to 8s. per ton lower than Cardiff steam coal, and 3s. to 4s. lower than Newcastle coal delivered at Genoa, Venice, or Trieste. This promptly brought the coal-ring to its bearings. The Welsh collieries threatened to cancel their contracts with the dealers if the latter did not clear off the arrears; and the dealers then found themselves compelled to reduce their prices in a few days from 30s. to 22s. per ton. Of this opportunity the British Government took advantage, and last week concluded contracts with Cardiff for delivery up to the 30th of June at about 22s. 6d. to 23s. per ton. Even this is an unjustifiable price; for on the London market best sea-borne coal has fallen from 28s. to 22s. per ton without in any way inducing buyers to come in. Everyone fears to do more than cover immediate requirements—the end of March being the usual time for the reduced spring prices to come into force. Even the London retail market prices have in the last few days been reduced, which is a very unusual proceeding at the beginning of March.

The weakness of the market was further accentuated by the sudden news that ten miles of rails between Barnsley and London were crowded with laden coal-trucks; so much so that collieries in the Barnsley district were obliged to work short time owing to the scarcity of empty trucks. Of course, this circumstance was attributed to all kinds of causes—to the stormy weather, to the number of railway employees called out to the war, &c., &c.; but not to the most obvious one of an intentional withholding of these quantities of coal from the market. The coal for export from the Humber ports was dealt with in the same manner.

Gradually, however, these enormous quantities of detained coal reached their destination; and this again had a strongly depressing effect on the coal forwarded to the various markets by rail. Thus in the last few days, further reductions of 1s. 6d. to 2s. per ton have taken place both in the North and at Cardiff; so that best Cardiff steam coal can now be easily obtained for immediate delivery at 20s. to 20s. 6d. per ton.

We do not deny that, of late, Russia, Austria, Germany, and France have made greater demands on England in the matter of coal, and that home requirements have also increased. The withdrawal of workers from the pits, and of employees from the railways, may also have produced some effect. But of an actual scarcity of coal there has never been any question. The scarcity has been entirely an artificial one. The high prices were engineered. We cannot, however, reckon upon a return of low ones. In January, the exported English coal still amounted to only 3,106,484 tons, as compared with 3,117,790 tons in the corresponding month of last year, and only in the last few weeks have the shipments increased. Thus, for example, last week 196,758 tons of coal were shipped from Scottish ports, which is 58,157 tons more than in the corresponding week of 1899; and since the beginning of the year 1,381,388 tons, or 283,366 tons more than last year, have been shipped. These increased shipments are, however, due to the fact that people had recourse to Scotch coal because they could no longer pay the price of English.

MANCHESTER CORPORATION GAS AND WATER SUPPLY.

The Sulphate of Ammonia Plant—The Extra Pipe from Thirlmere.

At the Monthly Meeting of the Manchester City Council last Wednesday, the minutes of the Gas Committee were adopted without discussion. In addition to the recommendations already referred to in the "Journal," they included a resolution asking the Finance Committee to borrow, on the most favourable terms, £25,000 for the erection of sulphate of ammonia works, under the sanction of the Local Government Board dated the 8th of January last. The Committee also recommended the Electricity Committee to pay to the Gas Committee 10s. per cent. for collecting, receiving, and banking the electricity accounts; this suggestion having been made as the result of inquiries as to the methods adopted in other towns.

In moving the adoption of the Water Committee's proceedings, Sir John Harwood, the Chairman of that body, made special reference to a resolution contained therein to the effect that, in the opinion of the Committee, the time had arrived when the question of laying an additional pipe from Thirlmere should receive serious attention, and that the matter should be referred back to the Thirlmere Sub-Committee for the purpose of investigation, with the view of a report on the scheme being presented to the Council. This work, Sir John remarked, would have been proceeded with at once, on account of the large increase in the consumption of water, but for the extraordinary rise in the price of iron pipes. The pipes already laid down cost £240,000. But the expense of an additional pipe-line now would, according to a recent estimate, be £370,000; so that the total estimate of £500,000 would be very largely exceeded. For the pipes to connect Longdendale and Godley, enabling them to utilize the flood water which now escaped, tenders had come in from three of the best-known pipe-makers in England and Scotland; and the lowest was £12,670. It was thought that this connection would be sufficient to meet their requirements until they had made the pipe-line from Thirlmere referred to in the resolution. The Water Committee also requested the Finance Committee to borrow on the water-works account a further sum of £50,000. The minutes of the Committee were passed.

A long list of proposals to advance the salaries of various officials in the Gas, Water, Electricity, and other departments was also on the *agenda*; but it was left over to be dealt with at an adjourned meeting of the Council.

The Honley District Council and the Gas-Works.—A Sub-Committee of the above-named District Council has been appointed to approach the Directors of the Gas Company with the view of ascertaining whether they are willing to part with their undertaking to the Corporation.

Reductions in Price.—The Weston-super-Mare Gas Company have decided to reduce the price of gas by 2d. per 1000 cubic feet as from Jan. 1 last. It was announced, at the last meeting of the Uxbridge District Council, that the Gas Company had reduced the price of gas from 3s. 11d. to 3s. 6d. for lighting purposes only.

The Heckmondwike District Council and the Gas-Works.—The Heckmondwike District Council have resolved to approach the Liversedge District Council with a view to discussing the desirability of purchasing the local gas-works. These, which are situated within the Liversedge Council's area, supply both Heckmondwike and Liversedge; and abortive attempts have been previously made to acquire the property.

The Price of Gas and Workmen's Hours and Wages at Morley.—At a meeting of the Morley Town Council on Monday last week, it was resolved to advance the price of gas from 2s. 4d. to 2s. 7d. per 1000 cubic feet. The Gas Committee reported that they had had an interview with the stokers employed at the works with regard to a demand for the following concessions: (1) Eight hours a day, (2) extra men to work low fires, (3) 5s. 3d. per shift, and (4) double pay for Christmas Day and Good Friday. The question had been settled by re-arranging the hours of employment, and offering the men 5s. 3d. per shift of eight hours and double pay for Christmas Day and Good Friday.

A Gas-Works Offered for Sale by Auction.—At the Auction Mart, Tokenhouse Yard, last Tuesday, Mr. Alfred Richards offered for sale a property of a kind which does not often come "under the hammer." This was the freehold gas-works at Bagshot, Surrey, consisting of a retort-house and coal-store, condenser, tar and liquor well, purifier-house, two gasholders, governor-house, and mains to a total length of about 3700 yards—the whole to be sold as a going concern. The profits from the works had been estimated to amount to £310 per annum. Before the bidding commenced, Mr. W. A. Schultz, the Secretary of the Ascot District Gas Company, drew attention to the fact that the works were situated within the district of his Company. The Auctioneer replied that there was no doubt at all that the Ascot Gas Company had power, under their Act of Parliament, to extend their mains through the locality supplied by the Bagshot works; but the former proprietor of the works always considered it so unlikely they would do so, that he had not thought it worth while to oppose the application of the Ascot Gas Company for their Act. The bidding started at £1200, and finally reached £2250, at which figure it ceased. The Auctioneer thereupon announced that, as the expert who had been called in valued the undertaking at £4500, this was the reserve price put upon it. The property was therefore withdrawn.

PROVINCIAL GAS AND WATER COMPANIES.

Gas Companies.

The 69th ordinary general meeting of the Bognor Gas Company was held last Tuesday, when the Directors' report showed a net balance of £1175 for the six months ending Dec. 31. They recommended that a dividend be declared of 5¼ per cent. for the half year on the original shares, and of 3¾ per cent. upon the new shares; making 10½ and 7½ per cent. respectively for the year. These dividends would amount to £606; leaving a balance of £569 to the credit of the profit and loss account. The report was adopted.

At the half-yearly meeting of the Cheltenham Gas Company last Thursday, the Chairman (Mr. R. Ticehurst), in moving the adoption of the report, noticed in the "JOURNAL" for the 27th ult., stated that the receipts from residuals were £3800 more than in the preceding year. On the other hand, the cost of coal was £4272 greater. A reserve stock of 7000 tons had tided the Company over the difficult season just before and after Christmas. The number of cooking-stoves on hire was 3375, being an increase of 728 during the year. The "Cheltenham" cooker was very popular—no less than 2465 of the stoves in use being of this make; and 753 were fitted with coin meters. The report was adopted.

At the annual meeting of the Dartmouth Gas Company last week, the Directors reported that new purifying plant had been erected at a cost of £825, of which £700 had been raised by debentures at 3½ per cent., and the remainder paid out of revenue. The receipts amounted to £3769, and the expenditure to £3263. A dividend of 13s. per share, equal to 10 per cent., was declared. The Chairman (Dr. R. W. Soper) said that a very favourable coal contract for some part of the year enabled them to keep the gas-rate at the old figure; but if the high price of coal continued, the Directors would have to seriously consider whether the charge for gas should not be raised. Mr. J. Bartlett complimented the Manager (Mr. J. Tall) upon erecting the new plant without the services of an engineer. The Manager said it would more than pay for itself by the saving effected in material and labour. The Directors would soon have to look into the question of whether they should not supply prepayment meters, which would bring in a class of customers now consuming oil.

The half-yearly meeting of the Hastings and St. Leonards Gas Company was held on the 1st inst.—Dr. G. G. Gray in the chair. In their report, the Directors stated that in the six months ending Dec. 31 there had been the very satisfactory increase of more than 15 million cubic feet, or nearly 8 per cent., on the quantity of gas sold, as compared with the corresponding half of 1898. Of course, trouble had been experienced with the coal supplies; and had it not been for the large quantities stored during the summer, serious inconvenience must have resulted. On the other hand, residuals had improved in value. The accounts accompanying the report showed that £32,165 had been received for gas and £7406 for residuals—the total receipts being £41,889. The expenditure was £30,209 (including £16,831 for coal and oil and £1862 for coal duty paid to the Corporation); so that there was a sum of £11,680 to go to the profit and loss account. The amount available for distribution was £51,967; and the Directors recommended the declaration of the statutory dividends. Under the supervision of Mr. Charles E. Botley, M.Inst.C.E., the Company's Engineer and Manager, 15,522 tons of Newcastle coal, 123 tons of cannel, and 147,101 gallons of oil were used in the production of 212,949,000 cubic feet of gas (including 53,999,000 cubic feet of oil gas), of which 207,588,100 cubic feet were sold and 209,717,500 cubic feet accounted for. The estimated quantities of residuals produced were: Coke, 9696 tons; breeze, 759 tons; tar, 156,045 gallons; and ammoniacal liquor, 251,579 gallons. The Chairman, in moving the adoption of the report, said it was again his pleasure to congratulate the shareholders upon the very satisfactory half-year's working—he might say the satisfactory year's working, because, though the present was the first half of the financial year, it was the second half of the calendar year 1899. The report drew attention to the fact that there had been upwards of 15 million cubic feet more gas manufactured in the past six months. Putting this into pounds, shillings, and pence, it meant a rise of £2351 in the receipts for gas sold. In addition to this, there had been improvements under other heads; making an increase on the receipts side of £3241. On the expenditure side, there had been an advance in the cost of coals, carriage, wages, and rates and taxes. However, there was a profit balance of £11,680. The increase was not large; but, having regard to all the circumstances, it was satisfactory. The report referred to the great difficulty experienced during the winter in securing the necessary deliveries of coal; and he might add that it had been very great, when it was considered that the quantity of gas which now had to be made had reached upwards of 400 million cubic feet per annum. At times coal and labour could hardly be obtained for love or money; and Mr. Botley was to be congratulated that he had been able to help some of his brethren with coal. It had been a time of great anxiety. An issue of further capital would shortly be necessary, due to the natural increase of the Company's business; but he thought about £10,000 would be sufficient. Alderman Bray, in seconding the motion, congratulated Mr. Botley upon his successful work, and expressed his sympathy with him in the trying time through which he had passed. Mr. Oke, in supporting the motion, spoke in the highest possible terms of the management and present position of the Company. With regard to the coal question, he said he knew of two cases where gas companies had no coal at one time; and therefore it was satisfactory and gratifying to see that their own Engineer had been careful to get in a sufficient stock, and had realized that it was a mistake not to keep it up. The report was adopted.

The annual meeting of the Honley Gas Company was held on the 1st inst.—Mr. E. Crowther, the Chairman, presiding. In moving the adoption of the report and accounts, he said the shareholders would notice that more gas had been made and sold last year than in the previous twelve months, notwithstanding the fact that nearly all the mills had electric lighting installations of their own. More coke per ton of coal carbonized had also been sold. Discounts were considerably more, on account of extra discounts having been allowed for all gas used for cooking and lighting purposes. The net price for cooking was 2s. 3½d., and for lighting 3s. 5½d. per 1000 cubic feet. These prices would compare favourably with those charged in many towns of similar size. Another matter to which he would like to call their attention was the leakage. The Manager (Mr. J. Baldwin) had doggedly persisted in reducing it, and with much success. Some few years ago, it was more than 22 per cent.; last year it stood at a record point—viz., 6·17 per cent. The Directors considered this very satisfactory indeed. The report was adopted; and the payment of the usual dividend of 7½ per cent. per annum was sanctioned. Votes of thanks were accorded to the Chairman and Manager.

Mr. T. D. Wivell presided at the annual meeting of the Ilfracombe Gas Company, which was held last Wednesday. In their report, the Directors stated that, after carrying £200 to the reserve fund, the profit and loss account showed an available balance of £1809, from which amount the Directors recommended payment of the statutory dividends of 5 per cent. on the preference and consolidated ordinary stock. During the year the business had continued to progress satisfactorily. The greater portion of the increase in the make of gas occurred in the Midsummer and Michaelmas quarters, which was proof that gas was becoming popular for cooking purposes. No further extensions had been made at the Hele works, and no heavy expenditure for plant was anticipated during the current year; the Directors considering it advisable to defer every addition possible until the price of iron receded. The contracts entered into in June last for the supply of coal were happily favourable. The Chairman, in moving the adoption of the report, said that though the demand for coal had led to a great advance in the price, the Directors did not intend to increase the charge for gas unless coal became much dearer than they now anticipated. The gas consumed in the public lamps and buildings did not appear to be more than in former years; but the domestic consumption was augmenting, and they anticipated a still greater demand for cooking purposes. With regard to the electric light, the Company had been in negotiation with the District Council on the matter. The latter asked upon what terms the Company would take over the Provisional Order; and the terms given were generally considered the best the Council had received. On the 3rd of January, however, the Directors had a letter from the Clerk to the Council which stated that they had decided to defer the consideration of the Company's application *sine die*. He thought this was a very curt reply, after they had been asked to quote terms and had incurred certain expense. If the Council decided to undertake the supply of electricity to the town, the Directors would not have a word to say against it; but if they handed over the Order to any other company after the negotiations which had taken place, he believed the ratepayers would not consider it businesslike or in their interest. Mr. H. A. Willey seconded the motion; and it was unanimously carried. The dividends recommended were declared, and the thanks of the meeting were accorded to the Directors, Manager, and officials.

At the recent annual general meeting of the King's Lynn Gas Company, the Chairman (Mr. W. Burkitt), in moving the adoption of the report, in which the Directors recommended a dividend of 10 per cent., leaving a balance of £292, said the total revenue for the past year was £14,501, against £13,301 in 1898—an increase of £1200; while the expenditure was £10,293, against £9422, or £871 more. The extra cost of coal accounted for £668; and the remainder was money spent on repairs to mains and legal expenses. The coals carbonized amounted to 7430 tons, against 7198 tons in 1898—an increase of 330 tons; so that they had not suffered much from the electric light at present. The gas from 200 tons of coal had been entirely lost to the Company owing to the breakage of mains in connection with the sewerage and other works; and even with this loss they were able to declare their old dividend. A growing and important item was the revenue from slot meters. In 1898 the receipts from this source amounted to £12. Last year they had 165 meters, which brought in a revenue of £194; and the increase for the past six months had been £155. Mr. Pridgeon seconded the motion. Mr. Coulton stated that the Company had received some compensation from the Corporation for the damage sustained by the mains and the consequent loss of gas. The report was adopted, and the dividend recommended declared.

The half-yearly meeting of the Lewes Gas Company was held last Wednesday—Mr. J. Broad in the chair. The Directors reported that there was a profit of £1960 on the revenue account. After providing for interest on mortgages, the balance of net revenue was £2910; and the Directors recommended that a dividend for the half year be declared of 5 per cent. upon the consolidated original capital stock and of 3½ per cent. upon the additional capital stock. These dividends (after deduction of income-tax) would amount to £1434, and leave £1476 to be carried forward. In moving the adoption of the report, the Chairman said the Directors considered it a very satisfactory one. The receipts had increased, more especially in regard to the rental of meters and stoves; thereby showing that the public were appreciating gas for heating and cooking purposes. The receipts for residuals were greater; and it naturally followed on the high price of raw materials that they had to deal with. The expenditure had been heavier; but the Directors considered that when they were doing well was the time to maintain and consolidate their property, and they had accordingly spent a good deal of money on repairs. They would have to do the same, he thought, in the present year; and he hoped they would be in a position to do so, notwithstanding the high price of coals they had to face. Their contract would run out in a few weeks' time; and he trusted they might be able to enter into another at such a price as would enable them to continue the present low charge for gas. Alderman Kemp seconded the motion. Mr. A. W. Oke, in supporting it, remarked that one of the most satisfactory things in connection with the Company was the fact that they had had such an excellent contract for coal. This had enabled them to tide over a very serious time. On the 31st of December they had a large amount in stock, whereas other companies had been living from hand to mouth. The fact that coal had gone up in value had been compensated for, to some extent, by the increase in the returns from residuals. When they had to renew their coal contract, it would be gratifying to feel that, though the price they paid for their raw material would probably be a great deal higher than it had been, it would ultimately benefit gas companies. As a matter of fact, at Eastbourne, Hastings, Brighton, Bournemouth, and many other places, the increase in the sale of gas had been very large during the past half year. At Bournemouth, it was quite 20 per cent.; and this showed that, when coal was dear, people took the opportunity of using more gas. They felt that, while coal might rise suddenly in price, gas could not go up proportionately until the coal

market had been high for some time, because the companies failed to raise their prices; and if they obtained more consumers, he thought the Manager would bear him out in saying that people who commenced to use gas rarely gave it up. Another point worthy of mention was the extending use of prepayment meters; and he had no doubt the substantial increase in the receipts for gas was partly due to them. The report was adopted, and the dividends recommended were declared. A vote of thanks was accorded to the Chairman and Directors, which was acknowledged by the former, who thanked the Secretary (Mr. H. J. Hillman), the Manager (Mr. Levi Monk), and the staff generally, for the admirable manner in which they had carried out their duties. The two officers named briefly returned thanks, and the meeting terminated.

The annual meeting of the Lichfield Gas Company was held last Tuesday, when the Directors reported that the business of the Company was in a satisfactory condition. The usual dividends were declared. A vote of thanks was passed to the Chairman, and appreciation was expressed at the exertions of the new Manager (Mr. F. Key). After the meeting, several of the Directors and shareholders inspected the new show-room and offices recently added to the Company's premises, and much praise was given to the new arrangements.

The 24th annual general meeting of the Londonderry Gas Company was held on Friday, the 2nd inst.—Mr. W. Tillie in the chair. The Secretary (Mr. J. Macnie) having read the notice convening the meeting, the report and accounts were presented. The latter showed that the revenue from the sale of gas last year (82,593,000 cubic feet for ordinary consumption and 4,558,000 cubic feet for public lighting) was £13,993; and from the disposal of residual products, £3523—the total receipts being £18,058. The expenditure amounted to £13,768 (coals costing £8403); so that a sum of £4290 was carried to the profit and loss account, the balance on which was £18,761. Out of this, the Directors recommended the declaration of a dividend at the rate of 11 per cent. The consumption of gas increased last year beyond their expectation; but the cost of production was much higher, owing to advances in price of coal and all other materials. Taking these matters into consideration, they felt it necessary to revert to the price charged for gas previous to last year. The valuation of the Company's property was raised during the year to the extent of £327, which adds about £110 yearly to the expenses. The Chairman, in moving the adoption of the report, expressed his pleasure that the business of the Company was in a healthy and prosperous state. He said he had no doubt that, though they were working under great difficulties at present on account of the high price of coal and other materials, they would be able to surmount them, and make the concern as successful as it had ever been. They were menaced with the private lighting of the city by electricity; but he did not fear that this would be disastrous to their interests. In Londonderry there were great opportunities of increasing the consumption of gas for cooking, heating, and motive power. The laundries also were rapidly extending, and were dependent upon gas far more than upon electric light. He therefore had the greatest confidence that, even if the private lighting scheme was carried out, they would still be able to conduct their business successfully. The motion was unanimously passed. A vote of thanks having been accorded to the Chairman, Directors, Secretary, and staff, it was acknowledged by Mr. Tillie and Mr. Macnie, and the proceedings closed.

At the recent annual meeting of the Maldon (Essex) Gas Company, the Directors reported a satisfactory increase in the net profit, notwithstanding the reduction which had been made in the price of gas; and they recommended a dividend of 7½ per cent. The revenue account showed a profit of £923. The balance on the net revenue account at the close of the year amounted to £3150. Of the latter sum, £1353 was expended on capital account; leaving a balance of £1797 from which the dividend could be paid. Mr. W. K. Digby moved the adoption of the report. The motion was carried unanimously.

The half-yearly meeting of the Salisbury Gas Company was held on the 28th ult.—Mr. G. Fullford (Chairman of the Company) presiding. After the minutes of the previous meeting had been read and confirmed, the Chairman moved the adoption of the accounts and the payment of the usual dividends on the various classes of shares, ranging from 5 to 10 per cent. per annum. He explained the items in the accounts, and said that fortunately the Company's contract for twelve months' supply of coal was entered into in June last. At that time they had to pay a higher price; but he hoped before the next four months had expired they would find their staple commodity back to ordinary figures. As to the sales of gas, he believed for the year they would be fully up to the average. Mr. W. Young seconded the motion, which was carried unanimously. Mr. A. Watson said the thanks of the shareholders were due to the Chairman, Directors, and officers of the Company for their services during the past six months. He therefore proposed a vote of thanks to these gentlemen. Mr. C. Fullford seconded the proposition, and it was carried. The Chairman, in returning thanks, said they had the management of an important local industry, which contributed £500 per annum to the rating, and paid a weekly wages bill of £60. He desired to acknowledge the services of the officers of the Company and of their staff of workmen.

At the annual meeting of the Shotley Bridge and Consett Gas Company last Friday, a profit of £2307 was reported. It was announced that a new gasholder and tank (which would cost £7000) would be completed six months hence; and it was intended to create new stock to meet the cost. A dividend of 5 per cent. was declared.

At the half-yearly meeting of the Sutton (Surrey) Gas Company—Mr. Budgen presiding—the Directors reported that the past six months had been a period of prosperity. The increase in the Company's business had been unprecedented; the production of gas having advanced 15¼ per cent. over the corresponding half of 1898. Much of this was due to the growth of the district; but it was chiefly attributable to the large number of gas heating-stoves, and to the spread in popularity of the system of supply by slot meters. The gross revenue was £1600 more than in the latter half of 1898. The balance available for distribution was £7969; and the Directors recommended the payment of dividends at the rates of 10 and 7 per cent. per annum on the original and additional shares. The Chairman, in moving the adoption of the report, remarked that although the revenue had increased by upwards of £1600, their expenditure was £1695 greater. The supply of coal had been a matter of considerable anxiety to the Directors, as he thought it had been to all conductors of gas undertakings. They were fortunate in having obtained their coals in sufficient quantity to keep up the supply of gas, though they had done more business. During the half year, the consumers had increased from 1460 to 1540; cooking-stoves, which were an important factor in the business, from 345 to 366; and heating-stoves, from 58 to 95. Of slot meters, which were an entirely new departure, they had 287. This was a business which he thought might be satisfactorily cultivated, because even if they had to compete with electricity they believed the use of gas heating and cooking stoves would continue to extend. The report was adopted; and the dividends recommended were declared.

The 34th annual meeting of the Tynemouth Gas Company was held last Thursday, when the Chairman (Mr. J. B. Williamson) moved the adoption of the report and accounts, noticed in the "JOURNAL" last week. In doing so, he said the Company had had an unusually successful year. Their coals had been reasonable in price, owing to the favourable contract they succeeded in making. Residuals had given good results, and the staff and men had done excellent work, which was reflected in the increased revenue obtained from each ton of coal carbonized. Having referred to the trouble of unaccounted-for gas, he said the percentage of loss had been reduced from 9·23 to 6·7. Many of the large mains had been renewed during the year—a considerable share of the cost being borne by revenue, and only a fair proportion being charged to capital. The result had been that they were able to face without undue alarm a great advance in the price of coal; and should the high prices now ruling be not too long maintained, the Directors hoped no serious advance in the charge for gas might be necessary, if indeed it should be required at all. After paying the interest on the debentures, and providing for the full dividend, they were able to add £3065 surplus profit on the year's working to the balance brought from last year, and were thus able to carry the substantial sum of £4044 to the reserve fund, which now stood at the maximum. Having alluded to the increasing popularity of slot meters, he said the improvements in the retort-house continued to give good results. The new works had been fairly commenced; and it was expected they would be ready for making gas by the latter part of next year. Great attention had been given by the Engineers to ensure that only the most approved and economical methods were adopted; and the Directors were satisfied that these works would be of a model kind, both in efficiency and economy. Death, they regretted, had removed one of their very old servants, in the person of Mr. W. B. Davidson, who had been connected with the Company for 43 years. The report was adopted, and a dividend of 2½ per cent. for the past six months was declared, making with the interim dividend 5 per cent. for the year.

At the recent annual meeting of the Wellington (Salop) Gas Company, the Chairman (Mr. Harry Shepard) gave an interesting account of the past year's working; alluding to the new retorts which had replaced the old ones, and the arrangements made for erecting a new gasholder. He said that there were now 400 slot meters in use, and the number was steadily augmenting. Several gas-engines had lately been put down for manufacturing purposes; and these also were on the increase. The reduction in the price of gas had been happily met by an increased demand; and when the new holder and other projected improvements had been carried out, the shareholders would be possessed of one of the best equipped and most up-to-date gas-works in the Midlands. A dividend at the rate of 10 per cent. per annum was declared on the original shares of the Company for the six months ending the 31st of December, and one at the rate of 5 per cent. per annum on the new shares, both free of income-tax. The retiring Directors and Auditors were re-elected. At the close of the business, a vote of thanks was passed to the Directors, and also to the Engineer and Manager (Mr. Herman Taplay), for the able and careful way in which he had carried on the works and extensions.

At the recent annual meeting of the Weston-super-Mare Gas Company, the report submitted by the Directors recommended the statutory dividends, and also a reduction in the price of gas to private consumers, as from Jan. 1, of 2d. per 1000 cubic feet. The balance-sheet showed that during the year 100,894,950 cubic feet of gas had been sold (including 12,357,950 feet for public lighting and under contracts), producing a net revenue of £15,466, after allowing £1239 as discount to consumers. The rental of meters brought in £588, and the residual products £3441, which, with transfer fees, brought up the total income to £19,497. After defraying cost of manufacture, distribution, management, &c., £3721 was the balance carried forward to the profit and loss account.

Water Company.

The 35th ordinary general meeting of the Woking Water and Gas Company was held last Tuesday, at the offices, Great Winchester Street, E.C.—Mr. Charles Horsley in the chair. The Directors reported a balance of £2843 at the credit of the profit and loss account, out of which they recommended the payment of a dividend at the rate of 4½ per cent. per annum for the six months ending Dec. 31, less income-tax, which would absorb £1806, and that the balance of the preliminary expenses, amounting to £575, should be written off; leaving £462 to be carried forward. They stated that the expenses for the half year had been abnormally heavy, owing to the exceptional drought, necessitating increased pumping, and causing a large additional outlay for coal, labour, maintenance, and distribution. In moving the adoption of the report, the Chairman reminded the shareholders that the Company had obtained their Act, and had gone on with the preparation of the plans, &c., for the extensions, though money was so dear a short time ago that they did not think it advisable to issue any further capital then. They would want more water very soon, and they were authorized to get it from the Thames; but they could not do this without a great deal of expense, as they had a long way to convey it. The Directors would want the shareholders and their outside friends to take shares to a large amount, because the Thames was five or six miles distant from the Company's district, and they had the ground to buy and the Act of Parliament to pay for. It would be seen by the report and accounts that the Company were doing better. In view of the works rendered necessary in order to provide a further supply of water, they proposed to issue £20,000 of additional capital. The profits showed a slight decrease of £258; but this was in consequence of the high prices of coal, labour, &c., during the past year. The Directors saw their way to keeping up the dividend to 4½ per cent.; at any rate, he did not think it would go down. Sir John Baker seconded the motion. Replying to questions, the Chairman stated that their pumping was yielding a good supply. Recently, there had been

more than enough water, and the Company were able to assist Guildford; but they did not propose to do this except in cases of emergency. Mr. C. E. Jones asked how many gallons of water per head was supplied. The Chairman said he did not wish to state the exact figure, but it was under 20 gallons. The Engineer (Mr. J. Quick) said the supply per head would compare favourably with that of any other Company in the kingdom. The report and accounts were then adopted; and the dividend of 4½ per cent. was formally declared. Subsequently the Directors were authorized to issue additional capital to the amount named above, and to raise £5000 on loan; and the proceedings closed.

AUSTRALIAN GASLIGHT COMPANY.

The Half-Yearly Meeting of this Company was held at the Head Office, Sydney (N.S.W.), on Monday, Jan. 29—Mr. G. J. Cohen, the Chairman, presiding over a large gathering of shareholders.

The Secretary (Mr. R. J. Lukey) having read the advertisement convening the meeting, the report of the Directors was taken as read. In the course thereof, they stated that the profits for the six months ending Dec. 31 last amounted, with the balance brought forward, to £57,934. They recommended the payment of a dividend for the six months of 9s. per share, free of income-tax, which would absorb £51,135; leaving a balance of £6799 to be carried forward. The Engineer (Mr. T. J. Bush, M.Inst.C.E.) reported that the whole of the plant was in good condition. As the result of his visit to England, the Directors had decided to erect carburetted water-gas plant at their Head and Mortlake stations; and they expected to have it in full operation by September next. A contract had been entered into for ten years with the New South Wales Shale and Oil Company, Limited, to supply the oil required. In the course of the half year, 1130 slot meters had been fixed; making the total number in use 4130.

The Chairman, in moving the adoption of the report, said he was pleased to inform the shareholders that the undertaking was still prospering; the past half-year's operations having been very satisfactory. The prepayment meter consumers were increasing at the rate of 50 per week, the number of slot meters now in use being, as mentioned in the report, 4130. The extra consumption of gas by this new class of consumers for the past twelve months had reached 20 million cubic feet. With the view of keeping abreast of the times, and on the recommendation of their Engineer, the Directors had ordered from Messrs. Humphreys and Glasgow two sets of carburetted water-gas plant, each to manufacture 500,000 cubic feet of gas daily; and they should be in working order by September next. The Company had arranged to take the oil required in connection with this system of gas manufacture from the New South Wales Shale and Oil Company. The oil could now be obtained a little cheaper if imported; but, in view of a duty being imposed when federation took place, the Company, on the whole, would do better with local oil, and, in addition, would be supporting a local industry. He could not yet say what effect the Early Closing Act would have upon the consumption of gas. At present, the increase, which had been going on during the past six months, had not only been maintained, but exceeded. It would, however, probably have been greater had the Act not been passed. Comparing the Company's position with that of twenty years ago, he found that in 1880 the revenue was £140,000, against £300,000 now. The price of gas then was from 7s. to 10s. per 1000 cubic feet; whereas now it was only 4s. The sale of gas had increased from 355,233,000 to 1,373,560,000 cubic feet; the number of consumers from 9000 to 41,000; the public lights from 2738 to 10,250; and the amount paid in dividends from £37,491 to £102,270 per annum. The number of gas-cookers sold during the past year was 705; making a total of more than 9000 now in use.

The Deputy-Chairman (Mr. S. Dickinson) seconded the motion; and it was carried unanimously.

GAS, WATER, AND GENERAL INVESTMENT TRUST, LIMITED.

The Annual General Meeting of this Trust was held last Tuesday—Mr. J. B. Braithwaite in the chair. The Directors' report stated that after debiting revenue account with interest on debenture stock and all expenses, and crediting it with the sum of £3342 brought forward from last account, there remained a balance of £23,595, out of which an interim dividend was paid for the half year to July 28 last, at the rate of 4½ per cent. per annum on the preferred stock, amounting to £7308. The Directors now recommended further dividends at the rate of 4½ per cent. per annum on the preferred stock, and at the rate of 4 per cent. per annum on the deferred stock, for the six months to Jan. 28 last; making for the year 4½ per cent. on the preferred stock and 2 per cent. on the deferred stock. This would absorb £18,946 for the year, and leave a balance of £4649 to be carried forward. After deducting from the profits on sales the loss made on certain changes of investments, there remained a balance of £3812, which had been placed to the credit of suspense account for the adjustment of securities; and after debiting the amounts written off the cost of several of the securities during the year, there was a debit at this account of £98,852. The securities stand in the books at cost prices, less £105,704 written off out of realized profits, and the £98,852 placed to suspense account. Many of the securities held are still in default, and much depreciated in value; and so far as the Directors are able to judge, further provision will ultimately have to be made. The Trust, however, hold securities to a considerable amount, which have been received in lieu of interest, and for which no credit has been taken in the accounts. Cash received from sales of these securities would be available for revenue. The Chairman, in moving the adoption of the report, said the claims of the deferred shareholders were not being overlooked by the Board; and they were hoping that circumstances this year would be such as to enable them to make a larger increase in the dividend on this stock than on the present occasion. In time, they might even feel justified in recommending interim dividends on the deferred stock. They had still got a somewhat uphill fight before them, to bring the Trust into what could be described as a thoroughly satisfactory condition; but they were making steady progress in this direction. They had continued to follow the policy of providing for all losses as soon as ascertainable; and the result was that they had written down their investments by £41,330. On the other hand, they had made a profit on securities realized of £11,486—nearly three times the amount of the previous year. Against this, they had incurred a loss on securities realized of £7674, which left them with a balance on the right side of between £3000 and £4000. The most important event during the year had been the completion of arrangements by which the affairs of the Union Light and Power Company (in which the Trust had a very large interest) were placed on a thoroughly sound basis. The various interests of that Company had now been amalgamated under the title of the Utah Light and Power Company; and he (the Chairman) held the opinion that this security would likely be in the future a very valuable one to the Trust. The Trust had also extensive holdings for which no value was taken in the balance-sheet. One of the most important of these was their investment in the Kenilworth Sugar Estates. These estates had done very well indeed during the past year; and the Board were looking forward to much better results. After a short discussion, the report was adopted, and the dividends recommended were declared.

HARROW AND STANMORE GAS COMPANY.

The Half-Yearly Meeting of this Company was held on Monday last week at the Albion Tavern, Aldersgate Street, E.C.—Mr. Charles Horsley, J.P., presiding.

The Engineer and Secretary (Mr. J. L. Chapman) read the notice convening the meeting; and the report and accounts were then submitted.

The Chairman said his first words must be of regret at the absence of their Chairman (Mr. James Glaisher). Mr. Glaisher had been very ill; but he (Mr. Horsley) was exceedingly pleased to learn that he was now getting rapidly well. He did not think their Chairman had been absent from the meetings more than once or twice during the long course of years that he had been connected with the Company. Turning to the report and accounts, he thought the shareholders would agree that the past half year had been a prosperous one. The gas-rental, which amounted to £7359, showed an increase of £529, compared with the corresponding period of 1898. This was equal to 7¾ per cent. But taking the different districts which constituted their area of supply, he found that in the Harrow district the increase of rental was equal to 6¼ per cent., in the Sudbury and Harrow Weald district 11½ per cent., and in the Stanmore district 9½ per cent. The public lighting, too, gave them an increase of 6¾ per cent. The meter and stove rental had also increased; and the receipts for residuals had moved upwards. The coke receipts had no doubt improved owing to the higher price of coal; the increased income from coke and the other residuals being £206. The total receipts amounted to £9087, which was an increase of £782 compared with the December half of 1898. This he regarded as very good. The expenditure for the half year was £6198, or an increase of £484. The item of coal had necessarily advanced, mainly because the output of gas had been larger. As to repairs and maintenance, £137 more had been spent on the works, and £118 more on the mains. Then £200 had been written off the suspense account, which was a very proper thing to do. The profit for the half year was £2888, which was an increase of £297 compared with the second half of 1898. The dividend and loan interest required £2757; so that there was a surplus on the year of £130 to carry forward to the balance, which now amounted to £819. The quantity of coal gas made during the half year was 29,817,000 cubic feet, and of oil gas 8,467,000 cubic feet—making together a total of 38,284,000 feet. The quantity of gas sold was 33,912,000 cubic feet, used on works 530,000 feet, and unaccounted for 3,842,000 feet. This last figure represented slightly over 10 per cent.; but for the whole year, it was 8·15 per cent. He was not going into the reasons for the unaccounted-for gas being 10 per cent.; but there were several things which had assisted in swelling the amount. The water-gas plant had been established and was working; and he thought it would do even better than it had done in a few months' time. He moved that the report and accounts be adopted.

Mr. A. H. Baynes seconded the motion.

Mr. D. Hill said the capital seemed to be very much in excess of the amount of business done. He believed that the capital should average between £500 and £750 per million cubic feet; but in this Company it was considerably above that. He should like to know whether the Directors had taken up the slot-meter system. He was a Director of the Watford Gas Company; and they found these meters a vast help. They had nearly 1000 penny-in-the-slot meters, and were adding about twenty per month. Shilling-in-the-slot meters had also been found useful where they were at all uncertain as to a consumer's financial position. In the past twelve months, the amount collected from the penny-in-the-slot meters was about £2070. The consumption per slot meter was about 10,700 cubic feet in twelve months. The Company's own men did the work; and the Company found everything, including a stove—the cost per house averaging about £7.

The Chairman replied that the Harrow Company also supplied both shilling and penny in the slot meters; but he fancied the Watford district was totally different from their own. He believed that at Watford there were a great many more of the class of resident who would consume gas on the slot system. Regarding the capital, it must be remembered that they had bought up the Harrow and Stanmore Companies; and works could not be shut down, and new trunk mains laid, without increasing the capital.

The motion was unanimously carried.

Dividends at the rates of 8, 7, £5 12s., and 6 per cent. per annum on the various classes of capital were next declared.

The retiring Directors (Mr. Charles Horsley and Dr. J. W. L. Glaisher) were next re-elected.

Both gentlemen acknowledged the confidence of the shareholders; Dr. Glaisher remarking that his father was extremely well pleased with the balance-sheet on this occasion, and thought it was one of the best ever submitted to the shareholders.

On the motion of Mr. Charles Gandon, seconded by Mr. Frederick Lennard, Mr. Horace J. Rydon was re-appointed an Auditor.

Mr. Chapman, responding to a vote of thanks to himself and his staff, remarked that he was very pleased to hear that Mr. Glaisher considered the balance-sheet a good one. With regard to the water-gas plant, they had a few difficulties in starting it; but it was running all right now. The price of coke was a very important factor with them in connection with the manufacture of water gas. In Harrow they had only a certain demand for coke. When that demand was overcome as it were, the surplus had to go to London; and the cost of carriage and transport swallowed a very large portion of the receipts. Therefore, they now used the water-gas plant to keep the coke down to the normal. By carefully adjusting to their circumstances the use of the coal and water gas plants, the latter would add very much to the profit of the Company.

Mr. A. F. Phillips asked to be allowed to inquire of Mr. Hill how much the prepayment consumers of Watford had to pay in excess of the ordinary consumers.

Mr. Hill answered that the ordinary price was 2s. 10d., and the prepayment consumers paid 4s. The amount of gas given for a penny was 21 cubic feet. The money received from the extra charge was utilized for the repayment of capital and depreciation.

Mr. Phillips remarked that, in being able to charge as much as 1s. 2d. per 1000 cubic feet extra, the Watford Company were evidently doing a good business. They would not be able to charge so much in Harrow. He proceeded to move a vote of thanks to the Chairman and Directors, and expressed the regret of the shareholders at the cause of the absence of Mr. Glaisher.

Mr. Lennard seconded the motion, which was heartily agreed to.

A brief response by the Chairman concluded the meeting.

HORNSEY GAS COMPANY.

The Half-Yearly General Meeting of this Company was held on Friday, the 2nd inst., at the Offices, Chancery Lane, W.C.—Mr. John Drew in the chair.

The notice convening the meeting having been read, the report and accounts were presented.

The Chairman, in moving their adoption, dealt at some length with the causes which had led to the prevailing high prices of coal, and expressed his belief that, though this commodity would not be so cheap in the near future as it had been, the prices now paid did not represent the true market value. He remarked that the Board were averse to raising the charge for gas, but said this would have to be done if coal became dearer. The standard price the Company were authorized to charge was 3s. 9d. per 1000 cubic feet, which was reduced to 3s. 6d. in 1888, to 3s. 4d. in 1889, to 3s. 2d. in 1895, and to 3s. 1d. and 3s. in 1899; and the consumers, who had in consequence profited to the extent of £42,267 18s. 8d. in eleven years, could hardly object to paying a higher rate if the Company were forced to resort to it. The profits of the Company would be reduced by £2500 by a rise of 2s. 6d. per ton in coal. With regard to oil, the contracts would hold good until October; but the price had risen, and more would therefore have to be paid for it. The manufacture of gas by the carburetted water-gas plant had been a great boon to the Company, and had helped the Directors out of several difficulties. Turning to the subject of capital, he pointed out that the total amount raised on that account was £184,715, but that £194,856 had been spent; leaving a debt of £10,141 to the revenue account. During the past five years, £43,555 13s. 10d. had been laid out in providing new retort-houses, water-gas plant, and purifying machinery; while in the same period only £34,613 had been raised. Quite recently, £11,315 had been obtained by selling £9000 of 5 per cent. preference stock, which would more than cover the debt on capital account. In addition, there was a sum of £5978 of ordinary stock to be called up; and after this had been done, there would still remain £4324 of debenture stock to be borrowed. This year, however, £6000 would be required for new mains, &c., and £2500 for land and houses; consequently, application would have to be made in the next or following session of Parliament for power to raise additional capital. He concluded by calling the attention of the shareholders to the very large increase in the quantity of gas sold (15 million cubic feet), which was equal to 11 per cent., and showed clearly the vitality of the Company.

The report and accounts were adopted, and dividends at the rate of 11¾ per cent. on the "A" stock and of 8¾ per cent. on the "B," "C," and "D" stocks, were declared.

On the motion of the Chairman, seconded by Mr. E. T. E. Besley, Q.C., it was resolved that the "B," "C," and "D" stocks should be consolidated and converted into one stock.

The two retiring Directors (Mr. W. P. Bodkin and Mr. John Miles) and the retiring Auditor (Mr. F. E. Bodkin) having been re-elected, it was unanimously resolved that the remuneration of the Directors be increased from £800 to £1000 per annum.

Sir H. B. Poland, on the part of the Directors, thanked the shareholders for their confidence in the Board; and the proceedings then terminated.

CAGLIARI GAS AND WATER COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Tuesday, at the London Offices, No. 3, Lothbury, E.C.—Mr. John Aird, M.P., in the chair.

The Secretary (Mr. W. B. Peat) having read the notice convening the meeting,

The Chairman said the result of the year's working had, the Directors thought, been satisfactory. They had maintained that good feeling with the Authorities which had existed since the concession was first obtained, nearly thirty years ago. The Directors were able again this year to pay the dividend, as well as the bonus; and this result, in the face of some little difficulties which had occurred during the year, was very gratifying. They had had to incur certain expenditure in connection with a fault in one of the walls of their large reservoir—not in any way associated with the main wall, but the wall which protected one of the tributaries to the reservoir. This had entailed an additional outlay of some £200 or £300. But the difficulty was not a serious one; and it was being grappled with. They had also had to pay, like most other gas companies, more for coal. However, this had not been a serious item, because the money which they had obtained for coke had been much more, and in a great measure equalized the increase on the coal. In addition, more had had to be paid on account of exchange, in consequence of the increased rate. This had been somewhat exceptional in the past year; and they would probably have to pay an additional £200. Turning to more pleasing matters, there had, he said, been an increase in both the water and gas receipts, and the electric lighting also showed a larger profit. The rainfall, too, had been perfectly satisfactory, and had enabled the Company to keep their reservoirs sufficiently filled to ensure throughout a complete supply, not only to Cagliari, but also to the adjoining villages. Arrangements had been made to dispose of certain property which was bought some year or two since around the main reservoir; the Company retaining the land immediately adjacent to the water. The price received for the property in the re-sale had left them sufficient land to protect their works without any charge. Another very gratifying point was that during July last, a Government Commission inspected the works. It consisted of the Prefect, the Chief Government Engineer, the head of the Sanitary Department, and two medical men. They visited the reservoirs, found everything in perfect order, and expressed their complete satisfaction. The Company had benefited in the past year, and hoped to benefit still more, from an arrangement lately made, under the advice of Mr. Simmelkjör, their co-Director, to let out on hire the different gas fittings and services. It might interest many connected with similar companies to know that 1265 customers paid for their fittings, and 577 had them on hire, paying 10,598 frs. during the year. The capital employed in constructing these fittings and services was represented by 114,000 frs. It would be seen that not only did this increase the supply and the number of consumers, but it gave them a return on the capital employed of 9·28 per cent. per annum. It might also be of interest to know that out of 1842 consumers which they had in addition to the public supplies, 385 were served by meter, and 1457 by contract. The illuminating power of the gas had been kept up to the standard during the year; and consequently no fines had been levied. The unaccounted-for gas showed a slight increase; but the Directors were quite prepared to accept the explanation given by their representatives in Cagliari that this was, in great measure, due to the visit of the King of Sardinia. No doubt the great festivities entailed a larger consumption of gas; and the Company were desirous of assisting the inhabitants as much as possible in rendering the visit a happy occasion, and one worthy of Cagliari. The increase in the private lighting was very satisfactory. It was 14 per cent. over 1898, and was to a large extent due to the use of heating and cooking stoves. With regard to the management of the Company, after the death of Mr. Craig, the Directors appointed Mr. Ernesto Sanna to succeed him. The Directors desired to express their satisfaction of the earnest care and great interest Mr. Sanna took in the concern; and they wished also to place on record their appreciation of the efforts of Mr. Anderson and Mr. Webster. The Board felt sure that in the coming year these gentlemen would fulfil in an equally attentive manner the duties appertaining to their offices. A very able report had been prepared by Mr. Simmelkjör as to the future prospects of the Company. In the course of it, he said: "It is a matter of congratulation that the receipts of the Company continued to increase so fast, that we have already arrived at the same figure of total receipts as we had before the subvention was reduced." In formally moving that the report and accounts be adopted, he (the Chairman) might say how pleased the Directors were to be able to place before the shareholders a report which was encouraging both as regards the present position and future success of the Company.

Sir Frederick Wigan, Bart., seconded the motion.

Mr. R. Payne called attention to an item on the debit side of the balance-sheet, "Mains, &c., at the village of Pirri, £1666 17s. 5d.," and said, on the other side, there was a credit of a similar amount. He should like to know whether this was an available asset.

The Chairman replied that the Directors had always been anxious not to increase the capital account; and certain expenditure had been incurred which was properly capital, but which had not been so charged. This outlay at Pirri (which was an important village) would be repaid; and meanwhile interest was being paid on the money. The Board regarded it as a good asset; and this was why it had been dealt with in this way.

The motion was unanimously carried.

On the proposition of the Chairman, seconded by Mr. C. A. Swinburne, the interim dividend at the rate of 6 per cent. per annum was confirmed, and one at the rate of 8 per cent. for the past half year was declared, together with a bonus of 2s. 6d. per share.

Resolutions were also passed, re-electing the retiring Directors (Messrs. Blunt and Swinburne), and the Auditors (Messrs. Bishop and Robb).

The usual complimentary vote to the Chairman and Directors and officials concluded the proceedings.

ELECTRIC LIGHTING NOTES.

The application of the Salford Town Council for power to borrow £398,683 for purposes of electricity supply has resulted in the Board sanctioning £397,408. The sums excluded for the present are connected with drainage and retaining-wall work.

The Sutton Coldfield Town Council on Wednesday resolved to make application to the Local Government Board for sanction to borrow £26,000 for electric lighting works, and an additional £10,000 for future extensions to Four Oaks and other parts of the borough.

The Lincoln City Council have decided to apply to the Local Government Board for power to borrow £6000 to provide for the extension of the electric lighting plant. It is estimated that the additions will raise the number of lamps capable of being supplied from 18,000 to 25,000. The Committee are hopeful that in the coming year they will be able to pay their way, and have something to hand over to the rates.

The tradesmen of Wakefield have been discussing, at a meeting of their Association, the question of the charge for electricity; and it resulted in the passing of a resolution to apply to the Corporation for a reduction of the price for lighting purposes, the abolition of the rebate system, and a

reduction of meter-rents. The general opinion of the members was that the working of the rebate system had proved unsatisfactory, and that a lower charge per unit would lead to an increased consumption.

It was reported at the meeting of the Liverpool Corporation last Wednesday, that the accounts of the Electric Lighting Department for 1899 showed a net balance of £11,206. The Committee proposed to put £6000 of this to the credit of the renewal account, and the balance to the reserve account. Exception was taken to the passing of the recommendation, without a proper statement of accounts being submitted; and consequently its consideration was deferred until the accounts had been printed and circulated.

The West Hartlepool electric lighting project (says a northern contemporary) continues to make slow progress towards realization; and the patience of the city fathers thereat appears to be almost exhausted. The plant has been in readiness and the cables laid months ago; but the generating station is still far from completion, though the contractor responsible for that important adjunct of the scheme is understood to have been repeatedly "hurried up" in no gentle fashion. The public were promised the light more than a year ago; and last Tuesday, the Corporation came to a decision which makes it clear that they do not intend to brook further unreasonable delay.

It is estimated that £74,536 will be required for the erection and equipment of the power-house of the Devonport municipal electricity station; and the Town Council last Thursday sanctioned an application to the Local Government Board for permission to borrow the money. Electricity is to be generated not only for lighting purposes, but as motive power for various tramway schemes which are being carried out. In order to keep faith with one of the tramway companies, plant for traction purposes is to be forthwith provided. Alderman J. B. James, Chairman of the Electric Lighting Committee, said that some might consider the estimated cost of the works heavy; but it compared favourably with other towns. They were in an unfortunate situation with regard to the supply of motive power, because there was an enormous demand for engines and plant, and they were not equal to meeting it.

The tone of some remarks made at the meeting of the Sudbury (Suffolk) Town Council last Wednesday gives hope that the members are becoming a little more reasonable, and will consult the ratepayers in a proper manner before they venture into the electric lighting business, which, from the showing of their own electrical expert, is not likely to prove a very lucrative one for the town. As stated on a previous occasion in these "Notes," a circular has been sent round to a number of householders and tradesmen in the thoroughfares in which it is proposed to lay the cables; and, according to the Mayor, a good many of the replies which have been received are satisfactory. That may be; but it will require a considerable number of these satisfactory replies in Sudbury to make the suggested undertaking reach a paying level. Alderman Bell and Mr. Constable strongly urged the Council to fairly face the ratepayers on the question before committing themselves; and it is to be hoped that the sound arguments they advanced will have due weight.

At the meeting of the Exeter City Council last Wednesday, some particulars were given of the costs which have been incurred in contesting the claim of Mr. Rucker to a patent which it was alleged controlled the whole manufacture and use of transformers. The action was brought against the London Electric Supply Corporation; but a Defence Committee was formed, and the Exeter Corporation, among others, were subscribers to the fund. The Town Clerk stated that the action had been dismissed with costs, but that until the amount could be recovered from the plaintiff the defendants had to pay the costs. Another call had, therefore, to be made on the subscribers. The costs of Counsel, documents, &c., amounted to £4548, and the solicitors' costs to about £1000. Calls had been made to the extent of £2533; so that £3015 had to be raised. Exeter had already paid £5 8s., and was now asked to pay £19 9s. 5d. A cheque was drawn for the amount; the Town Clerk adding that this was cheaper than either defending the action or settling with the plaintiff for the use of the transformers.

After considerable delay, the Local Government Board have given their sanction to the raising of a further portion of the loan of £10,000 asked for by the Torquay Corporation for the extension of the electric lighting works. They, however, decline to permit the borrowing of £164 spent on works which were rendered useless by the change of the site of the generating station, and £200 excess of expenditure over the estimate in the case of the rectifiers. Yesterday week, the Town Council decided to apply for a further loan of £10,000 for additional generating and other plant, and £5000 for the extension of mains. In order to save time, the Electric Lighting Committee recommended that tenders for the work contemplated should be accepted conditionally upon the loan being sanctioned; also that the work be carried out under the superintendence of Mr. Storey, the Borough Electrical Engineer. Alderman Kerswill, Chairman of the Committee, stated that when the supply of electricity was commenced two years ago there were 55 private consumers and 3200 8-candle power lamps connected; whereas now there were 214 consumers, with 11,326 lamp connections. The total capacity of the plant was 11,500 lamps; so that it was loaded to a dangerous extent.

On the recommendation of the Electric Lighting Committee, the King's Lynn Corporation have decided to apply to the Local Government Board for power to borrow £10,000 in order to extend their works. Before the application is granted, however, there will be a tussle with some of the ratepayers. One of these—Mr. Thomas Brown, a shareholder in the Gas Company—considers it to be his duty to oppose; and at a meeting of the Company a few days ago, he stated that he had asked several of his friends, who were also large ratepayers, to join him in that opposition when the Inspector came down. Before the Local Government Board would sanction the spending of this further £10,000, the Corporation had to prove that it was reasonable and right that it should be spent; and he believed that he could show, on the contrary, that it would be a very unwise expenditure. The Corporation had already laid out £30,000 or £32,000 in an experiment with electric lighting; and he thought this was quite sufficient for a small borough like King's Lynn to spend. If in the course of another twelve months the Corporation could prove that the present expenditure had been wise and businesslike, and that the results were such as would satisfy any investor of a similar sum, his objection would fail. He had promises of support amounting to about £20,000—one-fourth of the rateable value; and the cost would only be about £20 altogether. It was argued that the Corporation must go on spending, because they were compelled to supply electric current to any ratepayer who desired to have it. But they were not obliged to supply the public lamps; and a quarter of the total current was now going to them. Everybody outside the borough who had seen the light given by the beautiful little glow-worms said the public lighting was a miserable failure. He contended that gas with incandescent burners was the illuminant for public thoroughfares; and the Corporation ought to make a bargain with the Gas Company to do the street lighting. He was told there were 990 electric lamps where there used to be about 412 gas-lamps; and the cost would be enormous. He was sure he was right in saying that with incandescent gas-burners the Gas Company could give four times the present light at about half the cost. The Company decided to contribute a sum not exceeding £5 in joining with other ratepayers in protesting against any further capital expenditure.

A striking example of how an electric lighting account can be "adjusted" was afforded at a recent meeting of the Southampton Town Council. A statement of income and expenditure for the nine months ending Dec. 31 last, prepared by the Borough Accountant (Mr. A. Ramshaw) in accordance with the resolution of the Council of June 28, 1899, had been submitted to the Electric Lighting Committee. It was resolved that they failed to see the value of the return, in which the income received and the liabilities incurred were set forth as identical with the amounts estimated in the previous year, and that Mr. Ramshaw be requested to prepare a return of the actual income, including assets, and the actual expenditure, including liabilities, for the nine months ending the 31st of December. One of the members of the Council (Alderman Le Feuvre), referring to this matter, said the financial estimate presented to the Council with reference to the Electricity Department set forth that they expected to receive £10,152 10s., and to spend £9969; and in the statement submitted to the Committee it was shown that £7614 7s. 6d. was the actual income. It turned out, on close examination of these figures, that £7614 and three half-crowns was exactly three-fourths of the estimated income for the whole twelve months. It was an extraordinary fact that the Electricity Committee had received three-fourths, as was said in Committee, to a postage stamp. When they came to the expenditure, they saw it was estimated at £9969 13s. 7d. If they took three-fourths of this they would arrive at £7477 5s. 2d.; and, by a most extraordinary coincidence, this was actually the expenditure for the nine months. (A Voice: Marvellous.) His friend said "Marvellous;" but he was going to use another word. He said it was not marvellous, but a frightful exhibition of the way an account could be cooked; and he was sorry to say there must have been two departments engaged in preparing this account. If it was got up in that way, how could they be sure that they had correct figures with regard to other departments? He would say it was a melancholy exhibition to save the trouble of going into the actual income for the nine months, that the estimated income and expenditure should have been divided by three-quarters, and some gentleman should have thought that many of the 52 members of the Council would not take the trouble to examine into them. He endorsed the resolution the Committee came to. Alderman Bance remarked that it seemed to him to be a very natural complaint on the part of Alderman Le Feuvre; but he was a member of the Committee, and had the privilege of seeing these accounts, which were not printed, and it could scarcely be said that the whole of the 52 members could have seen them. Alderman Le Feuvre acknowledged that he was wrong in saying the whole of the 52. Alderman Bance went on to say it seemed to him that the return was a bogus one, and therefore it made one suspicious as to what state the department could be in to submit such a thing; and how the head of the department could be so lax as to bring up the statement, he could not understand. The Finance Committee would do well to look into the department, and see how it was that they could get a return of such a character. Mr. Blakeway stated, as a member of the Committee, that he was in sympathy with their resolution. They felt disgusted, as a trading Committee, that they were denied the privilege of knowing the position in which they stood at the end of a certain period. It was one of the most important Committees, and they intended to have a proper account kept of the liabilities and assets. The Committee were not going to lose sight of the resolution; and it gave him pleasure to support everything Alderman Le Feuvre had said with reference to the matter. Alderman Bone said the Electricity Committee had nothing to do with the preparation of the return. It was the Borough Accountant; and if he could not get it, he should have called the Electricity Committee, who would have used their authority. The further particulars would be prepared and presented; but as far as the Electricity Committee were concerned, there was no responsibility for the return. It was the Borough Accountant's department; and therefore the Electricity Committee should not be blamed. Alderman Le Feuvre said that when he spoke previously on the subject of the resolution of the Electricity Committee he did so not only as a member of that Committee, but also as a member of the Finance Committee. He said he cordially endorsed every word of the resolution which was unanimously passed by the former Committee. That Committee had no knowledge of the return. It was placed on the table; and he supposed he was the only member who saw it before it was put there. What they complained of was that they had not an opportunity of seeing what the return was.

West Bromwich Gas Supply.—In moving, at the meeting of the West Bromwich Town Council last Wednesday, that £2000 out of the gas profits of the year be allocated in relief of the general district rate, Mr. Bushell said the cost of material had so increased that the Committee could hold out no hope of any profit next year; and it might be necessary to increase the price of gas. Alderman Blades thought the price should be kept down, so that consumers should have the benefit.

The Morley Corporation and their Gas Workers.—At the meeting of the Morley Town Council on Monday last week, the Gas Committee reported that they had had an interview with the stokers employed at the gas-works with regard to their demand for the following concessions: Eight hours a day, extra men to work low fires, 5s. 3d. per shift, and double time for Christmas Day and Good Friday; and that the question had been settled by re-arranging the hours of employment, and offering the men 5s. 3d. per shift of eight hours, and double time for Christmas Day and Good Friday. The men have accepted the offer.

LONDON COUNTY COUNCIL AND THE WATER QUESTION.

Reply to the Report of the Royal Commission—The Government to be Approached.

At the Meeting of the London County Council last Tuesday—Lord Welby in the chair—the Water Committee presented a long report on the subject of the report of the Royal Commission on the Metropolitan Water Supply, a full abstract of which has already been given in the "Journal." In their introductory remarks, the Committee say that seeing that the long investigation by the Commission closed on the 23rd of March last year, they hoped to have been in possession of the report in time to allow the Council to give the whole subject mature consideration before being obliged to decide upon their policy in regard to proceeding with the Bills already deposited in Parliament. The period, however, within which a decision must be come to on this question was so short that the Committee thought it well to place the Council at once in possession of their views as to the general effect of the report, though it was impossible to enter upon any detailed criticism of it which they might have desired. They then proceeded to set forth at length the Council's water policy, which has always been "purchase and public ownership of the Metropolitan Water Supply." They went on to say that in 1895 a Parliamentary Committee presided over by Mr. David Plunket practically assented to two propositions—first, that it was expedient that the Council should purchase; and, secondly, that the terms of purchase should not be those usual under the Lands Clauses Acts. The Council's Bills would, it was believed, have probably been passed, had it not been for the sudden dissolution of Parliament. In the following year the Commission was appointed to inquire into the expediency of purchase in the interests of the ratepayers and water consumers. After giving a short account of the proceedings before that body, the Committee dealt with the recommendations. Taking first the question of purchase, the Committee claimed that the report of the Commission "once more affirms the main principles for which the Council have contended, and does so with the very arguments that have been used in support of this policy during the whole course of the controversy." As to the terms of purchase, the Committee considered that if the recommendations of the Commission were properly carried into effect, it would be desirable to have some special form of arbitration clause, such as the one their Counsel submitted to the Commission, in which they put forward the view that "the fair value of the Companies' undertakings should be ascertained by a court of arbitration of the highest standing, with the fullest powers to inquire into all the circumstances of each individual case." The Committee expressed the belief that the views to which they gave expression were in accordance with those held by the Council; but if the present form of clause appeared to be unsuitable, they had no doubt the Council would not refuse to accept some reasonable modification of it. They thought some arrangement might be arrived at with Her Majesty's Government; and they suggested that negotiations should be at once set on foot with this object. The Committee next dealt with the question of the future Water Authority suggested by the Commission. As the proposed Water Board would give London only one-third of the total number of members, while on the basis of population or rateable value it would be entitled to at least three-fourths, the Committee considered that the proposal was one which could never be fairly imposed. Apart from the objections in principle to the water supply being entrusted to a body that would not directly represent the public, it was not likely that so heterogeneous a Trust as that which was proposed would afford a really satisfactory administrative body. These and other conclusions led the Committee to the conclusion that the Board proposed by the Commission was open to very serious objections; but they thought it was not impossible that some form of joint management between Inner and Outer London might be suggested which London could agree to. In any case, as the expediency of purchase by some authority had been affirmed by the Commission, there could be no reason why Parliament should not in the present session decide upon the method and principle of purchase, apart from the question of ultimate management. The Committee devoted the concluding portion of their report to the consideration of the future supply of water to the Metropolis, and discussed the observations of the Commission on the comparative cost of the Welsh and Thames supplies. In their view, it was not inconceivable that, after a vast system of storage reservoirs had been constructed at Staines, circumstances might arise which would render the condition of the river so serious that London would, long before 1941, be forced by pubic opinion to incur an expenditure upon further storage greatly in excess of that indicated by the Commissioners. With regard to the cost of storage as affected by the experience of 1898 and 1899, the Committee said:

> As far as can be ascertained from their report, it would seem that, in the opinion of the Commission, the gross storage required to satisfy the conditions of a year like 1893, and to supply 300 million gallons a day, is 23,677 million gallons, and the cost of this will be £14,800,000. We are, however, advised that if the storage is to meet the needs of a year similar to 1898, the gross amount would have to be increased by about 12,700 million gallons, and would cost about £17,500,000. Further, if the works are to be capable of complying with the conditions of two consecutive dry years, such as were the years 1898 and 1899, then the gross storage would have to be 49,800 million gallons, and would cost about £21,800,000. If our view of the case is correct—viz, that in constructing works for the future the needs of the most unfavourable year must be provided for—the cost of a Staines scheme will exceed that of a Welsh scheme. But even if we accept the estimates of cost arrived at by the Commissioners, there still remain weighty objections to the construction of storage reservoirs standing, as those in course of erection do, high above the level of the land, and covering, as the Commission state, no less than 10 square miles of country; and when all things are considered, it may be more to the interests of London to incur the necessary expenditure, and obtain thereby a supply of unpolluted and soft water stored in the hills of Wales and delivered to London by gravitation, than to draw from more or less polluted rivers large additional quantities of hard water, and store it in vast and dangerous reservoirs in the midst of what will soon be populous suburbs.
>
> As to the necessity of securing a water bearing area, the Committee pointed out that opportunities for obtaining any such supply as that contemplated in Wales are every year becoming fewer, and it was highly probable, if London took no action at the present time, that within the next few years every water-bearing area of sufficient size, within a reasonable distance of the Metropolis, would be appropriated by other cities. They thought, therefore, it was incumbent upon the Council to make some attempt to safeguard London in the future. They quoted the paragraph of the report in which the Commissioners said: "There is no doubt something attractive in the scheme of bringing water from the Welsh mountains for the supply of London; and one would be glad if it were possible now to secure a watershed to be used hereafter, if London should require it." The Committee remark that the opportunity of obtaining this was provided by the Council's Welsh Supply Bill; and they trust Parliament would not refuse to allow that Bill to go forward, for the purpose, at any rate, of authorizing the acquisition, on behalf of the public, of the rights of purchasing the lands in Wales, as to which notices had been given. The powers so obtained might, they said, be held in abeyance, or be directed to be transferred to a future authority if it should require them, and if, after further investigation into this difficult problem, Parliament should deem it advisable that the future supply of the Metropolis should be drawn from Wales rather than from the Thames. In this respect, therefore, they came to the conclusion that Her Majesty's Government should at once be approached, with the view to ascertain whether there might not be some means whereby the Welsh Supply Bill could be allowed to proceed; and they recommended—"(1) That, in view of the urgent reasons which exist against further delay in dealing with the question of London Water Supply, the First Lord of the Treasury be requested to receive a deputation with reference to the London Water (Purchase) Bill and the London Water (Welsh Supply) Bill; and (2) that it be referred to the Parliamentary and Water Committees to make the necessary arrangements for the deputation."

Mr. Dickinson (Chairman of the Water Committee), in moving the adoption of the first recommendation, said the Council would all agree that the London Water Question was one of great complexity, and that it was impossible to deal with it upon any narrow or preconceived notions. The London Conservative members had decided to ask for the rejection of the Council's Bills. In doing this, they had taken upon themselves a very grave responsibility. A turning-point had now been reached in the matter. The Council must either go forward with the policy of purchase, or they must drop it. The report of the Royal Commission, in so far as that policy was concerned, was in absolute agreement with all the Council had been pressing for during the last ten years. With regard to the terms, they were not quite in such absolute agreement. The Council had always contended that the Companies should be bought out upon the basis of competing concerns, and not as monopolies, since they had only acquired the monopoly by agreement between themselves. In this the Commission did not entirely concur; but he did not say the Council would not be justified in accepting something less than they had asked for. The Commission had looked upon the matter of price from the worst point of view for the public; and he was sanguine that, when this question came to be settled, the public would find that they had a better bargain than was forecast by the Commission. In regard to the sinking-fund clauses suggested by the Commissioners, the Council should be congratulated, for it was what they had always contended for. With regard to the matter of the future supply, he did not think they would ever have the question of Thames storage against Welsh supply settled until they got rid of private interests. The Commission had apparently reported in favour of storage entirely on the question of cost; but he believed, if the matter were fairly settled, it would be as cheap to get a proper supply from Wales as to build enormous and hideous reservoirs in the Thames Valley. At any rate, they now had the opportunity of obtaining a water-bearing area in Wales; and such areas were very few. The suggested allocation of members on the proposed Water Board would, if carried into effect, result in a gross injustice to London, which was to have 10 members only, while the outside Authorities were to have 12. As London would have by far the heaviest burden to bear in the matter, and would have to find the greatest amount of money, he claimed that it should have a majority on the Board. Any new body to deal with the water supply should owe its origin to municipal life and energy. But the Water Committee were willing, in the interests of London—disagreeing as they did with some of the suggestions of the Commission—to effect a compromise; and, as the first step, they considered it advisable to approach the Government on the matter.

Mr. Harris said he could not understand on what particular lines it was suggested that they should approach the Government. Briefly stated, the Commission had reported in favour of the policy of the minority of the Council, and adversely to that of the majority. It would not be reasonable to expect those whose policy had been upheld by the Commission to ask the Government to carry out the policy which had been condemned; and it would not be reasonable or fruitful of good results to go to the Government who had appointed the Commission and ask them to carry out any condemned policy. The Water Committee were practically asking the Council to go forward with the old policy of the majority, which was known as that of severance, without any assurance as to modification. He moved, as an amendment, to leave out of the resolution all words after "with reference to," and substitute the words "the report of the Royal Commission, and action on the broad lines laid down in that report." He believed this to be a more promising basis of negotiation than that proposed by the Committee. At any rate, in assenting to the deputation, the minority on the Council would safeguard their own opinions, which, in the result, had received the support of the Commission.

Mr. Beachcroft, in seconding the amendment, said the main endeavour of the Council at the present time should be to induce the Government to carry out the recommendations of the Commission. He did not think it was possible for a compromise to be arrived at before the second reading of the Council's Bills. It was hopeless to think that the Welsh Bill could be sent to a Committee this session, in face of the report of the Commission. Before that could be settled, they must deal with the question of purchase and authority. The Council had obtained nearly all they wanted in the findings of the Commission; and they should now go to the Government and offer their help in giving effect to those findings, and attempting to discover the cost, and seeing whether they could not settle an authority satisfactory to all parties.

Mr. Cornwall remarked that, looking to the urgency of the matter, he could see no reason why the Government should not take the Council's Bills as a basis of settlement.

Mr. Whitmore, M.P., welcomed Mr. Dickinson's speech as being couched in conciliatory terms. He denied that the contemplated action of the London Unionist members in this matter was either obstructive or destructive. Speaking for himself, he wished to see the water question settled both satisfactorily and quickly; and he thought it could be settled on the lines of the Royal Commission report. Undoubtedly, a second reading would be refused to the Council's Bills, and rightly so, because, on the whole, they were in direct conflict with the report of the Commission. If the Progressives would now only join hands with the Moderates in trying to get the Government to take up the matter on the lines of the report, the present might be the opportunity for sinking all their differences on a subject which ought never to have been allowed to enter the arid arena of party politics, and for bringing the whole matter to a satisfactory settlement.

Mr. M'Kinnon Wood supported the recommendation, and denied that the Council were pledged to a policy of severance. They were quite prepared, if it was practicable, to meet the views of the other side and those expressed by the Commission. But to go to the Government and back up a proposal for a Water Trust such as that suggested by the Commission, was a course to which he believed the members of his party would never consent.

Sir A. Arnold congratulated the Council on the remarkable unanimity shown in the matter of approaching the Government on the water question. It was the duty of the Council to go to them and say: "Here are our Bills; is it possible to make any use of these proposals?" He would never be a party to the constitution of such an authority as that which was set forth by the Commission, because they could not give up the reasonable claim of the people of London to a due proportion of representation. Further, he objected to the establishment in London of another non-representative body.

Mr. Cohen, M.P., pointed out that the London Unionist members had not pledged themselves to support all the details of the proposals of the Commission. They only said that they formed the lines on which it was possible that the matter could be fairly settled.

Dr. White thought they were likely to do little unless they were prepared to accept, not in word, but in substance, the recommendations of the Commission.

Mr. Stuart, M.P., said it would facilitate the whole position if they knew what the Government intended to do with the Council's Bills, which were to come up on the following Tuesday. This should be seen to at once; but the matter of the report of the Commission might be left over for the present. He was glad to recognize the conciliatory spirit in the Council; and, in order to avoid a division, he would suggest that the amendment should be withdrawn, and the words "having regard to the report of the recent Royal Commission" added to the recommendation.

Mr. Lawson pointed out that delay was fatal, for it would render the cost of purchase infinitely greater. As there were so many points of agreement, and as legislation could only come this session through the Council's Bills, he hoped the Council would accept the recommendation with the addition suggested by Mr. Stuart.

Mr. Cousins condemned the expenditure entailed by the Council in promoting Bills which they knew would not be accepted.

Mr. Dickinson, in closing the debate, expressed regret that his Committee had not been met in any way by the Moderates. The amendment would certainly tie their hands, and make it impossible that there should be any legislation this year. He could not accept the amendment, but would be willing to place at the end of the recommendation the words suggested by Mr. Stuart. He appealed to Mr. Harris to withdraw his amendment, and allow the matter to go forward on the broad lines suggested by the Committee.

No reply being made by Mr. Harris, the Council divided, with this result: For the amendment, 30; against it, 70—majority, 40.

Sir J. Hutton then moved to add to the recommendation the words "having regard to the report of the recent Royal Commission."

Colonel Ford seconded the amendment; and it was agreed to.

The recommendation, as amended, was then carried, on a division, by 72 votes to 29. The matter was referred to the Parliamentary and Water Committees.

Heswall and Acetylene Gas.—A Gas and Lighting Company was recently formed for the purpose of supplying acetylene gas in the parish of Heswall; but the promoters have been speedily disappointed. A request for the consent of the Parish Council to an application to the Board of Trade for a Provisional Order led to the matter being considered by a Committee; and, presumably on their advice, the Council decided to refuse the application. However, in order to give the ratepayers a voice in the matter, a public meeting was held, at which the Council laid the whole question before them. The place of meeting, it is stated, was beautifully illuminated by Husson's "Safety" acetylene gas. The matter seems to have been fairly discussed; and, in the result, the ratepayers confirmed the decision of the Council—it being considered preferable that the Council should adopt the Lighting Act on their own account.

The Management and Development of the Birkenhead Gas and Water Undertakings.—At the meeting of the Birkenhead Town Council last Wednesday, Alderman Bloor, on the presentation of the minutes of the Gas, Water, &c., Committee, referred to a recommendation to increase the salary of Mr. T. O. Paterson, the Gas Engineer, by £100 a year. He said Mr. Paterson was appointed in 1880, and had had only one rise of £50 ten years ago. He did not ask for an increase then, nor had he done so now. The Committee recommended the increase with every confidence, as their Engineer was a most valuable servant, and the work had enormously increased. In 1880, there were 6025 consumers, now there were 13,000; and during the twenty years the Gas Committee had handed over £98,200 in relief of the rates. All the numerous new works had been carried out from the Engineer's own plans. The resolution was unanimously adopted. Alderman Bloor then moved that the salary of Mr. W. A. Richardson, the Water Engineer, should be increased by £50. He also had been in their service twenty years, and had only had one increase of £50 in ten years. He had done valuable work, and was thoroughly worth the increased salary, having saved the town large sums of money by his skilful work. The water estate in twenty years had contributed £35,000 to the borough funds. The resolution was carried unanimously.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 667.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 13	10½	Alliance & Dublin 10 p. c.	20¼–21½	..	4 17 8
100,000	10	,,	7½	Do. 7 p. c.	14–15	..	5 0 0
800,000	100	Jan. 2	5	Australian 5 p. c. Deb.	100–102	..	4 18 0
200,000	5	Nov. 15	6	Bombay, Ltd.	6¼–6¾	+¼	4 8 11
40,000	5	,,	5	Do. New, £4 paid	4¼–4¾	+¼	5 1 1
880,000	Stk.	Feb. 23	12	Brentford Consolidated	267–272*	..	4 8 3
270,000	,,	,,	9	Do. New	203–208*	..	4 6 7
50,000	,,	,,	5	Do. 5 p. c. Pref.	140–145*	..	3 9 0
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb.	118–123	..	3 5 1
220,000	Stk.	Sept. 15	11½	Brighton & Hove Orig.	255–260	..	4 8 6
226,320	,,	,,	8½	Do. A. Ord. Stk.	185–190	..	4 9 6
999,500	Stk.	Feb. 23	5	Bristol, 5 p. c. max.	125–130*	..	3 16 11
420,000	20	Sept. 29	10	British	43–44	..	4 10 11
50,000	10	Feb. 23	12	Bromley, Ord. 10 p. c.	24–26*	..	4 12 4
70,000	10	,,	9	Do. 7 p. c.	19–21*	..	4 5 8
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd.	9¾–10½	..	5 17 1
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	98–100	..	4 0 0
150,000	20	July 13	8½	Cagliari, Ltd.	26–28	..	5 17 10
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	13½–14½	..	5 10 4
50,000	55	Nov. 2	6	Do. 6 p. c. 1st Mort.	56–58	..	5 3 5
550,000	Stk.	Oct 13	13½	Commercial Old Stock.	305–310	..	4 7 1
200,750	,,	,,	10½	Do. New do.	240–245	..	4 5 9
200,750	,,	Dec. 14	4½	Do. 4½ p. c. Deb.	142–145	+1	3 2 1
800,000	Stk.	Dec. 14	9	Continental Union, Ltd.	170–180	−4	5 0 0
200,000	,,	,,	7	Do. 7 p. c. Pref.	178–183	..	3 16 6
51,300	Stk	Feb. 23	14	Croydon A 10 p. c.	335–340*	..	4 2 4
173,400	,,	,,	11	Do. B 7 p. c.	265–270*	..	4 1 5
555,000	Stk.	Feb. 23	5½	Crystal Palace Ord. 5 p. c.	122–127*	..	4 2 8
60,000	,,	,,	5	Do. 5 p. c. Pref.	132–137*	..	3 13 0
486,990	10	Jan. 26	11	European, Ltd.	20–21	..	5 4 9
854,090	10	,,	11	Do. £7 10s. paid	15–16	..	5 3 2
14,993,675	Stk.	Feb. 9	4⅞	Gas-light and Coke	4 p. c. Ord.	103–105	−2	4 13 4
2,500,000	,,	,,	3½		3½ p. c. max.	97–99	+1	3 10 8
3,799,735	,,	,,	4		4 p. c. Con. Pref.	119–122	..	3 5 7
3,993,975	,,	Dec. 14	3		3 p. c. Con. Deb.	99–101	..	2 19 5
70,000	10	Nov. 15	8	Hongkong & China, Ltd.		13½–14½	..	5 10 4
3,000,000	Stk.	Nov. 15	10	Imperial Continental		215–218	−2	4 11 9
475,000	Stk.	Feb. 9	3½	Do. 3½ p. c. Deb. Red.		100–103	..	3 8 0
75,000	5	Dec. 14	6	Malta & Medn., Ltd.		4½–5½	..	5 9 1
500,000	100	Oct. 2	5	Met. of Melbourne	5 p. c. Deb.	110–114	..	4 7 9
250,000	100	,,	4½		4½ p. c. Deb.	107–109	..	4 2 7
541,920	20	Nov. 15	3	Monte Video, Ltd.		11–12	..	5 0 0
666,946	Stk.	Feb. 23	9½	Newc'tle & Gatesh'd Con.		215–220*	..	4 4 1
299,255	Stk.	Dec. 29	8½	Do. 8½ p. c. Deb.		104–107	..	3 5 5
60,000	5	Feb. 23	7	Ottoman, Ltd.		4½–5½*	..	6 13 4

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
150,000	5	Nov. 30	8	Oriental, Ltd.	7–7½	..	5 6 8
135,000	5	,,	8	Do. New, £4 10s. pd.	6½–6¾	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.	1½–1¾	..	4 11 5
500,000	100	Dec. 1	6	People's Gas of Chicago	2nd Mtg. Bonds.	102–106	..	5 13 2
851,070	10	Oct. 13	7	River Plate Ord.		11¼–11¾	+¼	5 19 2
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.		100–102	..	3 18 5
250,000	10	Sept. 15	10	San Paulo, Ltd.		12–13	..	7 13 10
135,000	Stk.	Sept. 15	10	Sheffield A.		249–251	..	3 19 8
209,053	,,	,,	10	Do. B.		249–251	..	3 19 8
447,427	,,	,,	10	Do. C.		249–251	..	3 19 8
5,600,000	Stk.	Feb. 23	5⅓	South Metrop., 4 p. c. Cri.		135–138*	+2	3 17 3
1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb.		100–102	..	2 18 10
120,000	Stk.	Aug. 31	6	Tottenham and Edmonton	A. 5 p. c. B. 3½ p. c. 4 p. c. Deb.	141–143	..	4 3 11
250,520	,,	,,	4½			102–104	..	4 6 6
55,100	,,	Dec. 14	4			113–117	..	3 8 5
182,380	10	Jan. 12	5	Tuscan, Ltd.		8½–9½	..	5 5 3
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.		101–104	..	4 16 2
				WATER COMPANIES.			
780,399	Stk.	Dec. 29	11	Chelsea, Ord.		307–312	..	3 10 6
150,000	,,	,,	5	Do. 5 p. c. Pref.		157–162	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75		145–150	..	3 0 0
175,785	,,	Sept. 29	4½	Do. 4½ p. c. Deb.		148–153	..	2 18 10
1,720,560	Stk.	Oct. 13	7	East London, Ord.		205–210	..	3 6 8
654,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb.		145–150	..	3 0 0
890,000	,,	,,	3	Do. 3 p. c. Deb.		99–101	..	2 19 5
700,000	50	Dec. 14	7½	Grand Junction	10 p. c. max. 4 p. c. Deb.	108–110	..	3 8 2
310,000	Stk.	Sept. 29	4			131–136	..	2 18 10
708,000	Stk.	Feb. 23	14	Kent		310–320*	−20	4 7 6
160,000	,,	,,	7	Do. New, 7 p. c. max.		200–210*	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.		295–300	..	3 10 0
406,200	100	,,	8	Do. 7½ p. c. max.		215–220	..	3 12 9
850,000	Stk.	Sept. 29	4	Do. 4 p. c. Deb.		135–138	..	2 18 0
500,000	100	Feb. 23	13½	New River, New Shares		420–425*	..	3 3 6
1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb.		132–137	..	2 18 5
902,300	Stk.	Dec. 14	7½	South-wark and	Ord. 7½ p. c. max. 5 p. c. Pref.	200–205	..	3 13 2
126,500	100	,,	7½			190–195	..	3 16 11
489,200	Stk.	,,	5			160–165	..	3 0 7
1,019,585	,,	Oct. 13	4	Vauxhall	4 p. c. A Deb.	131–136	..	2 18 10
1,155,066	Stk.	Dec. 14	16	West Middlesex		290–295	..	3 7 9
200,000	,,	,,	4½	Do. 4½ p. c. Deb.		147–152	..	2 19 3
200,000	,,	Sept. 15	11	Do. 3 p. c. Deb.		100–102	..	2 18 10

* Ex div.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Town Council of Aberdeen, on Monday, considered a report by the Gas and Electric Lighting Committee recommending, for the second time, that no action should be taken with reference to the complaint by the Plumbers' Association regarding the fitting up of gas-stoves and the like by servants of the Corporation who are not plumbers. The adoption of the recommendation having been proposed, it was moved that either plumbers should be employed to do the work, or that the men who were employed should be paid the plumbers' standard rate of wages. The Council adopted the recommendation of the Committee by 28 votes to 5. It is difficult to see how they could have done otherwise. The counter-motion was certainly not one which Trade Unionists would have accepted; and had it become the finding of the Council, it would most assuredly have led to further complaints.

The Corporation of Dundee are endeavouring at present to formulate a scheme of holidays for the workmen in their employment. The Conveners of Committees on Monday, after conference, agreed to recommend that the workmen in the Gas Department should receive, with pay for those employed from year to year, four days' holidays, that those in the Water Department should receive five days, and so on. It puzzles me to understand on what principle a gas worker should get a day less than a water-works employee. Possibly the Conveners have a good reason; but whether they have or not, it certainly strikes me that four or five days a year is not very much rest—especially for men who work on Sundays. Hitherto the Corporation have been in the habit of giving their employees a picnic annually; but this is to be discontinued.

The Dumfries Gas Commissioners are advertising that gas consumers may have burners free of cost on applying at the gas office. At the last meeting of the Commission, it was stated that during the past month 25 complaints of want of gas were received from consumers. Some of these were owing to frost, which they could not prevent; but many of the complaints they received were due to old burners. It was stated that in some instances burners had been in use for ten or twelve years. This supplying of gas-burners free is a much disputed question. Those who disapprove of the practice would seem to derive support for their views from the fact that in a town where free burners can be had, people will not apply for them. If free burners are to be given, something more is apparently required than handing them out; a man must be sent to fix them up. The present year at Dumfries, it was reported, showed a large increase in the consumption of gas, and would be the most prosperous year the Commissioners ever had, notwithstanding the disadvantages under which the business has laboured.

In Perth, the gas and electricity undertakings are both in the hands of the Corporation; and they are so much mixed up together that the Secretary for Scotland has found it to be impossible for him to sanction the Commissioners raising money for the electric light undertaking beyond the present borrowing powers of the Gas Commission. He, however, has recommended the Corporation to procure a Provisional Order, under which it would be competent for him to authorize the raising of money for public purposes in the city. The Police Commissioners of the city met on Thursday night, and resolved to proceed with an application for a Provisional Order, in which it is proposed to take powers to borrow £100,000. One-half of this sum is to be for gas, and the other half for electricity purposes. It is not expected that the whole will be required; but it is recognized to be good financial policy to have always something in hand.

Mr. W. Doig, who was for a long time Provost of Forfar, died there on Thursday last. Mr. Doig was a self-educated man. He began life as a hand-loom weaver; but gave up manual labour at an early age, and became a dealer in cattle and game. In this pursuit, he was very successful. But the conditions of his early life imposed many limitations upon him; and while he did much work for his native town, a great deal of which was highly commendable, he had a habit of getting into a minority which frequently led to hard things being said, and to his getting less credit than, perhaps, he deserved for what he did. In the later years of his life, he inclined to the party who affect to look with hostile eyes upon the management of the gas-works, which was certainly much to be regretted, because his influence upon the side of the administering body would have been valuable. While Mr. Doig was Provost of the burgh, gravitation water supply works were constructed, at a cost of £50,000. The Corporation were not satisfied with the quality of a portion of the work, and required it to be reconstructed, at a cost of over £5000. The Contractors declined to do the work; but Provost Doig tenaciously stuck to the position which the Corporation had taken up, and, after an arbitration which lasted for three weeks, he had the satisfaction of receiving an award in favour of the town.

The Falkirk Extension and Water Bills are not, after all, to be contested in Parliament, as it was expected they would be. Yesterday a conference was held between representatives of the burgh of Falkirk and the county of Stirling; and, in the course of a sitting of an hour-and-a-half's duration, terms were come to, by which the Bills promoted by the respective bodies will not be opposed by either. There are other objectors to both measures; but it is expected that their opposition will be trifling. The agreement between the parties is to the effect that the burgh boundaries are to be extended as proposed; the burgh paying compensation to the county for loss of revenue. Then, as to the water supplies, the burgh are to allow the county to retain in their area the district of Laurieston, and are to extend the burgh supply to the portion of the parish of Airth which is not yet supplied by them. The County Council are, in turn, to undertake to supply High Bonnybridge with water—an arrangement which does away with the necessity for the construction, by the Falkirk and Larbert Water Trust, of filters at a high level. The arrangements are mutually advantageous; and the coming to terms before going to London means the saving of more money than will be required to carry the arrangement into execution.

The Edinburgh and District Water Trust are about to appoint a Resident Engineer for their new Talla works. There is some difficulty with the new Contractor (Mr. John Best) as to taking over the work already

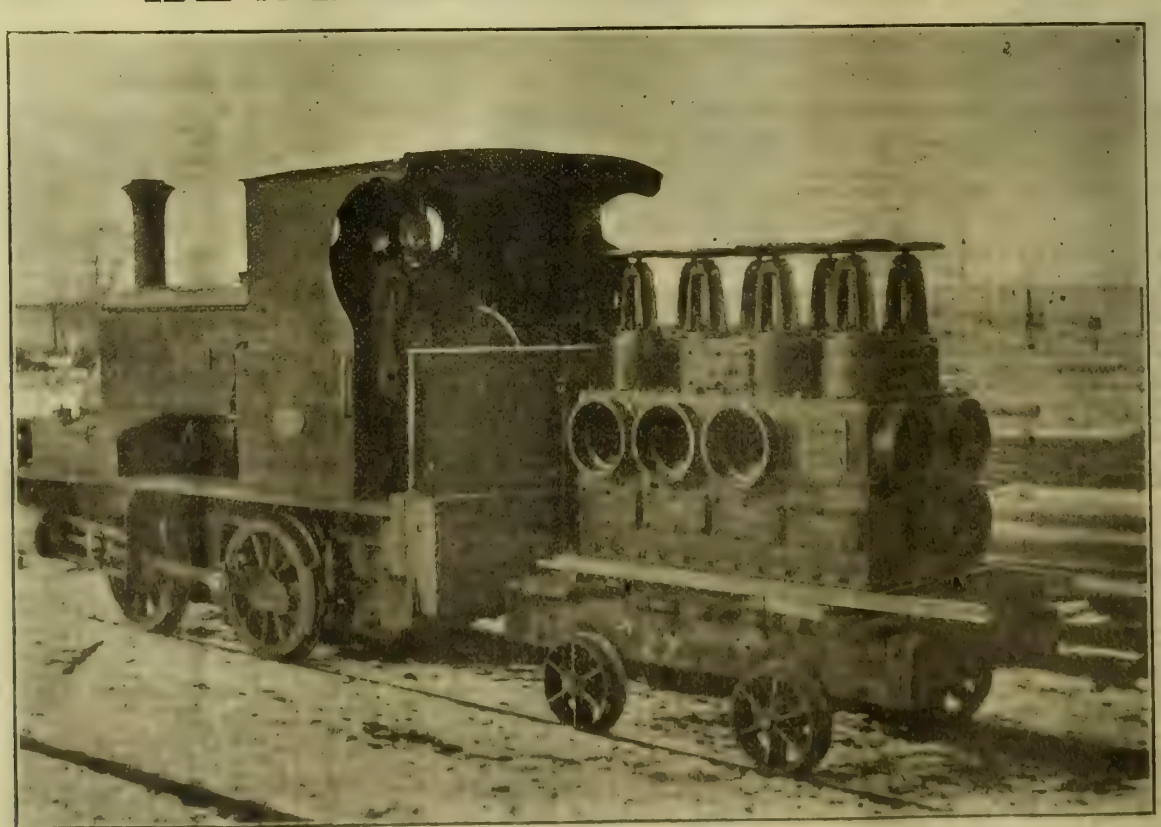
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executed by Messrs. James Young and Sons. Mr. Best will only agree to become responsible for it on condition that it has been executed according to contract. The Water Trust are unwilling to agree to this condition, which, I confess, has a suspicious air about it, because the Trustees can easily satisfy themselves whether the work has or has not been executed according to contract. If it has, such a condition would be useless. The matter is to be referred to the decision of Mr. A. Asher, Q.C. It is, however, wisely considered to be inadvisable to have such an important work as the construction of the puddle trench for the reservoir supervised only by an inspector with a weekly wage of 40s. The Engineer to the Trust (Mr. J. Wilson) is at present enjoying three months' leave of absence, on account of the state of his health. This week the Trust, at his own request, granted him further leave for three months, and appointed Mr. W. A. Tait to be interim Engineer.

The bursting of the embankment of the Loch Glow reservoir last year has entailed an expenditure by the Fife County Council of £4081, of which £1466 has been spent upon the strengthening of the embankment. There is likely to be difficulty over the raising of the money; there being a conflict of opinion as to whether the whole county or the district served by the reservoir should bear the cost of repairing and improving the embankment. A third proposal is to endeavour to fix liability upon the engineers who constructed the reservoir, on the ground that they did not make it sufficiently strong. This latter course is recommended on the strength of a report by an independent engineer; but this gentleman was not called in till after the embankment had given way, and it was by that time patent to everyone that the embankment had not been made sufficiently strong. So that not much encouragement to litigate is obtained from the opinion of the independent engineer. Nothing has as yet been decided upon as to liability; and in the circumstances, I consider it would be invidious to mention names.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *March* 10.

Sulphate of Ammonia.—The firmness of the past few weeks continues, though prices do not advance rapidly. Although consumers bought sparingly throughout February, exports were exceptionally heavy (mainly against contracts previously entered into); and the month closed with practically no stocks in the hands of makers. The lateness of the season has enabled consumers to delay their further supplementary purchasing; but the demand for "covering" purposes is still sufficient to absorb current production, and everything offered has found a ready sale. The closing quotations are £12 2s. 6d. to £12 5s. per ton; and these prices have also been paid for March delivery, f.o.b. at the ports. There has again been considerable interest in the forward position; but the advanced ideas of makers have rather checked business.

Nitrate of Soda is firm in all positions; and spot quotations are 8s. 10½d. per cwt. for ordinary, and 9s. for fine quality.

LONDON, *March* 10.

Tar Products.—Carbolic acid is easier, and lower prices are prevailing. Pitch is dearer; and makers, being either well sold or oversold, are now asking more money for the remainder of this season. A moderately steady market exists for creosote and other tar oils. Both for crude naphtha, as well as for solvent and heavy naphthas, there is only a poor market; and lower prices are being taken.

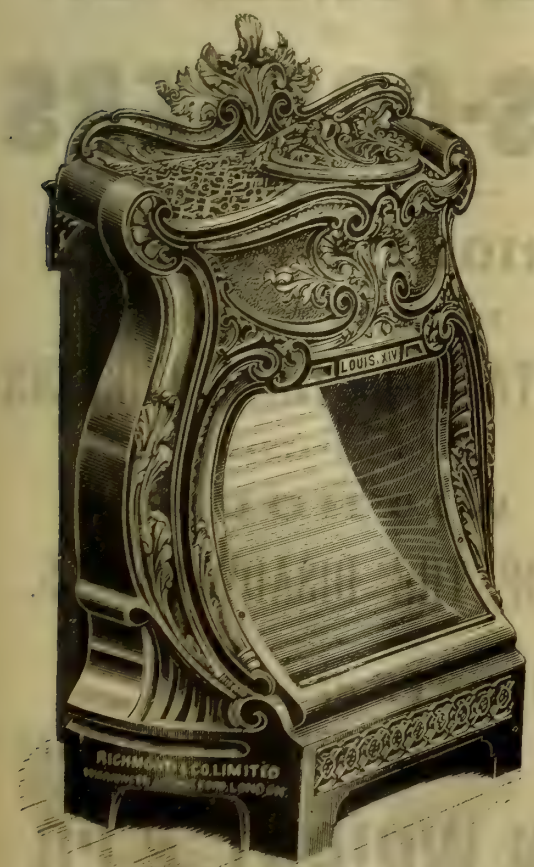
The average values obtaining during the week were: Tar, 17s. to 26s. Pitch, east coast, 37s.; west coast, 35s. Benzol, 90's, ordinary, 7d.; special qualities for gas, 8½d.; 50's, 9½d. Toluol, 90's, 1s. 2d.; pure, 2s. Solvent naphtha, 1s. 2d. Crude, 30 per cent., naphtha, 4¾d. Heavy naphtha, 1s. Creosote, 3¼d. Heavy oils, 3¾d. Carbolic acid, 50's, 2s. 5d.; 60's, 2s. 9d. Crude naphthalene, 60s. Anthracene, nominal, "A," 4d.; "B," 2½d.

Sulphate of Ammonia is firm, and a large business is being done both for prompt and forward deliveries—for prompt, at £12, less 3½ per cent., and for forward some makers would accept a shade less.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Although there is undoubtedly, as reported last week, an easing down in the coal market here, so far as inland trade is concerned, the continued exceptional pressure for shipment more than counteracts any falling off in requirements for home consumption. Any surplus output that collieries have over their local trade, they are readily able to dispose of for shipment at considerably above inland prices; 3s. to 4s. per ton above their list basis pit quotations being generally obtained without difficulty, where they book orders for shipment. This position is not unnaturally a great inducement to colliery proprietors who have any facilities for shipment, to withdraw as much coal as possible from their inland trade; and this is tending to keep up a shortness of supplies, especially in the hard qualities suitable for iron-making, steam, and general manufacturing purposes. The outlook generally may be regarded as not at all a satisfactory one for large users of fuel; and, judging from the present attitude of coalowners, it is evident they anticipate being able to command a very considerable advance over last year's prices on the important gas coal and locomotive fuel contracts that during the next few months will come upon the market. There would seem to be every probability of an exceptionally large shipping demand for the Baltic and the Black Sea, which will practically withdraw any competition with Lancashire for these contracts so far as Yorkshire is concerned; and already the question of the prices that are to be quoted on these contracts has been under consideration. On gas coal contracts, the advance over last year generally talked of is about 4s. to 4s. 6d. per ton—bringing the better qualities of screened gas coal to about 14s. at the pit, which would inevitably lead to a considerable increase in the price of gas to consumers. On locomotive fuel, the advance asked will probably be about 5s. per ton—bringing the prices up to 13s. at the pit; and it is not unlikely that 12s. 6d. may be the minimum figure collieries will agree to accept. As to the general home trade, it may be briefly reported that on house-fire qualities the demand is steadily lessening; but collieries have no surplus supplies to put into stock, and prices are



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exceedingly strong at the list basis. Common round coals are in brisk demand for steam, forge, and general manufacturing purposes; and with supplies restricted by the considerable quantities going away for shipment, it is difficult to place orders at the pit at anything under 12s. 6d. per ton. Slack is not quite so stiff as it has been—at any rate, so far as special prices are concerned—and although Lancashire collieries are mostly still short of slack, consumers are evidently able to cover requirements in other districts, and are not disposed to pay the higher rates that were ruling recently. Good ordinary rough slack does not now average above 9s. 6d. per ton at the pit, with not more than 10s. 6d. obtainable for the best qualities. For shipment, special prices have to be paid; and these still tend upwards—16s. 6d. to 17s. per ton having been obtained during the past week without difficulty for steam coals, delivered at the ports on the Mersey. For coke, there is a continued pressing demand in excess of what makers can produce; but they still hold back from advancing list rates. These, however, are exceedingly firm at about 30s. per ton at the ovens, as the minimum for foundry cokes, and 23s. to 23s. 6d. for furnace sorts.

Northern Coal Trade.—There is a firmer demand for coal, and the shipments have again been very heavy; the arrivals of steamers being numerous. The tendency of prices has thus been rather upwards—more especially when the coal has to be delivered over the whole of the shipping season. Best Northumbrian steam coals are now quoted at 18s. to 19s. per ton f.o.b., with a little variation according to the time of delivery. Second-class coals are about 1s. per ton lower, and for steam smalls the quotation is 11s. to 11s. 6d. The gas coal trade is rather steadier; and several of the contracts for small ports on the Continent are being arranged—the prices under such being somewhere near 15s. per ton f.o.b. The demand for gas coals is still a very large one; and there is not much free coal for occasional sale. But for any such, the price quoted may be about 16s. per ton f.o.b. There should be soon a decrease in the large shipments coastwise of gas coals; but against this will be set some increase in the exports. Coke is very firm, and seems dearer. Gas coke is being rather more heavily exported; but there is not much change in the position in other respects, and prices are unaltered.

Scotch Coal Trade.—There is an easier tone in the market. Supplies are more plentiful; and prices are a shade less. Forward contracting at current rates is, however, common. The prices quoted are: Main 14s. to 14s. 3d. per ton f.o.b. Glasgow, ell 15s. to 16s., and splint 15s. to 15s. 6d. The shipments for the week amounted to 181,088 tons—a decrease of 16,988 tons upon the previous week, but an increase of 40,727 tons upon the corresponding week of last year. For the year to date, the total shipments have been 1,583,502 tons—an increase of 355,781 tons upon the same period of the previous year.

The Sale of Gas in Newcastle.—Despite the increased use of electricity, there is a steady growth in the quantity of gas sold by the Newcastle-on-Tyne and Gateshead Gas Company. In 1888 it was 1,378,453,000 cubic feet; in 1899, 2,373,956,000 cubic feet. There is thus in eleven years an increase of upwards of 72 per cent.

Wellington (Salop) Water Supply.—It has been decided to increase very considerably the storage capacity of the water reservoir of the Wellington Urban District Council at the foot of the Wrekin; and Mr. R. E. W. Berrington, of Wolverhampton, has been selected to carry out the necessary works.

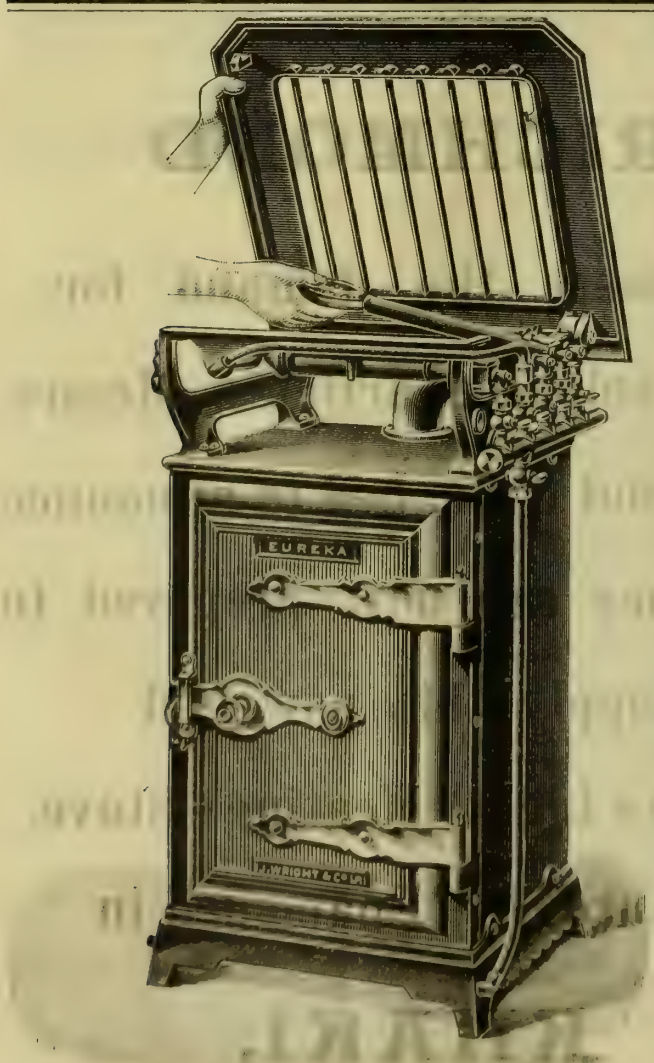
The Newport (I.W.) Town Council and the Gas-Works.—At the meeting of the Newport (I.W.) Town Council last Tuesday, the Mayor (Mr. G. B. Purkis) proposed that the Council should appoint a Special Committee to consider and report as to the advisability of the Corporation taking the necessary steps to obtain statutory powers to purchase the gas undertaking. After some discussion, the proposition was agreed to with two dissentients.

Metropolitan of Melbourne Gas Company.—The gross receipts of this Company for the six months ending the 31st of December last amounted to £155,215, as compared with £146,188 in the second half of 1898. The gross profit was £70,525, against £61,908; and the net amount available for distribution is £38,068, against £34,501. The Directors recommend a dividend at the rate of 8 per cent., after the payment of which there will be a balance of £213.

The New Issue of Brentford Gas Stock.—With reference to the recent announcement in the "Journal" of the withdrawal by the Directors of the Brentford Gas Company of the invitation for tenders for their new issue of 4 per cent. debenture stock, we are informed by the Secretary (Mr. W. Mann) that this step was necessitated by the discovery of the omission of a small formality in the notice convening the meeting on the 11th of February, 1898, at which authority for raising the money by debentures was believed to have been obtained. The invitations for tenders will, he states, be re-issued after a meeting has been duly convened for the purpose.

A Traction Engine Causes a Gas Explosion in Dublin.—What might have been a very disastrous explosion of gas, but which was happily attended by no injury to any person, occurred in one of the sewers in Fish Street, Dublin, last Wednesday. It alarmed the whole neighbourhood, and was sufficiently severe to blow off the cast-iron cover of the manhole, and to considerably disturb the earth around it. It appears that the explosion was due to an escape of gas from a broken main. A heavy traction engine and waggons conveying pipes had previously passed down the street; and it is surmised that the weight of the engine caused the damage to the main.

Coventry Corporation and the North Warwickshire Water Bill.—A conference took place last Thursday between the Parliamentary Agents of the North Warwickshire Water Company and representatives of the Coventry Corporation, with reference to the opposition of the latter to the Bill of the former. Terms were arranged for the withdrawal of the petition of the Corporation. The promoters undertook to strike out the whole or parts of clauses which gave roving powers of which the Corporation complained. They are also to insert in the Bill a clause saving any rights which the Corporation may possess at the present time to sink wells and take water from any area within the Company's limits of supply.



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CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE.
The Prospects of Reunion of the National Associations 729
The Parliamentary Week 730
Illuminating Gas Transmission at High Pressure. 730
The Danger of the Pump 730
The Affairs of the Sheffield United Gas Company. 731
The Workmen's Compensation Act and Casual Labourers . . . 731
WATER AND SANITARY AFFAIRS—
The London County Council and the Water Question—Deputation to the Local Government Board 731
Mr. Shaw Lefevre's Attack on the Staines Scheme 732
The Local Government Board and Typhoid Fever Epidemics . . 732
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market 733
Electric Lighting Memoranda. 733
The Municipalization of Public Supplies in America 734
The Cost of Old-Age Pensions 734
A Chapter in the Early History of Gas Lighting 735
The Labour Market. 735
NOTES:—
Lighting Gas-Burners by the Induction Spark. 736
The Durability of Paint 736
A Source of Waste in Steam-Engines 736
TECHNICAL RECORD:—
Mr. J. Shiress Will on the Law in Regard to Underground Water, and its Bearing on the Jordeson Case. 737
REGISTER OF PATENTS:—
Coin-Controlled Vending Attachments for Gas-Meters—Burchard, L. S. (W. Webber) 742
Tough Incandescent Mantles—Hentze, O., and Müller, H. . . . 742
Igniting Gas-Burners from a Distance—Bollé, C. (C. Fitzlaff) . . 742
Acetylene-Generator—Berger, F.. 742
Generating Acetylene—Turner, T. G. 742
Liquid-Meters—Kent, W. G. 743
Scrubbers—Zschocke, G. 743
Patent Notices 743
CORRESPONDENCE:—
The Presence of Naphthalene in Coal Gas 744
Profit-Sharing and Automatic Meter Supplies at Stafford . . . 744
The Maiden Lane Electric Station Fire 744
PARLIAMENTARY INTELLIGENCE:—
Gleanings from the Committee Rooms 745
House of Lords—Progress of Bills 746
House of Commons—Second Reading of East London and Lambeth Water Bills; Progress of Bills 746
House of Commons Committees—
Southport Corporation Bill 747
Ossett Corporation Gas Bill and Ossett Gas Bill 749
Morecambe Urban District Council Gas Bill 751
LEGAL INTELLIGENCE:—
High Court of Justice (Ireland)—Chancery Division—Alliance and Dublin Consumers' Gas Company *v.* County Council of Dublin; Damage to Gas-Pipes by Steam-Rollers 752
A Salutary Lesson for a Gas Stoker 754
Acetylene *v.* Coal Gas 754
Disputed Meter Registration 754
Unlawful Interference with Water-Mains 754
The Charge of Falsifying Books and Embezzlement 754
MISCELLANEOUS:—
The Jubilee of Mr. Charles Sellers 755
Mr. W. J. Liberty on the Rise and Development of the London Gas Supply 755
Incandescent Gas Lighting at Plymouth 756
The Supply of Carburetted Water Gas in Dublin 756
Meeting of the Sheffield United Gas Company 757
Walsall Corporation Gas Supply 757
Leicester Corporation Gas and Electric Lighting Departments—The Results of the Last Half-Year's Working 758
Bradford Corporation Gas Supply—A Prosperous Half-Year's Working 758
Smethwick Corporation Gas Undertaking 758
Winding-Up of the Mantleless Incandescent Gas Corporation . . 759
Electric Lighting Notes 759
The London County Council and the Water Question—Deputation to the President of the Local Government Board 760
Halifax Water Supply—New Reservoirs to be Constructed. . . 760
Notes from Scotland. 760
Gas and Water Companies' Stock and Share List. 761
Current Sales of Gas Products 762
Coal Trade Reports 763
PARAGRAPHS:—
PERSONAL: Mr. William Willmore; Mr. A. W. Walker; Mr. W. W. Townsend; Mr. C. J. P. Wadman-Smith; Mr. F. Higginson; Mr. H. K. Kindler 736
OBITUARY: Mr. E. Betteridge; Mr. John Langton; Mr. John Thomas Wharton; Mr. George James Symons; M. Samson Jordan 736
The Proposed Trip of the Gas Institute Members to Paris . . . 732
Municipal Trading 735
The Dissolution of the Kettering Water Company—Sales of Shares 746
Trial of "Intensified" Gas at Portsmouth 756
The Dispute between the Newcastle and Gateshead Gas Company and their Workmen—The Public Lighting of Molesey—Long Eaton Gas Company—Extension of West's Stoking Machinery at Beckton and Sheffield—Protest against the Increase in Price at Totnes—Sheppy Gas Company 764
Increase of Price at Wantage—Serious Accident on the Birmingham Water-Works—Divining for Water in South Devon—Torquay Water-Works—The Rating of Reservoirs—The Opposition to the Sevenoaks Water Company's Provisional Order. 765
Brigg Gas-Works under the District Council—Leamington Gas-Works Purchase Question—Incandescent Gas Lighting at Bolton—Bognor Water Company—The Supply of Gas in the Cleckheaton District—Worcester Water Supply—Water Pumping in West Suffolk—Fatal Accident at Garston (Liverpool) Gas-Works—Leicester Water Supply 766
Wolverhampton Corporation and the Gas-Works—Arrol-Foulis Stoking Machinery for the Dundee Gas-Works—Dover Gas Company—Truro Corporation and the Water-Works—Extended Adoption of the Gadd and Mason System of Gasholder Construction—Bankruptcy of a Gas Manager—Wrexham Gas Company . 767
Water-Works Profits at Wolverhampton—The Explosion at St. Helens—Ripponden District Water Supply 768

EDITORIAL NOTES.

The Prospects of Reunion of the National Associations.

It is with much satisfaction we to-day report substantial progress of the movement for reuniting the members of the two national gas organizations in one representative body. Indeed, it is hardly too much to say that all the necessary preliminaries have been settled by agreement between the Sub-Committees of the two Councils who have had to perform the delicate and laborious task of drafting the proposed new rules and discussing questions of form. We understand that the results of these deliberations are now ready to be laid before the respective Councils, who will, of course, circulate them, if approved, among the members. The subject will then be submitted to the forthcoming general meetings. It would be to reproach the individual reputations of the members of the Associations for good sense and right feeling, to imagine that they will receive the fruits of the labours that have been so willingly given in their interest in any other spirit than that which has inspired their colleagues who have brought the business so far. The goodwill and tactfulness displayed on both sides deserve the amplest recognition. The future is with the members themselves. We have no information as to the nature of the scheme that has been provisionally agreed upon. It is, of course, understood by all concerned that the deputations from the Councils who have given their services in this matter possessed no plenary powers whatever. It is open to any member to move approval, modification, or rejection of the whole scheme, or of any part of it; and the proper opportunity for doing so will be provided. Meanwhile, we venture to offer the hint that no premature views of the subject should be published in the usual channels of controversy. It is so very easy to commit oneself in this way to positions from which it is difficult to depart, however desirable this course may be found in the light of riper counsels. Let it be suggested, therefore, that letters to the "Journal" in this connection, before the meeting, should be restricted to impersonal and strictly constitutional subjects; and even these, where there is any doubt as to their harmlessness, had probably better go to the Councils. Still, there is one order of questions which might very fairly be discussed in the interim in the "Correspondence" columns of the "Journal," especially as it is hardly likely to form part of the proposed scheme of amalgamation. This is the matter of whether it is expedient and practicable to simplify professional organization by the reduction of the number of independent technical societies, and uniting any or all of them to the new national organization as District Sections. The question has often been raised, but never in a practical and pointed manner with the intention of pushing it to a decision.

The idea is eminently "topical" at this juncture, because in the drafting of the new constitution of the united national organization provision can well be made for carrying it into effect. We do not know how the matter strikes the majority of those personally affected by the consideration who read their "Journal" regularly; but it has for some time been borne in upon the editorial consciousness that the fashion of organizing and clubbing people for all manner of objects has been greatly overdone. Union for the increase of individual power is sound in principle; but when there are too many unions—call them by any name one likes—the result is not to promote strength, but to weaken the individual by encouraging in him dependence on the official element in the society to do what he ought to do for himself. The multiplication of societies also distracts people's attention, and dissipates whatever force resides in the natural human desire for fellowship. In short, while union is good, concentration is even better. When union makes for concentration—when it puts the pointed head on the spear, so to speak—then it is admirable. When, instead of making one stout spear, the same force is divided up and spent in producing a bundle of small weak sticks, indifferently pointed, it is perilously near being wasted altogether. We do not wish to force on this argument if it fails to meet with a sympathetic response from those more directly concerned with its particular application to the order of gas technical societies throughout the country. The subject is worth mentioning, however, because the

new scheme of a national technical organization, while offering a fitting opportunity for leaving the way open, has no necessary or natural bearing upon this subsidiary question. The framers of the new scheme have most probably thought they had enough to do to arrange a course for the union of the existing organizations as they stand, without undertaking anything more.

The Parliamentary Week.

Parliamentary business has been very brisk during the past week. In regard to the more general aspect of Private Bill procedure, a victory for common sense and a commensurate discomfiture of Party spirit was achieved by the appointment of a Committee nominated by the Committee of Selection to deal with the Electric Power Bills. This is a very important decision. Hitherto it has been the unfortunate practice of the House of Commons to appoint what is called a Hybrid Committee to consider highly controversial projects. This means that selected "representatives" of the various "interests" affected by a Bill have been put upon the Committee, and allowed to fight it out between them. The general result has not been satisfactory to the public or creditable to Parliament. An illustration in point was the Committee on the Petroleum Bill of last session. This year, in view of the interest and national importance attaching to the Electric Power Bills, Lord Balcarres, the Member for the Chorley Division of Lancashire, moved that these schemes should be referred to a Committee to be appointed by the Committee of Selection. Thereupon Mr. Galloway, the Member for South-West Manchester, but really representing the Municipalism enthroned at the Manchester Town Hall, moved as an amendment that the Bills should be thrown to the dogs of the opposing "interests," in the bad old way. All the official municipalizers rallied to his support. The President of the Board of Trade, however, knocked these gentlemen on the head in the most effectual fashion, by declaring for a "perfectly independent Committee, quite as independent "as the ordinary Private Bill Committee." He was supported by Mr. Bryce, who remarked that the Committee of Selection would take the utmost care that no one who could be called a partisan had a seat on the tribunal to which the Bills would be referred. The spokesman for partisan Municipalism bowed to the storm; but he was not let off without a sharp lesson from Sir H. H. Fowler, who roundly declared that "the representation of interests "should cease, if the Committees of the House were to "possess, as they formerly did, the confidence of the Com-"mittee as absolutely impartial tribunals." This is what the Petroleum Committee, with its overpowering taint of Scotch paraffin oil, has done for itself and its kind. Eventually the appointment of the Committee as proposed was ordered, with no futile restriction as to quorum.

Descending to the particulars of gas legislation, the Committees have been busy with the cases of Ossett, Southport, Morecambe, and Brighton. Particulars will be found in other columns. There were two Bills relating to Ossett—of the Corporation and the Gas Company respectively. After negotiations of the usual character, the latter Bill was dropped and the former allowed to proceed, on terms. An analogous state of affairs at Glastonbury was settled "out of court," on similar lines. The Southport Corporation Gas Bill went through, notwithstanding the somewhat factitious opposition of Birkdale. The Morecambe Gas Bill was passed by the Select Committee yesterday afternoon. At Brighton, trouble has arisen on the proposal of the Corporation to lay their high-pressure electric cable through a narrow thoroughfare in what the Gas Company regard as dangerous proximity to their trunk gas-main from Hove to Brighton. The Metropolitan Gas Bills, including that of the County Council for the legalization of the portable photometer, have been listed, and may possibly be reached by the end of the week, although the heavy River Lea Conservancy Bill is in front of them. The rule of impartiality strictly observed by the authorities in selecting members to serve on Private Bill Committees, has had the effect of imposing the responsibility for disposing of these Bills upon a coterie of four country members. Mr. Oldroyd (Dewsbury) is the Chairman of the Committee; and with him are associated Mr. Stanley Leighton (Oswestry), Mr. Emmott (Oldham), and Mr. Nicol (Argyllshire). These gentlemen are all absolutely "dark horses" in gas matters; but they have been instructed to consider the report of Sir James Rankin's Committee of last session; and they will certainly know all about the subject before they are quit of it.

Illuminating Gas Transmission at High Pressure.

The interesting technical question of the distribution of illuminating gas under pressures considerably higher than those hitherto worked with in gas engineering, receives some further elucidation by the successful experiment of Mr. F. H. Shelton, described in the last number of the "Journal." Mr. Shelton observes that there is nothing but custom to warrant the usual system of distributing coal gas at what he calls the "zephyr-like pressure" of a few inches of water. With all respect, we venture to plead that this is the same view of the matter that has been taken in these columns; and we have all along welcomed the alternative of high-pressure gas transmission as preferable to the laying down of even larger and more numerous low-pressure mains. The circumstances in which Mr. Shelton undertook the transmission of illuminating gas at high pressure in the United States are so clearly and well narrated by himself, that we do not propose to recapitulate them. To sum up, however, he laid a 3-inch screwed wrought-iron gas-main, 5 miles long, for the supply of an outlying district, and made it bottle-tight for a pressure of 60 lbs. per square inch. Now he works the pipe-line, and finds it answer well at a normal transmission pressure of 50 lbs. per square inch. There is no reason why it should not continue to answer. The bogey of internal condensation need not frighten anybody. Mr. Shelton has to do with carburetted water gas of 20 to 22 candle power, not too well made. This is not a commercial product in this country. Common coal gas, such as is supplied all over England, Wales, and Ireland, will bear a pressure of 60 lbs. per square inch without any loss of quality noticeably greater than that of the same gas sent a like distance at low pressures. The only question in the case is that of the character of the main, the connections, and the fittings. Of course, the ordinary valves and governors will not do for such increased pressures; but they can be superseded. It is becoming increasingly apparent that there will soon be no room in the subsoil of English streets for all the pipes and cables that ask for admission there; and the gas-mains will have to do more work for the room they take. This is not a question in which local gas managers will have the preponderating voice. If the old mains and the old system of gas distribution prove inadequate, new methods will have to be adopted. Local authorities would be justified in objecting to the blocking up of the only possible avenues of approach by huge gas-mains, when smaller ones would suffice, merely on the plea that low-pressure gas distribution had always been customary. Fortunately, the resources of mechanical science are not exhausted in this respect. Indeed, so far as the transmission and distribution of gas at high pressure is in question, these resources can scarcely be said to have been broached. The position now created is that every gas engineer who is called upon to lay a new trunk main should adjust his work to the possible eventuality of its being called upon to bear a very much greater strain than a few years ago would have been thought of as within the range of possibility.

The Danger of the Pump.

Mr. J. Shiress Will, Q.C., long renowned as an authority on gas and water law, has given the Surveyors' Institution a learned paper, which we reproduce elsewhere, on the "Law of Underground Water." It is unnecessary to emphasize the importance, legal and practical, of this subject. Gas managers especially are uneasily cognizant of it, from the circumstance of many of their professional cares being mixed up with subsoil water. Without elaborating this aspect of the matter, it is expedient to proceed to the teachings of the Hull gasholder case, which is the latest instance of the perils that do environ the gas manager who is driven to meddle with a water-logged subsoil. It has apparently been established that there is no law against a landowner pumping out the water from his own freehold, whenever, for any reason, it is necessary or convenient for him to do so, although by so doing he may cause alterations of the ground level and other physical features of the adjacent lands. The right to drain, however, is not to be stretched to cover the act of abstracting water from the subsoil where in the process any soil, such as running silt or sand, is necessarily also withdrawn and the adjacent land is thereby caused to subside. This was the special point

in *Jordeson v. Sutton, Southcoates, and Drypool Gas Company*. Mr. Shiress Will clearly describes the circumstances in which the point arose. The question was practically one of degree. The neighbouring landlord had no right to support by the subsoil water, but he had to support by soil. To what, therefore, was the damage he suffered by the defendants' pumping due in fact—to abstraction of water or of soil? A knotty point; and it is not surprising that the Judges disagreed upon it. Mr. Shiress Will's review of the case, and of the precedents cited in connection with it, is luminous and suggestive; but, unfortunately for the public, the House of Lords, acting doubtless in the interest of the parties, shirked the difficulty of laying down the law in the matter. Consequently, the issue will some day have to be tried over again. For the present, it will be as well for gas engineers sinking gasholder tanks or making deep trenches in the subsoil where questions of lateral support are likely to arise, to take very special and particular precautions to avoid removing soil with the land water. This is difficult with some wet ground; but at any rate, if everything that forethought and knowledge can suggest is done to avoid committing a wrong, or legal "nuisance," this would constitute an additional defence to a possible action for damages. A gas company buy land for a particular purpose, such as the construction of storage for gas, which involves a different treatment of the land from that which would serve the purposes of agriculture or ordinary building. There is a statutory right to use the land for the particular purpose; but this right has to be exercised subject to a multiplicity of concurrent rights belonging to others besides the owners of the particular site. He would be a very bold man who should attempt an off-hand balancing of all these rights with the attendant wrongs. Mr. Shiress Will prudently refrains from doing anything of the kind; and one cannot do better than observe equal reticence. That there is danger in the pump, however, is a warning that is never thrown away on those who are compelled to make use of it.

The Affairs of the Sheffield United Gas Company.

The affairs of the Sheffield United Gaslight Company, as described at the recent half-yearly meeting by the Chairman, Sir F. T. Mappin, Bart., M.P., are as usual flourishing. The last reduction of price was made at a time when it looked like being a loss of £18,000 a year; but, like most operations of the kind resolved upon by reason of an intelligent anticipation of probabilities, it has been justified. The Company have felt the pinch of advanced costs; but as they had their plant well up to current requirements, they are able to slack off for a while in some departments until prices rule easier once more. This shows, taken in connection with the contrary experience of Darlington, how dangerous may be delays in making all necessary repairs and renewals. The increase in gas consumption in Sheffield has been very great; and so, apparently, has been the local trouble with naphthalene. The subject of the coal supplies of the Company furnished the Chairman with matter for an interesting part of his speech, the topic being quite out of the ordinary. Sir F. T. Mappin also had a "dig" at those advisers of the Corporation who had advocated the artificial extension of the public electric lighting, at fourfold the cost of similar service by gas, with the object of supporting the Corporation electricity supply undertaking at the expense of the ratepayers. The Sheffield Company do not seem to be quite happy at the prospect of the necessary renewals of their coal contracts at the inevitable advance. The most important question is, what the amount of this advance is likely to be; on which problem it would be as impossible as it would certainly be impolitic to advance a firm opinion.

The Workmen's Compensation Act and Casual Labourers.

The judgment delivered by the Court of Appeal in the case of *Lysons v. Andrew Knowles and Sons, Limited*, affords yet another example of the surprises in store for the author of an Act of Parliament when that Act comes to be construed in its absolute literalness by the Judges in the Courts; for we do not believe that it was contemplated by those responsible for drafting the Workmen's Compensation Act, to exclude from its scope the casual labourer. That, however, is the effect of the decision in the case to which we propose now to refer. The facts were briefly as follows: The plaintiff was engaged as a pitman at the defendants' colliery, and commenced work on July 18, 1899. He went to work next on July 20, and was accidentally injured in the course of his employment. The Judge of the Salford County Court awarded him compensation under the Workmen's Compensation Act. The defendants appealed; and it has now been held by the Supreme Court that plaintiff was not entitled to compensation under the Act, because he had not been in the service of the defendants for at least two weeks. The judgment turned upon the construction of the wording of the first schedule of the Act, paragraph 1. It is there provided that the compensation payable to a workman totally or partially disabled shall be a weekly sum "not exceeding fifty per cent. of his average "weekly earnings during the previous twelve months, if he "has been so long employed; but if not, then for any less "period during which he has been in the employment of "the same employer," &c. The Court held that before a man's "average weekly earnings" can be ascertained for the purpose of the Act, he must have been working at least two weeks for the same employer in the employment in the course of which the accident happened. The same line of reasoning would also, it would appear, deprive the dependants of any man killed during the first fortnight of his employment of compensation under the Act; for it is provided in the first schedule that, "if the period of the workman's "employment by the said employer has been less than the "said three years, then the amount of his earnings during "the said three years shall be deemed to be 156 times his "average weekly earnings during the period of his actual "employment under the said employer." This decision of the Court of Appeal obviously excludes from the benefits of the Act the general body of casual labourers, who, more especially at the Docks, are rarely in the employ of the same master for two consecutive days, not to speak of weeks. It would of course, further, exclude all hands during the first fortnight of their engagement; and during the early winter months Gas Companies have many such men on their works. That they would avail themselves of the law as laid down by *Lysons v. Knowles*, and refuse compensation to any such man or his dependants if he were injured or killed, we should, however, be sorry to believe. A man's moral right to compensation for injury received in the course of his work does not rest upon the length of his service, but upon the fact that by undertaking such work he incurred the risk of injury; and we have little doubt that the promoters of the Act regret that its literal construction has the effect of excluding men of less than two weeks' standing. It would not be surprising, when the Act comes up for revision—it is avowedly only an experimental measure—to find the wording of the schedule so amended as to bring within its provisions the casual labourers now excluded.

WATER AND SANITARY AFFAIRS.

There were two reasons for the President of the Local Government Board being unable to hold out any hopes to the deputation from the London County Council who waited upon him at the House of Commons last Wednesday on the subject of the Metropolitan Water Question. In the first place, they certainly had a weak case; and, in the second, Mr. Chaplin had had a strong one presented to him by the other side on the previous day. However, he listened patiently to the statement made by Mr. Dickinson, the new Chairman of the Council, who is also the Chairman of the Water Committee, and said he must carefully consider the matter before making any definite pronouncement. The Council were desirous of ascertaining the intentions of the Government with respect to the two Bills which are now before Parliament, and stand for second reading next Thursday. He urged that they should both be allowed to go to a Select Committee, in order that, the question of purchase being practically settled, the Council might be authorized to acquire the water undertakings conditionally upon their passing them on to some body to be specially formed to manage them, if Parliament saw fit, and if the Council were allowed to have a voice in settling the constitution of that body. In other words, they would like to get rid of the Water Companies, and obtain possession of their property, even if they afterwards had to give it up. The idea is preposterous. If there is to be a change, let the water-works be handed over direct to a new authority. As Mr. Chaplin told the deputation, the Royal Commission, while strongly recommending the transfer of

the water supply of the Metropolis to a public body, were most emphatic in the expression of their opinion that the County Council should not be that body; and therefore it seems to be idle to expect the Government to support a Bill of which the object is diametrically opposed to that view. Then the Council would like a further inquiry in regard to the respective merits of the Welsh and Staines schemes. They consider that, though the Commission paid great attention to the financial aspect of this part of their inquiry, there are many other questions affecting these schemes which have not been thoroughly investigated. But, in face of the final report of the Commission, some extracts from which Mr. Chaplin was careful to quote, he could not confess to being impressed by the arguments adduced in support of the Council's Bills. In fact, he stated plainly that, notwithstanding the suggestions made as to possible modifications in them, they seemed to him to be in "distinct conflict" with the recommendations of the Commission.

While upon the subject of the Staines scheme, further reference may be made to the alarmist letter by Mr. G. Shaw Lefevre which appeared in "The Times" on the 5th inst. Although dated the 24th ult., it was either not sent to Printing House Square or was crowded out until, curiously enough, the very day before the London County Council's reply to the report of the Royal Commission was to come up for discussion. The object of the writer was evidently to contrast the Staines scheme unfavourably with the Welsh one; and in order to do this he employed language which savoured rather of sensationalism and sentimentalism than of engineering knowledge. We pointed out at the time that there would be ample opportunity of discussing the questions raised by him before any of the Metropolitan Water Bills receives the Royal Assent; and since then we looked for some reply from the parties interested in the works attacked. Nothing appeared till Monday last week, when Messrs. John Aird and Sons, who are constructing the reservoirs, bore brief testimony to the stability of the works. Last Friday, however, "The Times" contained two letters—one from Sir Frederick Bramwell, undated, and the other from Colonel Lockwood, M.P., the Chairman of the East London Water Company, dated the 9th inst. They are somewhat belated, but nevertheless welcome. Sir Frederick does not trouble himself much about the sentimental—or, as he calls it, the "æsthetic"—portions of Mr. Shaw Lefevre's letter, but deals mainly with the engineering questions. He makes his first point by remarking that when a person seeks to discredit the decisions of two Royal Commissions, he should himself be "qualified by engineering knowledge to arrive at trust-"worthy conclusions on the subject;" and he fails to gather from the letter that the writer possesses such qualifications. All Mr. Shaw Lefevre's random talk about the "hideous "towering reservoirs"—36 feet high!—which caused him to be "appalled" at the prospect of their multiplication, is ridiculed; while his criticism of their engineering details is proved to be absolutely worthless. Sir Frederick reminds Mr. Shaw Lefevre that Lord Balfour's Commission, who expressed their approval of the Staines scheme, comprised three eminent Engineers who were convinced of the utility, the safety, and the expediency of constructing reservoirs in that neighbourhood; and that the members of Lord Llandaff's Commission visited the works now in progress. Moreover, before the scheme was undertaken it had been examined and approved by Sir Frederick and the late Mr. Thomas Hawksley. This makes the strictures passed upon it by an amateur all the more valueless. In fact, as Sir Frederick says, if the letter had been simply signed "A.B.," nobody would have paid the slightest attention to it; and he has shown pretty clearly in his reply that it would have been properly treated upon its merits. Colonel Lockwood replies in much the same strain. He points out that the works contemplated by the East London Company constitute the conclusion of the whole scheme which received the approval of Lord Balfour's Commission; and that the designs, dimensions, and other technical statistics, have been adopted by the Directors upon the advice of Mr. Bryan, their responsible Chief Engineer, after confirmation by some of the most eminent civil engineers in the kingdom. He pertinently adds that the question of how the enormously increasing population of East London are to be supplied with water, unless the Company have the means to store it when the rivers are in flood, has apparently never entered into Mr. Shaw Lefevre's calculations. But this is a pressing and grave question with the Directors, who are responsible for the making of due provision in this respect; and yet they are constantly being obstructed in their endeavours to discharge their duty.

In the "JOURNAL" for the 6th inst., reference was made to the beneficial results following an inquiry by one of the Medical Inspectors of the Local Government Board into the water supply and drainage of Falmouth. A gentle admonition from the Board might, we have reason to believe, prove beneficial in another town, the Local Authority of which have also been somewhat lax in their duties. Ilkeston, like Falmouth, has been suffering from typhoid fever; and seeing that the water supply, for which the Town Council—not a Water Company in this case—are responsible, has been condemned, as altogether unfit for public use, by one of the Board's Inspectors, the Medical Officer of Health of the town, and Dr. Klein, the eminent bacteriologist, one can scarcely be surprised at it. A certain brook has for rather more than six years been regarded as the main source of contamination; and a resolution was some time ago submitted to the Council urging its severance. Yet year after year has passed, and nothing has been done. What has been the result? We learn that typhoid fever has become "a regular visitor in "the town;" and the present attack is stated to be the worst that has been experienced. The ratepayers could stand it no longer; and a short time ago they held a public meeting on the subject. The Chairman evidently expected that some hard things would be said about what he called their "respected Corporation," for he warned the speakers at the very outset that "personalities must be avoided." The caution was hardly needed, for it transpired that the chief cause of complaint had been removed by the decision of the General Works Committee of the Corporation, on the night preceding the meeting, to call in professional advice as to the best means of getting a sufficient and pure supply of water, with the idea of cutting off the condemned brook. Moreover, the Corporation had, in self-defence, circulated a leaflet, in which it was stated that Dr. Klein had not been able to discover the actual typhoid germ in the water. But one of the speakers declared that the Doctor had found the nearest approach to it. However, germ or no germ, there is the "regular visitor"—typhoid fever; and it appears to be fostered by the water supply. Another speaker—a clergyman, but certainly not a man of peace—advocated the formation of a Ratepayers' Association to prosecute the Corporation for damages for every case of fever, and to appeal to the Local Government Board to turn the Council out of office. He also advised his hearers to refuse to pay the water-rate; and his advice was actually received with applause. In the result, a resolution was passed urging upon the Council the necessity of obtaining a sufficient supply of pure water.

The Proposed Trip of the Gas Institute Members to Paris.—Writing under yesterday's date, Mr. S. Y. Shoubridge, Engineer of the Crystal Palace District Gas Company, says: "I have just received from the Secretary of the Gas Institute a notice informing me that the Council of the Institute have received from the Société Technique de l'Industrie du Gaz en France, and have accepted, a cordial invitation to the Institute to participate in the International Gas Congress to be held in Paris next September. Mr. Dunn also sends particulars of arrangements that have been made to facilitate the journey to and from Paris. The members of the Gas Institute are proud of their loyalty, and sing "God Save the Queen" with great fervour on all suitable occasions. They must, therefore, in common with all other Britons, feel a burning indignation at the insults that have been showered on our Queen and nation by a section of the French Press. The French people, as a whole, perhaps do not sympathize with these ill-mannered attacks on their neighbours and friends; but it must be remembered that the insults continue, and have not been reproved either by the French Government or by the French people. Under these circumstances, I regret very much that the Council of the Gas Institute accepted the invitation of the Société Technique. They would, in my opinion, have acted more in accordance with the feelings of the members had they declined to participate in the forthcoming Congress. The members, however, are in no way bound by the action of the Council; and I fervently hope that not a single one of them will attend the Congress or the Exhibition. By staying away, they will be able to offer a dignified and effective protest against the calumnious and vindictive attacks that have been, and still are being, made by the Paris Press against our country and our Queen."

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 761.)

A GREAT calm fell upon all the Stock Markets last week. This was scarcely what was expected, seeing that the good news from the seat of war was calculated to animate and brighten things. But the week seemed to be given up almost entirely to the War Loan, which engrossed what attention was not being directed to the fortnightly settlement. While business was thus confined within very limited proportions, every department was firm and steady to a marked degree; and prices throughout the list show a more or less considerable advance. In the Money Market, the demand has been very strong, both for War Loan subscriptions, and for Stock Exchange settlement purposes, though the supply did not fall short. Discount rates moved in the direction of greater ease. In the Gas Market, business fell very quiet indeed—the greater attraction of the War Loan appearing to affect even that department; for there was a considerable falling off from the volume of business which had ruled in the preceding week. Towards the end of the week, there was just a little sign of re-awakening activity; but it had not time to develop itself. Changes in quotation were next to nothing; in fact, apart from *ex div.* adjustments, there were only three. Of these, two were in the upward direction, and one was downward. None of the Metropolitan undertakings moved. In Gaslight issues, a little quiet business was done daily between 103½ and 104½ until just before the close, when a bargain was marked at 105—the best of the week. The secured issues were lightly dealt in at about middle figures. South Metropolitan was almost forgotten till the closing day, when some transactions took place—138 being the highest figure recorded. Hardly anything was done in Commercials. A very limited number of dealings took place in Suburbans and Provincials; and they presented no feature of importance. The Continental Companies were excessively quiet; and they also showed a disposition to weakness. Imperial receded a couple of points; and Union changed hands several times at 170. Among the undertakings in the remoter world, Buenos Ayres debenture advanced; and Cape Town had a marked improvement in view of the brighter prospects in South Africa. Business in the Water Companies was almost suspended; and there was no change in any quotation beyond an *ex div.* adjustment.

The daily operations were: On Monday and Tuesday, business was very slight; and there was no move of any sort. Wednesday was a degree more active; but still much below a fair average. Cape Town advanced 1; but Imperial Continental receded 1. Thursday relapsed into extreme inactivity; and the only change was an advance of 1 in Buenos Ayres debenture. Friday was more brisk in comparison, though not actually lively. Cape Town rose ½; but Imperial Continental fell 1 more. No further movements in prices occurred on Saturday.

ELECTRIC LIGHTING MEMORANDA.

The Conflict of Municipalities in London—Disputes over Finance—Under which Rule?—The True Use of Statutory Protection.

IT is very fashionable and fascinating to commend the panacea of Municipalism as a sure means of endowing localities with the best of all possible public services, especially that of electric lighting. Those amateurs of parochial politics who fondly imagine that "Municipalize!" is the last word of wisdom in this connection, would be disagreeably surprised to learn that in the happy land of Municipal Government, there are degrees. London provides plenty of teaching in this regard, for those who really wish to know more about the merits of the fashionable principle than they can glean from the "blow-hard" declarations of a partisan newspaper. We had occasion last week, for example, to discuss in another part of the "JOURNAL" a claim set up on behalf of the London County Council to be a Municipality. It so happens a strong light has been thrown upon the status of the County Council in regard to the real Municipal Authorities of the Metropolis—the statutory Vestries—by what has transpired in respect of the electric lighting loans of the latter. There cannot be two Municipalities for the same place. The Parish of Islington is unquestionably a part of London; and as unquestionably the Local Authority—the Municipal Authority—for this parish is not the London County Council, but the Vestry. The same argument applies to all the statutory Parochial and District Authorities of London; and if all these constituent divisions of the Metropolis are taken away from the presumed area for which the County Council claim to be the "Municipality," what remains? If the County Council are not really the Municipal Authority of London, however, they possess certain statutory and strictly-defined powers in relation to the true Municipal—that is, the Parochial and District—Authorities. It is for this reason we say that in the domain of Municipal Government, there are degrees.

It is not less true than deplorable that the Municipal Authorities of London and the County Council, ranked by its partisans as the Municipality for the Metropolis, do not agree very well. They fall out over money matters—that potent source of squabbling all the world over. The Vestries entertain their own views as to the terms on which they should raise money for carrying on their work, including electric lighting. As Municipalities, their opinions on such a matter are, of course, entitled to respect. But the other municipal opinion—that of the County Council—does not accept it. Between such a clashing of municipal judgments, where is the amateur of the "principle" to place his faith? As an instance, the Vestry of Islington made application to the London County Council for sanction to the borrowing by the Vestry of sums of £13,200 and £56,261 for electric lighting purposes. So long ago as January, the Finance Committee of the Council reported adversely upon the proposal, on the ground that the information and details supplied only justified them in recommending advances of £10,000 and £38,000 respectively on account. The Vestry declined to accept these doles, and defended the sufficiency of the information supplied with the applications, on which they claimed the right of judgment. To that the Finance Committee of the County Council reply that this right belongs to the Council, as the sanctioning authority, and that the position taken up by the Vestry in the matter is "quite untenable." Hence a deadlock has arisen. In order to justify themselves to the Council, the Finance Committee explain that, while they were not satisfied that the prices stated by the Vestry for the proposed works were fair and reasonable, they were nevertheless willing to let the Vestry have the sums mentioned to go on with, pending a settlement; in this respect following what they understand to be the practice of the Local Government Board in such cases. For this purpose, therefore, the so-called Municipality plays the part of a Government Department!

Furthermore, in "showing cause" against the applications of the Islington Vestry, the Finance Committee of the Council state that they raised certain points against the Vestry on Oct. 27 last, to which the Vestry Clerk replied on Nov. 15. These replies were reviewed in turn by the Council's Engineer, and remitted to the Vestry for their consideration. The only answer vouchsafed by the Vestry is that already given, to which is added the remark that "it is now feared, owing to the delay in obtaining the Council's sanction," that the sums originally asked for "will prove to be insufficient." Thus it appears that a good deal of friction attends the working of the machinery of local self-government in London, where not one, but two, authorities claiming the powers of a Municipality are in operation in the same area. To which authority is the confiding believer in the "principle" to yield allegiance? And when it is remembered that the same Council who assert their right of judgment over the financial proposals of the Vestries, in other fields of action claim to be superior to the criticism of Royal Commissions, and batter the doors of Parliament year after year with projects of which the very Vestries are able to demonstrate the extravagance and superfluity, the general municipal position thus displayed is no great credit to the "principle."

The task laid upon the Chairman of the City of London Company at the recent general meeting was not an easy nor a pleasant one. He had to tell the proprietors that the threatened competition of the previous year was an accomplished fact. Not that the competition had actually commenced, but the powers for it had been secured by the Company's rivals in trade. The blame for this was, naturally, placed by the Chairman on the Corporation of the City. He declared that the Corporation had broken their own pledges, and had taken advantage of the wrong committed by a member of their own body to break their contracts with the Company. "On the same reasoning, they might borrow a sum of money from the bank, and then refuse to refund it on the ground that some member of their body held Bank Stock." This is very pretty, as a piece of vindictive grumbling; but it is hardly business. On the other hand, the Chairman unintentionally gave the old policy of the Company away by avowing that "the policy of the Board had been to reduce the price of electric energy to its consumers as soon as they (*sic*) could afford to do so; but in consequence of the threatened opposition they had no alternative but to reduce the price to a par with, or below, that of the competing Company.' Here is the whole secret in a nutshell. When will the directors of public supply companies understand that the reason for any statutory protection they may enjoy is not that they should do the work at their own prices, but at the same or even lower prices than the same service could be rendered by anybody else? The very fact of the City of London Company having been compelled by the appearance of competition to reduce their prices, justifies the competition. That is the point; but evidently Sir David Salomons does not yet understand it. Statutory privileges are granted to a trading company, or to a municipal committee, for the good of the public. Unhappily, these privileges are often abused to cover up administrative incompetence and monopolistic greed. That the City of London Electric Lighting Company, now that they must expect to share their district with another undertaking, should be selling electricity cheaper than they would have done if they had remained monarchs of all they surveyed, is an end that most distinctly justifies the means.

The death has occurred, after a long illness, of Mr. Bernard Dawson, the inventor of the "Dawson" gas-producer. Deceased was well known as a furnace engineer and an iron and steel works expert of considerable repute. He was a member of the Iron and Steel Institute.

THE MUNICIPALIZATION OF PUBLIC SUPPLIES IN AMERICA.

Gas supply statistics sometimes appear in unexpected quarters. There was recently transmitted to the "Journal" office an unpretentious volume bearing the "compliments" of Mr. David Ross, Secretary of the Bureau of Labour Statistics of the State of Illinois. This was the tenth biennial report of the State Commissioners of Labour. But why favour us with this official communication? Simply because a good half of the report is devoted to "a study of the results of private and municipal ownership in the operation of gas-works, electric light and power plants, and water-works" in the cities and towns of the State of Illinois. The testimony to the universality of the circulation of the "Journal" is as gratifying as it is remarkable; and we can do no other than acknowledge the courtesy of Mr. Ross, and give other regular readers of the "Journal" some of the benefit of the labours in gas supply criticism of the Commission of which he is Secretary.

The State of Illinois is evidently following closely that of Massachusetts in the work of collecting and classifying gas-works statistics; but with differences of method and object. In the case of Illinois, the purpose of the State Bureau was to acquire some definite data upon which the opposing principles of the public and private ownership of "certain public utilities," including the supply of gas and water to towns, might be compared on the merits. We learn also that the United States Department of Labour is actually engaged upon a similar investigation covering the whole country. This is a big business indeed. Meanwhile, the State Authorities of Illinois thought that the amount of interest manifested in the subject of the municipal ownership of public services warranted their undertaking to collect the facts, without prejudice, for the information of those who cannot ascertain them by personal effort. Consequently, the report now in question is "not an attempt to demonstrate either the feasibility or futility of municipal ownership, but simply an effort to establish the relative economy of public and private management—that is, to discover which costs the community more for corresponding service, the plant operated by the municipal or the private corporation."

At the outset, it may be remarked that it is dangerous to put the question so generally. This is how the English "Progressives" in municipal politics are accustomed to treat it; but only because they have their answer cut-and-dried. English public men who are not visionaries are accustomed to keep a firm hold of the particular example, and examine it by the light of what is expedient. They know full well that expediency might be proved in ninety-nine out of a hundred cases, without affecting the rights of the hundredth example. This is because all the cases are absolutely independent of one another. If one municipalization resulted in loss, the victims would derive neither help nor solace from looking on at the success of the others. Still, an inquiry into the facts cannot but be instructive, so long as the result is not misapplied. It is reassuring to learn that American official opinion fully admits that "the economic results of operation are often contingent upon terms not common to any considerable number of establishments." This saving clause being secured, we can push along with the statistics.

In the State of Illinois at the present day, there are 57 gas undertakings privately owned; 236 electric light and power plants, 197 being private and 39 municipalized; and 165 water-works, 35 private and 130 municipal. These are somewhat remarkable figures. Out of 458 undertakings of the kinds named, which are located in 243 cities and towns, the electric light plants are far more numerous than all the rest. The water-works come next; while there are only one-fourth as many gas-works as electric light plants. It is further to be observed that the gas-works are all private enterprises, while one-sixth of the electric light plants and three-fourths of the water-works are municipal. These figures, it should be said at once, do not correspond in all respects with those that might be collected from an English province. The multiplication of electric lighting installations, far in excess of the number of towns, prepares one for the disclosure that many of these are factory appendages, sometimes doing a little outside lighting. After making necessary deductions, however, 202 more or less public electricity supply establishments remain to be tabulated among the assets of the State of Illinois—a number far exceeding that of the gas-works. Many of them are small; nearly 28 per cent. of the scheduled towns having less than 2000 population.

It is curious that there is not a municipal gas-works in the State. It is to be feared, also, that the Commissioners for some reason have devoted their attention to the very "small potatoes" of the industry. We miss all entry of anything that might be referred to the city of Chicago, which, we believe, is more or less in the State of Illinois. Not one of the works scheduled makes a million cubic feet of gas per day. This consideration depreciates the value of the whole compilation. It is so far satisfactory to learn that the smaller gas industry of this great State is doing pretty well, speaking financially; some of the works owning up to a net profit of over 15 per cent. on the total investment. But in the technical sense, the working is less creditable; the average gas leakage being upwards of 12 per cent. No less than 11 out of 25 works showed a loss on the business of 1898. It seems to be very difficult to ascertain exactly what is the cash price of gas in most towns. There is always a nominal price, of course; but it is subject to so many "contingent modifications" that it is meaningless. Manifestly, the gas business in these parts is an elastic affair; and this perhaps accounts for the popularity of electric lighting. The absence of municipal gas-works renders impossible the kind of comparison of results which the State Commission specially aimed at.

In electric lighting, the conditions are different. There are a good number of public electric lighting plants, large and small; but more private ventures. They are all on a fairly uniform footing. It is significant that the cost of coal in Illinois ranges from 18¾ cents to $3 per ton. The municipalities usually pay 6 per cent. on the money raised for carrying on this business. The electricity supply undertakings, public or private, derive their revenue almost exclusively from lighting, just as they do here. Only a few possess any motor connections. In order to arrive at a means of comparing the working results of the two classes of undertakings, all the expenditure on revenue account was cast into percentages of the total cost of production. After all, the differences do not amount to much. It should be ascribed to the owners for financial righteousness, however, that the municipalities write off for depreciation an average of 5·04 per cent. of the investment; while the private owners write off as much as 6·35 per cent. in the best cases. It is convincingly shown that electric lighting companies, on the whole, make a paying thing of it. Also, it appears that "municipal plants have been successful as a rule in producing light for public use at a cost materially less than the price for the same which is usually paid to private companies, and have done this both with and without revenue from commercial business."

A good deal might be said concerning the section of the report relating to water-works, which gives the startling information that of the whole number of such works in the State, only two deliver water from reservoirs, and none depends wholly on a gravitation service. Water is generally pumped direct as required. The sale of water wholly by meter is only the rule in three cases. Municipalization of the supply "does not ordinarily afford lower prices to private users;" but it enables the local authorities to help themselves more lavishly to water for public purposes.

On the whole, inquirers will find much information relating to American conditions of the gas, water, and electricity supply industries in these carefully-prepared statistics, the presentation of which does the Commissioners great credit. That the book sheds any additional light on the general principle it was meant to elucidate is doubtful. As we have already observed, the question of the expediency of municipalization is not susceptible of a general answer. It depends upon the particular circumstances; and it depends upon the particular municipality. We have local authorities in the United Kingdom who might be trusted to do anything and everything in this line, to the good of the town. With others it is different. So it is in the United States, probably; and so it ever will be.

THE COST OF OLD-AGE PENSIONS.

The report of yet another Committee on Old-Age Pensions for the Deserving Poor has now been issued. This report is the complement of that laid before the House of Commons last autumn by Mr. Chaplin's Select Committee, a *résumé* of which was given in the "Journal" for Sept. 12. Mr. Chaplin's Committee, it will be remembered, formulated a scheme for granting a pension of 5s. a week to the country, and 7s. a week to the town labourer who, being a British subject possessed of less than 10s. a week, shall not have been sentenced to imprisonment without the option of a fine, nor have received relief from the poor-rate, within the preceding twenty years, and shall have given proof of his desire to himself make provision for his old age. The Committee recommended that one-half the necessary funds should be provided from the rates, and the other half from the Exchequer, but did not, for lack of sufficient data, make any definite estimate of the probable cost.

A Committee—comprising Sir Edward Hamilton, the Assistant Secretary to the Treasury, Mr. Provis of the Local Government Board, Mr. Brabrook, the Chief Registrar of Friendly Societies, and Mr. Noel Humphreys, the Chief Clerk to the Registrar-General—was accordingly appointed by Mr. Chaplin to estimate and report upon the cost of the scheme propounded by his Committee. The task entrusted to this Departmental Committee of statistical experts was no light one. They confined their attention to determining the probable cost of such a scheme in 1901, in 1911, and in 1921. In order to arrive thereat, they had first to estimate the total number of persons over 65 years of age at each of these periods, and then to estimate how many would be barred from receiving the proposed pension by crime, poverty, riches, or unworthiness. They estimate that 2 per cent. of those over 65 years of age would be found to have been sentenced to imprisonment after the age of 45; that in England 27 per cent., in Scotland 16 per cent., and in Ireland 25 per cent. would be found to be, or to have been, paupers (not a very satisfactory reflection, especially for the Englishman); that 37 per cent. would be in possession of 10s. or more per week; and that a further 10 per cent. would fail to give proof of any attempt at self-help. That is to say, only about one person out of every

four of those reaching the age of 65 would be entitled to the proposed pension.

Upon this basis, the Departmental Committee estimate that what may be called Mr. Chaplin's scheme would cost, including working expenses, £10,300,000 a year in 1901, £12,650,000 in 1911, and £15,650,000 by 1921. To give some idea of what an expenditure of 10 millions per annum would mean, if met, as the Select Committee suggested, half out of the rates and half by taxation, it may be said that it would represent about 2½d. in the pound added to the income-tax, and, so far as the Metropolis itself is concerned, something like 3d. in the pound on to the rates. As employers are both rate and tax payers, those who already provide pensions for their aged employees would be in the position of having either to pay for the pensions of both their own men and of other people's employees or to discontinue a system which is of the utmost value for promoting amicable relations between them and their workpeople. We have before now commented upon the curious refusal of all the Committees appointed to inquire into the question of Old-Age Pensions to take into account the fact that no inconsiderable number of employers in a large way of business have already in operation plans for providing for their men's old age. The prospect of any scheme for State-provided pensions being adopted in these times of extraordinary expenditure is very remote; and by the time the favourable occasion arises—if it ever do arise—it may be found that employers and Friendly Societies between them have practically solved the problem. The history of this question during the past few years illustrates only too clearly the unwisdom—to use no stronger word—of proposing at election times to solve a social problem which, after the election, proves, as might have been foreseen, to be most difficult of solution, especially when the proposal would put money in the pockets of the electorate. We say this in no party spirit; the failing is common—as is the temptation—to all parties. It is none the less to be strongly deprecated. It savours too much of the policy of *quid pro quo*.

A CHAPTER IN THE EARLY HISTORY OF GAS LIGHTING.

Close upon sixty years ago—to be exact, on Nov. 1, 1843—Professor Thomas Thomson, F.R.S., who was for many years President of the Philosophical Society of Glasgow, read a paper before that body on "Coal Gas;" and at its close a thoughtful and ingenious member, Mr. John Hart, who took a deep interest in such matters, made a communication in which he gave some consideration to the famous inventor Lord Dundonald and his practical work at Culross Abbey in the distillation of pit coal. He said that having heard that Lord Dundonald used gas from coal as a light long before Mr. Murdoch's discovery, and being in Culross Abbey while it was unroofed and in a state of ruin, he naturally began to examine the walls to see if he could discover any trace of the pipes, when he was informed by Sir Robert Preston's gardener that none were used, as some of the old people of Culross who saw it told him that the gas was carried in a vessel from the tar-works, and burnt in the Abbey. He afterwards learnt that an intelligent old man, a blacksmith in the neighbourhood, had long been in the employment of his Lordship, and that he had been his assistant in many of his experiments about that period; and from him Mr. Hart received the following account.

His Lordship having been in the company of some scientific friends, on the following morning he mentioned to his blacksmith that, on the previous night, he had been shown a work* which gave an account of a process for distilling pit coal, and from which a substance like tar might be obtained in considerable quantities. This he wished to try, as he thought it might be made to serve the purposes of common tar. He then told the blacksmith to come along with him to the garden, where he pointed out a spot, and gave him instructions to set about the erection of an oven or kiln to try it. The experiment succeeding, nothing more was done until the process was secured by a patent. Soon after, nine cylindrical ovens of brick were built in a row, along a bank of earth. They were about 3 feet in width and about 7 feet deep, and were hemispherical at both top and bottom. Each had a moveable cover at the top for charging, and a well-fitted door at the bottom for regulating the combustion. A 7-inch cast-iron pipe near the top conveyed the products to the condenser, placed on the top of the bank. It was a flat box of lead, having divisions partly crossing it to detain tar vapours, and very much resembled the coolers used by brewers; having on its upper surface a rim to retain cold water, with which it was plentifully supplied. The tar was conducted by a pipe into similar cylinders of brickwork on the opposite side of the bank. Each of these had a small opening in the top for the escape of the uncondensable portion of the products. To these openings the workmen were in the habit of attaching a cast-iron pipe by means of a lump of soft clay, and lighting the gas at the other end to give them light. Lord Dundonald was also in the habit of burning the gas in the Abbey as a curiosity; and for this purpose he had constructed a vessel somewhat resembling a large tea urn. This he frequently caused to be filled with gas and carried up to the Abbey to light the hall, especially when he had company. On one occasion, after a fresh charge, the workman having applied his light too soon, an explosion took place, which nearly killed some of the men, and tore off the top of the condenser, and one of the workmen's wives passing near it at the time was blown off the bank, but fortunately did not sustain any injury. After this accident, however, the men became very cautious in applying a light to the pipe until the whole of the atmospheric air had been displaced.

Mr. Hart proceeded to say that, in giving this statement, he did not mean to detract in the slightest degree from the merits of Mr. Murdoch, as it appeared that he (Murdoch) knew nothing of what was going on at Culross. All he wished to show was the state of knowledge on the subject of gas lighting in Scotland ten or twelve years prior to Mr. Murdoch's discoveries. As Lord Dundonald's object was the manufacture of tar, his researches would probably be confined to the quantity of that product, and not to the quality of the gas; and as his gas from the tar-kilns was very poor, being made from common coal, and also partly mixed with the air after combustion in the kilns, the light must have been inferior to that of candles. But even although he had observed the great illuminating power of gas produced from cannel coal, the high price of cast-iron pipes, and the little use they were put to, especially in Scotland, at that period, must have rendered such an idea as that of supplying it generally, if it had even occurred to him, or even to Dr. Clayton, as something perfectly impracticable. It required a more extensive knowledge and experience in engineering than any of these gentlemen possessed to entertain for a moment the practicability of such a scheme. Even Mr. Murdoch and his friends at Soho seem to have had their doubts about the possibility of raising funds sufficient for such a gigantic undertaking as the lighting of a city, if one might judge from the little interest they took in it even after the lighting up of the cotton factory of Messrs. Phillips and Lee at Salford.

Mr. Hart then went on to describe the process his Lordship adopted—common coal rather than cannel being used. The flame was very grey, and he thought it would be possible to make the gas take up an additional quantity of carbon by passing it over wood charcoal at a strong red heat prior to its entering the condenser, and that he might also produce a greater quantity of gas by more effectually decomposing the tar. The experiment he instanced did not prove successful, and he did not prosecute it any further. When he saw the report drawn up by Dr. Henry, of the analysis of the gas obtained by him from the same retort during different periods of the charge, the deterioration of the gas in the later period seemed to him to proceed rather from the deposition of the carbon in the gas, by coming in contact with the newly-formed coke in the outer portion of the charge, than from an inferior gas being given off from the coal in the centre of the retort.

* This might probably have been Dr. Richard Watson's "Chemical Essays," published in 1787, in which the author detailed experiments he had made on the distillation of pit coal, and also gave the quantities of coke and tar obtained from various kinds of coal.—Ed. J.G.L.

THE LABOUR MARKET.

The Board of Trade returns of the state of employment during the first two months of the year show that work remains plentiful; the percentages of members of Trade Unions unemployed being 2·7 in January, and 2·9 in February—figures lower (with one exception) than those for the corresponding period of any year since 1891. So far as the coal trade is concerned, employment in January was on the whole much the same as a year ago; but in February it was exceptionally good. The average time worked by the collieries included in the returns was higher than any previously recorded in the six years during which the statistics have been compiled. The average time worked by these collieries—representing about two-thirds of the total trade—was 5·69 days per week in the four weeks ended Feb. 24, as compared with 5·63 days per week a year ago, when trade was especially active. In the pig-iron trade, seven more furnaces were in blast, and 1255 more people were employed, at the end of February than on the same date in 1899. Except in the building trades, increases in wages continue to be generally reported. In the two months, some 714,000 workpeople—including 617,000 colliery employees—received increases equal to about 1s. 5d. each per week. In January, 625 gas workers, employed chiefly at Salford, and in February 1061, most of whom are employed at Newcastle-on-Tyne, received increases of from 2½ to 5 per cent. The practical immunity from industrial disputes is still a marked and satisfactory feature of the returns. During the two months, some 70 disputes were recorded, affecting 22,662 workpeople. Of these, only three disputes, involving 3681 persons remained unsettled at the end of February. The Trade Union agitators will, at this rate, soon be the only out-of-works.

Municipal Trading.—A Paper on "Municipal Trading" was read before the Scottish Society of Economists at Edinburgh last Wednesday, by Mr. John Harrison, Chairman of the Edinburgh Chamber of Commerce. He contended that local authorities had no right to conduct any undertaking for making profit, and that every enterprise they engaged in should be for the direct service of the individual members of the constituency. He also held that Councils should not interfere in any business unless they possessed a monopoly.

PERSONAL.

Mr. WILLIAM WILLMORE, who is 97 years of age, has just been re-elected a Director of the Windsor Gas Company.

Mr. A. W. WALKER, one of the fitters and inspectors of the Elland Gas Company, in whose service he has been for eleven years, has been appointed Manager of the Hadley Gas-Works, near Stafford.

The Directors of the Wakefield Gas Company have unanimously appointed Mr. W. W. TOWNSEND Assistant Gas Manager under his father, Mr. H. Townsend, the Engineer and Manager of the Company.

Mr. C. J. P. WADMAN-SMITH, Engineer and Manager of the Tadcaster Gas-Works, was last Tuesday selected, out of 66 applicants, as Manager of the Brigg Gas-Works, which (as intimated elsewhere) on the following day passed into the hands of the District Council, under the provisions of the Act of last session.

Last Saturday, Mr. F. HIGGINSON, of Elland, was appointed Manager and Secretary of the Broadstairs Gas Company—a position for which applications were invited in the "JOURNAL" for the 6th inst. The successful candidate served for three years under Mr. Robert Porter at the Holmfirth Gas-Works, and is at present in that gentleman's office.

Mr. H. K. KINDLER, Assistant-Manager of the Stockton Gas-Works, who has obtained a similar appointment with the Maidstone Gas Company, was recently presented with a purse of gold and a silver tea service by the officials and workmen, by whom he was highly respected. The Corporation also, at their last meeting, voted him a special sum of £25 in recognition of his valuable services in connection with the preparatory work relating to the installation of the electric light in the borough.

OBITUARY.

The death is announced of Mr. E. BETTERIDGE, aged 75, the Chairman of the Westerham Gas Company, and connected with the district water supply until the undertaking was absorbed by the Kent Water Company.

Mr. JOHN LANGTON, who for nearly 30 years was Manager of the Driffield Gas-Works, died in the town on Monday of last week, at the age of 63 years. He was formerly at Scarborough, and only resigned his position as Gas Manager at Driffield at the close of last year.

The death is reported of Mr. JOHN THOMAS WHARTON, who was mainly instrumental in forming the Cleveland Water Company some 32 years ago, so as to provide a sufficient supply to about eighteen of the towns and villages round about Saltburn-by-the-Sea, Yorkshire. The deceased gentleman was for many years Chairman of the Company—a position now occupied by his son, Mr. W. H. A. Wharton.

We regret to record the death, on the 10th inst., at his residence in Camden Square, of Mr. GEORGE JAMES SYMONS, who enjoyed a unique reputation as an authority on rainfall statistics. Deceased was born in London in 1838. He joined the Meteorological Society in 1856, and became in the following year one of the meteorological reporters to the Registrar-General—a post which he held till his death. In 1860 he published his first annual volume of "British Rainfall," which contained records from 168 stations—163 in England and 5 in Wales—there being none in Scotland and Ireland. He gradually developed a vast organization of voluntary observers, so that his last published volume—that for 1898—contained records from 3404 stations—2545 in England, 237 in Wales, 436 in Scotland, and 186 in Ireland. The Council of the Society of Arts in 1897 awarded him the Albert Medal. He was a member of the Council of the Royal Meteorological Society from 1863, was President in 1880-1, and Secretary from 1873 to 1879 and from 1882 to 1899.

The current number of the "Journal des Usines à Gaz" is in mourning for M. SAMSON JORDAN, who, in conjunction with M. Monnier and the late M. Servier, founded that publication. Deceased had spent an active and useful life. On leaving the Central School of Arts and Manufactures in Paris, he entered, in 1855, the service of the Marseilles Gas Company. Having filled the position of Deputy-Manager of the Exploitation du Gaz, he was called to Paris in 1862 to take the position of Engineering Director of the Central Service. In 1873 he was chosen a Delegate Director—a post which he retained for upwards of fourteen years; and he was on the Board till his death. In 1868 he was nominated, at the age of 36, one of the Professors at the Central School, where he gained the cross of the Legion of Honour, which was subsequently replaced by the officer's rosette. His knowledge of gas engineering and metallurgy was in requisition by the Committees of various scientific Societies in France, including the Society of Civil Engineers, over which he was called upon to preside. He was one of the founders of the Société Technique du Gaz en France, of which he was President in 1880; and when, three years later, the members met in Marseilles, he offered them a welcome on behalf of the Gas Company. On the occasion of the funeral, a fitting tribute to the memory of the deceased was paid by M. Vautier, the President of the Society.

NOTES.

Lighting Gas-Burners by the Induction Spark.

The various methods of lighting gas-burners at a distance are always worthy of notice. Recently, "Progressive Age" has published a communication from a correspondent in New Haven, Connecticut, which is interesting as indicating the actual condition of gas lighting practice in this part of the world. The correspondent narrates how he improved the lighting of a church by substituting efficient Welsbach gas-burners for the ineffective lights previously used. After the lighting had been altered to the new system, the difficulty of ignition arose. This was overcome by the application of an electric-spark method. It involved the fitting of an induction spark attachment to the top of every one of the glass chimneys. This consisted of a porcelain cap, made for the purpose, and placed in electrical connection with the induction coil. The glass chimney was a sufficient insulator for the spark attachments, which were connected in series, and the last was simply connected for the return with the gas-pipe itself below the burner. Mr. Charles D. Sherman, who describes the arrangement, was careful to try the effect first on an exhibition set of lights at the gas-works; and he was delighted with the quickness and economy of the method. It was at any rate a saving over the old laborious method of lighting by torch. The essential part of the apparatus is the Ruhmkorff 1½-inch spark coil, and six battery cells. Mr. Sherman states that the only perishable element of the fixture is the battery material; but it might be suggested that an insulated spark attachment, kept exposed to the action of the products of gas combustion at the top of a Welsbach lamp chimney, cannot be regarded as above risk of deterioration.

The Durability of Paint.

Before the Newcastle Section of the Society of Chemical Industry, Mr. Harry Smith, F.I.C., recently reviewed modern technical literature on the subject of preservative paints for iron-work. He has also conducted experiments in this line himself during the last two years; the object being to test the behaviour of such paints as are actually in everyday use in this country. The most severe tests consisted of painting shallow iron dishes with the pigment, and filling them with water which was allowed to slowly evaporate. The red-lead paints came best out of this trial—being practically unaffected. The zinc-whites and white-leads came next. All the other paints suffered badly; boiled oil alone showing the worst. It was the same with painted iron slips merely exposed to the weather, as regards the plain boiled oil; but all the other paints bore this test very well. Other tests were made with slips kept constantly immersed in water, when again the lead and zinc paints turned out the best. Good iron oxide, however, was not far behind. Iron oxide also makes a tougher paint than red lead, which is in fact troublesome to mix properly and apply satisfactorily. Zinc white is preferable to white lead. The Forth Bridge iron-work is cleaned and painted outside, at intervals of three years, with a mixture of red-lead and iron-oxide paint, followed by a finishing coat of brown oxide paint. Equal quantities, by measure, of the two paints are used; and 1 lb. of it covers 6 square yards of surface. Where the salt water sprays the ironwork, this is scraped and painted once a year. Various protecting compositions have been tried by the Resident Engineer; but the old paint mixture is always reverted to in the end.

A Source of Waste in Steam-Engines.

A curious point relating to the economy of steam-engines was made by Dr. J. T. Nicholson, of the Manchester Municipal Technical Schools, at a recent meeting of the Manchester Association of Engineers. He brought forward some interesting results of experiments made by himself, in conjunction with a colleague, to ascertain the lines on which economy might be sought. These experiments went to show that the leakage of steam past the valves from the steam-chest into the exhaust, without going through the cylinder at all, is much larger, and of greater consequence, than is usually imagined. In the case of a high-speed engine of American type, of 60-horse power, with automatic cut-off, the leak must have been as much as 500 lbs. to 600 lbs. of steam per hour. Of this amount, 300 lbs. was actually measured, and the balance inferred when the engine was running under normal conditions. It was also ascertained that the leakage occurred in the form of water—that is to say, there was simply a flow of water to this extent across the valve face. The deduction to be drawn was that if the formation of the water could be prevented, so that the only thing to pass would be steam, this source of waste would be stopped. The object could be attained by heating the valve faces, or superheating the steam; and thus an economy is effected which is often ascribed to totally different things. In an experiment specially designed to test this theory of waste, the steam was superheated sufficiently to heat the valve faces 20° above the saturated temperature; and the leakage was thereby reduced from 300 lbs. to 120 lbs. in an hour. The suggestion was offered that this is the reason of the great improvement realized by the Parsons steam turbine, wherein the leakage is reduced by the superheating of the steam. This matter is to be thoroughly investigated at the Technical School, on a special engine with interchangeable steam valves.

TECHNICAL RECORD.

THE LAW IN REGARD TO UNDERGROUND WATER.

Its Bearing on the Jordeson Gasholder Case.

At the Meeting of the Surveyors' Institution on Monday last week, Mr. J. SHIRESS WILL, Q.C., read the following paper on the above subject:—

The law with regard to the question of ownership in underground water first became definitely settled in the year 1859 by the case of *Chasemore v. Richards* (7 H. L. Cases, 349). The facts of that case are very interesting; and it will add to the interest if we call to mind the locality and the parties to that famous litigation. The plaintiff was the occupier of an ancient mill on the River Wandle, and for more than sixty years he and the preceding occupiers of the mill had used and enjoyed as of right the flow of the river for the purpose of working their mill. The defendant represented the members of the Local Board of Health of Croydon (as the Local Authority was then styled), who, for the purposes of supplying the town of Croydon with water, sank a well to the depth of 74 feet in their own land in the town of Croydon and about a quarter-of-a-mile from the River Wandle, and pumped up large quantities of water from their well. By means of the well and the pumping, the Local Board of Health diverted, abstracted, and intercepted underground water (but underground water only) that otherwise would have flowed and found its way into the River Wandle, and so to the plaintiff's mill. The quantity so diverted, abstracted, and intercepted was sufficient to be of sensible value towards the working of the mill. The water was underground water not flowing in any defined channel, but percolating or oozing through the soil more or less, according to the quantity of rain that might chance to fall. The learned Lords who took part in the decision of the case were Lords Chelmsford, Cranworth, Wensleydale, Kingsdown, and Brougham. The judgment of the House of Lords was unanimous. They held that the principles which regulate the rights of owners of land in respect to water flowing in known and defined channels, whether upon or below the surface of the ground, do not apply to underground water which percolates through the strata in no known channels. Lord Cranworth, in the course of his judgment, said:

> The right to running water has always been properly described as a natural right, just like the right to the air we breathe; they are the gifts of Nature, and no one has a right to appropriate them. There is no difficulty in enforcing that right, because running water is something visible, and no one can interrupt it without knowing whether he does or does not do injury to those who are above or below him. But if the doctrine could be applied to water merely percolating, as it is said, through the soil, and eventually reaching some stream, it would always be a matter that would require the evidence of scientific men to state whether or not there had been interruption, and whether or not there had been injury. It is a process of Nature not apparent; and therefore such percolating water has not received the protection which water running in a natural channel on the surface has always received.

Of the judicial decisions prior to the case of *Chasemore v. Richards*, it is only necessary to refer to two. The first is the case of *Acton v. Blundell*, in 1843. The plaintiff in that case was the owner and occupier of a piece of land on which was a cotton-mill, in a street called the Wallgate, in the town of Wigan, in which he carried on the business of a cotton spinner. A former owner and occupier of the land and mill had sunk a well in such land, and raised water for the working of the mill. The defendants sank a coal-pit in their own land at about three-quarters of a mile from the plaintiff's well; and about three years after they sank a second pit at a somewhat less distance. The consequence was that by the first pit the supply of water was considerably diminished in the plaintiff's well, and by the second it was rendered altogether insufficient for the purposes of the mill. The judgment of the Exchequer Chamber was delivered by Chief Justice Tindal. It was held the action would not lie. He said:

> We think the present case is not to be governed by the law which applies to rivers and flowing streams, but that it rather falls within the principle which gives to the owner of the soil all that lies beneath his surface—that the land immediately below is his property, whether it is solid rock or porous ground, venous earth, or part soil, part water; that the person who owns the surface may dig therein and apply all that is there found to his own purposes at his free will and pleasure; and that if, in the exercise of such right, he intercepts or drains off the water collected from underground springs in his neighbour's well, this inconvenience to his neighbour falls within the description of *damnum absque injuriâ*, which cannot become the ground of an action.

This case and the judgment were cited with approbation in the House of Lords in the case of *Chasemore v. Richards*.

The other case is that of *Dickinson v. The Grand Junction Canal Company*, in 1852. In that case, the plaintiff, who owned certain paper-mills, sought an injunction to restrain the defendants from abstracting by means of a well (1) water after it had formed part of a stream, and (2) percolating water which would, but for the well, have found its way into the stream. The decision really turned upon the construction of the terms of an agreement and of a Special Act of Parliament. The judgment of the Court of Exchequer was delivered by Lord Chief Baron Pollock, who held that the millowner had a right of action as to the first and also as to the second point. But it was not necessary for the purposes of the case to determine the common-law right of the parties as to the second point; and this is clearly indicated by Justice Wightman, who delivered the opinion of the consulted Judges in *Chasemore v. Richards*. Since the decision of the House of Lords in the later case, that of the Court of Exchequer cannot be considered as of value on the question of the common-law rights of parties regarding underground percolating water.

An owner of land has an unqualified right to drain it for agricultural purposes, in order to get rid of mere surface water—that supply of water being casual, and its flow following no regular or defined course. Therefore a neighbouring proprietor cannot complain that he is thereby deprived of such water which otherwise would have come to his land. (See *Rawstron v. Taylor*, in 1855, 11 Exch., 369; and, further, *Jordeson v. Sutton, Southcoates, and Drypool Gas Company*, referred to later.) That case was soon followed in 1856 by that of *Broadbent v. Ramsbotham* in the same Court, which decided that a landowner has a right to appropriate surface water which does not flow over his land in any definite channel, although the water is thereby prevented from reaching a watercourse which it previously supplied, and which had for more than fifty years worked the plaintiff's mill. Baron Alderson, in delivering the judgment of the Court in that case, said:

> No doubt all the water falling from heaven and shed upon the surface of a hill, at the foot of which a brook runs, must, by the natural force of gravity, find its way to the bottom, and so into the brook; but this does not prevent the owner of the land on which the water falls from dealing with it as he may please, and appropriating it. He cannot, it is true, do so if the water has arrived at, and is flowing in, some natural channel already formed. But he has a perfect right to appropriate it before it arrives at such a channel. In this case a basin is formed in his land, which belongs to him, and the water from the heavens lodges there. There is here no watercourse at all. If the water exceeds a certain depth, it escapes at the lowest point, and squanders itself (so to speak) over the adjoining surface. The owner of the soil has clearly a right to drain this shallow pond, and to get rid of the inconvenience at his own pleasure.

The principles laid down in the case of *Chasemore v. Richards* have never been shaken or departed from. In every case that has arisen since then, the difficulty has been, not whether the decision in *Chasemore v. Richards* was right, but rather in its application to the facts of the particular case. An examination of the more important of the decisions will illustrate this.

In *Dudden v. Clutton Union*, in 1857, there was a certain spring from which the water flowed in a natural stream, which turned the plaintiff's mill. The Clutton Workhouse was situated about a mile away from this spring, and the Guardians desired to get a supply of water from it for the workhouse. Having acquired a licence from the owner of the land in which the spring was, they made a tank in the ground and caught the water as it rose from the earth. What the defendant here did was, not to sink a well and so obtain percolating underground water, but to take the water after it had arrived at the spring-head, and prevent it from going down, although it had not then actually entered what may be called the channel from the top of the spring. The plaintiff accordingly succeeded in his action.

In *Regina v. Metropolitan Board of Works*, in 1863, it appeared that part of an estate at Lewisham was situate upon a deep bed of gravel, which itself was embedded in a basin of clay extending under it and the lands adjoining. In the lower part of the property was a pond of the depth of 4 feet, formed in the gravel bed, which had existed there from time immemorial, and in which the water rose naturally in considerable quantity from several powerful springs at the bottom of it, and thence overflowed the western edge of the clay basin and formed a rivulet, which ran through the grounds and supplied ornamental ponds therein, and was used for the cattle and for supplying the garden of the house. The Metropolitan Commissioners of Sewers (a body whose duties and liabilities were afterwards, by statute, transferred to the Metropolitan Board of Works), in constructing a sewer along and under the centre of a highway, cut through the bed of gravel and the basin of clay which enclosed it, at a distance from the estate varying from 17 to 153 yards. The immediate effect was to drain the springs rising in the bed of gravel, and prevent them from finding their way into the pond, so that it became dry, and the rivulet and other ponds ceased to be supplied with water. Section 50 of the Metropolitan Sewers Act, 1848 (11 & 12 Vic., cap. 112), contained certain provisions for compensating parties prejudicially affected. It was held that, independently of the statute, the owner was not entitled to compensation, as the effect of the sewer was only to intercept underground water which would otherwise rise into the pond. (On the same point, see *Brain v. Marfell.*)

In the case of *The Grand Junction Canal Company v. Shugar*, in 1871, the Grand Junction Canal Company, in pursuance of powers given by their Acts, had, many years before the litigation arose, intercepted a stream flowing from a pond called the Silk-Mill Pond, near Tring, and caused the water to flow into a branch of the canal. The Local Board of Health of Tring made a drain near to and below the pond. The case did not turn upon the question of the abstraction of underground percolating water. Lord Hatherley found on the evidence that, owing to the faulty construction of the drain, water was directly abstracted from the running stream. It was on this point that the injunction was granted. The argument of Sir Roundell Palmer, Q.C., for the Canal Company, is thus reported:

> The Local Board say that the damage has been done by intercepting subterranean springs, which they have a right to do; but we say that, though we perhaps lose some water in that way, we lose more by their drawing off the surface water.

The Lord Chancellor, in giving his judgment, said:

In this case there is, *ex concessis*, a defined channel in which this water was flowing; and I think the evidence is clear that some of it is withdrawn by the drain which the Local Board have made. . . . I do not think *Chasemore v. Richards*, or any other case, has decided more than this—that you have a right to all the water which you can draw from the different sources which may percolate underground; but that has no bearing at all on what you may do with regard to water which is in a defined channel, and which you are not to touch. If you cannot get at the underground water without touching the water in a defined surface channel, I think you cannot get at it at all.

In regard to the facts of this case, Lord Justice Vaughan Williams observed in the Jordeson case:

With regard to the case of *The Grand Junction Canal Company v. Shugar*, it seems tolerably clear, from the longer report in the "Law Times," that Lord Hatherley treated the case as one in which there was a direct tapping of an overground stream flowing in a defined channel, and not merely a withdrawal of percolating underground water.

And Justice North, in the case of *The Corporation of Bradford v. Pickles*, in 1894, in dealing with the Grand Junction case, said that as he read that case it was one in which subterranean water had passed into a defined channel, from which it was subsequently abstracted.

The case of *The Ballacorkish Silver, Lead, and Copper Mining Company v. Harrison*, in 1873, was decided in the Privy Council on appeal from the Court of Chancery in the Isle of Man. The appellants, by a lease from the Crown, were entitled to the minerals under certain lands occupied by the respondents. They sank certain shafts and enlarged others and worked the mines. The damage complained of by the respondents was the withdrawal, by percolation into the mine, of water which it was averred would otherwise flow into, and, having flowed into, would have been retained in, the wells or springs on the respondents' land. It appears that a new level had been driven by the appellants under the respondents' land about two years before the litigation, and that from that time the wells and springs were dried up. It does not appear to have been denied that if the litigant parties had been the respective owners of two adjacent closes, and one of them, mining in his own land, had drawn off, by natural percolation through the soil, the water which fed a spring or well on the land of the other, no action would have lain, and that the cases of *Acton v. Blundell* and *Chasemore v. Richards* would have governed the matter. It was sought, however, by the respondents, to distinguish that particular case on certain very special grounds—viz., that the appellants represented, through the Crown, the Lord of the Manor, and that the respondents were customary tenants of the manor; and that the lord, having granted the surface to the customary tenants, could not lawfully derogate from his own grant by so working the mines as to inflict damage of this description upon the tenants. The judgment of the Privy Council was in favour of the appellants in the particular circumstances of the case.

In the case of *Bunting v. Hicks*, in 1894, it appeared that the plaintiff was an owner of property through which a stream of water flowed. The defendant was the owner of land higher up the same stream, and the stream rose in a spinny on his land. The defendant constructed on the lower side of this spinny a large pond, into which he collected the water which rose in the spinny, and which therefore had flowed thereout, and found its way to the land of the plaintiff. From this pond, the defendant, a brickmaker, took and carried away considerable quantities of water—at the rate of about 30 cartloads a day—for the purposes of brickmaking. Here it is obvious that there was no taking of underground percolating water, but of water after it had come to the surface. The Court of Appeal therefore granted an injunction.

In the case of *The Corporation of Bradford v. Pickles*, it appeared that the Bradford Corporation derived a supply of water from a large spring known as Many Wells, which issues from the ground 20 or 30 yards to the east of Doll Lane, and also from a stream to the south of Many Wells, which had its origin in a smaller spring on the respondent's land, close to Doll Lane, at a point known as the Watering Spot, from which the water runs in a definite channel into Trooper Farm. It was an admitted fact in the case that the statutes, to the benefit of whose provisions the Bradford Corporation were now entitled, made no provision for compensating the defendant in the event of any right or interest of his being prejudicially affected. In 1892, the respondent began to sink a shaft on his land adjoining the lane, and to the west of the Many Wells spring, and also to drive a level through his land for the professed purpose of draining the strata with a view to the working of his minerals. These operations had the effect of occasionally discolouring the water in the spring, and also of diminishing to some extent the quantity in it and in the stream coming from the Watering Spot; and it became apparent that, if persevered in, they would result in a considerable and permanent diminution of the water supply obtainable from these sources. The Bradford Corporation sought an injunction to restrain the defendant. The House of Lords (Lords Halsbury, Watson, Ashbourne, and Macnaghten), affirming the decision of the Court of Appeal, decided in favour of the defendant. The Lord Chancellor said:

The acts done, or sought to be done, by the defendant were all done upon his own land, and the interference, whatever it is, with the flow of water is an interference with water which is underground, and not shown to be water flowing in any defined stream, but is percolating water, which but for such interference would undoubtedly reach the plaintiffs' works, and in that sense does deprive them of the water which they would otherwise get.

It will be noted, in passing, that the House of Lords decided in this case—and such a decision was in no way new, for many decisions to the like effect have been given in the past—that if a man has a right to do a particular act, his motive in doing so is immaterial, and cannot render the act unlawful.

The case of *Mostyn v. Atherton*, in 1899, related to St. Winifred's well, in the Urban District of Holywell, in Flintshire. It was a famous well, and had for many centuries been, and still was, visited by pilgrims, who drank the water and bathed in it. A natural stream flowed down from the well to the estuary of the River Dee. The Holywell Urban District Council, who were in possession of the land from which the water issued, granted to a certain firm the sole and exclusive right to abstract and use water at specified times from the well for the purpose of storing, making up in casks, jars, and bottles, and treating, preparing, and selling the same with the right to use existing pipes tapping the well which had been inserted by the promoters of a waterworks company formerly projected, but now abandoned. The effect of this abstraction of the water would be to diminish the flow past the works of the riparian proprietors on the banks of the stream. The right thus sought to be conferred was not to sink a well, and so obtain and divert percolating water, but to take water from the spring itself. Mr. Justice Byrne, following the case of *Dudden v. Clutton Union*, granted an injunction.

In the course of his judgment in *Chasemore v. Richards*, Lord Chelmsford used the expressions "certain and definite course," and "a certain and defined course, whether in an open visible stream or in a known subterranean channel," as contrasts or antitheses to "water percolating through underground strata, which has no certain course, and no defined limits, but which oozes through the soil in every direction in which the rain penetrates." And in another part of his judgment he drew the distinction between "water flowing in a definite channel," and "water, whether above or under ground, not flowing in a stream at all, but either draining off the surface of the land, or oozing through the underground soil in varying quantities and in uncertain directions, depending upon variations of the atmosphere." Lord Chelmsford further said he agreed with the observation of Lord Chief Baron Pollock, in *Dickinson v. Grand Junction Canal Company*, that "if the course of a subterranean stream were well known, as is the case with many which sink underground, pursue for a short space a subterraneous course, and then emerge again, it never could be contended that the owner of the soil under which the stream flowed could not maintain an action for the diversion of it, if it took place under such circumstances as would have enabled him to recover had the stream been wholly above ground."

Two Irish cases may here be cited as illustrating what may be considered as a known or defined underground channel. The first is the case of *Ewart v. Belfast Poor Law Guardians*, in 1881. The facts as stated by Chief Baron Palles were as follows: The plaintiff and one Andrew Clements were respectively the owners and occupiers of two adjoining parcels of land situated upon the eastern slope of Cavehill, in the county of Antrim. The plaintiff's land was at a lower level than that of Clements, and from its surface, at a distance of from 30 to 40 feet from Clements' lands, water of great purity, and of considerable value for bleaching purposes, formerly issued, and thence flowed through the plaintiff's land in a defined surface channel. The defendants, as the Sanitary Authority for Ligoniel, made borings, with the consent of Clements, upon his lands, for the purpose of obtaining a sufficient supply of water for the village, and ultimately found a copious underground flow, estimated as capable of yielding 70,000 gallons a day. Trenches were then excavated in Clements' land, which prevented this underground water from flowing down the hill in the direction of the plaintiff's land; and thereupon the spring in question ceased to flow. His Lordship said there could be no doubt that some of the water thus diverted by the defendants would otherwise have flowed to the plaintiff's lands, and emerged at the spring in question. There was conflicting expert evidence as to whether the water diverted used to flow in a defined channel underground "in the sense of a channel capable of being ascertained and defined by opening the ground by excavation." The Lord Chief Baron, without deciding the question of fact, said:

I feel myself bound, for the purpose of my decision, to assume that it has been established as a matter of fact that the water did flow in a channel defined in the sense which I have mentioned. I assume, therefore, that the water percolating through the strata of the upper portions of Clements' plot ultimately finds its way to the point upon Clements' land designated upon the model; that it there enters a subterranean channel by which it is conducted to, and emerges as a spring at, a point in the plaintiff's land. This water had not previously flowed upon the surface in the form of a continuous stream in a defined channel. The channel, if it existed at all, has been ascertained only by means of deep excavations upon Clements' lands, the making of which by the plaintiffs without Clements' consent would have been an act of trespass.

Elsewhere the Lord Chief Baron lays stress on the fact that the "well-defined channel" referred to was one which was not only unknown at the time of the acts complained of, but was "incapable of being ascertained by the exercise of reasonable diligence." Then, having quoted the cases of *Dickinson v. Grand Junction Canal Company* and *Chasemore v. Richards*, he proceeded to say that the case was intermediate between the two. It was that of "water flowing in a course which in a sense may be said to be certain and defined, but which is not an open visible stream nor a known subterranean channel." He concluded by saying he was of opinion that the principle of *Chase-*

more v. Richards applied to "all subterranean water which does not flow in a defined and known channel."

Lord Justice Deasy, after reviewing the evidence, expressed the opinion that the plaintiff had failed to prove that there existed at the time of the excavations any definite subterranean course by which the water flowed; and he added that, in his view, it was not proved that there was a defined channel, not to say a known one, and that there was nothing to prevent the defendants from applying the water to the sanitary purposes which they contemplated.

Lord Justice FitzGibbon, in his judgment, said:

It is not possible to say with certainty whether the course through which the water has flowed since the opening of the ground was before that opening in any sense a "defined channel," or was only a part of the natural reservoir which, until it was tapped by the defendants, found an outlet upon the plaintiff's land. I assume, however, for the same reason as my Lord Chief Baron (namely, that if the point was material, further inquiry should be directed), that the water did flow underground, for some distance at least, in a definite—that is, a contracted and bounded—channel and stream, but that its course was unknown, invisible, and undefined by human knowledge. This, to my mind, is the only sense in which the words "defined channel" can be used in deciding upon rights. In my opinion, it is impossible to recognize a natural right which would subject the lands of another to the burden of maintaining an unknown flow of water (whatever be the geological character of its channel), without introducing every difficulty which has already prevailed to prevent the recognition of such a right in respect of "percolating" water strictly so called. It appears to me to be impossible to find the test of the existence of either natural rights or acquired easements in *ex post facto* geological investigations. Yet it is by some such means alone that any difference could be discovered between oozing or precolating water and water running through, or collecting in, underground fissures.

Lord O'Hagan stated that he concurred in the judgment of Lord Justice FitzGibbon. The judgment of the Court of Appeal was therefore in favour of the Guardians.

The next of the Irish cases is that of *Black v. Ballymena Township Commissioners*, in 1886, decided by Vice-Chancellor Chatterton. In the course of the case, the decision in the Ewart case was very much discussed. It appeared that the Ballymena Commissioners, who were the Urban Sanitary Authority for the town of Ballymena, had obtained a Provisional Order (confirmed by Parliament) to abstract water from the River Quolie, in accordance with certain plans and specifications, for the purpose of supplying the town of Ballymena with water. The works were begun; but, owing to an accident, they were discontinued, and the Commissioners sought for some temporary means of obtaining a supply of water. By arrangement, they made an excavation in the neighbourhood of the River Quolie, from which a supply of water became obtainable. The plaintiffs, who were millowners on the river, and therefore entitled to its free and uninterrupted flow, made a twofold complaint. They said, first, that the excavation tapped water which was not underground, percolating, or oozing water, but water flowing through a certain defined underground channel; and, secondly, they complained that the operations of the Commissioners drew water direct from the Quolie. Upon the first point there was much evidence both ways. In the result, the Vice-Chancellor found as a fact that there formerly existed along the place of the alleged underground defined channel "a known and visible surface channel," and that this surface channel had become filled up with stones and soil coming down from the high ground adjoining it, but that the water continued to flow under the stones and other material through a defined channel. On this point, therefore, he held that the case of *Chasemore v. Richards* did not apply, because here was an instance where a known and defined underground channel had been tapped. On the second point, he decided that, as a matter of fact, the cutting of the trench close to the banks of the Quolie abstracted water actually flowing in the river. He therefore granted an injunction.

The case is the more valuable for the light it throws upon the earlier decision in Ewart's case. Upon the question of what is a "known" or "defined" channel, the Vice-Chancellor said:

So far the law on the subject is clear, but a difficulty appears still to exist as to the application of this rule by reason of the use of the word "known" in connection with the word "defined;" and it does not seem to have been sufficiently laid down as yet what the nature or extent of the knowledge is which must be proved to exist in order to constitute the riparian relation. It cannot mean that a channel should be visible throughout its course, which would be an impossibility from the very fact of its being subterranean. In considering this question, the knowledge required cannot be reasonably held to be that derived from a discovery in part by excavation exposing the channel, but must be knowledge, by reasonable inference, from existing and observed facts in the natural, or rather the pre-existing, condition of the surface of the ground. The onus of proof lies, of course, on the plaintiff claiming the right; and it lies upon him to show that, without opening the ground by excavation, or having recourse to abstruse speculations of scientific persons, men of ordinary powers and attainments would know, or could with reasonable diligence ascertain, that the stream, when it emerges into light, comes from, and has flowed through, a defined subterranean channel. The instance given in some of the cases of a stream sinking underground when it reaches a certain place, pursuing for a short space a subterraneous course, and then emerging, shows plainly the kind of knowledge required. No one knows, as a matter of fact, that it flows underground from the one point to the other in a defined channel, or, indeed, even that it is the same stream; but our reason, grounded on our knowledge of ordinary natural laws, and on the impossibility or great improbability of the phenomena being otherwise accounted for, leads to an inference of fact, amounting practically to knowledge, that it is the same stream, and that it has flowed underground in a defined channel. The question of fact to be determined in such cases is, whether the water appearing at a given point and then becoming a surface stream comes from subterraneous percolation or oozing, or flows in a defined channel or watercourse underground to the point where it so appears; and for the decision of that question it lies on the party asserting his right to the flow to show affirmatively—not as a matter of fact, but as a reasonable inference from known facts—that the water comes to the place of emergence, not by percolation or oozing, but in a defined channel. Beyond this I do not think proof of knowledge can be required without destroying the claim of right to the flow of underground streams altogether.

In the case of *M'Nab v. Robertson*, in 1897, in the House of Lords, the primary question was whether water percolating discontinuously through or along strata can properly be described as a "stream." A lessor demised by lease a distillery, cottages, 13½ acres of land with two ponds, "together with right to the water in the said ponds and in the streams leading thereto." The lease contained a warrandice clause (covenant for title). The lessor afterwards sunk a tank on ground outside the demised premises, and drew off, from marshy ground, percolating water which would have found its way eventually into one of the ponds. The lessee of the distillery complained of this, for it lessened the water in the ponds; and the question resolved itself into whether the landlord was derogating from his lease, which included the "right to the water in the said ponds and in the streams leading thereto." Lords Watson, Shand, and Davey held (affirming the decision of the Court of Session in Scotland) that the water percolating through the ground towards the pond was not water in any "stream" leading to the pond. The Lord Chancellor (Lord Halsbury) differed from this view, because, on a question of the construction of the lease, he held that, as between the lessor and lessee, all the sources of supply of the ponds were included in the words "water in the said ponds and in the streams leading thereto." Lord Watson, in the course of his judgment, said:

According to my apprehension, the word "stream," in its primary and natural sense, denotes a body of water having, as such body, a continuous flow in one direction. It is frequently used to signify running water at places where its flow is rapid, as distinguished from its sluggish current in other places. I see no reason to doubt that a subterraneous flow of water may in some circumstances possess the very same characteristics as a body of water running on the surface. But, in my opinion, water, whether falling from the sky or escaping from a spring, which does not flow onward with any continuity of parts, but becomes dissipated in the earth's strata, and simply percolates through or along those strata until it issues from them at a lower level, through dislocation of the strata or otherwise, cannot with any propriety be described as a stream. And I may add that the insertion of a common rubble or other agricultural drain in these strata, while it tends to accelerate percolation, does not constitute a stream as I understand that expression.

The Lord Chancellor referring to the expression "streams," said he thought the root idea was "water in motion from one place to another, as distinguished from stagnant water."

In the case of *Womersley v. Church*, in 1867, it was decided by the Master of the Rolls (Lord Romilly) that the owner of a well is entitled to an injunction to restrain his neighbour from so keeping and using a cesspool on his land as thereby to pollute the water in the well. The point which was here made for the defendant was that the water which supplied the well was underground percolating water not flowing in any defined channel, and that the plaintiff had no title to it until it reached his well and so became impounded; and that if it was polluted on the way before it was so impounded, the plaintiff had no cause to complain. That contention, however, did not prevail.

A later case on this subject is the more interesting from the instructive judgment of Lord Justice Lindley (now Master of the Rolls). It is the case of *Ballard v. Tomlinson*, in 1885. The plaintiff was a brewer at Brentford, and the owner of land and premises there, where he and his predecessors had for years carried on the business of brewers. From 1849, until a few years before 1882, when the action was commenced, the water used for the purpose of the brewery was drawn from a deep well upon the premises. This well was sunk through the London clay and the sand immediately below into the chalk stratum to a depth of about 300 feet beneath the surface. Both the sand and the chalk were water-bearing strata, from which the water found its way, by natural pressure, into the well, and thence was pumped up for the use of the brewery. The defendant Tomlinson was the owner of land and premises adjoining the plaintiff's, and only separated from the brewery by a public highway. A few years before the action, the defendant Tomlinson erected on his premises a printing-house which he let to the other defendant, Jackson, who occupied it for his business. There was a deep well also on the defendant's land, going down to about the same depth as the plaintiff's well—the distance between the two being about 99 yards. The level of the surface of the ground at the defendant's well was about 10 feet higher than that at the plaintiff's well. The defendant's well had formerly supplied water to a distillery which had once been carried on at the defendant's premises; but the distillery had been discontinued in 1874, when the defendant Tomlinson constructed a drain from a water-closet attached to the printing-house, by means of which the sewage of the closet and the refuse of the office found its way into the defendant's well. The two wells had a common source of supply of water, which percolated underground from the defendant's land to that of the plaintiff, and there was evidence that the sewage and refuse which were discharged into the defendant's well polluted such common source of supply to such an extent that the plaintiff was unable to use the water from his well for brewing purposes, and that he had in consequence thereof sustained damage. It was held by the Court of Appeal, reversing the decision of Mr. Justice Pearson, that, though until the plaintiff had appropriated the percolating water by impounding it in his well he had no property in it, and though he could only

appropriate the water by the artificial means of pumping, yet that he had a good cause of action, and was entitled to an injunction. To appreciate the *ratio dicidendi* in this case, it is very instructive to read the judgment of Lord Justice Lindley. He said:

> If a man chooses to put filth on his land, he must take care not to let it escape on to his neighbour's land, and not to let it poison the air which reaches it. So if a man chooses to poison his own well he must take care not to poison waters which other persons have a right to use as much as himself. To hold the contrary, on the ground that the water is not their property until they get it, and that it is poisoned before they get it, is to take an inadequate view of the subject, and to overlook the fact that the law of nuisance is not based exclusively on rights of property. Light is not property; and yet if a man has a right to have it come to his windows, he can maintain an action against those who prevent it from so coming. So air is not property; but a man who poisons the air which another has a right to breathe, commits an actionable wrong.

The learned Judge then, after referring to *Womersley v. Church*, *Hodgkinson v. Ennor* (1863), and *Whaley v. Laing* (1858), said these decisions showed that *primâ facie* one man had no right to foul water which another had a right to get; and if he had a right to get it, the fact that by pumping he drew it partly from the defendant's land was immaterial.

The law thus settled was followed in the later case of *King v. Oxford Co-operative Society*, in 1884, where paraffin oil leaked from barrels stored on the defendants' premises, and found its way into the plaintiff's well.

It was settled by the decision of the House of Lords in *Backhouse v. Bonomi*, in 1861, that an owner of land has a right at common law to support from the adjacent and subjacent soil. This right does not depend upon prescription, but is inherent in the property. That being so, the question arose whether an owner of land has any such right at common law to the support of underground water. The Court of Exchequer decided that there was no such common-law right of support; and the Court of Exchequer Chamber, on appeal, affirmed the decision. (See *Popplewell v. Hodgkinson*, in 1869.) In view of later decisions, it becomes desirable to examine the facts of this case. The defendants had made excavations to a great depth, for the purpose of the foundation for a church about to be erected on wet and spongy land. The consequence was to let down certain cottages of the plaintiff, built about two years previously on adjoining land of the same character. Before erecting his cottages, the plaintiff had done nothing with the land, either by draining or otherwise, to make it more suitable to bear the weight of the cottages. By the excavation, the plaintiff's land was drained, and it subsided, and the cottages were cracked and injured. The land would have subsided even if no buildings had been erected on it. The Judges who heard the case were Lord Chief Justice Cockburn and Justices Keating, Lush, Hannen, and Brett. The judgment of the Court of Exchequer Chamber was delivered by Lord Chief Justice Cockburn, who said they were all of opinion that the judgment of the Court below ought to be affirmed. Though there was no doubt that a man had no right to withdraw from his neighbour the support of adjacent soil, there was nothing at common law to prevent his draining that soil, if for any reason it became necessary or convenient for him to do so.

It may be added that a point was made in the course of the case, that the land on which the excavation was made and the land of the plaintiff originally belonged to the same owner, and that he conveyed both in 1835 for building purposes, subject to a chief rent. The purchaser in 1864 disposed of the plaintiff's portion for similar purposes; and the various conveyances contained covenants on the part of the grantees respectively to build a sufficient number of messuages or dwelling-houses to secure the rent reserved. The Lord Chief Justice on this point said:

> Although it is true that the plaintiff's land and the land which has been drained once had a common owner, and although the plaintiff's land was, in a certain sense, conveyed to him for building purposes, at all events so far as the stipulation to build to secure due payment of the perpetual rent-charge goes, yet there is nothing to warrant the inference that there was an implied condition in the grant to prevent the defendant from doing with the adjacent land what was really incidental to its ordinary use—draining it in order to render it more capable of being adapted to building purposes.

In an earlier case in the House of Lords—viz., that of *Elliot v. The North-Eastern Railway Company*, in 1863, it had been decided that a railway company who had purchased a piece of land for the construction of their line and a railway bridge were not entitled to the additional support furnished by the water in a drowned mine.

The decision in the case of *Popplewell v. Hodgkinson* was very much discussed in the later case of *Shelfer v. City of London Electric Lighting Company* and *Meux's Brewery Company v. City of London Electric Lighting Company*, in 1895. The plaintiffs in these actions were respectively the owners and the tenant of a public-house called the Waterman's Arms, situated at Bankside, on the Thames. The defendants, in 1891, acquired land adjacent, but not contiguous, to the Waterman's Arms, and situate on the western side thereof, and they erected on the land so acquired sheds, engine-houses, a shaft, and all the buildings and machinery necessary for forming a large central station for the purpose of supplying electric light over a considerable area. Foundations for the works were sunk from 25 to 30 feet below the surface of the ground. The plaintiffs complained of vibration and noise, and a crack in the wall, which extended through two storeys, and was in some places 2 inches in width; and a hearthstone was also cracked. The defendants contended that, if there had been subsidence, it was due to the abstraction of water owing to the excavations they had made; and they argued that there was no right of action for diminution of support by abstraction of subterranean water—relying upon *Popplewell v. Hodgkinson*. In reply, it was argued for the plaintiffs that the case cited, though an authority as regards natural support, had nothing to do with easement or grant, which was what the plaintiffs relied upon; and Mr. Justice Kekewich, in deciding the point, said:

> The case cited on this point is *Popplewell v. Hodgkinson*. But, as was pointed out by Mr. Warmington, that case does not depend on grant. Here I have a case of grant—that is to say, I have a case of a statutory right by a prescription equivalent to grant; and if the defendants, being the adjoining owners, have deprived Meux's Brewery Company of their support, the Brewery Company can sue them on that ground, notwithstanding, as it seems to me, that they have withdrawn that support by withdrawing the water in the soil. There is no right of action against them for withdrawing the water which is only percolating through the soil, and does not run through a definite channel. Meux's Brewery Company could not claim on that ground. But if by reason of doing that which is lawful—that is to say, withdrawing the water—the defendants have done that which is unlawful, and withdrawn the support, then the right of action seems to follow.

His Lordship, in the result, decided that what the defendants had done amounted to a nuisance at common law; but he refused an injunction—thus leaving the plaintiffs to make their claim for damages. The case ultimately went to the Court of Appeal, and there the sole question was whether or not there should be an injunction, which they granted. Nothing turned upon the question of support.

Though you may abstract underground percolating water from your neighbour's land in the way before indicated, an important qualification arises where you cannot do this without taking along with the water soil, such as running silt or sand, if you thereby cause your neighbour's land to subside. This point arose in the case of *Jordeson v. Sutton, Southcoates, and Drypool Gas Company*.* The defendants in this case were a Gas Company duly authorized by a Special Act to erect on certain lands, shown on the deposited plan, and described in the schedule, gasholders and other works for the manufacture and storage of gas. Under these powers, they proceeded to excavate the land in question for the purpose of erecting the gasholder. In doing so, they penetrated a large and extensive stratum of what is called "running silt," consisting of fine sand or silt and stagnant water—the expression "running" merely indicating that if the stratum were cut into the silt would run through the opening made. In their natural and undisturbed state, the component parts of the stratum were uniform throughout; there was no sediment of silt at the bottom, and the water was found at all parts. This stratum was well known to persons acquainted with the geological structure of the earth at Hull, and was, it appeared, a constant source of trouble to all who had to make deep excavations into it for building and other purposes. It extended for some miles both in length and breadth; it was some 6 feet in thickness, and commenced some 22 feet below the surface of the land on which the defendants' works and the plaintiff's houses stood. The boundary between the plaintiff's land and that of the defendants was about 6 feet from the excavation; and the plaintiff's houses were from 7 to 12 feet from the boundary. The defendants excavated to a depth of 37 feet from the surface. They took the precautionary measure of constructing a temporary barricade to seal up the stratum and prevent the silt from falling in. The excavation was kept dry by frequent pumping, the effect of which was to cause large quantities of water, together with some silt from the stratum under the plaintiff's land, to ooze into the excavation through the interstices in the barricade. This water again had to be got rid of by pumping—some of the silt coming away with it in the process. It was not alleged that the plaintiff's houses by their weight caused the land to subside more than it would have done without them. As to the consistency of the stratum in question, the evidence went to show that the quantity of water in it changed from time to time according to the rainfall—the proportion of water to silt or sand varying, according to different witnesses, from one-tenth of water to nine-tenths of silt, or from one-fifth of water to four-fifths of silt; all the witnesses agreeing that the silt always greatly preponderated over the water. In draining their excavation, the defendants withdrew a large quantity of the running silt from under the plaintiff's land, and thus caused a subsidence of the surface, with consequent structural injury to his houses.

There were two points decided by the Court of Appeal in this case, which it is desirable to keep quite distinct for our present purpose. The first point I will deal with at once, and it is this: The defendants' Special Act incorporated, as is usual, the Gas-Works Clauses Acts, 1847 and 1871. Both of these Acts contain a nuisance clause, providing that "nothing in this or the Special Act contained shall prevent the undertakers from being liable to an indictment for nuisance, or to any other legal proceeding to which they may be liable, in consequence of making or supplying gas." The Court of Appeal decided that the works of the defendants constituted a nuisance within the meaning of these Acts, and that "nuisance" included nuisance to private individuals as well as to the public. The second point decided is, however, a more important one for our present

* See *ante*, p. 545.

occasion. A majority of the three Judges (the Master of the Rolls and Lord Justice Rigby) decided that the plaintiff's land was supported, not by a stratum of water, but by a bed of wet sand or running silt; and that as the defendants had caused the subsidence of the plaintiff's land by withdrawing this support, they had committed an actionable nuisance at common law entitling the plaintiff to damages. They therefore held that the decision in *Popplewell v. Hodgkinson* was inapplicable, as dealing only with support by water. Lord Justice Vaughan Williams, upon his view of the facts, held that the subsidence had been caused by the withdrawal of subterranean water support, and therefore that *Popplewell v. Hodgkinson* applied. The difference between the Judges seemed to be upon the question of fact rather than upon any question of law—in other words, whether what was withdrawn was in fact land support or water support.

The same point arose in America in the case of *Cabot v. Kingman* in 1896. The case was argued in the Supreme Court of Massachusetts before seven Judges. A majority of four to three decided in favour of the view adopted by our own Court of Appeal; Chief Justice Field observing:

Whatever may be true of percolating waters, we think that the defendants had no right to take away the soil of the plaintiff in land which they had not taken under the statutes, and that it is immaterial that the soil was removed by means of pumps from the trench into which it had fallen by its own weight, or had been carried by percolating water. We are unable to distinguish the case from one where the soil falls in from the surface in consequence of an excavation in the adjoining land. The plaintiff, if the facts be as he offered to prove, had been deprived of the lateral support to his land, in consequence of which the quicksand has run from under the surface of his land into the trench, and has been removed by means of pumps; and this has caused the surface to settle and crack. It was the duty of the defendants to prevent this in some manner if they did not take the plaintiff's land.

In connection with the Jordeson case, mention may be made here of the case of *Trinidad Asphalte Company v. Ambard* in 1899. It appears that at La Brea, in the Island of Trinidad, where the land slopes down from the Pitch Lake to the sea, a distance of about a mile, there is found near the surface a stratum of asphalte or pitch. In some places it crops out on the surface; but for the most part it lies at a depth varying from 4 to 7 feet. So long as it is undisturbed, it is stable and firm enough to support the soil above it in its natural state. The lands of the plaintiffs and the defendants adjoined; that of the defendants being at a somewhat lower level. The defendants excavated their land, thereby withdrawing support from the plaintiff's land. As the result, the section of the stratum of pitch thus exposed to the atmosphere began to melt and to ooze out, and the surface of the plaintiffs' land to sink and crack. A depression was formed, in shape like half a saucer, about 5 feet deep in the centre at the boundary line, and going back in a semicircle with a radius of about 60 feet. The judgment of the Privy Council was delivered by Lord Macnaghten, who said that it was not necessary to discuss the question as to the right of support from subterranean water, because the substance which afforded support in this case was not water.

The case of *Popplewell v. Hodgkinson* was much discussed in Jordeson's case. As has been pointed out, the majority of the Judges in that case held that the decision in *Popplewell v. Hodgkinson* was not applicable, because it dealt only with support by water. The Master of the Rolls, taking that view, said:

In this view of the evidence, it is unnecessary for me to decide whether, if the defendants had done nothing more than pump underground water from their own land, and thereby let down the plaintiff's houses, an action could have been maintained against them. *Popplewell v. Hodgkinson* looks like, and has generally been regarded as, an authority that no action will lie in such a case. But I am not satisfied that this broad question can be considered as finally settled by that or any other decision. The question involves very important considerations. Two conflicting rights have to be reconciled—namely, the right to support and the right to pump water. It is not necessary to decide which is to give way to the other. I leave the question where it is.

Lord Justice Rigby, who took the same view, said:

It has been argued that the case of *Popplewell v. Hodgkinson* has established the rule that under no circumstances can there be any right to support to land from water, or, in other words, that any landowner may, by operations on his own land, draw away water not flowing in a defined stream from beneath his neighbour's land without regard to any consequence which may arise to that neighbour. Even if this were so, it would not follow that a bed of running silt, such as we have to deal with in the present case, could be drawn away; and in my judgment the extreme logical conclusion from the proposition really established in *Popplewell v. Hodgkinson* would not lead to such a result. That case, in my opinion, has no application to the present. I do not, therefore, intend to express a final judgment as to the exact interpretation of that case, though, as at present advised, I am by no means prepared to give it so far-reaching an effect as is contended for. . . . If, with regard to a swampy tract of land, it were held that no man could drain his own soil because by so doing he would also drain his neighbour's, and so let down the surface, the ordinary beneficial enjoyment of the land would be impossible without agreement by all the landowners affected, and the rule would be: "Once a morass, always a morass." It is against this extreme logical result that I am disposed to consider the decision in *Popplewell v. Hodgkinson* to be directed. Having come to the conclusion that in such a case as that before the Court there was no natural right on the part of the plaintiff to prevent his neighbour from draining his land for ordinary uses that might be foreseen (including, under the circumstances of the particular case, the obtaining of a proper foundation for substantial buildings), though the result might be to let down the plaintiff's surface in its natural condition, the conclusion was not altered by the fact that, two or three years before action, the plaintiff had chosen to build small houses on the insecure foundation of his own swampy soil. The Court recognized the possibility of such a right as that claimed by the plaintiff being conferred by grant, express or implied, which, in my judgment, involves the conclusion that, when support to buildings from water is enjoyed for twenty years, the right to it becomes absolute.

Lord Justice Vaughan Williams, who took the view that what was withdrawn was water, approved of the decision in *Popplewell v. Hodgkinson*, and in the course of his judgment said "it seemed to him that the right of support by water to soil did not depend upon the same considerations as the right of support by soil;" and he also said:

To affirm the right of support is to affirm that no land can be drained, or well or trench dug, without the risk of an action for letting down the surface of neighbouring land. I cannot persuade myself that such a right is for the interests of society, or essential to the beneficial ownership of land; and if the right is based upon an implied grant supposed to be made when lands belonging to one proprietor were divided by him between two or more other persons, it seems going very far to invent obligations in respect of unknowable and changing subject-matter like underground water. On the whole, I think that both the decided cases and the reason of the thing negative the right of support by water; and this conclusion is fortified by the absence of any affirmation of such a right in the English authorities and text-books, and by the terms in which the right of support is dealt with in the Roman law.

It is to be borne in mind that the decision in the case of *Popplewell v. Hodgkinson*, though resting on the high authority of the Exchequer Chamber, is not a decision of the highest tribunal. The doubts which have been suggested by the Judges in regard to it are of two kinds. In the first place, it is hinted that the whole question whether there is any right of support from underground percolating water (upon facts such as existed in that case) may require reconsideration. In the second place, a new question is suggested—viz., whether such a right may not be acquired by grant expressed or implied. A case of the latter kind was attempted to be made out in *Popplewell v. Hodgkinson*, but failed on the facts. In Shelfer's case, a case of prescription under 2 & 3 Wm. IV., cap. 71, sec. 3, was set up on the principle of *Dalton v. Angus* (1881). In the latter case, the House of Lords decided that a right to lateral support from adjoining land can be acquired by twenty years' uninterrupted enjoyment for a building proved to have been newly erected (or altered so as to increase the lateral pressure) at the beginning of that time, provided that the enjoyment is peaceable and without deception or concealment, and so open that it must be known that some support is being enjoyed by the building. The enjoyment must, in legal phraseology, have been *nec per vim*, *nec clam*, *nec precario*. Lord Selborne there, after quoting these words, says: "All these conditions are capable, in my judgment, of being fulfilled as to the right of support to buildings." It is a coming question whether they are capable of being fulfilled as to support by underground water. Mr. Justice Kekewich, in Shelfer's case, decided in favour of a right of support founded upon the statutory prescription which presumes a grant. The remarks of at least one of the Judges in Jordeson's case would seem to tend in the same direction, though all of the Judges reserved their judgment on the point. What is to be the upshot, time must soon determine. The consequence of a decision by the House of Lords upholding a prescriptive right after twenty years' enjoyment must have a vast and far-reaching effect, and must seriously affect building operations where underground water is likely to be met with. Jordeson's case was taken by appeal to the House of Lords, and came on for argument a few weeks ago. After the arguments had proceeded for some time, the parties came to terms.* We are therefore deprived for the time of the advantage of knowing the views of their Lordships upon the interesting questions discussed in the Court of Appeal.

The Court of Referees in Parliament, in dealing with this matter, have acted on the principles laid down in *Chasemore v. Richards*. They have disallowed *locus standi* where mere underground percolating water is threatened, and they have allowed it in cases where they have been satisfied that there was *primâ facie* evidence of the existence of an underground defined and known channel. Where the supply is in the hands of local authorities, and they derive their water from an artesian well or wells, it sometimes happens that these are threatened by a scheme for sinking another well in the neighbourhood. In such cases, local authorities have *locus standi* to protect their water supply, not on the ground of any right to underground water, but because of the Standing Order of the House of Commons providing for *locus standi* where they allege that their district will be injuriously affected. A notable instance in point is that of the Nottingham Corporation Bill of 1897. The proposal of Nottingham was to sink artesian wells into the pebble beds of that region. Various other Local Authorities—Mansfield, Newark, and others—had already, at great expense, sunk wells of their own in various parts of the pebble beds. These Local Authorities were heard to oppose the Bill on the ground that their wells would be prejudicially affected by those proposed by Nottingham. But what if the then existing wells had not belonged to local authorities but to private individuals or to a water company? They would probably have had no *locus standi*—at least in the House of Commons. Instances of seeming hardship sometimes arise. Take the case of Hertfordshire, which already complains of being unduly drained by the wells of the New River Company. In 1896, the Company promoted a Bill for power to sink more wells. In that case the landowners might not have had *locus standi* but for the fact that the Bill was referred to a Hybrid Committee, before whom all petitioners are heard without the ordeal of passing through the Court of

* See *ante*, p. 545.

Referees. A Hybrid Committee is, however, not always considered a satisfactory tribunal.

I may add, in conclusion, that County Councils have, by the Standing Orders of both the House of Lords and the House of Commons *locus standi* to oppose Bills relating to water supply, where they allege that the county, or any part thereof, will be prejudicially affected.

REGISTER OF PATENTS.

Coin-Controlled Vending Attachments for Gas-Meters.—Burchard, L. S.; a communication from W. Webber, of New York. No. 2681; Feb. 6, 1899.

As the title indicates, this invention relates to a machine which can be fixed complete to existing meters; the valve controlling the supply of gas being connected to, and forming part of, the machine, rather than of the meter proper. The valve is opened by a certain portion or division of the machine which, except for the time when a coin proper to the machine is inserted in it, and employed as the ward of a key, is inoperative as to all other parts of the machine. Of course, if the power of the purchaser's hand were allowed to open the valve positively and directly, it would be possible to open the valve partially, and, by then holding the handle in this position, to obtain an indefinite supply of gas. Hence the arrangement provided only allows the power of the purchaser's hand, operating through the coin, to compress and release a spring in such fashion that the purchaser must part irrevocably with his control of the coin before the spring can act to open the valve—without the inserted coin, the purchaser cannot compress the spring; and till he parts with the coin, the spring cannot act to open the valve and set the valve-closing part a certain distance away from its zero or valve-closed position. Each subsequent coin inserted and rotated by the purchaser, while having no effect upon the valve, serves to cause the spring to set the valve-closing part another prescribed step or distance from zero. This step-by-step recession of the valve-closing part—*i.e.*, its path or movement in the valve-opening direction—is in the arc of a circle, and is effected by causing the spring to deliver tangential blows against the periphery of a circular toothed rack, by means of a pivoted pawl projected into, and withdrawn from, engagement with the rack by the spring acting on the pawl through cams. The rack and the valve-closing part are fixed to the same shaft, and move together. Attached also to the shaft is a justifying disc, which is divided into equidistant recesses—each corresponding exactly to the step or arc of rotation intended to be given to the valve-closing part by each coin inserted. For instance, if it is intended that one coin shall remove the valve-closing part one-tenth of a circle (36°) from zero, the disc will have ten teeth, if one-twelfth (30°) twelve teeth, and so on. It is evident that, if the steps are tenths, and ten coins were successively inserted at one time, the valve-closing part would be rotated completely around against the wrong side of the valve-closing lever, and would act to close the valve, and the parts would be in the zero position again. To prevent this, a portion of the periphery of the toothed rack is left blank or mutilated of teeth; so that if more (say) than eight coins be inserted at one time, the pawl becomes inoperative as to the rack, and the coins drop idly into the till without forcing or injuring the machine.

This main portion of the machine—viz., that in which the coin acts as a gag or temporary mechanical part—is provided with various special features, so as to prevent the improper or fraudulent use of the machine: *e.g.*, the use of too large or too small a coin, of coins or strings, wires, tapes, strips, &c., waxing, sticking, or wedging them in the coin-carrier in order to prevent their discharge, inserting strips of metal through the slot, &c. These and the other constructional details are not describable apart from the sheets of drawings (five in number) which accompany the lengthy specification—11 pages in all. There are 23 separate claims made for the patent.

Producing Tough Incandescent Mantles.—Hentze, O., and Müller, H., of Leipzig. No. 4589; March 2, 1899.

The patentees claim that, after "many laborious experiments," they have succeeded in discovering a process of manufacturing incandescent gas-burner mantles, by means of which such resistance and hardness can be imparted to them "as make them insensible against rough handling and careless shocks, not only without reducing their candle power, but actually increasing it, as clearly shown by experiments."

The process consists in impregnating mantles or hoods made of a tissue of cotton, wool, or silk, with the nitrates of thorium and cerium, or the like, "with the addition of Carlsbad salts and Carlsbad mineral spring-water of any one or all the different sources of Carlsbad, or their ingredients."

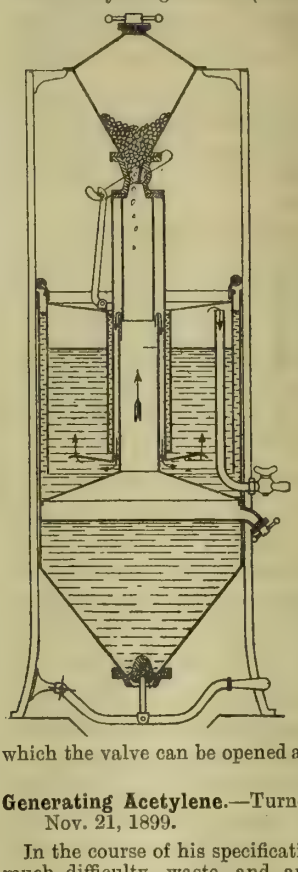
Igniting Gas-Burners from a Distance.—Bollé, C.; a communication from C. Fitzlaff, of Berlin. No. 6473; March 25, 1899.

This invention relates to electrical apparatus attached to a gas-burner in such a way that of the two separately excitable equal bobbins of which it is composed (for the ignition and extinction of the gas respectively), the ignition-bobbin has to perform more work than the extinction bobbin, in consequence of having to attract the armature to a greater distance than that of the armature of the extinction-bobbin, and also to lift a spring loaded contact and sparking rod, in order that a current capable of effecting the opening of the gas-cock will also effect its closing with certainty.

To light a gas burner, a pilot jet is arranged at its side, which is first lit by an electric spark, which then lights the main burner. For this purpose, a bye pass is arranged above the cock leading to a vertical tube, which is in conductive connection with the ignition bobbin, and armed at its upper end with a strip of platinum. Inside the tube, but insulated from it, an igniting contact rod is arranged, which at its upper end is armed with a platinum point ordinarily resting upon the strip of platinum and at its lower end is at such distance from the ignition armature that the latter has to lift the igniting rod before opening the cock. When a current sent through the ignition bobbin can do this, the platinum strip and point are separated, and the sparks between them light the pilot-jet, which in its turn lights the main burner. If the current is insufficient to do this, the cock remains closed; but if it is sufficient to do so, and if the force required for lifting the igniting-rod is greater than that needed for turning the cock, the current will have also sufficient strength to close the cock when the extinction-bobbin is excited by pushing down the extinction-button. A spring is arranged for pressing the igniting-rod downwards, by means of which the force required for lifting it can be adjusted so as to meet the above requirements.

Acetylene-Generator.—Berger, F., of Vienne, France. No. 6933; March 30, 1899.

This acetylene generator (as shown) comprises a water-reservoir, divided in two by a partition. The upper compartment forms a gas holder and also a purifier for the gas; the lower one serves for evolving the gas. In the upper compartment is a bell furnished with lugs, to which is pivoted a link having at its free end a notch and a heelpiece or projection. To the lower end of the receiver for the carbide is affixed a distributor, consisting of a box with a passage in which revolves the spindle of a distributing-valve. To the under part of the base of the distributor is fixed a cylindrical body concentrically arranged to the gasholder bell. This cylinder is fitted with an internal pipe serving for the passage of the carbide; the cylinder terminating at its lower end with a disc having small perforations for the purpose of dividing the gas entering the water in the upper compartment. In order to allow of the deposited lime being removed from the tank, this latter is made of funnel-shape at the lower end, and is closed by a valve formed of a disc of india-rubber compressed between two metallic discs (the one concave, and the other convex) on a spindle provided with a forked head. The spindle is pivoted by its forked head to an operating lever arranged externally to the funnel, and by means of which the valve can be opened and closed as desired.



Generating Acetylene.—Turner, T. G., of New York. No. 23,179; Nov. 21, 1899.

In the course of his specification, the patentee remarks that heretofore much difficulty, waste, and annoyance have been occasioned in the manufacture of acetylene on account of the premature decomposition of the calcium carbide and the consequent escape of the gas. It has been proposed to feed the carbide to the water through the medium of valved hoppers, moveable buckets or receptacles, and other discharging means; but with such constructions, "the mounting of the moveable discharging appliances cannot be made sufficiently tight to prevent the escape of gas from the generator, and still allow the automatically operated devices by means of which the discharging means are manipulated to accurately perform their functions with a necessary degree of certainty." Furthermore, in handling the carbide to transfer it from the original packages

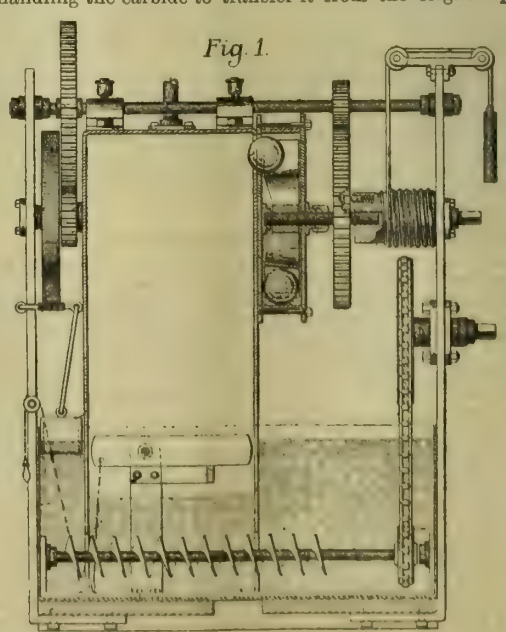


Fig. 1.

to the apparatus, and depositing it in the hoppers of the discharging devices, the carbide is attacked by the moisture contained in the atmosphere, and slacked to a greater or less extent—causing it to set free the gas. And again, "the handling, storage, and shipment of calcium carbide are attended with much danger on account of fire; and for this reason insurance companies have refused to permit the use of acetylene gas apparatus on insured property, and railroads have refrained from assuming the great risk arising from the dangers incident to the handling

of calcium carbide." It is the object of this invention to obviate all of these difficulties by providing appliances (as shown in the engraving) with the use of which the calcium carbide will be tightly enclosed from the time of packing for shipment until it is subjected to the action of

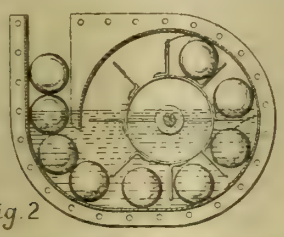


Fig. 2

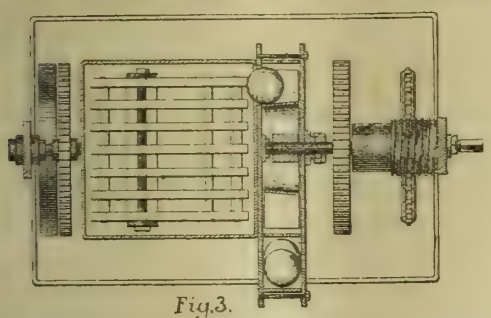


Fig. 3.

water in the generator. Further objects are (1) to provide appliances for feeding carbide into a generator, by means of which the premature, and also the subsequent, escape of gas will be prevented; (2) to provide devices for feeding carbide to a receptacle which shall be automatic in operation, and which shall avoid all possibility of leakage of gas without depending upon closely fitting packing devices between moving parts; (3) to so construct the apparatus that the carbide will be liberated from its container automatically and entirely after it shall have been deposited into the generator; and (4) to so construct the appliances that the carbide will be automatically liberated by the mutilation of its container upon its arrival within the generator.

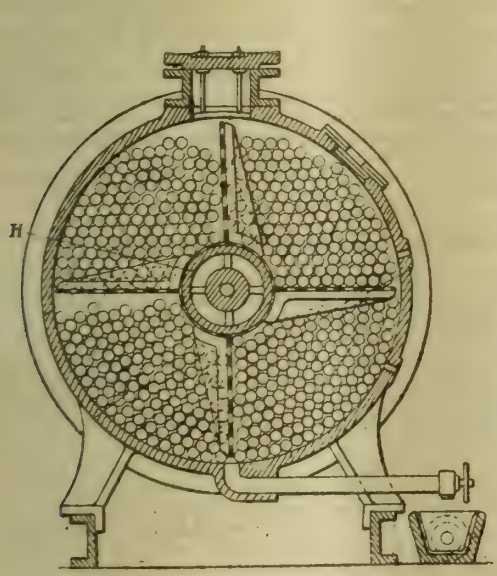
The arrangement consists in certain combinations of well-known parts of apparatus, as shown in the illustrations—a sectional view, an enlarged view, showing the feed wheel, its casing and water-seal, and a horizontal sectional view. The working of the plant will be clear, without any more extended reference to the engravings.

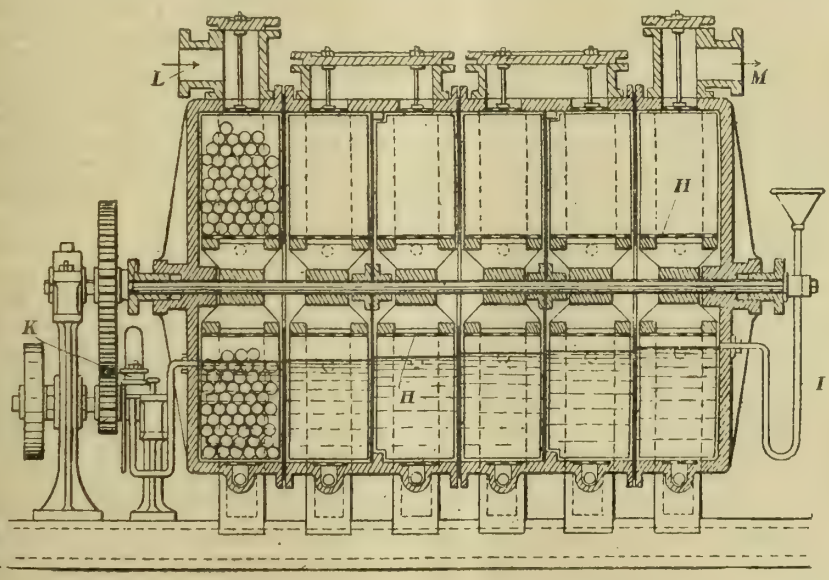
Liquid-Meters.—Kent, W. G., of High Holborn, W.C. No. 6936; March 30, 1899.

This invention relates to water-meters having a cylinder to which liquid is admitted and withdrawn by means of a slide-valve—such as are described in patent No. 21,793 of 1891. In such meters, if there is only a small flow of water, it sometimes happens that the pistons and valves do not perform their full stroke; the result being that the fluid-passage through the valve is unduly contracted. According to the present invention, a spring or its equivalent—such as a tumbling weight, a double inclined plane, or the like—is provided, tending to move the valve to its extreme positions immediately it has passed its central position; and preferably the spring which keeps the valve against its seat is employed for this purpose. This may be done by pivoting to the back of the valve a short lever or rocker, whose other end is pivoted to the ends of a bow spring. The valve moves towards its central position against the spring (which is bent outwards) until the rocker is at right angles to the valve; but immediately this point is passed, the tendency of the spring is to force the valve onwards.

Scrubbers.—Zschocke, G., of Kaiserslautern, Germany. No. 24,056; Dec. 2, 1899.

This invention relates to a gas-scrubber charged with loose filling of any suitable description, but preferably of globular form—such, for example, as wooden spheres, loosely arranged in the several compartments. The shaft of the scrubber is provided with wings or blades which, when rotated, cause the scrubbing medium to be constantly agitated, so as to more effectually remove the ammonia and tar from the lower parts of the scrubber, and prevent any clogging by the tar. The





scrubbing surface of the filling material may be increased, says the patentee, by perforating the same in several directions.

As shown, the scrubber consists of a cylindrical casing having partition-walls, which divide it into a number of compartments or chambers, connected by openings arranged alternately in the middle and at their upper portion. Each chamber is furnished with several wings or vanes covered with perforated plates or sheets, and firmly secured to the central shaft. In order to prevent the filling material passing from one chamber to another through the openings in the partition-walls during the rotation of the scrubber, each chamber is provided with a perforated drum H adapted to rotate with the wings or vanes. The liquid for washing the gas enters through a pipe I into the first chamber at the right-hand side, and fills it to a certain level; whereupon the liquid flows from one chamber to another, and is discharged "in the form of a rich ammonia water" from the last chamber at K. The gas to be scrubbed enters at L at the opposite end of the scrubber; flows between and through the filling material in the first chamber on the left in a radial direction towards the middle; then into the second chamber, passing through it in a radial direction towards the periphery; then through the openings near the periphery of the casing into the third chamber; and so on until it leaves the scrubber at M. The shaft receives motion from gearing arranged to revolve it in one direction only, or, if desired, to reverse the movement automatically at predetermined times.

APPLICATIONS FOR LETTERS PATENT.

4134.—Tully, C. B., "Enriching gases for illuminating purposes." March 5.
4182.—Prager, A., "Automatically igniting gas-lamps." March 5.
4187-8.—Metzger, J. P., "Pressure-regulating valves." March 5.
4191.—Berry, S. H., and Seagrave, G., "Generating acetylene gas." March 5.
4195.—Widmann, W., "Acetylene gas-generators." March 5.
4200.—Bergdolt, L. F., "Acetylene gas-generators." March 5.
4230.—Fitzpatrick, H. D., "Electric gas-lighters." A communication from C. Hubert. March 6.
4259.—Fraser & Chalmers, Ltd., and Whitmore, F. L., "Governors for gas or air compressors." March 6.
4260.—Hicks, W. G., "Automatic gas lighting." March 6.
4307.—Kent, W. G., "Liquid-meters." March 6.
4342.—Coombs, J. A., "Gaseous fluid compressors." March 7.
4356.—Miller, G. H., "Gas cooking stoves and grills." March 7.
4381.—Cottrell, G. R., "Apparatus for mixing gas and air." March 7.
4400.—Stevenson, W. H., "Bye-pass gas-tap with self-lighting attachment." March 8.
4407.—Stevenson, G., "Acetylene gas." March 8.
4419.—Main, R. B. & A. P., and Sherburn, W. H., "Gas-grillers." March 8.
4420.—Main, R. B. & A. P., and Sherburn, W. H., "Burner for gas heating." March 8.
4421.—Main, R. B. & A. P., and Sherburn, W. H., "Gas-grillers." March 8.
4445.—Hatch, G., "Hand service cart for gas and water works." March 8.
4490.—Morris, W., "Gas and oil engines of the 'Otto' type." March 9.
4526.—Clamond, C., "Gas-stoves." March 8.
4539.—Schuster, E., "Device for testing gas-pipe systems." March 9.
4587.—Simkin, C., "Gas-burners." A communication from T. D. Wardlaw. March 10.
4606.—Anspach, J., "Lighting gas at a distance." March 10.
4607.—Arnswaldt, H. von, "Electrical gas-lighters." March 10.
4611.—Rosenthal, A., "Incandescent gas-lamps." March 10.
4630.—Craven, R. E. P., "Fluid pressure actuating valves." March 10.

A final dividend of 25s. per share for the past year is recommended by the Directors of the Shanghai Water-Works Company, Limited; an interim dividend of 15s. per share having been paid in July last.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Presence of Naphthalene in Coal Gas.

Sir,—I venture to ask you to allow me a little space for some criticisms on the paper by Mr. R. W. Allen reported in this week's "Journal."

As remarked by Dr. Otto Hehner, there is nothing astonishing in the conclusion of Mr. Allen that the quantities of naphthalene carried by hydrogen, carbonic acid, and air are identical, as this is only in accord with well-established laws. I am nevertheless inclined to doubt the accuracy of the figures given in Table II. (p. 673). If alongside the quantities there given are placed columns of differences, it will be manifest that the figures do not follow any natural law.

Temperature. Fahr.	Grs. per 100 C. Ft. (Allen).	First Difference.	Second Difference.	Temperature. Fahr.	Grs. per 100 C. Ft. (Allen).	First Difference.	Second Difference.
32°	6·0			131°	317·0	109·0	56·0
41	9·8	3 8	0·5	140	482·0	165·0	76·0
50	14·1	4·3	0·6	149	723·0	241·0	86·0
59	19·0	4·9	0·7	158	1050·0	327·0	53·0
68	24·6	5·6	0·7	167	1430·0	380·0	88·0
77	30·9	6·3	2·3	176	1898·0	468·0	60·0
86	39·5	8 6	9·4	185	2426·0	528·0	81·0
95	57·5	18·0	8·0	194	3035·0	609·0	83·0
104	83·5	26·0	22·5	203	3727·0	692·0	1·0
113	132·0	48·5	27·5	212	4420·0	693·0	
122	208·0	76·0	33·0				

Moreover, the figures at low temperatures are higher than those obtained in the careful experiments of Mr. W. Irwin. Perhaps this discrepancy may be due to a phenomenon noticed by Mr. Irwin, which has escaped the attention of Mr. Allen, and which I have the permission of Mr. Irwin to describe. Mr. Irwin passed a measured quantity of air over naphthalene in a U-tube in a similar way to Mr. Allen; weighed the U-tube; and forthwith again passed air through, and again weighed—repeating the experiment several times in succession. The loss of weight was much greater the first time than the second; but the second, third, fourth, and fifth times the results were concordant, and were taken as correct. The tube containing the naphthalene was then left closed; and on resuming the experiments after an interval of some days, the same phenomenon was again noticed. With fresh naphthalene, or naphthalene which had been allowed to rest for some time, the loss of weight at first was much greater. I do not at present venture to explain this phenomenon, though possible explanations have occurred to Mr. Irwin and myself; but if this has not been noticed by Mr. Allen, it would very seriously affect the accuracy of his results at low temperatures, at which it is impossible to check the results by barometrical methods.

Is not Mr. Allen in error in assuming that Dr. Bueb's results are confirmatory of his figures? I am under the impression that Dr. Bueb extracts the naphthalene from his gas immediately after a hot condenser of the Pelouze and Audouin type, and before the gas has cooled down so low as 60° Fahr.

It is no doubt advisable from time to time to test the accuracy of the classical researches of Regnault and Gay Lussac; but I am surprised to learn that Dr. Clowes said in the discussion that he and others had held that naphthalene was carried by coal gas in larger quantities than it would be by any of the simple gases. Why he or anyone else should hold this view, I do not know—seeing that it is not only contrary to the laws established by Gay Lussac, but also to my experience as stated in my paper read at the meeting of the Gas Institute in June last.

Mr. Allen's conclusion, that coal gas containing vapours of aromatic hydrocarbons can carry as much naphthalene as if it did not contain these vapours, is also contrary to Gay Lussac's law; and moreover I do not think it can be rightly deduced from his experiments.

Consider, first, the experiments in which air was saturated at 60° Fahr. with various vapours, and afterwards passed over naphthalene at 140° Fahr. The conditions of these experiments are not calculated to test the question at issue. The temperature of 140° Fahr. is considerably above the boiling-point of ether and carbon disulphide, which consequently at this temperature do not behave as vapours at all. Chloroform boils at 141° Fahr., and even benzene and alcohol are approaching so near their boiling-points that they tend to partake of the properties of gases. It must also be noted that at 140° Fahr. benzene has a vapour tension of about 450 millimetres, or over seven times its vapour tension at 60° Fahr. The air saturated at 60° Fahr. was, therefore, only one-seventh saturated at 140° Fahr. To have made the experiment at all conclusive, it should have been conducted at a very much lower temperature. The same remark applies to the experiment on coal gas with and without treatment for the removal of naphthalene. As pointed out in my paper above referred to, coal gas of 18-candle power only contains sufficient benzene, toluene, xylene, and cumene collectively to saturate the gas to the extent of about 25 per cent. at 60° Fahr. At 113° Fahr. (I imagine the 130° in your report to be a misprint), the percentage saturation is reduced to about 4 per cent. This, judging by the irregularity of the figures as disclosed by the table given above, is within the limits of experimental error. At the temperature of this experiment, an error of one-tenth of a degree Centigrade affects the quantity of naphthalene carried by more than one per cent.

It would be interesting to know why Mr. Allen did not try this experiment at ordinary temperatures; or, if he did, what were the results.

In the latter part of his paper, Mr. Allen assumes that gas which originally contained no naphthalene did deposit some in the mains. I think, with Dr. Hehner, that this requires more proof than has yet been offered. To begin with, Mr. Allen appears to have worked in all his experiments with only 1·27 cubic feet of gas. At 60° Fahr., this quantity of gas can retain less than one-tenth of a grain of naphthalene—an amount hardly likely to be detected by Mr. Allen's process.

Mr. Allen appears to have been influenced by the difficulty of understanding how so small a quantity can produce so much trouble in the street mains. When slowly sublimed, naphthalene condenses in such a form that one-quarter of an ounce occupies a cubic foot of space (see Roscoe and Schorlemmer, Vol. III., part vi., p 32). If a cubic foot of deposit in a street main contains less than one ounce of pure naphthalene, it will be readily seen where it can come from.

Mr. R. Forbes Carpenter asks whether I have had any deposit in clean mains when the gas entering these mains contained no naphthalene. The question is an appropriate one. I have, however, no experience on the point, as I do not think we ever send out any gas entirely free from naphthalene. I do know, however, that a small reduction of the amount of naphthalene in the gas is sufficient to diminish, and a larger reduction to entirely obviate, the formation of solid deposits in the mains.

Burnley, March 15, 1900. Jno. P. Leather.

Profit-Sharing and Automatic Meter Supplies at Stafford.

Sir,—I have read with great interest Mr. J. F. Bell's admirable address at the meeting of the Midland Association of Gas Managers, held on the 1st inst., at Birmingham, as reported in the "Journal" of March 6.

First of all I am glad to be able to welcome Mr. Bell into the ranks of the profit-sharing employers of labour. His is a remarkable addition—representing as it does a corporation and not a company; and I can only hope that the results will be as satisfactory as I believe they will be. Throughout the gas industry, there will be the hope that his experience may be satisfactory, as it will thus show that profit-sharing can be made a success apart from the personality of Mr. George Livesey. It will be a great step forward to prove this.

I notice particularly the figures Mr. Bell gives of automatic-meter installations with and without cookers. They are, indeed, well worthy of the consideration of every gas company and corporation who have not yet made cooking stoves a *sine quâ non* with their automatic installations. Mr. Bell's diagram, and the forcible way in which the figures are represented, showing that the consumption of the six summer months with a cooker is roughly four times that without a cooker, and even in the six winter months is more than double, proves up to the hilt the whole of the contentions I put forward in my articles on "Slot Cookers and All About Them" which you were good enough to publish some fifteen months ago.

I have only to-day been favoured by Mr. J. T. Lewis, of Wellingborough, with a list of 60 consumers of a small Gas Company of which he is Consulting Engineer. Amongst 60 consumers, he has sold on an average 15,075 cubic feet of gas for cookers alone; and this, with gas at 3s. 8d. per 1000 cubic feet, gives an average gas-rental of £2 15s. 4d. per consumer—a total which no gas company would consider beneath their notice, even for an ordinary meter. I am glad to know that the further this question of the supply of slot-cookers is investigated, the more conclusive is the evidence in its favour.

March 16, 1900. E. W. T. Richmond.

The Maiden Lane Electrical Station Fire.

Sir,—In the article, dealing with the fire at the above station, in your "Journal," we observe among other things you suggest that this Company is withholding information as to the cause of the fire. We really must protest against what is, in our opinion, a very unfair and, as a matter of fact, unwarranted assumption. Neither the fire experts, Insurance Companies, nor ourselves have been able to, in any way, trace or account for the origin of the fire. We would give much to be able to do so. Such evidence as there is, however, distinctly negatives the theory of fire from electrical causes.

You then go on to suggest that no recognition has been made of services rendered by the District Officers of the Gaslight and Coke Company, who, being appealed to, lent lamps and gave all help in their power to our "distracted" Engineers. We cannot find any authority for this statement. The officials of the Gas Company were not appealed to by our Engineer, nor, so far as we can ascertain, his subordinates; nor were lamps lent, or any assistance rendered whatever. Our Engineers, so far from being "distracted," were remarkably cool and self-possessed, as we think the celerity with which the service was resumed amply testifies.

We are happy to say that our relations with the officers of the Gaslight and Coke Company are most cordial; and had such an appeal been made, we have no doubt whatever that they would have rendered all the assistance which it has been suggested by you was rendered.

We do not propose to enter into the controversial matter of your article, but wish only, as we are sure is the case with yourself, that the facts should be fairly and accurately stated.

Maiden Lane, Strand, March 16, 1900. The Charing Cross and Strand Electricity Supply Corporation, Ltd., Edward Wilmot Seale, Secretary.

[We willingly give publicity to the above communication from the Secretary of the Charing Cross and Strand Electricity Supply Corporation, but cannot agree with his assertion that there was anything unfair or unwarranted in the remarks we made last week upon the fire at the Maiden Lane station. That the cause of the fire was and remains unknown is admitted; and this is all that was said. There was not a word in our article capable of being read as a suggestion that the Company are withholding information on this very serious matter. As regards the statement concerning the good offices rendered on this occasion by the District Officials of the Gaslight and Coke Company, this was made as a piece of news which came to us on good authority; and we had no reason to doubt either the fact or the good will of the officers referred to. They are always ready to help professional brethren in distress. These matters of mutual courtesy are not necessarily reported to secretarial offices.—Ed. J.G.L.]

A dividend of £1 has been declared on the shares of the Anglo-Romano Gas Company, payable in London on and after the 16th prox.

PARLIAMENTARY INTELLIGENCE.

Gleanings from the Committee Rooms.

The comparative silence which has reigned for six months or more in the corridors leading to the Committee rooms of the Houses of Parliament was broken last Tuesday; and the work of investigating, pruning and ingrafting provisions, and finally passing or rejecting Private Bills which have been fortunate in reaching the Committee stage was entered upon in real earnest by noble Lords and honourable Commoners. Before the sittings commenced, there was the usual busy scene. Eminent counsel, their aspiring successors and coadjutors, parliamentary agents, witnesses of degree varying from the expert down to the humblest member of small local administrations and companies eager to stretch their wings farther or obtain greater powers, and clerks and attendants, were all bustling hither and thither with bags and bundles of documents destined by their authors to secure, by skilful use, victory or defeat. The professionals, both legal and otherwise, looked intensely pleased with themselves and all around them, and with good reason, for the session promises in several directions to be for many of them a fairly busy and profitable one. For the gas industry, the work in the Committee rooms will be of the deepest interest; and the eyes of gas directors and managers all over the kingdom will be turned to Westminster, watching for developments which may in the future mean much to them. Many engineers and directors feel that some of the proposals before Parliament involve momentous issues for gas companies, which, it is feared, if ratified by the Legislature, will not hereafter conduce to their happiness and advantage. Much uncertainty has been engendered by the report of the Select Committee on the Powers of Charge of the Metropolitan Gas Companies, and by the report of the Departmental Committee on Water Gas; and more immediately attractive are the Bill of the South Metropolitan Gas Company and that of the London County Council to legalize peripatetic gas-testing. Whatever becomes law in regard to the Metropolis, it is argued, may be, sooner or later, applied to suburban and provincial companies; and therefore many companies are hoping that there will be no innovations in established practice which may ultimately affect them. It is difficult to get any pronounced outside opinions on the measures alluded to; and so far engineers do not venture beyond generalities in referring to them. There are those who view the proposals of the South Metropolitan Gas Company in the light of an experiment, which, if unsuccessful in the case of that Company, will assuredly not be further countenanced by Parliament; and this is undoubtedly the intelligent view to take. The intention of the London County Council to introduce the testing of gas by perambulating photometers in any nook or on any dead-ended main, if they can obtain parliamentary sanction, is another matter altogether. The proposal is flagrantly unjust, and is so generally regarded; and if such a method of testing comes into force in London, it may safely be said that local authorities in the provinces where the gas supply is furnished by companies—particularly where the electric lighting is in the hands of the authorities themselves—will not be long in making a move in a similar direction.

Speaking of the London County Council, we have in the Bill to which reference has been made another instance of how intensely funny (impertinent would perhaps be a better word) that Authority are in some of their methods and views. In this Bill, they have—apparently without consulting the Corporation, certainly without their consent—included the City within the purview of the measure. The testing of the gas within the City bounds comes entirely within the jurisdiction of the Corporation; and therefore the Council have evidently arrived at the conclusion that the Corporation have become so ancient that they are incapable of continuing, without assistance, to adequately look after such a simple duty. But the Corporation have capable and responsible officers to watch over their interests in this respect; and they are not likely to brook any interference by, nor do they require any guidance from, the County Council. The Corporation have been advised to oppose the Bill; and the evidence which will be put forward by them is sure to be of an interesting character, and should be of immense value to the Gas Companies in the opposition they may offer.

In the draft of a certain Bill before Parliament this session, there was a clause which was intended to empower the Directors of a Gas Company to compensate themselves in the event of the transfer of the works to the Local Authority. This nice arrangement (for the Directors) met the eyes of the "censor," and the Bill proceeded on its way *minus* that little provision. Directors may save themselves annoyance in future by making a mental note of this.

In connection with a Bill to empower the Brighton Corporation to construct electric tramways and other electricity works, the Brighton Gas Company have put in an appearance in opposition, in order to object to the Corporation taking high-tension cables along a narrow roadway in which high-pressure gas-mains are laid. The whole of the Company's output passes along the road in question; and therefore the matter is of considerable moment to them. It is also a point of importance to the gas industry generally; and it is to be hoped that the Company will secure a valuable decision.

There were only a few Committees sitting last week; but measures dealing with gas matters were fairly represented. The two Bills from Ossett had the honour of opening the ball before a Commons Committee. In the one case, the Corporation sought power to acquire the gas undertaking, and in the other the Company asked for extended powers and additional capital. So far as the proceedings went, there was nothing particularly noteworthy about them. It was an ordinary case of a Corporation who had made ineffectual offers for the purchase of the gas undertaking. Then, when the Company were proposing an application to Parliament for necessary additional powers, it was considered an opportune time by the Corporation to endeavour to obtain powers of compulsory purchase. The usual stock complaints as to the quality and price of the gas were paraded before the Committee, and certain other shortcomings of an unimportant nature were advanced. The whole of Tuesday's sitting, and the greater portion of the morning of Wednesday, were consumed by the opening address of Mr. Balfour Browne on behalf of the Corporation and the hearing of local evidence. There was no remarkable point in all this; but it may, of course, be that, had the professional witnesses who had been retained for the Corporation had an opportunity of stating their views, a little more strength might have been put into the case. However, bad as the Corporation would have the Committee believe the administration of the Company and their supply had been, they were keenly earnest in their desire to become possessed of the property. For their part, the Company some time since expressed a willingness to consider any adequate terms for transfer which might be placed before them; but those which were tendered were not such as the Directors felt they could advise shareholders to accept. Under such circumstances, although the parties had pursued their own courses until they faced each other in the Committee room, a settlement, even at the eleventh hour, did not appear improbable. Wednesday morning brought with it significant confidential conferences between the professional gentlemen engaged on the Bills; and this continued the whole morning while uninteresting evidence was being tediously drawn out. On reassembling after luncheon, Counsel made the announcement (which appeared to give general satisfaction) that an agreement for transfer had been arrived at. The terms of settlement will be found fully set forth in our report of the proceedings; and a more equitable basis for transfer it would be difficult to devise. Among its interesting features is one which gives us particular pleasure. It is the fifth clause, which provides for the compensation of the Manager and Secretary in terms similar to those inserted in the Yeovil Bill two years ago. "Remember Yeovil!" was the watchword we gave when gas companies' officials obtained that precedent for parliamentary recognition and protection of their interests. Yeovil has been remembered, and will be, it is to be hoped, for many a long year. The professional witnesses engaged for the Company were Mr. Corbet Woodall, Mr. E. H. Stevenson, and Mr. Samuel Wood (Messrs. Alfred Lass, Wood, and Drew), and for the Corporation Mr. W. A. M'Intosh Valon, Mr. Arthur Silverthorne, and Mr. C. A. Craven. In large measure, the credit for bringing about such an acceptable agreement is due, on the one side, to Mr. Corbet Woodall and Mr. Stevenson, and on the other to Mr. Valon and Mr. Silverthorne. The pity of it is that there was not a little unbending before the heavy costs inseparable from parliamentary action were incurred.

Somewhat similar terms to those agreed upon in the case of Ossett have been arranged in connection with the two Gas Bills from Glastonbury. The object of the Company's Bill was to obtain incorporation and enlarged powers; and the Corporation, by their Bill, proposed the transfer of the undertaking at a valuation to be determined by arbitration under the Arbitration Act, 1889. The Company's Bill has been withdrawn under the following purchasing conditions: The Lands Clauses as applied to the taking of land otherwise than by agreement; £825 towards the expenses of the Company promoting their own Bill, opposing the Corporation, and winding up; the Yeovil clauses as to excess works and compensation of Secretary and Manager; the Company to take all cash balances, value of stocks, &c., at date of transfer; the Company's Bill to be withdrawn. These terms were arranged between Mr. W. A. Valon on behalf of the Company and Mr. E. H. Stevenson for the Corporation.

For thirty years or so, an arrangement has existed in connection with the gas supply to Birkdale by Southport the very nature of which could not fail to produce trouble; and, as our columns have borne witness, trouble there has been. The ownership of, and exclusive right over, the gas-mains in Birkdale is invested in the District Council, and the Southport Corporation supply the gas, for which privilege they pay the District Council 8d. per 1000 cubic feet consumed in Birkdale. This, briefly, is the arrangement which exists, and which was embodied in the Corporation Act of 1871. Its working, more particularly during the last few years, has not been a happy experience for Southport. Countless almost have been the allegations as to deficiencies in illuminating power; and it is only a few years since that costly litigation arose over the matter. So far as this point goes, Birkdale insists on using a different burner from the Sugg "G" employed at Southport to test the gas; and Professor Vivian B. Lewes has shown that this accounts for a divergence of no less than 4·7 candles to the disadvantage of the suppliers of the gas. Viewing the past from a disinterested standpoint, it cannot be said that Birkdale has adopted a reasonable attitude in their dealings with Southport; and therefore we cannot see that the smaller authority have much to complain about when the larger (who naturally have no desire to part with the custom of the district) take measures to protect themselves against this incessant worry in the future. The position the Corporation take is that, whatever deficiencies may exist in the supply of the district are internal, and are really due to the inadequacy of the Council's distributing system to meet the increased draught upon it. To correct this, they decided to insert, in an Extension and Tramways Bill in the present session of Parliament, clauses giving them a supervisory power over the Birkdale mains. They asked that the Birkdale Council should, within six months after the passing of the Act, provide and maintain within their district adequate and properly arranged mains and pipes to enable the Corporation to supply gas at a reasonable initial pressure; and in case of default on the part of the District Council, they desired to be endowed with liberty to lay such mains and pipes, and to recover the cost from the District Council. They also wished to have power to authorize some competent person (not being an officer of the Corporation) to inspect and report to them upon the mains; any difference to be submitted to an arbitrator to be appointed by the Board of Trade. Complicated by such a knotty condition of affairs, the situation was an awkward one for the Commons Committee who were confronted with it; and the strong retinue of distinguished witnesses that the Corporation had present was evidence that they recognized the imperative necessity of endorsing their application by the highest opinion the land could produce. To support the Gas Committee and their Engineer (Mr. John Booth), Mr. George Livesey, Mr. Corbet Woodall, Professor Lewes, and Mr. William Smith, of Bolton, were called; and their evidence, as reported elsewhere, is worth perusal. There was one proposition advanced by Mr. Livesey with which few engineers will disagree, and that is that gas-mains should, under all circumstances, be under the direct control of the suppliers of the gas. On behalf of Birkdale, no evidence was called; and we rather regret this, as it would have been interesting to have heard the evidence of the two witnesses who had been retained—Mr. Isaac Carr and Mr. C. R. Bellamy—to rebut the testimony of the powerful witnesses on the other side. The line which Mr. Carr would no doubt have taken would have been to show that, from careful investigations on the spot, the pressure

in the district was sufficient, and that therefore the Birkdale distributing system was not responsible for the complaints of the past. However, Mr. Wedderburn did not elect to call any evidence to show that the Corporation could be regarded as chargeable with failure in any one respect; but he made an eloquent appeal to the Committee not to permit Southport to "invade" the Birkdale district in the manner proposed. Counsel also suggested that, if the Committee passed the clauses, they should approve of the principle of a clause to empower the District Council to give to the Southport Corporation notice to determine the gas supply at the expiration of two years after the service of the notice. This was perhaps a little cool, but therein is found the whole secret of the trouble. It is the South African difficulty in miniature; Birkdale aspires to be a sovereign state in respect of its gas supply. They do not now like the statutory contract of 1871, and would prefer to be their own gas providers. In the result, the Committee passed the clauses in the Bill referring to Birkdale; but, even if the Corporation succeed in carrying them through the Lords, we are afraid they will not give absolute immunity from friction. The Corporation, however, will be the gainers, inasmuch as they will secure the right of seeing that the gas they supply has fair play after it leaves the Southport mains.

There were other gas clauses in the Southport Bill; and, in regard to one of them, an expression of opinion was given by an eminent Counsel which local authorities may find it useful to remember. In the clause referred to, the Corporation sought to establish a reserve fund to the extent of £25,000, to answer any deficiency that might happen in the revenue, or to meet any extraordinary claim or liability. There was a question in the minds of the Committee as to whether Birkdale should not participate in the advantages of this reserve fund; and they asked for the views of Mr. Balfour Browne, who represented the Corporation. The learned Counsel said he felt the point, and thought the fairest thing would be to strike out the clause. This was promptly done.

The Bill which the Morecambe District Council are promoting, to authorize the carrying into effect of the agreement they have made with the Gas Company for the transfer of the undertaking, was among the first of the measures down for the consideration of Sir T. Gibson Carmichael's Committee; but it was not reached before midday on Friday. It had to encounter the opposition of only one Local Authority—that of the adjoining district of Heysham. Now Heysham is a district equal in size to Morecambe, but at present it is sparsely populated. The Midland Railway Company, however, are spending a million of money in constructing a huge harbour there; so that Heysham bids fair to develop into a centre of great commercial activity. This promising district is within the statutory limits of the Morecambe Gas Company; and therefore the Heysham Council feel somewhat slighted in not having been fully consulted before their neighbours entered into the transaction which the Bill is intended to seal. In their judgment the price the District Council have contracted to give for the undertaking is excessive; and one of the purposes of their opposition was to ensure that this (from their point of view) abnormal price should not affect the payment they would have to make to Morecambe should they desire to furnish themselves with gas. But beyond this, they sought exemption from all the well-recognized principles which govern the sale and purchase of an established business. They wished to pay nothing for goodwill, and nothing for prospective value of the right of supply—in fact, the mere value of the pipes as such was all they seemed to think they should be asked to pay for in the event of severance. It is unnecessary here to enter into the question as to whether or not the price to be paid by Morecambe for the undertaking is excessive. Suffice it to say it transpired in the evidence that the sum to be paid—£141,000, or, including all expenses, about £158,000—is less than Mr. Thomas Newbigging and Mr. E. H. Stevenson advised Morecambe to give if necessary; and Mr. Corbet Woodall, for the Company, pronounced it to be a very fair bargain for both parties. Then as to the separation of Heysham from the district of supply, the Bill makes full provision for the purchase by local authorities, by agreement or arbitration, of portions of the undertaking outside Morecambe. The Engineers consulted by the Heysham Council were Mr. Arthur Silverthorne and Mr. T. N. Ritson, of Kendal; and the evidence of the latter disclosed the fact that the question of establishing independent gas-works for Heysham has already been under consideration.

The proceedings on the Morecambe Bill were concluded yesterday. At one stage its success looked very precarious. In their report upon the proposals, the Local Government Board suggested that the Committee should very carefully consider whether the terms of purchase were such as would make the transaction a desirable one for the ratepayers; and the Committee made a rigorous inquiry into the matter. Mr. Newbigging was recalled, and underwent a critical examination upon his figures. He showed very clearly that this was a case in which the extremely excellent prospects of the Company should receive due consideration; and, on the experience of the past, he predicted a minimum increase of 20 per cent. in the consumption of gas in the coming year. The result indicated that his evidence on the point was satisfactory to the Committee. With regard to the remarks already made as to the position taken up by Heysham, the interval between Friday and Monday appeared to have brought about a considerable modification in the views of the opposing Counsel as to what would be a fair method of procedure in the event of his clients desiring to purchase the portion of the undertaking in their district. On this point he confined himself yesterday to asking the Committee, if they decided to pass the Bill, to insert a clause enabling Heysham to erect independent works, and that, in doing so, they should be free from having to pay an enhanced price in view of the "extravagant" figure being paid by Morecambe. But the question of the price now being paid is of little consequence to Heysham so far as purchase is concerned, as, in the event of severance, if an agreement were not effected, the matter would go to arbitration; and the present transaction would have no weight with an arbitrator in deciding the price Heysham should be called upon to pay. And so we take it the Committee felt; for they passed the preamble of the Bill, subject to two alterations in clauses not affecting the points dealt with here.

A point worth noting transpired during the proceedings on the Morecambe Bill. A member of the Committee stated that the period for the repayment of costs incurred in the promotion of Bills had been reduced, save in exceptional circumstances, to five (instead of ten) years.

HOUSE OF LORDS.

The following further progress was made with Private Bills last week:—

Bill brought from the Commons and read the first time: Rugeley Gas Bill.

Bills reported with amendments: East Stirlingshire Water Bill, Higham Ferrers Water Bill, Menstone Water (Transfer) Bill, Otley Urban District Council Water Bill.

Opposition withdrawn: Falkirk Corporation Bill, Great Berkhampstead Water Bill, Newport (Mon.) Gas Bill.

The Cleethorpes Gas Bill, the Exmouth and District Water Bill, the Exmouth Urban District Water Bill, the Fishguard Water and Gas Bill, the Glyncorrwg Urban District Council Gas Bill, the Mountain Ash Water Bill, and the Paignton Urban District Water Bill, were referred to a Select Committee, consisting of Lord Elgin (Chairman), the Earl of Stamford, Viscount Templetown, Lord Napier, and Lord Somerton; to meet on Wednesday, March 21.

HOUSE OF COMMONS.

Tuesday, March 13.

EAST LONDON AND LAMBETH WATER BILLS.

On the order for the second reading of the East London Water Bill,

Mr. STUART pointed out that, by the Act of last session which sanctioned intercommunication between the Water Companies' systems, a clause had been introduced which barred the Companies from bringing forward that Act as a valuable asset in case of purchase. He should like to hear the opinion of the President of the Local Government Board with reference to this clause in connection with the Bills before the House. In proposing purchase, the Royal Commission had taken into account the existence of the sinking fund as part of their financial estimate. It was important to safeguard the existence of that fund; and he should like to know whether the Government intended to support intact the principle of the fund in the East London Company's Bill as well as in the case of the Lambeth Water Company.

Mr. CHAPLIN said the East London Company's Bill was for sanction to an increase of storage, to meet the wants of the water consumers of London; and on this account alone he should feel it to be his duty to support the second reading. The intercommunication proposal would apply to this Bill as well as to the Lambeth Water Bill. The question of the sinking fund did not apply to the East London Company; but there was a clause in the present Bill relating to it. In the case of the Lambeth Bill, the principle did apply. These were matters, however, which ought to be referred to the Select Committee in the first instance.

The Bill was read a second time, as was also the Lambeth Water Bill.

The following further progress was made with Private Bills last week:—

Bills read a second time and committed: East London Water Bill, Lambeth Water Bill, Wolverhampton Gas Bill.

Bills reported with amendments: Airdrie, Coatbridge, and District Water Trust Bill, Grantham Gas Bill, Ossett Corporation Gas Bill, Redhill Gas Bill, Southport Extension and Tramways Bill.

Bill withdrawn: Ossett Gas Bill.

Bill read the third time and passed: Rugeley Gas Bill.

The Gaslight and Coke, Commercial Gas, and South Metropolitan Gas Companies Bill, the Gaslight and Coke Company Bill, the South Metropolitan Gas Bill, and the Wandsworth and Putney Gas Bill were referred to a Select Committee, consisting of Mr. Oldroyd (Chairman), Mr. Stanley Leighton, Mr. Emmott, and Mr. Nicol; to meet on Tuesday, March 20.

Bills for the prevention of the pollution of rivers and the amendment of the Petroleum Act, 1879, were brought in last week, and read the first time.

The Dissolution of the Kettering Water Company.—The Directors of the Kettering Water Company have issued a report and statement of accounts on the winding up of the undertaking. The total assets have been realized, and all the outstanding accounts paid; and there is a balance of £3415 available for final distribution. This will be disposed of by a payment of 16s. 6d. on each "A" share and 11s. 6½d. on each "B" share; being the same proportion on each class as was contained in the general scheme of distribution. Exclusive of the payment, by way of dividend, on the 28th of November last, of 7s. 6d. per "A" share and 5s. 3d. per "B" share, the present distribution will make the total amount paid to the proprietors as £29 16s. 6d. on each "A" share, and £20 17s. 6½d. on each "B" share—a result which the Directors cannot but regard as eminently satisfactory. The affairs of the Company having thus been wound up, and the moneys distributed, the undertaking is dissolved by virtue of section 15 of the Kettering Water Act, 1898.

Sales of Shares.—Last Tuesday evening, at Chatham, a few £50 "A" shares in the Rochester, Chatham, and Strood Gas Company, producing 10 per cent. per annum, were sold by auction at £126 and £127 per share. Four £12 10s. "B" shares, producing 7 per cent., fetched £21 10s. each. Some £3 6s. 8d. "C" shares, realizing 7 per cent., were disposed of at £6 each. A few £8 10s. "D" shares, producing 10 per cent., fetched from £21 10s. to £22 per share. At the same sale, 23 £5 original shares in the Brompton, Chatham, &c., Water-Works Company were disposed of at from £14 15s. to £14 12s. 6d. per share. Messrs. Baxter, Payne, and Lepper recently disposed of 85 £10 (7 per cent.) shares in the Bromley Gas Company, at prices ranging from £20 to £20 10s. each. Five £10 shares (10 per cent.) realized £26 5s. each. At Croydon, last Thursday, Messrs. Hooker and Webb sold a quantity of consolidated "B" ordinary stock and 5 per cent. perpetual debenture stock of the Croydon Commercial Gas Company—the former at £270 to £275, and the latter at £145 per £100 of stock. Last Friday, Messrs. Hards and Bradley sold 20 original fully paid £10 shares in the West Kent Gas Company for £139, and a similar number of £10 shares in the Dartford Gas Company for £343; the two Companies' dividends being respectively 10 and 7 per cent.

HOUSE OF COMMONS COMMITTEE.

Wednesday, March 14.

(*Before Sir* SAMUEL HOARE, *Chairman, Mr.* HAZELL, *Mr.* DRAGE, *and Mr.* SOAMES.)

SOUTHPORT CORPORATION BILL.

The Bill of the Southport Corporation to extend the boundaries of the borough, to construct tramways, and for other purposes, was considered by the above Committee on Tuesday and following days. The Bill was divided into nine parts, each of which was separately dealt with. These related to the extension of the borough, the seashore and pier, tramways, gas, electricity, and borrowing powers. The sixth portion dealt with the gas question; the sections of the Bill specially relating to this being Nos. 58 and 59, which were to the effect that within six months after the passing of the Act the Birkdale District Council should provide adequate mains and pipes to enable the Southport Corporation to supply gas at a reasonable pressure within the district of the Council. It was also stipulated that the Corporation should from time to time authorize some competent person to inspect the mains, for the purpose of seeing that they were maintained in good order.

Mr. BALFOUR BROWNE, Q.C., Mr. FREEMAN, Q.C., and Mr. DAVIES WILLIAMS appeared as Counsel for the Corporation. There were several petitioners against the extension portion of the Bill; the Scarisbrick Trustees being represented by Mr. SQUAREY, the Hesketh Trustees by Mr. WORSLEY TAYLOR, Q.C., and Mr. TALBOT, and the Urban District Council of Birkdale by Mr. WEDDERBURN, Q.C., and Mr. HORRIDGE.

Mr. BALFOUR BROWNE, in opening the gas portion of the Bill, said the point was of great importance. The borough of Southport, by a section in their Act of 1871, had the power to supply gas within a radius of 6 miles of the Town Hall of Southport. The first gas-works were erected in 1850; and some time afterwards the Corporation began to supply gas in Birkdale, through pipes laid down by certain of the inhabitants. By a subsequent Act, the Corporation were empowered to supply the residents of Birkdale through mains and service-pipes which the Local Authority of Birkdale had laid. An agreement was entered into between the two Authorities, by which it was decided that the Birkdale Authority should have the exclusive right to lay gas-mains within the township, and should keep these mains and pipes in good repair, and offer them to the Corporation of Southport for the supply of gas. In consideration of this, the Corporation agreed to pay to the Birkdale Authority a sum of 4½d. for every 1000 cubic feet of gas supplied in Birkdale, and an additional sum of 3½d. per 1000 cubic feet for the gas supplied to private consumers. All the Corporation sought to do in the Bill was to make it possible for them to carry out this agreement effectively. As a matter of fact, the mains in Birkdale were too small for the supply; and the result was that there had been many complaints from the Birkdale consumers. By clause 58 of the Bill, the Southport Corporation sought powers to compel the Birkdale Authority to provide adequate and properly arranged pipes and mains; and that in case of default, the Corporation should be empowered to lay the mains and recover the cost from the District Council. Further, they asked power to employ an independent and competent person to inspect from time to time the mains and pipes, to see if there was any leakage of gas; and that the Birkdale Authority should be required to repair the pipes should they be found defective. There was also the provision that, in case of any difference of opinion between the two Authorities, the matter should go to arbitration before an Arbitrator appointed by the Board of Trade. The learned Counsel then read and criticized the petition of the Birkdale District Council. Their first allegation was that the Corporation, though bound to provide gas to Birkdale at a maximum charge of 4s. per 1000 cubic feet, and of illuminating power equal to 20 sperm candles, had afterwards raised the price and lowered the illuminating power. This, the learned Counsel urged, was only for two years during the coal famine; and it was done with the consent of the Board of Trade. Other allegations were that the charge at Birkdale was higher than at Southport, and that the Corporation had made a large profit out of the gas undertaking, and had expended such profit for the benefit of Southport exclusively. To this he replied that it was quite usual—indeed the rule—for a corporation to charge extra for gas supplied to an outlying district. The profits had been greatly exaggerated; the fact being that the average profit had only been about 4½ per cent. on the capital outlay. The petitioners also alleged that the illuminating power of the gas was always 3 candles below the standard, but this was not true. The Act of 1881 provided, by section 35, that the gas should have an illuminating power equal to 20 sperm candles, as tested by an argand or other approved burner. But the Birkdale Authority had contended that they were bound to test the gas by an argand burner; leaving out the remainder of the section. The Birkdale people had obtained a conviction against them for supplying gas of lower illuminating power than the standard. But they had carried the case to the High Court; and the Court decided that the conviction was wrong, and that the gas could be tested by any approved burner. In conclusion, the learned Counsel said the complaints had become so numerous that they were obliged to appeal to the Committee to decide between themselves and the Birkdale Authority. He asked that they should not be prevented by the action of Birkdale from making a necessary improvement.

Mr. T. P. Griffiths, the Mayor of Southport, said the clauses in the Bill were necessary. Their limit of supply was restricted to 6 miles from the Town Hall. A sum of £255,000 had been expended on the works. By the Act of 1871, the Birkdale Authority had the exclusive right to lay mains and pipes in their district; but the gas was to be supplied by Southport. They had expected that, in the matter of mains, Birkdale would have advanced *pari passu* with Southport; but while Southport had very considerably increased their mains, Birkdale had not done so since 1871. The gas undertaking was well laid out; but owing to the insufficient mains, there were many complaints from Birkdale. Birkdale said their mains were sufficient, but that the quality of the gas was at fault. They did not ask Parliament to decide the matter, but only to allow the question to be decided by an Arbitrator appointed by the Board of Trade. In his opinion, the clauses they asked would only give effect to the agreement of 1871. Birkdale had received the charge of 4½d. per 1000 cubic feet for township supplies, and 8d. for domestic supplies, for 28 years; and in this way they had obtained £29,000, or over £1000 a year. They should, therefore, have kept the mains in repair. As to the profits, they had only made on the average a profit of 4½ per cent. on the gas undertaking. In regard to the illuminating power of the gas, the matter had been brought to a head by Birkdale. The Corporation of Southport were summoned and convicted for supplying gas below the standard; but the case was carried on appeal to the High Court of Justice, where the conviction was quashed. Southport was quite satisfied with the pressure at which the gas was supplied; and if the Southport people, who took four-fifths of the gas, were satisfied, they considered the pressure was ample.

Cross-examined by Mr. WEDDERBURN: Previous to 1871, the supply of gas to Birkdale had been by agreement. A Birkdale Company secured a Provisional Order to supply gas; and in 1871, the agreement was come to by which Southport supplied Birkdale. In the Act of 1871, there was no provision for charging more to Birkdale than to Southport. Section 43 of the Act defined the duty of Birkdale as to the mains and pipes.

Mr. WEDDERBURN: If we failed to do anything which the Act required, you could have got a *mandamus*, and taken us to the Court?

Witness: Of course.

Then, as you have not done so, may we not take it that there has been no such breach of the law?—Well, you may take it that way. Up to 1884, there was no difference in the price of gas supplied to the two districts; from 1884 to 1894, the charge at Birkdale had been 3d. per 1000 cubic feet higher than at Southport; and since 1894, the charge had been 6d. more.

Then from 1884 to 1894, you got 3d. back of the 8d. we are paid for the use of the mains and pipes; and since 1894, 6d. I put it to you that the spirit of the Act was that Birkdale and Southport should pay the same rate, and that you are getting back part of your payment to us?

The CHAIRMAN: I see nothing in the Act about the charge.

Mr. WEDDERBURN: I put it only as the spirit of the Act.

Replying to Mr. SOAMES, witness said the population of Southport was 52,000, and of Birkdale 16,000. The consumption of gas at Birkdale was rather more than one-fifth of the whole. They were not contemplating extending their works at Southport. These were ample, even for an increased demand; and if Birkdale was taken from them, their works would be too large.

Mr. *William Smith*, Gas Engineer to the Corporation of Bolton, said he considered the system at Southport was excellent, and the pressure ample—indeed, it was 2-10ths higher than the pressure under which they supplied at Bolton. On Feb. 6, he visited Southport and tested the pressure at various points. The pressure at the works was 22-10ths, and at the boundary of the Birkdale district 18-10ths; so that the loss between the works and the boundary—a distance of about 3 miles—was only 4-10ths. But in Birkdale, he found the loss was 8-10ths—a result due, he considered, to the defective mains. In 1894 he inspected the supply, and then recommended in his report that the mains at Birkdale should be increased; but nothing had been done. The plant at the gas-works was equal to the estimated demand for many years. The 20-inch main would supply a very much larger population.

Mr. FREEMAN read a letter to the local Press, from a Councillor who said the gas was so bad he could not see to read his newspaper.

Witness: I do not wonder at it. With the present pressure, I should have been surprised if it had been otherwise.

The CHAIRMAN asked what was the present price of the gas.

Mr. FREEMAN replied that the price was 3s. per 1000 cubic feet at Southport, 3s. 6d. at Birkdale, and 4s. at Ainsdale.

Mr. *Corbet Woodall*, examined by Mr. FREEMAN, said he had examined the system of distribution within the area of the Southport Corporation. The mains were adequate and well arranged, as was shown by the fact that the pressure was so uniform. With an initial pressure of 22-10ths at the gas-works, there was a minimum of 17-10ths or 18-10ths at the remote part of Southport and along the boundary between Southport and Birkdale. This proved conclusively that the mains were adequate, and that everything was working satisfactorily. Directly they crossed into the boundary of Birkdale, there was a considerable falling off in the pressure. He attributed this to the fact that on the Birkdale side of the boundary the mains were constricted so very much in comparison with those that brought the gas to the boundary. After a visit he made to Southport, the Corporation officers carried out some tests at 6.30 p.m. The consumption at that time would be at its highest. Starting with an initial pressure of 22-10ths at the works, they found the record varied from 17-10ths to 11-10ths on Feb. 1, and from 16-10ths to 10-10ths on Feb. 2. The general fact was that the pressure was diminished by about one-half very soon after the boundary was crossed. From the automatic registers produced, he was sure that, for the consumption of gas, the size of the pipe was too small. As a Gas Engineer of experience, he would expect to find such a drop a cause of great dissatisfaction. The tests showed that larger mains ought to be laid in Birkdale.

Mr. FREEMAN: In your opinion, do the clauses which are proposed in the Bill fairly meet that requirement.

Witness: I think they do. I am bound to say that I regard the whole arrangement as an unfortunate one ever to have been entered into; and for my part I can see no reason why, after thirty years of apparently almost constant disputes, it should not be altered. To my mind, the better plan would be for the Birkdale people to sell their mains to the Southport Corporation, and let Southport have all the responsibility—in fact, they have the responsibility now—and the facility to perform their duties properly.

But short of that somewhat Draconian measure, do you think what we are suggesting is the next way of getting over the difficulty?—I do.

In further examination, witness said it was not reasonable that, when the Corporation had provided an adequate supply, Birkdale should be allowed to cut themselves off. They could give a satisfactory supply if Birkdale fulfilled their duties. He did not like to suggest it; but such a proposal seemed to him rather to indicate that Birkdale did not mind putting Southport under the disrepute of giving a bad supply, because it created dissatisfaction with the Southport supply, and might lead to a demand for a change. The faults found by the consumers were due to want of pressure, and not to the quality of the gas.

Mr. WEDDERBURN: I suppose one method of dealing with combatants of thirty years' standing is to separate them. That is one way of satisfactorily ending a quarrel?

Witness: It is a method; but it depends altogether upon the circumstances of the case.

Cross-examination continued: In his opinion, they could not cut off Birkdale without causing considerable loss to Southport, who had spent a good deal of money in building gas-works and laying down mains to supply a large area of which Birkdale was a part. If Southport were coming for powers at the present time to supply Birkdale as well as themselves, he would expect Birkdale to ask for a purchase clause, and he would expect Parliament to give it; it was according to precedent. Under the Act of 1871 there was a contract between Birkdale and Southport; and the only statutory obligation upon Birkdale at present was that, while they should have the exclusive right to lay gas mains and pipes, they should keep them in good repair. Part VI. of the Bill, he allowed, would create a different state of things. The Birkdale people had read the contract in such a way as to make their supply unsatisfactory. The present was an exceptional case. He could not remember a similar one, though he knew there was one, in which a local authority owned the pipes and another supplied into them.

Mr. Wedderburn: I put it to you that the real test for the consumer is, What is the economic pressure at the burner?

Witness: I really do not understand "economic pressure."

I will put it in the simplest form I can. The real test for the consumer is the pressure he gets as the gas comes out of the burner?—Yes; up to his burner.

Then what do you say is the pressure, at a Sugg burner, between the governor and the burner?—I really am not quite sure. I should think about 5-10ths. That would be from the argand burner.

The "Christiania" burner?—The "Christiania" would require rather more; it is a flat-flame burner. The pressure required for the different kinds of burners differs very much indeed. The majority of burners that are used are such as to destroy about two-thirds of the light of the gas, and require a very heavy pressure to drive the gas through them at all. Then, again, I should like to mention that the incandescent burner, which is so generally in use now, requires a larger amount of pressure than either of the others I have been dealing with.

Cross-examination resumed: He went over the works of the Southport Corporation in 1898, and made a report that if they managed things better they could get a still larger profit. The new profit would not, however, be realized until a considerable amount had been spent in rebuilding.

Mr. Wedderburn: So we may take it that now we are before the Committee, and now that both parties are discontented with their bargain of 1871, and it may be that the Southport Corporation will before long have to alter their works, if any moment will ever be opportune to reconsider the matter and to put an end to the dispute, this is the opportune moment?

Witness: I do not see that at all. I say the Southport Corporation have done exceedingly well by the consumers of gas over their area. They have excellent works, sufficient for Southport, Birkdale, and the district.

Re-examined by Mr. Freeman: If the control of a Government Department was brought to bear, and Birkdale kept their pipes in order, there would be no further difficulty. Though, as he had said, if Southport were coming to take powers to-day, a purchase clause in favour of the outside district would be inserted in the Bill, he had never known of such a clause being put in against the will of the corporation.

The Chairman: If the mains were made larger in Birkdale, as is suggested, would there probably be a larger consumption of gas?

Witness: There would, and considerably larger. I think that Birkdale would find it to their interest to make the alteration suggested, because of the increased amount they would receive from the change.

That is the very point; and that is why I ask the question whether, if your view turns out to be correct—if Birkdale were to be put to any expense—you think they ought to get a return for it from a larger consumption of gas?—They would, and I believe a very profitable return.

By the Committee: The large mains in Southport were much bigger than were now required for Southport alone, and more than would be needed even with the increased growth of the borough.

Thursday, March 15.

Mr. *George Lloyd*, Accountant to the Borough of Southport, gave particulars of the profit on the gas undertaking from 1871 down to the present time. He estimated that the average profit on the capital invested was only 4·3 per cent. per annum, which was less than Parliament allowed to boroughs for electric light undertakings.

By Mr. Wedderburn: During the last five years, the average profit had been £11,000 per annum. In his opinion, only 7 per cent. was contributed by Birkdale.

By the Chairman: The capital outlay on the undertaking, which at the commencement was £37,000, had been increased, till at the present time it was £238,000. During the last five years, the net profit had been over 5 per cent. on the capital outlay. This period would include 1895, which was a record year. Only one-fourteenth of the net profit was derived from Birkdale.

Professor *Vivian B. Lewes* said he had tested the gas at Southport and Birkdale on several occasions in 1896, 1897, and again this year. He had been a witness in the prosecution instituted against the Southport Corporation by the Birkdale Local Authority. He had no reason to quarrel with the results obtained by Birkdale. It was merely a question of the burner which should be used. The Birkdale authorities were using burners entirely unfitted for the purpose of testing the gas. They were using a 15-hole argand burner. The Southport Corporation, who were the makers of the gas, naturally chose a burner better suited to the purpose; and the difference between these two burners was 4·7 candles in the illuminating power of the gas. Coming down to later times, Parliament had decided, in the case of the Preston Gas Company, that the Company were entitled to use the Sugg "F" burner, as it was a suitable one. He agreed that 15-10ths was a very good distributing pressure, and one that would ensure satisfaction to the consumers. The initial pressure of 22-10ths was, in his opinion, reasonable.

Cross-examined by Mr. Wedderburn: He had made no personal tests as regarded the pressure. Of course, the pressure would be affected by the extent of consumption, so that how far it was good would merely be a matter varying day by day, according to the extent of the consumption in the district.

Mr. Wedderburn: Is one also to take it that, as small pipes come more in contact with the gas than large, therefore in all cases large pipes are better than small?

Witness: They are for keeping up illuminating power.

In re-examination, witness said that the 15-10ths to which he had referred did not relate to the boundary alone, but to the whole area of supply. This was the pressure which he considered should be in the whole of the streets of Birkdale.

By the Chairman: A pressure of 15-10ths from the main would be the proper pressure, for the reason that there was now a very great increase in the use of incandescent burners.

Mr. *George Livesey*, in answer to Mr. Davies Williams, said he had heard the evidence as to the drop in the pressure of the gas when it entered the district of Birkdale. He had read clause 58 of the Bill; and under the existing circumstances, it was both a reasonable and necessary clause.

Mr. Williams: Can you give the Committee your own explanation of how the pressure really drops in mains of the kind in use in Birkdale?

Witness: If you suddenly reduce the capacity of the mains, the pressure of necessity is also reduced. It always is so. If you have large mains, the pressure is carried farther on into the district. It is always considered bad to suddenly reduce the size of a main.

You have had, of course, a very extensive experience in gas matters. What do you say of our initial pressure of 22-10ths?—I think it is an indication that the mains throughout Southport, at any rate, are ample for their purpose, because I consider 22-10ths a low initial pressure.

The fact that, with an initial pressure of 22-10ths, the pressure at the boundary of our district only comes down to 18-10ths, shows that the arrangement of the mains is adequate and well arranged?—I suppose it is a distance of not far short of 2 miles; and the loss of only 4-10ths in 2 miles is very small indeed.

Whatever the initial pressure might be, at the boundary there would certainly be an enormous drop?—Yes; there would be bound to be a considerable drop.

And whatever the pressure at the boundary might be, are you of opinion that the arrangements for distribution in Birkdale are radically bad?—The mains ought to be under the control of the suppliers of the gas.

Cross-examined by Mr. Wedderburn: Your view is that the mains should be entirely under the control of those who supply the gas?

Witness: Yes; but I do not think Birkdale is large enough to start on its own account.

Mr. Wedderburn: Occupying the position you do, of course we should not expect to find you in favour of municipalization.

Witness (continuing) said in London they had very much increased the initial pressure. The South Metropolitan Company had increased their pressure to 40-10ths or 45-10ths. If the pressure at the Southport works was increased, there would, of course, be an increased pressure at Birkdale; but if they increased the pressure more than was required, the Southport consumers would be forced to burn more gas than they needed. There would be too large a supply in Southport if the Birkdale people got what they wanted.

Mr. Wedderburn: That is to say, we have got to do some expensive work in Birkdale, in order that the Southport people may not be put to expense themselves?

Witness: No; it is not quite that. If the pressure was increased in Southport, it would be detrimental to the consumers there. They get an ample supply.

You have told us you have made no personal tests; and I understand, in expressing approval of this section of the Bill, you do so upon the assumption that so much of the evidence as you have heard is right?—I approve of the section of the Bill under the circumstances; but I say the whole conditions are wrong, and they will never produce agreement between the parties.

This concluded the evidence for the promoters.

Mr. Wedderburn then addressed the Committee. He could not help expressing surprise that the promoters had only brought forward expert evidence. They had not produced a single consumer of gas in Birkdale to say that at the present moment he was discontented. The question was one of the very greatest importance to the people of Birkdale, both as gas consumers and as ratepayers. It was whether the Birkdale Urban District Council were to have a chance of freedom, or whether by the clause proposed the Committee were to forge fetters which it never was intended they should wear. He asked the Committee to adopt one of two courses—either to reject altogether clause 58, in which case they would be able next year to come to Parliament with a Bill to enable them to free themselves from Southport altogether; or, if the Committee agreed to pass the clause, which bestowed gigantic and unprecedented powers on Southport, that they should give Birkdale a purchase clause, enabling them to cease their relations with Southport in the matter of gas. He contended that the proposal in the Bill was as wanting in principle as it was wanting in precedent. The action of Birkdale in not carrying out the Provisional Order which they obtained, had had the effect of laying up for themselves a thirty-years' war. The Act of 1871 introduced the contract with which neither party was now satisfied. It was impossible to dislike it more than Birkdale did; and that Southport did not like it, was proved by their seeking to alter it in the present Bill. He contended that the agreement was unjust, and confidently asked the Committee not to pass the clause the promoters asked for.

The Chairman, after a short consultation, said the Committee had decided that the preamble of the Bill, so far as related to Part VI., was proved. On clause 63, when they came to consider the clauses, the Committee would like to have some explanation. The question was then raised as to the reserve fund. If such a fund were started, the Committee would have to consider if any advantage should be given to the Birkdale people.

Mr. Balfour Browne said he quite understood the point. It did seem rather unfair to ask Birkdale to contribute to a sinking fund; so he thought they had better strike the clause out altogether.

The Chairman: Very well. Clause 63 is struck out.

The remaining clauses were gone through; and the Bill was ordered to be reported to the House.

HOUSE OF COMMONS COMMITTEE.

Tuesday, March 13.

(*Before Mr.* Lewis Fry, *Chairman, Sir* John Kinloch, *Mr.* Cornwallis, *and Mr.* Trevelyan).

OSSETT CORPORATION GAS BILL AND OSSETT GAS BILL.

These Bills came up together to-day, as competing measures, for consideration by the above-named Committee of the House of Commons. The first is to authorize the sale of the undertaking of the Ossett Gas Company to the Corporation, and to enable the latter to supply gas within the borough and to places adjacent. The Ossett Gas Bill is "to extend the powers of, and amend, the Act relating to the Ossett Gas Company, and for other purposes."

Mr. Balfour Browne, Q.C., Mr. Blennerhassett, Q.C., and Mr. W. L. Williams appeared for the Corporation; and the Gas Company were represented by Mr. Claude Baggallay, Q.C., and Mr. Honoratus Lloyd. The Horbury District Council reserved appearance by Counsel on their petition against the Corporation Bill, but instructed Mr. Wedderburn, Q.C., and Mr. W. L. Williams to appear for them in opposition to the Gas Company's Bill.

Mr. Balfour Browne, in opening the case for the Corporation Bill, said the measure was a simple one. It proposed the purchase of the undertaking which had been supplying gas to Ossett and Horbury. The adjacent districts of Shillington and Crigglestone were not supplied, but the Corporation were seeking power to supply them. Of course, if the Corporation Bill passed, the Company's Bill would not, because they were seeking to raise £50,000 to carry on their works, which would be entirely unnecessary if they were purchased. Parliament would hardly give them power to supply two places outside, if they were to be purchased by the Corporation. The main question, therefore, was were the Corporation or were they not to have the power of purchase. Horbury was not within the borough; it was an independent place. Ossett received its Charter in 1820; the rateable value in 1871 being £27,069, in 1881 £40,000, in 1891 £42,000, and now £45,000. The population, which in 1871 was 9200, was now 12,500. The debt of the borough, which had all been incurred for important public objects, amounted to £70,000. The rates were 5s. in the pound for general district purposes, and 2s. for the poor. They had a contract for the supply of water from the neighbouring authorities of Dewsbury and Heckmondwike; the water being largely obtained in bulk. The Gas Company were established in 1855, to supply gas to Ossett and Horbury. Their capital was £12,000; and they were authorized to borrow £3000 in addition. In 1872, they obtained further capital amounting to £38,000, with borrowing powers to the extent of £7000; and in 1867 the Company converted the £3000 borrowing powers into shares at 10 per cent. Here came in his first complaint. The action to which he referred was a perfectly legal thing for the Company to do. They had power to borrow £3000; and he supposed they would borrow at 3½ or 4 per cent. While they were paying the interest on the £3000, it was a small charge on the consumers; but when the sum was converted into 10 per cent. shares, £300 a year had to be charged to the consumer. This amount came out of the pocket of the consumer; and from his point of view, it was clear that the Company might have managed their business more economically. Not that the transaction was in any way illegal. In 1871, the Company were going to apply for further powers; and a public meeting was held on Nov. 27, with a view to authorize the Local Board to purchase the works. From that time down to the present moment, there had been a growing desire on the part of the town to become possessors of the gas undertaking, and to oust the Company on fair terms. The town had at that time made an offer of £11 5s. for every £10 share. The offer was then thought to be liberal; but the Company declined to consider it. They said: "You are only Ossett. You cannot speak for Horbury; and we will not listen to the proposal until Horbury joins with Ossett and makes an offer." The negotiations thus broke down. The Company now sought to raise £50,000 of new capital, and to borrow £12,500. The Committee would be told that, until the very date of the notice for the Bill, there was no negotiation with the Corporation for the sale of their undertaking; and he ventured to think that they never would have promoted their measure at all, had they not gone to some gentleman from London—an expert—who said: "Oh! if you can only get Parliament to pass a Bill, you can greatly enhance the value which will attach to your undertaking when the Corporation come to purchase." He would ask the Committee to see that the Company obtained fair terms, but to refuse to pass a Bill which would have the effect of enhancing the value of the concern in view of purchase. The Company also sought power to convert their ordinary stock from 10 per cent. to 5 per cent. capital. Of course, if the Bill of the Corporation passed, it would be unnecessary to convert at all; but if the Gas Company were to continue to exist, there was ample precedent for the proposed conversion. It would not increase or enhance the value at all. The price which the Company were charging to-day was 2s. 9d. per 1000 cubic feet; and the Committee would hear that ever since 1871 there had been serious complaints with regard to the charge which had been made. It might be taken—whether the Corporation were justified in their complaints or not—that the Company could supply gas at 2s. 9d. per 1000 cubic feet. What were they now proposing? Why, to ask Parliament to authorize them to charge, not a maximum price, but a standard price of 3s. 6d. per 1000 cubic feet, the result of which would be a margin between 2s. 9d. and 3s. 6d. of 9d. If their scheme were successful, they would at once put the price up to 3s. 6d. and reduce it to 2s. 9d., which would enable them to declare 2¼ per cent. more dividend on the 10 per cent. stock. Obviously, this was a mere juggle to get 2¼ per cent. more from the consumers. As to the 7 per cent. stock, the proposal would enable the Company to divide £1 11s. 6d. more on that; supplying exactly the same gas that they did now. He thought, therefore, he was justified in saying that the whole object of the Bill was to enhance the value in view of purchase. The Company proposed to raise the illuminating power of the gas from 14 to 15 candles; but he ventured to say that every gas company who had come to Parliament during recent years had increased the illuminating power of their gas. From 15 to 16 candles was the usual illuminating power in all places near Ossett. The Company also sought authority to build houses for their workmen. They had obtained a power of this kind already; and in the houses they had erected they had people living who had nothing at all to do with the works, so that they had actually become speculating builders under their Act of Parliament.

Mr. Baggallay (interrupting) remarked that he had been making inquiries with regard to a point just dealt with by his learned friend; and he was informed that, though in the Bill originally deposited the standard price of gas was 3s. 6d., in the filled-up Bill it was 3s. 4d. There was a neutral zone between 3s. and 3s. 4d. which would not affect the dividends.

Mr. Balfour Browne said that that was a death-bed repentance. They realized that their original proposal was a monstrous one, and had put forward another which would still enable them to raise their dividends, though not to so great an extent. This kind of transfer was taking place every day; and he had never seen a case in which a fair and liberal award was not given to a gas company. If the present Company obtained that, would they be any worse off than now? There were numerous complaints made against the Company. In the first place, great delay had taken place in the lighting of parts of their district, and oil-lamps had had to be resorted to. Then there had been complaints made as to the manner in which the streets had been restored after the pipes had been laid down; and this, he thought, was one strong reason why gas and water supplies should be in the hands of the municipal authorities. It was a bad thing to have two bodies dealing with the same street. With regard to quality, in 1885 the gas was so bad that the people in the town could not see at night to do their business; and in 1893, during the prevalence of a severe frost, for the reason that the mains had water in them which became frozen, the lamps in the town could not be lit. The Company had been asked to refund the money they had received for public lighting during this period; but they had declined. These were small points, but they showed that there was friction; and his contention was that this friction could be avoided if the lighting were put into the hands of the Corporation. After referring to other complaints as to bad lighting and high price of the gas, the learned Counsel proceeded to quote the correspondence as to purchase by the Corporation. He pointed out that in 1896 they had offered the Company £78,840 for their undertaking. This the Company had refused to accept. He also referred to the facts that the Company had acted illegally by paying the income-tax on the dividends of the shareholders when the maximum of 10 per cent. had been reached; and that the Corporation had tested the feeling of the ratepayers on Jan. 28, 1899, by taking a poll on the purchase question, when 833 had voted for purchase and 171 against. Thus the ratepayers had endorsed the action of the Town Council, which had been in favour of purchase. Having alluded to the many precedents supporting compulsory purchase, he dealt with the petition of the Gas Company against the Corporation Bill. The 8th paragraph set forth: "Your petitioners were incorporated and empowered as in the preamble of the Bill recited; and they strongly object to sell or part with their undertaking. They have for many years past supplied gas within the borough; and practically no complaints have ever been made as to the supply, price, or quality of gas or otherwise. They have not, nor does the Bill suggest that they have, been guilty of any misconduct or negligence in the execution of the powers conferred, or in performing the duties imposed upon them by any of the Acts referred to in the preamble." These statements he denied, and undertook to disprove in the evidence he should tender, as also the following: "No public necessity has been, or can be, alleged which would justify the proposed compulsory transfer of your petitioners' property to the Corporation. Your petitioners have always managed their undertaking with efficiency and economy, and to the satisfaction of the consumers; and they submit that it is unjust to them, and contrary to the interests of the ratepayers of the borough, that the powers sought by the Bill should be granted." In the next paragraph the petitioners said: "The area within which your petitioners have been, or are, supplying gas extends beyond the district under the control and management of the Corporation; and this constitutes a further reason why Parliament should not sanction the transfer—especially as the Bill (clause 52) provides for the profit of the gas undertaking being carried to the credit of the district fund of the Corporation, instead of being applied to the reduction of the price of gas." This referred to the old argument that the Corporation should not be allowed to buy because part of the undertaking was in Horbury. But Horbury and the Ossett Corporation had come to an agreement, and were to be partners. The petition went on to say: "Your petitioners are now promoting a Bill pending in your honourable House, to enable them to meet the growing demand for gas within the limits of supply, and to enable them to continue the conduct of their business in the future with efficiency and economy, and to place them in a position to meet all modern requirements." The answer to this was that the Corporation did not believe there was any large increased demand for gas. Besides, they still had money in hand, or ought to have, to satisfy the wants of the district without raising fresh capital. The petitioners said: "Your petitioners, while objecting most strongly to any powers being conferred upon the Corporation for compulsory acquisition, would point out that the determination of the consideration, in accordance with the provisions of the Arbitration Act, 1889, is a procedure unusual and unfair to the Company, and contrary to the practice of Parliament; and there are also other provisions with regard to the proposed acquisition to which your petitioners strongly object." The appeal to arbitration was not unfair. It was a monstrous thing to say that a measure passed with the approval of the Legislature did an unfair thing. All that was proposed was to leave the question of price to the decision of the Arbitrator. In most instances, the Lands Clauses Act had been put in; but in the case of Matlock Bath, though the Company fought for the Lands Clauses principle, arbitration clauses were inserted. He maintained, therefore, that the proposal was not contrary to the practice of Parliament. Clause 13 of the petition said: "Your petitioners submit that the proposals of the Bill will inflict great and needless injury on your petitioners, and their property, rights, and interests, without any corresponding benefit to the public, or to the owners of property or ratepayers or consumers of gas within their district." How was this? The Company could invest their money in some other undertaking, and secure a similar dividend to that they were now receiving. Altogether, he must describe the petition as a very weak one. The learned Counsel then dealt with the petition of the Corporation against the Bill of the Gas Company, which covered points

for the most part dealt with in the evidence. In the course of it, he read a letter from the Corporation to the Gas Company, in which they expressed their wish to meet the shareholders and principal officers of the Company fairly, and asking on what terms the Directors would be willing to sell the undertaking. To this the Gas Company, through their Solicitors, replied that they would be prepared to place before the shareholders a proposal by the Corporation for the purchase of the under taking as soon as they were definitely assured that terms for the future had been arranged by the Corporation and the Horbury Urban District Council.

Alderman *Frederick Audesley*, who was the first witness examined by Mr. Blennerhasset, said he was Chairman of the Gas Purchase Committee of the Corporation, and gave details as to the establishment and working of the Ossett Gas Company. For the past 25 years, complaints had been constant and serious as to the gas supply and the working of the undertaking; but the Directors had been callous to all entreaties. Witness give instances to show that the Company had neglected to lay pipes for the supply of some districts, even when the supply was urgently desired by the inhabitants, and repeated applications were made for it. The Corporation had spent hundreds of pounds in laying gas-mains; the alternative being either to go without light or to pay the cost of getting it themselves. He described the movement in Ossett for the acquisition of the gas-works, which had culminated in the promotion of the Corporation Bill. Witness also described the illegal action of the Company in paying the income-tax of shareholders while they were dividing their maximum dividends.

Mr. Claude Baggallay admitted that down to 1898 the Company had paid income-tax when declaring their maximum dividend, which was clearly illegal. But other gas companies had done the same thing; and it was not until the Morley case drew attention to the illegality, that the practice was abandoned. The amount paid for income-tax was £1050, spread over a number of years.

Witness, in further examination, stated that the Corporation were now willing to give £86,500 for the undertaking, or to submit the matter to arbitration. Among other objectionable proceedings, the Company had purchased lands contrary to their statutory powers.

Cross-examined by Mr. Claude Baggallay: He was aware that if a gas company were required to extend their service beyond a certain distance from the mains they were entitled by Parliament to ask for guarantees from the persons to be supplied. At the same time, companies were bound by their parliamentary obligations to give a gas supply to the full extent of their means. As to the sliding-scale, he considered it very unjust to the consumers. Under it, the shareholders at Wakefield received 11½ per cent., whereas they used to have 10 per cent. He did not inquire whether the standard price was fair or not. The charge for gas was lower at Wakefield than at Ossett. There were very few places around Ossett where the local authorities did not supply gas themselves. There was a majority of the townspeople of Ossett in favour of purchasing the gas undertaking. After that, they lost the majority; but they regained it two years ago.

In re-examination, witness said that there were several coal mines in Ossett itself; and the material for making gas was therefore cheap. At Heckmondwike, the price of gas was 2s. 6d. per 1000 feet.

Councillor *Wormald*, Mayor of Ossett, said he was a manufacturer in the town and a large consumer of gas. The local Chamber of Commerce had passed a resolution in 1887 complaining of the "wretched quality of the gas," and requesting a supply of greater illuminating power. This had not much effect on the Company. Subsequently, in 1894, a conference of representatives of public bodies was held to discuss the subject; and a deputation was appointed to wait on the Company. In 1895, there was another conference, to consider the question of a reduction in the price of gas and the improvement of the quality. Another deputation was then appointed; but all to no purpose. He went on to say that, as Mayor of the borough, he had received frequent complaints about bad gas, poor light, and blackened ceilings. The complaints which had been made were not matters of yesterday, but had gone back for a considerable time. He was decidedly in favour of the Corporation taking over the supply.

Cross-examined by Mr. Lloyd: Do you suggest that in this district, and under existing conditions, 2s. 9d. per 1000 cubic feet is an unreasonable price for gas?

Witness: I think it might have been sold for less in days gone by.

But speak of to-day?—I do not think it is an exorbitant price, considering the cost of coal just now.

It is complained that the gas leads to the blackening of the ceilings?—Well, that is a lady's complaint.

Do you think much of it?—They like to keep their homes as clean as they can. It may be that, the richer the gas, the more it blackens the ceilings.

Mr. *W. Brook*, Town Clerk of Ossett, gave evidence as to the negotiations which had taken place between the Corporation and the Company. He stated that the quality and the price of gas, with other things, had formed a constant source of complaint against the Company.

Wednesday, March 14.

Mr. *Brook*, continuing his evidence, said that he received a letter on Oct. 4 last from the Company, which contained the first intimation he had, in any shape or form, that they were going to promote a Bill. No one was more surprised than the Corporation when they had the intimation. In his capacity as Town Clerk, he had received many complaints as to the quality and the price of the gas. The unsatisfactory character of the supply was the common talk of the town. With regard to the views of the neighbouring districts, the Corporation had had an interview with the Parish Council of Shillington, and found that they had decided to support the Corporation Bill, and were willing and anxious that Ossett should supply them. So far as Crigglestone was concerned, he had written to the Clerk of the Parish Council; and the last letter he had received from that gentleman was to the effect that the Council intended to support the Company's Bill. That district desired to have a supply from the Company, in preference to the Corporation. He had written to the Solicitors of the Company, asking permission to inspect their works; and the Company had refused. The suggestion was made on the previous day that the Corporation had been invited to go and test the gas; but nothing of the kind had been done to his knowledge since he had been in Ossett—during the last seven years. If there had been such a suggestion made within that time, he must have heard of it. As to the purchase of land by the Company, he had searched the register kept at Wakefield, and had found that on Sept. 7, 1888, the Company had purchased a field containing 9874 square yards and 9 cottages, from John King, for which they paid £1460. He had also found that on July 31, 1891, the Company purchased from Eli Townend another field containing 2 acres 3 roods, for £800.

Cross-examined by Mr. Lloyd, witness said that, so far as the statutory majority was concerned, the town of Ossett had wavered in its opposition to the Gas Company, and on the subject of the purchase of the undertaking. The town, however, was now absolutely and entirely in favour of purchase, and of the Corporation Bill. That had now been cemented by the promotion of the Company's Bill, and by the agreement which had been arrived at between the Local Authorities of Ossett and Horbury. This, up to the present time, had been the most serious impediment in the way of the purchase of the gas undertaking by the Corporation.

Mr. Lloyd: If your Bill is not passed, do you not think that the Gas Company will have to raise further capital?

Witness: I do not think so; but I am not an expert.

You express an opinion, and I want to see what it is worth. In your opinion, if the Bill of the Corporation is not passed will it not be necessary for the Company to raise further capital?—They have not yet exhausted their present capital; but I may say that I do not know the existing position of the Company.

You take on yourself to say that further capital is not necessary?—I am not an expert, and cannot go into details.

You complain of the price of the gas?—I do. I suggest that 2s. 9d. per 1000 cubic feet is an unreasonable price. I have ascertained the price of gas sold by local authorities in the immediate neighbourhood of Ossett, and have found that it is heavier in Ossett than elsewhere.

Have you selected places of about equal size?—I have taken about half-a-dozen places like Dewsbury. In that town, to one section of the consumers the price is 3s. per 1000 cubic feet; but the public lighting is free. They make a profit of £3000 a year, which goes in reduction of the rates.

Do the Corporation look forward to reducing the price of gas out of the profits?—Yes.

Do you look forward to reducing the price of gas in your borough?—I do. We ask for a maximum rate of 4s. per 1000 cubic feet—taking that amount in order to be prepared for contingencies.

By the Committee: I should say that the Corporation are the largest customers of the Company. We pay them £600 or £700 a year. We are allowed a discount.

Mr. Lloyd: Is it not the fact that the Company have reduced the price of gas from time to time?

Witness: Not since the Corporation have asked them to do so.

That is because they had reduced it so much before—from 5s. 10d. per 1000 cubic feet in 1856 to 2s. 9d. Have the Corporation taken steps to test the quality of the gas?—Not since I have been Town Clerk.

You complain that the Company would not allow you to inspect their works?—Yes.

But Mr. Silverthorne has done so?—Yes; in 1896.

And he reported them to be in very good order, did he not?—Well, some parts of them.

As to the purchase of land, do you refer to the land which the Company have acquired near their works?—Yes.

If your Bill passed, would you not desire to acquire that land?—Undoubtedly—or some portion of it. Our complaint is that the Company bought land without statutory powers, and without having any definite purpose for the use of it.

In re-examination, witness said that, in a more or less degree, during the past 25 years there had been friction between the Corporation and the Company in regard to the gas supply. The Local Authority had always been a varying body; but in spite of changes which had taken place from time to time, there had always been friction between them and the Company.

Mr. *J. W. Smith*, merino and mungo manufacturer, of Ossett, said that he had been a member of the Local Board from 1878 until 1890, and a member of the Corporation from 1892 until the present time. He was in favour of the Corporation acquiring the gas undertaking. There had been continual complaints of the gas, and in his opinion these complaints had always been just. He thought the Company should be able to produce gas at a far less price than 2s. 9d. per 1000 cubic feet. The Company enjoyed peculiar advantages in the matter of coal supply. There were four or five collieries in the town of Ossett—one of them within 200 yards of the gas-works.

Mr. *Walter Hirst*, Borough Surveyor of Ossett, said that there were 378 public lamps supplied with gas by the Company; and the amount paid them by the Corporation was £939 13s. 1d. in 1896-7, and £900 8s. 5d. in 1898-9. Ossett had grown considerably in the interim. The gas supply for public lighting purposes had frequently been complained of, both as to quality and price; and complaint had also been made as to the unsatisfactory way in which the roads were broken up in the laying of mains. He himself had had to make complaint on these matters; and in addition to this, it was a fact that the consumers had from time to time complained of the unsatisfactory nature of the supply to them.

The Chairman: Do you think that if the works are taken over by the Corporation the price of gas will be reduced to the consumers?

Witness: I think the Corporation will be able to manufacture gas as cheaply as the Company, but I do not say cheaper.

Are you in favour of taking over the works?—I do not wish to express any opinion on that point.

Mr. *Arthur Silverthorne* said his first introduction to the gas supply of Ossett was in March, 1896. He was then consulted in regard to the project for the acquisition of the gas-works by the Corporation. He was asked to make a report on the condition of the works, and to give an opinion as to the margin of capacity for the production of gas remaining to them. Application was made for him to be allowed to inspect the works, and permission was given by the Company. He accordingly made the inspection, and submitted his report in May, 1896.

The Chairman: Tell us shortly the result of your inspection.

Witness said the works, in his opinion, were capable of supplying

630,000 cubic feet of gas per day; but the actual production was only 404,000 feet. He had found that the exhausting apparatus was of an old pattern, and not on the rotary principle; and this he did not think satisfactory. He had hinted as much in his report; and he had since learnt that the system he had found fault with had been abandoned. The leakage was 16 per cent.—an amount which, in his experience, was almost unique.

The CHAIRMAN: May we take it that the high rate of leakage is owing to defective mains?

Witness: It might be due to one of three causes, or to all of them—viz., to subsidence which exists in colliery districts, to condensation, or to repairs and renewals not having been conducted to the extent one would reasonably expect. There are indications that the renewals were upon a ridiculous figure; and it is upon this fact that I found my criticism as to the possibility of the leakage being considerably reduced. No doubt, if the leakage could be reduced the price of gas might be greatly lowered.

Mr. WILLIAMS: Did you advise the Corporation to make a specific offer for the purchase of the works?

Witness: Yes; £78,840. I considered that a fair and reasonable offer to make to the Company for purchase by agreement; but I believe it was rejected.

In answer to further questions, witness said he inferred that the Company had taken every opportunity that presented itself of spending capital, because they were not under the auction clauses. They had spent money on extensions, on cottages, purchase of land, and so forth. If instead of spending capital they had borrowed the money, they could have made all these extensions at a very much less cost. The expenditure which had been incurred was reflected now in an unnecessary charge on capital account. The gas would have been cheaper—in fact, it would have been possible to sell it at 2s. 6d. per 1000 cubic feet, if they had followed the course of borrowing money at a cheap rate, instead of raising capital at 7 per cent. interest. The undertaking was now in a position exceedingly suitable for the transfer. He had always been of opinion that a local authority had not invariably a right to insist on a transfer. If the position was that a company had received from Parliament certain duties or a certain possibility of raising capital, he maintained that, until this capital was exhausted, the company had really a *raison d'être* for refusing purchase or for protecting themselves against purchase. But when a company had used up all the capital authorized by Parliament, he said most positively that Parliament then could fairly hand over the concern to the local authority. When the capital was exhausted, the company had no longer any interest in the matter, and Parliament could very properly hand the undertaking over to the corporation. The offer now made for the undertaking—£86,000—was a very liberal one.

At this point, the Committee decided to take a short adjournment for luncheon. On their return to the Committee-room,

Mr. BAGGALLAY said: I think the labours of the Committee will be shortened. An approach has been made, from one side or the other, which has brought about a position in which the Company felt they could discuss terms; and, after some negotiations, the following terms have been agreed to: (1) The Company to be purchased under the provisions of the Lands Clauses Act, with reference to the purchase and taking of land otherwise than by agreement. Notice to be given within six months of the passing of the Act. (2) The mortgage debt to be taken over by the Corporation. (3) The reserve fund to be divided equally between the Company and the Corporation. (4) The Company to be entitled to reasonable costs and expenses of the promotion of the Company's Bill out of cash in hand. (5) The Manager and Secretary to be compensated under the Yeovil clauses. (6) The Company's Bill to be withdrawn. (7) Winding-up costs to be limited to £225. (8) The Morley Corporation Gas Act, section 11, to be adapted and inserted—that is, with regard to the distribution of money within the Company. (9) All contracts, other than in ordinary course of business, to be subject to the approval of the Corporation from this date.

The CHAIRMAN: The Committee are very glad to hear that an arrangement has been arrived at.

Thursday, March 15.

The Committee devoted a brief period this morning to the consideration of the agreement announced on the previous day by Mr. Baggallay, as having been arrived at between the Corporation of Ossett and the Gas Company. New clauses were drawn up, and others amended. Under these amendments, the settlement of the price to be paid for the gas undertaking by the Corporation will be decided by arbitration under the Lands Clauses Act. It will be for the Arbitrator to say whether or not as much as 10 per cent. shall be allowed in consideration of compulsory purchase.

The Bill of the Corporation was ordered to be reported.

HOUSE OF COMMONS COMMITTEE.

Friday, March 16.

(*Before Sir* T. GIBSON-CARMICHAEL, *Chairman, Sir* W. CAMERON GULL, *and Mr.* HORNIMAN.)

MORECAMBE URBAN DISTRICT COUNCIL GAS BILL.

This Bill, which provides for the transfer of the undertaking of the Morecambe Gas and Light Company to the Urban District Council, came before the above Committee to-day.

Mr. BALFOUR BROWNE, Q.C., and Mr. HONORATUS LLOYD represented the promoters. Mr. MOON appeared for the Morecambe Gas Company against any alterations in the Bill; and Mr. BLENNERHASSETT, Q.C., and Mr. HULTON, for the opponents, the Heysham Urban District Council.

Mr. BALFOUR BROWNE, in opening the case for the Bill, said that in 1856 a Company, without statutory powers, was formed to supply Morecambe with gas; and in 1897, the Company obtained an Act. In 1896 and 1897, the Morecambe Council purchased the undertaking of a Company called the Electric Light Power Company, Limited; and in 1898, the Gas Company applied for a Provisional Order to increase their capital. Soon after this, negotiations took place between the Company and the Local Authority, and terms were come to for the purchase of the gas undertaking. The Gas Company supplied not only Morecambe, but other districts, including parts of Heysham. Morecambe was now a place of considerable importance. In 1852, its rateable value was only £4480; and in 1897, it was £78,773. Its population had increased very rapidly—having risen from 6476 in 1891 to 12,853 in 1899. Morecambe was one of those places on the Lancashire coast where the steady population did not give the least idea of the enormous excursion traffic which was done in the summer. Hundreds of thousands of people were brought in for the day, or for the week-ends, from all parts of Lancashire and Yorkshire. The Company and the Corporation had agreed to the terms of purchase; the amount being £141,000, which, together with a loan of £9000 and compensation, would amount to £158,000. The only people who were opposing were the Urban District Council of Heysham. At the last census, there were only 766 people in the place; but it was estimated that the population by the middle of 1899 had become something like 4000—the greater portion being in the Sandylands district, which the Gas Company supplied. He did not quite understand what Heysham wanted, as the Morecambe Council had inserted the following clause (clause 18), which he thought was perfectly fair:—

> If at any time after the passing of this Act any Local Authority whose district is beyond the district of the Council, but as to the whole or any part thereof within their limits for the supply of gas, shall give not less than six months' notice in writing to the Council of their desire to purchase such portion of the undertaking of the Council as is contained within the district of any such Local Authority, and shall obtain the consent of the Local Government Board to such purchase, and shall apply to Parliament or the Local Government Board for power to purchase such portion of the undertaking of the Council (except the mains and pipes or other apparatus which shall be necessary for supplying with gas any other part of the limits of the Council for the supply of gas), and to supply gas within such district, then it shall not be lawful for the Council to oppose such application (except as to the details thereof); and if such powers of purchase and supply be granted, the Council shall sell, and such Local Authority shall purchase, the portion of the undertaking of the Council (except as aforesaid) within the district of such Local Authority, at such price, being a sum in gross, and upon such terms and conditions, as shall be fixed in default of agreement by arbitration under the provisions of the Lands Clauses Acts.

This was very much like the clause introduced into the Airdrie and Coatbridge Act of last year; and it had been put in absolutely voluntarily. It was in almost the words of the Stockport Act, which transferred the Stockport Water Company to the Corporation last year, and which was fought out in both Houses of Parliament very carefully. Heysham might say that Morecambe was paying too much for the undertaking; but this would not increase the price Heysham would have to pay. Under this clause, the Arbitrator would simply have to consider the value of the undertaking so far as Heysham was concerned, without regard to the price which the Morecambe Council had paid to the Company. The undertaking had been well conducted; the works were in excellent condition; and besides being capable of supplying the gas that was being sent out to-day, there was a large excess plant which could cope with a much greater demand in future. The Urban District Council of Heysham, in their petition, said that it would be unfair and unjust to compel them to purchase their portion of the Gas Company's undertaking in the manner provided by clause 18. The Morecambe Council were advised that they were buying the concern cheap; but when Heysham came to purchase their bit of it, they would not have to pay on the £158,000, nor on anything in relation to it. They would have to go to an Arbitrator; and the Arbitrator, under the clause, would have to find out the value of the portion of the undertaking which was in Heysham. He could give the Committee a list of twenty cases where portions of an undertaking had been bought and sold upon the conditions stated in clause 18. In one case, which might be in the minds of the gentlemen who drew up the Heysham petition, a very serious injustice had been done by stipulating that they should purchase the mains, pipes, fittings, and apparatus, instead of a portion of the undertaking. Stockton and Middlesbrough bought the undertaking of the Water Company; and the full significance of the clause not being understood, they agreed to part with the mains, pipes, fittings, and apparatus in the district of any of the outlying Local Authorities. Kirkleatham, one of the districts, gave notice that they wanted to purchase the mains, pipes, fittings, and apparatus; and the matter was referred to arbitration. The Stockton and Middlesbrough people said: "We have paid for the goodwill; and the goodwill in this district, together with the value of the pipes, amounts to £29,000." The Arbitrator did not take exactly this view; but he put it at £25,000. The other side said: "All we have got to purchase, whatever you paid for it, are the pipes; and the pipes were valued at £8000," The case went up to the House of Lords; and it was held that Kirkleatham was right, and that, though the Arbitrator found that the loss to Stockton and Middlesbrough was £25,000, they were only to be paid £8000. Since then everybody had said: "We will not have that clause. We must have the clause which says 'a portion of the undertaking.'"

Mr. *Thomas Newbigging* said that years ago he had advised the Gas Company as to some extensions and developments that they were making; and recently he had visited and inspected the works. He had also been over the district of supply. The capital of the Company, under their first Act, consisted of £20,000 consolidated original stock, and £16,000 additional. This £16,000 was to be raised by auction; and the Company issued £10,406 of preference stock, on which they obtained a premium of £5994. In 1899, the Company obtained a Provisional Order giving them power to issue further capital stock to the amount of £16,000, to be raised under the auction clauses. Of this latter amount, £3600 was offered by auction last year, and realized, with the premium, £10,000. The borrowing powers under the Act of 1879 were £9000, and under the Order of 1899 £4000. The Company were under the sliding-scale; the standard price being 5s. per 1000 cubic feet. The standard rates of dividend on the original capital were 10 per cent., on the additional capital 7 per cent., and on the preference capital 6 per cent. The price charged for gas in the half year ending December last was 3s. 3d. per 1000 cubic feet for lighting, and 2s. 10d. per 1000 cubic feet for cooking. This enabled the Company to pay a dividend of 15¼ per cent. on the original stock, and 12¼ per cent. on the additional stock. Notwithstanding that electricity had been adopted for the public lighting, there had been an increase of nearly 30 per cent. in the profits—showing that the profitable part of the business was still growing rapidly. The

gas-works were well managed, and were in excellent order throughout; and they were largely in excess of the present requirements. He considered that the retorts were 114 per cent. in excess, the scrubbers 202 per cent., the purifiers 117 per cent., and storage 30 per cent. The condensers, exhausters, and station-meter were working up to their full capacity. In the negotiations for the sale of the undertaking, he had acted on behalf of the Council; and he considered that the bargain was a very good one for them. In point of fact, they had bought a statutory company at the price of a non-statutory company. He believed that, had they gone to arbitration, the award would have been higher.

Cross-examined by Mr. Blennerhassett, witness said they were willing to insert a clause in the Bill protecting Heysham from being charged any higher price than Morecambe. The filled-up Bill reduced the standard price to 4s. 6d. per 1000 cubic feet; but having regard to the growth of the district, he did not think that they would ever have to charge more than the present price. The profits for the year 1899 were £5483. He believed that a million of money was to be spent by the Midland Railway in making a deep-sea harbour at Heysham. The intention of the promoters of the Bill was that, if the Heysham Council bought their portion of the undertaking, they should pay for the goodwill within their limits. He knew that the Model Clause was entirely different to clause 18; but the Model Clause was never followed nowadays.

Re-examined by Mr. Balfour Browne: If Heysham bought from the Company, they would certainly have to pay for the goodwill; but they were now proposing that when they bought from the Morecambe Council Heysham should have the goodwill thrown in. By means of the incandescent gas-burner and the penny-in-the-slot meter, they had been able to hold their own against electric lighting.

Mr. *E. H. Stevenson* said that he was engaged by the Morecambe Council, with Mr. Newbigging, to arrange the purchase of the undertaking. His object had been, of course, to buy at the cheapest price. The works were very good indeed; they had a considerable surplus of manufacturing plant. They made a better bargain with the Company than they had recommended the Council to make; for the Company accepted a lower price than they had advised the Council to give, if absolutely necessary. As they were actually supplying in the Heysham district, it would be unfair to take away the goodwill value without paying for it. Practically the "pipes, fittings, and other apparatus" clause had been a dead-letter for a long time, until last year. Then it was inserted in some Bills in which there were no mains, or only a few yards of mains, outside. Since 1890, there had been 41 cases in which the "portion of the undertaking" clause had been put in, as compared with 19 in which it had not; and among those 19 were the 6 which were passed last year. The Model Clause was therefore practically a dead-letter. The Model Clause really led to great hardship. In the Wakefield case, for instance, £40,000 was given for the goodwill, and only £1500 was paid on the re-sale. The standard price in the Bill was a reasonable one, and would never have to be put in force unless there was some awful coal famine such as occurred in 1873. The growth of the undertaking was so great that it would allow for a very large increase in the price of coal without the necessity of raising the price of gas.

Mr. *Corbet Woodall* said that he had advised the Gas Company in regard to the sale of their works. The Company had been very prosperous. They were incorporated by Act in 1879. The sale of gas in the following year was as low as 8 million cubic feet; but in 1899 it had increased to 68 millions—showing that in nineteen years the business had increased more than eight-fold, which was, in his experience, quite unique. Acting for the Company, he had met Mr. Newbigging and Mr. Stevenson; and he considered that the price agreed upon was a fair one, although not extravagant. What he had sought was to obtain for the Company a sum which, invested in equal, or rather in better, security would give them the same income that they were deriving, and were certain to continue to derive, from the gas undertaking. The claim put forward by Heysham was most unreasonable. If the Gas Company were supplying Heysham only, and the Local Authority were buying it, they would have to pay them for goodwill; and why they should be released from this because they were only buying a part of the undertaking, he could not understand.

Cross-examined by Mr. Blennerhassett, witness said that if they had gone before an Arbitrator they would probably have paid a higher price.

Mr. Moon, on behalf of the Gas Company, then asked to be heard against alterations.

The Committee, however, declined to hear Counsel on the preamble.

The case for the Heysham District Council was then considered.

Mr. *R. B. Lee* and Mr. *James Harrison*, members of the Heysham Council, said that the Gas Company only lit a small part of Heysham, and had no works in the district. The place was rapidly increasing, particularly as the Midland Railway were now spending about a million of money upon developing the harbour; and the Local Authority would soon want to become their own lighting authority. When Heysham took over the mains and pipes which were in their district, they ought not to be called upon to pay the large sum for goodwill and prospective value which the Morecambe Council were undertaking in the Bill to pay to the Company. Mr. Harrison, in cross-examination by Mr. Balfour Browne, admitted that a certain sum ought to be paid for goodwill; but in re-examination by Mr. Blennerhassett, he said they ought only to pay for the mains and the pipes.

Mr. *T. N. Ritson*, of Kendal, who was called by Mr. Blennerhassett, said that the Morecambe Company were only supplying a very small portion of Heysham, which was a growing district; and any extension of the works in Morecambe which might be required for enabling them to give additional supplies, would be very costly.

In cross-examination by Mr. Balfour Browne, witness admitted that anybody purchasing the undertaking from the Company would have to pay for the goodwill of the Heysham portion of the undertaking.

The Committee then adjourned till Monday.

Yesterday week at a meeting of the ratepayers of Wolverhampton, power was given to the Town Council to oppose the East Shropshire Water Bill, for supplying with water certain parishes in the county of Salop and the county of Stafford, and the Wolverhampton Gas Bill, by which the Wolverhampton Gas Company seek to secure further capital and powers.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE (IRELAND)—CHANCERY DIVISION.

Friday, March 9.

(*Before the* Master of the Rolls.)

Alliance and Dublin Consumers' Gas Company v. County Council of Dublin—Damage to Gas-Pipes by Steam-Rollers.

To-day proceedings were commenced in an action brought by the above-named Company for an injunction to restrain the defendants from "using or causing to be used any steam or other roller in such a way as to fracture, damage, or injure the gas-mains, service-pipes, or other works of the Company," and for damages. The Company alleged that their pipes had been broken at the Kenilworth Park Road; the Kilmacud Road at Dundrum, and at Cabra, by the action of the defendants' steam-roller in the repair of the streets, &c. The defendants paid £11 14s. into Court in respect of injury to the main at Kenilworth Park; and the plaintiffs accepted this amount for damage. The defendants pleaded, in reference to other causes of action, that the plaintiffs' mains were not properly constructed, and were laid at too shallow a distance from the road surface.

Mr. S. Ronan, Q.C., Mr. J. Gordon, Q.C., and Mr. J. Pim appeared for the plaintiffs; Mr. T. L. O'Shaughnessy, Q.C., Mr. T. M. Healy, Q.C., M.P., and Mr. J. J. Clancy, M.P., represented the defendants.

Mr. Ronan, in opening the case, said the action was brought to ascertain how far the road authorities were entitled to use steam-rollers so as to injure the mains of the plaintiffs. On June 7, 1899, the Secretary of the Gas Company (Mr. Cotton) wrote to Mr. Collen, the County Surveyor, pointing out that the new sewer constructed on the Churchtown Road was placed right under their mains, and that a passing car had broken a main. Mr. Collen replied: "I am the judge of how the public road is to be restored, not any of your staff; and, for your information, I prescribe that the pipes be laid at least 3 feet below the surface of the road." Other breakages near Dundrum were brought to the notice of the County Council, and on Oct. 5, 1899, Mr. Collen wrote: "I should say that the party who lays a pipe should lay it at such a depth below the surface of the road that it may not be broken." Subsequently, other breakages were brought under the notice of the Company; and, after considerable correspondence, the matter was placed in the hands of their Solicitor, with a view to having a writ served. At that time the defendants pleaded that the road had been left in a soft condition by the Tramway Company, and they offered the amount of the damage which had been done to the plaintiffs in regard to Harold's Cross Road; also that the pipes, with the exception of that in the road named, were so constructed and laid as to be liable to be injured by the ordinary traffic. Counsel said it had been found that ordinary traffic did not injure the mains of the Company; but here a steam-roller was employed on an already prepared road. The original crust of the road had been broken up, and the roller was then used on a weakened road.

The following evidence was then given.

Mr. *W. F. Cotton*, the Managing-Director of the Company, explained the method in which the mains and service-pipes were laid. He had never heard of the service-pipes being injured, and no report had come in of breakages of the pipes until the steam-roller began to be used.

In cross-examination, witness said last year was the first time he heard of the County Council using steam-rollers, though he remembered them being employed in Blackrock and Kingstown.

Mr. O'Shaughnessy: And there are no broken pipes there?

Witness: There are, often. In further cross-examination, witness said that the Company gave local bodies notice when they wanted to open the ground—three days' notice, except in cases of emergency. An escape of gas would be regarded as a case of emergency. His idea was that the Company were to lay the pipes at such a depth that they would not be broken by ordinary traffic. He thought 18 inches would be deep enough for ordinary traffic.

Mr. *Waterfield*, Engineer to the Company, was then examined as to the depths at which the pipes were laid in several roads in the county. He said that, in his opinion, with a well-prepared roadway, 10 inches would be sufficient to protect the mains against ordinary traffic. A steam-roller was calculated to do far more harm to pipes than ordinary traffic, since it passed over the same place several times. A depth of 18 inches would be the maximum at which the pipes were laid in the county.

Several of the employees of the Company were also examined as to the laying of the mains in the roads where the injuries were alleged to have been occasioned.

Mr. *H. E. Jones* was then called. He said he had given evidence in the action brought by the Gaslight and Coke Company against the Vestry of St. George, Hanover Square, to restrain them from using the steam-roller. He had visited the sites of some of the damages which were the subject of this action, and was of opinion that even the least depth found—8 inches—would be sufficient to protect the main from all contingencies of ordinary traffic, if the surface pavement were in good repair and intact. It would not be possible, with the pavement worn thin and broken up by the stones being picked out in the manner which was customary to enable the new macadam stones to mix with and bed themselves into the stones of the old surface, that such a soil would support the pressure of a steam-roller. He was not able, from his experience, to limit the life of a gas-main. With reference to drains and culverts, vaults and arches, pipes and cellars, and other things, it was often impossible to lay the service-pipes at the depth one would wish. One would always like to have 18 inches; but with all these varieties of obstacles, it was not possible.

In answer to Mr. O'Shaughnessy, witness said he thought the pipe on the Kilmacud Road had been laid rather shallow.

Other witnesses were called and examined in regard to the breakages complained of by the plaintiffs; and this closed their case.

Mr. O'Shaughnessy, in opening the case for the defendants, said Mr. Collen, who had been for a long time County Surveyor, and was trying to do his duty to the public, seemed to have been met by the Managing-Director of the Gas Company in a most extraordinary spirit. In the first place, the Company contended that they opened the road whenever they pleased. The Company's idea was that they might lay their pipes

within a few inches of the surface of the soil, open the roadway whenever they chose, and put back the ground any way they chose, without giving the Surveyor the least opportunity of knowing what was done. Mr. Cotton's view was that a steam-roller was not to be used at all. The defendants plainly said that the Company's mains were not properly constructed or laid.

Saturday, March 10.

On the resumption of the proceedings to-day,

Mr. O'Shaughnessy continued his address on behalf of the defendants. He said they were a permanent body, and had, if he might use the expression, a permanent duty. They remained, not like the old Grand Jury, a corporation responsible for the management of the roads and for injuries upon them. What was the meaning of the section of the Act which set forth that the Council might have steam-rollers, and borrow money for the purpose of having them upon the roads? If the second part of this action were correct, and if the view suggested at the Bar were correct, Parliament had gone through the humbug of saying the Council might purchase steam-rollers, but must never employ them in such a way that they would be of any use. In the plaintiffs' case, there was not a shred of evidence to support the allegation of negligence on the part of the defendants, nor was there any to sustain the case that the defendants' steam-roller broke the pipe at Kilmacud. Another matter which would be proved was that the Company's pipes were put down in a way contrary to that in which they were laid in every part of the United Kingdom. At Cabra, the defendants said the injury was caused by the negligence of the plaintiffs' servants, who, having opened the road to put down a syphon-box, neglected to ram the earth again, in consequence of which the head of the pipes stood 2 inches above the level of the road. The real point in the case was raised by the defence, and it was whether the Company were entitled to lay their mains at a depth of from 8½ inches to 9 inches only, and their service-pipes practically on the ground. Counsel submitted that if his Lordship came to the conclusion that the use of the steam-roller was lawful, an action did not lie, and that it was not a nuisance, unless the roller was negligently used, or unless the Court could infer negligence from the fact of the actual injury that took place.

Mr. *Edgar Purnell Hooley*, the County Surveyor of Nottinghamshire, said gas-pipes in that county were laid 3 feet below the surface. He had examined the pipes at the place complained of by the plaintiffs. The pipe on the bridge at Kilmacud was most improperly laid. At one place the connection of the main was bare above the road, and it was not safe for ordinary traffic. A steam-roller weighing 12 tons had less bearing weight at any one point than an ordinary waggon weighing 2 tons.

Cross-examined by Mr. Ronan: He had not made any inquiries to ascertain whether, before steam-rollers were introduced, the Company complained of breakages.

Mr. *Thomas H. Walmesley*, Deputy-Superintendent of Gas-Mains in Manchester, said the minimum depth at which mains were laid in that city was 2 ft. 6 in. in the carriage road. The manner in which the pipes he had seen were laid in Dublin would not be tolerated in Manchester. He did not think they were laid sufficiently deep.

By Mr. Gordon: He did not inquire whether the pipes had been injured by ordinary traffic.

Mr. *H. Harris*, a mechanical engineer, of Messrs. John Fowler and Co., of Leeds, gave evidence as to the pressure per square inch on roads of a traction-engine of 15 tons weight. The portion of the Kilmacud broken pipe produced was undoubtedly part of a horizontally-cast pipe; and the difference between this and a vertically-cast pipe was that by the former method one side was usually much thinner than the other. In the broken portion of pipe produced, the thinnest side was ¼ inch, and the thickest side ⅜ inch thick. When a pipe had been vertically cast, one was supposed to get it of an equal thickness all round. He did not consider the gas-pipe on the railway bridge, with 9 inches of soil over it, was safely laid for ordinary traffic. He visited the other points on the Kilmacud Road, where the injuries were alleged to have been sustained, and did not consider the pipes had been safely laid. On the Cabra Road, the syphon-box protecting the pipe should have been set on a sand foundation.

In cross-examination by Mr. Ronan, witness said that, taking a four-wheeled cart having a weight of 1½ tons, a traction-engine, and a steam-roller, the cart would be most likely to injure the pipe on the Kilmacud Road. He did not ascertain that the ordinary traffic had injured these pipes in the past.

Mr. *W. Collen*, County Surveyor for Dublin, said that during the time he had charge of the roads there were constant openings of them by the Company where their pipes were laid. Generally speaking, he received notice one morning that the Company were to open a road on the previous day. Their general practice was to open a trench and throw the excavation into a heap. When the pipe had been laid, the hole was filled in again hodge-podge; and the result was that it sagged down with the traffic and weather. On the Cabra Road, the syphon-box and the filling were above the general level of the road on each side; and the filling wore down under the traffic and the weather, until the box was 3 inches over the level. It was not safe either for ordinary traffic or for the Company themselves. He had been steam-rolling in that neighbourhood since 1895. It was after he had written to Mr. Cotton about the ramming of the roads that he first heard of the complaints as to the roller. Before steam-rolling was introduced, he had been continuously served with notices for the opening of the roads with respect to escapes and repairs to mains. At one place the main was only 9½ inches below the surface; and the service-pipe was actually laid upon it. The mode in which the pipe was laid was not safe; and the pipe itself was an obstruction on the road. It was in danger from ordinary traffic. On the railway bridge, he thought 8½ inches was not deep enough to lay the pipe to protect it from the general traffic. It could easily be put under the footpath. At Overton, he had examined the spot where the injury was alleged to have been caused to the service-pipe, and could not discover the pipe. He found evidence that it had been there; and on inquiry he ascertained that gas had not been used in the house for a considerable time, and that the pipe had been cut off. At Harold's Cross, the Tramway Company had made a trench for their conduit, and at this particular place it followed the line of the gas-main for some distance. The trench was filled in badly by the Tramway Company, and remained in a soft condition. Witness then sent the steam-roller to make a good road there; the Company being under an agreement to pay for it. The soil in the trench was squeezed down; a layer of stones was then put on; and the stuff got under the pipe and caused it to rise vertically, springing the joint. When the matter was brought under his notice, he at once offered to pay for the damage.

The Court then adjourned till the following Tuesday.

Tuesday, March 13.

On the resumption of the proceedings this morning,

Mr. *Collen* was further examined by Mr. Healy. He said he employed, on an average, six steam-rollers; but up to October last an unusually large number—eleven—were working, owing to the fact that the rolling had to be finished by a certain date. Of these, one weighed 15 tons, one 10 tons, and the remainder were supposed to weigh 12½ tons. Rolling was essentially necessary for the repair and making of the roads; and on the north side of the county, which was the agricultural portion, where farmers formerly could scarcely draw a ton, they could now get close upon 2 tons. By rolling, the crust of the road was consolidated, and thus protection was afforded to pipes underneath. The condition of Kilmacud Road, combined with the steep incline there, made heavy rolling necessary. The centre of the road was much worn down, and it was essential to raise it considerably. The ratepayers favoured steam-rolling.

Mr. Healy: It may simplify matters if we admit these four breakages. We think it probable the Cabra one and the one at Sydenham were caused by the steam-roller; but we deny the probability in the other two cases. (To witness:) You think the Sydenham and Cabra breaks were caused by the steam-roller?

Witness: It is quite possible the break at Sydenham was caused by the steam-roller, or a heavy cart working in connection with it.

Do you say the same as to Cabra?—It is quite possible the roller displaced the syphon-box. There is no break there.

What do you say as to the bridge and Overton?—My opinion of the fracture on the bridge is that the roller did not cause it. As to Overton, I do not believe the roller did it at all. The Company do not allege that it was broken; they say the pipe was drawn a little out of the main, but not broken.

In cross-examination by Mr. Ronan, witness said he did not know of any instance of mains being broken before the steam-rollers were used; but the Company never notified when mains were broken—there was no necessity for it. A single horse could carry about 15 cwt. up the Kilmacud Road hill. He identified a letter he wrote to the Manager of the Company on the 5th of October, in which he said he would assume, until it was proved to the contrary, that the public at large were entitled to use the roads, except so far as they might be restricted by the road authorities; and that the road authorities were entitled to repair their roads in any way they thought fit, regardless of private property under the roads. When he put a steam-roller on any particular place, he did not consider whether it was likely to injure gas-mains or anything else. In his contracts for road repairs, 12 inches was the thickness of crust he prescribed. In certain places, half of this would be sufficient; it depended on the nature of the traffic and on the subsoil. On the Kilmacud Road, 12 inches would be desirable; but before the steam-roller was put on, he should say the crust in the middle of the road was about 3 inches thick.

Mr. Ronan: What was the thickness of the crust at the place where the main was laid?

Witness: About 4 inches, before it was rolled.

Do you think that was sufficient for ordinary traffic?—The reason I rolled it was to thicken the crust.

When doing that, you had no consideration whatever as to what the consequences might be to the main?—I had not. I did not know where the mains were, or at what depth they were laid. I assumed the Company would see that their mains were at a proper depth. I did not think it was my duty to see that they were deep enough.

In further cross-examination, witness said he frequently availed himself of the short notices served by the Company to send men to see how they filled in the openings. He wrote a letter on Sept. 17, 1898, protesting against the manner in which their men had restored the Stillorgan Road. The Company replied, pointing out they were not in fault, and that they had done and were doing all that was necessary. The box on the Cabra Road was first noticed about two years ago; but he had not called attention to it. From time to time the road men put stones around it.

The Master of the Rolls remarked that he had never known a fairer and more candid witness.

Mr. *P. C. Cowan*, Chief Engineering Inspector of the Local Government Board for Ireland, examined by Mr. Healy, said he had acted formerly as Surveyor for County Down. The gas and water mains in Belfast ran into the area under his charge; and he was aware that the mains were always laid under the footpaths at a depth of about 2 ft. 6 in. It was a matter of opinion as to what depth pipes should be laid under roads to ensure safety; but his view was that for ordinary traffic they would not be safe at a less depth than 18 inches.

Mr. *F. P. Dixon*, Engineer and Surveyor for Rathmines and Rathgar, said the pipes and mains in his case were laid at an insufficient depth to protect them from ordinary traffic. No pipe should, in his opinion, be laid at a less depth than 18 inches.

In cross-examination, witness said the steam-roller had been in use in his township for eight years, and the Gas Company alleged that it had broken two or three pipes.

Mr. *J. H. Middleton*, Surveyor to the Pembroke Urban District Council, said that since July, 1896, steam-rolling was practised in the township. The water-mains in Pembroke had a covering of 2 ft. 6 in.; but he never knew of a fracture of a pipe when there was only a covering of 18 inches. The syphon-box in the present case was not properly laid.

In cross-examination, witness said it had been alleged by the Company that the steam-roller had broken pipes in Pembroke. Forty or fifty syphon-boxes were put down in the township; but they were not laid in the clay. He had not made any objection to them.

Mr. *M. J. Buckley*, District Engineer and Surveyor for Drumcondra, said he never laid water-mains at a less depth than 2 feet, and was of opinion that gas-mains should not be laid nearer the surface than this, to protect them from ordinary traffic.

In cross-examination, witness said that he regarded steam-rollers as

"ordinary traffic." Syphon-boxes were put down in his district; but he had not complained to the Company of the way in which they were set.

This closed the case for the defendants.

One of the plaintiffs' witnesses was recalled, and identified the broken pieces of mains taken up by him in the Kilmacud Road.

Mr. HEALY then addressed his Lordship for the defendants.

Mr. GORDON having replied for the plaintiffs,

The MASTER OF THE ROLLS reserved judgment.

A Salutary Lesson for a Gas Stoker.

At the Isle of Wight County Petty Sessions a few days since, John Gallop, a gas stoker, living at Ventnor, was charged with an offence under the fourth section of the Conspiracy and Protection of Property Act, 1875. Mr. Calder Woods appeared to prosecute on behalf of the Ventnor Gas and Water Company, and said the facts were shortly as follows: Defendant was one of two stokers in the employ of the Company. In consequence of two Reservists having been called up for service in South Africa, the Company were rather short of employees at the time of this occurrence, and had therefore some difficulty in meeting the requirements of the public. On Saturday, Feb. 24, in consequence of defendant's action in suddenly leaving his work, the supply of gas was greatly diminished, until there was not more than a pound's worth left in store. From this it would be seen that the town was within measurable distance of being plunged into darkness. This, he ventured to submit, was a very serious state of things for a Company who had a duty imposed upon them by Act of Parliament. Mr. J. S. Ineson, the Secretary and Manager of the Company, stated that defendant was a skilled workman at a weekly wage, and subject to a week's notice. It was impossible to find a man to fill his place efficiently at short notice. Defendant left work on the morning of Feb. 24; and witness personally tried to get him to return. As he positively declined to do so, he (Mr. Ineson) was obliged to employ another man, who had never been in the works before, with the result that the fires were not properly attended to. The supply gradually dwindled away until at 11.30 at night, there was only about a pound's worth of gas left, which had been obtained by reducing the pressure to the town one-half during the whole of the evening. The only reason Gallop gave for leaving was that he had had a row with the other men. He was a very good workman; and the Company were sorry to lose him. The Chairman of the Bench (Admiral De Horsey) said he understood the prosecutors did not press for a heavy penalty; and the Bench were glad not to have to deal with defendant so severely as, perhaps, he deserved. He must be aware that it was a very serious offence, because there was a likelihood of punishing a whole community for the sake of a display of temper. Defendant would have to pay a fine of £1 and 9s. costs, or be imprisoned for 14 days. A fortnight was allowed for payment. Mr. Wood said the Company had no ill-feeling against the defendant, and were prepared to re-employ him, but they thought that serious notice ought to be taken of his action in suddenly leaving his work.

Acetylene v. Coal Gas.

An action was brought in the Falmouth County Court last Friday to recover £36, the cost of an acetylene gas generator and fittings. The plaintiff was Mr. J. J. Blight, an electrical engineer of Falmouth, and the defendants were Messrs. A. Thomas and Son, of Penryn. Mr. W. J. Terrill, who appeared for the defence, said his clients were the victims of misrepresentation. Plaintiff said that he sold the apparatus to the defendants, but denied that he induced them to take it by representing that acetylene would be much cheaper than coal gas. They did not manage the generator properly. When it was tested by himself, it did its work satisfactorily. One of the defendants stated that plaintiff persuaded him to take the apparatus by saying it would give a better light than coal gas at half the cost. He agreed to give it a trial on these conditions; but it cost him three times as much as ordinary coal gas, to the use of which he reverted. Mr. J. M. Thomas, the Manager of the Penryn Gas Company, said that at the price of gas at Penryn acetylene cost six times as much as coal gas consumed by means of a Welsbach burner. Acetylene was only used in isolated cases, where coal gas could not be procured. Plaintiff said New Street Station, Birmingham, was lit with it. It was not true that he told defendants acetylene would cost only half as much as coal gas. His Honour Judge Granger remarked that defendants ought to have had a written agreement in an experimental matter of this kind. He had no doubt that plaintiff was very anxious to induce defendants to adopt the more modern light. The question was whose memory was more correct. The misrepresentation need not be fraudulent; but if it induced defendants to enter into a contract, it was void. He must believe the defendants' version of what occurred, and thought there could be no doubt plaintiff did represent that acetylene cost half as much as coal gas. Judgment was given for defendants, with costs—the plaintiff to receive back the generator and fittings.

Disputed Meter Registration.

At the Uttoxeter County Court, on the 10th inst., a case was heard, before Judge Mulholland, in which the Uttoxeter Gas Company sought to recover from John Payne Hall, a shipping and general agent, £3 7s. 2d., the balance of an account due in respect of gas consumed by him in the lighting of his private house. The dispute went back to Christmas, 1895, when, it was stated, defendant complained about the quantity of gas he was charged with having burnt. In consequence of his complaint, the Company had the meter tested, stating that it was 3·50 per cent. fast. Defendant, not being satisfied, had the meter further tested by the District Inspector at Derby, a certificate being given that the meter was 3·84 per cent. fast. As the result of the test, the Company credited the defendant with an overcharge of 2200 cubic feet, extending over a period of twelve months. His Honour said it seemed to him that the meter had been playing pranks; and his judgment would be for an allowance on 14,000 cubic feet of gas as shown to have been burnt by the figures put in, less the amount of the 6s. already allowed by the Company.

At the Blackpool Police Court on Monday last week, a case was heard in which the Corporation sought to recover £5 7s. 1d. from Mr. Thomas Henderson, for gas supplied to him. The matter had been previously before the Court, and as Henderson disputed the accuracy of his meter, the case was adjourned in order to allow of a test being made by the Corporation Gas Engineer (Mr. John Chew). Directly after the hearing, a letter was written to the defendant, informing him that the meter would be inspected on the 2nd of March, and asking him to be present. In reply, he said he would not attend. Mr. Chew said he tested the meter, and found it registered correctly. He submitted the following readings: December quarter, 1897, 5800 cubic feet; March quarter, 1898, 1090 cubic feet; June quarter, 1898, 7000 cubic feet; September quarter, 1898 (the one preceding that in dispute), 7300 cubic feet; and December quarter, 1898, 27,100 cubic feet. The last reading was verified by a second inspector, which was a customary course to adopt when there was so large an increase. From Dec. 8, 1898, to Feb. 28, 1899, the meter registered 22,500 cubic feet; and one of the inspectors found that a gas-fire was burning the whole day at defendant's house. Mr. Buckley, for the defendant, contended that his client had not been treated fairly by the Corporation in the first instance. The meter was not properly stamped; and nothing would make him believe that he had burned as much gas as he was charged for. The Magistrates, after considering the matter in private, suggested that the parties should endeavour to arrive at a settlement. To allow of this, the case was adjourned for a short time. Eventually, it was announced, on behalf of the Corporation, that terms had been arranged with Mr. Henderson, but the amount was not disclosed.

Unlawful Interference with Water-Mains.

At the Halifax West Riding Court, on the 10th inst., before Mr. T. H. Norris and other Justices, Timms Ludgate, oil merchant, of Brighouse, was summoned by the Hipperholme District Council for having, on the 19th of January last, interfered with their water-mains contrary to the terms of section 19 of the Water-Works Clauses Act, 1863. Mr. E. H. Hill, who appeared for the prosecution, said that on the 17th of January the Council's Surveyor, Mr. John Sykes, was informed that a connection was required to be made to the water-main in Sutherland Road. The Surveyor told his informant to see the Council's authorized plumber, and he would attend to it. Next day the Surveyor was informed that another plumber, in the employ of Mr. Ogden, of Brighouse, was carrying out the work. On Mr. Ogden being questioned about the matter, he said the work was being proceeded with by the defendant's direction. The Surveyor was called, and said that when he went to the spot on the 18th, the water-main had been bared ready for the connection to be made. He warned the man who was in charge of the work that if the water was turned off or the main cut he would have to take the responsibility, and his reply was: "Well, I have instructions what to do." Mr. C. G .Calvert, the Council's authorized plumber, stated that on the 18th of January one of Mr. Ogden's men went to his shop and asked him to turn off the water in Sutherland Road; adding: "We are going to insert a T-piece into the main." Witness warned him that only the authorized plumber could do that; whereupon he rejoined: "We've got notice to do it, and we are going to do it." Mr. Ogden deposed to receiving instructions from the defendant to carry out the work. The defendant, addressing the Bench, said the first intimation he received from the Council that anything was wrong was when he was served with the summons. If he had known that he was not in order, he would have been glad to put himself right. He wrote to the Council in the first instance requesting them to lay on the water to his property; and they replied that they did not do this in private streets. Consequently he was bound to take steps to carry out the work himself. The Chairman said the Bench considered the case a very serious one. The defendant applied to the Council to put water into his premises; and they were entirely within their rights in acceding to, or in declining, his request. Because he could not get consent, the defendant took the matter into his own hands, and gave instructions to a plumber to do the work. The Bench thought that the plumber, as a qualified man, ought to have known that he could not act contrary to the Local Authority or their authorized plumber. The full penalty of £5 and 21s. 6d. costs was imposed. Defendant said he would appeal.

The Charge of Falsifying Books and Embezzlement.

At the Lambeth Police Court, last Wednesday, before Mr. Hopkins, Frank Fairfield Norris, described as of Acacia Grove, West Dulwich, was again brought up in custody, he having failed to find the bail fixed by the Magistrate, to further answer a summons complaining that he, being an officer employed by the Directors of Frank Wright's Prepayment Gas-Meter Corporation, Limited, did on various dates unlawfully, wilfully, and with intent to defraud, alter and falsify certain books of accounts belonging to his employers. There was a second summons against him for embezzling money received by him on account of the Directors. The previous proceedings in this case have already been reported (*ante*, pp. 548, 619, 685). Mr. Wontner appeared in support of the summonses; and the defendant was represented by Mr. Nicholls. Mr. Howard D. Burn, a solicitor, Managing-Director of the prosecuting Company, said he had known the defendant since the incorporation of the Company in 1895. During September last he found entries in the defendant's journal of secret commissions. This was the first he had heard of such payments. The defendant then admitted to witness that he had himself had £700 out of the £1000 thus entered. He said that his wife was entitled to a reversion to some property upon which he thought she could raise £700; and he asked whether the Directors would accept this, and not prosecute him. Witness told him that the proposition could not be entertained. Mr. Nicholls was proceeding to cross-examine the witness as to the alleged payments of secret commissions, when Mr. Hopkins intervened, and questioned whether it was desirable to go into this matter, seeing that the case was one which would have to go for trial. He committed the defendant, who reserved his defence, for trial at the Central Criminal Court, but offered to accept a surety in £100 for his appearance.

MISCELLANEOUS NEWS.

THE JUBILEE OF MR. CHARLES SELLERS.

At the York Gas-Works last Wednesday, a pleasant gathering took place to celebrate the birthday of Mr. Charles Sellers, the Engineer and Secretary of the York Gas Company, and the completion of more than fifty years' service. Mr. Sellers provided tea for all the staff, and presented 100 of the longest-service men with 5s. each, and the rest with 2s. 6d. each; while he gave a book to each of the officials. The ceremony took place in the workmen's mess-room, which was prettily decorated. Behind the platform was a very suitable motto, "Congratulations on the Double Event." On the right of the platform hung the Union Jack. At the far end of the room were the dates of Mr. Sellers's service—"1850-1900"—and these were flanked on either side by trophies of flags. The Chairman of the Company (Mr. J. R. Hill) and several of the Directors took part in the proceedings.

Mr. Sellers occupied the chair, and in the opening of his address reminded his hearers that when he met them last Christmas he told them that he had what sporting men would call a "double event" coming off this month—viz., the celebration of his birthday and the jubilee of his service with the Company. He further told them that whatever little rejoicing he might have to mark this double event they should share with him; and as he had done his best to carry out his promise, he hoped every man would enjoy the sharing. There was a very marked difference between the two events. A birthday was not an unusual thing, but very few men indeed had more than fifty years' service with one employer; and if a man was lucky enough to win such a jubilee, he could only have one in his lifetime. Therefore he (Mr. Sellers) had great cause to be thankful; and that was the most prominent feeling in his mind. He had cause to be very thankful that he had had health to finish his fifty years' service. During the whole of those fifty years he had enjoyed the confidence of his Directors; and, although they all valued their wages, there was something even that would live longer in their memories than wages, and that was the feeling that they had earned the good opinion of those they had served. Last, though not least, he had cause to be thankful because he had worked shoulder to shoulder with many brave comrades in the Company's service who, like Longfellow's Village Blacksmith, had tackled their work "week in, week out," and had "earned a night's repose." Mr. Sellers went on to point out some of the secrets of his success in attaining his jubilee; laying more especial stress upon the value of industry, thrift, and sobriety. He had not been a "rolling stone," and had never been out of employment for a single day since he was sixteen years old. The first five years of his business life were spent in the office of a firm of sharebrokers, and he should very probably have been there still had not the business fallen away. But the one in which he was now engaged would not fall away; in fact, it would take something more even than lyddite to knock its bottom out. It had had competition on the right of it, and competition on the left of it, and competition in front of it; and they had all shouted and thundered. But it still stood unmoved upon its little kopje; and he might still repeat the parody he once made upon Tennyson's Brook. However, it was not his intention to talk "shop;" but perhaps they would allow him to add a few words. Having given some particulars as to the introduction of gas lighting, Mr. Sellers went on to say that when it was first adopted in York, gas cost 13s. per 1000 cubic feet; while their scale of prices now ran from 1s. 8d. to 1s. 11d. In 1837 an opposition Company, called the Union Company, was started. This Company led to a great deal of senseless fighting, which, as usual, ended in the amalgamation of the two undertakings; and so closed what was then called "the battle of the trenches." In the year 1872—that is, 28 years ago—the Company reduced their price to 2s. 6d. per 1000 cubic feet. About the same time Birmingham did the same; and it was a matter of doubt as to which could claim the credit. At the beginning of his fifty years' service, the consumption of gas in York was rather more than 35 million cubic feet; while last year it was 444 millions—showing an increase of 409 millions, or no less than 1142 per cent. In other words, the annual consumption now was 12½ times as much as it was fifty years ago. Finally, as an item to remember, the Company sent out more gas during the sixteen days just before last Christmas than they delivered in the whole of the year 1850. All this would be interesting to everyone present, for it had in it good grounds for regarding the future with unmistakable confidence. Mr. Sellers's closing remarks were greeted with applause.

Mr. Hill expressed his thanks for the invitation given him to attend, and for Mr. Sellers's interesting speech. They hoped Mr. Sellers would be long spared to manage the York Gas Company, as they appreciated most highly his services. There had been many changes since he joined the Company, but none in the cordiality and happy relationship between him and his Board. He had ever enjoyed the full confidence of the Directors. Nor had there been any change in the deep interest which Mr. Sellers took in the employees' welfare. He had always felt, and still did feel, a deep interest in every man employed by the Company. Mr. Sellers would not like anyone to speak at length on his abilities; but he (Mr. Hill) must say they had in their Manager an example of fidelity, pluck, and industry which every young man present would do well to follow. He hoped Mr. Sellers's career would be emulated by them all. Mr. J. Melrose, J.P., the Vice-Chairman of the Company, congratulated Mr. Sellers on attaining his jubilee and his birthday. Mr. Sellers had referred to the time when he entered the service of the Company—a time which he (Mr. Melrose) remembered most distinctly. Things were in a very bad condition at that time. They used to pay 5s. or 6s. for a single jet little better than a candle; and now York stood pre-eminent, considering its geographical position, for its exceptionally low-priced gas. This was owing altogether to Mr. Sellers's superior management, and to his genial and straightforward manner. He trusted Mr. Sellers would have his health so long as it was his pleasure to continue the Manager of the Company. Other speakers fully endorsed these sentiments.

Mr. Leaf, the Assistant Manager of the Company, presented Mr. Sellers with a paper signed by about 300 of the workmen, congratulating him upon his birthday and jubilee.

A musical entertainment followed; and the rest of the evening was spent in a very enjoyable way.

THE RISE AND DEVELOPMENT OF THE LONDON GAS SUPPLY.

The Early History of the Companies—A Point Affecting the Suggested Transfer of the Nine Elms Gas-Works to the South Metropolitan Company.

At the Meeting last Wednesday of the Gas Engineering Society in the small hall attached to the Welsh Wesleyan Chapel, City Road, Mr. W. J. Liberty, the City Gas Inspector, read a paper on the above subject. It was of an interesting character, and upon its preparation the author had manifestly bestowed considerable labour. Its voluminous character, however, and the demands on our space of current topics and news, preclude our giving more than a superficial sketch of its contents.

The author divided the paper into the three important epochs that the gas industry of the Metropolis naturally falls into—viz., the period of free competition prior to 1857; next the time of close monopoly or "districting," when the various Companies divided London up between them (from 1857 to 1868) and stopped competition; and, lastly, the period during which the important Acts were passed regulating the selling and testing of gas, fixing the price, and controlling the dividends of the three great Companies, and further dealing with the introduction of the standard price, the sliding-scale, the auction clauses, &c., of the 1876 legislation. Having cited the titles and dates of formation of the principal of the numerous Companies which existed in London in the early part of the century, the author, referring to the South Metropolitan Company, said this was started in 1833 for the purpose of supplying cannel gas, and was incorporated in 1843. So precarious was its existence for the first few years that in 1847 it had a capital of no less than £19 per ton of coal carbonized, which equalled about £2000 capital for every million cubic feet of gas sold; but, by careful management, this was reduced by 1860 to £550 per million feet. The capital of the Gaslight and Coke Company at this time was about £650 per million. The Commercial Company was incorporated the same year that the Gas-Works Clauses Act was passed—viz., 1847. About this time competition was universal, there being as many as four or five companies supplying one district; and, as might be expected under these circumstances, the competing companies rarely paid anything like full dividends. The South Metropolitan Company paid 6 per cent., and most of the other Companies less, excepting the Imperial Company, who paid 10 per cent. The author included here a table showing the prices charged by the two Companies supplying the central parts of the Metropolis—viz., the Chartered Company and the City of London Company—during thirty years from 1823 to 1853. It disclosed a gradual fall in prices in that period from 15s. to 4s. per 1000 cubic feet.

In 1848 (which was the year of Mr. George Livesey's advent into the gas industry), the price of gas was practically 6s. per 1000 cubic feet all over the Metropolis. An agitation was then started to secure a reduction to 4s.; and this culminated in the founding of the Surrey Consumers' Company by Mr. John Thwaites and Mr. Alex. Croll, and of the Great Central Company by Mr. Charles Pearson (the City Solicitor) and Mr. Croll. In consequence, the whole of the Companies had to come down to a charge of 4s.; and their dividends accordingly suffered reduction. Until the passing of the Act of 1860, very few of the Companies paid more than 6 per cent. dividend, which was regarded as a very good return. The advent of the Great Central Consumers' Company in the City brought about competition between themselves and the Chartered and City Gas Companies. For the lighting of the public lamps in 1850, there was *bonâ-fide* competition between the rival Companies; and the result was the letting to the Great Central Company of the public lighting of the whole City at a reduced rate—producing a saving of £730 on the previous year. The public had, however, to submit to the inconvenience of having 1650 holes opened in the paving for the purpose of laying the supply-pipes to the public lamps alone. An invitation for tenders in 1852 resulted in the Chartered Company securing the lighting of a portion of the City; and the consequent re-connection of their pipes and disconnection of those of the Great Central Company resulted in about 1093 holes being again opened in the pavements. The competition was equally keen in the matter of private lighting; and all kinds of inducements were held out to the public to transfer their custom. The author gave examples of the curious literature that was circulated among the consumers about that time. Then, reverting to the question of price, he said it continued to stand at 4s. until the Companies were districted. Mr. Thwaites, who was the originator of the Consumers' Company, was likewise the originator of the districting, which took place on the south side of the Thames in 1853, and was followed on the north side in 1857. This having been accomplished, the price of gas was almost immediately put up to 4s. 6d.; and renewed agitation ended in the passing of the Metropolis Gas Act of 1860. Among other things this Act legalized districting, so that competition was killed. Mr. Liberty particularized the features of the Act which caused the Companies to be very prosperous, except perhaps the Chartered Company. A standard price of 4s. 6d. was fixed for a 12-candle gas. The Companies were able to pay full dividends—viz., 10 per cent., and were permitted to distribute large sums of money by way of back-dividends. This system, however, encouraged the wasteful expenditure of capital; and, as new capital was allotted at par to the shareholders, it was only natural that the holders of stock should be clamorous for more on such favourable terms, and with such authorized dividends. Thus no inducement was offered to reduce the price of gas. The inquiries by Sir John Trollope's Committee and Mr. (now Lord) Cardwell's Committee were next noticed at length; the general conclusion to which the latter arrived being that the Act of 1860, and the arrangements which it sanctioned, had been eminently favourable to the Companies, while the interests of the consumer had been inadequately protected. Too special attention could not, the author remarked, be drawn to the fact that the Committee were also of opinion that the Companies were only entitled to a 10 per cent. dividend after "exercising due care and management."

With the more modern legislation, commencing with the City of London Gas Act of 1868, most readers of the "Journal" have been made acquainted from time to time, and especially during the sittings of the Powers of Charge Committee. The recently issued work of Mr. Laurence W. S. Rostron on "The Powers of Charge of the Metropolitan Gas Companies" also deals very fully with the legislation since the year named. Therefore we must pass over the lengthy notes furnished by

Mr. Liberty, until we come to the sliding-scale. In regard to this, he said that London could not claim to be the originator of it, as it had already been put into the Sheffield Gas Company's Act of 1866; and the West Ham Gas Company's Act of 1869 likewise contained a sliding-scale. But so far as London was concerned, Mr. Livesey might be termed the "Father" of the sliding-scale. To show its effect, the author quoted from the heads of the evidence of Mr. H. E. Haward, the Comptroller to the London County Council, before the Gas Charges Committee of last year. He also included a table showing the Companies' and the consumers' share in the increased profits under the sliding-scale at per £100. In 1898, 85·5 per cent. went to the consumer and 14·5 per cent. only to the Company on the north side of the river, and the same proportion practically on the south side. As he remarked, consumption increases in a greater ratio than capital; so it will take more and more to reduce the price 1d., with a corresponding decrease in the amount to be received by the shareholders. Thus the strong interest on the part of the Companies to reduce expenditure is getting gradually and beautifully less. Information regarding the auction clauses and the standard price followed; and the introduction and development of the slot-meter system was also touched upon.

Towards the close of the paper, Mr. Liberty referred to the suggested transfer of the Nine Elms Gas-Works to the South Metropolitan Company, in order to call attention to the effect that this proposal, if consummated, would have upon the price of gas used for public purposes in the north of London. The Gaslight and Coke Company were compelled to charge for gas used for public purposes the lowest figure charged to any private consumer in any part of their district. As the charge for gas in their district south of the Thames had to be the same as that of the South Metropolitan Company, it was now 2s. 1d. per 1000 cubic feet; and, therefore, the Local Authorities on the north side had the advantage of gas at that price, as against the 3s. paid by the private consumers. If the transfer should come to pass, the Gaslight and Coke Company would be able (unless prevented by legislation) to charge immediately afterwards an additional 11d. per 1000 cubic feet for all gas consumed in the public lamps north of the river. In conversation with him, Mr. Livesey had said that he did not suppose the Company would be so rash as to put up the price 11d. all at once; but they would no doubt go up 1d. or 2d. at a time. Ultimately, however, they would, in the event of the transfer taking place, have to pay, as the matter now stood, 3s. per 1000 feet for all their gas. It would mean that, in the City alone, a saving of about £3000 per annum would be lost.

There was little discussion on the paper; and in the few remarks that were made, the Chairman (Mr. G. P. Lewis) and Mr. Charles Tanner complimented the author on the vast amount of interesting matter he had collected. The Secretary (Mr. E. D. Weippert) commented on the working of the auction clauses, and also made an allusion to the large additional revenue that the Gaslight and Coke Company would be able to derive from the Vestries north of the Thames if the transfer of the Nine Elms works was effected. Mr. A. Sherring thought the Local Authorities who were interested in the matter would have something to say, before any transfer was authorized, in defence of the privilege they at present possessed. Mr. Liberty, in replying, said he fancied that one of the reasons why the Gaslight and Coke Company did not appear to be very anxious to part with the Nine Elms works was because only about one-third of the gas made there was used in South London; the other two-thirds crossing the Thames for consumption on the north side. The station was one of the best situated for manufacturing purposes that the Company possessed. As regarded the Local Authorities, he believed they were conferring at the present time on the South Metropolitan Company's proposal; but it should not be forgotten by the Vestries that this question of the transfer of these works had been brought about by their own extreme agitation between 1894 and 1898 against the charges of the Gaslight and Coke Company.

A hearty vote of thanks was accorded to Mr. Liberty for his excellent contribution.

INCANDESCENT GAS LIGHTING AT PLYMOUTH.

Mr. Rider's Report Adopted.

The Plymouth Town Council had under consideration yesterday week the report of Mr. J. H. Rider, the Borough Electrical Engineer, given in the "Journal" last week (p. 687), recommending the conversion of the remainder of the ordinary gas-lamps to the incandescent system.

Alderman C. H. Radford, in moving the adoption of the report and the recommendation of the Electricity and Street Lighting Committee that it be carried into effect, reminded the Council that in May, 1898, Mr. C. R. Bellamy, of Liverpool, was called in to advise the Corporation as to the lighting of the town. He recommended the adoption of incandescent gas lighting in the streets not intended to be lighted by electricity. Since then the work had been placed in the hands of the Electricity Committee, and Mr. Rider and his assistants had devoted a great deal of time to the consideration of the subject. The Council had in the past been slow in carrying out the proper lighting of the borough. It was easy to increase the lighting, but not so easy to do it without adding to the cost. The Committee found that by adopting incandescent lighting they could save money in the cost of gas for the big lamps; but it was different with the bulk of the lamps, which consumed 4 cubic feet of gas per hour, and gave a light of only 12 candles. The Committee wished to increase the efficiency of these lamps, and had placed in the town others of various patterns, to give them a trial. By adopting incandescent mantles with a burner using only 2½ cubic feet of gas per hour, they would be able to effect a considerable saving in gas, while the illuminating power would be increased from 12 to about 40 or 50 candles. There would be a great saving in the cost of gas; but, on the other hand, the capital expenditure would be £4000, and for a trifling addition of £169 to the present expenditure they could add nearly three times to the light, and practically transform the lighting of the town.

Mr. J. A. Bellamy (Chairman of the Gas Company) said his Company were anxious that the town should be well lighted, and were the first to suggest that the Corporation should adopt incandescent burners. The Council were promised that the thing should be well done; but, in his opinion, and in that of those associated with him in the Gas Company, the Committee were running the risk of spoiling the ship for a halfpenny worth of tar. They were committed to the No. 2 burner.

Alderman Radford said he wished it to be understood that they were not committed to any particular burner, except that for the majority of the lamps it would be one consuming 2½ cubic feet of gas per hour.

Mr. Bellamy said he had no doubt the Committee wished to give the town a good light for a small amount of money; but they had made a mistake in recommending the No. 2 burner for the majority of the lamps. It was the wish of the Gas Company that the lighting should not only be satisfactory now, but in years to come, and that there should be no trouble in regard to unsatisfactory lighting when the burners were in. With the low pressure in some parts of Plymouth, the Company were satisfied that 2½ cubic feet of gas per hour could not pass through No. 2 burners. Looking at the matter from the standpoint of profit, it would be better for the Company if burners of that size were used; but they did not wish to see 1600 lamps fitted with a burner with which the inhabitants would be dissatisfied in twelve months. The Welsbach Company wrote: "Our main reason for objecting to the use of the No. 2 burner at Plymouth is on account of the gas pressure." If there was not sufficient pressure for the mantle to become incandescent, the light would be worse than with the present burners. The Gas Company could not avoid the pressure being less in some parts of the town than in others. Another point to be remembered was that if there was the slightest thing amiss with the burners, the small mantles would be quickly destroyed. Without spending more money than was anticipated on capital account, but by a little more consumption of gas, they would get far better lighting. They could get an efficient light, and specially for the byways, without purchasing new lanterns. For this purpose, some of the old lanterns might be converted at a comparatively trifling cost.

Mr. W. Y. Woollcombe said that, although Mr. Bellamy spoke from the point of view of the Gas Company, the Council would welcome his speech as containing expert information which would be a guidance and help to them. Acting upon what he had said as to the probable failure of the smaller burner, he (Mr. Woollcombe) moved that the question be referred back to the Committee.

Mr. J. P. Brown said if the matter went back to the Committee, they ought to have power to act. It must be left to them to decide between Mr. Bellamy and the views of their own officials.

Alderman Radford said Mr. Bellamy's position was that of the Chairman of a Company who wanted to sell more gas, and also to sell burners for the Welsbach Company.

Mr. Bellamy said he was not the advocate of any particular burner. His only concern was that they should have one of suitable size.

Alderman Radford observed that, at all events, the Gas Company were in communication with the Welsbach Company, and this led him to suppose that it was the Welsbach burners which were being advocated. It had been suggested that the scheme should be put on one side because the summer was approaching; but there were nearly 2000 lamps to convert, and, in order to get them all done by next September, it would be necessary to make an early start.

Mr. Rider, the Electrical Engineer, answering questions by members of the Council, said he was thoroughly satisfied that the burners recommended would give all the light that was needed. It was true that the naphthalene in the service-pipes would affect the light of the small burners; but it would equally affect that of the larger ones. If the statutory pressure was maintained, it was not sufficient to operate the burners properly. Unless it was higher than that, they could not have incandescent lighting.

The amendment to refer the matter back to the Committee was rejected by 31 votes to 4, and the report was adopted.

THE SUPPLY OF CARBURETTED WATER GAS IN DUBLIN.

Professor Emerson Reynolds, F.R.S., lecturing last week on gas analysis, in Trinity College, Dublin, drew attention to what he called an important change which has recently taken place in the city gas supply, by the addition of a considerable proportion of carburetted water gas to the ordinary product from coal. He explained how the fact of the change in the supply was recognized, and its extent measured. Twelve analyses of the city gas were made in the College laboratory between Nov. 25 and Feb. 5. The subsequent analyses showed that the proportion of carbonic oxide increased steadily until it reached 12·6 per cent. on the 7th inst. There was, therefore, he contended, no reasonable doubt that water gas had been added; and the conclusion was confirmed on inquiry of the Gas Company. The analysis of the 12th inst. showed a still greater proportion of carbonic oxide—17·9 per cent.; but this was probably due to some accidental cause, as the previous Saturday's analysis gave 10·6 per cent. Excluding the exceptional result just mentioned, the important fact remains that Dublin gas contained in the week ending the 10th inst. approximately twice as much poisonous carbonic oxide as it did at any time when analyzed before Feb. 16. In concluding, Professor Reynolds said: "I do not want you to suppose that there is any ground for undue alarm, or that the addition of the water gas to coal gas is not legitimate. On the contrary, I assume that the Dublin Gas Act leaves the Company free to make such addition, provided the illuminating power of the mixture be maintained by suitable carburetting at the standard value of 16 candles. I think, however, that the fact of so material a change in the nature of the supply should have been notified to consumers, in order that they might be on their guard against escape of the new gas through defective fittings, or by imperfect combustion from 'flaring' or unsuitable jets."

Trial of "Intensified" Gas at Portsmouth.—Some experiments are being made by the officials of the Portsea Island Gas Company with intensified gas lighting on the Somzée-Greyson system; and the four lamps they are now exhibiting outside their offices in Commercial Road, Landport, furnish illumination far outrivalling the arc electric lamp, at a cost of 1½d. per hour as compared with 10d. for the electric light. The four lamps have a luminosity of 2700-candle power. As the cost of gas in Portsmouth is 2s. 4d. per 1000 cubic feet, and that of electricity 4½d. per unit, the result given above is arrived at.

SHEFFIELD UNITED GASLIGHT COMPANY.

The Ninetieth Half-Yearly Meeting of this Company was held yesterday week—Sir Frederick T. Mappin, Bart., M.P., in the chair.

The General Manager and Secretary (Mr. Hanbury Thomas) having read the notice convening the meeting, the report of the Directors—summarized in the "Journal" for Feb. 20, p. 481—was taken as read.

The Chairman, in moving the adoption of the report and accounts, said the net balance for the half year was £46,386; and after paying interest on the debenture stock and the dividend at the rate of 10 per cent. per annum on all shares, the surplus on the present half-year's working was £3494, which, added to the balance brought forward on the last occasion, made the total amount £21,946 to carry forward. This, he thought, proved that the reduction of 2d. per 1000 cubic feet made some two years ago was a wise policy. At the time it was made, the reduction meant something like £18,000 a year. The reserve fund was full—amounting to £86,192. The most interesting part of the working for the half year was as follows: They had received more for gas by £10,305 than in the corresponding half of the preceding year, meter-rents were more by £443, coke by £6524, tar by £1312, sulphate of ammonia by £2755, the fittings department receipts by £513, and they had paid £766 less for salaries, on account of certain changes in the officials of the Company. Repairs to mains had cost £1089 less. The policy pursued for many years past had been to keep the mains and works in perfect condition; and now when prices of material and everything were so high, the Directors felt they might let the mains rest a while, and yet their position would not suffer. A donation of £500 to the Infirmary included in the accounts for December, 1898, did not appear this half year. On the other side of the account, they had paid £12,015 more for coal, for purifying material £700, for stokers' wages £1992, for repairs of works £881, and for dividend £704—leaving, after paying interest on the debenture stock and 10 per cent. dividend, a balance to carry forward to the present half year's credit of £21,946. The gas sold had been very remarkable—1342 million cubic feet, as against 1221 millions, or an increase of 121 millions over the corresponding half of 1898, equal to 9·87 per cent. The leakage had been 49,109,000 cubic feet, or 3·53 per cent., for the six months, which, in his opinion, was very satisfactory. He hoped they might always keep it at this low percentage. During the six months 1055 tests were made—showing the gas to be on an average equal to 17·48 candles; while for the twelve months 2151 tests had been made, showing an average of 17·5 candles. The additional number of meters fixed during the twelve months was 2956, ranging in size from 2 lights to 400 lights; and the total number of meters fixed to the end of 1899 was 61,459. Of gas-fires, 1239 had been fixed; boiling-stoves, 802; cookers let on hire, 443; and gas-engines, 105—all additional to the number fixed before. He was often surprised at the comparatively slow progress in the adoption of the Welsbach burners, of which they sold 7490 during the half year; and he asked himself how it was that consumers would not be at the trouble and the small expense they would have to sustain in going in more thoroughly for this light. No doubt in the near future the mantles would be much cheaper. In Germany they cost only 3d. each; but here, on account of the patents which still continued, they could not be sold so cheaply. The low price of them in Germany had evidently effected a wonderful increase in the Welsbach system of lighting; for he was told that in the centre of Germany 85 per cent. of the people used these burners. He had called attention on former occasions to the inattention of consumers to their fittings; and his remarks were fully borne out by a statement made by Mr. Livesey at the meeting of the South Metropolitan Gas Company. Mr. Livesey said that on testing some burners they had had to replace, his Company found that, instead of giving a light of 16¼-candle power, they gave from 14·4 candles down even to 7·9 candles. No wonder that people complained of the quality of their gas; but it was their burners, of course, that were at fault. The successful working of the Sheffield Gas Company during the half year, continued the Chairman, was indicated by their financial position; but he could assure the meeting that it had been by no means all plain sailing, either for the officials or for the Directors. It had been a time of great anxiety for them all; and he could say faithfully that during his connection with the Company he had never given so much consideration and attention and time to the affairs of the Company as he had during the last six months. Their old enemy naphthalene had been more active, and had worried them more than in any former year. They had had an army of gas-fitters at work, with whose services they had found it impossible to charge the consumers, as the Company took the blame upon themselves that the gas stopped up the pipes. The extraordinary thing was that when he first was Chairman of the Company they had no complaints from naphthalene, nor for fourteen years after; and only in the year 1887 did it make its appearance—at Neepsend. Effingham Street was free from it for two years later than that; but it had never been free since. At the Grimesthorpe new works, he was glad to say they had no signs of it at present. In September last, they had large stocks of coal (including one small mountain of 19,000 tons), when they received information that this portion of the stock was on fire. Every effort was made to get at the fire by using the coal, and by removing it. The result, however, was that they had immediately to stop their contractors from sending in coal as they had engaged to do. They could not do with it at Neepsend at that time; and they had to get along as best they could until they reached the fire. During that period their stock was reduced by 10,000 tons; and when they applied to their contractors to replace it, the contractors said it was very unfortunate, but they were so very busy, and were getting such good prices for their coal, that they really could not then make up the arrears, and the Company must be satisfied with what they could get. The Directors felt there was some reason in this, and that the contractors were not entirely to blame. For a time, therefore, they did as best they could; but on Jan. 29 they found that their stock of coal was under 10,000 tons. Very soon after this the Indoor Committee were called together; and their Solicitors were instructed to inform the contractors that, unless they arranged by noon on the following day to supply the Company with their arrears of coal, the Company would buy in the open market, and charge them with the difference in price. Some of the contractors were 2000 tons, 1000 tons, and 500 tons behind in carrying out their contracts. This step had a fairly good effect. All the contractors responded on the following day and saw the Manager, who made the best terms he could with them. On Jan. 4, the Manager was instructed to apply to the Watch Committee of the Corporation to light the public lamps half an hour later in the evening, and extinguish them half an hour earlier in the morning—a reduction in the charge for gas supplied to be made accordingly. The Committee very readily acquiesced in this, and it was carried out; and he did not think anyone was very much annoyed, or that any difficulties arose in consequence. It was not so much the quantity of gas that was saved that was of importance, but it showed the people in the locality that there was a difficulty in supplying as much gas as usual, and that the Company felt it was the duty of all to do something towards preventing Sheffield being placed in darkness. On March 2, however, after this shorter time of lighting had been in force for something like two months, the schedule time for lighting the public lamps was recommenced. Another matter he would like to mention on this occasion was that the Manager of the Electric Light Department of the Corporation and the public Press suggested that, wherever it was possible for the Corporation to substitute the use of electric light in the place of gas, it would be a good thing to do so. He suggested electric lighting for street-lamps, public baths, shambles, free libraries, open markets, and the Corn Exchange buildings. Well, if the electric light anywhere approached gas in price, he (the Chairman) could not have said much about it; but it was so much more costly than gas, that he thought not only the Sheffield Gas Company, who were such large ratepayers, but the townspeople at large, should have something to say in preventing such lavish expenditure. He found that the cost of the electric arc lamp for street lighting was from £18 to £23, whereas the 4-light Welsbach gas-lamps now used in many parts of Sheffield cost the Corporation only £5 0s. 2d. each. They were, moreover, more beautiful than the electric arc lamps; and he thought the people were satisfied with them. He hoped, therefore, that the Corporation would think further before incurring this large expense. Mr. Ritson, the President of the Manchester District Institution of Gas Engineers, in his Inaugural Address on Feb. 24, said that in consequence of the great advance in the price of coal, and unless it came down to a reasonable figure, he would not be surprised to see gas authorities going in wholesale for installations of carburetted water-gas plant; and then when the boom had passed coal-owners would find that the demand for coal by many of their customers had diminished. He (Sir Frederick) thought that if the present excessive prices for coal were continued, Mr. Ritson would prove to be right and that gas companies would put down water-gas plant. Hitherto the Sheffield Company had not done so; but the reason was that they could produce coal gas at a less price than carburetted water gas. At the present price of coal, however, this could not be done; and therefore the coal-owners should think twice before pressing their prices upward much higher. The official report on the output of coal in the United Kingdom showed that, in 1897, 202,129,931 tons were raised, of the value of £59,740,009; and, in 1898, 202,054,516 tons—a decrease of 75,415 tons. But this quantity was worth £64,169,382, or an increase of £4,429,373. Statistics as to last year's output were not yet to hand. The figures he had quoted apparently indicated that other countries were now producing coal in quantities that formerly they did not produce, and that many of them were supplying customers who formerly came to the English coal market.

The motion to adopt the report and accounts was seconded by Sir Henry Stephenson, and carried without discussion.

On the motion of the Chairman, seconded by Mr. Ebenezer Hall, dividends at the rate of 10 per cent. per annum were declared; and votes of thanks to the Directors and officers of the Company, and to Sir Frederick Mappin for presiding, concluded the meeting.

WALSALL CORPORATION GAS SUPPLY.

A Meeting of the Walsall Town Council was held on Monday last week, when the Gas Committee reported having considered the balance-sheet of the gas undertaking for the past year. They regretted that the net profit for the year was only £2677; being £890 less than in the preceding year. This, they said, was due to several causes, but mainly to increased cost of coal (which was £4700 more than the previous year), increased cost of repairs and maintenance of works, and the reduced quantity of gas made per ton of coal carbonized. This reduction of profits would necessitate a further transfer from the reserve fund, as during two years the amount of profit had been £2255 less than had been estimated. In the current year the increased cost of coal, lime, and other materials would probably be not less than £13,000; whereas the increased receipts from residuals would not be likely to exceed £3250. The Committee, however, believed that, with a view to increase the make of gas per ton of coal carbonized, it would be necessary to expend a further sum of £4000 for repairs and alterations, so that the total expenditure would be about £14,000 more than last year. Under the circumstances, they pointed out, it would be impossible to appropriate any sum from gas profits for the relief of the rates; and the Committee felt it absolutely necessary to recommend that the price of gas be increased 3d. per 1000 cubic feet, that the discount of 5 per cent. to consumers be reduced to 2½ per cent., and that the charge for public lamps be increased from £2 5s. to £2 15s. per lamp. As a result of this alteration, an increased income of £5975 was expected—leaving a deficiency of £8025 to be provided for. As mentioned in the "Journal" last week, the Committee asked for authority to engage an eminent gas engineer to report as to the condition of the gas-works and plant, and to advise what alterations and additions were desirable to increase the make of gas and reduce the cost of production. Subject to the expert considering it necessary, the Committee recommended the reconstruction of retorts and regenerator furnaces at an estimated cost of £5250.

Mr. Brownhill, in proposing the above recommendations, agreed that the report was not pleasant reading; but the Council now knew the worst they could know about the gas-works. While the gas-works were considered new, the retorts had been in use a great number of years; and it was now proposed to expend a considerable sum in substituting fresh ones.

Mr. Millerchip thought that, had an expert been called in twelve months earlier, the position would now have been more satisfactory.

The Committee's recommendations were adopted *nem. con.*

LEICESTER CORPORATION GAS AND ELECTRIC LIGHTING DEPARTMENTS.

The Results of the Last Half-Year's Working.

A Special Meeting of the Leicester Town Council was held last Wednesday, when the Gas and Electric Lighting Committee reported that the accounts of the gas undertaking for the half year to December last showed that the net profit, after paying interest on capital, was £17,761. Out of this sum had been paid £4722, the half-year's amount of the sinking fund, leaving a balance of £13,038, which, added to the balance of net profit (£15,294) for the half year to June, made a total of £28,333 to be applied to the district fund at the close of the current financial year (the 31st inst.), or from which the Council might, if so minded, increase the present reserve fund of £5000, under the authority of the Provisional Order amending the Gas and Water Transfer Act, 1878, or set aside a sum to be applicable for the renewal of works under the authority of section 17 of the Leicester Corporation Act, 1884. The Committee recommended that, to provide for claims under the Workmen's Compensation Act, a sum of £1000 be added to the reserve fund; and that the balance of £27,333 be applied to the district fund under the provisions of the 1878 Act. The Committee reported that the accounts of the electric lighting undertaking for the same half year showed that the result of the working, after paying interest on capital and £1068 on account of sinking fund, was a profit of £1089. The profit for the June half year was £337, making a total profit for the year of £1426. The amount of net loss to Dec. 31, 1898, was £679, which, deducted from last year's profits, showed a net profit of £747 on the working of the department since its commencement. The Committee recommended that a reserve fund be established and that this amount be placed to the fund. Having carefully considered as to the price of gas consumed for power purposes, the Committee recommended that a reduction of 4d. per 1000 cubic feet be made for gas so consumed.

Alderman Lennard, in moving the adoption of the report, said the surprising increase of profit in the gas department was not due to any deterioration of the quality of the gas supplied, but to the largely increased make on substantially the same capital, and also the fuller use made of the Aylestone Road works during the summer months. The electricity department had the initial difficulty common to all industrial undertakings, of being compelled to make a loss during the first three or four years of its existence; but now the receipts from the department were not only in excess of expenditure, but the Committee had wiped out all the losses from previous balance-sheets. It was probable that during the present year the Committee would be in a position to propose a further reduction in the price of electric current from 4d. to 3d., and from 2d. to 1½d. for motor power.

The report was adopted.

BRADFORD CORPORATION GAS SUPPLY.

A Prosperous Half-Year's Working.

At the Monthly Meeting of the Bradford City Council this day week—the Mayor (Mr. W. C. Lupton) presiding,

Alderman Aykroyd, the Chairman of the Gas Committee, in moving the adoption of their minutes, stated that the half year ended Dec. 31 last had witnessed one of the largest increases in the business of the Gas Department that had taken place for many years. During the six months the quantity of gas produced amounted to 920,869,000 cubic feet, or 61,000,000 cubic feet more than in the corresponding half of 1898. The quantity made per ton of coal carbonized was 10,323 cubic feet, as against 10,486 cubic feet in 1898—the slight falling-off being caused by the necessity of using a considerable quantity of stock coal, owing to the difficulty in getting supplies. There had been carbonized 89,197 tons of coal and cannel; and 36,954 tons of coke, 5777 tons of tar, and 12,272 tons of ammoniacal liquor were produced. The average cost of the coal and cannel used was 10s. 9d. per ton; being 5d. more than the average cost of the previous year. Coke and breeze had realized an average of 6s. 11½d. per ton; being 1s. 6½d. more than in the previous year. The value of tar products having gone up considerably, the returns for tar showed an improvement over those of last year—being 1s. 5½d. per ton of coal carbonized, as against 1s. 1¼d. in 1898. Ammoniacal liquor and chemicals also showed an improvement; the net yield from these per ton of coal carbonized being 1s. 11d., or 3½d. more than last year. The revenue account showed that coal cost £48,019, or an increase of £5585 over the corresponding half of 1898; purification cost £1767, or £203 more; salaries amounted to £635, being £25 more; wages paid for carbonizing were £11,659, or £816 more; repairs and maintenance of works and plant cost £3645, or £315 less; repairs to retorts amounted to £2306, or £511 less; team and yard labour and sundries accounted for £2534, being an increase of £291; repairs and maintenance of mains and services cost £2933, being an increase of £905; inspection of meters £1201, or £16 less; new public lamps and lighting, repairs and maintenance of lamps cost £4764, being a decrease of £137; clerks' salaries and collection of accounts cost £967, an increase of £10; stationery and printing £185, an increase of £40; rates and taxes cost £2778, or an increase of £9; new meters £2512, being £1054 more; while the cost of the gas stove department was £163, as compared with £11 last year. This increase was due to the Corporation fixing cooking-stoves, the first cost of which operation was necessarily a loss to the Corporation. There was not, however, the slightest doubt that this departure would prove a source of considerable revenue in the future. The general establishment charges (the chief item of which was that for Corporation water) amounted to £1692, being an increase of £391; bad debts were estimated at £518, as against £378 a year previously; and rents paid amounted to £207, or £31 less. On the other side of the account, the sale of gas realized £85,618, being an increase of £6915; the hire of meters produced £309, or £1 more; coke produced £12,872, an increase of £3539; tar yielded £6509, or £1974 more; spent oxide sold for £942, or an increase of £140; the sales of meters produced £1833, an increase of £297; sundry receipts amounted to £426, being an increase of £30; ammoniacal liquor realized £6274, or an increase of £1887; the profits from the sale of chemicals were £2300, or £56 less; and rents from cottages amounted to £540, being an increase of £11. The gross revenue for the half year was £117,627; and the gross profit £29,124, or £4889 more than in the corresponding half of 1898. From this, £134 had to be deducted for bank interest and commission; £5668 for the sinking-fund charges, being £1070 more than last year; interest on loans amounted to £8388, being a decrease of £436; and income-tax came to £1159, or £154 more. The net profit, therefore, for the half year amounted to £13,773; being £4358 more than a year ago. It must also be remembered, he said, that the street lighting of the city was done by the Gas Committee without charge—the cost for the half year being £12,546. The amount of net profit made during the period now under review was considerably more than for any previous half year since 1880, when the price of gas was 3s. per 1000 cubic feet, and the Gas Department was paid out of the rates for the cost of the public lighting. The satisfactory result of the past six months' working was owing to the Committee having made favourable purchases of coal last summer. In conclusion, he said he hoped that his statement would be satisfactory to the Council. It was exceedingly gratifying to himself that it should be of such a character, inasmuch as it was the first statement of the kind which he had had the honour of making; but unfortunately, he feared, he should never have the opportunity of making so favourable a statement in the future. The prospects of the future were rather depressing. The rise in the price of coal was almost alarming. The Gas Engineer (Mr. C. Wood) had told him that day that if the present enhanced price were maintained, it would cause an increase of their coal bill by £35,000 next year. At present there were some coal contracts in operation, and these were not yet completed. Mr. Whittingham, Mr. Land, and Mr. Triffitt, who were practical members of the Committee, said that they did not expect any reduction in price during the next year. It, therefore, might be necessary to consider how the increase in the price of coal was to be faced—whether by reverting to a charge for public lighting, or to an increased price for gas.

Mr. J. Freeman seconded the motion, which was agreed to without discussion.

THE SMETHWICK CORPORATION GAS UNDERTAKING.

The Past Year's Working.

The Secretary to the Gas Department of the Smethwick Corporation (Mr. W. J. Sturges) has submitted to the Town Council the accounts of the department for the year ending the 31st of December last, together with the usual comparative and analytical statement of the working results of the year, as compared with those of the previous twelve months. The borrowing powers remain as in the previous year; and the Gas Committee have instructed the Town Clerk to take steps for raising the balance of capital—£13,328—and to make application to the Local Government Board for a Provisional Order to authorize an increase in the borrowing powers to the extent of £50,000. The loan indebtedness has been reduced by £702; and the total debt at the end of the year was £158,593. There was expended on capital account £5613, of which £1940 was for the new retort-house, which has been completed at a total cost of £6111; £1587 for the coke-conveying plant; £788 for new and additional mains; and £1297 for meters—bringing the total capital expenditure up to £183,170. There was again a highly satisfactory development in the income from the sale of gas, which amounted to £30,114; being an increase of £2535, or 9·19 per cent., with a corresponding augmentation of 9 per cent. in the quantity of gas sold. The total number of meters in use on the 31st of December was 4081, as compared with 3538 at the close of 1898; being an increase of 543, viz.—179 ordinary and 364 prepayment. The income from slot meters amounted to £1540, against £1061 for 1898; and the number in use on Dec. 31 was 1120. The income derived from residuals showed a considerable improvement; the increase amounting to no less than £2082. Coke yielded £1214 more, owing to the larger quantity made and to an improvement of 1s. 6d. per ton in the net selling price; tar, £184 more, due to the larger production; and ammoniacal liquor, £684 more, owing to this cause and to better prices being obtained under the sliding-scale contract. The total income from all sources was £39,982, against £35,433 for 1898—an increase of £4549. Unfortunately, nearly all the extra revenue was absorbed by increased expenditure, the total of which amounted to £27,761, or £4035 more than in the previous year. The cost of manufacturing gas was £22,564, as compared with £19,002—an increase of £3562, or 16s. 10·335d. per ton of coal carbonized, against 16s. 4·152d. per ton in 1898. Coal accounted for £3123 more than before, due to the additional quantity carbonized—viz., 3515 tons—and also to the higher prices paid during the year; the average price being 12s. 7·764d. against 11s. 10·470d. per ton. Wages were £252 higher, due to the greater quantity of coal carbonized; but when worked out per ton of coal, the item showed a saving of 1¾d. per ton, resulting from the adoption of inclined retorts. The amount would have been considerably more, had it not been for the advances in wages at the gas-works granted by the Committee early in the year. With regard to manufacture, the quantity of coal and cannel carbonized was 26,765 tons, against 23,250 tons in 1898; the bulk of gas produced per ton being 9870 cubic feet, against 10,395 cubic feet in the previous year—a decrease of 525 cubic feet. This on the total tonnage represented more than 14 million cubic feet, or 1350 tons of coal, of the value of £850. In addition to this, there was a diminished yield of coke, worth £400. The gross profit last year was £12,221, as compared with £11,707 in 1898—an increase of £514. The balance standing to the credit of the profit and loss account at the beginning of the year was £5991, from which has been deducted the £2000 transferred to the district rate account and £600 transferred to the depreciation fund; leaving £3391 in hand for use as working capital. The net profit is £4191, as compared with £3979 for 1898—an increase of £212. This surplus will enable the Committee to contribute, as arranged, the £2000 to the general district rate, and £600 to the depreciation fund; leaving a balance of £1591 to be added to accumulated profits, the total of which will then amount to £4982. Mr. Sturges concludes by referring to the great advance in the price of coal, and to its effect upon the working of the undertaking in the current year. At the meeting of the Council last Tuesday, the Committee recommended the spending of £7078 for improvement of the works; but this clause, after a long discussion, was referred back to the Committee. The report was afterwards adopted.

WINDING UP OF THE MANTLELESS INCANDESCENT GAS CORPORATION, LIMITED.

A compulsory winding-up order having been made against the above-named Company, the meetings of creditors and shareholders were held last Tuesday, at the Carey Street offices of the Board of Trade—Mr. Winearls, Assistant Official Receiver, presiding. It appeared from the Chairman's statement that the Company was registered to acquire certain patent rights relating to the manufacture, &c., of mantleless gas-burners in Great Britain, France, Austria, New Zealand, and the United States. The original patentee was Mr. Thomas Rowan, of the firm of Messrs. T. Rowan and Co., of St. Mary Axe, E.C. In November, 1896, the patents were sold to Dr. Thomas Rowan, a relative of the patentee, for £15,000, payable partly in cash and partly in shares of a company to be formed. In April, 1897, an agreement was entered into between Dr. Thomas Rowan and Mr. E. Hurd (otherwise known as R. Dennis), as Trustee for the Company, then in course of formation, for the sale of the patents to the latter for £110,000, payable as to £10,000 in cash and the balance in shares. The agreement provided that at least £25,000 of the capital of the Company should be underwritten. The Company was registered in June, 1897, with a nominal capital of £150,000, and the registered offices were first in Victoria Street, Westminster, and latterly in Queen Victoria Street, E.C. The first meeting of Directors was held in June, 1897, when Mr. Arthur Crawshay Bailey submitted a prospectus on behalf of Messrs. Floyd and Co., the promoters. The prospectus was approved, but was not issued. In the following October, a fresh prospectus was prepared by the promoters, and issued to the ironmongery trade. A further prospectus was distributed in January, 1898; but the necessary subscriptions not having been obtained by March, the vendors entered into a new agreement with the promoters, under which they agreed to sell the business of Messrs. T. Rowan and Co. to the Company for £2000 in cash and bills, and the patents for £110,000 in shares. The minimum amount upon which the Directors were to proceed to allotment was reduced from £25,000 to £10,000. On March 28, 1898, applications were received from various parties, making, with the shares already subscribed for, a total of £10,000. Subsequently the application moneys and calls on some of the shares were not paid; and in other cases the applicants could not be traced. The Official Receiver was of opinion that applications were put forward by Mr. A. C. Bailey for the purpose of inducing the Directors to proceed to allotment; thereby enabling the promoters to obtain control of 60,000 shares which they were to receive out of the purchase consideration. The Official Receiver would consider whether he should not apply for an order to examine publicly the parties concerned in the promotion. Early in April, 1898, the Directors endeavoured to complete the transfer of the patents to the Corporation; but the authorities at Somerset House declined to file the contract until the stamp duty had been paid on the whole of the £110,000. A contract necessary for protecting the fully-paid shares was accepted by the authorities; but the vendors refused to take the shares, and on that account contended that an assignment which was made of the British patents was invalid. The Corporation had never been registered as the owners of the patents; and the vendors claimed that the title was still vested in them. That question would have to be investigated by the Liquidator, because unless the patents were held to be the property of the Corporation, there would be nothing for the unsecured creditors and shareholders. At both meetings, Mr. W. H. Pannell, Chartered Accountant, was nominated as Liquidator; and it was stated that the suggestion had been made that the patents should be sold to another company on terms which would benefit all parties interested.

ELECTRIC LIGHTING NOTES.

By a majority of one, the Ryde Town Council have decided to apply to the Local Government Board for sanction to borrow £30,000 for carrying out a scheme of electric lighting.

The Town Council of Colwyn Bay and Colwyn have received the sanction of the Local Government Board to borrow the sum of £5120 for the purpose of their electric lighting scheme; and instructions have been given to the contractor to commence the work forthwith.

The Eastbourne Corporation having acquired the undertaking of the Electric Light Company, that undertaking has ceased to exist. The shareholders have been paid out with twice the nominal value of their shares; and the dividend for last year was 12½ per cent. On the settlement, gratuities were distributed to the Directors, the officers, and the employees.

Colonel Langton Coke, of the Local Government Board, last week held an inquiry at Crewe into an application by the Corporation to borrow £10,000 for works of electric lighting within the borough. The Town Clerk, Mr. Frederick Cooke, stated that the Council had already obtained sanction to spend £26,000 on electric lighting; and this additional £10,000 was wanted for lighting side-streets. There was no opposition.

At the annual meeting of the Newmarket Electric Light Company last week, Mr. G. H. Verrall (Chairman of the Directors), in moving the adoption of the report and accounts, said that their authorized capital was £30,000; and it had been decided to issue £15,000 more in £10 shares, and £15,000 in 5 per cent. debentures. In the nine months to December last, the Company had made a profit of £99 16s. 5d., or £47 8s. 9d. less the interest on debentures issued. They were now supplying over 2000 eight-candle power lights, and had applications for nearly another 1000. They were compelled to increase their plant to such an extent that they could double their output. Their prospects were, therefore, eminently satisfactory.

Last Friday, Mr. E. A. Standford Fawcett held an inquiry in the Council Chamber, Whitby, into the District Council's application for sanction to borrow £26,000 for electric lighting purposes. Mr. W. Seaton Gray, Clerk to the Council, opened the proceedings; after which Mr. A. H. Preece, of Messrs. Preece and Cardew, gave particulars of the scheme. Mr. W. Brown, a member of the Council, drew the Inspector's attention to the fact that the town had not had an opportunity of expressing its opinion on the matter; and he suggested that it should be ascertained before the sanction was given. The Clerk explained that the report of Messrs. Preece and Cardew was laid on the table for any councillor to see; and he took it that it was public property. The Rev. Francis Hayden Williams supported Mr. Brown's statement that the town ought to be consulted on the matter. The proceedings then concluded. The Inspector, with the officials, visited the site of the proposed station.

At the last meeting of the Guildford Town Council, the Town Clerk (Mr. F. F. Smallpeice) read a letter from the Secretary of the Guildford Electricity Supply Company, Limited, in reply to the resolution recently adopted by the Council, inquiring of the Company whether they were willing to sell their undertaking to the Corporation, and, if so, upon what terms. He stated that the Directors had considered the matter, and would recommend the shareholders, subject to the necessary sanction of the Board of Trade, to dispose of the entire undertaking for £25,000. Mr. C. H. Brown, who moved the original resolution, proposed—"That the Town Clerk be instructed to write to the Guildford Electricity Supply Company, acknowledging the receipt of their letter, and stating that, if they are prepared to negotiate as to the question of price, the Council will be pleased to appoint a small Committee to meet the Directors and discuss the matter with them." Mr. Taylor seconded the proposition; and it was carried.

The Leamington Corporation have abandoned the idea of acquiring the local electric light undertaking. At the meeting of the Corporation on Monday last week, the Electric Light Committee recommended that, if the suggested clauses and amendments filed by the Corporation were accepted by the Midland Electric Light and Power Company, Limited, and embodied in the Order for which they were now applying, the Corporation should abandon the Order obtained by them in 1899, and withdraw their opposition to the Company's Order. Alderman Bland said the Committee, before arriving at their present decision, had exhausted all possible means of coming to an agreement with Mr. Arthur Chamberlain. He had since written to Mr. Chamberlain, asking whether he was prepared to accept for his undertaking the sum of nearly £30,000, which had previously been mentioned; and, in reply, Mr. Chamberlain made demands which amounted to something like double this sum. The only alternative he left them was to go to arbitration; but, owing to the conditions which the Board of Trade had attached to the Corporation's Order, they did not feel justified in doing that. The Committee, he might mention, had spent £1100 in endeavouring to obtain a satisfactory Order. Mr. Heath Stubbs thought that, under the circumstances, the Council would be very ill-advised to proceed. The Committee's report was adopted.

According to a statement made at last week's meeting of the Bradford Town Council by Mr. T. H. Shaw, the Chairman of the Electricity Committee, the total income of the department for the half year ended Dec. 31 was £17,654, as compared with £13,011 for the corresponding period in the preceding year, or an increased income of £4643. The total expenditure for the half year (including interest and sinking fund) was £14,256, as against £10,519 for the corresponding period of the preceding year. The net profit for the half year, therefore, was £3397, as against £2491—being an increase of £905 on the corresponding period of 1898. The number of consumers was 1075, as against 850, or an increase of 21 per cent. The total number of units of current consumed was 1,360,319, against 926,732, or an increase of 47 per cent., irrespective of current supplied for the public lamps. The total profits since the opening of the works in September, 1889, after paying interest and sinking fund, amounted to £26,013; and the total amount written off for depreciation had been £14,372—leaving the sum of £11,640 to be appropriated as the Council might direct. The trade profit—*i.e.*, the profit before charging interest and sinking fund—for the last half year worked out to £4 19s. 2d. per cent., on a capital outlay of £202,702; and the net profit, after charging interest and sinking fund, showed a percentage of £1 13s. 5d. on the same outlay. Taking the December and the preceding June half years together, the trade profit amounted to £17,617, representing £8 13s. 10d. per cent. on the capital outlay. The net profit amounted to £5130, and represented £2 10s. 8d. per cent. on the outlay.

In moving the adoption of the proceedings of the Lighting Committee of the Brighton Corporation at the meeting of that body last Thursday, Mr. Dutton Briant made an exhaustive statement relative to the past year's operations at the electricity works. He mentioned that the Committee had a reserve fund of £4881. According to the latest returns available, the current was being supplied for lighting purposes at a lower rate than that charged in any other place in the kingdom, and this in face of the fact that coals—the principal item of expenditure—cost twice as much in Brighton as in many other towns. The effect of the reduction made last year was that private consumers had paid £3385 less for their supply than it would have cost them under the 1898 scale, which was a low one. The ratepayers, as distinct from the consumers, had benefited to the extent of upwards of £1200. Street lighting last year cost £1128 less than it would have done under the 1898 scale; and the lighting of the Town Hall, Pavilion, and other public buildings, £95 less—making a total of £1223. The profits on the year, after providing for bad debts, amounted to £16,700, against £19,200 in 1898—a difference of £2500. The income had been £4514 less; so that if they deducted the decrease profit (£2500), they would see that, but for the reduction in price, the gross profits this year would have shown a net increase of £2014. The Committee proposed that the whole of the net profits—£1455—should be applied in relief of the rates; and this, with the £9539 already paid, would make a total of £10,994. The proceedings were confirmed.

The inhabitants of Coventry were invited last week to attend a public meeting to assent to the opposing by the Corporation of the North Warwickshire Water Company's Bill. The Mayor, Alderman A. S. Thomson, the Assistant Town Clerk, and one ratepayer only were present. The Mayor said it was necessary to call such a meeting to enable the Corporation to incur the expense which might be involved in opposing the Company's Bill. In the Bill certain roving powers were sought, which, if granted, might interfere with the sources of the Corporation water supply. It was believed that the application for these powers would be dropped; but it was essential the Corporation should have *locus standi* in the matter. He moved a formal resolution to the effect that the Bill be opposed; and this was adopted.

LONDON COUNTY COUNCIL AND THE WATER QUESTION.

Deputation to the President of the Local Government Board.

Last Wednesday, the President of the Local Government Board (Mr. Chaplin) received, at the House of Commons, a deputation from the London County Council on the subject of the Bills now before Parliament relating to the water supply of the Metropolis. Among the members of the deputation were Mr. W. H. Dickinson (the new Chairman of the Council), Sir Arthur Arnold, Mr. James Stuart, M.P., and Sir Alexander Binnie, the Chief Engineer, Mr. C. J. Stewart, the Clerk, and Mr. G. L. Gomme, the Statistical Officer of the Council.

Mr. Dickinson, in introducing the subject, said the deputation were acting under a resolution of the Council with a view of ascertaining what were the intentions of the Government as to the two Bills now before Parliament for the purpose of dealing with the Water Companies and the acquisition of a water area in Wales. It was of the greatest importance that no further delay should take place, as it had been estimated that if the matter were delayed for another year it would add at least a further £1,000,000 to the cost of the transaction; and he urged that the Council should be at least protected against such a loss in favour of the interests of the ratepayers. The Royal Commission had paid very great attention to the question of cost as between the Staines scheme and the Welsh scheme, and had arrived at the conclusion that the Staines scheme would be the cheaper of the two. But there were many other questions raised between the two schemes besides the financial one; and he wished to urge upon the Government that whatever should be done with reference to the source of the water supply of London should be undertaken after thorough inquiry, and without any reference to, or influence by, the Water Companies. He felt sure, when the Council only had Her Majesty's Government to deal with, the matter would be settled without any difficulty. The areas available for water supply were being swallowed up very rapidly, and therefore it was of the greatest importance that no further delay should take place in coming to an ultimate decision on the subject. He suggested that provision should be made in the Bill which would be passed that, if the Council should take over the property of the Water Companies, they should also have power to bring in a future Bill to settle the question of the water authority for the Metropolis. In conclusion, he would urge that it was of the utmost importance that the matter should be dealt with during the present session, while abundant opportunity existed.

Mr. Chaplin, in reply, said he was very pleased to gather from Mr. Dickinson that, in many respects, there was a considerable amount of agreement between the views of the County Council and those of Lord Llandaff's Commission. He was not prepared to disagree with Mr. Dickinson that the question of purchase might now be considered as practically settled; but perhaps undue importance had been attached to the immediate urgency for proceeding with this question. He did not think any of the objections which had been raised against not proceeding during the present session were insuperable. Mr. Dickinson, he acknowledged, had gone far to remove some of the difficulties which had hitherto been felt by the different parties to this question; but he seemed to think that a further inquiry was called for as between the relative merits of two schemes—one for bringing water from Wales, and the other known as the Staines reservoirs scheme—both of which had been carefully examined by the Commission. They had taken a great deal of evidence upon the subject, and had come to clear conclusions upon which they had no doubt whatever; and he was somewhat doubtful as to the expediency of holding a second inquiry upon a subject which had been so fully threshed out. On this point, however, he would like to consider more carefully the views which Mr. Dickinson had put forward. The main object of the deputation was to elicit from the Government an undertaking that the County Council's Water Bills should be allowed to go to a Select Committee this session, upon the understanding that the Council, should they become the purchasers of the undertakings of the different Water Companies, would be willing to agree to a transfer of them on some future occasion to some body other than themselves, if Parliament so thought fit.

Mr. Dickinson: Subject to the constitution of the body, to a certain extent. I do not say to any body.

Mr. Chaplin: That means, I apprehend, a body that must be agreeable to the views of the London County Council.

Mr. Dickinson: No, Sir. I think our views are that, provided the question of the constitution of the body is thoroughly threshed out, and we may have an opportunity of putting before a Committee of the House, or any other authority, our views with regard to the constitution of that body, I think I may say "Yes" to your question. It is an important admission to make.

Mr. Chaplin said the Government were bound to consider very carefully the recommendations of a Commission which they had themselves appointed. They had not yet had the advantage of seeing the evidence which was laid before that Commission; and before pronouncing a conclusive opinion, he should like to have that opportunity. The report was a most able and exhaustive review of the whole question; and the public were greatly indebted to Lord Llandaff and his colleagues for the care, labour, and attention they had given to the subject. In some of their most important conclusions—notably the one with regard to the sufficiency of the present sources of supply they were entirely in harmony with those which had been arrived at by Lord Balfour's Commission. The Llandaff report contained some very precise recommendations, among them being the following: First, that the undertakings of the Companies should be acquired by a public authority; secondly, it stated most explicitly that the purchaser should not be the London County Council; thirdly, that the present sources of supply in the valleys of the Thames and Lea are sufficient in quantity and quality, with adequate storage, for a great number of years; and, fourthly, that to embark at once upon a scheme for bringing water from Wales would be to throw an unnecessary burden on the present and next generation of water consumers and ratepayers and their immediate successors their reason being that the cost of a Welsh supply would be immensely greater than that of storage. The two Bills under discussion were, first, a Bill for the purchase of the undertakings of the Water Companies by the County Council; and, secondly, a Bill for the purpose of bringing water to London from Wales. In spite of the suggestions as to possible modifications, he was unable to reconcile these Bills with the recommendations of the Commission—indeed, they seem to him to be in distinct conflict with them. At the same time, having heard Mr. Dickinson, he would like to consider the subject more carefully before making any definite statement upon it. He did not wish to be understood as holding out any hopes to the deputation; but it was only due to Mr. Dickinson that his able and exhaustive statement should be fully considered. At the same time, he should mention that other views of an opposite character had been pressed upon him from quarters to which he was bound to attach very great importance. A deputation waited upon him the previous day, consisting of something like fifty members representing Metropolitan constituencies, and asked him to take an exactly opposite view.

Mr. Dickinson, in thanking Mr. Chaplin for the extremely kind way in which he had received the deputation, expressed the hope that the Government would give the matter a little further consideration. There was no doubt that all kinds of interests were pushing in different directions in this matter; and their great difficulty in regard to the settlement of the London Water Question was to get rid of some of them. If once the Water Companies were out of the way, they would find it a very much simpler matter to satisfy the other conflicting interests.

The deputation then withdrew.

HALIFAX WATER SUPPLY.

New Reservoirs to be Constructed.

The Halifax Town Council are about to commence the construction of extensive new reservoirs at Walshaw Dean. The present water supply for the town, after allowing for compensation water, amounts to about 5¼ million gallons per day, which has proved ample, not only for the requirements of the borough, but for the numerous surrounding districts which the Corporation, under their Act of Parliament, are bound to supply. The demands upon the reservoirs, however, are yearly increasing; and this fact, together with the possibility of a dry season occurring, has induced the Corporation to provide for an additional supply. The new reservoirs are to be three in number, with a total drainage area of 2315 acres; and they will provide a further available water supply of 2½ million gallons per day. Their construction, it is anticipated, will involve an expenditure of from £150,000 to £200,000. Thus far, the capital expenditure of the Corporation on their water-works (including £30,000 paid for the small systems of supply in existence at the incorporation of the borough) has amounted to £721,110; and for many years now the undertaking has realized substantial annual profits for the ratepayers. The length of the three new reservoirs, which will take about seven years to complete, will be 1½ miles—the largest being the centre reservoir. One great advantage of the site secured is that, being surrounded by large tracks of moorland, the Corporation will be spared the necessity of purchasing any of the adjacent land for the protection of the water supply; whereas recently, in connection with their other reservoirs, they have been called upon to lay out considerable sums in acquiring adjacent farm property, as the drainage from the heavily manured fields was, it was feared, finding its way into the water. Walshaw Dean is situate above Hebden Bridge, not very far away from the present Widdop reservoir. Messrs. Hill, of Manchester, are the Engineers for the scheme now being undertaken.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Corporation of Paisley are about to take a step in the direction in which public opinion among technical people has of late been gravitating, in the matter of the illuminating power of the gas supply. At present they are supplying, under the Paisley Corporation Gas Act of 1870, gas of not less than 25-candle power. It is proposed that the illuminating power be of not less than 20 candles. A clause to this effect is to be introduced into a Corporation Bill which is being prepared. Of course, although the power were obtained, it does not follow—and indeed it is not likely—that it would be utilized; but freedom to lower the illuminating power as far as 20 candles gives the Gas Manager a means of tiding over critical moments which he can scarcely secure anywhere else. This step in Paisley is a great blow to enrichment processes. A few years ago, they came in like a flood; but now the trend seems to be rather against them, though it might have been expected that the dear coal of the present time would have operated in favour of any form of enrichment which was not derived from coal.

At Paisley, the Corporation are the undertakers under the Electric Lighting Acts; and the curious circumstance has emerged that their borrowing powers for electricity purposes are not under the Electric Lighting Acts or their own Provisional Order, but under the Corporation Gas Acts. This has been discovered by a reply which the Corporation have received from the Under Secretary for Scotland, to an application by them for further borrowing powers for the extension of the electric light installation. The Corporation, it appears, can only borrow for electric lighting purposes to the extent of their unexercised borrowing powers under the Gas Acts. The unexhausted borrowing powers under the Gas Acts will, in May next, amount to £13,000. It has been resolved to borrow this sum in the meantime, for electric lighting purposes, and to obtain further borrowing powers for electricity to the amount of £20,000, on the understanding that, should the Order be obtained, the right to borrow to the extent of £13,000 for the gas undertaking should revert to the Corporation. This roundabout arrangement may be the best in the circumstances; but surely some simpler method of obtaining finances might be adopted.

An action bearing upon the lighting of common stairs has been decided by Sheriff-Substitute Guthrie, in the Glasgow Sheriff Court. A woman claimed £250 as damages for injuries which she said she had sustained by falling down a common stair, after dark, one evening in November last. Such stairs are, in Glasgow, lighted by the Corporation, who charge the cost upon the occupiers. The pursuer averred that her fall was the result of the imperfect lighting of the stair. The defence was

that the stair was not under the control of the Corporation; being one which leads to business premises, and which is closed to the public after business hours. They also said that the accident was due to contributory negligence on the part of the pursuer. The Sheriff has sustained the latter plea, and dismissed the action, with expenses to the defenders. He bases his decision upon the fact that the pursuer was, on her own showing, acquainted with the stair, and that she must consequently have been careless. The decision may be useful to other lighting authorities.

On Tuesday night of this week, Mr. Henry O'Connor, of Messrs. James Milne and Son, Limited, delivered a lecture upon "Some Engineering Points in a Modern Gas-Works," to the East of Scotland Engineering Association, in Edinburgh. Mr. O'Connor illustrated his remarks practically, by means of a small gas-works. The members derived much information from the lecture, and cordially thanked Mr. O'Connor for his trouble. The small model gas-works which was used is a very neat affair; and it, combined with Mr. O'Connor's fine platform style, would make his lecture a splendid attraction to any committee organizing a course of popular lectures.

At a meeting of the Perth Gas Commission on Monday, the offers of Messrs. Clapham Brothers, Limited, of Keighley, for condensers and purifiers at the new gas-works, and of Messrs. Bryan Donkin and Co., Limited, of London, for exhausters, were accepted. Mr. Donnelly moved that they should delay fixing the contracts in the meantime, on account of the high price of materials. He mentioned that the estimated cost of the works had increased from £52,000 to £74,000. This motion, however, was not seconded. The Commissioners agreed to postpone consideration of the subject of extending the purifiers in the new works—a step which is already believed to be necessary, on account of the phenomenal increase in the gas consumption. At the meeting, one of the Commissioners complained of the gas not being of sufficient illuminating power; and the explanation given was that, on account of the great increase in the output, the works are unable to satisfactorily meet the demand.

The Dunfermline Gas Commissioners, on Monday, sanctioned the execution of repairs upon the gas-works, as recommended by Mr. Hubert Pooley, their Engineer, at a cost of £355. On account of Mr. Pooley being absent through indisposition, it was agreed to delay consideration of his recommendations with reference to extensions of carbonizing plant, condensers, and scrubber.

I have before referred to the unfortunate want of unanimity among the Commissioners of the newly-created burgh of Monifieth. The bone of contention is the gas supply. In a spirit of panic—which is the bane of all popular electoral systems—the community rescinded the adoption of the Burghs Gas Supply Act, after which a Company was formed and erected works for the supply of gas. Provost Stewart, who had been the principal mover in the whole matter—both when it was the adoption of the Act, and when it was the formation of the Company which was being considered—became the Chairman of the Company. There is no reason to think that his object in all that he has done has been other than to improve the condition of the burgh; but his good actions have been ill requited. Those who procured the rejection of the Gas Act, have never ceased to condemn the arrangements that have been made with the Gas Company. They have carried their opposition to an extreme length this week. A motion was made at a meeting of the Commission to the effect that all further communications between the Company and the Commission be considered in public, and be dealt with only by those members of the Commission who are not shareholders in the Gas Company. This is the point upon which the community of Stirling were frightened into rejecting the gas transfer. It has arisen elsewhere; but it is observable everywhere that it is only men of small mind who make use of the argument. The Monifieth Commission, by six votes to three, adopted the motion. It is a useless resolution in two respects. It will not be possible—or at least it will be inadvisable—to consider all matters in public; and it is not by resolution of a municipality that the conduct of corporation meetings is regulated. The members have their powers, individual and corporate, conferred upon them by Act of Parliament. Consequently, if Provost Stewart should disregard this resolution and insist upon exercising his rights, the business of the Corporation will be suspended until power should be taken to enforce lawful authority. The same party in the Commission moved that the account of the Gas Company for gas supplied to the public lamps be not paid in the meantime. The Commission, however, agreed to pay the account.

In the last number of the "Journal," notice was taken of the presentations made to Mr. James Lyon, in celebration of the completion of his fifty years' labours in connection with the Glasgow Gas-Works. Bearing on that event, some particulars of his life-work may be interesting. Mr. Lyon entered the service of the Glasgow Gaslight Company on Feb. 13, 1850, and drew his first pay on the 5th of the following month. Under his uncle, Mr. Ritchie, who was the Treasurer and Engineer to the Company at the time, he served in various capacities till August, 1869, when the Company and the City and Suburban Gas Company ceased to exist, and the gas undertaking of the city and suburbs was, by Act of Parliament, acquired by the Corporation of Glasgow. He had already served to some extent as paymaster to the workmen of the Gaslight Company; and when the "acquisition" took place, there was no difficulty in formally recognizing him in the permanent office of "paymaster of the forces." During these thirty years, what an amount of money has passed through his hands; for the sum paid out by Mr. Lyon now reaches to £180,000 or £190,000 per annum! This year it is confidently estimated that it will exceed £193,000; and it takes him four days of every week to do his payments. When the pays passed from the fortnightly to the weekly stage in November, 1889, the total outlay was increased by about £20,000. This reform was brought about chiefly through the advocacy of one member of the Gas Committee. At that time the three-shift system came into operation at the several gas-works. It was the desire of Mr. Foulis that no two works should be paid on the same day; and at first, thirty years ago, the pay-sheet was covered by about £50,000 per annum. Even that amount was considerably above what the pay-sheet contained in 1818, when the works of the Gaslight Company came into operation for the first time. When the gas supply was municipalized in 1869, the gross revenue was £235,701; the price of gas being 4s. 7d. per 1000 cubic feet. In the last report, however, the gross revenue was given for 1898-9 at £700,149, with the price reduced to 2s. 2d. per 1000 cubic feet. Perhaps the last year of the two Gas Companies should rather be taken, when the income was about £190,000.

The water supply to the town of Kelso has been regarded for a long

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 733.

Issue.	Share	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 13	10½	Alliance & Dublin 10 p. c.	20½—21½	..	4 17 8
100,000	10	,,	7½	Do. 7 p. c.	14—15	..	5 0 0
300,000	[illegible]	Jan. 2	5	Australian 5 p. c. Deb.	100—102	..	4 18 0
200,000	5	Nov. 15	6	Bombay, Ltd.	6¼—6¾	..	4 8 11
10,000	5	,,	6	Do. New, £4 paid	4¼—4¾	..	5 1 1
380,000	Stk.	Feb. 23	12	Brentford Consolidated	267—272	..	4 8 3
270,000	,,	,,	9	Do. New	203—208	..	4 6 7
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb.	118—123	..	3 5 1
220,000	Stk.	Mar. 14	11½	Brighton & Hove Orig.	250—255	..	4 10 2
226,320	,,	,,	8½	Do. A. Ord. Stk.	180—185	..	4 11 11
999,500	Stk.	Feb. 23	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	[illegible]	Sept. 29	10	British	43—44	..	4 10 11
50,000	10	Feb. 23	12	Bromley, Ord. 10 p. c.	24—26	..	4 12 4
70,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd.	9¾—10¼	..	5 17 1
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	99—101	+1	3 19 3
150,000	20	Mar. 14	8½	Cagliari, Ltd.	25—27	..	6 2 3
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	15—16	+1½	5 0 0
50,000	50	Nov. 2	6	Do. 6 p. c. 1st Mort.	56—58	..	5 3 5
550,000	Stk.	Oct 13	13½	Commercial Old Stock	305—310	..	4 7 1
200,750	,,	,,	10½	Do. New do.	240—245	..	4 5 9
200,750	,,	Dec. 14	4½	Do. 4½ p. c. Deb.	142—145	..	3 2 1
600,000	Stk.	Dec. 14	9	Continental Union, Ltd.	170—180	..	5 0 0
260,000	,,	,,	7	Do. 7 p. c. Pref.	178—183	..	3 16 6
51,600	Stk	Feb. 23	14	Croydon A 10 p. c.	335—340	..	4 2 4
173,400	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
500,000	Stk.	Feb. 23	5½	Crystal Palace Ord. 5 p. c.	122—127	..	4 2 8
60,000	,,	,,	5	Do. 5 p. c. Pref.	132—137	..	3 13 0
400,000	10	Jan. 26	11	European, Ltd.	20—21	..	5 4 9
854,000	10	,,	11	Do. £7 10s. paid	15—16	..	5 8 2
14,993,075	Stk.	Feb. 9	4%	Gaslight and Coke	4 p. c. Ord.	103—105	..	4 13 4
2,800,000	,,	,,	3½		3½ p. c. max.	97—99	..	3 10 8
3,799,735	,,	,,	4		4 p. c. Con. Pref.	119—122	..	3 5 7
3,993,975	,,	Dec. 14	3		3 p. c. Con. Deb.	99—101	..	2 19 5
70,000	10	Nov. 15	8	Hongkong & China, Ltd.		13½—14½	..	5 10 4
3,800,000	Stk.	Nov. 15	10	Imperial Continental		213—216	−2	4 12 7
473,000	Stk.	Feb. 9	3½	Do. 3½ p. c. Deb. Red.		100—103	..	3 8 0
75,000	5	Dec. 14	6	Malta & Medn., Ltd.		4½—5½	..	5 9 1
550,000	100	Oct. 2	5	Met. of Melbourne	5 p. c. Deb.	110—114	..	4 7 9
250,000	100	,,	4½		4½ p. c. Deb.	107—109	..	4 2 7
642,920	20	Nov. 15	3	Monte Video, Ltd.		11—12	..	5 0 0
667,946	Stk.	Feb. 23	9½	Newc'tle & Gatesh'd Con.		215—220	..	4 4 1
299,855	Stk.	Dec. 29	8½	Do. 8½ p. c. Deb.		104—107	..	3 5 5
60,000	5	Feb. 23	7	Ottoman, Ltd.		4½—5½	..	6 13 4
				* Ex div.			

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
150,000	5	Nov. 30	8	Oriental, Ltd.	7—7½	..	5 6 8
135,000	5	,,	8	Do. New, £4 10s. pd.	6½—6¾	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.	1¼—1¾	..	4 11 5
500,000	100	Dec. 1	6	People's Gas of Chicago	2nd Mtg. Bonds	102—106	..	5 13 2
851,070	10	Oct. 13	7	River Plate Ord.		11¼—11¾	..	5 19 2
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.		100—102	..	18 5
250,000	10	Sept. 15	10	San Paulo, Ltd.		12—13	..	7 13 10
135,000	Stk.	Sept. 15	10	Sheffield A.		249—251	..	3 19 8
209,053	,,	,,	10	Do. B.		249—251	..	3 19 8
447,427	,,	,,	10	Do. C.		249—251	..	3 19 8
5,600,000	Stk.	Feb. 23	5½	South Metrop., 4 p. c. Ord.		135—138	..	3 17 3
1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb.		100—102	..	2 18 10
120,000	Stk.	Mar. 14	6	Tottenham and Edmonton	A. 5 p. c. B. 3½ p. c. 4 p. c. Deb.	139—141	+1	4 5 1
250,520	,,	,,	4½			100—102	..	4 8 3
55,100	,,	Dec. 14	4			113—117	..	3 8 5
182,380	10	Jan. 12	5	Tuscan, Ltd.		8½—9½	..	5 5 3
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.		101—104	..	4 16 2
				WATER COMPANIES.			
780,399	Stk.	Dec. 29	11	Chelsea, Ord.		307—312	..	3 10 6
160,000	,,	,,	5	Do. 5 p. c. Pref.		157—162	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75		145—150	..	3 0 0
175,785	,,	Sept. 29	4½	Do. 4½ p. c. Deb.		148—153	..	2 18 10
1,720,560	Stk.	Oct. 13	7	East London, Ord.		205—210	..	3 6 8
654,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb.		145—150	..	3 0 0
390,000	,,	,,	3	Do. 3 p. c. Deb.		99—101	..	2 19 5
700,000	50	Dec. 14	7½	Grand Junction	10 p. c. max. 4 p. c. Deb.	108—110	..	3 8 2
810,000	Stk.	Sept. 29	4			131—136	..	2 18 10
708,000	Stk.	Feb. 23	14	Kent		310—320	..	4 7 6
160,000	,,	,,	7	Do. New, 7 p. c. max.		200—210	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.		295—300	..	3 10 0
406,200	100	,,	8	Do. 7½ p. c. max.		215—220	..	3 12 9
850,000	Stk.	Sept. 29	4	Do. 4 p. c. Deb.		135—138	..	2 18 0
500,000	100	Feb. 23	13½	New River, New Shares		420—425	..	3 3 6
1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb.		132—137	..	2 18 5
902,300	Stk.	Dec. 14	7½	Southwark and	Ord. 7½ p. c. max. 5 p. c. Pref.	200—205	..	3 13 2
126,500	100	,,	7½			190—195	..	3 16 11
489,200	Stk.	,,	5			160—165	..	3 0 7
1,019,585	,,	Oct. 13	4	Vauxhall	4 p. c. A Deb.	131—136	..	2 18 10
1,155,066	Stk.	Dec. 14	16	West Middlesex		290—295	..	3 7 9
200,000	,,	,,	4½	Do. 4½ p. c. Deb.		147—152	..	2 19 11
200,000	,,	Mar. 14	8	Do. 8 p. c. Deb.		99—101*	+½	2 19 5
				*Ex div.			

time as in an unsatisfactory position. To remedy it, the Town Council obtained expert advice, and were proceeding to arrange for an augmentation to the supply from Heatherhope when a municipal election occurred, and the scheme was defeated. The new Council have adopted a plan for obtaining the augmented supply from another source, known as Ladyrig. The cost of this scheme—about £4000—is much less than was that of the other. In order to ascertain public feeling in the matter, a meeting of the inhabitants was held on Wednesday evening; and in the end the meeting, rejecting a motion for delay, instructed the Council to proceed at once with the Ladyrig scheme. There is a good deal of strong feeling on the subject.

This week has been a busy one at Westminster over Water Bills for Scotland. The most important, financially, is that of the Motherwell Commissioners, who propose to expend about £200,000 in bringing in a new supply from the Cutter Water, a tributary of the River Clyde above Symington. This is a long way to go; but it is almost the only available source of water supply which can be had in the wide area around Motherwell, which is so largely a mining country. The two towns of Airdrie and Coatbridge are about to be supplied with water from the same vicinity. It is an upland, pastoral district, and yields abundant water of great purity. The Motherwell Bill has passed a House of Lords Committee, but not in its entirety. The promoters—I suppose with the intention of getting a larger rating area, and so being able to keep down the charge, which is expected to be at first 2s. 3d. to 2s. 6d. per pound—proposed to include a portion of the county in their area. To this the County Council objected, because they are at present constructing works for the supply of the district which the burgh of Motherwell proposed to take; and they have borrowed money upon the security of the rates in that and the other districts within their area. They even suggested that the Commissioners of Motherwell might buy water from them, instead of going on with their own scheme; but this proposal was not entertained. The Committee, in passing the Bill, confined it to the burgh, and excluded the operation of the measure from the county. Parliamentary Committees, I suppose, have some principles by which they are guided in dealing with the granting of powers to local authorities; but they cannot be of the hard-and-fast order, and this probably is one of the beauties of our Constitution.

In the case of Airdrie and Coatbridge, which are at present supplied with water by a Company, a Bill was this week before a House of Commons Committee for the purpose of creating a Trust to take over the undertaking. The area, in this instance, is not confined to the two burghs, but includes large portions of the adjacent county, the entire area containing a population of nearly 100,000 persons. This Bill has also been passed; and the terms upon which the transfer will be made will fall to be determined by arbitration. It is probable that in the case of Airdrie and Coatbridge the inclusion of part of the county in the area of supply is to be attributed to the fact that the Company have been supplying the district with water, and that the Bill simply continues an arrangement which has been found to work well.

The two Water Bills dealing with Falkirk and adjoining districts have also received the sanction of a House of Lords Committee. In the one, the County Council propose to supply with water a wide stretch of country to the west of Falkirk. Almost the only opposition to the Bill was stated on behalf of the Railway Companies, who were taken by surprise when a new clause was inserted proposing to exempt agricultural land from rating, and, in the case of farm subjects, to assess only the buildings; whereas, in the case of railways, they were, in addition to paying upon their buildings, to be rated on one-fourth of the valuation of their lines. The Railway Companies asked to be put upon the same footing as the owners of land. The Committee declined to accede to the proposal, and passed the clause as drafted. It looks a little hard on the Companies, who must pay full rates on all buildings on their systems, and also on one-fourth of the value of their lines. It is true they use water upon their lines, but they pay for it by meter. It is likely that the proposal of the County Council was only made as a sort of compromise, as otherwise they would have had to face opposition from the owners of land of the value of £28,000. This, however, ought not to have weighed with the Parliamentary Committee; and I confess that their decision does seem a little inequitable.

In the Bill of the Falkirk and District Water Trustees, the only opposition offered had reference to the quantity and quality of compensation water to be given to some papermakers. This was, in the end, amicably adjusted at 972,000 gallons per day from the new works—making, with the compensation at present being given, a total of 1,800,000 gallons per day. But after the agreement was come to, the parties quarrelled over a proposal by the papermakers, to the effect that the new compensation water should have preference to the town supply. Such a proposal could not be entertained; and it was rejected by the Committee. To have sanctioned it, would have meant that the water-works were to exist primarily for the benefit of the papermakers; the opposite is the fact.

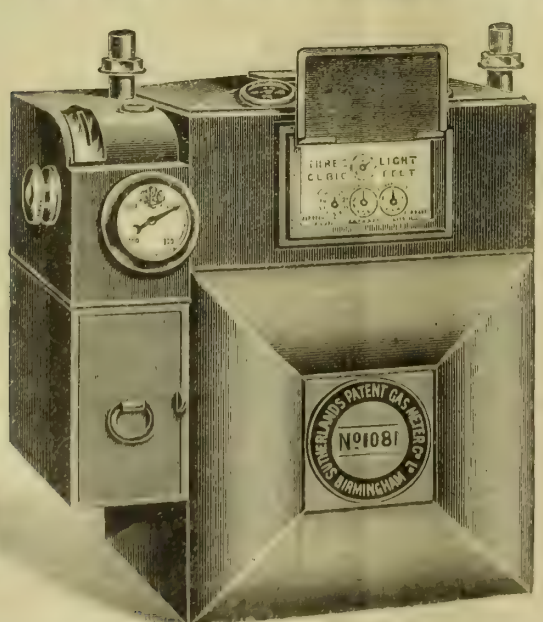
At a meeting of the Paisley Water Commissioners this week, in Committee, the Master of Works submitted an estimate of expenditure now required, or that would shortly be required, on the extension of piping, &c., showing for piping £152,500, extension of filters and tank £30,000, extension and alteration of distributing mains throughout the town £8000, and purchase of land wayleaves £15,000—total, £205,500. It was agreed to recommend that, in view of these contemplated extensions, the Commissioners apply for further borrowing powers to the extent of £200,000. The Clerk was instructed to take the necessary steps towards obtaining a Provisional Order; and the Provost was authorized to sign a petition to the Secretary for Scotland asking powers to borrow.

CURRENT SALES OF GAS PRODUCTS.

Liverpool, *March* 17.

Sulphate of Ammonia.—The market has been rather quiet. But prices have been maintained; and closing quotations are £12 1s. 3d. per ton Hull, and £12 2s. 6d. to £12 5s. f.o.b. other ports. Direct business continues to be a limited quantity. But everything offered has been readily bought; and there is nowhere any stock accumulating in the hands of makers. Home demand is appreciable; but, in the main, it is

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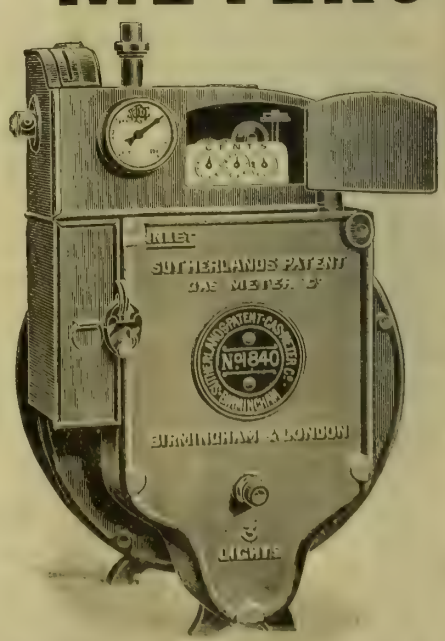
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being delayed by the lateness of the season. No important business in the forward position has been reported; makers being firm, and buyers not showing much interest.

Nitrate of Soda is firm at 8s. 10½d. per cwt. for ordinary, and 9s. for fine quality on spot. For a refined cargo due next month, above 9s. 4½d. per cwt. has been paid.

LONDON, *March* 17.

Tar Products.—The improved value of pitch is maintained especially for London and east coast quality, though there is a great disparity in prices at country ports—of course, largely arising from varying freight charges, but also on account of quality. Considerable business is reported in creosote oils; the contracts also showing a wide difference in value, depending again on quality and specification. Good liquid oil is still realizing high values; as much as 3½d. per gallon has been paid for this quality for a very large line indeed. Benzols are still weak in respect to market value, although the business in them is greater than ever. Fortunately, more and more benzol is being taken up for gas manufacture; and this will doubtless continue, so long as the article remains at its present very low price. All the light products of tar are somewhat depressed; naphthas are weaker and for the moment unsaleable. There is a good demand for naphthalene; and anthracene is again moving moderately well.

Business during the week has been marked at the following prices: Tar, 17s. 6d. to 27s. Pitch, east coast, 38s.; west coast, 35s. Benzol, 90's ordinary, 6½d.; special qualities for gas, 8d.; 50's, 9d. Toluol, 90's, 1s. 1d.; pure, 1s. 10½d. Solvent naphtha, 1s. 1d. Crude, 30 per cent., naphtha, 4½d. Heavy naphtha, 10d. Creosote, 2½d. to 3½d. Heavy oils, 3½d. Carbolic acid, 50's, 2s. 2d.; 60's, 2s. 6d. Naphthalene, 45s. to 70s. Anthracene, "A," 4d.; "B," 2½d.

Sulphate of Ammonia.—A steady business is being done, make is more than taken up, producers have no stocks, and at the moment there is but a small quantity available. The price obtaining U.K. may be taken as £12 to £12 5s. per ton, less 3½ per cent., according to port of shipment.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—A very strong position is maintained throughout the coal trade of this district. The lessened requirements for house-fire purposes are necessarily affecting the demand on the better qualities of round coal; and from Derbyshire and Staffordshire coals are coming into some outside markets at lower prices. But this apparently in no way affects the exceedingly firm attitude that is still maintained by colliery owners throughout Lancashire. In fact, any lessened demand has not yet been sufficient to enable them to put an appreciable quantity into stocks; and as these are practically depleted, any surplus output will for some time be required to replenish these necessary supplies. For steam and forge coals, the demand maintains much the same briskness that has been reported for a considerable time past; and at most of the Lancashire collieries supplies are short for requirements—many collieries being not a little concerned that they have been unable to take full advantage of the high prices which have been obtainable for shipment, as they have had so little they could send away to the ports, notwithstanding that they have cut down as much as possible deliveries to inland users. Prices for all descriptions of round coal are strong, on the basis of about 14s. 6d. to 15s. 6d. per ton at the pit for the better qualities of Arley, and 12s. 6d. to 13s. 6d. for the lower sorts of round coal. From very explicit statements that are being made in quarters that are well informed as to the movements taking place in the coal trade, it would appear that some really definite decision has now been come to with regard to the prices that are to be quoted for gas coals when applications for new contracts come upon the market. There have been several meetings of colliery owners representing the Lancashire gas coal trade; and it is stated distinctly that they have come to a decision, which is practically unanimous, to advance prices for the ensuing year's contracts 5s. per ton over the rates accepted last year. This would practically mean an upward move of about 50 per cent. on the 1899 prices. The figures that are talked of in some quarters as the minimum which colliery owners will be prepared to accept represent about 12s. 6d. to 13s. per ton at the pit for the lower qualities of gas coal, up to 14s. 6d. for the best screened descriptions. As to locomotive fuel, the Lancashire coalowners do not seem as yet to have taken up so decided an attitude. In some quarters, it is strongly urged that the advance to be charged to the railway companies shall, as on gas coals, be 5s. per ton. In well-informed circles, however, it is considered doubtful whether such an advance as this would be strictly adhered to; but 12s. 6d. to 13s. per ton are mentioned as the very lowest prices at which locomotive fuel contracts are likely to be taken for the ensuing year. For engine classes of fuel, there is a continued pressure, with the output of slack at Lancashire Collieries in most cases reported still much below the demand; and prices are strong at 9s. 6d. to 10s. per ton for common, and 10s. 6d. to 11s. for best sorts. The shipping trade is exceptionally active; but the pressure to buy at the special prices recently quoted has fallen off, and from 15s. 6d. to 16s. 6d. per ton represent the full figures now being obtained for steam coals delivered at the ports on the Mersey. Coke makers hold back from any further advance on their list rates; but where new contracts are offered, they are in some instances getting 1s. above the nominal basis. At the ovens, prices may be given as from 30s. to 30s. 6d. per ton for best foundry cokes, and 23s. to 23s. 6d. for ordinary furnace qualities.

Northern Coal Trade.—There is rather more activity in the coal trade of the North-east; and the shipments for the last week or so have been extremely heavy. Much of this coal is being sent on old contracts; but there is an increasing proportion being shipped at the current remunerative prices. Best Northumbrian steam coals are generally quoted at 18s. per ton f.o.b., and steam smalls are 11s.; most of the collieries having fairly full work for the present, and considerable orders ahead for shipping in the season for the Baltic. The gas coal trade is still very active, though there is a considerable part of the delivery on old contracts, some of which were behindhand. For occasional cargoes, the price of best Durham gas

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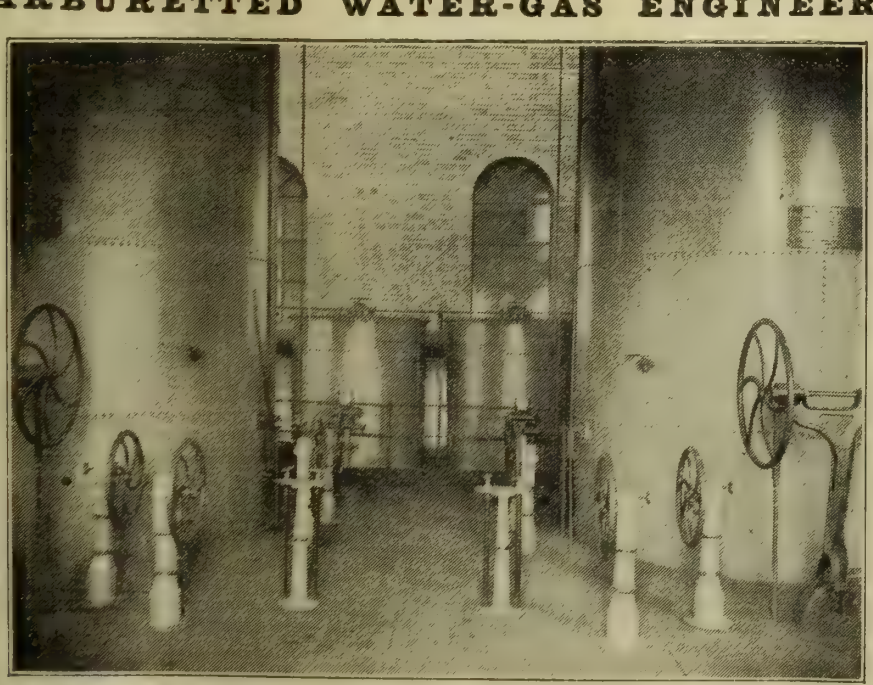
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coals is 16s. to 16s. 6d. per ton f.o.b.; but the contracts that are being placed are 1s. per ton or so below these rates. Nothing has, so far as is known, yet been done regarding the renewal of the big contracts for the southern gas companies; but it is expected that there will soon be some decision. In the coke trade there is continued activity, and firm prices. Gas coke is steady in quotation, as the production now begins to decrease appreciably, so that with fair exports the output is well taken up. There is no alteration this week in the price of gas coke.

Scotch Coal Trade.—The abnormal activity continues; the demand being probably not quite so strong. Prices, however, remain steady, with a prospect of their keeping so for some time. The quotations are: Main 14s. to 14s. 3d. per ton f.o.b. Glasgow, ell 15s. to 16s., and splint 15s. to 15s. 3d. The shipments for the week amounted to 196,303 tons—an increase of 15,215 tons upon the previous week, and of 62,267 tons upon the corresponding week of last year. For the year to date, the total shipments have amounted to 1,778,311 tons—an increase of 416,363 tons upon the same period.

The Dispute between the Newcastle and Gateshead Gas Company and their Workmen.—With reference to the arbitration proceedings to settle the dispute which has arisen between the Newcastle and Gateshead Gas Company and their workmen on the subject of wages and hours of labour, we learn that Mr. Thomas Newbigging will act for the Company and Mr. A. Wilkie for the men. An endeavour is being made to secure the services of Mr. John Burnett, the Chief Labour Correspondent of the Board of Trade, as Umpire.

The Public Lighting of Molesey.—At the annual meeting of the East and West Molesey Ratepayers' Association last Wednesday, the Committee, in the course of their report, stated that they had discussed the question of lighting the streets, for which many years ago gas was used, but now oil was employed. As the price of oil had increased, and that of gas decreased, and as gas lighting with incandescent mantles would give at least twice the illuminating power of the gas used, the Committee were of opinion that arrangements should be made with the Gas Company to light the streets in the district. The report was adopted.

Long Eaton Gas Company.—At the annual meeting of the Long Eaton Gas Company, Limited, last Thursday, the Directors reported a further substantial increase in the make of gas during the past twelve months, amounting to 10 per cent. more than in 1898, coupled with considerable augmentation in the number of consumers. There was no sign of abatement in the demand for cookers; a slot cooker being supplied free with each slot meter. The revenue from the sale of gas amounted to £8224, and that derived from residual products to £2143. The total receipts were £10,757; and the expenditure was £6842—leaving £3915 to be carried to the net revenue account. The amount available for distribution was £3986; and the Directors recommended the shareholders to declare dividends of 8s. 6d. per share on the "A" shares, and 6s. 6d. per share on the "B" shares (making, with the interim dividends, 12s. 6d. and 9s. 6d. per share respectively), to write off £170 for depreciation on cookers, to place £120 to an insurance fund, and to carry forward the balance. This was agreed to.

Extension of West's Stoking Machinery at Beckton and Sheffield.—The Gaslight and Coke Company have decided to extend the system of stoking machinery at their Beckton works, and have recently placed an order with West's Gas Improvement Company, Limited, for their latest type of stoking machinery, including steam-engines, coal-breakers, elevators, conveyors, hoppers, air compressor, and charging and drawing machines fitted with the most modern improvements. The same firm have also in hand an extension of their system of stoking machinery at the Grimesthorpe works of the Sheffield Gas Company.

Protest against the Increase in Price at Totnes.—The Totnes Mercantile Association met last week, under the presidency of the Mayor (Mr. T. W. Windeatt), to consider the question of the proposed increase in the price of gas from 3s. 6d. to 4s. 6d. per 1000 cubic feet. The Mayor expressed the opinion that the action of the Gas Company was arbitrary and mistaken. The Company had no statutory powers, and could not open the streets without the permission of the Corporation. A resolution was passed to the effect that the proposed increase was excessive, and would act detrimentally to the interests of the town; and requesting the Town Council to take up the matter.

Sheppy Gas Company.—At the annual general meeting of this Company last Wednesday, the Directors reported an increase of 6 per cent. in the consumption of gas last year, as compared with 1898. The revenue from the sale of gas amounted to £9249, and of residuals to £2804 (an increase of £513); the total receipts being £13,279. The expenditure was £9899; so that the balance carried to the profit and loss account was £3380. The amount available for distribution was £2818; and the Directors recommended the payment of the full statutory dividends. The Chairman (Mr. C. B. Shrubsole), in moving the adoption of the report, said that, in consequence of the advance in the price of coal, all gas materials had risen, and likewise labour. This had resulted in a general increase in the working expenses of the Company; but he was pleased to say that it had been so far covered by the larger consumption of gas, amounting to about 3¾ million cubic feet. He drew attention to the sum realized for residuals, which showed an increase of upwards of £500, principally derived from the sale of coke. A considerable advance had also taken place in the returns from ammoniacal liquor, representing about 60 per cent. over the previous year, due to the higher price given for sulphate. The works and plant were in good order; but the Engineer (Mr. W. T. Carpenter) had reported that considerable repairs were required to the retort-house this summer, while a new engine, exhauster, and washers would also be needed. There was also a probable further small advance in the price of coal; and to help them in this condition of affairs, the Local Authorities had modestly raised their rating by £570, which meant an additional payment of upwards of £200 a year—about two fifths of the present rate. The Directors were appealing against this; and they had every reason to believe they would be successful. The report was adopted. A vote of thanks having been accorded to the Secretary (Mr. H. Barber) and the Engineer, a similar compliment was paid to the Chairman and Directors. A resolution expressive of regret at the absence, through illness, of Mr. A. W. Marks, the former Secretary of the Company, was passed; and the proceedings terminated.

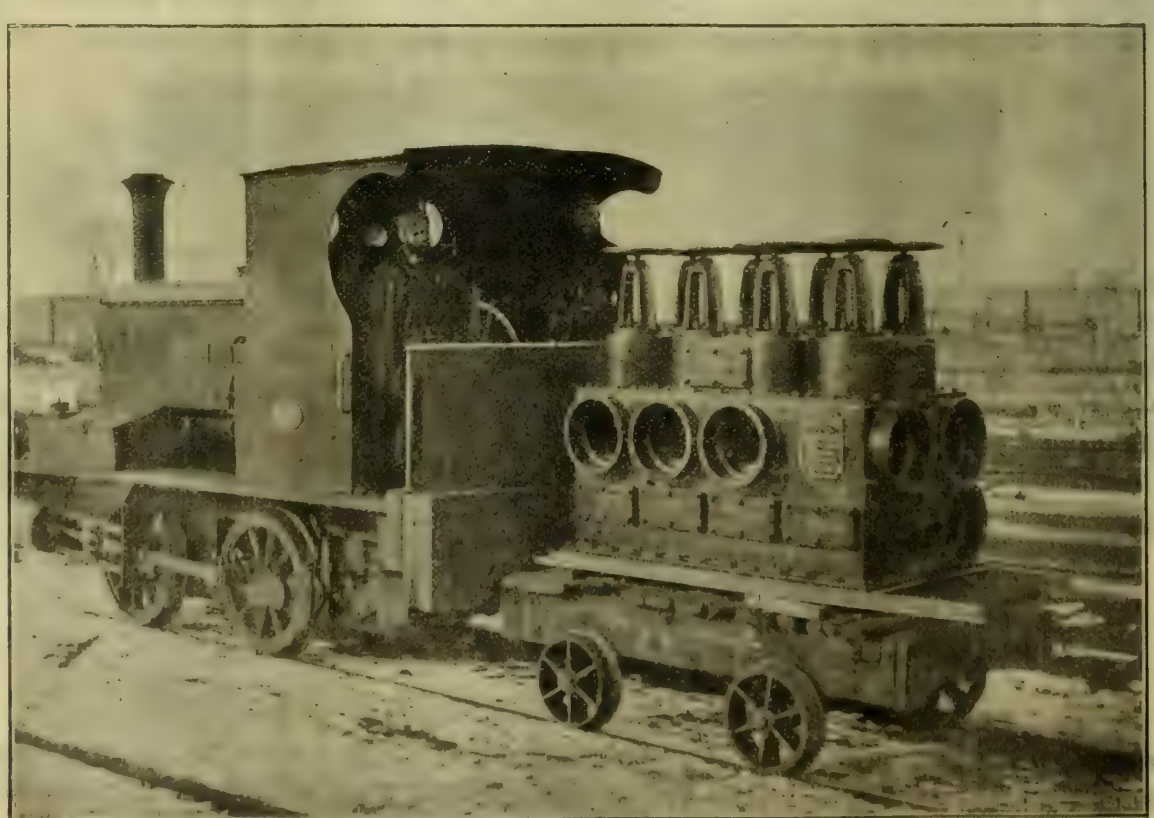
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CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE.
Municipal Trading . . . 789
Progress of Private Bills in Parliament . . . 790
Gas Troubles in Dublin . . . 790
Result of the Shrewsbury Gas-Mains Arbitration . . . 790
The Good and Bad of the Parliamentary Week . . . 791
The Coal and Oil Markets . . . 791
WATER AND SANITARY AFFAIRS—
Irish Obstruction on the London Water Bills . . . 792
Further Correspondence on the Staines and Welsh Schemes . . . 792
The Quality of London and Paris Water . . . 793
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market . . . 793
Electric Lighting Memoranda . . . 793
The Coal Market Abroad . . . 794
Municipal Corruption and Municipal Trading in America . . . 795
The International Gas Congress in Paris . . . 796
Recent Publications—"The Consumer's Handbook of the Law Relating to Gas, Water, and Electric Lighting;" "The Life and Letters of Sir Joseph Prestwich;" "Bacteria: Especially as They are Related to the Economy of Nature, to Industrial Processes, and to the Public Health" . . . 796
TECHNICAL RECORD:—
The Next Meeting of the Gas Institute . . . 798
Estimation of Naphthalene in Coal Gas . . . 798
Michigan (U.S.A.) Gas Association . . . 800
REGISTER OF PATENTS:—
Gas-Engines—Willcox, B. (A. Wolf and Co.) . . . 801
Carburation of Gas—Boult, A. J. (G. Peeters) . . . 801
Acetylene Generators—Thompson, W. P. (A. Wegmann-Hauser) . 801
Admission-Valves for Gas-Engines—Abel, C. D. (The Gasmotoren Fabrik Deutz) . . . 801
Economizers for Gas-Burners—Knaeps, C. . . . 802
Patent Notices . . . 802
CORRESPONDENCE:—
The Proposed Visit of the Gas Institute to Paris . . . 802
The Presence of Naphthalene in Coal Gas . . . 803
Gas Companies' Balance-Sheets . . . 804
Raising the Price of Gas . . . 804
PARLIAMENTARY INTELLIGENCE:—
Gleanings from the Committee Rooms . . . 804
House of Lords—Progress of Bills . . . 806
House of Commons—The London Water Supply Bills; The Supply of Water Gas in Dublin; Progress of Bills . . . 806
House of Commons Committees—
Glastonbury Corporation Gas Bill and Glastonbury and Street Gas Bill . . . 807
Morecambe Urban District Council Gas Bill . . . 808
Hartlepool Gas and Water Bill . . . 809
Brighton Corporation Bill . . . 811
London County Tramways (No. 2) Bill—The Rights of Gas and Water Companies . . . 812
Southport Water Bill . . . 813
North Warwickshire Water Bill . . . 814
House of Lords Committee—Higham Ferrers Water Bill . . . 814
LEGAL INTELLIGENCE:—
High Court of Justice (Ireland)—Chancery Division—Alliance and Dublin Consumers' Gas Company *v.* County Council of Dublin—Damage to Gas-Pipes by Steam-Rollers . . . 815
High Court of Justice—Queen's Bench Division—Sheen *v.* Haynes; The Promotion of the Automatic Gas-Meter Company 815
Birmingham Winter Assizes—The Baker Syndicate and Foster *v.* John Wright and Co., Limited, and Others . . . 816
The Recent Committal for Selling Infringing Mantles . . . 816
MISCELLANEOUS:—
The Shrewsbury Gas Company and the Corporation—The Award in the Recent Arbitration Proceedings . . . 817
The Transfer of the Loughborough Gas-Works to the Corporation—The Arbitration Award . . . 817
Meeting of the British Gaslight Company, Limited . . . 817
The Supply of Carburetted Water Gas in Dublin . . . 818
Gas-Works Extensions at Ilkeston . . . 818
Manchester Corporation Gas and Water Supply—Increases in Salaries; The Disturbance of Streets . . . 818
The Price of Gas at Stockton-on-Tees—An Increase Imminent . 819
Wath-upon-Dearne and District Gas Supply—Board of Trade Inquiry . . . 819
Electric Lighting Notes . . . 820
Output of Coal and Number of Persons Employed in Coal Mines in 1899 . . . 820
The Coal Crisis in Russia . . . 820
Gas and Water Companies' Stock and Share List . . . 821
County Councils and Water Supplies . . . 822
Oldham Corporation Water Supply—History of the Water-Works 823
Notes from Scotland . . . 824
Current Sales of Gas Products . . . 825
Coal Trade Reports . . . 826
PARAGRAPHS:—
PERSONAL: Mr. Frank Green; Mr. W. J. Dibdin, F.I.C., F.C.S.; Mr. John Chalmers; Mr. Andrew Wilson; Mr. Frank Higginson; Sir Forrest Fulton; Mr. C. F. Nixon; Sir Frederick Thorpe Mappin, Bart., M.P.; Sir Henry Stevenson; Mr. G. D. Malam . 797
OBITUARY: Maria Bowditch; Mr. Edward Clark; Ex-Provost Breingan . . . 798
Chambers of Commerce and the Metric System . . . 794
The Bunsen Memorial Lecture—Explosions of Gases—The Association of Gas and Water Engineers of Austria-Hungary—Society of Engineers—The Coal Contracts of the London Gas Companies—Carbonic Oxide Poisoning . . . 798
Sulphate of Ammonia and Nitrate of Soda in France—Water-Meters for Checking Consumption . . . 800
Increases in Price—The Suggested Transfer of the Leamington Gas-Works to the Corporation—High Wycombe Gas Company . 802
New Joint-Stock Companies—The Latest Russian Water Monopoly 804
Kempston Gas Company, Limited—Fatal Accident at the East Greenwich Gas-Works . . . 806
The Waste of Water at Epsom . . . 814
Electric Lamps Superseded by Gas Lights in Newcastle . . . 818
The New Gas-Works for Brussels—The Costs of Promoting and Opposing Water Bills for Newhaven and Seaford . . . 823
Windsor Royal Gas Company—Monte Video Water Company . 826
Wenlock Water Supply—New Water-Works for Todmorden—Torquay Gas Company . . . 827

EDITORIAL NOTES.

Municipal Trading.

It has been announced in the House of Commons that the appointment of the Committee on Municipal Trading will be taken this week; and there are indications that the avowed policy of the Progressive Party in this regard will receive sharp criticism. At the last monthly meeting of the London Chamber of Commerce, a short but pithy paper on the subject, by Lord Avebury—better known as Sir John Lubbock—was read by Mr. Charleton. This paper set forth that the indebtedness of British Local Authorities already much exceeds 100 millions sterling; and that if the present craze for Municipalism continues, it will rapidly assume more gigantic proportions. In Municipal Bills now before Parliament, powers are demanded for undertaking such diverse businesses as banking, pawnbroking, coal supply, saddlery, telephones, tailoring, manufacture of electrical fittings, of the residual products of gas, supply of apparatus for games, Turkish baths, cold-air stores, refrigerators, estate agency, printing, and constructing lifts. This is all very well; and nobody has ever yet attempted to draw the line between what is strictly proper to municipal enterprise and what should be left to private effort only. Every case must be decided on its merits; and it would be absurd to condemn any municipal project simply on the classification. The position taken up by Lord Avebury on the general question, however, is, if we may say so, very much the same as that defined long ago in these columns. There is so much for British Municipalities to do, and their financial resources are so limited, that it is a great pity when they fritter their powers away in mere huckstering speculations, instead of reserving them for things really worth the doing. As between trading and administration, there is a choice which we should like to see more generally exercised by English Municipalities in favour of the better part. By grasping after "profits," they are bound to let go the reins of good local government. The Mayor's chain of office ought not to be utilized to support the chandler's apron. It is for this reason that those statesmen who are able to see an inch beyond their nose deplore the obsession of Municipalities by the trading idea.

Municipalities, in short, should be reminded of the guiding principle that their first duty consists in doing what no other organization could do for the public. Of late years, under the sway of Progressivism, the contrary principle has become fashionable—that as soon as anybody has succeeded in showing that certain services are worth rendering, the Municipality should step in and monopolize them. And the new Manchester School maintain that, whenever a Municipality have gone into any line of business, no sort of competition in regard to it should be permitted by law. This is the state of things in respect to municipal trading that has already been signalized by the Association of Municipal Corporations. How much farther is it to go?

Meanwhile, it is gratifying to note that "The Times" has lent its powerful advocacy to the immediate reform long advocated in these columns—the proper statement and auditing of municipal accounts, "such as will enable "the public to understand whether or not an experiment "is a failure or a financial success." Our Progressive Local Authorities have not yet gone the length of the highly democratic Municipality of Paris, who have just voted their yearly Budget in secret session, so that the public should not know how the money goes; but we have only too many cooked municipal balance-sheets, which are nearly as bad. As "The Times" puts it: "At present "we are generally dependent on the report of a Com- "mittee probably more or less responsible for the experi- "ment, and little likely to be courageous enough to state "that which might make them unpopular." We are glad to mark that the same authority has learnt the lesson that this municipal juggling with figures is frequently displayed in connection with lighting. "In comparing the costs "of two systems of municipal lighting, for example, any "results can be extracted if the financial artist is free to "deal as he likes with depreciation and depreciation funds, "and to make all sorts of assumptions as to the superior "quality of the commodity offered by Municipalities."

Truly, after this, the "JOURNAL" and Professor Smith ought to feel that they have not been altogether as voices crying in the wilderness.

It should be a sufficient engagement for all candidates for municipal honours to declare their intention of having a fair, complete, and reliable audit of Corporation accounts. Happily there is not, in the United Kingdom, any present reason to fear the introduction of the "spoils" system of municipal administration, which is the canker of American democratic government. It is ignorance, heedlessness, prejudice, and incompetence that are to be dreaded. The only check upon Municipalities is a full disclosure of the consequences of ill-advised schemes. "A Corporation "which has traded foolishly does not go into the Bankruptcy Court; and the only way of stopping wasteful "enterprises is to subject accounts to impartial supervision. "Much has of late been said as to the right of Corporations "to compete with private individuals in the supply of gas, "water, &c. What is much more likely to be lost sight "of in these days, is the expediency of keeping a foothold "for the private individual or company offering the same "services as Corporations."

It all comes back to the general ruling, that these municipal adventures are to be judged on the ground of expediency; but the immediate duty of Parliament is to prevent insistent Progressivism from shifting the onus of proof of the advantages of Municipalism. To permit certain Municipal Corporations to do particular things because there is nobody else on the spot to do them so well, is a far different matter from the tacit acceptance by Parliament of the "right" asserted by the partisans of Progressive Municipalism to the preferential place in the same order of affairs. The great need is to 'ware "principles." Let the proof of the pudding be in the eating; and ensure that the public, who pay the cooks and maintain the kitchen, shall have an opportunity of tasting the product. Municipalities constantly need reminding that high professions do not excuse poor performance. They usually flatter themselves that they manage their business better than private owners; but the balance of evidence is just the other way. Not to touch upon the case of gas, water, or electricity supply, as to which we might be regarded as prejudiced, what is the record of the very latest, and by far the greatest, of municipal undertakings—the better housing of the poor of towns? In the matter of lodging-houses, the London County Council is a bad second to the Rowton Houses; and at Shoreditch the other day, Lord Rosebery satirically complimented the Vestry on having provided accommodation for 300 families, after having dispossessed many more. And the whole thing was done in such a style that the Vestry had to refuse the very much higher rents offered by other applicants than those for whom the buildings were intended. Well might Lord Avebury ask if this proceeding is housing, or dishousing, of the poor. And very much stronger is the general conclusion from all these considerations, that our Municipalities have immense responsibilities and problems to solve, which are enough to tax all their energies and to absorb all their resources, without their going aside to play in the fields of private enterprise.

Progress of Private Gas Bills in Parliament.

THE Committees on Private Bills have made good progress during the past week with the controversial Gas Bills submitted to them. There is not a great deal to comment upon in the settlements actually effected; and all the heaviest Bills are standing over. In the case of Morecambe, a rather curious point arose in consequence of the unusual circumstance that the outlying district of Heysham claims to have a bigger future than the present predominant partner in the gas undertaking. Something similar has been the cause of trouble in the experience of Glastonbury, which is held in suspense until an acceptable solution of the matter is formulated. This is a difficulty that may possibly be met with more frequently in future. Modern trade and industry is careless of old municipal boundaries; and when any new seaports, or new manufacturing centres, are founded in obedience to commercial conditions, it is too much to expect that they should be content to bind themselves for ever to the government of stationary Municipalities. The Hartlepool Gas Company have preserved their independent existence. Cleethorpes has passed safely through the Lords, at the cost of shedding an excessively high standard price. After the Easter recess—which it is generally understood this year begins unusually early, and lasts unusually long—the big Gas Bills will rivet professional attention upon their most portentous proposals.

Gas Troubles in Dublin.

THE Alliance and Dublin Consumers' Gas Company have been in trouble once more—and again through no fault of their own. The outward and visible evil this time was a lawsuit between the Company and the Corporation in regard to steam road-rolling. The Company had to seek an injunction against the Corporation, and also claimed damages for injuries actually sustained. The latter, of course, was a comparatively small matter; the injuries so far having been of trifling amount. The question of restraining the use of the Corporation rollers in such a manner as to cause further damage to the Company's distributing plant was of a different character. The Irish Master of the Rolls found that, as a matter of fact, certain main-breakages were caused by the Corporation roller; and the chief defence set up by the Corporation was the familiar one that the mains and pipes were unduly near the surface of the road. The question of law then arising was as to what should be regarded as a proper and sufficient depth for the mains. The Court answered that this must be such that the mains and pipes would be free from injury by ordinary traffic in the district in which they are laid. Steam-rolling, although lawful in itself, is not ordinary traffic in the circumstances shown to exist in this instance. The pipes were laid upwards of thirty years ago; and they stood the ordinary usage of the roads, without a single failure, until the steam-roller appeared on the scene. This settled it. The Court paid more heed to the test of thirty years' use than to all the expert evidence tendered as to what ought to have been done. The dictum of the Master of the Rolls on this head is worth registering. He said: "The law applicable to the case admits of no dispute. A "person who uses a public highway is bound to do so with "due regard to the rights and interests of others. If he "employs for his own purposes a vehicle of unusual or "extraordinary weight, or one carrying unusual and extra-"ordinary loads, he does so at his peril; and that even if "the use of such a vehicle is not in itself a nuisance or "otherwise unlawful." His Lordship added to this declaration a useful warning that neither highway authorities nor gas companies can do as they like with a public road. The injunction was granted, as prayed.

The Company were also dragged before the bar of public opinion for increasing the death-rate of Dublin by distributing an abnormal proportion of carbonic oxide with their gas. Mr. T. M. Healy asked a question in the House of Commons on this subject, and received a reply of the usual official character. It was Professor Emerson Reynolds, of Trinity College, who first raised the alarm of gas poisoning; he having in the course of a lecture declared that the proportion of carbon monoxide in Dublin gas had increased steadily of late, until on the 7th inst. it reached 12·6 per cent. This analysis showed, said the Professor, that the Company must have been turning carburetted water gas into their mains; and the conclusion was confirmed on inquiry of the Company. The circumstance of the Company having only just begun the manufacture of carburetted water gas before Professor Reynolds detected its presence, is a good testimonial to the vigilance exercised in the chemical laboratories of Trinity College; but there is some reason to believe that closer investigation would reveal a lack of agreement between the indications of analysis and the proportions of carburetted water gas actually made at the works. Professor Reynolds said that this product is much cheaper than coal gas—thus suggesting that it is to the interest of the Gas Company to make a large and possibly a preponderating quantity of it. But this, again, is a conclusion which would very probably be dispelled on fuller inquiry.

Result of the Shrewsbury Gas-Mains Arbitration.

THE interesting, and in many respects important, Shrewsbury arbitration has resulted in an award substantially for the Gas Company. The proceedings have been specially reported in the "JOURNAL" (see *ante*, pp. 549, 685). The matter in question was the amount of damage (if any) which had been sustained by the Company by reason of the exercise of the statutory powers vested in the Corporation for carrying out sewerage works in the borough. Action was taken under section 308 of the Public Health Act. The injury complained of was to the gas mains and

pipes in the roads opened for the sewerage works. Some of these trenches were very deep; and the consequence was that pipes were caused to settle, joints were drawn, and the gas-distribution plant generally was so affected that there was much leakage. The trouble dates from 1896; and a claim was made by the Company on the Corporation for ascertained damage up to 1898, when the sewerage contract was finished. This was partly satisfied by the Contractor. Ever since, however, the existence of injury to the distribution plant has continued to manifest itself by a greatly increased loss of gas not accounted for. During the years previous to the commencement of the sewerage operations, the percentage of unaccounted-for gas was between 5 and 6. Subsequently, it rose to between 8 and 9 per cent.; and the Company had to do a great deal of additional work to reduce this extraordinary loss. They accordingly claimed £1583 from the Corporation—the amount being made up of money spent on repairs, and the value of lost gas, which was charged at the selling price of 3s. per 1000 cubic feet. This was not the right thing to do; the proper charge unquestionably in such cases being that at which the lost gas could be made good by the Company. So the Umpire (Mr. James Mansergh) seems to have held. He decided that the fact of the damage to the Company's property was proved; and he has assessed the compensation to be paid by the Corporation to the Company in respect thereto at £930. The Corporation are to pay to the Company three-fourths of their costs of the reference, the whole of the costs of the award, and all their own costs upon the reference. This is doing substantial justice to the Company; and, of course, the ratepayers are both sad and sorry about it. They talk of the award costing the town £2000; and they contemplate ruefully the imposition of a special rate of 4d. or 5d. in the pound to pay for it, unless the Corporation are able to persuade the Local Government Board to allow them to charge it to the capital account of the sewerage works.

The particular and local aspect of the matter is not of any very special moment to our readers; but what is of real importance is the record that so adequate a remedy exists for a continuing injury of the kind in question at Shrewsbury. It is always to be regretted when those who have to live together—as Corporations and Gas Companies—are compelled to go to law with one another. It is as bad as litigation between partners in the same firm. Where the question at issue is one of damage to gas-mains, however, the owners of this class of property must take measures for their own protection. The consequences that may ensue upon the causing of external injury to gas-pipes in roads are so serious and far-reaching, that sewerage operations, road-rollers, thoroughfare improvements, and so forth, are bound to be very carefully watched by those responsible for the gas supply. The Shrewsbury case incidentally illustrates the value of keeping exact records of the data of gas distribution. As this had been carefully done, the only room for dispute was as to the amount of the compensation due for the disturbance of the old state of affairs. If the Corporation had confined their opposition to the question of the price of the lost gas, they would have saved their costs. Instead of this, they forced the Company to prove every material fact, and gave the Court a good deal of unnecessary trouble in hearing and sifting evidence as to the gas-mains being bad in places not affected by the sewerage operations. Indeed, Mr. Mansergh was constrained to protest against himself and his colleagues having to investigate these petty allegations. The mistake has cost the Corporation dear. But it was their way of fighting the case; and they must bear the consequences.

The Good and Bad of the Parliamentary Week.

It is a mere truism to characterize the House of Commons as an astonishing institution; but really no other qualification so properly fits its record for the past week. On Wednesday the House did an exemplary afternoon's work. It did something to remove a long-standing injustice to British shipowners, and continued in the path of well-doing by reading a second time a Bill to extend the Workmen's Compensation Act to agricultural labourers. The House agreed to this extension, in principle, without a dissentient voice; and the Bill was duly remitted to the Grand Committee on Trade. The only sound objection to the measure lies in its piecemeal character. Those who have believed in the principle of workpeople's compensation for injuries suffered in the course and by reason of their ordinary employment, have never willingly drawn the line between different occupations. If a course is right, it ought not to be upheld with limitations. All the same, practical men of the world know that universally desirable things can generally be most expediently obtained by instalments. As regards the great innovation of workmen's compensation, the procedure of the introducers of the Act in 1897 was a remarkable blend of boldness and prudence. They saw the danger of failure in attempting too much at a stroke; and accordingly they proposed to legislate by stage. Still they made the Act applicable to the most dangerous and best organized employments. Thus literally it was the first step that cost the most. The indefinite extension of the law of compensation is admittedly only a question of time and opportunity; and there is much fitness in the first enlargement being to include agricultural labour—the fountain and origin of all forms of toil. The agricultural labourers have not had to wait long for this recognition of their claim to be included among the best favoured of workers. The exaggerated fears of some employers of labour as to the cost of insurance under the Act have already subsided. It would have been fatal to the prospects of the Bill of 1897 to have added the cry of the farmers to the protests of the colliery proprietors; but now the latter can smilingly extend the hand of brotherhood to the agricultural employers. It will scarcely come to a penny postage stamp a week to insure the farm hand. And what a difference to him!

Of course, as being part of the game of party politics, the Opposition members and newspapers affect to regard the passing of the Bill with the assent of the Government as a wholesale conversion. "Three years ago, when the "Workmen's Compensation Bill was under discussion, "efforts made by the Opposition to include the agricul-"tural labourer were resisted alike by the Government "and their supporters. Now there is absolute unanimity "in supporting it." Certainly, for reasons already shown. All this "Codlin and Short" politics is beside the mark. Sir James Joicey spoke out like a man in the course of the discussion, confessing that many of the dangers anticipated from the original Act had not arisen. The Home Secretary handsomely admitted that the Act itself calls for some revision and extension; and every member who took part in the debate worthily maintained the credit of the House.

But what a change came over the same scene next day, when the formal order for the second reading of the London County Council's Water Bills was made the pretext for turning the House into a bear-garden! The authority of the Chair was set at naught; the Leader of the House had to be sent for—like a schoolmaster summoned to stop a fight in the playground—and the aspirations of the Progressive majority of the London County Council were nipped, all because the Irish members wanted the whole day to talk about an abstract resolution relating to the burden of Irish taxation. The unseemly squabble lasted longer than would have sufficed to dispose of the Bills in the order in the proper way. An extraordinary way of doing legislative business, indeed! The unkindest cut of all for the London Progressives was that this snub should have been administered by their quondam colleagues in politics. Underneath the immediate reproach, however, lies a serious menace to the reputation of Parliament as the custodian of national industrial interests. The practice of putting down Private Bills for their regular stages irrespective of all other parliamentary business is of long continuance; but it will have to be reconsidered if the growing fashion of discussing these Bills for thinly-veiled political objects is carried much farther. Every session sees the whole legislative machine blocked time and again, because some honourable member chooses to wreak his own purposes upon a Private Bill which a few years ago would have been sent upstairs as a matter of course. The case was different on Thursday; but the trouble was the same. Possibly these displays of spitefulness, or ineptitude, are properly referable to the senility of the present House of Commons. If this is the true interpretation of the phenomena, it is consoling to think that there must be a new Parliament before long.

The Coal and Oil Markets.

The preliminary figures relating to the output of coal and other minerals in 1899, published by the Home Office,

will be found to-day on p. 820. The statistics now published fully confirm the opinion more than once expressed in the "JOURNAL" that the scarcity of coal during the past winter was due to other causes than that of short output. The total quantity of coal raised during the year was no less than 220,085,303 tons, as compared with just over 202 millions in both the preceding years. Before 1897 the output had never reached 200 millions. The tonnage for 1899, therefore, exceeded all previous records by close upon 9 per cent. In face of such figures as these (which will come as no surprise to our readers, the estimated output for last year having been given as 225 million tons in these columns at the very beginning of January), the explanation put forward for non-delivery by many contractors—that they were being seriously hampered by the bad working of the men, and consequent short output—does not appear now, any more than it has ever appeared to us, very convincing. Moreover, it is to be observed that, while the output increased by 9 per cent., the number of men employed by the collieries was only 3 per cent. higher—the obvious inference being that the men worked better, not worse, in 1899 than in former years. That this was the case is shown by the fact that the output per man employed (calculated from the Home Office figures) was 302 tons per man last year, 286 tons in 1898, and 201 tons in 1897. Where, then, did all the coal go; for there was no doubt about the scarcity during the mid-winter months? About 7½ million tons more went abroad last year than in 1898. The balance of the increased output—*i.e.*, 10½ million tons—must have been consumed in this country, and something more; for stocks all round, alike at collieries, gas-works, and elsewhere, at the end of the year, were abnormally low. The consumption of coal at home must, indeed, have increased something like 12 to 15 per cent. last year, which is a very striking demonstration of the activity of every branch of trade; for the coal requirements form a sure barometer of the country's prosperity.

There are, moreover, no signs of any less quantity being required this year. Indeed, present conditions point to an even greater demand upon our coal resources; for not only does the export coal trade maintain and increase its volume, and the activity in the iron and allied trades continue, but, further, it must be remembered that a very considerable quantity will be required from the collieries to enable users to make good, to some extent at any rate, their depleted stocks. Very few gas managers would, we take it, care to run the risk of having again to cut things so very fine as many of them have had to do this winter. One would, in fact, be inclined to hazard the opinion that the quantity of coal required to be raised during the present year in order to supply the home and foreign markets, and to make up and maintain stocks at something approaching normal figures, will not fall far short of 235 million tons. Upon the question of whether the collieries will try—or, if they try, be able—to turn out this quantity, will largely depend the prices that will rule during the year.

We are not surprised—neither will managers who are looking to their carburetted water-gas plant for salvation next winter be pleased—to learn that the oil market is rapidly hardening in sympathy with the general situation. Prices 50 per cent. higher than before, and not much oil to be had at that, is not a great encouragement to the Gas Company contemplating an installation or extension of carburetted water-gas plant. Manufacturers of such plant will have to find some means of ensuring supplies of oil at reasonable prices if they are to make much headway among the Gas Companies in this country. We do not want to have to put up coal-gas and water-gas plant side by side, and use one or the other according as coal or oil is the cheaper. Cheap fuel may be too costly if it requires dear capital to procure.

WATER AND SANITARY AFFAIRS.

THE perpetration of "another injustice to Ireland" gave rise last Thursday to probably the most disorderly scene which has been witnessed in the House of Commons this session. As our readers are aware, the two Water Bills of the London County Council and the Bill of the associated Water Companies were down for second reading, "by "order," on that day; and a numerously signed "whip" had been issued to remind members of the fact, and to ensure as large an attendance as possible. It was perfectly well known that the Bills would be opposed at this stage; but it was thought that their fate for this session would be practically settled by the debate which would arise. Unfortunately, the Government had arranged to let the Irish members have last Thursday as a field-day for the discussion of the financial relations of this country and the Sister Isle, subject, of course, to the prior disposal of the private business, which, in accordance with the practice of the House, always takes precedence of public matters. The appearance of three contentious measures upon the paper, and the possibility of a long debate arising thereon, alarmed Mr. Redmond, the Member for Waterford, who saw in this circumstance an encroachment upon what he and his party regarded as time specially set apart for their use. Consequently, as soon as the order for the second reading of the Council's Purchase Bill was reached, he explained the nature of the arrangement which had been come to, and appealed to Mr. Stuart, who had charge of the measure, not to proceed with it. The latter was naturally reluctant to give way, as his two Bills were down "by order;" but he expressed his willingness to place himself in the hands of the House. When, however, he attempted to submit his motion, he was interrupted by shouts of "Divide" from the benches below the gangway. Then followed for the space of an hour a scene which was simply a disgrace to an assembly of legislators. Eventually, during a lull in the uproar, Mr. Stuart managed to convey to the House the fact that he was prepared to assent to the postponement of the debate; and he asked for a statement of the views of the Government on the point. Mr. Chaplin did not at first feel justified, in face of the coercion attempted by the Irish members, in assenting to Mr. Stuart's suggestion; but the timely arrival of the First Lord of the Treasury led eventually to the adjournment being agreed to. The whole proceeding was a striking example of the methods employed by the Irish Party. They never scruple to waste time by unseemly interruptions; but they are ready to fight on the floor of the House anyone who, as they think, encroaches upon their privileges. If the Irish members had allowed Mr. Stuart to go on, the time wasted in what was really a disgraceful brawl would probably have sufficed to dispose of the business which had given rise to it.

By a somewhat remarkable coincidence, "The Times" last Thursday contained a letter two columns in length by Mr. G. Shaw Lefevre on the subject of the Staines scheme and the London Water Supply, in answer to the letters of Sir Frederick Bramwell and Colonel Lockwood which appeared in the leading journal on the 16th inst. The publication of the letter was evidently arranged in view of the debate expected to take place on the Welsh Water Bill of the London County Council in the afternoon. But, as a financial contemporary rather wittily put it, ordinary members propose, but Irish members dispose; and, as already explained, the debate never came off. Mr. Shaw Lefevre says, in his opening sentence, that he does not think it necessary to deal at any length with the "some-"what belated and not very courteous replies" of his opponents. We are curious to know what his ideas of "length" may be, if one-third of a page of "The Times" is regarded as short. It is rather singular that his letter should be dated the 12th inst., and yet be a reply to statements which were not made public till the 16th—four days later. It is unnecessary here to deal with the various engineering and financial details brought forward by the writer in support of the Welsh scheme and against that which contemplates the construction of reservoirs in the valleys of the Thames and the Lea. The whole question was thoroughly investigated by the Royal Commission, with the assistance of Colonel Rathbone; and the public will, we imagine, accept their conclusions rather than those arrived at by Mr. Shaw Lefevre. It has often been said that figures can be made to prove anything; and he endeavours to show that the difference in the cost of the two schemes is much less than the £6,000,000 stated by the Commission. But, even at the cost of this sum, he thinks it would be worth while for London to secure the advantages of the Welsh scheme, and avoid what he calls the "evils and possible perils" of the other, seeing that the interest on the additional outlay would only entail a rate of a little over ¼d. in the pound on the districts served by the Water Companies. As to the future, he believes that it will be relatively less costly to increase the supply from Wales, when the aqueduct is finished, than from the

Thames and other sources. But it must be remembered that until that work is completed not a single drop of Welsh water could be conveyed to London; whereas, as Sir Frederick Bramwell very properly pointed out, the Staines scheme admits of reservoir after reservoir being added as and when the needs of the Metropolis require this to be done. Another member of the County Council—Mr. F. Verney—has rushed into print in support of the Welsh scheme on the ground of the softness and purity of the water it will furnish. We question whether the death-rate of London would be much lower with such a supply than it is now; soft water is deleterious in certain cases.

It is gratifying to find, from the last report presented to the Official Water Examiner by Sir William Crookes and Professor Dewar, that the exceptionally heavy rainfall of the past month—no less than 4·23 inches having been recorded at Oxford, as compared with an average for February of 1·76 inches—had not a very detrimental effect upon the London Water Supply. It is true that the organic carbon was higher, and the bacteriological purity of some of the filtered waters lower, than the average of the past few months. The water derived from the Thames was necessarily affected to the greatest extent; and therefore it is not surprising that the number of microbes was occasionally high. However, careful attention was paid to the filters; and things soon righted themselves. The statement that unfiltered Thames water contained (taking the mean of 24 samples) 8086 microbes per cubic centimetre, would be sufficient to evoke a great outcry about "dilute sewage," if it were not followed by a more consoling one that the mean of 270 samples from the clear-water wells of eight Thames-derived supplies showed only 66 microbes in the quantity named, or 34 less than Dr. Koch's standard. Moreover, there is the further assurance that the organisms contained in the exceptional samples were "harmless river microbes." So much for the Thames. As far as the New River and the Lea are concerned, notwithstanding the floods, the bacterial quality of the water from these sources was exceptionally good. The testimony of two such Chemists as Sir William Crookes and his colleague ought to satisfy the most sceptical, especially in view of the fact that London water is submitted to chemical analysis and physical examination by Dr. Thorpe, on behalf of the Local Government Board. But the County Council are not satisfied. They like to make their own examinations, at a cost to the ratepayers of £37 a week. Last Tuesday, the Water Committee were voted, in spite of protests, a sum of £400 to cover the cost of these analyses up to the end of the present month; and authority was given to the Chemist (Dr. Frank Clowes) to continue them for another six months. Dr. White very properly complained at this waste of public money; no less than £3000 having been spent by the Committee in the past three years.

While we receive fairly reassuring reports on the quality of London water, our neighbours across the Channel are not so favoured. According to the Paris Correspondent of the "Pall Mall Gazette," visitors to the Exhibition will do well to "beware of the water-bottle;" from which it may fairly be inferred that the supply—like a large number of the citizens rather more than a century ago—is "suspect." Of course, when the water of the Seine has to be turned on in the summer, nobody looks for absolute purity; but Parisians have always trusted the spring water. It seems now, however, that this is very far from being above suspicion. The Municipality have, we are told, been listening to some ugly stories in this connection; and all the greater importance attaches to them from the fact that typhoid fever has been more or less prevalent in the city throughout the winter. We pointed out last July that, after fresh sources of supply had been tapped at vast expense, the water was found to be polluted. This is now proved beyond question by the discovery therein of the typhoid bacillus; and the result is that the consumers suffer. The authorities are perplexed and disappointed at the result of their labours to procure a pure supply for the city; and all they can do is to confess that their water cannot be recommended for consumption unless it has been boiled. This confession, as our contemporary's correspondent says, is "all too eloquent as it stands" to need any comment. We may not, in regard to water supply, be living under the best possible conditions in London; but, at all events, we do not appear to be so badly off in this respect as the Parisians.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 821.)

THE week just concluded opened on the Stock Exchange brighter and stronger, and with every promise of a considerable revival in activity. But this was scarcely maintained all through; and from time to time a little check was encountered which warned operators not to be too free. Still, some departments sailed along gaily enough without being taken aback; Americans being conspicuous in the front. Prices there showed a nice advance; and nowhere was there any falling off in value to an extent that arrested attention. Consols and the War Loan were strong. The tendency in the Money Market was somewhat variable; but at the close it was decidedly firmer, and rates for discount stiffened. Business in the Gas Market was more animated than in the preceding week, though it never rose to anything more than a fair average. It was also nearly destitute of any feature of interest; and movements in value were extremely few in number and but slight in degree. And they were irregular, too; the ups and the downs being actuated by special circumstances affecting each. In Gaslight issues, the ordinary opened with the rising tendency it had displayed at the close of the previous week, and at once proceeded to improve upon it to the extent of one point. But there it stuck fast; and transactions every day were marked at the same level figures. The secured issues were moderately dealt in, at about middle prices, without giving any sign of a disposition to move either way. A single bargain in South Metropolitan was all the business recorded in that line; but it was at top price. Commercials were lightly dealt in at fair average figures. There was next to nothing effected in the Suburban and Provincial group; and the only variation in price was a drop in British. The Continental Companies again showed weakness; but there was not much business done in them. A fall of two points lowered Imperial. The undertakings in the remoter parts of the earth were all devoid of any feature of interest. Business in the Water Companies remained in the same extremely quiescent condition; and the tendency was all in the downward direction wherever a change took place. Kent was the chief sufferer, followed in a lesser degree by Lambeth and West Middlesex.

The daily operations were: Business in Gas was moderate on Monday; and very few issues were dealt in. Among them Gaslight ordinary advanced 1; but British receded ½. On Tuesday transactions were mostly confined to Gaslight ordinary, which held its position. Quotations did not move. Wednesday was almost a repetition of Tuesday's operations; and again quotations stood still. Thursday's dealings were very limited; and the only feature was a fall of 1 in Imperial Continental. Friday was about the quietest day of the week; and there was no change of any sort in Gas prices. In Water, Kent fell 4½, Lambeth debenture 3, and West Middlesex 2. On Saturday, prices in general were steady and unchanged, except for Imperial Continental, which fell 1 more.

ELECTRIC LIGHTING MEMORANDA.

Mr. J. Swinburne on Electric Tramways—The Danger of Electrolysis—The Ideal Road—The London County Council and Electric Tramways.

AN opportunity has not previously offered itself for noticing here an entertaining and suggestive article on "The Electric Tramway and its Future" contributed to the February number of "Feilden's Magazine" by Mr. James Swinburne. To style the gifted author the chartered humorist of the electrical engineering profession might be regarded as a derogatory expression; and we esteem Mr. Swinburne far too highly to wish to class him as a mere "funny man." But, like Sir Frederick Bramwell, Mr. Swinburne wears his gift of engineering insight and his acquired mechanical science-lore so lightly, that he can give an amusing turn to what in less expert hands would be the heaviest of technical subjects. Mr. Swinburne sets out the case for electric tramways very neatly. Electric working for tramways only really made a start when the overhead trolley-wire system came into use. This system has the obvious advantage of cheapness, combined with efficiency. It has the disadvantage of earth return with consequent electrolytic troubles; and it is unsightly. Compared with accumulator, steam, gas, and oil systems, it has also the drawback of demanding special permanent way, and a system of electrical distribution. As regards the first objection, its unsightliness, we agree with Mr. Swinburne that this is of little real weight where tramways do mostly run. There was a very reasonable and proper distaste felt in this country for the crude, slap-dash trolley-wire work tolerated in the United States towns whose streets are not streets but only thoroughfares. In due course, however, the English deftness in making mechanical things "eyeable," combined with better financial conditions, came to the rescue of the trolley-wire; and now only a puritan of æstheticism could charge the overhead electric equipment of a good tramway as worse to look at than the cars themselves.

Our own criticism of the trolley-wire system has had other and stronger bases. We suspected that electrolysis of gas and water mains and services in crowded thoroughfares invaded by

this method of tramway working would prove a more troublesome matter than its perfervid advocates would admit; and we also hold that the system is not applicable to the working of tramways just at those busy crossings and terminations in crowded localities where it is most desirable to get rid of the horses. In respect to the former objection, it is gratifying rather than satisfactory to find Mr. Swinburne in full agreement with us. We wish devoutly that we were mistaken; for the position as it exists is very serious. Mr. Swinburne curtly dismisses the usual airy plea that if there is good rail bonding, practically all the current will come back by the rails and return conductors. He characterizes the question as "really exceedingly difficult and obscure." Very little British experience has yet been had in regard to it; electric tramways being at present few and comparatively small. The system is rapidly growing, however; and "the corrosion of water and gas pipes is a matter that goes on day after day, and year after year, and the difficulty increases enormously with the area of distribution." After discussing various suggested expedients for obviating or minimizing the mischief, Mr. Swinburne emphatically declares once more that the chance of electrolysis is the real evil of the trolley and any other earth-return system.

This is a grave prospect. The pipes are in the roads already, and the trolley-wire comes to them. This is the only gleam of comfort in the situation; but preservation from injury is better than a remedy for damage done. Gas and water companies will have to look after their property. Wherever the trolley-wire goes, the old-time security of the gas and water distributing plant is destroyed. A very troublesome consideration in this connection is the truth of experience, that sharp electrolytic action occurs in isolated patches, which thus constitute "danger areas." Nobody can say beforehand whereabouts these areas are likely to be found. In the United States, a distinct line of electrical engineering practice has been opened out by one or two specialists for the detection and treatment of this phenomenon, which is so obstinate that, as Mr. Swinburne remarks, it has even been proposed to substitute stoneware for metal gas and water pipes. Things must be at a pretty pass when this counsel of despair is reached. Mr. Swinburne suggests that "scape-goats" of spelter or old rails might be used in such places to save the pipes. On the general question of electric traction, he is disposed to pin his faith, notwithstanding all experience, to accumulators. This method of carrying power he regards as the only electrical means of meeting the self-contained gas and steam power tram-cars on their own ground. The present accumulator is claimed to be very nearly, but not quite, good enough for practical use. The only question is how the margin separating it from complete success is to be passed. It is interesting to note that Mr. Swinburne's ideal solution of the problem of town traffic is automotor vehicles running on hard, smooth, clean roads, and therefore not restricted to a line of rails and an inflexible system. It is obvious that, the assumed necessity of considering the foothold of horses once deleted from the problem of town road-making, the construction of the road surface would be something very different from anything that has hitherto been adopted.

Some of the considerations here expressed reappeared in the proceedings of the House of Commons Committee on the Bill of the London County Council for authorizing the working of the Metropolitan tramways by electrical power. A capital sum of 3 millions sterling is involved in this project; and the question of electrolysis duly cropped up on the discussion of the preamble. It was complained that the Bill as it stood did not sufficiently protect the gas and water pipes; and it was urged that the users of electricity for tramway purposes ought to be made answerable for any damage done to this class of property, whether they used the best known methods or not. The point is of capital importance; but the Committee had no evidence brought before them showing that there has ever been any loss sustained in this country by electrolytic action on gas or water pipes. Consequently they elected to leave the matter among the others over which the Board of Trade will have the duty of watching as the enterprise goes on. The Committee were satisfied that the Board of Trade would take all necessary care of the threatened pipes. This is a high compliment to the Department; but it is not misplaced. For their part, the gas and water companies do not set up any claim to special protection in the sense of keeping electrical tramways at a distance for fear of what the consequences may be to themselves. The policy of the dog-in-the-manger has been municipalized of late years in respect of statutory electricity supply; but the gas and water companies do not follow it. They know that the major consideration of the public convenience must prevail over any fears they may reasonably entertain of increased risk in distribution work; and they are not disposed to cry out before they are hurt.

Chambers of Commerce and the Metric System.—At the recent annual meeting of the Association of Chambers of Commerce, a resolution was passed requesting the Association again to urge Her Majesty's Government (*a*) to introduce into, and endeavour to carry through, Parliament as speedily as possible a Bill providing that the use of the metric system of weights and measures shall be compulsory in this country within a period of not more than two years from the passing of the Bill; and (*b*) to adopt the system with as little delay as possible in all specifications for Government contracts.

THE COAL MARKET ABROAD.

The influence of the heavy and increasing demand for British coal abroad, in helping to bring about and maintain the present shortage of supplies in this country, has been already pointed out in the "Journal." It is obvious that, the export trade having such an influence on the home markets, an acquaintance with the principal factors in producing the enormous foreign demand for coal, and information bearing upon the question of whether these factors are likely to be permanent or are merely factitious and temporary, are essential to the formation of a judgment as to the probable future of the coal trade in the United Kingdom. Official information relating to the condition of the market in two countries to which considerable quantities of British coal are being shipped has been recently published, and may be considered briefly.

The growth of the exports of coal from this country to Russia has been very striking; the quantity shipped there in 1899 being 3,397,791 tons, as compared with 2,195,067 tons in 1898, and just over 2 millions in 1897. The increase last year in the exports to Russia was in fact heavier than to any other country—France coming next with an increase of 1,153,774 tons. The causes of this enormous increase in the requirements of Russia are discussed in a report received by the Foreign Office from Mr. H. Cooke, the British Commercial Agent in that country, and published almost *in extenso* in another column to-day, under the title of "The Coal Crisis in Russia." The report bears witness to the fact that that crisis is really acute, and has resulted in an "abnormal rise in prices, the exhaustion of available stocks, and the dearness of kindred mineral fuels;" and this state of affairs, be it observed, exists in Russia—as the shortage of coal subsists in this country—in spite of a very large increase (sevenfold in twenty years) in the output of native coal. It is attributed by Mr. Cooke, partly to "the undoubted rise and development of late years in the industrial activity of Russia, and the extension of railways and navigation" (in which latter category we presume he includes the growth of the Russian Navy); partly to the fact that the price of naphtha and kindred fuels had been previously artificially inflated by the action of syndicates and rings—leading to a greater demand for coal; partly to the fact that the vast coal resources of Russia have not been developed to an extent at all adequate to meet the home requirements. This is, in some measure, due to insufficient railway accommodation and generally defective transport arrangements.

As to the prospect of the native resources being sufficiently developed in the near future to meet the increased home demand, Mr. Cooke points out that the probability may even be the other way about, as the general industries of the country "are still in their youth, too; so that there seems no early prospect of the supply and demand coming more in reach of each other." It is obvious, therefore, that no relief can as yet be expected to the English coal market from any reduction in the demand from Russia. The opening of the Trans-Siberian Railway, and the development of the surrounding districts, will rather tend, we should say, to stimulate that demand.

It is interesting to note the steps taken by the Russian Government in their attempt to ward off the effects of the scarcity of coal—steps, some of which would, to put it mildly, be resented by coal-owners in England. The import duties have been either materially reduced or entirely suspended; all coal for use on the railways being admitted free until September. Then, at Warsaw, wholesale dealers have been summarily ordered, under heavy penalties, to keep prices below certain fixed limits; seventeen of the largest dealers having, further, been placed under police supervision! "By the end of December, dealers at Warsaw had raised prices to 225 roubles the load of 600 pouds [say 35s. per ton], while it cost them 100 roubles. The Government now forces them to sell at prices not higher than 115 roubles the load." The result has, we are told, not been entirely successful; the Government being obliged to send across the frontier for Silesian coal, which, however, it has failed to obtain. Hence the large orders recently placed in Wales.

The second country which has been abnormally short of coal, and in respect of which official information is to hand, is Austria. There the scarcity is due, as our readers are aware, to a strike of the miners; and from reports received by the Foreign Office from H.M. Commercial *Attaché* at Vienna, we now learn more particulars than have hitherto been available. The strike began on a small scale early in January in Moravia and Silesia; but it has since developed into the greatest strike that has ever taken place in Austria. Out of an approximate total of 110,000 coal miners, no less than 90,000 are said to be on strike. This number of men would, in the ordinary way, turn out something over 2¼ million tons a month; so that the effect upon the demand for coal from England through Germany (the latter country exporting her own coal and importing English coal) can easily be realized. Fortunately this increased demand will necessarily be limited to the duration of the strike, and the period immediately following its termination; although the colliery owners are reported to be firmly determined not to begin working again with full numbers, but to reduce production.

The men's demands were at first limited to an increase of wages; but they subsequently included the substitution of an eight-hours (bank to bank) shift, in place of the ten-hours system as at present in force; the fixing of a minimum wage; weekly

instead of monthly payments of wages; and free lights. Efforts at conciliation, by means of the Boards established by law in 1896, have proved unsuccessful; the main point of contention being the demand for an eight-hours shift. The employers made sundry concessions to the miners, including a 12 per cent. increase in wages; but against the eight-hours shift they took a determined stand, while the men have been equally bent upon obtaining this, their principal, demand.

The latest news, however, is that many of the men are returning to work, and that the complete collapse of the strike is within measurable distance; the men being unable to longer maintain the struggle. The leaders are reported to have informed the men that they could not advise the continuation of the strike, but must ask them to return to work unconditionally—all the funds having been exhausted. As the owners announce that, so soon as the men have resumed work, they will open negotiations as to the granting of higher wages, it is to be hoped that—in spite of the many incitements to violence made by the Czech Socialists, who are attempting to profit by the upset—this bitter and costly struggle will almost immediately cease, if it have not already done so. It is madness for either men or masters to miss the golden harvest at present to be reaped in the coal trade. They are both making hay while the sun shines in this country. It is, indeed, anticipated that the sliding-scale audit in Wales at the end of this month will show a larger advance than has been conceded for ten years. For the relief of the home market to be anticipated in, say, a couple of months' time by the resumption of work in Austria, the coal buyer will be duly grateful; but we fear it will be at least partially discounted by a steadily growing demand from Russia. A further move in the direction of an increased supply in Germany has been taken by the Rhine-Westphalian Syndicate, which has recently removed the restriction hitherto imposed upon the output of the collieries belonging to it, and has granted them permission to raise and sell all the coal they can. But the effect of this action will not be felt for some months; and although it is bound to come, the time of cheap coal is not yet.

MUNICIPAL CORRUPTION AND MUNICIPAL TRADING IN THE UNITED STATES.

The frailties and ambitions of our own Municipal Authorities—especially in regard to the widely prevailing mania for embarking upon every form of industrial enterprise—have been, and undoubtedly will be, the frequent subject of comment in these columns. It may, therefore, not be without interest to consider the experience of our American cousins in this respect, and the tendencies observable in their municipal politics. The subject is especially within the province of a journal devoted to the interests of gas lighting and water supply undertakings, for the history of the relations between the gas and water companies of America and the governing bodies of their areas of supply would fill a goodly tome, and afford the choicest reading. An article published in the last December number of the "Contemporary Review," entitled "The Trend in American Cities" (by Mr. J. W. Martin), affords much illuminating information regarding the working of Municipal Government in the States at the present time, though the inferences drawn by the writer from the conditions and tendencies he depicts are decidedly paradoxical. That they would at first sight so appear to an Englishman, Mr. Martin is conscious; and he seeks accordingly to reconcile the inconsistent—with what success we will presently consider. The two most prominent features of the municipal life in the States are, says Mr. Martin, the continuance of corruption—though of a somewhat less flagrant character than formerly—and a growing tendency towards municipal monopolistic trading. "Effect and cause," would be the natural reflection of a student of the subject; but no, "evil and that which will effect its cure," says the reviewer. Before proceeding to discuss this apparently and, we think, demonstrably false conclusion, we will briefly notice the existing condition of American municipal affairs as depicted by Mr. Martin in his article.

That politics both municipal and general in the United States are blighted with the canker of corruption, to such an extent that it has been, and is, a matter of no little difficulty to persuade an honest man with a regard for his reputation to enter political life, is so notorious that we may state the fact without exposing ourselves to the accusation of slandering our American friends. We do so, moreover, without any intention of drawing comparisons with English institutions; we rather wish to, thereby, point a warning to the thick-and-thin advocates of "Municipalism" (blessed word!) in this country. The article before us details many instances of the prevailing corruption, and especially refers for proof thereof to the evidence given by the famous "Boss" Croker before the Committee that was appointed last year (by the Republican party) to investigate the government of Greater New York City by his—the Democratic—party. Mr. Croker not only did not deny that his political morality rose no higher than the code which has for its motto "To the victors the spoils," but even appeared to glory in the completeness with which he had carried this principle into action. All appointments were, under his *régime*, subject to the approval of the city leader. Judges had to pay heavy subsidies to the election funds, and to appoint referees and arbitrators agreeable to the leader; while employees, from the scavenger to the City Treasurer, were adherents of the reigning party. "Working for my own profit? Of course. Day and night, and every day." Such is the summary we are given of the cynical avowals of the Democratic "Boss."

It is not, however, in New York alone that the principles of Tammany are practised. In Philadelphia, we are told, "the City Hall is still incomplete, though a self-perpetuating Commission has spent upon it over £4,000,000 . . . In Chicago, during last year [1898] the regulation that street-paving for more than a small amount should be let by contract to the lowest bidder was evaded in favour of party friends by the arrangement that separate bills for less than the limiting sum should be presented for bits of the work; the same contractor sending in a sheaf of accounts for one length of street. Quantities of street-repairing were paid for and not executed." The little matter of the unfinished, though well financed, City Hall is, however, but an item in the count against Philadelphia, which, says Mr. Martin, "is shamefully pre-eminent for the flagrant rottenness of its government." Its record on the gas and water questions we may quote at length.

> For many years the incompetent Council refused to allow the gas-works to be kept in a proper state of repair. They overloaded the staff with crowds of political henchmen; hundreds of thousands of cubic feet were supplied without proper check; improvements in manufacture were refused; and accounts were kept in an imbecile fashion. It is freely asserted, and commonly believed, that this policy was deliberately pursued at the instigation of those interested in securing possession of the works. At last, in 1897, the Council consummated its folly and treason by leasing the works to a Corporation, after hundreds of thousands of dollars, it is widely believed, were distributed amongst the aldermen in bribes.

So much for gas. In regard to the water supply, the final stage was not reached.

> In the spring of 1899, an epidemic of typhoid fever—attributed by doctors to the impure, unfiltered water which is distributed through the city mains—caused over 400 deaths in Philadelphia in ten weeks. Public indignation was hot, because again and again the Council had been warned by the medical profession, and strongly urged to construct the necessary filters and reservoirs. But either through careless neglect or malevolent design, the reform of the system was delayed, and typhoid fever germs were called in as allies of the speculators who wanted the water, as well as gas. But this time the criminal conspiracy to prevent efficient administration, and so to force on the sale of the works, was too strongly suspected for success; and the demand of the citizens was for "the purification of our present supply by sand filtration under city ownership and control." That demand has prevailed; and the necessary funds have at last been voted by the Council.

The writer having, by repeated instances, shown the prevalence of corruption in many of the principal American Municipalities, proceeds to prove the growing tendency of the citizens to adopt municipal trading—especially the control of such undertakings as gas, water, and tramways. In so doing, however, he incidentally shows that, in those cities where the Reform party has got the better of the corrupters and corrupted, and the public services are administered successfully and honourably, the change is due, not to the entrusting of these services to the care of the Municipal Council, but by their administration at the hands of a clean-handed and upright citizen who has been allowed to take the executive power out of the hands of the Council. Thus we are told that the magic change has, in Boston, been due to the public spirit and energy of Mayor Quincy, and that he is able to achieve his reforms by practically superseding the municipal authorities altogether. "Gradually the two chambers of the City Legislature have been stripped of their powers . . . Contemporaneously the Mayor is increasing the number of honorary appointive commissions . . . through which he secures the sympathy and assistance of representative people of good standing and ability, and evades the obstacles which an inept Council always presents to American reformers."

The weakness of the position so created lies, it will be seen, in the fact that for the maintenance of efficient administration it is necessary that an incorruptible man shall occupy the post of supreme authority in the Municipality. If Mayor Quincy were succeeded by an incipient Croker, what would become of Boston? Its last state would be as bad as its first. It is evident, in fact, that what is needed for the salvation of the American cities from the clutch of the corrupter is not, as Mr. Martin suggests, the handing over of all the public services to the control of municipal authorities notoriously corrupt, but the election to the Councils of upright men. If there were no possibility of the private Corporations corrupting public authorities, the former would turn from the attempt to "do" the Municipality to the more reputable, if sometimes less remunerative, occupation of doing their duty. If the case is really so bad as Mr. Martin would have us believe, there would be little hope for consumers in America ever receiving honest treatment except at the hands of some accidental and irregular autocrat such as Mayor Quincy; for the only alternatives which offer themselves to the American citizen are said to be those of suffering greater or less scoundrelism. "The alternative is not between honesty with private enterprise and dishonesty with public ownership, but between periodical and gigantic frauds, along with the surrender of city property, and the retention of valuable rights at the risk of constant petty peculation. . . . It is cheaper for the city to lose small sums annually through the selection of workmen for political reasons, than to remain in the grasp of private Corporations who can levy exorbitant charges." And then we are told that the trend towards municipal trading—or, as it is called,

city ownership—"makes for righteousness!" We can only say that it is a very short way on a long road.

The lesson appears to us to be rather to keep Municipalities and trading concerns as far apart as possible. We are not, in this country without evidence of the evil results of their juxtaposition. We have had the American experience the other way round. In Philadelphia, the Municipality were suborned into depreciating the water supply in order that a private Corporation might acquire the monopoly at an unjustly low figure. In London, the County Council have attempted to hamper the Water Companies in their work of supply, in order to prejudice them in the eyes of the public, and keep down the purchase price. Let trading concerns stick to trading, and governing bodies to governing. It is not good for men to trade with public money. To a certain extent, it is inevitable; but in so far as it is not inevitable, it should be avoided.

THE INTERNATIONAL GAS CONGRESS IN PARIS.

The rules applying to the attendance and discussions at the forthcoming congress of gas engineers in Paris have just been received from the Offices of the Société Technique du Gaz en France. The conference will open on the 2nd of September, and last for about five days. Those who wish to send papers on the subjects suggested for discussion are reminded that they should be forwarded before the 1st of June; and those who desire to take part in any of the discussions should send in their names by the 1st of July, when advance copies of the papers to be read will be forwarded to them. The programme of questions proposed to be discussed is as follows:—

1.—Inclined Retorts: Improvements and arrangements in different countries; their adoption in large gas-works. Compare the capital cost of inclined retorts with horizontals; economical result of this comparison on a basis of 1000 cubic metres made per day; opportunity of adopting them in medium-sized works; comparison of results on this system with stoking machinery, technically and financially.
2.—Mechanical stoking and general mechanical appliances for use in gas-works.
3.—Coke-conveying plant.
4.—Producers away from the furnaces, and feeding any one arch. Advantages of this arrangement.
5.—Effect of regenerative furnaces and of doing away with the hydraulic main seal on the production of ammonia.
6.—Measuring high temperatures.
7.—Thermal reactions in the distillation of coal.
8.—Conditions for establishing a modern gas-works.
9.—What are the best and most economical means of purifying gas? Choice of materials and their preparation.
10.—Uses of spent purifying material.
11.—The principal causes of the development of the production, sale, and uses of bye-products during the second half of the century.
12.—What progress has been made in the manufacture of yellow prussiate of potash in gas-works, and what are its advantages?
13.—Manufacture of cyanides in gas-works.
14.—The adoption in gas-works of plant for carburetting poor gas.
15.—Means of preventing obstructions due to naphthalene.
16.—In what way can the normal loss of gas in distribution be reduced.

There are also other questions referring to wet, dry, and prepayment meters; to the use of gas for heating and motive power; to the possibility of adopting an international standard for testing the illuminating value of gas; to general photometry; and, finally, to the best ways and means for interesting and educating stokers, foremen, and others in their work.

RECENT PUBLICATIONS.

The Consumer's Handbook of the Law Relating to Gas, Water, and Electric Lighting. By Lawrence Duckworth. (Effingham Wilson.)

The author of this handbook, who is a barrister of the Middle Temple, is known as the exponent in a concise form of the law on various subjects; and in the work under notice he has endeavoured to explain it as affecting consumers of gas, water, and electricity. Only 24 out of the 96 pages in the book are devoted to gas, and 10 to electric lighting; so that the bulk of the contents relates to water supply. The author deals first with the breaking up and reinstatement of streets, &c., for furnishing a supply of gas, and then sets forth the rights of the suppliers and the responsibilities of the consumers in connection therewith. He indicates the penalties incurred for non-fulfilment by gas companies of the duties imposed upon them by statute, and shows how, and by whom, these penalties may be enforced. As already mentioned, the subject of water supply is treated at greater length; the author's exposition of the law being accompanied by the authorized rates of payment for water supplied by the different Metropolitan Companies. For much valuable information in regard to these Companies Mr. Duckworth acknowledges his indebtedness to Mr. Alfred Lass's "Analysis." The law in regard to electric lighting being contained in only three Acts of Parliament, and being in some respects similar to that relating to gas and water supply, the author is able to present in a few pages those points which are of special interest to the consumer. In an introductory chapter, he deals with some general principles in connection with his subject, and he has compiled a useful index. Consumers of both gas and water are very prone to charge the suppliers of these commodities with either exceeding or neglecting their duties; but they are not so ready to acknowledge their own responsibilities as users. If this arises from their ignorance of the law under which the supply is furnished, this state of things should prevail no longer, in view of the existence of such handbooks as that prepared by Mr. Duckworth.

The Life and Letters of Sir Joseph Prestwich. By his Wife. (William Blackwood and Sons.)

The name of Prestwich will be familiar to all acquainted with the work of the Royal Commissions of the past half century, for Sir Joseph was a distinguished member of two famous Commissions dealing with questions of importance to our readers. He was chosen, for his intimate acquaintance with the geology of the Metropolis and Home Counties, to be the geological member of the Royal Commission on Water Supply appointed in 1864, and was a prominent member of the Royal Coal Commission of 1866-71. His principal work in connection with the Water Commission was the drawing up of a hydro-geological map of the Thames Basin, for the purpose of showing the extent of the permeable and impermeable strata, and the position of all the principal springs. To these were added contour lines to mark the height of the springs and of the rivers in the different parts of their course. This map was accompanied by a plate of sections showing the dimensions of the underground reservoirs furnishing the springs, which, with the direct flow of rainfall from off the impermeable strata, give the total quantities of water available for the supply of London and other towns in the Thames Basin. These drawings—through the parsimony of the Treasury it is said—have unfortunately never been published, but are believed to be still pigeon-holed at the Stationery Office. Prestwich was, in fact, the leading authority of his day on the subject of the bearing of geological structure on the question of water supply; and the list of papers, books, &c., of which he was the author, contains references to numerous publications dealing therewith, from a paper read before the Royal Institute of British Architects in 1850—on the geological conditions which determine the relative value of the water-bearing strata of the Tertiary and Cretaceous Series, and on the probability of finding in the lower members of the latter, beneath London, fresh and large sources of water supply—down to the issue in 1895 of a revised edition of his "Geological Inquiry Respecting the Water-Bearing Strata of the Country round London, with reference especially to the Water Supply of the Metropolis, and including some Remarks on Springs."

He also, as we have said, made excellent practical use of his knowledge of geology as a member of the Royal Commission on Coal; Sir Roderick Murchison, in one of the sub-reports declaring himself "bound specially to record his admiration" of the researches made by Prestwich, both in regard to the known and the concealed coal-fields. He (Prestwich) was a strong supporter of his friend Godwin-Austen's theory as to the existence of coal-basins under the secondary and tertiary formations of the South and South-east of England—a theory since demonstrated to be in accordance with facts. The address which, as President, Prestwich delivered to the Geological Society, in 1872, comprised a review of these two principal fields in which his geological knowledge found scope for practical application; the first portion being devoted to "Our Springs and Water Supply," the second to "Our Coals and Coal Supply."

This record of his life which we have under notice possesses interest mainly for those who were fortunate enough to be the friends of Prestwich, and for students of geology and its practical applications; but for the general reader it has much value as being, without set purpose, the teacher of the possibility and value of the utilization of leisure time. Those who are unacquainted with his life will, after reading of the eminence he achieved in the world of science, be astonished to learn that Prestwich was engaged all his life in business in the City; and that his immense store of geological knowledge, and his intimate and complete acquaintance with the geology, not only of the districts in the close vicinity of the Metropolis, but of all the South-east and, to a lesser degree, of the South-west of England, were acquired in his "spare time" out of business hours. His industry and enthusiasm were indeed prodigious; and the story of his life of incessant, but much-delighted-in, work should shame the apathetic and indolent into making some fuller use of the powers they possess, small though they may be. Of the 24 hours, one-third, in the case of many engaged in commercial life, falls within the category of leisure time. How many make a profitable—that is, intelligent—use of that leisure? The circulation enjoyed by the scrappy, mind-debilitating publications of to-day is an eloquent answer.

Withal, be it noted, Prestwich was not a prig by any manner of means. He "had a passion for waltzing," music was always a great pleasure to him, and, as Sir Archibald Geikie says, he

was possessed of child-like simplicity of heart, unaffected modesty, and genuine goodness. As to the book under review, it were ungrateful to criticize as a contribution to literature the devoted labours of Lady Prestwich. The work, as was perhaps to be expected, has for its chief fault a failure to judge between the essential and the unimportant; for its great virtue, the presentment in simple language of the story of a true man of science and a real English gentleman.

Bacteria; Especially as they are related to the Economy of Nature, to Industrial Processes, and to the Public Health. By George Newman, M.D., &c. (John Murray.)

The science of bacteriology has suffered considerably in its public repute, both from the over-optimism of those of its devotees who have predicted the immediate extinction of this or that disease and a great prolongation of human life as the outcome of its study, as well as from the alarmist declarations of others who have inspired the general public with a belief that the bacterium is necessarily a destructive organism. The latter class apparently delight in horrifying their fellows by lurid warnings of the bacterial dangers lurking in the commonplaces of every-day life; so that men feel that there is no safety for them outside a sterilized glass case, and become bacteria-haunted—until they remember that their forefathers contrived to live to a respectable age in spite of the billions of micro-organisms dogging their every step, and so come eventually to regard the bacteriologist as a harmless crank with a microbe in his bonnet. Dr. Newman, in the volume before us, has done much towards placing the science in its true light, and has succeeded in writing a very interesting—indeed, fascinating—and withal extremely practical, treatise on the relation of bacteriology to the economics of daily life, as well as giving a full account of the results of its study up to the present time.

The whole of the 350 pages comprised in Dr. Newman's book are full of interest, and well repay perusal. But we can only notice, and that inadequately, the chapter with which we are most directly concerned—that on "Bacteria in Water." The subject is dealt with very comprehensively, from a detailed account of the method pursued (with illustrations of the apparatus required) in the systematic investigation of the bacteriology of a water suspected of bacterial pollution, to the description of the structure and characteristics of the chief disease organisms found in water. In giving the necessary directions for the accurate conduct of an examination of water for micro-organisms, stress is rightly laid upon the need for scrupulous carefulness in regard to using only sterilized vessels for collecting samples, and also upon the necessity for avoiding any delay in the examining of samples, in order not to obtain results falsified by the fallacies arising from the rapid multiplication of germs. As an example of this multiplication, may be mentioned the case of a sample of well water which at the date of collection contained 7, but at the expiration of three days 495,000 micro-organisms per cubic centimetre.

Upon the question of the standard of bacterial purity by which a water is to be classified, Dr. Newman, "after some experience of water examination, would favour a standard of 'under 500' [bacteria per cubic centimetre] being a potable water, if the 500 were of a nature indicating neither sewage pollution nor disease." This does not appear to us to be a sufficiently high standard for drinking water. Koch's standard is 100 bacteria per cubic centimetre. Judged even by this much higher requirement of purity, the water of the London Companies is well within the limit. Numbers (unless obviously enormously high) are, however, as Dr. Newman points out, by no means the only necessary guide to a verdict upon a water. "The presence of rapidly liquefying bacteria *associated with sewage or surface pollution* would, even though present in fewer numbers than a standard, condemn a water." The point is also emphasized that a chemical and a bacteriological report assist each other. "The former is able to tell us the quantity of salts and condition of the organic matter present; the latter the number and quality of micro-organisms. Neither can take the place of the other; and, generally speaking, both are more or less useless until we can learn, by inspection and investigation of the source of the water, the origin of the organic matter or contamination. Hence a water report should contain, not only a record of physical characters, of chemical constituents, and of the presence or absence of micro-organisms, injurious and otherwise, but it should also contain information obtained by personal investigation of the source. Only thus can a reasonable opinion be expected. Moreover, it is generally only possible to form an accurate judgment of a water from watching its history—that is, not from one examination only, but from a series of observations. A water yielding a steady standard of bacterial contents is a much more satisfactory water, from every point of view, than one which is unstable—one month possessing 500 bacteria per cubic centimetre, and another month 5000."

The causes of the purification of polluted water by the action of natural forces are enumerated by Dr. Newman and briefly explained; oxidation, dilution, and sedimentation being named as the three principal agents. The results of Prausnitz's investigations of the water of the Iser before, directly after, and at distances beyond, the point at which it receives the drainage of Munich, and Professor Percy Frankland's notes upon the River Dee, afford striking examples of the extent to which polluted streams are purified by natural means. The methods of artificial purification of water are considered at some length; and the effect of filter-beds in arresting bacteria, both by chemical and mechanical action, is fully dealt with. The importance of the layer of scum and mud on the surface of the sand at the top of the filter-bed in the nitrification of unoxidized substances, emphasized by Dr. Newman, was originally pointed out by Koch, whose "Water Filtration and Cholera"—which owed much to the investigations of Professor Percy Frankland—was of great value in calling attention to the efficacy of careful sand filtration in preventing the spread of disease.

Upon the inefficiency, and positive harmfulness, of the great majority of filters used in domestic houses, the author rightly lays great stress. He gives, however, an unqualified recommendation to the Pasteur-Chamberland candle-filters. As to the supposed efficacy of charcoal as a filtering medium, we are reminded that, "as a matter of experment and practice, it has been found by Frankland, Woodhead, and others, that charcoal actually adds to the number of germs after it has been in use for some days."

With the sections relating to the diseases conveyed by water, the bacteriology of sewage and sewage-polluted waters, and the other chapters in this most readable book, it is impossible in this review to deal. We can unhesitatingly recommend it to the study of everyone, for all are concerned with the influence of bacteriology upon problems of health and sanitation; but especially is it to be commended to those who are responsible for the water supply of this country.

PERSONAL.

Mr. Frank Green, Assistant at the Hamilton Corporation Gas-Works, has been appointed Draughtsman and Assistant-Manager for the Ceará Gas Company, Brazil.

Mr. W. J. Dibdin, F.I.C., F.C.S., formerly Chemist and Superintending Gas Examiner to the London County Council, has been appointed Gas Examiner to the Gravesend Corporation.

The recommendation of the Gas Committee of the Greenock Corporation that Mr. John Chalmers should succeed Mr. S. Stewart as Manager of the gas-works, mentioned in the "Journal" a fortnight ago, has been confirmed.

Mr. Andrew Wilson, the Manager of the Perth Gas-Works, has sent in his resignation, and it has been accepted. Mr. Wilson was appointed, in succession to Mr. Thomas Whimster, in November, 1895; having been previously in Carlisle.

Last Friday, the employees of the Elland Gas-Works had a farewell supper, under the presidency of the Engineer (Mr. R. Porter), in honour of the success of Mr. Frank Higginson in obtaining the appointment of Manager and Secretary of the Broadstairs Gas Company, as announced in the "Journal" last week. An interesting feature of the proceedings was the presentation to Mr. Higginson of a handsome oak timepiece, bearing a suitable inscription.

The appointment of Recorder of London, vacant by the recent death of Sir Charles Hall, has been conferred upon Sir Forrest Fulton, the Common Serjeant. The new Recorder, it may be remembered, was the introducer of the Metropolitan Water Companies (Regulation of Powers) Bill, which was passed on Aug. 8, 1887. It is referred to generally as Forrest Fulton's Act; and under its provisions water may not be cut off where the rate therefor is payable by the owner of the property supplied.

We learn with regret that among the names of the wounded City Imperial Volunteers (Mounted Infantry) with Lord Roberts is that of Mr. C. F. Nixon, a member of the clerical staff of the Gaslight and Coke Company at their Fulham works. Mr. Nixon had the distinction of being chosen as one of the orderlies to General Macdonald, but was unfortunately severely wounded in the chest during the fighting at Paardeberg in which his General was also slightly injured. We hope to hear of Mr. Nixon's speedy recovery, and trust he will be able to return to his duties in London none the worse for the injuries he has received in the service of his country abroad.

In the "Journal" for the 31st of October last, we mentioned that the Sheffield City Council had recognized the eminent services rendered by Sir Frederick Thorpe Mappin, Bart., M.P., and Sir Henry Stephenson—the former the Chairman, and the latter a Director of the Sheffield United Gas Company—by conferring upon them the honorary freedom of the city. The certificates, enclosed in silver-gilt caskets of beautiful design, were presented at the Town Hall last Thursday afternoon, in the presence of a large and distinguished company. The above-named gentlemen, with the Duke of Norfolk, to whom a similar presentation was made, head the roll of freemen of the city.

Yesterday week, at the meeting of the Bingley District Council, the Chairman of the Gas Committee (Mr. Gatecliff) took advantage of the opportunity to pay a warm appreciation to the work of Mr. G. D. Malam, the Gas Engineer and Manager, who, he reminded the members, was attending the meeting for the last time as an official of the Council—his retirement taking effect at the end of the month. He said that the members knew that when Mr. Malam was appointed, over twenty-two years ago, the gas-works were in a bankrupt condition, and gas

was twice the price it was to-day. Not only since then had the price of gas been reduced by one-half, but the amount of capital had also been reduced by one-half. The Chairman (Mr. A. Hartley) also spoke in acknowledgment of the valuable services of Mr. Malam.

OBITUARY.

The death occurred in London last Thursday, at the age of 80, of MARIA, widow of the Rev. W. R. Bowditch, B.A., Vicar of Wakefield, whose name is closely associated with the early history of gas lighting.

The death is announced of Mr. EDWARD CLARK, who from 1873 to 1893 was a member of the Lancaster Corporation, and twice filled the office of Mayor—in 1880 and 1884. During his first year in that capacity he inaugurated the water-works extension under powers obtained from Parliament in 1876, by which the daily supply that the town was enabled to take from the fells was increased to two million gallons.

Ex-Provost BREINGAN, of Helensburgh, died there last Tuesday. He had been a member of the Burgh Commission for nearly fifty years. Among many other offices which he held was that of the chairmanship of the Helensburgh Gas Company, which he only relinquished on the transfer of the Company's undertaking to the Corporation. Mr. Breingan was the moving spirit in the introduction of a gravitation water supply into the burgh.

The Bunsen Memorial Lecture.—Sir Henry Roscoe, F.R.S., will deliver the Bunsen Memorial Lecture of the Chemical Society after the annual meeting on Thursday next, when the Longstaff Medal will be presented to Professor W. H. Perken, junr., F.R.S.

Explosions of Gases.—Mr. J. K. Wood, of Dundee, read a paper on the "Explosion of Gases" before the Physical Society of Dundee on Saturday, the 17th inst. The subject was dealt with in its historical, chemical, and practical aspects; and the communication was highly interesting.

The Association of Gas and Water Engineers of Austria-Hungary.—"Der Gastechniker," the official organ of this Association, announces that the annual general meeting this year will be held at Presburg, in Hungary, on the 24th of May and two following days. The President of the Association is Herr H. Nachtsheim.

Society of Engineers.—At the ordinary meeting of the Society next Monday, the paper to be read will be on "Disinfection of the Maidstone Water-Service Mains;" the authors being Dr. G. Sims Woodhead, M.A., and Mr. W. J. Ware. Dr. Woodhead, it may be remembered, took a prominent part in the investigation which resulted from the epidemic of typhoid fever at Maidstone in September, 1897.

The Coal Contracts of the London Gas Companies.—The "Iron and Coal Trades Review" learns, "on excellent authority," that "the Metropolitan Gas Companies are now negotiating their contracts for the supply of coal for the ensuing year, and are being asked as much as 16s. per ton for that description of fuel, against 8s. 6d. per ton quoted at this time last year, and 6s. 6d. per ton paid some years ago. The Gas Companies are naturally disposed to resist this great advance, and are proposing to make short contracts, in the hope and belief that the present prices cannot last much longer. The Companies are taking steps to advance the price of gas by 3d. per 1000, in order to meet this serious rise in the cost of coal. They cannot recoup themselves in any other way; for the most that they can hope to secure as additional price for their coke is 2s. 6d. to 3s. per ton of coal carbonized."

Carbonic Oxide Poisoning.—An apt illustration of the manner in which medical scares may be initiated is furnished by some recent researches in which that much-maligned component of carburetted water gas, carbonic oxide, is well to the fore. It appears that the medical men and scaremongers who sought out water gas as their victim some time ago, and actually secured a half-hearted condemnation of that useful auxiliary of coal gas at the hands of a Commission appointed by the Home Secretary, might have also found their *bête noire*, carbonic oxide, in the tobacco smoke which so many freely inhale for a not inconsiderable term of their working lives. The "Deutsche Aerzte Zeitung" points out that evidence on the proportion of carbonic oxide in tobacco smoke, and on its toxic action, has hitherto been strangely contradictory. Exhaustive researches now, however, have proved that carbonic oxide is constantly present in tobacco smoke, but that the proportion varies with the rate of combustion and the amount of air aspirated. It ranges from 0·6 to 7 per cent. Yet even this would scarcely have been expected from the common experiences of smokers. Whether or not the daily absorption of small quantities of carbonic oxide, continued year after year, has an injurious chemical action on the blood of smokers, is a question which remains to be further investigated. We may, however, certainly expect to see all those who are unwilling to run the risk of a supply of carburetted water gas to our dwellings at once discard their tobacco, lest they bear unwilling testimony to the harmlessness of frequent small doses of carbonic oxide.

TECHNICAL RECORD.

THE NEXT MEETING OF THE GAS INSTITUTE.

We have received from Mr. Walter T. Dunn, the Secretary of the Gas Institute, the preliminary circular he has sent to the members in regard to the next annual meeting, which will be held in London on the 12th and 13th of June, under the presidency of Mr. E. Herbert Stevenson, M.Inst.C.E. Of course, no indication can be given of the nature of the technical business, as this matter is now under the consideration of the Council; but it may be expected to be up to the average of that of recent years, though probably the papers may be fewer in number. The usual premiums, with the President's Medal, will be presented as awards for contributions to the proceedings at the last meeting; and similar premiums are offered in connection with the forthcoming one. Following out the precedent of 1889, arrangements are being made for an excursion to Paris, in order to afford members an opportunity of visiting the International Exhibition. It is proposed to leave London on the evening of the second day of the meeting, and return on the following Saturday; though the visit may be prolonged if desired. The Council, as our readers are aware, have received from the Société Technique du Gaz en France a cordial invitation to the members of the Institute to participate in the International Gas Congress which, as already announced, is to be held in Paris on the 3rd and 4th of September next; and it has been accepted. The French Society are desirous of having papers from this country presented at the conference; and the assistance of the Institute has been invited in the matter. The Council trust the announcement may have the effect of ensuring a satisfactory representation of Great Britain at this international gathering. The circular closes with an invitation to those who have not already joined the Institute to enter its ranks, and with an appeal for support to its Benevolent Fund.

ESTIMATION OF NAPHTHALENE IN COAL GAS.

Paper by Dr. Colman and Mr. J. F. Smith.

At the Meeting of the Nottingham Section of the Society of Chemical Industry, at Burton-on-Trent, on the 31st of January, a paper on the above subject, prepared by Dr. Harold G. Colman (Chemist at the Saltley Gas-Works, Birmingham) and Mr. J. F. Smith, was presented. We published in the succeeding issue of the "JOURNAL" a brief abstract of the paper, but are now able to give the full text, as it appears in the current issue of the Society's "Journal."

No accurate method has hitherto been published for the exact estimation of the quantity of naphthalene present in coal gas, although a knowledge of the amount is of the utmost importance, in view of the great trouble experienced in so many gas undertakings from the separation of the hydrocarbon in the solid form in the mains and services. This brings about local stoppages, sometimes amounting to hundreds a day in large towns.

The great difficulty which has been experienced in devising a method of quantitative determination is due to the fact that naphthalene is a somewhat inert substance, and most reagents capable of extracting it from the gas simultaneously remove other hydrocarbons which are present in much larger quantity than naphthalene; and no ready method of separating the latter from such mixtures is known. Mr. J. P. Leather, in a recent paper,* has proposed a method which consists in passing large volumes of gas (200 to 300 cubic feet) at a slow rate through pure benzene, and then carefully evaporating off the latter. The residual oil contains all the naphthalene, but is mixed with a much larger quantity of toluene, xylene, &c. Details of the method of isolating the naphthalene from the mixture are not given in the paper; but this is apparently carried out by fractional distillation, which can at best give very approximate results. The method, moreover, is very cumbersome, as it takes several days to complete a test, and large quantities of gas and benzene must be employed.

After many unsuccessful attempts, the authors have succeeded in obtaining a method which gives results of sufficient accuracy for technical purposes, and which can be carried out much more rapidly than that proposed by Mr. Leather. It depends on the well-known fact that naphthalene combines with picric acid to form a fairly stable crystalline compound—$C_{10}H_8$, $C_6H_3N_3O_7$—which is scarcely soluble in aqueous picric acid. When gas containing naphthalene vapour is passed through a solution of picric acid, the whole of the naphthalene is removed, and separates out in combination with picric acid, as a crystalline precipitate. It was at first hoped that it would be possible to estimate the naphthalene by passing the gas through a definite volume of picric acid solution of known strength; filtering off the precipitate, and determining the amount of picric acid in the filtrate by alkalimetry. From the difference between the quantity of picric acid thus found, and the amount originally taken, the quantity of naphthalene in the gas passed could be calculated. The results, however, came out much too low; the reason being that the precipitate formed does not consist of pure naphthalene picrate, but is a mixture of the latter with varying quantities

* See "JOURNAL," Vol. LXXIII., p. 1734.

of free naphthalene. This difficulty has been overcome by treating the mixed solution and precipitate in a manner similar to that adopted by Herr F. W. Küster in his method for the estimation of naphthalene when mixed with other solid hydrocarbons which do not form stable compounds with picric acid.

In carrying out the test, a solution of the acid is employed which is nearly saturated at the ordinary temperature (about 1-20th normal). The strength of the solution is accurately determined by titration with decinormal baryta water or decinormal caustic soda; using as an indicator lacmoid, the colour of which changes from brownish yellow to green as soon as an excess of alkali is present. In standardizing the alkali, lacmoid must also be used as the indicator.

For the absorption of the naphthalene, a series of four bottles is employed, the first of which has a capacity of about 300 c.c., and contains 100 c.c. of picric acid solution; the second and third are small bottles, each containing 50 c.c.; the fourth bottle is empty, and serves to retain any splashings of acid solution from the other bottles, the gas passing thence to the meter. The gas is bubbled through at the rate of 0·5 to 1 cubic foot per hour until from 10 to 15 feet have been passed. As a rule, the whole of the naphthalene is retained in the first bottle, the liquid in the other bottles remaining quite clear. It is, however, possible that in very warm weather, or if the test is carried out in a very warm room, this might no longer be the case; and it would then, perhaps, be advisable to add a fourth bottle of solution. After the gas has been shut off, the contents of the second and third bottles are transferred to the first; the solution being washed out from the former with as small a quantity of water as possible.

Küster's method of procedure is then closely followed. The bottle is closed with an india-rubber stopper, through which passes a glass tube, closed at the lower end, but having a small hole blown in the side about an inch from the bottom. The tube is placed so that this hole is just below the bottom of the stopper, and the bottle then evacuated as completely as possible with a water-jet pump. While the pump is still working, the tube is raised so that the small hole is well above the bottom of the stopper—the bottle being thus sealed. It is then placed in a water bath containing sufficient water to cover it, the water is heated to the boiling-point, and the heating continued until the liquid is quite clear. The bottle is then removed and allowed to cool, with occasional shaking to wash down any naphthalene which may sublime on to the upper portion of the bottle. After standing for some time, preferably over night, the naphthalene picrate separates out completely, and is then filtered off on the pump, and the precipitate washed with a small quantity of water. (If much water is used, too low results are obtained; as, although naphthalene picrate is scarcely soluble in picric acid solution, it dissolves appreciably in water—100 c.c. of the latter dissolving 0·1857 gramme at 14°.) The combined filtrate and washings are made up to 500 c.c., well mixed, and 100 c.c. titrated with decinormal caustic soda or baryta water. From these data the quantity of picric acid which has combined with the naphthalene can be readily calculated. Naphthalene picrate has the formula $C_{10}H_8$, $C_6H_3N_3O_7$—*i.e.*, 229 parts of picric acid are united with 128 parts of naphthalene; and therefore the quantity of picric acid thus found multiplied by $\frac{128}{229}$ gives the quantity (0·559) of naphthalene in the volume of gas passed. For technical purposes, it is most convenient to calculate the result to grains of naphthalene per 100 cubic feet of gas.

In order to test the accuracy of the method, air was passed through a weighed U-tube filled with naphthalene, and then through a solution of picric acid, which was subsequently treated in the manner described above. The amount of naphthalene found agreed closely with the actual quantity taken up by the air, which was determined by the loss of weight of the U-tube. The results are given in the following table:—

Weight of Naphthalene Taken.	Weight of Naphthalene Found.	Difference.
Gramme.	Gramme.	Gramme.
0·040*	0·038	— 0·002
0·029*	0·030	+ 0·001
0·086*	0·085	— 0·001
0·261†	0·254	— 0·007
0·110†	0·106	— 0·004
0·129†	0·126	— 0·003
0·150†	0·136	— 0·014

* Decinormal baryta water used for titration.
† Decinormal caustic soda used for titration.

In the last test given, where the error is greatest, the naphthalene picrate was intentionally washed with more than 100 c.c. of water, which, as pointed out above, dissolves appreciable quantities of the compound, and causes a low result. In the remaining tests, the average result is 2·45 per cent. low. In five out of the six cases, the result is too low, and only too high in one case. The method described, therefore, is accurate to about 1 part in 30 parts.

To prove that the other hydrocarbons contained in coal gas are not absorbed by picric acid in a manner which affects the test, a sample of the hydrocarbons present in the gas along with naphthalene, and boiling at a lower temperature, was made by carefully fractionating the portion of coal tar boiling below 200° C. until it was completely free from naphthalene. Air was then passed over 4·86 grammes of this liquid heated to 50° C. until it had disappeared, and the resulting gas passed through picric acid solution. On working out the test, it was found that only 0·001 gramme of picric acid had been precipitated—a quantity which is within the limits of experimental error. Any higher boiling hydrocarbons in the gas which form stable picrates (such as methylnaphthalenes) would, however, be precipitated, and therefore recorded as naphthalene in the test.

The ordinary gas pressure is not sufficient to force the gas through the series of bottles used for the test; but where the full gasholder pressure can be utilized, this will generally be sufficient. If this is not available, the pressure may be increased by means of a water-jet pump; but this has the disadvantage that the gas is washed with a large volume of water, which might remove some of the naphthalene. The authors therefore prefer the following arrangement, which can also be employed for any tests where higher pressure is required, and also for making tests such as estimation of ammonia, &c., in the crude gas before the exhauster, where it is under less than atmospheric pressure. The method consists in enclosing the meter in a stout case of galvanized iron, the top of which can be closed air-tight by means of suitable clamps and packing, and having a piece of plate glass fixed in front, to allow of the meter index being read off. The inlet of the meter is connected by means of a union, as shown in fig. 1, to a tube passing outside the meter-case, which is connected by a flexible tube to the testing apparatus—the outlet of the meter remaining open.

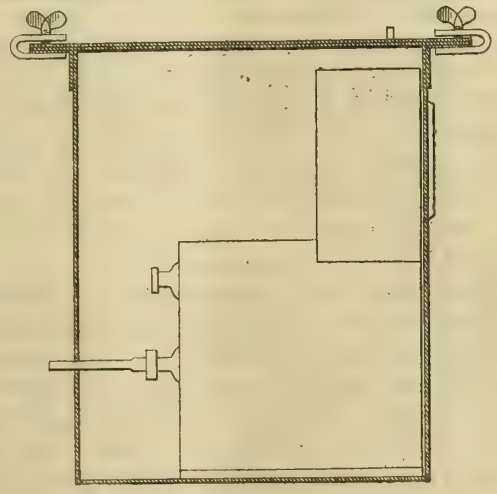


Fig. 1.

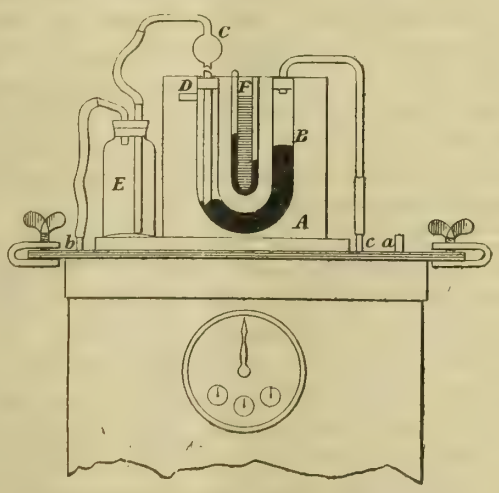


Fig. 2.

On the cover are three tubes, *a*, *b*, *c* (fig. 2), and a fourth, not shown in the drawing, which is attached to the mercury pressure-gauge F. The tube *a* is connected to a small steam or water-jet vacuum pump; and *b* and *c* to the pressure-regulator A. When the pump is started, and the air drawn from the meter-case, the mercury level rises in the right-hand limb of the U-tube B, and falls in the left-hand limb; this continuing until the level in the latter is below the bottom of the tube C. As soon as this occurs, air is drawn into the meter-case through the side tube D and the vertical tube C, so that the vacuum cannot then rise higher. Any desired amount of vacuum can be obtained by simply regulating the height of the tube C; and so long as the pump exhausts gas more quickly than it passes in through the meter, or through any leaks in the case, this vacuum is constantly maintained. The bottle E is interposed in order to catch any globules of mercury which may be carried over with the current of air.

With this apparatus, therefore, the pressure around the meter can readily be regulated to any desired amount below that of the atmosphere, and a vacuum of 2 inches of mercury (= 27 inches of water) is amply sufficient to draw the gas through any testing

apparatus, even if the gas itself is under the vacuum of 12 inches of water. The authors have employed it for several years with satisfactory results; no difficulty having been experienced in the working of it. In making the usual correction of the volume of gas registered by the meter for temperature and pressure, the amount of vacuum shown on the mercury pressure-gauge F must be deducted from the reading of the barometer, as this represents the difference between the atmospheric pressure and that within the meter-case.

As regards the results obtained with coal gas, very little information can at present be given. By the time the method was worked out, all trouble from naphthalene stoppages had disappeared, as is usually the case in Birmingham in the winter months; and the tests made up to the present time with the gas supplied to the town have shown only the presence of a quantity of naphthalene varying from 1·5 grains per 100 cubic feet to *nil*. It may also be mentioned that the picric acid solution can be used as a ready qualitative test for naphthalene; one milligramme giving a quite perceptible precipitate in the solution. If, therefore, after passing from 2 to 3 cubic feet of gas through the solution, no precipitate is formed, it may be safely concluded that the gas only contains, at most, traces of naphthalene.

MICHIGAN (U.S.A.) GAS ASSOCIATION.

The Seventh Annual Meeting of this Association was held at Detroit, on the 21st and 22nd ult., under the chairmanship of the President, Mr. L. E. Walker.

The President delivered an Inaugural Address, in the course of which, referring to the general state of prosperity, he spoke of the increasing use of gas for fuel, but expressed disappointment that, in respect to gas-engines, it was almost standing still. He directed attention to the difficulty experienced in disposing of tar at any reasonable price, particularly in small works, and invited information as to the most efficient methods of using it as a fuel. He deprecated "gas wars," as likely to injure the industry in general, by leading people to suppose that if gas was sold in one place at a price lower than actual cost, it could be sold under similar conditions everywhere.

Mr. Sedgwick Dean read a paper entitled "Differential *v.* Uniform Prices for Gas." The advantages claimed for differential prices were: An increased day consumption, meeting a popular demand, a material aid to introducing new business (as, if the stove was once adopted, it would not be long before lighting burners followed), and a tendency to reduce the idea of "monopoly" which was conveyed by the one-price system. With regard to the first point, he said it might have carried force 25 years ago; but at present many gas companies had reached a 50 per cent. day consumption, or over. The day consumption had been encouraged at the expense of the night consumption; and there was no economic benefit to be gained by further concessions. As to popular demand, no doubt a few might be captivated by special cheap lines; but he thought the majority would appreciate a straightforward, uniform method of business. Low prices might stimulate sales; but what was gained in one way might be lost in another. If gas was sold at 4s. 2d. per 1000 cubic feet for fuel purposes, and 5s. 10d. for lighting, who could say that the gain in fuel was not more than counterbalanced by the loss on light, and that better results would not follow a uniform 5s. rate? He could not understand the use of a customer who counted in the rental-book, but not in the profit side of the balance-sheet. While he could not perceive the justice of having two different prices according to the purpose for which gas is used, he admitted the principle of discount on a quantity. Uniform rates saved the consumer the cost of duplicate pipes, and the companies that of duplicating meters and accounts. The investment in meters, and the cost of reading the index, collection, and office work, were important items. The price of gas should be based on the cost of production; and the public had a right to demand uniform price for uniform service rendered. He therefore argued that differential prices for gas were outside fair business principles, and should be discontinued; and that a uniform price was economical, both to the consumers and to the gas company.

Mr. George Osius read a paper on "Ammonia: Its Saving and Concentration." His remarks were more especially intended for managers of small works who had not as yet given any attention to the saving and utilization of their ammoniacal liquor. Having insisted on the necessity for ample washing or scrubbing capacity, he proceeded to deal with the storage of tar and liquor. If only one tank was available, he advised partitioning off a portion for tar. A partition or wall should extend to within 1 foot of the top of the tank. A second partition should descend from the top of the tank to 6 inches below the other, and about 2 inches space be left between the two. This arrangement formed an effective separator. The condensed liquids being delivered into the tar compartment, all tar would be arrested, and clear liquor only would overflow into the second. The liquor should be pumped from this second compartment for the supply of the scrubber. The construction and method of working a concentrator were next described; and, by means of this apparatus, the crude liquor could be reduced to one-tenth its bulk. The concentrated liquor was to be stored in iron tanks only, and could be loaded for carriage into tank cars or iron drums.

The subject of "Meter Testing" formed the text of an important paper by Mr. Paul Doty, who, after enlarging on the importance of keeping up the efficiency of the meters, said that to secure this condition repairs at regular intervals—such as cleaning valves, oiling diaphragms, &c.—were indispensable. It was good practice to get every meter into the repairing and testing shops at least once in three years. He attached great importance to the "open" test (made with the outlet open full bore), as well as to the capacity test (made at the normal capacity of the meter), and the small-flame test. The results of these three tests, compared together, showed accurately the value of the meter in practice. He described in detail the precautions necessary to secure reliable tests, also the system adopted in his testing and repairing rooms, and exhibited a table showing the results of testing 5200 meters. Of these, 2770 were found to be slow; and 1850, or only one-third, were fit for use. He believed that the efficiency of the average meter was between 99 and 99·5 per cent.—in other words, 0·5 to 1 per cent. against the seller. Of 790 new meters tested, all came within the limits of 1 per cent. fast and 1·5 per cent. slow; 199 being correct, 222 fast, and 369 slow. The cost of his testing and repairing shop averaged 4s. per meter per annum, or not more than ½d. per 1000 cubic feet of gas sold; and he believed it was a very profitable investment. Apart from this, it was a great advantage to secure correct registration.

Mr. S. Milo Dole submitted a paper on "The Business End of a Small Gas-Works." While he did not belittle the importance of strict attention to costs and manufacturing statistics at the works, he insisted that, without a thorough grasp and complete understanding of the business relations between the gas company and the public, success would not be the ultimate result. There must not only be competent handling of the accounts, but judicious advertising, a first-class office, and an intelligent office staff. No fixed rules, applicable to all communities and classes alike, could be laid down; but each case must be dealt with according to its special requirements. The same might be said of advertising—both as to matter selected and the medium for circulation. In many instances, expert assistance was desirable; for it was not every man who had the ability to say a good deal in a few words, or to put those words in attractive form. He also thought there was too much tendency to concentrate the whole under one manager; and that in towns of 8000 or more population, it would be better for one man to take the technical, and another the business part of the works. Improved results would follow if the manager took up the branch in which he had been most successful, and engaged a competent assistant for the other; and he should be willing to recognize, and have others recognize, the real position held by his assistant.

Mr. H. H. Hyde, of Racine (Wis.) was elected President for the ensuing year; and it was decided that the next meeting should be held at Grand Rapids. A Committee was appointed to solicit subscriptions on behalf of a fund for establishing a scholarship in the Michigan University to be known as the Gas Engineering Scholarship; and a contribution of £20 from the Association was voted to the fund. It was also decided that the Committee should be permanent, and have charge of the scholarship.

Sulphate of Ammonia and Nitrate of Soda in France.—Statistics relating to the importation of sulphate of ammonia and nitrate of soda into France during the past three years show that there has been a decrease in the case of the former material and an increase in that of the latter. In 1897, there were 27,201 metric tons of sulphate sent into France, mainly from England; whereas in the two succeeding years the figures were 20,057 and 11,886 tons respectively. The imports last year, therefore, were 15,315 tons less than in 1897. Nitrate of soda, on the other hand, is growing in favour. Three years ago, the imports were 202,634 metric tons; while in 1898 they were 222,957 tons, and last year 261,388 tons.

Water-Meters for Checking Consumption.—Water-meters are now receiving careful attention in Cambridge (Mass.), where the problem of keeping the consumption down to a reasonable amount is fast becoming a serious one. For a few years domestic consumers have been allowed to choose between meter and "fixture" rates; and during 1899, 160 meters were put up in the business districts. The revenue received from the latter has been 28½ per cent. more than it was under the fixture rates, though the use of meters on domestic services has reduced the revenue from them by 11 per cent. The "Engineering Record" says the city must either adopt the meter system on a much larger scale, or spend between $500,000 and $600,000 for new works, which, with the waste checked, will not become necessary for ten to fifteen years. There is the further probability that the ultimate saving in interest and sinking fund charges, if useless waste is stopped, will be sufficient to pay for a new conduit. The Water Board recently made the following statement: "As all our water has to be pumped, and each gallon represents a certain amount of coal consumed, the water takers who are careful in the use of water, and guard against waste, are, under our present system, contributing to pay for the expense incurred by the wasteful and the careless, which is unjust. Under the meter system this injustice would be remedied."

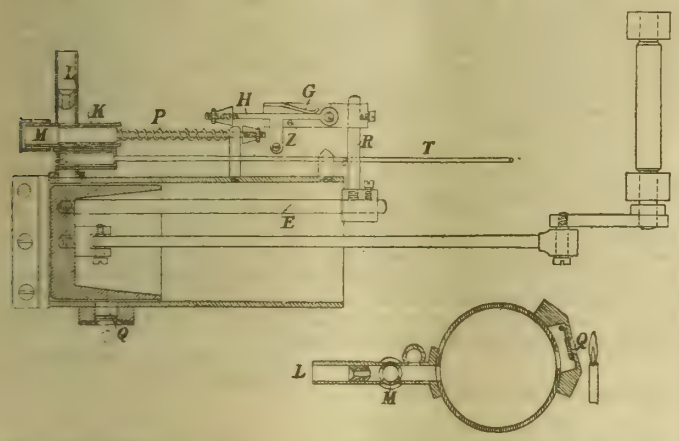
REGISTER OF PATENTS.

Gas-Engines.—Willcox, B.; a communication from A. Wolf and Co., of Frankfort-on-Maine. No. 7626; April 11, 1899.

This invention has for its object to provide a gas-engine without the necessity for the employment of either eccentric or toothed wheels; the valve motion being independent of the fly-wheel shaft. The engine operates in either direction, according as it is started.

Such a motor is illustrated in longitudinal and transverse section.

The cylinder is open at the forward end, and the piston in it is connected with the crank of the shaft, carrying the fly-wheel as usual. Another rod E projects from the piston, and carries by its cross-head the rod R, to which is connected a piece G, upon which is hinged a rod H carrying a cone or catch, and pressed by a spring against a stop.



When the piston moves from the position shown towards the other end of the cylinder, this cone or catch strikes against another cone or catch fixed to the outer end of the rod P of the piston-valve K, which is thereby displaced so as to allow the mixture of gas and air to pass from the conduits L and M to the cylinder behind the piston. As the piston further moves forward, the piece Z, fixed to the rod H, strikes against a stop on the cylinder, thereby lifting the cone or catch, and releasing the cone or catch on the rod P, which is then returned by the spring, and so causes the valve to close the gas and air ports immediately before the piston passes the opening Q in the cylinder. After the piston has passed the opening, the mixture is ignited (in any known manner), and drives the piston forward. When the piston has arrived at the end of its outer stroke, the rod R strikes against a projection on the rod T of the piston-valve, which is thereby operated to allow the products of combustion to escape during the return stroke of the piston. Shortly before the return stroke has been completed, the rod R strikes against another projection on the valve-rod, thereby re-closing the exhaust opening. A new cycle then commences; and so on, during the operation of the engine.

By small secondary air-admission valves, controlled by the piston-valve K, which open and close during the stroke of the piston-valve, more or less additional air can be admitted, and the charge in the working cylinder be thus modified.

Carburation of Gas.—Boult, A. J.; a communication from G. Peeters, of Brussels. No. 8545; April 24, 1899.

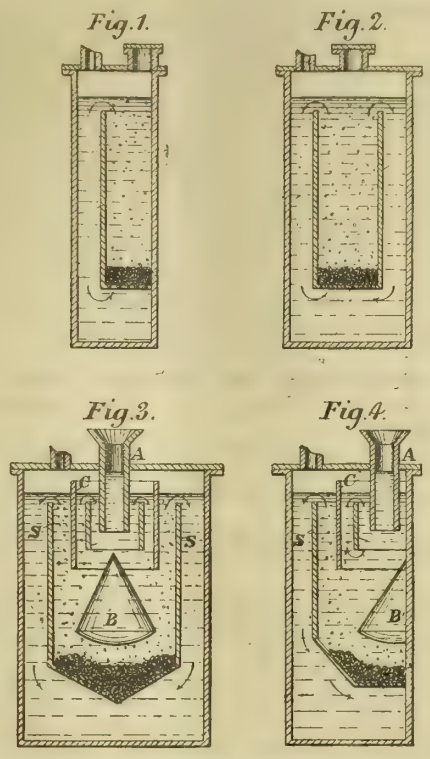
The patentee does not file with his specification a drawing showing the form of apparatus best suited to carry out the object of his invention, the claim for which is: "In a carburetting process of gases used for lighting, inserting a carburettor or carburettors in the gas-conduit—said carburettor consisting of a suitable receiver or recipient enclosing a filaceous, fibrous, spongy, or porous medium, passed through beforehand by a suitable gas until it is charged with the carburetting principles of the gas; then passing the feeding gas of the lighting apparatus through the said carburettor, the said gas keeping up the saturation of the medium on the one hand, and becoming carburetted on the other hand."

Acetylene Generators.—Thompson, W. P.; a communication from A. Wegmann-Hauser, of Zurich, Switzerland. No. 8648; April 25, 1899.

The illustration shows several forms in which this acetylene generator can be made. In all of them, it is divided into compartments which communicate with one another above and below the partitions. One compartment serves for receiving the carbide on a grating, and water flows into it upwards, together with the acetylene which is released at the surface, and then flows over the partition down into the second compartment. In this latter, it descends, then passes under the grating, and is again drawn above the grating by the upward suction produced by the rising of the acetylene. It flows through the latter, and the carbide lying thereon, into the first compartment; and so forth.

Owing to the specifically lighter water charged with gas, and which rises upwards, being separated by a partition from the specifically heavier descending water which is freed from gas, very energetic circulation of the water in the course indicated is said to be brought about. "The carbide is thereby constantly washed through, and thus the hydrate of lime which, on the evolution of gas, forms on the surface of the pieces of carbide, and by impeding the evolution of the gas causes heating, is constantly washed away, so that the pieces of carbide retain a crystalline surface. The evolution of gas takes place, therefore, very rapidly, and without any heating or polymerization; and acetylene of the highest purity and evenness of quality is produced."

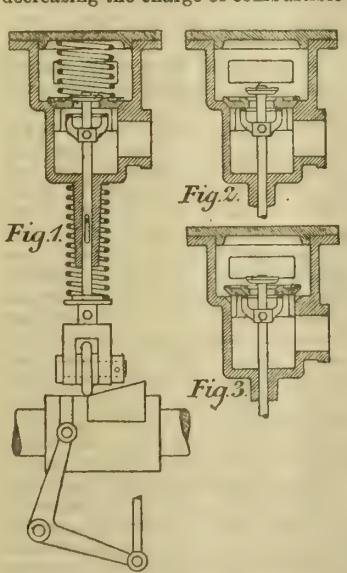
Figs. 1 and 2 will be easily understood without further explanation. Fig. 3 shows a carbide feed-pipe A, provided with a water-seal, which is protected against the escape of gas by the way in which the water circulation is directed. A conical body B is arranged beneath the pipe, by means of which the water and acetylene rising from the grating are forced against the partition S, so that the gas cannot rise directly against the feed-pipe. In order that, even during a violent evolution of gas, no acetylene may penetrate into the feed-pipe A, a pipe C is provided projecting above the surface of the gas-evolving water. A secondary or subsidiary circulation is thus established in the space between the pipes, which circulation may be further assisted by another pipe on the outer



side of which the water rises upwards, while the water releases on its surface the bubbles of gas passing through it under the pipe C, in order afterwards to descend, freed from the gas, on the inner side of the outer pipe; and so forth. A sufficiently gas-tight closing of the feed-pipe is thus produced; and carbide may be conveyed into the generator through this feed-pipe without allowing gas to escape from, or air to enter, the generator. The same object is attained if, as shown in fig. 4, the arrangement is not a central one.

Admission-Valves for Gas-Engines.—Abel, C. D.; a communication from the Gasmotoren Fabrik Deutz, of Koeln-Deutz, Germany No. 887; Jan. 15, 1900.

This invention relates to the regulating admission-valve apparatus for gas motor-engines, the power of which is regulated by increasing or decreasing the charge of combustible gas or the total charge of gas and air mixture—the engine being for this purpose provided with a regulating admission-valve, which is raised to a greater or less extent from its seat by the valve-gear acted upon by the governor, according as the load on the engine is greater or smaller. With this method of regulation, however, as the patentees point out, the disadvantage arises that the smaller the combustible charge to be admitted is, the greater is the inaccuracy of its regulation. On the one hand, with a large lift of the valve, any small inaccuracy that may occur in the extent of the lift (owing to play in the joints of the valve-gear, inaccuracy of the regulating cam, and other inaccuracies of adjustment by the governor) has no appreciable effect on the volume of the charge. On the other hand, the same amount of inaccuracy will, in the case of charges of small volume, produce a comparatively considerable variation as the ratio between the inaccuracies and the extent of valve-lift will be materially increased.



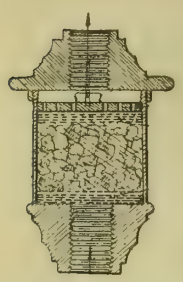
The present invention has for its object to do away, to a greater or less extent, with these disadvantages, by employing valve-apparatus consisting of a combination of two or more separate valves so arranged that, for small charges, only one of the valves is opened; so that any inaccuracy in the extent of the lift will not cause so much variation in the area of the charging orifice as would be the case if both the combined valves were raised.

Fig. 1 shows a vertical section of the valve-apparatus. It consists of two concentrically arranged valves, of which the central one is attached to the stem by which it is directly lifted by means of the valve-gear, and which carries a bracket so arranged that, after the central valve has been raised to a certain height, the bracket comes in contact with, and raises, the first-named annular valve. The valve-stem is connected either directly (as shown) or indirectly to a roller, which bears upon a moveable sleeve actuated by the governor-lever, and which carries an inclined cam operating in the now well-known manner. Fig. 2 shows the apparatus

after the opening of the central valve; the outer valve being still closed. Fig. 3 illustrates both the central and outer valves raised by the further motion of the stem.

Economizers for Gas-Burners.—Knaeps, C., of Brussels. No. 24,598; Dec. 11, 1899.

The patentee claims to have invented an "economical or saving economizer for gas-burners," shown as consisting of a body or casing of cylindrical or other suitable shape, formed in one piece with a suitable junction or union serving to fix the economizer upon the gas-supply pipe to the burner. The cylindrical body or casing contains a number of washers of perforated metal, or of wire gauze, &c., upon which is placed some filtering material, surmounted by washers similar to those first mentioned, held in position by a perforated screw-threaded plate or diaphragm screwed into the upper internally screw-threaded part of the cylindrical body or casing. The economizer is closed by a removable cap or cover, forming a junction or union adapted to receive the burner—the whole being "for the purpose of ensuring uniformity in gas pressure, and to enable a large ecomony or saving in the consumption to be effected."



APPLICATIONS FOR LETTERS PATENT.

4641.—Richards, W. F., "Production of gas for regenerative gas-furnaces." March 12.

4713.—Parnall, W. H., and Ruth, L. J., "Acetylene-gas apparatus." March 13.

4736.—Arzt, A. H., "Gas for illuminating and heating purposes." March 13.

4739.—Leckband, T. H. J., "Gas-meters." March 13.

4759.—M'Allister, E. A., and Gilroy, J. W., "Improved carburettor." March 13.

4775.—Green, W. O., "Prepayment gas-meters." March 13.

4786.—Morelle, C. T., "Generating acetylene gas." March 13.

4791.—Duncan, J. H. H., and Barnett, H. T., "Incandescent gas lighting apparatus." March 13.

4956.—Micoletzky, C., and Spitzer, J., "Gas-furnaces." March 15.

5028.—Hardie, R., "Pressure reducing valves." March 16.

5033.—Van Vriesland, A. I., "Compressing gas." March 16.

5089.—Dougill, A., "Gas and like engines." March 17.

Increases in Price.—The Walton-on-Thames and Weybridge Gas Company announce an increase of 9d. per 1000 cubic feet in the price of gas from the 25th inst. Owing to the Gas Committee of the Stoke-upon-Trent Town Council having to pay £3250 more for their coal than they paid under the last contract, they have been compelled to raise the price of gas from 2s. 9d. and 3s. to 3s. 6d. per 1000 cubic feet.

The Suggested Transfer of the Leamington Gas-Works to the Corporation.—At the seventieth ordinary general meeting of the Leamington Priors Gas Company last Tuesday (when a dividend of 10 per cent. on the "A" shares and 7 per cent. on the "B" shares was agreed to), the Directors reported the receipt of a notice from the Corporation requiring the Company to sell their undertaking, property, rights, powers, and privileges in accordance with, and subject to the provisions of, the Leamington Corporation Act, 1896. Mr. George Livesey had, they said, been retained on behalf of the Company; and negotiations for the transfer were now in progress. A special meeting of the proprietors would, however, have to be held shortly to consider the matter.

High Wycombe Gas Company.—At the recent half-yearly meeting of this Company, the Directors reported that the profits realized in the six months ending Dec. 31 justified them in recommending a dividend for this period of 6 per cent. on the ordinary shares, and of 4½ per cent. on the additional shares, free of income-tax. They stated that the half year had been one of exceptional activity. The Company had introduced means to stimulate the undertaking and to keep abreast of the times; the innovations being inspection of the customers' fittings, the laying on of supplies and the fixing of gas-fittings free of charge for manufacturing purposes; also the supply and fixing of gas-engines on the hire-purchase system. The Company boasted of being the pioneers of such a scheme throughout the world; and the Directors looked forward with much confidence to increased revenue, as already ten gas-engines had been sold—thus showing how the manufacturing public appreciated this most economical motive power. The increased business had resulted in additional consumption to the extent of nearly 20 per cent. There were no signs of abatement in the demand for automatic meters and heating and cooking stoves. The total number of slot meters out was 694; of cookers and grillers, 648; and of gas-fires, 58. These numbers were exclusive of the appliances bought by consumers without the intervention of the Company. During the past half year, the works had been improved by additional manufacturing plant to the extent of 25 per cent.; while the distributing system had also been considerably extended and augmented. The accounts accompanying the report showed that the profit had been £1510. In moving the adoption of the report, the Chairman (Mr. G. Wheeler) gave some particulars, compiled by the Manager, as to the progress of the Company. They showed that in 1897 the capital expended was £4203, or at the rate of £1 1s. per ton of coal carbonized; in 1898, £3818, or 19s. 1d. per ton; in 1899, £4661, or 18s. 7½d. per ton. The Company had about nine miles of mains, yielding a revenue of £900 per mile per annum (which was exceptionally good for a town like High Wycombe); and 150 customers per mile. The maximum consumption of gas at Christmas, 1899, was 294,000 cubic feet per 24 hours, or 17 per cent. increase on the previous year, and 20 per cent. more than two years ago. About 1500 lights were put in last season for manufacturing purposes, exclusive of those for domestic lighting and the slot system. The report was adopted; and a vote of thanks was accorded to the Manager and Secretary for his services. In acknowledging the compliment, Mr. Wicks said he thought the increase of 50 per cent. in the profits for the past two years was marvellous, considering that the Company had lost a big customer in the public lighting. With regard to consumption, they were paid for 93 per cent. of the gas made, which was a high average.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Proposed Visit of the Gas Institute to Paris.

Sir,—Living as I do among foreigners all more or less antagonistic to England, reading as I do foreign daily papers full of invective against our country, seeing as I do shop windows decked with heartless caricatures of our beloved Queen, I thoroughly appreciate the patriotic feelings of Mr. S. Y. Shoubridge, but still feel that his protest against the visit of the members of the Gas Institute to the Paris Congress of the Société Technique de l'Industrie du Gaz en France is ill-timed and ill-judged. It is a communication which will sorely wound the feelings of M. Vautier and his colleagues.

I can assure Mr. Shoubridge that the ill-feeling existing against our nation in France is superficial to a degree, and is the outcome of the scurrilous Boulevard press. Thoughtful Frenchmen view with disgust these ribald effusions, and resent with force the attacks on Her Majesty; and I can safely say that the welcome extended to their English colleagues will outshine the welcome extended to the members of any other National Associations.

The Exhibition itself is intended to be a Palace of Peace and Goodwill; and it would be a churlish act on our part to refuse the hand of friendship, and thrust away the olive-branch extended to us.

Let us not do our French scientific brethren the palpable injustice of confounding them with the leaders of an irresponsible Press. Rather let us meet them cordially; showing them that we appreciate their hospitality. Let us prove to them that we are units of a great nation, above petty personalities; and let us by our visit endeavour to contribute towards the establishment of a friendship which is necessary for the mutual welfare of both England and France.

F. D. Marshall, President,
Institution of Gas Engineers.

Copenhagen, March 22, 1900.

Sir,—I hope your esteemed correspondent, Mr. Shoubridge, may be induced to modify his advice to the Associations of Gas Engineers, and that, on reflection, members will give pause before adopting the view that, because we must despise and deplore the scurrility of a few paltry newspaper writers and illustrators, we should practically resent and avenge them by shunning the Exhibition and avoiding the friendly overtures of our French *collaborateurs*, and generally the French people.

"Two wrongs do not make one right;" and, in my opinion, we should as a profession (and indeed individually) make a great mistake if we endeavoured to fix upon the nation responsibility for a few extremists. There are a number, like myself, who have been in touch with French engineers throughout the past months, and have been in French towns, and can assure Mr. Shoubridge and other doubting friends that the feeling of the mass of the people is in no sense such as these few papers might lead one to think.

On the other hand, much kind feeling and courtesy have been my own experience; and even apology and kindly remonstrance were made on my purchasing last December a number of "*Le Rire*" and other papers which I got to see what it was that was objected to. I can assure Mr. Shoubridge that the articles, and their foul illustrations, were entirely beneath contempt, and such as no respectable Frenchman would allow in his family.

We must try to draw nearer to, rather than shun, our neighbours, and show them that we can afford to laugh at these outbreaks of the few, just as we laugh at some of our own Members of Parliament who have cranks, and as the great mass of the Irish people have to laugh and ignore the excesses in the *mis*representations of their sentiments by some of those who profess to represent their constituencies.

We must not be two thin-skinned, and we must make for peace and conciliation—always, of course, preserving our self-respect.

H. E. Jones.

Stepney, March 24, 1900.

Sir,—As one who has just returned from a visit to Paris, where he received the greatest kindness from professional brethren, permit me to express regret that an English Gas Engineer should have written so bluntly, and I may say harshly, as Mr. Shoubridge has done in last week's "Journal" concerning the proposed Paris Exhibition trip of the Gas Institute.

I fear that his hasty words will give unmerited pain to a number of good French friends of all of us, who are as guiltless as he is of complicity in, or approval of, the scurrilities of a licentious Press. It should be remembered that this malignant sore of the French body politic hurts the French more than it does any other nation; and for one insult levelled at England, there are daily scores and hundreds hurled at all that good French citizens hold sacred and worshipful. Mr. Shoubridge speaks for himself alone; and his protest would have been all the more dignified and effective if he had made it quietly, by staying away from the proposed excursion.

If it were not so strictly individual, it would put in an awkward position those who, while feeling on questions of national politics as keenly as he does, yet think fit to exercise their own judgment of what is correct behaviour in all the circumstances, and will go to Paris, or stay at home, as they think right. Besides, the engagement, such as it is, is of longer standing than the present deplorable trouble; and it was made as part of a mutual feeling of fellowship which it is to be hoped will last when all these passing clouds of misrepresentation and false patriotism are past and forgotten.

An English Gas Engineer.

March 22, 1900.

Sir,—In your last issue there appeared a letter from Mr. S. Y. Shoubridge, regretting the acceptance by the Council of the Gas Institute of the invitation of the Société Technique du Gaz to attend the forthcoming International Gas Congress at Paris. He expressed the hope that no member of the Gas Institute will present himself; as he thinks that, by staying away, "a dignified and effective protest" would be made against

certain recent attacks that have been made on our Queen and country, by a portion of the French Press.

This letter must have been read with surprise and regret by many—with surprise, that anyone of experience and ability, and holding a prominent position, should so far lose his sense of proportion, and of the fitness of things, as to confuse the petty vulgarisms of a small section of the lower French Press with the polite discussions of gentlemen, of all countries and of all shades of opinion, interested in the progress of the science of gas lighting; with regret, inasmuch as it tends to foster the less worthy passions, and to lead to undesirable recriminations, besides showing questionable taste in reply to so cordial an invitation, given with such good intent.

In this connection may be quoted a recent declaration by Lord Russell of Killowen, who said "that any public man in either of the two countries who uses expressions calculated to create or excite feelings of animosity between the two peoples is acting contrary to the interests of the two countries." Does Mr. Shoubridge consider that the French people, as a whole, would be justified in considering themselves insulted by our Queen, Government, and nation, because of vulgar caricatures, however outrageous, which might appear in some of our cheap comic papers? Even our more important newspapers only represent a very small section of opinion; and, therefore, is not the best method of procedure, in cases of indecent abuse, one of complete disregard? A silent reply is often the most crushing and effective. It is a false patriotism, which is not to be confounded with "singing 'God Save the Queen' with great fervour on all suitable occasions," that inspires the noticing and prosecuting of these imbecile attacks on a universally respected Sovereign and nation. "Le Temps" may well ask, "Do not people in London as well as in Paris know the value of the jokes in the illustrated papers? One blushes to insist on these truths. We are glad that they are evident to Englishmen of weight and distinction, as they are in France to all our fellow-citizens who reflect a little."

It is, then, Englishmen of weight who may be expected to put to shame all these paltry boycotts, and to offer a dignified protest against what is ignoble, by a hearty acceptance of, and personal co-operation in, the invitation of the Société Technique du Gaz to the International Gas Congress of 1900.

AN ENGLISH MEMBER OF THE SOCIÉTÉ TECHNIQUE DU GAZ.

March 21, 1900.

SIR,—It is to be regretted that Mr. Shoubridge should, through your columns, sound a discordant note as to the proposed excursion to Paris by the Gas Institute after the London meeting in June next. Is it wise to question the decision of the Council not to alter its pre-arranged excursion to Paris simply because of the tone of the French gutter-press? Even if there had been no disclaimers on the part of representative Frenchmen as to the value which should be set upon the insults of "a *section* of the French press," why should the Gas Institute add fuel to the flame by slighting a nation for the offence of scribes who pander to the passions of the mob?

The invitation to the Gas Congress in September stands quite apart, and should not be confused with the June excursion. The mere statement quoted by Mr. Shoubridge, that "The Council of the Institute have received from the Société Technique de l'Industrie du Gaz en France, and have accepted, a cordial invitation to the Institute to participate in the International Gas Congress to be held in Paris next September," is sufficient evidence of good feeling on the part of the gas industry of France, as distinguished from the French press; and the Gas Institute has shown commendable wisdom in reciprocating the kindly feeling displayed in the invitation.

Is it not preferable to reduce the strain, and allay groundless irritation, on both sides by accepting the stretched-out hand rather than by offering the closed fist, as has been suggested in Mr. Shoubridge's unfortunate letter?

After such a manifesto from one who holds a high and honourable record in connection with the Gas Institute and its work, it is to be feared that, without some expression of approval of the Council's action, they may be greatly hampered in their efforts to foster those cordial relations between members of the gas industry in both countries which, on every ground, ought to be maintained.

SCOTUS.

March 23, 1900.

SIR,—I wish to express my hearty sympathy with the remarks of Mr. S. Y. Shoubridge in the current issue of the "JOURNAL." I can quite see that it may have been difficult for the Council, as representing a purely technical body, to refuse the invitation of the French Society; but I trust the members individually will not be slow in showing, by their replies to Mr. Dunn's circular, that they can sink their pleasures for their patriotism.

E. H. MILLARD.

Durham, March 21, 1900.

The Presence of Naphthalene in Coal Gas.

SIR,—May I be permitted to reply briefly to Mr. J. P. Leather's criticisms in the last number of the "JOURNAL," on the paper read by me before the Society of Chemical Industry on March 5.

Like Dr. Otto Hehner, Mr. Leather totally misunderstands the object of the experiments being conducted with air and hydrogen, as well as with coal gas. That these gases ultimately required identical weights of naphthalene to saturate them, I never doubted. The question—one of great importance where some hundreds of experiments were to be made—was whether equal volumes of the different gases completely saturated themselves with naphthalene in the same time, and at what speed the gas had to be passed over the naphthalene to ensure saturation. That the numbers I obtained are greater than those of Mr. W. Irwin is only to be expected; for, as I showed in my paper, the gas takes a very considerable time to completely saturate itself with the vapour of the naphthalene. Thus 1·27 cubic feet were not absolutely saturated with a length of passage of less than 135 hours. An increase in the volume of gas employed would necessitate a proportionate increase in the duration of the experiment; so that 100 cubic feet of gas would require a length of passage of 10,630 hours to ensure complete saturation! Did Mr. Irwin in his experiments employ a speed of passage for his gas in any way comparable to this; or did he determine a coefficient with which to multiply the value obtained at a much greater speed in the way I did. (See the forthcoming April number of the "Transactions of the Chemical Society.")

That the discrepancy between Mr. Irwin's results and my own can be explained, as Mr. Leather conjectures, by a failure on my part to observe that the losses of weight due to successive passages of equal volumes of gas are greater for the first than for the following experiments, is hardly to be entertained when account is taken of the fact that my experiments usually numbered between thirty and forty at each temperature. That I did not observe the peculiar phenomenon is quite true. This may be explained partly by the fact that I always did two or three rough preliminary experiments, but chiefly I think owing to my naphthalene being perfectly dry and perfectly pure. That perfectly pure dry naphthalene should behave as he says, is inconceivable.

Dr. Bueb's practical results, I did not quote in confirmation of accurate experimental results, but merely mentioned them as an interesting parallel. For real comparison, they are valueless; for there is no evidence that the gas was saturated before treatment with the petroleum oil and benzol, or that all the naphthalene was removed by the process.

Mr. Leather's arguments concerning the correctness of my deduction on the influence of the vapours of the solvents for the naphthalene on the amount of that body required to saturate a given volume of gas, are rather perplexing. He himself states that ordinary coal gas contains only sufficient solvent vapours of naphthalene to saturate the gas to the extent of 25 per cent. Yet he objects to experiments of mine—conducted at a higher temperature, merely to increase the weight of naphthalene carried over—in which the gas was saturated to the extent of 15 per cent. with a solvent vapour, as not being suitable for comparison. From a slight disagreement between the figures at the highest temperatures as read off from a diagram, Mr. Leather deduces an experimental error of 4 per cent. In this, he is quite wrong; the total possible errors of experiment being less than 1 per cent. He cannot, therefore, dismiss the results obtained at 113° Fahr. by actual experiment on the ground that the variations to be expected were within the limits of experimental error.

Finally, with regard to the assumption to which Mr. Leather objects—that the gas which formed deposits originally contained no naphthalene. He seems to think that it was owing to the non-formation of nitrophthalic acid that I made this deduction. The test for nitro-phthalic acid was only a confirmation, and was applied to the frozen-out product, not of 1·27 cubic feet, but of about 100 cubic feet. The real basis of my conclusion was this: If the coal gas contained naphthalene as it left the works, it necessarily contained some of it at every point of the distribution; for the whole could not be condensed out under the conditions to which it was subjected. Now, if the coal gas passed over the naphthalene contained even a trace of that solid, the results would always have differed with those obtained with air and hydrogen. But, at both low and high temperatures, with the same speed of passage, they were always the same. The great number of experiments made, and the length of time during which they were conducted, effectually precludes the idea that the gas as it left the pipe from which it was taken contained any naphthalene. Yet other pipes at equal distances from the works were being blocked up. On my assumption, this is easily explained. The conditions in the pipes where deposits took place were suitable for the formation of naphthalene, while those in any of the pipes through which my gas had passed were not. This seems to me to be a workable hypothesis. However, as I stated in my paper, it is only tentative, and wants experimental verification.

R. W. ALLEN.

Guy's Hospital, S.E., March 21, 1900.

SIR,—In replying to the discussion on his paper, on the presence of naphthalene in coal gas, Mr. R. W. Allen remarked that he did not think the method recently proposed by Mr. Smith and myself for the estimation of naphthalene in coal gas would give accurate results, inasmuch as benzene, which is always present in the gas, also combines with picric acid. It will, however, be seen from the full paper when it is published* that the presence of benzene and similar hydrocarbon vapours does not affect the accuracy of the test; for although most, if not all, of these do combine with picric acid under certain conditions, they are not obtained by the action of the vapours of the hydrocarbons on an *aqueous* solution of picric acid, whereas the naphthalene picrate is readily formed under these conditions. Thus it was found that about 5 grains of a mixture of the various hydrocarbon vapours occurring in coal gas, and boiling at a lower temperature than naphthalene, when volatilized in a current of air and passed through aqueous picric acid, had practically no effect whatever on the latter.

Any higher boiling hydrocarbons present in the gas, and which form stable compounds with picric acid—such as the methylnaphthalenes—would yield a precipitate with picric acid, and would, therefore, be recorded as naphthalene by the test. The greatest amount of such hydrocarbons in the gas is, however, probably extremely small, and would not materially affect the accuracy of the method.

HAROLD G. COLMAN.

Saltley Gas-Works, Birmingham, March 22, 1900.

SIR,—I am sorry I was unavoidably prevented from attending the meeting of the Society of Chemical Industry when Mr. Allen's paper on "Naphthalene in Coal Gas" was read and discussed; but I feel I should have shared in the feeling of surprise which Mr. Allen's theory evoked. Certainly, it upsets most of the preconceived ideas on the subject; but none the less does it require careful consideration.

So far as we are concerned at Hastings, the trouble with naphthalene is under control, owing to the means adopted for dealing with it, which are well known; so that it is now more of academic interest to us. But I am bound to say that diagrams made before our carburation process was in operation indicated that extremes in temperature, either rising or falling, always showed a similar curve as regards naphthalene complaints a few days afterwards. I also feel fully convinced that aqueous vapour (which is considerably increased when carburetted water gas is made) is an important factor in facilitating deposits. If Mr.

* The full text of the paper referred to by our correspondent (an abstract of it only having so far appeared in our columns) is given to-day, p. 798.—ED. J.G.L.

Allen's theory is tenable, it would account to some extent for the erraticity of naphthalene deposits as explained by different works under similar conditions—the one being troubled, and the other having none.

The question of condensation is an important point; but I may mention that I have always adopted here the plan of taking the gas and tar away together—drawing the heavy tar off at intervals; and there is no question of the absorption of naphthalene in this way. But this did not relieve us from trouble in the distribution of the gas. One point in connection with condensation is a difficult one—viz., that the proper apparatus remains constant but a short time owing to fluctuations or increasing make of gas, and the various inequalities of temperature which cannot be perfectly controlled under all conditions whatever system is adopted.

Mr. Leather's letter in your last issue is an important contribution on the question, in view of the theory advanced by Mr. Allen.

Hastings, March 22, 1900. CHAS. E. BOTLEY.

Gas Companies' Balance-Sheets.

SIR,—The "statements" as to the "Coal carbonized," "Gas made," and "Residual products—coke, &c.," which the balance-sheets of most gas companies now contain, are of much importance to the shareholders and others interested in their welfare, as they indicate in great measure the economic working of the plant. They show the growth in efficiency and output, and afford a means of comparing one company's working with another.

But since the introduction of carburetted water-gas plant, the utility of these statements has been somewhat impaired. As a rule, simply a line has been added in the balance-sheet, giving the quantity of "Oil used," &c.—forgetting that the "statements" need revision all round, in order to make clear the effect of the innovation. The statement of "Gas made" should be sub-divided into "Coal gas" and "Carburetted water gas." Under "Residual products," the "Coke used on works" should be divided into two columns—one headed "For coal gas," and the other "For carburetted water gas."

The reasons for this are the following: Before the advent of carburetted water gas, it could always be determined from the balance-sheet (at least, very approximately) what percentage of coke was used for heating the retort-settings. Now this is impossible, as the "Coke used" includes that consumed in the generators of the water-gas plant. By separating the quantities as I suggest, the fuel economy of working either the coal-gas plant or the carburetted water-gas plant would be evident.

Before water-gas plant came into use, the statements given under the headings referred to above enabled the shareholders to determine the quantity of gas made per ton of coal carbonized. Now this is impossible, as the gas made by both processes—viz., coal gas and carburetted water gas—is given in *total*, instead of being separated. Hence the economy of working the two different plants is not evident, as I think it should be, if the statements are to be of the service to the shareholders (when comparing the working results with those of other companies) that they used to be. If we have two separate and distinct processes of gas making, it would be desirable that the economic working of *each* should be evident—not the one mixed up with the other.

The suggested modifications to the statements in the balance-sheet involve very little alteration, and will occupy but very little space, although giving all the information required to bring them up to their former standard of utility.

71, *King William Street, E.C., March* 17, 1900. F. S. CRIPPS.

P.S.—Since writing the above letter, I find that Mr. George Livesey has already drawn attention to the matter (see "JOURNAL" for Feb. 20 last). I have also seen the accounts of the Crystal Palace District Gas Company to December last, in which I find the idea put into practice and carried out even more completely than I suggest.—F. S. C.

Raising the Price of Gas.

SIR,—Looking at the serious state of the coal market generally, would it not be very helpful to Directors and Managers if through the "JOURNAL" you could elicit an expression of opinion from all the leading Engineers and Managers as to the course which should be adopted in reference to raising the price of gas? The replies must be very short—*multum in parvo;* and the more the better. Such a course would be a guide and satisfy Gas Managers and the public generally, if a united expression could be thus obtained.

Aylesbury, March 24, 1900. GEORGE LANE.

New Joint Stock Companies.—The Elche Water-Works Company, Limited, has been registered with a capital of £7000, in £1 shares, to acquire the business of the Alicante Water-Works Company, Limited, and to supply water to the town of Elche, in Spain. The gas-meter manufacturing business founded by the late Mr. George Newton at Oldham in 1862 has been converted into a private limited liability company, under the title of "George Newton, Limited," with a capital of £15,000, in £1 shares. Mr. Robert Newton, the founder's son, who has carried on the undertaking since 1876, will be the Managing-Director; and he will be assisted by his sons.

The Latest Russian Water Monopoly.—The town of Kovno is situated on the borders of the River Niemen, on the Russo-German frontier. It has a population of 72,000, and numerous factories make it a busy industrial centre. The concession granted to the Company supplying the place with water (constituted under the title of the Kovno Water-Works Company, Limited) gives them the monopoly for a period of 70 years. The Company has a capital of £100,000, in 100,000 shares of £1 each; but, in addition, there has been an issue of 500,000 bonds of £10, bearing 4½ per cent. interest. This monopoly is of considerable value, and therefore the Russian Government have decided not to grant any such concession in future. Each town will, it seems, have to construct its own works and supply water for the inhabitants. In the case of Kovno, it is reckoned that, with a consumption of 4¾ gallons per family per day, the annual supply will be about 172½ million gallons.

PARLIAMENTARY INTELLIGENCE.

Gleanings from the Committee Rooms.

The progress of Gas Bills through Parliament is proceeding merrily. A large proportion of them are going forward without opposition; and in the case of certain others which have been threatened with hostility, there are rumours afloat as to likely agreement with the opponents. In fact, compacts of various kinds between promoters on the one side and malcontents and property-coveting authorities on the other seem to be the order of the day. Last Tuesday we announced settlements for purchase in the Ossett and Glastonbury cases, although in the latter the Corporation during the past week had to encounter a little disaffection with the bargain on the part of their neighbours in the district of Street. Then, early in the week, the Bedford Gas Company's Bill was withdrawn from the Committee to which it had been referred; and information is to hand that negotiation has resulted in the opposition being satisfied. Other withdrawals from Committees have been the Bills of the Kingston-on-Thames Gas Company and the Newtown and Llanllwchaiarn District Council; and we hear that the adjustment of differences has been effected in both. We do not know yet the exact nature of the arrangements; but, in the latter case (which is a Purchase Bill), the point or points at issue were very small, and no question of principle was involved. Terms of purchase are being discussed in connection with at least one other Bill; and the West Hartlepool Corporation have, in the proceedings on the Company's Bill, announced their intention of applying for purchasing powers next session. In truth, the municipalization of gas undertakings is having quite a little spurt. The instances of Morecambe and Glastonbury show that, if the parties to an agreement for transfer wish to avert after-trouble, they must take the outlying authorities within the gas-supply area into their confidence before completing their contract. Local authorities may also mark the confirmation, in the Hartlepool proceedings, of the futility of applying to Parliament for the insertion of a purchase clause in a Gas Company's Bill unless they can show clear maladministration of the Company's affairs. Very strong evidence is required on this point, as well as testimony that it is desirable in the interests of the ratepayers that there should be a change of proprietorship. The submission of a Purchase Bill which can be fairly and squarely discussed on its merits is far preferable. Another point worth notice is that the conversion and consolidation of Gas Companies' capital continues to find favour, and has received endorsement in two instances in the course of the past week—viz., in the Hartlepool and Cleethorpes Bills.

The Committee work of the past week has been almost destitute of notable contest in regard to gas matters; but in the latter part of this week and the following, there may be compensating activity. The group of London Gas Bills, two of which contain proposals the like of which has not been before Parliament for many a long day, will come under the consideration of the Commons Committee now sitting in Room 13 (it is to be hoped the promoters of the Bills are not in any way superstitious). The Committee have been kept closely engaged since Tuesday last with the measure introduced by the Lea Conservancy. Judging by the number of Counsel in attendance and the witnesses examined, a large number of interests are concerned in the questions involved. When the Committee rose on Friday, the promoters' case was practically completed—Counsel merely reserving the right to call another witness yesterday morning. It is impossible to say at the time of writing how long the hearing of the opponents' cases will occupy; but some of them are simply requiring modification of, or additions to, clauses. But it is very doubtful whether the Bill will be disposed of before the close of Wednesday's sitting. However, directly the end is reached, the Committee will take up the consideration of the Gas Bills. If the order in which they are down for consideration is followed, that of the London County Council will be proceeded with; and it will be succeeded in turn by the Gaslight and Coke Company Bill, the South Metropolitan Bill, and the Wandsworth and Putney Company's Bill. Very complete preparations have been made for supporting and opposing these Bills; and neither promoters or opponents are likely to leave a stone unturned to carry or overthrow them. Several of the witnesses who will be called have been hovering about the scene of the coming action during the past few days.

The satisfaction of the requirements of the Bedford Corporation in connection with the Gas Company's Bill was not a serious matter. The Company have agreed not to manufacture or convert the "bye-products of tar" upon certain lands; they have acceded to the desire of the Corporation to have supervisory powers in relation to the laying of gas pipes and mains; and, within three months after the passing of the Act, they are to deposit with the Town Clerk a map showing the course and situation of the mains belonging to them within the borough, and at the end of every six months the map is to be corrected to date. In default, the Company are to be liable to a penalty of £5.

Many will rejoice with the Brighton and Hove Gas Company and their Engineer (Mr. Joseph Cash, M.Inst.C.E.) upon the success of the stand which they made in connection with the proposal of the Corporation of Brighton to carry a high-tension electric cable in a continuous proximate line with the high-pressure gas-main running from the Company's works. The happy result was secured, too, without the intervention of the Commons Committee whose wearisome and difficult duty it was to sit for several days in order to unravel, and pronounce judgment upon, the different issues involved in a large tramway and electricity scheme which the Brighton Corporation are seeking powers to carry out. In the general purposes of the Bill readers of the "JOURNAL" have little interest, but they have in the point in regard to which the Gas Company sought relief, in order to protect themselves, their property, and their consumers. But in obtaining all they desired without a contest before the Committee, the gas industry, and the electrical too for the matter of that, has lost what, we believe, would have been an interesting and helpful addition to our knowledge on the question of the electrolysis of gas and water pipes. However, the time may yet come when Brighton will contribute a chapter to the recorded information on the subject; and it will be for the Corporation to take care that the opportunity does not arise. There were several points in the Bill upon which the Gas Company prayed to be heard; but the most momentous was the one referred to. Shortly the facts were: The Corporation asked power to construct a generating

station at Southwick adjoining the works of the Gas Company, and to lay electric lines for the conveyance of high-tension current along a narrow roadway (termed the "towing-path") leading from the proposed generating station to the main road from Shoreham to Brighton. In the towing-path in question reposes the high-pressure mains which convey gas from the Company's works to the gasholder stations—at Hove two miles distant, and Blackrock six miles. Very naturally and properly the Company objected to such undesirable neighbours for their high-pressure mains as high-tension electric cables would have been, owing to the perpetual danger of fusion or electrolytic action. It is not difficult to picture what a stupendous calamity might arise under these particular circumstances, especially during the night hours. It would not merely be a question of the escape of the gas passing from the works at great pressure, but there would be the danger of a rapid exhaustion of the gas which had already passed to the holders. Then, in the event of a conflagration or explosion, it would be a miracle if the high-tension cables did not suffer destruction. Such a disaster would mean that the whole of Brighton would be temporarily deprived of its gas supply as well as the electric current on which the tramways and a large portion of the lighting would depend. But all chances of such an appalling catastrophe have now been averted. By the early part of last week, the Corporation saw that the Gas Company intended to resist their proposal, and defend themselves to the end; and then, and not till then, they adopted a reasonable course. They abandoned their original idea of carrying the cables along the towing-path, and decided on another route. They also conceded certain other clauses affording protection to the Company. It is to be deplored that the Corporation did not arrive at this reasonable frame of mind two or three weeks sooner, as then much labour, expense, and anxiety would have been saved to the Company. But there is this great consolation that, by their persistence, the Company have escaped from what would have been a perpetual source of danger, and a constant nightmare to their Engineer.

If gas and water companies are to secure special protection against, and compensation for, damage to their distribution systems by electrolytic action, they must at once set about collecting actual instances of such occurrences *in this country*. Experience from America as to the doings of this insidious enemy has no weight with at any rate one Select Committee of the House of Commons, although it is not long since that another Committee appointed by an instruction of the House did not hestitate to accept for their guidance statistics in regard to the distribution of water gas in that country. In the foregoing paragraph, it is shown that the Brighton Gas Company were successful in obtaining protective clauses without the aid of a Parliamentary Committee; but, as will be seen by a report elsewhere, the South Metropolitan Gas Company and the Lambeth Water-Works Company were not so fortunate in connection with the London County Council (Electrical) Tramways Bill. For this result, inability to produce at the moment specific cases of damage in this country seems to be accountable. The Companies asked for protection clauses, and compensation in the event of injury; and they took exception to a clause in the Bill giving the County Council power to alter the position of their pipes and mains—the Companies reasonably claiming the right to do such work themselves. The appeals of Counsel and witnesses on these points had no effect. What the Committee wanted was evidence of actual cases of loss in this country occasioned by fusion or electrical action; and, in the absence of these, they declared that they were satisfied that the Bill and the existing legislation afforded ample protection.

The sound of the last words on the Morecambe Gas Purchase Bill had hardly died away on the afternoon of yesterday week when the attention of Sir T. Gibson Carmichael's Committee was invited by Mr. Balfour Browne to the Hartlepool Gas and Water Company's Bill. It was a meritorious case which he had to lay before the Committee in support; and in contrast, the case of the opposition sadly lacked point and stability. But this is not the fault of anyone engaged in its preparation. Where impeachable weaknesses do not exist, it is idle to expect a man to make a telling attack. The whole object of the West Hartlepool Corporation in appearing in opposition was to pave the way for an application next session for purchasing powers—in other words, they wanted to tie the hands of the Company by obtaining the insertion in the present Bill of a clause entitling them to come next session for a Purchase Bill without opposition on the part of the Company. Now let us see (dealing only with the gas undertaking) whether the Committee would have been justified in doing this. With a uniform rate of progression, the gas consumption has increased almost fourfold in the last twenty years; and at the present time, with discounts, the average charge for gas is a trifle over 2s. per 1000 cubic feet, which is a lower price than in three large neighbouring towns where the gas-works are owned by the Local Authorities. In only seven years out of the 54 of their existence, have the Company paid their maximum dividends of 10 and 7 per cent. Back-dividends have never been paid; and so far as can be ascertained, no claim has ever been made for them. This record shows that big dividends have been sacrificed to a very liberal consideration of the consumers, and that, as a natural consequence, a sound and continuously growing business has been assured. The prudent policy pursued by the Directors and their Engineer and Manager (Mr. Thomas Bower) has already stood the Company in good stead in the Parliamentary Committee Rooms; and it has placed before the West Hartlepool Corporation a stupendous task when they essay next session, if they continue in the same frame of mind as now, to prove to Parliament that the interests of the consumers will be better served by them than they have been by the Company. Returning to the present Bill, its purposes are to authorize the consolidation and conversion of the capital into 5 per cent. maximum ordinary stock, and to enable the Company to raise £200,000 additional capital, with the usual borrowing powers. The Corporation objected to the conversion on the ground that there would be an appreciation in the value of the stock, which would prejudice them in the event of purchase. When will local authorities disabuse their minds of this fallacy, and learn something of the fundamental principles which guide arbitrators in arriving at the price to be paid for an undertaking? Then they also objected to the amount of the new capital, and asked for a reduction. The insertion of a purchase clause, as already stated, was desired; and among minor points the Corporation requested a lowering of the maximum price, and the provision of an additional testing-station. So far as could be gathered, there was not a word of complaint against the administration of the Company—excepting that £2700 has been wrongly paid in respect of income-tax during the years of maximum dividends; and this the Company's Counsel has promised shall be entered in the accounts as applied towards the redemption of the amount due for back-dividends. In addressing the Committee at the close of the evidence, the opposing Counsel receded somewhat from the position previously taken up. He withdrew his objection to the conversion of the capital, and almost exclusively confined himself to asking for a reduction of the capital, and the insertion of a clause ensuring that nothing contained in the Bill should prejudice the Corporation in their application for purchasing powers next session. The only result was that the Committee deprived the Company of one-fourth of the proposed additional capital, and ignored the other requests of the Corporation. The curtailment of the capital to this extent will not harm the Company; and the Corporation have really gained little by it. Mr. Corbet Woodall and Mr. E. H. Stevenson were the professional witnesses for the Company; and Mr. W. A. M'Intosh Valon was retained on behalf of the Corporation.

The unpretentious Bill introduced this session by the Cleethorpes Gas Company came before a Committee of the House of Lords for a few minutes on Wednesday last; but, had it not been for the questionable action of the District Council, their Lordships would not have been troubled with the measure even for that length of time, and the Company and the ratepayers would not have been inflicted with unnecessary expense. Prior to this stage being reached, the Company had shown the utmost regard for the views of all interested in any way in the provisions of the Bill. The local Water Company had had protection granted to their supply in respect of the uses to which certain land is to be put which the Gas Company propose to acquire; and in the Bill as finally presented to the Committee, the interests of the consumers and of the District Council had been studied in a praiseworthy manner. In fact, it is difficult to discover in the Bill the slightest excuse for any antagonism. This being so, we can only suppose that the opposition of the District Council was prompted by a little vain ambition to take some part, however small, in the parliamentary proceedings; for the absolute weakness of their position was clearly shown by the course their Counsel took almost immediately after the Bill was introduced to the Committee. The main features of the Bill are the conversion and consolidation of the capital into 5 per cent. stock, additional money powers to the extent of £60,000, with authority to borrow one-third, the adjustment of the sliding-scale, the reduction of the standard price from 6s. to 4s., and the acquisition of further lands. There are a number of other clauses which will contribute both to the advancement of the Company's business and the benefit of the consumers. The Company have a particularly clean record; and selfishness has not by any means been a prominent trait of their policy. Although by their Order of 1879, the Company possessed sliding-scale powers, with an initial price, as already stated, of 6s., they have never, even partially, exercised their rights. The present price of gas is 3s.; but they have never divided more than 10 and 7 per cent. As Mr. Corbet Woodall (who supported the Bill) pointed out to their Lordships, the Company were actually entitled, at a charge of 3s. and with their high standard price, to pay a dividend on the 10 per cent. shares of 19 per cent. and on the 7 per cent. shares of 16 per cent. During the recapitulation of the heads of the Bill by the Company's Counsel, and a few minutes' evidence by Mr. Woodall, the Counsel for the opposition wisely saw that there was nothing they could honestly contend for, excepting a slight additional reduction of the standard price; and overtures resulted in a ready agreement to cut it down by a further 3d., which makes the initial figure the same as in the neighbouring town of Grimsby. The opposing Counsel then withdrew; and their Lordships said the Bill might proceed. The whole affair was a perfect farce; and it is to be regretted that those who are responsible for folly of this kind cannot be made to pay the expenses which their action entails.

We must congratulate the Heysham District Council upon the fact that they do not stand alone in entertaining the queer notion that an outlying Local Authority within the area of a gas undertaking which is being acquired by a Corporation should not be called upon to pay anything more than the mere value of the pipes, should they at any time wish to purchase the part of the system within their own district. Street, which is adjacent to Glastonbury, is governed by a District Council, who foster a similar view. The Glastonbury Corporation and Gas Company (both of whom had Bills before Parliament this session) have, as announced last week, entered into a covenant for the transfer of the gas undertaking; and, before a Committee of the House of Commons last Friday, Street raised certain objections to this agreement, for the ostensible purpose of getting themselves placed in a better position in regard to purchase than they were in under the Company. We can quite understand the District Council having a preference for being supplied with gas by the Company rather than a neighbouring Authority, and we have sympathy with their disapproval of the proposal that the ratepayers of Glastonbury should benefit from the surplus profits, seeing that a considerable proportion of such profits will be derived from the consumers of Street, while, if the undertaking remained in the possession of the Company, the chances would be greater of reductions in price, in which benefits the consumers of Street would share equally with Glastonbury. Thus far we go with Street; but that they should be allowed to purchase the portion of the gas pipes and mains in their district at their mere pipe value, without any other consideration, is a proposition with which we must decline to identify ourselves. For their present position, Street is entirely to blame. They knew that the Glastonbury Corporation were promoting a Purchase Bill; and, if they had gone the right way to work a few months ago, instead of waiting until they entered the Committee room last Friday, it is quite possible that there might have been a Glastonbury and Street Gas Board before the end of this year. However, under the Corporation Bill, the District Council still possess the powers of purchase that they obtained in a Provisional Order some years ago; and it will be for them to make the best use of this lever, if they desire to become partners in the concern in the future. The preamble of the Corporation Bill was passed by the Committee; but they have reserved until to-morrow morning the acceptance or rejection of clauses to be brought before them by Street embracing the following: The Chesterfield clause as to the appropriation of surplus profits, an equality clause as to price, the limitation of the reserve fund to 10 per cent., a maximum price of 4s., and the apportionment of the sinking fund between the two districts according to

the consumption of gas, so that, in the event of Street purchasing the part of the undertaking in their area, they may be credited with their share of the fund. This last requirement will no doubt give rise to some spirited argument. Mr. E. H. Stevenson and Mr. W. A. Valon were present on behalf of the parties to the transfer agreement; and Mr. H. E. Jones was retained to watch the interests of Street.

Last week attention was called to the fact that this session the term allowed for the repayment of costs incurred in the promotion of Bills has been reduced, save under exceptional circumstances, from ten to five years. In this connection it is interesting to note that the Ossett Corporation have been allowed ten years for re-paying the costs of their Gas Bill, and 45 years for the money required to complete the purchase of the gas-works. According to Mr. E. H. Stevenson, the limitation to five years will make it difficult for any local authority who acquire a small gas undertaking to derive from it, under present circumstances, any surplus profits during that period.

As originally drawn, the North Warwickshire Water Bill contained clauses conferring upon the North Warwickshire Water Company certain powers to which the Coventry Corporation objected, as mentioned last week. These clauses have now been struck out of the Bill; and the Company have undertaken to insert an additional clause saving any rights the Corporation possess to sink wells and take water from any area within their own limits. The Corporation have therefore withdrawn their opposition.

The London Hydraulic Power Company obtained an Act in 1884 which very largely extended the district in which they were authorized to supply hydraulic power, and in which district they had the usual power of water companies to break up streets for the purpose of laying pipes. In this Act there was also power to extend the mains and works outside the defined area with the consent of the Metropolitan Board of Works (now the London County Council) and the Vestries concerned. Under the Act, the mains of the Company have been laid throughout the defined area; and, with the consent of the Local Authorities, have been extended largely outside in order to supply the demand that arises from time to time for hydraulic power. Until recently all the Vestries acted in a reasonable manner as regards their consent; but some few of the Vestries during the last year or two have imposed conditions on their assent which the Company consider oppressive. A Bill was promoted by the Company this session in order to permit an appeal to the Board of Trade in the event of unreasonable action on the part of the Vestries. Many of the principal Vestries interested did not petition against the Bill; but some of the other Vestries did, and also the London County Council. The claim made by the Council was that the clause of the Act of 1884 requiring the assent of the Metropolitan Board of Works constituted a parliamentary bargain which should not be upset unless obstructive action could be shown. As it was admitted by the promoters that, as far as the County Council were concerned, they had done nothing to which the Company could object, the petition of the Council was successful; and the Committee found the preamble of the Bill was not proved.

HOUSE OF LORDS.

The following further progress was made with Private Bills last week:—

Bills reported, with amendments: Great Berkhampsted Water Bill, Motherwell Water Bill, Newport (Mon.) Gas Bill.

Bills read the third time and passed: Higham Ferrers Water Bill, Menstone Water (Transfer) Bill, Otley Urban District Council Water Bill.

The opposition to the Fishguard Water and Gas Bill, the Kingston-upon-Thames Gas Bill, and the Newtown and Llanllwchaiarn Urban District Gas Bill was withdrawn.

The Dorking Water Bill was referred to a Select Committee, consisting of Lord Clifford of Chudleigh (Chairman), the Earl of Portsmouth, the Earl of Romney, Lord Hatherton, and Lord Seaton; to meet on Thursday, March 22.

HOUSE OF COMMONS.

Thursday, March 22.

THE LONDON WATER SUPPLY BILLS.

The London Water (Purchase) Bill, the London Water (Welsh Supply) Bill, and the Metropolitan Water Companies Bill were on the paper for second reading to-day, "by order." On the order in regard to the first-named Bill being read, Mr. J. Redmond appealed to the promoters and opponents of the Bills to postpone the consideration of them, as the Irish members had obtained this day, by arrangement with the Government, for the discussion of the financial relations between Ireland and England. The Speaker asked Mr. Stuart, who was in charge of the first two Bills, what he purposed doing. He replied that the London Water Bills had been put down before any such arrangement as that referred to had been arrived at. However, he was quite in the hands of the House, and was prepared to shorten the debate or postpone it. A disorderly scene, caused by the Irish members, ensued; and eventually, on the suggestion of the First Lord of the Treasury, the debate was adjourned for a week.

Friday, March 23.

THE SUPPLY OF WATER GAS IN DUBLIN.

Mr. T. M. Healy asked the President of the Board of Trade if his attention had been called to the published report of Professor E. Reynolds, of Trinity College, Dublin (see *ante*, p. 756), warning the public of his discovery that the Dublin Gas Company, without notice to the citizens or the Corporation, had turned 17 per cent. of carbon monoxide into their mains. He inquired further whether the Board of Trade received any notice of this intermixture of water gas with coal gas in Dublin; and whether the President was aware that water gas was the most deadly gaseous poison known, was absolutely fatal to animal life, and that its use as an illuminant had been made illegal in many American States; also that leakages from the Dublin mains were constant, and that since the introduction of water gas the death-rate among the population had risen so enormously that the Lord Lieutenant had appointed a Commission to investigate the cause. He wished to know if the right honourable gentleman had any information to show whether the poison from water gas was cumulative in the human system, and whether any remedy known to science existed for cases of even partial poisoning; and if the Government would take any steps to protect the public from the admixture of this product with ordinary coal gas.

Mr. Ritchie: I have not seen the published report to which the honourable and learned member refers; but I understand that Professor Reynolds, in a lecture at Trinity College, recently made some observations as to the increased proportion of carbonic oxide in the gas supplied in Dublin, due to the admixture of carburetted water gas with coal gas. The Board of Trade received no notice of the intention of the Gas Company to make any alteration in the nature of the gas, nor are the Company required to give such notice; but they have now informed the Board that the plans of the necessary works were submitted to the Corporation, and their purpose explained. I am not aware that the use of water gas has been made illegal in any American State; but, from the report issued last year of a Home Office Departmental Committee who inquired into the question of the supply of water gas, it appears that in the United States carburetted water gas is very largely used, and formed in 1896 about 70 per cent. of the total gas supply. The honourable and learned member will, by a perusal of the report, obtain much information with reference to this interesting subject which it is impossible to summarize in an answer to his question. The Local Government Board for Ireland inform me that they are not aware whether the high death-rate is in any degree attributable to the alleged leakage of gas. The Commission appointed by the Lord Lieutenant has directed its inquiries into the general causes of the death-rate; and pending the report of the Commission, the Board can express no definite opinion on the point.

Mr. Healy asked if there was any difficulty in granting to Irish members such a Committee as that which was nominated for the London members with regard to the gas in the Metropolis.

Mr. Ritchie replied that if the honourable and learned gentleman would call at the Board of Trade, they would be glad to put before him all the information they possessed.

The following further progress was made with Private Bills last week:—

Lords Bills read the first time and referred to the Examiners: Menstone Water (Transfer) Bill, Otley Urban District Council Water Bill.

Bill read a second time and committed: Rickmansworth and Uxbridge Valley Water Bill.

Bills reported, with amendments: Hartlepool Gas and Water Bill, Morecambe Urban District Council (Gas) Bill, North Warwickshire Water Bill, Southport Water Bill, Spalding Urban District Council (Water) Bill, Wetherby District Water Bill.

The Standing Orders Committee recommended that the Portland Urban District Council should be permitted to deposit a petition for a Bill.

The Chairman of Ways and Means (the Right Hon. J. W. Lowther) reported from the Committee on the Grantham Gas Bill that a report from the Secretary of State for the Home Department relative to clause 41 of the Bill (power to inspect gas-fittings in new buildings) had been considered by them; and that they had inserted amendments in the clause providing for the statement by the Company of their requirements as regards pipes and fittings if requested prior to the commencement of the work, and as so amended had passed the clause.

The Poplar District Board of Works have presented a petition in favour of the Gaslight and Coke, Commercial Gas, and South Metropolitan Gas Companies Bill.

The Vestry of St. Mary Abbotts, Kensington, have petitioned, without asking to be heard, against the London Water (Purchase and Welsh Supply) Bills.

Kempston Gas Company, Limited.—The annual meeting of this Company was held on the 17th inst., when the Directors reported a balance of £136 available for distribution; and they recommended the payment of a dividend of 6 per cent., free of income-tax. Owing to the increased demand for gas, an auxiliary supply has been obtained from the Bedford Gas Company. The Directors believe that the abolition of meter-rents has had a good effect, and stimulated the demand for gas. The dividend recommended was declared.

Fatal Accident at the East Greenwich Gas-Works.—Last Tuesday, an inquest was held at Greenwich on the body of George Wilmot, who met his death at the East Greenwich Gas-Works. Mr. Passmore appeared for the South Metropolitan Gas Company; and Mr. Joseph Owner, Inspector of Factories, was present. The evidence showed that the crane driver was working the crane, to which was attached a skip weighing, when loaded, about 18 cwt. When the skip was about 8 feet from the bottom of the hold of the barge, the driver attempted to hoist and swing it at the same time, when the clutch came out, and the skip fell on to deceased and another man. No reason could be assigned for the clutch coming out; and nothing could be done, as the driver had one hand on the reversing lever and the other on the screw lever. He placed his foot on the brake as soon as he saw the skip going down; but it was too late. The crane was not worked regularly every day, as there were travelling cranes on the wharf. New clutches were square, and the one which caused the accident was worn at the corners. Dr. Hugh Davies deposed to deceased's external injuries, and said that, in his opinion, death was instantaneous. At the request of Mr. Passmore, Mr. J. Tysoe, the Superintendent of the Works, was examined. He deposed that the crane referred to was in good working order; and that the clutch, if properly placed, could not come out of position. The slight wearing of the clutch would not affect in any way the safety of the crane if the clutch were properly placed. He attributed the accident to the fact that the clutch had not been properly put in. The Directors of the Company were always anxious to have the best possible machinery. The Jury found that death was caused by "injuries sustained from a skip of lime having accidentally fallen on deceased while it was being raised by a crane, and that the skip fell owing to the worn condition of the clutch." It was understood from Mr. Passmore that the Company would provide for the widow of the deceased.

HOUSE OF COMMONS COMMITTEE.

Friday, March 23.

Before Mr. SCHWANN, *Chairman, Mr.* MOON, *Mr.* DOOGAN, *Commander* BETHELL, *and Mr.* BONHAM CARTER, *Referee.*)

GLASTONBURY CORPORATION GAS BILL AND GLASTONBURY AND STREET GAS BILL.

The object of the Corporation Bill was to enable the Glastonbury Corporation to buy up the undertaking of the Glastonbury and Street Gas and Coke Company. The Bill was one of ordinary purchase, and the Corporation of Glastonbury had come to terms; so that the main opposition to the Bill had disappeared. The terms of agreement were that the purchase should be under the Lands Clauses Act; that a sum of £200 be allowed by the Corporation for winding-up expenses; the Corporation to pay £625 towards the costs of the Company; servants of the Company to be protected; and the Company's Bill to be withdrawn on the preamble of the Corporation Bill being passed. The only opposition was that of the Street Urban District Council, whose district immediately adjoined Glastonbury.

Mr. WEDDERBURN, Q.C., and Mr. F. N. KEEN appeared for the Glastonbury Corporation. Mr. J. D. FITZGERALD, Q.C., and Mr. FORBES LANKESTER represented the Street Urban District Council. Counsel were reserved on behalf of the Glastonbury and Street Gas Company.

Mr. WEDDERBURN, in opening the case for the Corporation, said that the area of the Company consisted of the borough of Glastonbury and the small district called Street. The supply of gas was originally authorized in 1892, by the Glastonbury and Street Provisional Order. When the Glastonbury Corporation effected the purchase, they would acquire power over the area of the borough of Street; and after the purchase, Street would be on exactly the same terms with the Corporation as they now were with the Company. What was proposed would not affect them in the slightest, because in the present Bill there was inserted *mutatis mutandis* exactly the same clause as was in the Provisional Order of 1892, under which Street could at any time buy their portion of the undertaking. The ground of their opposition was, first, that they should have a special purchase clause—one better than they could ever have secured from the Company—which would enable them to buy the works and mains in their district at the price of old iron. Why this should be demanded, he could not conceive, because the Glastonbury Corporation had to purchase the mains from the Company, with goodwill attached, as part of a going concern. The mere fact that the undertaking was going to change hands was no ground for making an alteration in their position. Then the petitioners submitted that the proposals of the Bill were not in the interests of the gas consumers. Clause 52, they said, provided for the carrying of any surplus profit to the district fund, instead of in reduction of the price of gas; and as the Corporation of Glastonbury had no duties or obligations to perform towards the inhabitants of Street, the District Council apprehended that the interests of the consumers in their district would be sacrificed to those of the Glastonbury ratepayers. It was true Glastonbury proposed to carry surplusses, if made, to the district fund. Street said they should have a share in that. But while Glastonbury were going to pay a large price for the concern, and take a heavy responsibility, Street proposed to take no share of this responsibility. Street lost nothing, and should gain nothing. If they thought this was such a profitable undertaking that they would be able to reduce the rates, let them buy from Glastonbury, as they were empowered to do—but on the same terms as they could have bought from the Company.

Mr. *John Baily*, Mayor of Glastonbury, gave evidence in formal proof of the preamble. The position of Street was in no way affected under the Bill, because the same clause was inserted as to purchase by them as was in the Provisional Order.

Cross-examined by Mr. LANKESTER: Street was growing at a much greater rate than Glastonbury; Street being a developing place. Last year, he should say Street consumed one-fifth and Glastonbury four-fifths of the total production of gas. The negotiations for the purchase began in June last; but no suggestion was made to Street that they should join in it. The works would be managed to the advantage of Street as well as Glastonbury, because the price of gas would no doubt be reduced.

Mr. LANKESTER: When you have raised the capital, bought the concern, and paid off instalments of interest and sinking fund, and the undertaking comes into your hands, you, Glastonbury, will have it; and the Street consumers, who paid their proportion of the sinking fund and of the interest, will have no property in it?

Witness: No.

The consumers of Street will have paid the interest on capital and instalments on sinking fund; and at the end of the term, when the sinking fund has paid off the whole of the debt, they will have no property in the works they have paid for—do you think that is fair?—I think it is fair.

And also, if there are profits beyond what are sufficient to pay interest on capital and sinking fund, you think it is fair that Glastonbury should monopolize the whole of the profits?—Yes. Street consumers, however, will only pay for what gas they consume. I have not read the Bill or its provisions; but I think it a fair Bill.

Re-examined: He knew the main objects of the Bill; and the desirability of carrying it out had been discussed at many public meetings, which had approved of it. It would have been quite open to anyone from Street to have attended these meetings and discussed the Bill. The Street people could have summoned their own meetings, and taken their own course.

Mr. WEDDERBURN said if there was any question as to Street being charged a differential price, the promoters were prepared to give clauses ensuring perfect equality in the rates of charge.

Mr. *Morland*, Deputy-Mayor of Glastonbury, said the population of the place in 1891 was 4119; and it was estimated in 1899 to be 4417.

Mr. FITZGERALD said the population of Street in 1891 was 3517; and it was estimated now at a little over 4000.

Further examined, witness said the proposal of Street seemed to be a case of "Heads I win, tails you lose;" for they proposed to share in any advantage and run none of the risks of the purchase.

Cross-examined by Mr. FITZGERALD: It had always been open to Street to approach Glastonbury to join in the purchase; but they never did so. Glastonbury did not approach Street, because their Parliamentary Agent said there were difficulties in the way of setting up a joint authority. There was no provision that the profits should go in reduction of the price of gas; but there were forms of compulsion outside the Bill, in the borough, which would cause the bulk of the profit to be devoted to that purpose. The provision that the profits should go to reduce the district rate of Glastonbury was a theoretical, not a practical matter. There were about 800 ratepayers in Glastonbury; but he could not tell the number of gas consumers.

[A later witness stated that the number was between 300 and 400.]

Witness (continuing) said he was absolutely certain the profits would mainly go in reduction of the gas-rates. The Corporation were ready to bind themselves that the price of gas in Street should not be greater than in Glastonbury.

By Commander BETHELL: The Corporation of Glastonbury ran the risk of having to pay from the rates if the revenue for the next few years was not sufficient to meet the costs of the present Bill, or if the profits were not enough to pay the interest and provide for the sinking fund. The maximum price of 4s. 6d. per 1000 cubic feet in the Bill was that at which gas, until very recently, had been sold in Glastonbury.

Mr. MOON: If we authorized you to pay off the costs of the Bill in a certain number of years, would you be prepared to drop your proposal that the ultimate profits should be carried to the district fund?

Witness: I do not in that case see where the advantage to the ratepayers of Glastonbury would come in.

No; but it would be more fair to Street, would it not?—I do not think it would be fair, unless they offered to bear their share of the risk.

Quite so. They would, on the footing I propose. The cost of the Bill would be paid off out of profits; and then I suggest that, instead of the ultimate profits going to Glastonbury, from which Street obtains no benefit, there would be a reduction in the price of gas?—But in that case we might be compelled to carry on the supply at a loss.

The maximum of 4s. 6d. per 1000 cubic feet is a very high price?—But supposing we, as managing the gas-works, say we will charge 3s. 6d., we make a loss. This loss, under your proposal, would fall, not upon Street, but entirely upon Glastonbury.

But I assume you would not lower your price so as to inflict a loss?—I think a margin for possible mistakes is usually allowed in all business transactions.

You have that by the power to make a reserve fund equal to one-fifth of your capital?—I am afraid that is a little more technical than I can follow. Gas is being sold at 4s. per 1000 cubic feet, with concessions to large consumers.

Mr. *E. H. Stevenson* said it would be most inequitable that Street should be given power to purchase, not on the terms on which they would have bought from the Company, but on better terms—viz., without any allowance for goodwill. The clause was never put in now, except when one authority went into the district of another. He knew of no case in the last seven years where such a clause had been inserted. Glastonbury, when buying from the Company, would have to pay for goodwill, as regarded both Street and Glastonbury. It was not proposed under the Bill to alter the position of a single consumer in Street. He did not think the fact that surplus profits might be used to go to a reserve fund or to reduce the rate, instead of going to swell a dividend, made any difference to the consumers in Street. The Company were now selling gas at 6d. below their standard price. They could therefore divide 1½ per cent. more without making any reduction in price. There was absolutely no law which could compel them to reduce the price of gas one farthing; and they could carry forward any balance they liked. The Company had been charging 4s. 6d. per 1000 cubic feet, and only recently 4s.; so that quite lately there would have been no margin on the maximum of 4s. 6d. at present proposed. Any surplus after the purchase would go first to meet sinking fund, then to reserve fund, and finally in reduction of rates. He was certain that for the period—five years—in which the costs of the Act had to be paid off, Glastonbury would have to provide from the general rates for the gas concern; and if the price of coal remained as high as it was now, they would lose long after that period. It was not desirable that local authorities should make merely a slight profit, because this would mean that the price of gas would have to be altered from year to year with changing circumstances, which would greatly check the consumption of gas. He knew of no precedent for the suggestion that a gas authority purchasing a company should not make a profit.

Cross-examined by Mr. FITZGERALD: With reference to his last statement, he agreed there was a clause in the Chesterfield Act that the surplus (if any) should be applied in reduction of the price of gas, when and as circumstances should permit that to be done. The West Ham Gas Company was the only one which was prohibited strictly from carrying forward a profit. There the amount carried forward was to be equal to only 1d. per 1000 cubic feet; and the consequence was that the price had not been altered since 1879. With so slight a margin, they had not felt sufficiently safe to do so. The Burghs (Scotland) Gas Act said the revenue and expenditure were to be balanced as nearly as possible. This tended to continual variation in the price. The result was, he agreed, that profits could not aid the rates, but must ultimately go to reduce the price; but then there was no maximum price. Outside local authorities did not like that; and Street would not care to put themselves under Glastonbury with an unlimited price for gas. If Glastonbury could not have an unlimited price, they ought not to have the possibility of permanent loss thrown upon them. It was only honest that, if they were not to make a profit, they should not make a loss.

Re-examined: The facts of the Chesterfield case had no bearing whatever on the present one. Joint boards for gas purposes seldom lasted any length of time.

By the CHAIRMAN: Corporations very rarely carried forward balances. Sometimes they applied balances to reduce the rates, sometimes to extend the business; but if the demands of Street were granted, Glastonbury would be unable to use their balance to build up the undertaking. It was to the advantage of Street, as well as of Glastonbury, that the works should be so built up, and the capital invested not unduly increased. There were many places where the price of gas was as high as 4s. 6d. per 1000 cubic feet.

This closed the case for the promoters.

Mr. FITZGERALD, for the Street Urban District Council, said he should not call any evidence. At present there was equality between the two districts, because, under the sliding-scale, the same price must be charged throughout the whole area, and a reduction must therefore affect Street equally with Glastonbury. He had heard no reason why Glastonbury should seek to purchase the whole undertaking without consulting the Street people. In his experience, where a gas or water company supplied a large district comprising a number of local authorities, the practice was, unless one of the districts was very much larger than the others, to form a joint board, and enable all the authorities who desired to share in the joint purchase. He proceeded to inform the Committee of a number of cases in which joint boards, in regard both to the supply of gas and water, had been set up; among the instances cited being those of Accrington, Chesterfield, Hebden Bridge, and (in the present session) Airdrie and Coatbridge. In the Chesterfield case, the Company supplied the districts of a number of authorities; but some of the authorities did not desire to join, and so the board was formed of those that did. A provision was entered into that the surplus profits should go in reduction of the price of gas; and this provision operated for the benefit of every consumer, whether he dwelt within the district of one of the constituent authorities of the board or not. The advantage of a joint board was that it enabled all the parties to come in on equal terms. There was no allegation that the Glastonbury Company were not doing their duty, or were not well managed; and therefore no advantage could be gained by the transfer. He submitted that the Bill ought not to be sanctioned, if it would have an injurious effect upon Street; and it would have such effect, because, while now there was perfect equality between Street and Glastonbury, there would not be equality in the future if the Bill passed. The profit, now that the standard had been reached, must come under the sliding-scale, and (if the Company were to pay an increased dividend) go in reduction of the price; and he pointed out that of the excess profit the large bulk would go to the consumers. In the near future, the consumers of Street could look forward to a reduction of price, and to sharing largely in the surplus profits. Under the Bill, there was an end to this. There was no sliding-scale. There was a maximum price; but all profits were to go to the district fund, and therefore the consumers in Street were placed in an entirely different position, because they would have no interest at all in the profit. The only Public Act dealing with the transfer of gas companies to local authorities, directed that all profit must go to reduce the price; and this principle had certainly been recognized by Parliament. The money to provide interest and sinking fund would be paid equally by Street and Glastonbury; but at the end of 45 years, the Glastonbury Corporation would have the works free of charge—though half the money, or thereabouts, would have been provided by Street consumers. Then power was taken to form a reserve fund out of revenue, amounting to one-fifth the capital employed. One-tenth, however, was the usual proportion; and he saw no reason why it should be exceeded. This fund would also be partly provided by Street; but it would only benefit Glastonbury. With regard to the "pipe" clause, he agreed that in some cases it was inequitable. But in this instance, if they allowed the Bill to pass without it, they would do serious injustice to Street, because they would be allowing Glastonbury power to supply gas in another district against their will, without any opportunity having been given to that district to join in the purchase; and Street, if they ever wished to undertake the supply of gas, would have to buy that right from Glastonbury. This was not, however, a case in which there should be two separate gas-works; there being two towns adjoining, which together had a population of only 8000 or 9000. If the Bill passed, the chance of getting a reduction in price vanished for many years. This appeared to be a fatal objection; and he therefore asked the Committee not to sanction the Bill.

Mr. KEEN contended that the cases of joint boards which had been quoted had no application in the present case. In those instances, several authorities were combining to bear the burden; whereas here one authority alone were proposing to do so. The reason it was proposed to devote surplus profits to the reduction of the district rates, was that one authority was undertaking the whole responsibility of the purchase, and would have to meet any deficiency which might arise.

The CHAIRMAN (to Mr. Fitzgerald): Would you be satisfied with the Chesterfield clause?

Mr. FITZGERALD said that this clause would make a great difference. In further reply to the Committee, he stated that if the Bill itself were not rejected, the clauses he should ask for would be the Chesterfield clause, as to the appropriation of surplus profits; the equality clause, as to price; the reserve fund to be limited to 10 per cent.; the maximum price to be 4s. per 1000 cubic feet; the sinking fund to be divided according to proportion of gas sold between the two Authorities; and in the event of purchase by Street of their portion of the undertaking, Street to be credited with their proportion of the sinking fund. The latter was a provision which had been inserted in the Ossett Bill this session. It worked so that each authority, as the sinking fund was built up, was credited with having provided so much of the fund as was shown by its proportion of the consumption of gas. Then, if ever Street should purchase their share of the undertaking, they would be credited in the purchase with their share of the sinking fund.

The room was then cleared. On the re-admission of the public,

The CHAIRMAN said: The Committee have decided that the preamble of the Bill is proved; but we look to the opponents to bring up clauses embodying the suggestions which they have to make, and the Committee will decide what to accept or not, and the form.

The Committee then adjourned further discussion on the Bill till to-morrow (Wednesday).

At the meeting yesterday week of the Liversedge District Council, a deputation was appointed to confer with representatives of the Heckmondwike District Council as to the desirability of acquiring the works and powers of the Heckmondwike Gas Company.

It has been decided by the Lighting Committee of the Corporation of Newcastle-on-Tyne to require all tradesmen who have erected gas-lamps on the kerbs in front of their shops to keep same lighted full on during the night, or burning at least 2 cubic feet of gas per hour.

HOUSE OF COMMONS COMMITTEE.

Monday, March 19.

(*Before Sir* T. GIBSON-CARMICHAEL, *Chairman, Sir* W. CAMERON GULL, *and Mr.* HORNIMAN.)

MORECAMBE URBAN DISTRICT COUNCIL GAS BILL.

The consideration of this Bill, the opening proceedings on which were reported last week (p. 751), was concluded to-day.

Mr. BALFOUR BROWNE, Q.C., and Mr. HONORATUS LLOYD represented the promoters. Mr. MOON appeared for the Morecambe Gas Company against any alterations in the Bill; and Mr. BLENNERHASSETT, Q.C., and Mr. HULTON, for the opponents, the Heysham Urban District Council.

The CHAIRMAN informed Mr. Blennerhassett that the Committee desired that, in any further evidence which was to be given on behalf of the Heysham Urban District Council, attention should be directed to the question whether the Heysham people would be any the worse off, supposing the Bill were passed as it stood, in making a bargain with the Morecambe Authority, than they would be in bargaining with the Gas Company, with whom they would have to arrange if they wanted to start a gas-works at the present moment. Another point to which the Heysham evidence should be directed was whether, if the Morecambe people had made a bad bargain, an Arbitrator would or would not take that into consideration.

Alderman *Monkhouse*, Accountant, of Kendal, said his estimate of the total cost of buying the Gas Company under the terms proposed in the Bill was £160,000. At present, the Company had to pay interest on a comparatively small capital; but if the purchase was carried out, Morecambe would have to pay interest on a capital nearly four times as large, and redemption as well. This would compel them to raise the price of gas from 3s. 3d. to 3s. 11d. per 1000 cubic feet; and Heysham consumers would, of course, have to pay this enhanced rate. Clause 18 was unfair to Heysham, and would impose much too onerous terms upon that Authority, in case they wished to buy. He preferred the Model Clause.

Mr. *A. Silverthorne* said that, if he were sitting as Arbitrator, when Heysham acquired the right to supply in their district, he would look to the price paid by Morecambe as the first thing. Any Arbitrator would naturally assume that Parliament considered the price to be an equitable one, or it would not have passed the Bill; whereas the price was startlingly improvident, and there was no precedent for it. He unhesitatingly said that this was a purchase at the rate of 41 years. If the Model Clause were followed, Heysham would only have to pay Morecambe £2000 for the part of the undertaking within their district; but if clause 18 were adhered to, a purchase would cost Heysham £15,000. The agreement to purchase was peculiar in its terms, and would naturally lead to an extravagant price being fixed. One of the clauses said that, in the event of an arbitration, it should be an instruction to the Arbitrator "that in determining the value of the undertaking, regard shall be had to the improving value of the undertaking." The parties having agreed to terms, of course this clause had now gone; but it explained the price that had been arrived at. During the last 25 years, he had never seen any such stipulation in an agreement to purchase, except perhaps in the Yeovil case. He had taken out the profits of the Company per ton of coal carbonized. In 1897, they were over 16s., in 1898 over 12s., and in 1899 over 15s. This scale of profit indicated that something in the internal administration of the Company was not quite right. He considered, for one thing, that the undertaking was not properly assessed to the rates; it was, in fact, ridiculously under rated. With such an exorbitant profit as 15s. per ton of coal, the Company made a profit last year of £5484; but bringing the profits down to a rational standard, by properly rating the concern and so on, there should only have been a profit in 1899 of £3618. If the purchase was effected, Morecambe would have to meet an annual charge for interest and sinking fund of £7255; so that, with what he contended were the normal expenditure and the normal profits, there would be a deficiency of nearly £4000, which would have to be met either by raising the price of gas or by a rate-in-aid.

Mr. LLOYD, in cross-examination: If the District Council of Heysham were to come to Parliament desiring to get out of the Company's jurisdiction, would they not have to purchase under clause 18 or some similar terms?

Witness: They would.

The only way in which Heysham could get rid of the Gas Company's monopoly in their district, would be by buying upon these terms the part of the undertaking which is within their district?—They would not buy, because they would have to pay for the monopoly.

Do you tell the Committee that the Heysham district is in this position—that it never can hope to have gas-works of its own?—It certainly cannot. It is not large enough to do so with advantage.

In further cross-examination, witness stated that 25 years' purchase was the proper basis to take for this Company. Their earnings were well secured, but not so well secured as if electricity had not been introduced. In the Ambleside case, in which he was concerned, the Arbitrator did not take witness's view of the value of the undertaking, and awarded a sum which, though much below what was claimed on the other side, might work out to 34 years' purchase. But witness's views had since been corroborated by the fact that rates-in-aid had had to be raised. Gas could not hope to continue its successful competition with electricity if extravagant prices were to be paid for gas undertakings and rates-in-aid were rendered necessary.

In reply to an intimation from the Committee,

Mr. *Newbigging* was re-called on behalf of the promoters. He said he calculated that the first year after purchase the Morecambe Council would have to find £7249 for interest and sinking fund; and he reckoned that, putting 5s. 6d. a ton for the extra cost of coal, and allowing for the natural increase in the supply, the profits, including the savings in Directors' fees, &c., for the first year would certainly reach within £100 of this amount. He had never known a statutory concern bought more cheaply than the price agreed upon for the Morecambe Company. Very few transfers paid during the first year of the change.

Mr. BLENNERHASSETT, addressing the Committee on behalf of Heysham, said there was no public need for the Bill; and he hoped therefore the Committee would reject it altogether. But if it were passed, he trusted

the Committee would protect Heysham by imposing the Model Clause upon the promoters, in place of clause 18.

Mr. Balfour Browne, in replying for the promoters, stated that the profits for 1899 were £5484. The past year's increase was 29½ per cent.; and as the Company's business had for years been growing rapidly, he thought it would be a moderate calculation to assume an increase next year of 25 per cent. This would mean an addition of £1371. Then the Morecambe Council could raise money at a very much cheaper rate than the Company—namely, at 4d. per 1000 cubic feet, as compared with 1s. 3d.—and this would mean a saving of £779. Altogether, according to this calculation, the Council might look forward to an income of £7634 with which to meet Mr. Newbigging's £7249, without taking credit for the saving in Directors' fees, or anything of that sort.

The Committee, after a short deliberation, decided to pass the Bill, on the condition that the promoters would insert clauses dealing with the charges in Heysham, and with the objection of the Local Government Board in regard to the payment of the sums raised by the Company on mortgage.

Mr. Balfour Browne said the Lord Chairman had held that it was better to let the mortgage stand as it was.

Mr. Moon said that, the money being raised by bonds payable at variable dates, they could not be converted as suggested by the Board.

Mr. Balfour Browne suggested that the best thing to do would be to provide a sinking fund against these bonds when they fell due.

To this the Committee agreed; and also to Mr. Balfour Browne's clause prohibiting a higher price to be charged in Heysham than was charged in Morecambe under similar circumstances.

HOUSE OF COMMONS COMMITTEE.

Monday, March 19.

(*Before Sir* T. Gibson-Carmichael, *Chairman, Sir* W. Cameron Gull, *Mr.* Orr-Ewing, *and Mr.* Horniman.)

HARTLEPOOL GAS AND WATER BILL.

This was a Bill to consolidate and convert the capital of the Hartlepool Gas and Water Company, and to enable the Company to raise additional moneys in order to carry out works already authorized.

Mr. Balfour Browne, Q.C., Mr. Claude Baggallay, Q.C., and Mr. Russell Griffiths appeared for the promoters. Mr. Pember, Q.C., Mr. Wedderburn, Q.C., and Mr. Lankester represented the Corporation of West Hartlepool.

Mr. Balfour Browne, in opening the case, said the Company had done their duty in the past; and there had not been a single word of complaint made about them. The only petitioner against the Bill was the Corporation of West Hartlepool, which formed part of the district of supply; and the Corporation made no complaint. The Company was incorporated in 1846, when the population of the district was between 4000 and 5000. The capital was at that time authorized to be £9000, with a maximum dividend of 10 per cent. In 1849, the Company was re-incorporated; and £25,000 was added to the capital, also with a maximum dividend of 10 per cent. In 1855, the Company was again re-incorporated; and the capital was brought up to £100,000—the new capital (£66,000) being entitled to a maximum dividend of 7½ per cent. In 1867, another Act was passed extending the limits of supply, and authorizing the raising of an additional £100,000. This capital was entitled to a maximum dividend of 7 per cent. The Acts of 1855 and 1867 each empowered the raising of £25,000 loan capital. In 1874, the Company had an Act for water purposes authorizing new works; and in 1878, by another Act, the capital was increased to £400,000 all told—£100,000 of the new capital being relegated to gas purposes, and the other £100,000 to water purposes. This was the first time in the history of the Company that the capital was ear-marked. This new capital was also entitled to 7 per cent. In the same Act, £50,000 of loan capital was authorized. In 1890, the Company came to Parliament for power to enlarge their gas-works, but did not ask for an increase of capital. In 1898, they were again in Parliament, mainly for the water-works. The capital was then increased by £80,000, with a maximum dividend of 7 per cent., which was ear-marked for water purposes; and the Company were by the same Act empowered to borrow £20,000. As things now stood, the Company had been authorized to raise £480,000 of share capital, of which £390,000 had been paid up; and £120,000 of loan capital, of which £36,500 remained to be raised. The Bill was an absolutely essential one, as more capital was required; the population of the Company's district now numbering about 80,000. The Company wished to take power to raise £200,000 further capital, by the addition of new ordinary or preference stock, which was to be ear-marked for the gas undertaking. It was proposed to consolidate all the shares, and convert them into stock bearing dividend at 5 per cent. It did not make a bit of difference to consumers of gas whether the Company paid 10 per cent. on £100, or 5 per cent. on £200. If a man went into the market now to buy any of their £10 shares, he would have to pay a very large premium indeed—probably he would have to pay £200 for £100 worth of stock. But the public did not know this; and it led to dissatisfaction, both among the people who were consuming the gas and among the employees in the works, who said: "Look at this 10 per cent.," when in point of fact no one was getting 10 per cent., except perhaps the lucky man who was able over fifty years ago to buy some of the original stock. He was going to resist as strongly as he could any attempt to put a purchase clause in the Bill; but supposing the Local Authority were authorized to purchase, this conversion, as it was not going to increase the Company's income by one farthing, would not affect the price that would have to be paid. The petition of the West Hartlepool Corporation, while complaining that the Bill proposed to increase the capital of the Company without giving any compensating advantage to the consumers, was really a petition for a purchase clause. In 1898, when the Company were last before Parliament, the West Hartlepool Corporation presented a petition in the very same words; and the matter was threshed out before Sir James Kitson's Committee, and decided against them. It was monstrous for them to come again, and try once more the very same conclusion that was decided against them only two years ago.

Tuesday, March 20.

Mr. *W. H. Fisher*, formerly President of the Hartlepool Chamber of Commerce, and now Chairman of the Company, gave evidence as to their capital powers. Although the Company had authority to issue preference stock, they had never availed themselves of the option. The greater part of the capital now applied for was wanted for carrying out extensions of gas-works authorized by the Act of 1890. By April 1 next, the whole of the share capital granted by the Acts down to 1878 would have been issued; and all the borrowing powers up to that date would have been exercised, except to the extent of £16,500—£6500 of which was allocated to the water portion of the undertaking, and £10,000 to the gas. In 1878, the make of gas was 103,788,400 cubic feet; and in 1899, it was 400,939,900 cubic feet—the increase having been continuous throughout that period, and not sudden. The plant was now worked to its utmost capacity; and as the district was rapidly developing, an extension of works was necessary. It was proposed to raise the new capital under the auction clauses, and bring the premiums into account. Hitherto, the premiums on the gas capital had been exclusive of the amount authorized; and this was the case with the water capital until the Act of 1898. The Company had only paid maximum dividends of 10 per cent. for 7 out of the 54 years they had been in existence; and of these only the last four years had been consecutive. Back-dividends had never been paid; and, so far as he knew, no claim had been made for them. Apart from the question of consolidation, the new capital was limited to a dividend of 5 per cent. They did not want to increase their borrowing powers under the existing Acts, in consequence of the conversion of the stock; and if it were necessary, they would insert words in the Bill making this clear. The present charge for gas was 2s. 4d. per 1000 cubic feet, less discounts, which reduced the actual average charge to a trifle over 2s. In Stockton, Middlesbrough, and Darlington the gas undertakings belonged to the Local Authority; but their charges were not so low as in Hartlepool. If they were merely a Gas Company, they would like to have the benefit of the sliding-scale; their difficulty in regard to adopting it, was that they were also a water undertaking.

Cross-examined by Mr. Pember. It would do the Company a great deal of harm if they had a purchase clause hanging over them. Since 1878, they had spent £156,000 on the gas undertaking; this amount including the premiums. If they obtained the new capital with the proposed borrowing powers, amounting together to £250,000, he calculated that it would last them for ten or twelve years.

Mr. Pember: I put it to you that this new capital will enable you to keep out of Parliament for a generation?

Witness: I do not think it will last more than ten or twelve years.

Mr. *Thomas Bower*, Engineer and Manager to the Company, said that the average annual increase in the demand for gas during the last two years had been 9·2 per cent. The daily capacity of the existing works was 1,847,000 cubic feet, which, deducting 10 per cent. for contingencies, meant an available make of 1,662,000 cubic feet; and this, even with the 332,000 cubic feet of water gas which they had, would leave them very much under their maximum day's consumption last winter. In 1894, they had 6982 consumers; and in 1897, 11,497—an average increase of 12·9 per cent. per annum. Since the period when his service commenced, sixteen years ago, the gas sold had increased 183 per cent., which meant an annual increase of 11·4 per cent. On the basis of this experience, in fifteen years' time the demand for gas would reach 947 millions; and to supply this extra quantity new works capable of producing 600 million cubic feet per annum would be required, which would cost £360,000 to build. On the basis of the increase in the consumption during the last two years, the new capital would only last ten or twelve years. The price of gas sixteen years ago was 2s. 6d. per 1000 cubic feet net, as against practically 2s. now.

Cross-examined by Mr. Wedderburn: Possibly two-thirds of the consumption came from West Hartlepool. The new capital practically doubled their gas capital. During the last three years, they had paid the maximum dividend free of income-tax. The premiums on the stock sold by auction—amounting altogether to £42,000—had been spent in enlarging the works. He did not think a purchase clause should be put into the Bill; but if it were, then West Hartlepool should only "have a say in it" to the extent of two-thirds.

Mr. *Corbet Woodall* said he had read the Bill, and approved of the conversion and consolidation of the stock. This was done first, he thought, in the case of Bristol, to avoid misapprehension on the part of workmen and the public as to the actual dividend paid to the shareholders. It was much more convenient to have one class of stock paying 5 per cent., than several stocks of different denomination. So far as he could see, the conversion of the stock could inflict no disadvantage on the public. In 1898, he predicted that the Company would require more capital owing to the rate of increase of consumption. In seven years, the consumption of gas had nearly doubled. At present the works were not sufficient for the output. Last winter all the retorts were in use. It was necessary to enable the Company to carry on their work that they should be allowed to raise £250,000 additional capital, of which £50,000 would be raised by loan. The general rule of Parliament was to give a gas company as much additional capital as would meet the requirements for twelve or fifteen years. A gas company could have no interest in procuring a larger amount of capital than their necessities required. He estimated the increased consumption of gas at 7 per cent. compound; and capitalizing this for fourteen years, at £500 per million feet, would practically absorb the whole of the proposed capital. He knew the gas-works at Hartlepool. They were carried on in an up-to-date manner, and were well managed. Even if the shares should appreciate as a result of the conversion, it would not affect the selling price of the undertaking, as an Arbitrator would base his estimate on profits, and not on the market price of the shares. He objected to an alteration of the maximum price of gas. The maximum had practically nothing to do with the price charged, as was evident by the fact that the maximum in this case was 5s. per 1000 cubic feet, while the price charged to the consumer was only a little over 2s. He saw no necessity for an additional testing-station; and he was opposed to the insertion of a clause giving the Corporation an option to purchase, because it might make the Directors always work up to the possibility of an early purchase, and it would enable the Corporation, if they desired, to seize an unfavourable moment for a compulsory sale. If the Corporation were really in earnest about

purchasing the undertaking, the best way would be for them to come to Parliament with a Bill for the purpose. In his opinion, the public would derive no advantage if the gas undertaking was in the hands of the Corporation, because the Company could raise their capital at as cheap a rate as the Corporation.

In reply to Mr. WEDDERBURN, witness said he thought it would be a mistake to reduce the maximum price of gas from 5s. to 3s. per 1000 cubic feet, as the Company might, if coal kept at a high level, have to come to Parliament to increase it again, which would be very silly. He understood such a clause as was now asked for was given in the case of the Airdrie and Coatbridge Water Bill. He did not believe the conversion would prejudice the purchase of the undertaking; but even if it did, there was no reason to object to it, as the conversion was not proposed with a view to a transfer of the undertaking. He did not consider the rate of increase which he had taken was excessive, as he believed both the consumption of gas and the population of the district would go on increasing. Even the introduction of electricity, he did not believe would materially affect the consumption of gas. It had not done so in the case of his own house. He had the electric light; but his gas bill was as large as before. If the Corporation contemplated purchase next year, he denied that there was anything in the Bill to prejudice them.

The CHAIRMAN at this stage, said what the Committee would like to know was how long the proposed capital would be likely to last without a fresh application to Parliament.

Mr. *Edmund H. Stevenson* thought Mr. Woodall's estimate of £500 per million cubic feet of increase was too low in a working-class locality, and that £650 was nearer the mark. On this basis, the capital would not last more than ten years. He also gave it as his opinion that the Bill would not prejudice the Corporation in the event of their deciding to purchase.

This closed the case for the promoters.

Mr. *Macfarlane*, Mayor of West Hartlepool, was the first witness called for the petitioners. He said at their last meeting there was a unanimous feeling on the part of the Corporation that they should have the power to purchase the undertaking of the Gas and Water Company. To allow a conversion of the stock, would, he thought, be unfair as against a possible purchaser, as it would increase the value of the shares. He was quite willing that there should be a reasonable limit fixed for the power of purchase. West Hartlepool had no objection that the other areas should join in any purchase scheme. In the interest of the future population, the Corporation felt it their duty to take this step. What he desired was that the Bill should be passed with a proviso that West Hartlepool should be entitled to come to Parliament next year with a Bill to purchase the undertaking.

Cross-examined by Mr. BALFOUR BROWNE, witness admitted that when a purchase clause was asked to be inserted in the Bill of 1898, Parliament declined to do so.

Mr. *Thomas Robinson*, Chairman of the Parliamentary Committee of the Corporation, gave corroborative evidence as to the desire to purchase. They wanted a clause inserted so as to prevent the Company opposing a Purchase Bill when brought forward next year. He was willing to give an undertaking to bring in such a Bill next year to purchase the concern on fair terms.

Mr. *W. A. Valon* considered the present demand for capital on the part of the Company was excessive. All his experience was in favour of municipalities owning gas undertakings, as it usually meant lower prices to the ratepayers.

Wednesday, March 21.

Mr. WEDDERBURN, in his address to the Committee on behalf of the Corporation of West Hartlepool, said if it was to be taken that anything done on behalf of conversion was not to prejudice the Corporation, then they would not object to the conversion of the capital. But he asked the Committee to take into consideration the amount of capital now applied for. The Company wanted £200,000 additional capital for the gas undertaking. They were really asking that their capital should be trebled. Was it reasonable that, with a population of 72,000, they should ask for such an amount? Taking the consumption per head at 4500 cubic feet, this amount of capital would enable the Company to supply a total population of about 200,000. It was altogether unreasonable. In the last ten years, the population had increased by 23,000. Was it in the least likely that, within fifteen years, the population would be 200,000? The Company were asking not to have to come again to Parliament for fifty years. He submitted that the amount of capital named in the Bill was far too large. He could not understand Mr. Woodall's objection to a reduction of the maximum charge, seeing that he said it meant nothing, as, although it was at present 5s. per 1000 cubic feet, the price of gas was only a little over 2s. With regard to the option purchase clause, the Committee would see the difficulty in which the Corporation were placed this year. At the time when the Company gave notice of their Bill, it was too late for the Corporation to come to Parliament with a Bill of their own for the purchase of the undertaking, because they would have had to consult two other districts. Mr. Balfour Browne, in his opening statement, said the Corporation raised the purchase question in 1898; and as the result of the wrestle on that occasion the Corporation were thrown. This was not the fact. The point then was that there was not the requisite authority given in favour of purchase, because it was the water undertaking, and not the gas, which it was then desired to acquire; and Mr. Balfour Browne was able successfully to contend that the Corporation were not in a position to ask for purchase. This being so, they had suggested that the Committee should give them the Airdrie and Coatbridge clause; but the main point he desired to make was that nothing which occurred this year should prejudice them in the application which the Corporation undertook to make next year—the application which would be involved in bringing in a Bill for purchase. While he, as Counsel for the Corporation, gave an undertaking that they would come forward next year with a proposal to purchase either as much of the undertaking as was in West Hartlepool or the whole jointly, he asked that, of the additional capital which the Committee might empower the promoters of the present Bill to raise, no portion should be issued until the Corporation had come to Parliament with their Bill, so that every matter might be left over.

Mr. BAGGALLAY: I shall certainly not give any such undertaking.

Mr. WEDDERBURN said it would not prejudice the Company if such an undertaking were given; and the refusal to give it showed that the object was to appreciate the price at which the Corporation would have to purchase. The only excuse the Company could have for raising additional capital at once would be that they urgently wanted more works for the supply of gas. This was not so, because their own evidence showed that the works were equal to the present supply. The Company's Manager, in his examination-in-chief, was asked: "Are the works equal to the strain put upon them for the supply of gas at present?" His answer was: "They are." Even assuming there was a slight increase—an increase, say, of 9 or 10 per cent.—they still had ample works, because Mr. Bower said that last year water-gas plant had been laid down which would enable them to produce a million cubic feet per day. Thus it was perfectly clear, from the evidence of their own Manager, that the Company had got all they wanted for the moment, and from the other evidence that they still had a margin. The Company did not require any additional capital this year. He asked therefore that the matter should be left entirely open until the Corporation came forward to purchase. Nothing could be fairer; anything else would be most unfair. It had been impossible for the Corporation to produce this year a substantive Bill; therefore let them play the game fairly. Let nothing be done which would enable the Company to say that the Committee had gone into the matter and decided in any sense against the Corporation. Although raising additional capital would not prejudice the Corporation in any application they might make next year, it might possibly prejudice them in regard to price.

Sir CAMERON GULL: You are not asking us to give you the Airdrie and Coatbridge precedent.

Mr. WEDDERBURN: I am not going so far as that. I do not ask the Committee to refuse such additional capital as they think fit; but I ask that we shall not be prejudiced. Let it be understood that the whole matter is left over till next year.

Sir CAMERON GULL: In the Airdrie and Coatbridge clause, there was no restriction to the Company raising the capital authorized and going on with their works.

Mr. WEDDERBURN held that his suggestion was something less than was embodied in the Airdrie and Coatbridge clause. If, on the other hand, the Committee thought that what was given in that clause was less than he had asked, he should be content with the clause. The principle remained the same. If it were laid down, as in the Airdrie and Coatbridge clause, that next year the Company should only oppose the Corporation on matters of detail, he would be content.

Mr. BAGGALLAY: May I, before addressing you, Sir, ask whether the point as to anything in the nature of reconstruction and of raising or spending capital not taking place until the Corporation bring forward a Bill has been decided against my learned friend. Otherwise I should like to say a word about that.

The CHAIRMAN: I think the Committee would be against him on that point, and that you had better go on.

Mr. ORR-EWING: Do you agree to the proposal to insert a clause giving the Corporation power to purchase?

Mr. BAGGALLAY said he did not assent to that at all. It was assumed at once that such an instruction was meant to have some effect. Every word put into an Act of Parliament was interpreted as being intended to have some operation; and if there was none apparent on the face of it, they had to find out some meaning to attach to it. Directly they put in words of this sort, the Arbitrator would have to ask himself why they were there. Such words, being harmful and useless, would lead to litigation. The process in a case of purchase was this. The value on the market on the amount of capital had nothing to do with the matter. What a gas or a water undertaking was worth was what it would bring in per annum. It was its maintainable revenue, which was to be multiplied by a certain number of years' purchase, ascertained by having regard to the security of the revenue. The only other point was the question of capital. With a dexterity which did his learned friend credit, he said the amount of the gas capital was now only £125,000. His learned friend had evidently not read the accounts. On June 30, 1899, the amount of capital expended for gas purposes exceeded £245,000. This was a remarkable discrepancy. Under the Act of 1878, the £100,000 of capital authorized realized when sold by auction £160,000; but £60,000 did not carry dividend. Then the borrowing powers had not been taken into consideration.

Mr. WEDDERBURN remarked that his learned friend had not appreciated his point. The sum named had kept the Company out of Parliament for twenty years.

Mr. BAGGALLAY said his learned friend forgot the £60,000 of premiums and £25,000 borrowing powers, of which £10,000 had been raised. In addition, at the commencement of 1878 the Company had £60,000 which was not spent; so that they had had £235,000 to use for gas purposes since 1878. In that year, they had works above the requirements. The total amount of capital now was £250,000; but this included all premiums. By every penny that the premium was increased, so was the amount of dividend paid reduced. The Company, therefore, had no inducement to spend a penny more than was requisite. Under these circumstances, he submitted that no alteration should be made in the amount of capital which was proposed. The question was as to the sufficiency of the capital. On this point, they had the evidence of Mr. Woodall, Mr. Stevenson, and Mr. Bower. These gentlemen knew the works; and they told the Committee that in twelve years the whole of the capital would be absorbed. The only evidence against this was that of Mr. Valon, who had never seen the works. Mr. Valon, to overcome the evidence of the three gentlemen named, said he generally took 5 per cent. at compound interest as the rate for the increase of consumption; and this would mean that the capital asked for would last over twenty years. But Mr. Bower showed that between 1883 and 1889 there was an increase of 83 per cent. in consumption, or 11·4 per cent. per annum. Taking this as the basis of increased consumption for the next fifteen years, he said the demand for gas would then reach 947 million cubic feet. To supply this extra quantity, additional works capable of producing 600 millions per annum would be required; and the cost of putting up such works would be £360,000, on the basis of £600 per million cubic feet. Mr. Valon in his figures did not take into consideration anything for working capital. The view expressed by Mr. Woodall in regard to the amount of capital asked for, was fully confirmed

by Mr. Stevenson. He submitted that the amount of capital asked for was reasonable, and ought not to be altered. The Company might have to come to Parliament again for capital for the water undertaking.

Mr. PEMBER: But that is not gas.

Mr. BAGGALLAY: Whether we come for water or for gas, makes no difference. The Corporation always raise the same point. They seem to have a stereotyped petition for the purpose. In 1898, when the Company were in Parliament for water, gas was raised; and now we are here for gas, water is raised.

Sir CAMERON GULL said Mr. Woodall estimated that £150,000 would be sufficient capital for ten years.

Mr. BAGGALLAY: Of course, less capital would be required for a smaller number of years.

Sir CAMERON GULL noticed that Mr. Stevenson at once altered the basis of calculation; and, of course, the result came out differently.

Mr. BAGGALLAY did not think he could add anything more.

The CHAIRMAN said the Committee would like to hear something about the income-tax.

Mr. BAGGALLAY did not know what amount had been so expended.

The CHAIRMAN: But you do not intend to make this illegal expenditure in future.

Mr. BAGGALLAY held that the Company were entitled to pay this so long as their back-dividends did not reach the maximum of 10 per cent.; but if they paid it after all the dividends had reached the maximum, then it would be illegal.

Mr. PEMBER thought there ought to be some means of seeing that the money paid for income-tax came off back-dividends.

Mr. BAGGALLAY said that, with regard to his statement of the law as to how far the payments were illegal and irregular, Mr. Pember admitted that he had fairly put the case. With regard to the amount—altogether about £2700—which had been paid irregularly, the Company had no objection, if the Committee thought fit, to make it appear in future accounts as applied towards the redemption of the amount due in respect of back-dividends. This would be perfectly right and legal. It was purely a matter of accounting.

The CHAIRMAN: Subject to your cutting down the capital from £200,000 to £150,000, with the usual borrowing powers, we shall declare the preamble of the Bill proved.

HOUSE OF COMMONS COMMITTEE.

Thursday, March 15.

(*Before Mr.* SCHWANN, *Chairman, Commander* BETHELL, *Mr.* DOOGAN, *Mr.* MOON, *and Mr.* BONHAM CARTER, *Referee.*)

BRIGHTON CORPORATION BILL.

This Bill, which provides *inter alia* for the construction of tramways entirely in the town of Brighton, the acquisition of land for purposes connected therewith, at a cost of £200,000, and the erection of a generating station at Southwick, three or four miles outside the town, at a cost of £400,000, including purchase of land, was considered to-day.

Mr. PEMBER, Q.C., who opened the case for the Bill, said the Corporation had gone thoroughly into the question of the system of electricity to be used; and after visiting a number of towns to examine their methods of electric traction, decided to adopt the overhead-trolley system. Dealing with the petition in opposition of the Brighton and Hove General Gas Company, he said they alleged that by the use of electric power for working the tramways, very serious damage would be caused to the Company's gas mains and services lying under the roads along which the tramways are to run. In the event of an escape of electric current, these mains and services would be damaged and destroyed, the Company would suffer by the escape of gas, and grave danger of personal injury to the public and to property would ensue. The Company also alleged that damage might be occasioned to their mains and services from vibration caused by the working of the tramways, which would cause leakage of gas from the joints of the mains and services, and bring about grave danger of explosion. They opposed the power that was sought by the Corporation (as they alleged, in clause 40) to alter the position of their pipes without notice to the Company; holding that it must cause great inconvenience to the Company and to consumers. Clause 40 was, however, Counsel pointed out, the ordinary clause. If it was absolutely necessary to give special protection, the Committee would doubtless consider the point with regard to the Company's earlier allegations. What was true of Brighton must be true of every town or road in which gas-pipes were laid; and unless the Committee were going to say gas-pipes and electric wires could not lie in the same street—and he did not think they were, having regard to what had been done in London and every other town where electricity was consumed—he saw nothing special in this case. The Electric and Gas Acts contained clauses in which the utmost care had been taken that nothing whatever should be done which could possibly lead to the terrible consequences suggested. This must be a matter of clauses; but he pointed out that the General Acts required abundance of precautions to be taken to prevent either electrolysis or fusion. Moreover, clause 27 of the Bill provided ample protection—being the Model Clause which was based on the report of the Committee of both Houses of Parliament upon electric traction. This was found sufficient all over the kingdom; and he did not know what more the Gas Company could want. The wires, he added, were to be laid in earthenware pipes; so that all chance of danger, if not absolutely removed, would be minimized to an extraordinary degree.

Mr. J. E. Stafford, Mayor of Brighton, gave evidence generally supporting the scheme.

Mr. LITTLER, Q.C. (who, with Mr. DU CANE, appeared for the Brighton and Hove General Gas Company), suggested, in cross-examination, that the position of the Corporation's existing electric mains in relation to the gas-mains had not been very satisfactory to the Company. Witness thought there had been complaints on both sides, but was unable to say the Corporation had always denied liability. With their existing electric power, the Corporation could not work the tramways.

Mr. Joseph Kincaid, of Messrs. Kincaid, Waller, and Manville, said he, in conjunction with the Borough Engineer of Brighton, laid out the tramway scheme, which he described in detail. With reference to the allegation of the Gas Company that their property would be injured by vibration, he said he had constructed many miles of tramway over the mains of gas and water companies, with the consent and approval of the engineers of the companies; and there had been no complaints. As to working electric tramways over mains, he laid, in Bristol, an electric tramway over a main for nearly 2 miles; and the Engineer told him recently that there had been no bad effect. Clause 27 of the Bill, which embodied the regulations of the Board of Trade for the protection of gas-mains and other similar things, was the Model Clause for Bills of this kind.

On Friday, the Committee were engaged considering the portion of the tramway scheme affecting Dyke Road, which was warmly opposed by a number of frontagers; and this part of the case was still being heard when the Committee adjourned.

Tuesday, March 20.

On Monday and this morning the Committee were engaged with the tramway part of the scheme. This afternoon,

Mr. LITTLER informed the Committee, with regard to the important points raised by the Brighton and Hove Gas Company in opposition—one being as to an enormous electrical main running along a private road, and another as to the groining of the Company's works—the Corporation had seen their way to concede what the Company thought to be fair and reasonable terms, and clauses would be brought up at a later stage to carry out the agreement. He rather regretted, in one sense, that the agreement was arrived at, because otherwise the Committee might have had some interesting details as to electrical fusion.

Mr. PEMBER acquiesced in Mr. Littler's statement that the opposition had been withdrawn, and that the clauses would be brought up.

Thursday, March 22.

The electrical portion of the Bill having been considered on Wednesday, the case with reference to the increase of the water supply of Brighton was taken to-day.

Mr. PEMBER stated that Hove had always been supplied with water by Brighton; and the present proposal was to raise £350,000, in order to carry out works which would increase the supply (as it was estimated) to 9,800,000 gallons a day; the maximum day's demand hitherto having been 7,600,000 gallons. This increase was regarded as sufficient for the requirements of the whole area for the next twenty years. The only opposition was that of the Hove Corporation, who stated that Brighton made a large profit out of the water charges, which they devoted to the reduction of the Brighton general rates, instead of, as Hove contended should be the case, to the reduction of the water charges over the whole area of supply.

Eventually the Committee decided against the contention of Hove, and passed the preamble of the Bill relating to water.

Consideration of the clauses was then proceeded with. Clause 40 gives power to the Corporation to alter the position, *inter alia*, of gas-pipes laid in the streets—causing as little detriment and inconvenience as circumstances admit, and making full compensation for all damage. This was a clause objected to by the Gas Company. The following are the additions to this clause on which the opposition of the Gas Company was withdrawn:—

2.—Before the Corporation alter the position of any such main or other pipe or apparatus laid down or used by any such Company, they shall (except in cases of emergency) deliver to the Company to whom the same belongs a detailed description of the alteration proposed to be made, together with notice specifying the time at which they will begin to make such alteration; such particulars and notice to be given seven days at least before the commencement of the work for effecting such alteration. If it should appear to such Company that such works would interfere with, or impede, the supply of gas, such Company may, on giving notice to the Corporation to that effect by their own Engineer or workmen, do and execute such works; and the Corporation shall, on the completion thereof, pay to the Company the reasonable expenses incurred by them in the execution thereof.

3.—In the event of the works described in such notice to the Company not being objected to, the same shall be executed in accordance therewith by the Corporation under the superintendence of the Company to whom such pipe belongs, unless such Company refuses or neglects to give such superintendence at the time specified in the notice for the commencement of such work, or discontinues the same during the execution of such work; and the Corporation shall execute such work to the reasonable satisfaction of the Engineer of such Company.

4.—If any difference arise between the Corporation or the Borough Engineer and any such Company or their Engineer touching the amount of any costs, expenses, or charges under the provisions of this section to be paid by the Corporation to any such Company, or touching any work, matter, or thing with reference to such mains, pipes, or apparatus under such provisions to be done or executed by the Corporation, or the mode of doing or executing the same, such difference shall be settled by an Engineer to be agreed upon by the Borough Engineer and such Company respectively, or, failing agreement, by such Engineer as shall, on the application of the Borough Engineer or such Company, be named by the President of the Institution of Civil Engineers.

The following was also accepted (being part of the compromise with the Gas Company) as an addition to clause 51, under which works below high-water mark are not to be commenced without the consent of the Board of Trade:—

Twenty-one days' notice in writing of any application to the Board of Trade for their consent to the construction of any groyne or other protective work proposed to be constructed by the Corporation under the powers of this Act on the sea beach or foreshore and bed of the sea adjacent to the lands described in the schedule to this Act, shall be served, together with plans and sections of the intended works, on the Brighton and Hove General Gas Company by the Corporation.

The first volume of the minutes of evidence taken by the Royal Commission on the Metropolitan Water Supply has been published. It consists of 686 pages, and includes the proceedings down to the close of the 31st day of the inquiry (July 25, 1898), when the Commissioners adjourned till the following November.

HOUSE OF COMMONS COMMITTEE.

Monday, March 19.

(*Before Sir* SAMUEL HOARE, *Chairman, Mr.* ASHTON, *Mr.* SOAMES, *and Mr.* DRAGE.)

LONDON COUNTY TRAMWAYS (No. 2) BILL.—THE RIGHTS OF GAS AND WATER COMPANIES.

This is a Bill to empower the Council to employ electricity as a means of traction on the tramways which they now control, or may hereafter control. At present there are 115 miles of tramway laid in London, 72 miles of which have been purchased by the Council; and the Council, by another Bill they are promoting in the present session, propose to make branches linking up various lines in the northern district. The cost has been £1,704,000. By the end of 1903, additional tramways (30 miles in extent) will fall into the hands of the Council. The whole of the northern section (48 miles in extent) is at present leased to the North Metropolitan Company, whose lease terminates in 1910. By the present Bill, the Council seek powers to work the tramways electrically by the best plan. They propose to adopt either the conduit or the surface-contact system; but they retain the right to use the overhead system, should they find it desirable, in suburban districts. They provide, however, that they shall not adopt the overhead system without the consent of the Local Authorities. From the experience of electric traction in Glasgow, the Council anticipate an extra profit of 3·38d. per car-mile, which, on the mileage travelled, would amount to £140,000. The cost of equipping this portion electrically would be £850,000; so that, after allowing 7 per cent. for interest and sinking fund, a surplus of £81,000 would remain. Dr. Kennedy has reported on the question, and has decided, from his experience on the Continent and in the United States, that there is no difficulty in working tramways electrically in London, and that an underground system could be found which was both effective and fairly cheap. The Council are about to lay an experimental line between Westminster Bridge and Tooting, half of which will be on the conduit and half on the surface-contact system. By one or other method, Dr. Kennedy hopes to devise a scheme to work the tramways effectually and economically.

Mr. POPE, Q.C., Mr. FREEMAN, Q.C., and Mr. DU CANE appeared for the London County Council; Mr. CASTLE, Q.C., for the South Metropolitan Gas Company; Mr. CLAUDE BAGGALLAY, Q.C., for the Lambeth Water-Works Company; Mr. READER HARRIS, Q.C., for the East London Railway Company; Mr. ERSKINE POLLOCK, Q.C., for the Vestry of Hackney; Mr. PEMBROKE STEPHENS, Q.C., and Mr. VESEY KNOX, for the Wandsworth Board of Works; Mr. VESEY KNOX, for the Vestry of Battersea; and Mr. F. DODD, for the Vestry of St. Saviour's, Southwark.

Mr. *J. W. Benn*, the Chairman of the Highways Committee of the Council, Dr. *Kennedy*, and Sir *Alexander Binnie*, the Chief Engineer, to-day gave details as to the scheme.

Tuesday, March 20.

Dr. *Kennedy* was this morning cross-examined at some length by Mr. CASTLE, as to damage that might occur to the mains and pipes of the Gas and Water Companies through the leakage of the electric current. The Council had reserved the power to adopt the overhead system; but the best method was, in his opinion, the conduit system with the insulated return. This system had insulated conductors throughout, and did not use the rails or earth as a return. The possibility of electrolysis due to leakage currents was thus obviated. There was undoubtedly a chance of electrolysis due to leakage occurring from an uninsulated return. The Board of Trade regulations, however, instructed that the leakage should be found out; and he (Dr. Kennedy) believed there was not a record of a tramway working under these regulations where electrolysis had been discovered. Every line in the country was working with an earth return under these regulations. There was no case with an insulated return.

By the COMMITTEE: If these really were serious currents in the earth, it would be a dangerous matter. It had been found in America, where the leakages were very great, to be most serious.

Witness (continuing) said, in his view, there was no difficulty in preventing any such currents, or in discovering the leakage. Under existing regulations, no case of electrolysis had, to his knowledge, taken place.

Sir *A. Binnie*, in cross-examination, said all the alterations of mains and pipes had been made by the workmen of the several Companies. There had been a serious accident at Manchester, in which the Engineer was killed. This had called the attention of the gas companies to the danger; but he thought the insertion of a clause that any alteration in the mains should be made by the Company, if they so desired, would take away the controlling power of the Council as to the way in which the work should be performed.

Replying to the COMMITTEE, witness said the alteration of the tramways would not interfere with the water-pipes at all; but it would with the gas-pipes.

At the conclusion of the promoters' case, the opposition of the East London Railway Company was considered.

Mr. CASTLE then addressed the Committee on behalf of the South Metropolitan Gas Company. He said there were two points which raised very important questions. The County Council were seeking to introduce, to an unprecedented extent, electricity as a motive power; and one of the effects of this, unless the current was under perfect control, was that there was a possibility of escape which might produce a vast amount of damage to underground pipes and mains. They had not had in this country, up to the present time, sufficient experience of what electricity could and might do with regard to electrolysis, as a means of eating and wearing into iron pipes below the surface of the ground; but great mischief had admittedly been done in the United States. There was the possibility that similar results might occur in London; and the Company had, therefore, come to ask from Parliament that protection to their mains to which they were entitled. If the Council were right, that the regulations of the Board of Trade would prevent injury to the mains, then a protection clause would be inoperative. But if, on the other hand, leakage occurred, and harm was done, they would obtain compensation from those who should give the compensation, without having to consider whether it was the fault of the Board of Trade in not having made proper regulations, or the fault of the Council in not having followed the regulations. The Board of Trade, he was informed, had not carried out the recommendation of the report of 1898, which advised that there should be a clause inserted giving them full power of supervision and control. No such clause was in the present regulations, which were not of 1898, but of 1894. The Company did not wish to bring in the question of the Board of Trade. They said: "You are introducing, for your purposes, an unreasonable amount of electricity. If that electricity escapes and does us damage, let us be compensated." This protection was necessary for the public, as well as for the Company. He asked, therefore, that the Council should insert a clause in their Bill to give the Company full compensation for any injury to their pipes or mains by electrolytic action. Then as to the second point, the Company wished to have confirmed by Parliament what was admittedly the practice—that they should be entitled to do the work which the Council required done in connection with their mains. The interference of the Council's men would be a positive danger to the public; and so the Company asked for a clause to protect them from such a contingency.

Mr. *C. C. Carpenter*, Chief Engineer of the South Metropolitan Gas Company, was called in support of the claim. He said the Company's area of supply was 50 or 60 square miles. He had seen the clause giving the Council power to alter their pipes and mains. If this work were carried out by the Council, he should decline the responsibility of supervising it. Even with experts, the operation was dangerous. Such work had invariably been done by the Company themselves. Since the Tramways Act of 1870, there had not been a case in which a Tramway Company or the Council had ever attempted to alter the pipes. Indeed, he was ignorant that they had any powers under their Acts to do so. The Company had been so impressed with the danger, that they had opposed all Bills in Parliament this session which contained a clause to that effect. This was the first time the matter had come before Parliament. The work of altering mains and services required to be done by trained men, and under expert supervision. This question of electrolysis had been brought under his notice by experience abroad—particularly in America. Other corporations were now considering the question. It was not that the regulations were ineffective, but that there had not been sufficient opportunity of testing them.

By the COMMITTEE: He did not know any case where a clause had been given to a gas or water company with reference to damage by fusion. He only knew that damage had arisen.

Mr. BAGGALLAY, for the Lambeth Water Company, said the question taken up was in the nature of a test case. Through the Lambeth Company, the London Companies were acting in concert. There were two questions; and they were both very important. One was whether there should be a liability on the part of the London County Council to pay compensation in the event of damage being done; and the other, whether the work which had to be done in the way of altering the mains of statutory bodies having statutory obligations to the public should be done by the bodies who were responsible or by some foreign body. The County Council and the Local Authorities had no power at present to interfere with the pipes or mains of either of the Companies. If they obtained any authority in the future, it would be simply the power conferred upon them by the Act which they (the Committee) sanctioned.

Mr. FREEMAN: Under the Tramways Act, they have power.

Mr. BAGGALLAY said Parliament only gave the power under the Tramways Act by passing the Special Bill which made it applicable; but until the Bill passed, neither County Council nor Vestry had power to touch any mains or pipes. The first point he would deal with was whether they should or should not have a compensation clause. Mr. Benn had said if they were not protected they should be; and he (Mr. Benn) said he had been advised that the clauses of the Bill with regard to electrolysis and fusion sufficiently protected the Company. This question could only be determined by the test of experience; and that experience they had not now. The question then came to this: Are the regulations which have been already made, or which can hereafter be made, sufficient protection? This was the whole point in determining whether they should have a compensation clause. If the regulations were sufficient, and they were complied with by those working the trams, then under the clause the Council would incur no liability to pay compensation. Then if they assumed that the regulations were sufficient, and were not complied with, the Companies would have the right to compensation under the general law. But, in the third contingency, where the regulations were insufficient though properly complied with, a compensation clause was absolutely necessary to do justice to the parties injured. If the Council complied with the regulations, they would be protected by their clause, and no action would lie. This was the case they wished to urge—the contingency of the regulations proving insufficient. They had been, he believed, framed as well as they could be; but admittedly they could not meet all cases. The learned Counsel quoted the evidence of Sir W. Preece before the Joint Committee, in 1898, and the report of the Committee, which said: "The clauses which protect gas and water pipes have worked satisfactorily, and should be continued; but the Committee would direct attention to the observations of Mr. (now Sir W.) Preece, as regards the difficulty arising from the working of tramways by trolley wires. His suggestion as to a strong control clause should be carefully considered." Nothing, however, had been done to alter the regulations then existing; so that there were still contingencies. The Companies did not know what their risk might be; they did not even know what system the Council would adopt. The Council were still experimenting; and Parliament should in equity take care that if the Companies were damaged by their action, provision should be made for compensation. The learned Counsel then dealt at some length with the question of the alteration of pipes; urging that the fact that the Local Authority always asked the Companies to move their own mains, was the strongest evidence of the necessity of their clause. Considering their obligations to the public, it was only right the Companies should have the protection they asked.

Replying to a question from the Chairman, Mr. BAGGALLAY said he could not at the moment give the Committee any precedent for the introduction in a Tramway Bill of a clause such as he desired. This was, he believed, the first time it had been asked for. Anyhow, it was the first time electric traction had been introduced into London.

Mr. *James Swinburne* said he had gone into the question of the damage that was likely to arise to gas and water mains from electric tramways

being carried over them. In little towns the Board of Trade regulations—which were intended to deal with small systems—would, he thought, protect gas and water pipes sufficiently; but in a large system like that proposed in the present Bill, there was no saying how far the pipes might be attacked. They certainly would be attacked to some extent. It was a matter of degree; but as the attack was a very insidious one, it was very difficult to tell how much damage could be done before it was found out. The damage was spread over the whole system. One could not find out anything, until suddenly a pipe went somewhere; and then all the pipes might be discovered to be bad. Insulated returns would practically get over the difficulty; but by any other method, the pipes would be liable to danger.

Mr. Baggallay: Is there any machinery provided by the regulations of the Board of Trade which would ensure discovery of electrolytic action.

Witness: No; there is none known yet. You cannot tell whether there is any electrolytic action until you find it has taken place.

Until the mischief is done?—Yes; practically.

Is it silent and secret?—Yes.

And continuous?—Yes; because it is obvious you cannot go and bore holes all over towns, and connect little pivot wires with your mains, to know what is happening. I am dealing with practical methods.

Then if Dr. Kennedy said that there was machinery in the regulations for discovering the action of electrolysis at once, you differ from him?—I respectfully differ. I mean Professor Kennedy is a great authority.

In cross-examination by Mr. Du Cane, witness said he could not agree that for all practical purposes the Board of Trade regulations would prevent electrolytic action. The regulations were aimed to make the action as small as possible; that was all he could say. He did not maintain that they were perfect. Personally he did not know of any case of electrolytic action where a tramway was working under the Board of Trade regulations.

In re-examination, witness said the regulations had been in operation since 1894. Electric tramways had been of very gradual growth; but they were going ahead tremendously now. They had a very small and limited experience of the effect of electricity; and he thought the Companies were, therefore, entitled to be protected if electrolysis set in.

By the Chairman: The ordinary wear and tear of pipes was nothing to what would be due to electrolysis. He could not give cases where he had seen damage done. In fact, the damage done by existing tramways would not be known yet.

By the Committee: There were no means of finding a leakage of current that left the rail, went to a pipe, and then returned to the rail. The only way would be to see the injury done to the rail itself. This was to some extent a safeguard.

Wednesday, March 21.

Mr. Vesey Knox to-day addressed the Committee on behalf of the Battersea Vestry; and Mr. Pembroke Stephens followed for the Wandsworth Board of Works.

Dr. *Kennedy*, re-called by the Chairman, said he estimated the cost of the electrical equipment of the London tramways would be £14,450 per mile of single track. This included the whole cost of lines, rolling stock, and generating station. The total length of tramways was equal to 207 miles of single track. The sum he named was for the conversion of the lines. At present only 72 miles had been purchased, which had cost £1,704,000.

Thursday, March 22.

Mr. *H. E. Haward*, the Comptroller of the County Council, was examined as to the financial arrangements of that body. Their loans were borrowed with the approval of the Treasury, and were sanctioned by Parliament in their annual Money Bill.

Mr. Pope then replied on some points of the case suggested by the Chairman. As to the Gas and Water Companies, they claimed that the Council should guarantee that no injury should be done by the trams to their pipes and mains. Other causes than electrolysis affected the life of the pipes; and the Companies had no monopoly of the road, but where only entitled to a user. He agreed that the Council would be liable if they did not take the best means of preventing damage; but what was asked was that the users of electricity should be liable to damages whether they employed the best methods or not. This liability did not exist. Ought it to exist? They were willing to come under the liability if they did not obey the regulations; but they should not be asked to do more. It was admitted that there was no risk of electrolytic action if the conduit system with an insulated return was adopted. There might be some danger in the surface-contact system; but Mr. Swinburne had agreed that he had never known of injury where the Board of Trade regulations had been carried out. The learned Counsel asked the Committee to remember that all the Bill proposed to do was to change the mode of traction.

The Chairman, after a short consultation with the Committee, said: The Committee wish me to make a few remarks with reference to our decision, as the matter is one of considerable importance. By this Bill, the London County Council apply for authority to use electric power for traction on their tramways. As the estimated amount of the expenditure contemplated by the Bill is £3,000,000, the proposal is by far the largest and most important of its kind which has yet been before this House. The petitioners against the Bill are the Vestry of Battersea, the Wandsworth District Board of Works, the Vestries of Hackney and Southwark on clauses, the East London Railway Company, the Lambeth Water Company, and the South Metropolitan Gas Company. Of the forty Vestries whose districts are represented on the London County Council, all have agreed to the provisions of the Bill, with the exception of Hackney, Wandsworth, Battersea, and, possibly, on clauses Southwark. The Committee are satisfied that if London is to have the full advantage of electric tramways, it will not be desirable that special provisions should be introduced into the Bill for the protection of the three Vestries which have petitioned. The Committee are influenced in this decision by the fact that Hackney has six members, Wandsworth two, and Battersea two on the County Council; so that if any grievance arises in their districts, they have equal opportunity with other districts represented on the County Council of bringing that grievance forward before the County Council. In reference to the petitions of the Gas and Water Companies, no evidence has been placed before the Committee as to any cases of loss in this country sustained by fusion of, or electrical action on, gas and water pipes. The Committee are satisfied that the provisions of the present Bill and the enactments of the Tramways Act, 1890, with the fact that the London County Council are subject to the Board of Trade, both as to the approval of their system of traction, and as to regulations that may from time to time be laid down, make every reasonable provision to meet the contention of the two Companies. The Committee, with these remarks, find the preamble of the Bill proved.

The Committee then proceeded to consider the various clauses of the Bill.

HOUSE OF COMMONS COMMITTEE.

Wednesday, March 21.

(*Before Sir* T. Gibson-Carmichael, *Chairman, Sir* Cameron Gull, *Mr.* F. J. Horniman, *and Mr.* Orr-Ewing.)

SOUTHPORT WATER BILL.

This was a Bill having for its object the granting of further powers to the Southport Water-Works Company. It included the construction of a new service tank at Aughton, with a high-level pumping-station, and the raising of £60,000 of additional capital. The petitioners against the Bill were the Corporation of Southport, the Southport and District Property Owners' Association, the Rural District Council of West Lancashire, and the Urban District Council of Birkdale.

Mr. Balfour Browne, in opening the case for the promoters, said the works proposed would be subsidiary to, and in connection with, existing works, with a view to giving a better pressure of water to some of the districts supplied. The additional capital of £60,000 would be raised by the creation and issue of new shares. This was a perfectly legitimate extension of existing works and extension of capital; and why anybody should object to this, it was difficult to see. As to the opposition of the Southport Corporation, this body wanted a clause by which the Company should be compelled to sell, and the Corporation should have the power of purchase. This was an absolutely unprecedented proposal in the case of a Water Company. It was alleged that the Bill was promoted for speculative purposes and not in the interest of the ratepayers; but he really did not know what this meant. This was a genuine promotion, and not a speculative one. As to the petition of the Urban District Council of Birkdale, it alleged that the inhabitants of the Birkdale district would be injuriously affected by the provisions of the Bill. It was submitted that provision should be made in the Bill for restricting the amount of capital authorized to the sum likely to be required in the near future; and that the proposed power to convert the loan capital into share capital should be omitted. But the most important paragraph in the petition was that which complained of the quality of the water supplied by the Company—particularly in regard to its hardness; and it was suggested that the Company should be required to take proper steps to efficiently soften the water before it was supplied for consumption.

Counsel for the Birkdale Corporation said that the part of the petition which related to the hardness of the water would not be pressed.

Mr. Balfour Browne added that another proposal of the petitioners was that provisions should be inserted in the Bill requiring the Company to sell to the petitioners so much of the undertaking as related to their district, upon terms and conditions which, while not inflicting any hardship or loss upon the shareholders of the Company, would not impose an undue burden upon the ratepayers of the district.

Mr. *Henry Rofe*, General Manager of the Company, said it was the West Lancashire Rural District Council who complained of the ineffective pressure; but the contemplated works would make the distribution more effective than at present. The Company had always been able to assure a supply day and night; and the proposed duplicate plant was to enable them to meet requirements up to the total possible amount. He calculated that the additional capital would last for eight or ten years to come. The cost of softening the water would be very great. He did not know any single company or corporate water undertaking as efficiently conducted as the Southport Water-Works.

In cross-examination by Mr. Freeman, witness said that, in his opinion, increased storage was necessary.

Thursday, March 22.

Mr. Honoratus Lloyd pointed out that in one or two of the petitions certain allegations of discourtesy on the part of the Company's officials were made. He desired to know if these charges would be pressed, because, if so, it would be necessary to call the officials against whom the charges were made.

No reply was made by Counsel for the petitioners.

Mr. *Joseph Holland* was called by Mr. Lloyd Thompson, and said he had heard of no complaints from consumers, either in regard to himself or other officials of the Company.

It was here stated by Counsel for the petitioners that they did not intend to further pursue this portion of the case against the Bill.

Mr. *Peter Balmer*, a property owner in the neighbourhood of Aughton, and Vice-Chairman of the Aughton Parish Council, said the opposition of the West Lancashire Rural District Council came as a surprise to many members of the Aughton Parish Council. Aughton had been well served by the Company, who had practically made the place since 1872. There was great need at present of increased pressure.

Mr. *Charles Hawksley* described the proposed extension of the works at Aughton, which he said would, when carried out, enable the Company to give a proper supply of water to every consumer in the area. The amount of capital sought to be raised was £60,000 in shares, and £15,000 by way of loan. The Company's mains must be extended in the near future, if they were to fulfil the obligations placed upon them by Parliament. So far the Company had performed their duties with satisfaction. They would, however, have to come to Parliament again in seven or eight years, as new mains would be necessary. The estimated cost of the proposed works was £28,400—for the tower and tank £4000, and for the other portions £24,400.

Mr. *C. M. Eaton*, said the Company's charges were slightly above the

average; but they had, by concessions voluntarily made by the Company, been brought down to or below the average—at least for houses under £8 in value. He considered that the regulations of the Company were both reasonable and proper. It might be contended by the Southport Corporation that the proposed new works were unnecessary; but it would be unreasonable to reject the Company's Bill on that account, because the price of the undertaking would not be affected in the event of the Corporation obtaining compulsory purchasing powers.

This closed the case for the Bill.

Mr. Worsley Taylor, in opening for the petition of the West Lancashire Rural District Council against the Bill, said no charge of misconduct was made against the Company. He, however, contended that the policy of Parliament was to give to local authorities the power to supply water; and many companies had agreed to transfer their undertakings, because they feared if they refused to do so Parliament would order the transfer. If the supply were left in the hands of companies, the user of the water would be stinted and restricted; whereas local authorities having charge of the supply would encourage all proper use of the water, in order to improve the sanitary condition of their districts. No suggestion had been made in the present case that the transfer would lead to hardship; and the common-sense view of the matter was not to adopt such a course as would necessitate litigation next year.

Mr. *A. Dickinson*, Clerk to the Council, in reply to Mr. Vesey Knox, said that, for a few years at any rate, none of the proposed works were of an essential character. The Council he represented considered it was beneficial to the public at large that water undertakings should be controlled by the local authority. His Council had an agreement with the promoters by which the water-rate could not exceed the amount at present charged.

In answer to Mr. Lloyd, witness said the Company had behaved admirably towards his district, and he had no fault whatever to find with them.

Mr. Horridge, on behalf of the Birkdale Urban District Council, said although Southport and Birkdale were fighting each other last week in regard to the question of the gas supply, Birkdale desired to support the Corporation of Southport in every way they could in the taking over by a Joint Board of the water undertaking. They had agreed to the promotion of a Bill next session to constitute such a Board—power being reserved to the Birkdale Council to purchase their portion of the works if they so desired.

Alderman *Griffith*, Mayor of Southport, examined by Mr. Pope, said Southport was practically unanimous in favour of the acquisition of the water undertaking. The Corporation had been contemplating purchase since 1867.

The Committee having deliberated in private,

The Chairman said: Subject to certain provisions, we find the preamble of the Bill proved. First, the capital to be reduced to £40,000, and the usual borrowing powers; secondly, the money borrowed, as well as the new shares, to be subject to the auction clauses; and, lastly, a clause to be inserted providing that the powers bestowed by this Bill shall not enhance the value of the undertaking in the event of purchase under a Bill next session by the combined Local Authorities, except so far as the money that may have been actually spent on works at the time of the purchase.

Mr. Balfour Browne said the promoters would bring up a clause next morning which would carry out this decision.

The Committee then adjourned till next morning, when the clauses were adjusted, and the Bill ordered to be reported.

HOUSE OF COMMONS COMMITTEE.

Tuesday, March 20.

Before Mr. Lewis Fry, *Chairman, Sir* John Kinloch, *Mr.* Cornwallis, *and Mr.* Trevelyan.)

NORTH WARWICKSHIRE WATER BILL.

This Bill proposed to enable the Company to increase their capital by £48,000, with £12,000 borrowing powers; to extend the limits of supply to a number of rural districts in the neighbourhood of Coventry and Birmingham; and to construct the necessary works, consisting of wells and reservoirs, for the supply of the extended district. In the course of the proceedings, it transpired that there was no opposition to the preamble, and that the main contest was on the question of the term within which the Local Authority should be allowed to purchase the works.

Mr. Balfour Browne, Q.C., Mr. Wedderburn, Q.C., and Mr. W. H. Leese represented the promoters. The opponents were the Meriden and Solihull Rural District Councils, for whom Mr. Forbes Lankester and Mr. Bassett Hopkins respectively appeared.

Mr. Balfour Browne, in opening the case, said that most of the Local Authorities were in favour of the Bill, and that an arrangement had been come to between the County Council and the promoters that the Company should be allowed to supply for 25 years, after which any of the Local Authorities should be at liberty to acquire the portions of the undertaking within their districts. These were terms which, he thought, ought to satisfy all the opponents; but the two District Councils wanted what he regarded as unreasonable—they wanted the right to purchase the works at any time. This was contrary to every precedent and every principle of fairness. The Company were quite prepared to embark the shareholders' money in the works if, as in the case of tramways or electric light, they were allowed a certain time to recoup themselves; but no one would invest his money unless he saw that there was a chance of getting some return for it.

Mr. Lankester said that was not the case of the opponents. In the clause which they suggested, they proposed to purchase the "undertaking;" and if there was any value in it, they would certainly have to pay for it.

Mr. Balfour Browne said that, even though the "undertaking" were purchased, it might be that the Company had just put down £1000 worth of pipes, and had not even commenced to supply, in which case there would be no value in the "undertaking." They must have some continuity of tenure.

Formal evidence was tendered in support of the preamble.

The Chairman inquired if Solihull objected to be included in the Bill.

Mr. Bassett Hopkins said they did not object to being included, if they obtained the right to purchase when they were so advised, because there would be a proposal at some future time for joint action, and they might at some later period be able to combine their interest with the interest of the city of Birmingham, and thus be partakers in the advantage of a great public supply from Wales. They did not want to be bound hand and foot to the Company for ever, or even for 25 years. They wished to be in a position to buy at any time that they desired.

Sir J. Kinloch: If the conditions you ask should be applied to all the other districts, it would be impossible for the Company to succeed. No one would invest his money.

Mr. Lankester admitted that they all ought to have the same sort of right; but if protection were given only to the two opposing districts, they would be satisfied. There was not the slightest doubt that Birmingham wanted to supply the whole of the Solihull district (as they now supplied a part), as soon as they conveniently could, and that the district would prefer to be supplied with Welsh water rather than with water pumped from wells by the Company. He suggested that the purchase term should be reduced to ten years.

Mr. Balfour Browne said that if this concession were made to the two opposing districts, when the Bill came before the House of Lords they would have all the other districts seeking to obtain similar rights.

The Chairman said they might assume that, whatever clause the Committee adopted, it would be a general one, applying to the whole of the area.

The Chairman, after deliberating with the Committee in private, declared the preamble proved. As regarded the power to purchase, the Committee thought a general clause should be adopted applying to all of the rural districts; and they proposed to reduce the period from 25 to 10 years.

Other protective clauses asked for by the petitioners—relating to an indemnity for the abstraction of water from existing wells and springs, and to a waiving of the charge in case the water supplied by the Company should not be of a potable character—were rejected by the Committee; the Chairman declaring on the latter point that the consumer was sufficiently protected under the general law.

The Bill was then ordered to be reported for third reading.

HOUSE OF LORDS COMMITTEE.

(*Before Lord* Windsor, *Chairman, the Marquis of* Granby, *Lord* Newton, *Earl* Lucan, *and Earl* Verulam.)

HIGHAM FERRERS WATER BILL.

By this Bill, which came before the above-named Committee of the House of Lords on Tuesday last, the Higham Ferrers Water Company sought power to construct works for the supply of water to Higham Ferrers, in Northamptonshire, and adjacent villages. At present, the district is supplied from shallow wells. The works have been designed by Mr. Thomas Hennell. It is proposed to impound the waters flowing from about 2000 acres, by an embankment 32 feet high across the valley. The rainfall of the district has averaged 26 inches for 25 years; and the Engineer anticipates getting a supply of 650,000 gallons a day. There would be a reservoir of a capacity of 131,000,000 gallons, or 262 days' storage at 500,000 gallons daily, which he considered would be an ample supply. The water would be filtered at the storage reservoir, and pumped into the service reservoir. It was not proposed to pump any spring or underground water. The capital of the Company was put at £72,000. The estimated cost of the works was £25,000, of the mains £22,000, and of the branches £20,000. The original Bill gave no allowance for compensation water; but the promoters expressed their willingness to consider any suggestion of the landowners in this direction.

The need of a water supply was proved by Mr. Palmer, Mayor of Higham Ferrers, Mr. Owen Parker, the ex-Mayor, and Dr. Crewe, the Medical Officer of Health. The only opposition was from the local landowners, who contended there was no public necessity for taking the water, spoiling the brooks, and depriving them of their rights. The Committee ultimately passed the preamble of the Bill subject to a sufficient and satisfactory compensation clause. It was agreed that the Company should give compensation water to the extent of 100,000 gallons a day, with the addition of an extra provision of 100,000 gallons for the ten days in the year when the sheepwashing is in progress. The Bill, as amended, was ordered to be reported to the House.

The Waste of Water at Epsom.—At a recent meeting of the Epsom District Council, the important question of the water supply of the town, about which many complaints have been made, came up for further consideration. Some time ago, Mr. Graham, Engineer of the Sutton Water Company, was appointed to investigate the matter. As the result, he found that 60 gallons of water were being consumed, or wasted, daily per head of the population. A waste inspector was subsequently appointed, and in the month of February he served 81 notices. He found in one place that there were 700 gallons of water per hour running to waste, and close by 520 gallons. All the mains, however, were sound; therefore the waste occurred between the pipes and the consumers, but it did not rest with the latter entirely, as the Council had allowed certain things to accumulate which ought not to have existed. Of the 81 notices, 34 had not been complied with, and 22 of the houses belonged to one owner. Mr. Graham had attended a meeting of the Water Committee, and recommended that every house should have a separate supply, and that wherever stopcocks were difficult to get at, or were faulty, they should be remedied. This the Council agreed to do. When the matter was attended to, Mr. Graham was quite certain that they would have as much water as they could possibly need for very many years to come. Mr. Aston, who brought these facts before the Council, said they were beyond argument, and showed that it was possible, by husbanding their resources and exercising their powers, and also by enlisting the sympathies of the ratepayers, to about halve the quantity of water consumed. If they did this, he was confident that in the future they could look forward to having practically an abundant supply.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE (IRELAND)—CHANCERY DIVISION.

Saturday, March 24.

(*Before the* MASTER OF THE ROLLS.)

Alliance and Dublin Consumers' Gas Company v. County Council of Dublin—Damage to Gas-Pipes by Steam-Rollers.

This case, the proceedings in which were reported in the "JOURNAL" last week (p. 752), was decided to-day.

The MASTER OF THE ROLLS, in giving judgment, said he had no doubt the injury at Cabra Road was caused by the use of the steam-roller; but he was not sure it might not have been caused by ordinary traffic. What was called by some of the witnesses a syphon-box, but what was in reality a pressure-box, was set there to test the pressure of the gas supplied in the mains. This box was, in his opinion, placed too near to the road surface; in fact, it was actually above the road—some of the witnesses stated 2 inches. This, of course, was improper, and on a public road would be a nuisance; and he was not satisfied that the box was properly fixed. Not as a matter of law, but of common sense, such appliances should have a secure foundation of concrete, brick, or other firm material which would prevent them from being forced down on the pressure-pipe. At the same time, he did not believe it was left, as had been suggested, resting on a bunch of hay; but he declined to hold that in this case the damage resulted from anything special or peculiar to the steam-roller. The injury at Kilmacud was caused to a main on the slope of a bridge over the Dublin, Wicklow, and Wexford Railway. It was said there was no proof that the roller had been seen there after the 3rd of October; and as the first complaint was not made until the 23rd, the injury could not have been caused by the roller. Mr. Collen, while not admitting that it was broken by the roller, did not take up the position that the roller had not been there, or could not have caused the damage, though he did not think it improbable that it might have been caused by a cart. His Lordship, however, found the roller was on the road about the time stated; and he was much struck by the fact that the defendants could have proved that it was not to blame by establishing an *alibi* for it, or by proving that it did not pass over the pipe. While they gave an amount of skilled evidence, they did not produce the drivers of any of their rollers. He thought the main was broken by the roller; but whether the defendants were responsible or not was a different question. The injury to the service-pipe at Sydenham was practically admitted to have been caused by the defendants. There was no evidence of there having been much traffic recently on the road in question; while the roller was undoubtedly working there. At Overton there was no evidence that the pipe was actually broken. It was drawn at its junction with the main. As to the injury at Harold's Cross, though liability was admitted, it was right to say that the explanation given was that the Tramway Company had opened the ground over the pipe, and had filled it in so loosely that Mr. Collen, sending the steam-roller to consolidate the road surface, and finding the subsoil soft, placed stones on it, which, being crushed in, caused the mischief. This explanation was hardly satisfactory. The main being 18 inches down, he (his Lordship) could not treat it as an unqualified admission, and the use of rollers, themselves unfit and unsuitable, as an accident of an isolated character. The main contention was that the defendants were not liable—the mains and pipes having been improperly laid, so as to be unsafe. He was of opinion that there was no negligence attributable to the defendants in the management of their steam-rollers. It was not shown that they worked them in an improper manner, or that they were improperly constructed, or heavier than those used elsewhere. Still less was it the case that they brought the rollers there, knowing where the pipes were, and not caring whether they injured them or not. The action was not really brought in respect of negligence in that sense. The only negligence in question was that with which the plaintiffs were charged—and it was relied upon by the defendants—that the mains and pipes were laid unduly near the surface of the road. That the damage would not have happened had they been laid at a greater depth seemed reasonably clear. The law furnished but one test as to what was and what was not the proper depth—viz., that it must be such as to render the mains and pipes safe from injury by ordinary traffic in the district in which they were laid. Several witnesses had been examined on both sides, some of them of great experience; and, in reference to Mr. Collen, he desired to repeat what he said during the trial, that he did not remember having seen a scientific witness—particularly one personally concerned in the case, as he was from his position—whose evidence was given with so much complete candour and fairness. By this he did not mean that he was a witness for the other side, but that he had told the truth. The witness, however, seemed to be under a misapprehension as to the law. At one time he thought, the use of steam-rollers being lawful, the defendants had the right to use them regardless of anyone. Other witnesses for the defence were of opinion that the mains and pipes were not placed deep enough; and perhaps he (his Lordship) would not be prepared to differ greatly from that. What was ordinary traffic to-day might not have been ordinary traffic ten, twenty, thirty, or forty years ago. Most of the witnesses for the defence included steam-rollers as ordinary traffic; but this was an entire fallacy, as these pipes were laid at a time when steam-rollers were not used, and traffic then included no such weights. The pipes and mains must have been properly laid then, because it appeared that they had stood the test of ordinary traffic during that time. When the first roller came on the road were the Gas Company to relay their pipes? This would mean ruin to the Company. Or were they to go after the rollers and patch and repair the injuries from time to time caused by them? That would be equally ruinous and disastrous. Their pipes and mains were adequate for a period approaching forty years. For the whole time not a single breakage by ordinary traffic had been proved. In his opinion, the use of the pipes for upwards of thirty years was far more convincing than any amount of mere opinion as to what ought now to be done. He considered, as a matter of fact, that the pipes were laid, though not so deep as more modern engineers would require, sufficiently deep to bear the ordinary traffic of these roads. The Grand Jury themselves, who were the road authority until quite recently, were entirely, in his opinion, committed to this view. Assuming that they took the most elementary view of what their duty was, they must have seen that the pipes were properly laid, as they were in the first instance. The law applicable to the case admitted of no dispute. A person who used a public highway was bound to do so with due regard to the rights and interests of others. If he employed for his own purposes a vehicle of unusual or extraordinary weight, or one carrying unusual and extraordinary loads, he did so at his peril, even if the user of such a vehicle was not in itself a nuisance or otherwise unlawful. In the present case, the user of the steam-roller could not be said to be in itself unlawful. Mr. Collen thought that he had absolute control of the roads, and that it was the business of the Gas Company to look out for their pipes if they came in the way of the rollers. Possibly the plaintiffs also went too far on the other side when they replied that the defendants were acting illegally in using the roller, though they may have only meant in using it so far as to injure pipes lawfully laid. [His Lordship quoted *The Gaslight and Coke Company v. The Vestry of St. Mary Abbotts*, and *The Guardians of Armagh Union v. Bell.*] If the defendants were liable at all, was it a case for an injunction? In his opinion, most clearly it was. The whole course of the defendants' evidence was that, if steam-rollers were ordinary traffic, the main and pipes of the plaintiffs' distributing system were not laid so as to be capable of supporting it uninjured. Consequently, if the use of the rollers was to continue without regard to anything but the convenience of the defendants, the destruction of the plaintiffs' pipes must follow, because the argument was that the pipes were so lightly laid that they were liable to be injured by ordinary traffic; and it followed *à fortiori* that extraordinary traffic was far more likely to injure them. He would grant the injunction against the use of steam-rollers as asked by the plaintiffs; but he would not give any decree as to damages, for the injuries were very trifling.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Thursday, March 22.

(*Before Mr. Justice* MATHEW.)

Sheen v. Haynes—The Promotion of the Automatic Gas-Meter Company.

This was an action brought by the plaintiff against the defendant, to recover £1125 in cash and a like amount in fully-paid shares in the Automatic Gas-Meter (1895) Company, Limited, in respect of work done and money expended by him for and at the request of the defendant. He alleged that £1125 was due to him in connection with his having journeyed to Manchester on the defendant's business, and of his having offered to provide a sum of £10,000 in order to form and float a large company, with adequate capital, to acquire the property and undertaking of the Automatic Gas-Meter Company; his commission being at the rate of 7½ per cent. in cash. The defendant, the plaintiff further alleged, agreed to transfer to him £1125 in fully-paid shares; and plaintiff in the alternative claimed £2000 by reason of defendant's refusal to hand the shares to him. The defence was a denial of any agreement.

Mr. PICKFORD, Q.C., and Mr. F. DODD appeared for the plaintiff; Mr. DUKE, Q.C., and Mr. BODILLY represented the defendant.

Plaintiff gave evidence in support of his claim, and, in cross-examination, said he had several interviews with defendant on this matter in Liverpool, Manchester, and London. It was in Liverpool that the agreement on which his claim was based was made. The effect of the agreement was that they were to be mutually interested in the formation of a larger company at a time which was found most convenient.

Defendant was also called, and denied that he ever made any such agreement as that alleged by the plaintiff. He admitted asking plaintiff to find £10,000 in debentures; but he never promised to pay him 7½ per cent. in cash. The Automatic Gas-Meter Company was now incorporated with a new Company called "Meters Limited."

Mr. *T. G. Marsh* was called, and denied that the Company was under any necessity to enter into such a contract as that alleged by the plaintiff. It was a prosperous concern.

His LORDSHIP, in giving judgment, said the plaintiff in 1895 was a Director of a Company called the Breweries' Guarantee Corporation, which was intended to give guarantees for debentures or shares for a small commission. The defendant was Director of a Company called the Automatic Gas-Meter Company, which had recently been established, and which obtained the assignment of a valuable patent. In October, 1895, it was found necessary that the Company should obtain further capital; and defendant, representing them, was put in communication with the plaintiff. The first proposal was that the capital of the Company should be increased to the extent of £10,000 in debentures, which were to have been guaranteed by the Breweries Corporation. According to the plaintiff's story, he suggested a different way of proceeding. He proposed that a new Company should be formed to take over the assets of the old one, and that the new concern should pay a much larger sum than was to be paid to the shareholders of the previous one. These two gentlemen understood each other, and knew that if the new Company were formed, as was suggested, there would be a handsome margin of profit to be divided among the promoters. This idea struck the defendant as feasible; and they arranged together that they should be concerned in the promotion of the new Company, and that there should be an opportunity of sharing the profits. Three representatives, including the plaintiff, inspected the works. When the plaintiff went, he at once saw the defendant, who imparted to him the intelligence that the idea had been taken up warmly by a Syndicate at Manchester, and that they proposed to promote the new Company without the assistance of the plaintiff. Plaintiff expressed his annoyance; but the defendant consoled him by saying that his position should be the same as if the arrangement come to between them had been carried out. He suggested that the inspection of the property should take place, and the opinion of the Breweries Corporation be ascertained as to whether the property was security for the £10,000, as this would facilitate the arrangement with the Syndicate. The Syndicate had a meeting at an hotel, and decided to bring the new Company out, and to form themselves into a limited liability undertaking, called "Commerce, Limited." Plaintiff gave a dinner at the hotel when all the gentlemen were present; and he said that at this dinner an arrangement was come to that he was to have 7½ per cent. in cash on

account of the 15,000 shares which he was to underwrite. The plaintiff and a Mr. Smith succeeded in placing the shares they had underwritten. The defendant did not, and he incurred liability in regard to another Company—the Holophane Company—in which he was interested with the plaintiff to the extent of some £3000 or £4000. He was pressed by the Holophane Company to pay the money; and, under pressure, he gave them an order on the plaintiff to pay whatever was due to him in respect of the agreement entered into for the underwriting of the Holophane shares. Plaintiff then prepared a statement of account, which showed a balance of £750 due to the defendant. This amount was paid in September, and evidently accepted by the defendant as correct; but a difference arose, and there was an action in Chancery between the parties. As to the amount now sued for, the defendant's case was an absolute denial of everything alleged by the plaintiff; but, after carefully considering the evidence, he had come to the conclusion that the plaintiff had made out his case, and was entitled to what he asked. He therefore gave judgment for £1125 in cash; and, as to the shares, he left it to Counsel to arrange the exact figures and mention the matter to him again if necessary.

BIRMINGHAM WINTER ASSIZES.

Nisi Prius Court—Tuesday, March 20.

(*Before Mr. Commissioner* Walton, Q.C., *and a Jury.*)

The Baker Syndicate, Limited, and Foster v. John Wright and Co., Limited, and Others—The Promotion of a Gas-Meter Company.

This was an action brought by the Baker Syndicate and Mr. Harry Seymour Foster, M.P. for Lowestoft, against Messrs. John Wright and Co., Limited, gas-stove manufacturers, of Birmingham, Mr. Ernest Wright, Mr. J. Frederick Wright, and Mr. A. G. Sutherland, to obtain damages for an alleged breach of contract, and to recover money paid in connection with the contract.

Mr. Jelf, Q.C., Mr. Stanger, Q.C., and Mr. Gordon appeared for the plaintiffs; Mr. Hugo Young, Q.C., and Mr. Wills represented the defendants.

Stated shortly, the case for the plaintiffs was that the Syndicate had purchased a patent invention, and were proceeding to form a company in London for the purpose of the manufacture of the patent, when they were brought into contact with Messrs. John Wright and Co., who persuaded them, it was alleged, not to proceed with the London Company, but to start a Birmingham Company, of which they (Messrs. Wright) would be the promoters. This agreement was accepted, and the arrangements were nearly carried out, when the defendants repudiated the contract. The plaintiffs had to make compensation to various people in connection with the preparations for the formation of the London Company, which had been given up, it was alleged, on account of the defendants' proposal. On the other hand, the defendants alleged that no concluding contract was entered into, and further that the Managing-Directors of Messrs. John Wright and Co. had no authority, and never represented that they had any authority, to bind the Company to any contract, although they had authority to negotiate.

Mr. Jelf explained the details of the case in the course of a long opening statement. He said that the plaintiffs were a London Company started for the purpose of forming and financing various industrial undertakings. Mr. Foster was the Chairman, and had a large interest in the concern. Mr. Ernest Wright and Mr. J. Frederick Wright were joint Managing-Directors of Messrs. John Wright and Co.; and they were brought into the action because the Company said they had no authority to make the contract. The other defendant, Mr. Sutherland, was a foreman in the Company's employ, against whom at one time a cause of action might have been made out; but he (the learned Counsel) did not think he was in a position to establish liability against him. The patent referred to was one which Messrs. Greenall and Heaton had invented and sold to the Syndicate. It was called the "Positive" gas-meter, which had been found an extremely useful one, and had been approved by legal authorities, patent agents, and commercial men. The plaintiffs, having purchased the patent, proceeded to promote a Company to work it. Out of the £40,000 which required to be underwritten, they had obtained the sum of £25,000; and Mr. Foster was recommended by Messrs. Agar, Bates, and Co., accountants, to see whether Messrs. John Wright and Co. would be likely to do the balance of the underwriting. Accordingly, on July 27, 1898, an interview took place on the premises of Messrs. Wright between Messrs. Foster and Greenall and Messrs. Ernest & J. F. Wright. Mr. Foster proposed an arrangement with regard to the underwriting and the manufacture of the meters. No settlement was arrived at, however; the two Mr. Wrights promising to consider the matter. On the 29th of July a letter was written on Messrs. Wright's notepaper to Mr. Foster, asking him to meet them again, as they had a proposal to make. They stated that they had a penny-in-the-slot attachment of their own, and were about to bring out a Company to manufacture it, and also ordinary gas-meters, in connection with Messrs. John Wright and Co. It had occurred to them that this Company might run with the plaintiffs' proposed meter company. They had, the letter continued, the necessary buildings, plant, and staff, both for their manufacture and their sale. They would only be willing to join forces, however, on condition that the flotation was a moderate one.

Mr. Hugo Young pointed out that the letter was not signed on behalf of the Company, but by Messrs. J. F. & E. Wright; and the reply was to be sent to Mr. J. F. Wright's private address.

Mr. Jelf (continuing) said an interview took place between Mr. Foster, Mr. Greenall, and Messrs. J. F. & E. Wright, in the Conservative Club, Birmingham; and on that occasion the agreement upon which the action was brought was accepted. The two Mr. Wrights told Mr. Greenall that they had authority to bind the defendant Company, and that, in fact, they were the Company. The terms were that the defendants were to pay all the expenses in connection with the formation of the proposed Company to the first allotment; and they were to provide on their premises, in Thimblemill Lane, Birmingham, a meter-shop, and be prepared to turn out 10,000 "Positive" meters in a year. Also that the defendants' existing stock of meters should be purchased and taken over by the new Company. The defendants were to do all the clerical work, allow the use of their travellers by the new Company, and hand over any improvements. In return for this the defendants were to receive 30,000 fully-paid shares in the new concern. Messrs. Wright said it must be a Birmingham Company; and they stipulated that two of them should have seats on the Board. Mr. Foster accepted these proposals, and put an end to the arrangements in connection with the London Company which was being formed. Everything was carried out to the registration of the Company, when the defendants repudiated the contract and their liability.

Mr. Hugo Young here stated that the defendants' case was that there had been no concluded agreement with the Wrights. They had no authority from the Company to do more than negotiate.

Mr. *Harry Seymour Foster* was called, and examined by Mr. Stanger. He said he was the Chairman of the Baker Syndicate, and his offices were at 165, Fenchurch Street, London. In the early part of 1897, his attention was called to the "Positive" meter, which was tested by a number of experts and eminent men, whose reports were entirely satisfactory. The patent was purchased, and preparations were made for the formation of a London Company—a sum of £2000 having been spent in connection with it. Speaking of the interview at the Conservative Club, Birmingham, he said that Mr. Ernest Wright was the principal spokesman. He asked witness to abandon his London scheme, and put his meter into their Company. Their proposal was that Messrs. John Wright and Co. should float the Company with a capital of £120,000. The plaintiffs were to have £30,000 of this, Messrs. John Wright and Co. £30,000, and Messrs. J. F. & E. Wright and A. G. Sutherland £30,000 for their penny-in-the-slot meter patent. Mr. Greenall asked what authority they had to bind Messrs. John Wright and Co., whereupon witness said Mr. Wright replied that he and his brother were Messrs. John Wright and Co. In October, there was another interview between witness and the two Messrs. Wright, when one of them said they had very bad news for him. They had had a Board meeting, and their Chairman had declined to sanction the agreement, on the ground that Messrs. John Wright and Co. would be injured in their business if people subscribed shares on the strength of their name and it proved a failure. Mr. Ernest Wright said he felt bound to agree with the Chairman (Mr. Sanders); and those were the points he himself had previously raised.

Mr. Foster was still under examination when the Court rose.

Wednesday, March 21.

On the resumption of the proceedings to-day,

Mr. *Foster* was severely cross-examined by Mr. Young on the subject of the various undertakings in the promotion of which he had been engaged since 1881. He was then cross-examined on the subject of the agreement with Messrs. Wright, with the view of showing that the defendants had not heedlessly repudiated the contract.

An argument arising on this point,

The Commissioner said the real question was whether or not the defendants had done their best to carry out the agreement.

Mr. Jelf maintained that the contract only bound them to do their best.

In further cross-examination, witness admitted that the defendants received a report from Mr. Dugald Clerk, which was on some points adverse to their patent. He did not think it would have been of any use going to the public on this report. He would have consulted some higher authority on patents. He would have gone to the public with one man saying it was valueless, and another saying it was good.

Mr. *John Greenall*, the inventor of the "Positive" meter, corroborated Mr. Foster's version of what happened on the occasion of the interview at which the agreement with Messrs. Wright was come to. He was certain they said they had full authority to pledge the Company.

In cross-examination, witness admitted that Messrs. Wright intimated that they would have to consult the Directors.

Evidence having been given by two witnesses as to the value of the patent in question, the plaintiffs' case closed.

Mr. Young submitted that there was no case to go to the Jury. He objected that there was no concluded agreement, and that, if there were, the one set up in the statement of claim was not it. There was merely a contract to contract.

A long legal argument ensued. Eventually,

The Commissioner held that there was evidence to show that there was a complete contract, and therefore he could not stop the case.

Mr. Young then objected that there was no clause in the Articles of Association of Messrs. John Wright and Co. which gave power to enter nto such a transaction as that which had been alleged.

Thursday, March 22.

At the sitting of the Court this morning,

Mr. Jelf said he was pleased to inform his Lordship and the Jury that he need not trouble them further, as the case had been settled. He therefore asked to be allowed to withdraw the record.

The request was granted.

It is stated that the result of the case reported above was that the defendants submitted to judgment for £900 and costs.

The Recent Committal for Selling Infringing Mantles.

In the Chancery Division of the High Court of Justice last Friday, Mr. Hughes applied to Mr. Justice Kekewich, on behalf of George Collins, of Birmingham, who was recently sent to gaol for breach of an injunction restraining him from selling mantles which were an infringement of those manufactured by the Welsbach Incandescent Gas Light Company (see *ante*, p. 685). Mr. Hughes said the defendant was sorry for his offence, and asked that he might be released. He had already been in gaol for a fortnight. Mr. Walter, who appeared for the Company, said they did not wish to press unduly; but this was the third time they had had to proceed against the defendant. If, however, he would undertake not to offend again, he (Mr. Walter) would not oppose the application for his release. His Lordship made an order accordingly.

MISCELLANEOUS NEWS.

THE SHREWSBURY GAS COMPANY AND THE CORPORATION.

Award in the Recent Arbitration Proceedings.

As the result of the arbitration reported in the "JOURNAL" for Feb. 27 and March 13—with respect to a claim for £1583 made by the Shrewsbury Gas Company against the Shrewsbury Corporation, as compensation for damage alleged to have been caused to their mains, with consequent loss of gas, in carrying out the new system of sewerage in the town—the Umpire (Mr. James Mansergh) yesterday week gave his award. He finds that "the Company have sustained damage by reason of the exercise of the statutory powers vested in the Corporation in relation to the carrying out and construction of the sewerage works;" and he assesses the amount of the compensation to be paid to the Company by the Corporation in respect of such loss or damage at £930. He orders the Corporation to pay to the Company three-fourths of their costs of and consequent upon the reference, as well as all the costs of the award.

THE TRANSFER OF THE LOUGHBOROUGH GAS-WORKS TO THE CORPORATION.

Arbitration Award.

In the session of 1899, an Act of Parliament was passed by which the Loughborough Corporation were empowered to purchase the undertaking of the Loughborough Gas Company, on terms to be settled by arbitration; and the matter was subsequently referred to Mr. Corbet Woodall for the Company and Mr. Alfred Colson for the Corporation. The award was taken up last week, when it was found that the figure arrived at as the value of the works and plant was £87,098. By the provisions of the Corporation Act of last session, the Corporation have to pay 10 per cent. on the purchase price, as compensation for compulsory purchase, and £500 towards the Company's costs, together with the expenses of arbitration, transfer of the undertaking, and winding up of the Company. The mortgage debt of the Company (£8750) is to be taken over with the concern, and constitute a first charge on the property.

BRITISH GASLIGHT COMPANY, LIMITED.

The Half-Yearly General Meeting of this Company was held last Wednesday, at the London Offices, No. 11, George Yard, Lombard Street, E.C.—Mr. J. HORSLEY PALMER in the chair.

The SECRETARY (Mr. H. B. Chamberlain) read the notice convening the meeting, and also the report of the Directors for the six months ending Dec. 31 last. The latter stated that the balance of profit was £22,006, after making certain deductions, and adding £347 from the Trowbridge reserve fund; the parliamentary interest at that station not having been realized by this amount. The deductions referred to were: Income-tax £798, Hull excess profit £867, Potteries do. £1176, Hull debenture interest £1015, Norwich do. £918, Potteries do. £386; making, with the shillings and pence, £5162. Regarding the Hull station, the gas-rental showed an increase of £2528, as compared with the corresponding period of 1898. Coke contributed an additional £2062, tar and tar distilling £1440, and ammoniacal liquor and sulphate of ammonia £164. Coal cost 11s. 8d. per ton, against 10s. 8d.; and coke realized 10s. 2d. per ton as against 8s. 1d. The gas sent out was 467,459,294 cubic feet, as against 447,245,751 feet, or an increase of 20,213,543 feet—equal to 4·51 per cent. The profit realized was £867 in excess of the parliamentary interest allowed. This sum had been invested in Consols; making the reserve fund at this station £36,102. Concerning the Norwich works, the gas-rental showed an increase of £2786. The receipts for coke increased by £894, and tar and ammoniacal liquor by £392. Coal cost 15s. 10d. per ton, as against 15s. 1d. Coke realized 10s. 1d. per chaldron, as compared with 8s. 7d. The gas sent out was 177,608,000 cubic feet, as against 157,803,000 feet, or an increase of 19,805,000 feet—equal to 12·55 per cent. The profit realized was £3481 less than the parliamentary interest. As to the Potteries station, the gas-rental exhibited an increase of £1917; and coke, tar, ammoniacal liquor, and sulphate of ammonia £1529. Coal cost 10s. 9d. per ton, against 8s. 11d.; and coke realized 7s. 3d. per ton, as compared with 4s. 11d. The gas sent out was 186,968,000 cubic feet, as against 169,942,000 feet, or an increase of 17,026,000 feet—equal to 10·01 per cent. The profit realized was £1176 in excess of the parliamentary interest allowed. This sum had been invested in Consols; making the reserve fund at this station £19,298. Respecting the Trowbridge undertaking, the gas-rental showed an increase of £354; and the residual products realized £177 more. Coal cost 14s. 11d. as against 13s. 7d.; and coke produced 7s. 9d. per chaldron, as against 6s. 3d. The gas sent out was 29,125,006 cubic feet, as compared with 26,546,067 feet, which was an increase of 2,578,939 feet—equal to 9·71 per cent. The profit realized was £347 less than the parliamentary interest. This sum would be taken from the reserve fund; leaving a balance of £2775 to the credit of that account. In regard to the Holywell station, the gas-rental showed an increase of £42; and the residual products of £57. The profit realized was £270. The result therefore was that the total profit added to the previous balance of profit and loss amounted to £47,091. From this the Directors recommended a dividend at the rate of 10 per cent. per annum, clear of income-tax. This would amount to £21,000, and leave a balance of £26,091.

The CHAIRMAN, in moving the adoption of the report and accounts, said he was afraid on this occasion he should have to keep the shareholders a little longer than usual, as there were a good many points of interest upon which he wished to remark. First of all, with regard to the balance of profit, he might state that it was exactly the same as, or within £12 of, the profit realized in the corresponding half of 1898. Dealing with the Company's stations in detail, and taking the one of greatest importance first—that was, Hull—he said they had done a great deal of good work there during the past half year. There had been an increase of nearly 5 per cent. in the output of gas, and a very considerable rise in the total of the slot meters and stoves fixed. Generally, the business at Hull was progressing in a most satisfactory manner. With such progress as this, and with the large amount of gas they would have to provide for the Corporation to supply the Kingston-upon-Hull district from the 1st of next month, it naturally followed that a substantial capital outlay was required. In one of the districts—that was, the south-eastern district of Hull, in the direction in which the North-Eastern Railway Company's depôts and warehouses and a portion of the new docks were—the pressure of gas was very insufficient; and, in order to meet the needs of that district (which was growing very much), the Directors had given out orders to the pipe makers, and also to their Contractors (Messrs. John Aird and Sons) to lay a large sized main into the district. This would cost about £13,000. The quantity of gas which they would have to supply to the Corporation for the Kingston-upon-Hull district was estimated at 110 million cubic feet; and, in consequence, they required increased storage to provide for this. As he informed the shareholders six months ago, they had in progress a large gasholder and tank. The tank, which was begun last half year, was almost completed; and during the coming summer, the gasholder would be put in. They had also to erect new condensers and scrubbers for the same purpose. The coupling up of the mains to supply the old town had been completed, the meter had been tested, and everything had been found in working order; and, as he had said, delivery of gas would commence on the 1st of April. Roughly speaking, the total capital required for Hull would be about £70,000. There was one thing he had to regret; and it was that their Engineer, Mr. Dougall, had been far from well. He had had a great strain put upon him by all this new work; and the Directors had been obliged to enforce his taking a very considerable holiday. He was now in the South of France, and was very much better. The Directors sincerely hoped that he would return to his duties completely restored to health in perhaps a month or more. Their Chief Engineer was one of those gentlemen who would stick to his work until the last moment—until, in fact, the Directors absolutely forced him to take a rest. He (the Chairman) had little to tell the shareholders with regard to Norwich, because they had not been executing any important works there. The increase in the consumption of gas, however, was immense. It was 12½ per cent. over the half year; and, therefore, the Directors hoped they were picking up the ground that was lost there in years gone by. With regard to the Potteries station, he had a good many things to say to the shareholders. It would be remembered that a few weeks ago, a Wharncliffe meeting was held for the purpose of getting the shareholders to sanction the promotion of a Bill in Parliament to raise fresh capital and buy additional land at the Potteries station. At that time, he fully explained to the shareholders present the necessities of that station. The action of the Shelton Coal Company, who were undermining their works, necessitated the construction of new works. The increase in the consumption of gas was very large; and the demand on the existing works was nearly equal to the maximum output. Therefore they were obliged, in addition to any defects owing to the Shelton Coal Company's workings, to increase the works by putting up fresh plant and buying additional land. He stated at the Wharncliffe meeting that he hoped there would be no opposition to the Bill. At the last moment, however, the Corporation of Hanley had decided to oppose it; but, on the other hand, the Company's friends at Tunstall said there was no necessity for opposition, and had refused to join in it. The opposition, however, was of such a weak nature that he hardly believed it would be carried before a Parliamentary Committee. Anyway the Bill would not come on until after Easter; so he did not like to prophesy. They had expended on capital account at the Potteries £1280, and about £560 for stoves. The increase in slot meters and stoves still continued; and the average consumption of gas by the slot meters was 10,424 cubic feet, which, so far as this class of business went, was a very satisfactory return. The land the Directors had purchased was contiguous to the present works, and alongside the North Stafford Railway; so that they would have a very good opportunity in the future of getting their coal into the works at, they hoped, a somewhat cheaper rate than now. With regard to the subsidences which had occurred, some of the shareholders might say, "How is it you have not arranged to purchase the freehold" (because the Company's land was copyhold) "and come to some agreement that the coal should not be extracted from underneath the works." The Lords of the Manor, he might inform the proprietors, were the Duchy of Lancaster; and although portions of the land had been enfranchized, whenever the Directors approached the Duchy of Lancaster to enfranchize the copyhold, the latter would insist upon the insertion in the deed of a clause reserving the minerals, and debarring the purchasers from any claim for damage by reason of mining operations. Therefore, it was hardly worth while enfranchizing the copyhold with such a clause inserted. With regard to the smaller station at Trowbridge, there again there was a very large increase—above 10 per cent.—in the consumption of gas. The Directors had thought fit to remodel these works, which were very old. In this matter (although only a small one), they had had valuable help and assistance from their colleague, Mr. Corbet Woodall, who had gone very fully into it. The retort-house had been remodelled; and a new gasholder tank had just been finished. The holder for that tank was in course of erection; and during next summer it was intended to re-set the retort-beds on the regenerative system. Some other additions in the way of the enlargement of offices and new sulphate of ammonia plant would make the Trowbridge station quite a model country works. All this would necessitate the expenditure of about £9000. It was rather difficult to state, in round figures, the exact amount of money that would be required at the Potteries station for the land, new gasholders, and so on; but they would be spending very soon from £30,000 to £40,000. This brought him really to the last question he wished to touch upon—that was, the raising of fresh capital for the various purposes he had mentioned. It would be remembered that he stated the total amount to be spent at Hull would be about £70,000; at the Potteries it would be certainly £30,000 and probably more; and at Trowbridge £9000. It was the intention of the Directors to issue during the coming summer 1500 ordinary shares; and the shareholders would have notice sent to them in the usual manner, asking them to subscribe for the shares. This was all he had to say with regard to the actual position of their business; but there was one other matter upon which he might

make a few remarks. He believed every chairman of every gas company at the meetings lately had spoken about coal. The shareholders all knew that the price of coal was now very much higher than it had been in the last few years. The Company must face this matter; and the Directors thought the gas consumers should also assist in facing it. They could not expect to receive gas at the extraordinarily low price at which the Company had been in the habit of supplying it at two of their principal stations. At Hull it was 1s. 10d. per 1000 cubic feet, which was far below that charged by the other two undertakings there. Then at the Potteries the price was 2s. 3d., which was much less than was charged by undertakings in the neighbourhood, most of which belonged to Corporations. Therefore it was only fair that, when coal rose to such an extent as now, gas consumers should pay rather more for their gas than they had hitherto done. Nobody regretted more than himself the rise in the price of gas; but there were occasions when it must occur. The Directors had always made a point of selling gas at the lowest possible figure; and he was sure the shareholders were benefited thereby.

Mr. Corbet Woodall seconded the motion.

Mr. R. Stevens inquired at what price the Directors proposed to issue the new shares.

The Chairman said, while he would not make any pledge in regard to this matter, he might say that the Directors had always issued shares to the shareholders at a slightly beneficial "turn," if he might so describe it; and he had no doubt the Directors would remember the precedents when making a further issue.

The motion was unanimously adopted.

The Chairman moved the declaration of a dividend at the rate of 20s. per share, clear of income-tax. He reminded the shareholders that the income-tax was going to be 1s. in the pound; and therefore they might regard the payment of the dividend free of income-tax in the light of a bonus.

Major-General W. T. Corrie seconded the motion, which was agreed to.

The Chairman and Directors and the officials were suitably thanked for their services; and the acknowledgments of the Chairman and Secretary concluded the proceedings.

THE SUPPLY OF CARBURETTED WATER GAS IN DUBLIN.

As the outcome of Professor Emerson Reynolds's statement of the results of his analyses of the gas supplied to Dublin since the starting there of the carburetted water gas plant (see last week's "Journal," p. 756), a question was asked in the House of Commons on Friday, as noted elsewhere to-day, p. 806. On notice of the question being given, the President of the Board of Trade placed himself in communication with the Alliance and Dublin Consumers' Gas Company; and in a letter (dated the 21st inst.), the Secretary of the Company, Mr. Francis J. Cotton, wrote as follows:—

The Corporation and the citizens of Dublin were well aware of the Company's intention to introduce carburetted water gas. The matter was fully discussed in the Press before the Company completed the plant for its manufacture. On the plans of the building being submitted to the Corporation, they raised the question as to its use; and the matter was referred to Sir Charles Cameron, the City Analyst, to thoroughly investigate and report to the Public Health Committee. Sir Charles Cameron, after thorough investigation, recommended the Public Health Committee to approve of the plans.

There is no foundation in the statement that the Company has "turned 17 per cent. carbon monoxide into their mains." Professor Reynolds states that "the analysis of the 12th inst. showed a still greater proportion of carbon monoxide—17·9 per cent., but this was probably due to some accidental cause." On reference to the percentage of water gas used that week, it will be seen that 17·9 per cent. of carbon monoxide could not have existed in the mixture of gas issued to the consumers; and we can only conclude that Professor Reynolds has made some mistake in his analysis.

No notice was sent to the Board of Trade as to the intermixture of water gas with coal gas, as we know of no Statute bearing on the subject.

With regard to the poisonous nature of this gas, I am to refer you to the report of the Departmental Committee appointed by the Home Office to inquire into the use of water gas and other gas containing a large precentage of carbon monoxide—Jan. 17, 1899. It will be found on referring to this report that the use of this illuminant is not illegal in the United States.

With regard to leakage from the gas-mains in Dublin, they are no more frequent than in other cities, except where the mains have been broken lately by steam-rollers or traction-engines.

The statement "that since the introduction of water gas the death-rate amongst the population has risen so enormously that the Lord Lieutenant has appointed a Commission to investigate the cause," is absolutely without foundation. On the 17th of January, the Lord Lieutenant, in a letter addressed to the Secretary of the Local Government Board, suggested "that the present state of the public health in Dublin would appear to make it highly desirable that a public inquiry should at once be held by a Committee composed, if possible, of representatives of all the authorities concerned." Water gas was not manufactured, nor issued, by this Company before Feb. 5, and the increased death-rate in Dublin was principally among the very poor classes, very few (if any) of whom use gas.

With regard to the remainder of Mr. Healy's question, we must again refer you to the report of the Home Office Committee.

The return furnished by Sir Charles Cameron, the Officer of Public Health, shows that since Feb. 5 when carburetted water gas was introduced, the death-rate has been decreasing instead of increasing.

Electric Lamps Superseded by Gas Lights in Newcastle.—The Lighting Committee of Newcastle on Tyne Corporation, at a meeting held last Tuesday, decided to give notice to the Electric Lighting Company for the abolition of the large lamps in Blackett Street, Grainger Street, Neville Street, and Barras Bridge, and resolved that these streets be lighted with incandescent gas-lamps in groups, similar to those round the foot of the Monument.

GAS-WORKS EXTENSIONS AT ILKESTON.

Local Government Board Inquiry.

Last Thursday, Colonel J. T. Marsh, one of the Local Government Board Inspectors, held a public inquiry at Ilkeston, in connection with the application by the Corporation to the Central Board for a Provisional Order "to enable the Corporation to purchase and acquire by agreement and hold additional lands for the purpose of their gas undertaking, and thereon to construct, alter, enlarge, or, when necessary, remove buildings, apparatus, and works for the manufacture and storage of gas and of residual products, and to confer additional borrowing powers upon the Corporation, and to incorporate with the Provisional Order, with or without alteration, some or all the provisions of the Gas-Works Clauses Act, 1871, the Lands Clauses Acts, and the Public Health Acts."

The Town Clerk (Mr. Wright Lissett), in opening the case, stated that when the works were purchased from a private Company in 1878, they were of a very limited character, and the apparatus and plant were generally old-fashioned. The Corporation obtained a loan for the purchase money, and since then had spent large amounts on the works. The population of the town then was 12,000, and was now more than double—being about 27,000. The gas made in the year ending March, 1882, amounted to 26 million cubic feet, with 647 customers and 134 street-lamps. This last year the corresponding figures were 74 million cubic feet of gas, 2200 customers, and 382 street-lamps. There had been a continually increased demand for gas. The increase last year was 7 million cubic feet. The premises and plant had been several times enlarged and improved. The storage capacity in 1878 was 72,000 cubic feet; and now it was 350,000 cubic feet. In one day last winter they sent out as much as 400,000 cubic feet of gas, which showed the storage capacity to be insufficient. They had obtained a Provisional Order for electric lighting and tramways, but no installation was yet established.

The Inspector remarked that the universal experience was that the provision of electricity did not affect the output of gas.

The Town Clerk went on to deal with the provision to be made for plant for treating ammoniacal liquor and coke, which added to the profits on the works. New purifiers were now absolutely necessary, an additional washer was needed, and more storage capacity for coal and coke was required. Another very important thing was to get additional railway sidings; the present limited and awkward accommodation involving considerable delay at times. Other requirements were a new station-meter and exhauster.

Plans of the land and properties proposed to be taken were then examined. The estimated cost of purchase, including the enfranchizement of one portion which was copyhold, was £4000.

The Town Clerk explained that the land adjoined the present works, and was a very convenient site for the purpose. The whole of the existing site was fully occupied; and it was necessary to get additional land close at hand, as unless they could do so they would have to secure land elsewhere and so erect a separate plant and gas-making station altogether—thus increasing the cost of supervision and working. The present truck entrance from the Midland Railway involved expenditure in the shape of horse haulage for every truck taken in, and the new sidings and direct entrance would be a great advantage.

The contracts for the purchase of the properties were then submitted for the Commissioner's inspection.

The Town Clerk pointed out that on the south side of the new site there was no probability of buildings being erected. The land on the other side of the railway was used by the Corporation as a depôt; and on the east side there was no prospect of other houses than those existing. On the north and west sides, there were populous districts. The matter had been well advertised, and there was no objection from ratepayers or property owners. All the houses now acquired by the Corporation were held on a weekly tenancy at a rent of 3s. 6d. or 4s. 6d. a week. It did not follow that all the houses would be cleared away, but some would. There were 34 houses being acquired.

The Inspector asked where they would place the dispossessed persons.

The Town Clerk thought they would only take 16 houses. The matter of further accommodation had not yet been considered.

At the close of the inquiry, the Inspector visited the gas-works.

MANCHESTER CORPORATION GAS AND WATER SUPPLY.

Increases in Salaries—The Disturbance of the Streets.

At the Meeting of the Manchester City Council last Wednesday, a long list of recommendations from the Gas and other Committees, for advances in the salaries of officials, came up for consideration.

Alderman Gibson, Chairman of the Gas Committee, in proposing that the salary of Mr. Charles Nickson, the Superintendent, be raised from £600 to £700 per annum, said he could give such reasons for the proposal as would, he was sure, meet with the approval of the Council. Mr. Nickson was appointed Chief Superintendent in 1883. In that year the turnover of the Gas Department was £834,686 per annum; whereas last year it had risen to £1,132,366. During the period of this increase, the department had been under Mr. Nickson's control; and yet he was to-day getting £100 a year less than his predecessor. Mr. Nickson had been a servant of the Corporation for 55 years, for 47 of which he had been connected with the Gas Department. Since he had been Chief Superintendent, his salary had only been advanced twice. That it had not been raised to a greater extent was due to his (Mr. Nickson's) own modesty; for during the time of his (Alderman Gibson's) chairmanship, this matter had never once been mentioned to him. He then submitted a few figures showing the economy in administration in the Gas Department (apart from the gas-works and the actual manufacture of gas) effected under Mr. Nickson's *régime*. He said that when that gentleman took office, the cost of administration was 17·89d. per ton of coal carbonized. Last year it was only 15·89d.; there having been a gradual diminution during the whole period. If the cost had been 17d. per ton last year, they would have had to pay £3625 more for salaries than they actually paid. This saving, he claimed, was due mainly to Mr. Nickson. Taking the accounts of other large undertakings as given

in "Field's Analysis," and on the basis, not of coal carbonized but per 1000 cubic feet of gas actually sold, he found the average of Birmingham, Bolton, Carlisle, Leicester, Nottingham, Oldham, and Salford, was 0·56d.; whereas in Manchester the cost was only 0·35d. These figures represented a very considerable saving in the cost of administration; and, in view of the economies effected during Mr. Nickson's tenure of office, and the large increase of business which had taken place, they would be doing him only a tardy act of justice in placing him on the same footing as his predecessor with regard to salary. Mr. Nickson was one of the best servants the Manchester Corporation had ever had.

The Lord Mayor (the Right Hon. Thomas Briggs), the Deputy-Chairman of the Committee, seconded the motion.

Mr. Wilson said that, while he had great respect for Mr. Nickson, and while every member of the Council knew he was an excellent servant of the Corporation, he thought that gentleman had reached too advanced an age to justify them in increasing his salary.

Mr. Shuttleworth moved, as an amendment, that the increase be only £50 per annum.

Mr. Hodge seconded the amendment.

Dr. Bishop asked if there had been any dissension among the members of the Gas Committee on this matter. He would also be glad to know if the recommendation was a unanimous one.

Alderman Gibson replied that when he first brought the matter before the Committee they voted against the proposal; but it was owing to the fact that there were many new members, who had no knowledge of Mr. Nickson's ability and worth. Subsequently, after he had fully explained the reasons of his proposal, it was carried by 10 votes to 4.

On being put to the vote, the amendment was lost—25 voting for, and 49 against it; and the original motion was declared carried.

The following advances of salaries were then adopted without discussion: Mr. F. A. Price, Deputy Superintendent, from £350 to £400; Mr. F. P. Smith, Accountant, from £250 to £275; Mr. F. J. Caldecott, Audit Clerk, from £250 to £275; Mr. G. Whittaker, Chief Inspector, from £225 to £250; Mr. J. R. Hill, Deputy-Manager, Rochdale Road works, from £280 to £300; Mr. G. W. Tooley, resident foreman at the Rochdale Road works, from £163 16s. to £180; Mr. E. Williams, Chemist, from £220 to £250; Mr. J. S. Naylor, Deputy-Manager, Bradford Road works, from £250 to £280; Mr. E. Parker, Chemist, from £163 16s. to £180; Mr. J. Taylor, Clerk of Works, from £163 16s. to £180; Mr. J. Merrill, Manager, Gaythorn works, from £300 to £330; Mr. A. Massey, Manager, Droylesden works, from £190 to £200; Mr. T. H. Walmsley, Deputy Superintendent, Street Mains Department, from £225 to £250. To a recommendation to raise the salary of Mr. W. Rodger, Manager of the Bradford Road works, from £350 to £380, an amendment was moved to increase it by only £10; but it was lost.

On the recommendation of the Water-Works Committee, various advances of salaries in that department were agreed to. The salary of Mr. Joseph Haynes, General Inspector and Surveyor of Mains, was raised from £425 to £475; Mr. L. Holme Lewis, Engineer and Manager of the hydraulic power supply, from £450 to £475; and Mr. Alfred Neill, Assistant Financial Superintendent, from £325 to £340.

Sir John Harwood proposed, and Alderman Higginbottom seconded, a motion to the effect that, as it was desirable to obviate the frequent disturbance of the surface of the streets in the city which were under the charge of the Paving, Sewering, and Highways Committee, any other Committees of the Council intending to interfere with the surface of the streets for any purpose should, except in cases of emergency, give notice to the Committee of their intention; and, upon receipt of such notice, it should be their duty to inform any other Committee having work to do of a kindred character, in order that it might be completed at the same time.

Mr. Fildes thought no good could come from the resolution, as it was impossible for employees of (say) the Electricity and Gas Committees to work on the same side of the street at one time; and it would be impracticable to have both sides of the street up at once.

Alderman Hoy agreed, to a large extent, with Mr. Fildes, and added that it might be well to consider whether, in the chief streets of the town, they could not have a large duct main which would carry the whole of the various Committees' underground work.

After some further discussion, the motion was carried.

THE PRICE OF GAS AT STOCKTON-ON-TEES.

An Increase Imminent.

According to the "Northern Echo," Stockton at present has to face the question of an increase in its rates, or the alternative of 6d. per 1000 cubic feet addition to the price of gas. During the Corporation financial year ending on the 31st inst., the Borough Fund Committee in making up their estimates last March allowed for a profit of £5000. Some few months after, however, the price of coal went up by leaps and bounds; and the Gas Committee found they could only complete their yearly contracts in July at enhanced prices. To counteract the decreased profit, the Corporation, on the recommendation of the Gas Committee, virtually increased the price of gas by 3d. per 1000 cubic feet. But later the resolution was rescinded by a majority of one, and the net price of gas fixed at 2s. 1½d. instead of 2s. 3d. The result has been that, instead of the £5000 estimated, the profit has been £3900. This amount of £1100 will have to be made up out of the present year's rates; and if the price of gas is allowed to remain as it is, the Gas Committee during the ensuing year, with the present high price of coal, instead of a profit, estimate a loss of some thousands of pounds. All this will have to be met in the current year's borough rate; and though the rates would have been considerably less this year—owing to a largely decreased loss on the water and wharf undertakings, and the fact that the rateable value of the borough has gone up very considerably during the year—the deficit can only be provided for by a 2d. borough rate in excess of last year, when it was 2s. 4d.

As an instance of the remarkable advance of coal, it may be stated (says our daily contemporary) that the Corporation, according to the quotations obtaining and expected to obtain, estimate that the amount of coal which cost them nearly £23,000 last year will cost them over £7000 more this. And it may also be of interest to add that if, as is proposed, the price of gas be increased 6d. per 1000 cubic feet from the 1st prox., the discount remaining at 15 per cent., the estimated profit of the gas undertaking will only be between £2000 and £3000, against the £5000 generally earned—showing that the 6d. will not meet the whole of the extra cost imposed by the coal famine. One of the overwhelming arguments in favour of the price of gas being increased in preference to the rates, from the ratepayer's point of view, is that if the loss falls upon the rates, he is paying for cheap gas for the inhabitants of Norton, Thornaby, and Eaglescliffe, who are outside the borough, and therefore do not contribute to its rates; and when it is stated that about one-fourth of the total make of gas is used outside the borough, it will be readily seen that this is a serious matter. To give an instance, of the £1100 loss or decreased profit last year on the gas-works, nearly £300 will have to be supplied by the Stockton ratepayer over and above what he should have if the outside districts had been called upon to pay for the increased cost of production, or 3d. instead of 1½d. per 1000 feet.

The Finance Committee of the Corporation met last Thursday to receive the estimates from the various Committees; and, after considering the matter, they came to the conclusion that it was the most business-like method to raise the price of gas. A special meeting of the Corporation is to be called for to-morrow (Wednesday) to receive the estimates and declare the borough and district rates for the ensuing municipal year. The Gas Committee have given notice of their intention to move that all previous orders relating to the price of gas in Stockton be rescinded, and that the price be increased by 6d. per 1000 cubic feet—making the net charge, after allowing the usual discount of 15 per cent. for payment within fourteen days, 2s. 7½d. in the borough, 2s. 9½d. at Thornaby, and other places in proportion. If the price of gas is not increased, the borough rate will be 2s. 6d. in the pound, against 2s. 4d. last year. But, on the other hand, if the price of gas is increased by 6d., the borough rate will be 1s. 7d., or a reduction of no less than 11d. Against this the district rate is increased 1d., which is accounted for largely, if not wholly, by the preliminary expense in connection with the new electric light works, and the fact that the first year's interest and redemption on the capital sum borrowed has to be paid without any return.

WATH-UPON-DEARNE AND DISTRICT GAS SUPPLY.

Board of Trade Inquiry.

At the Wath Town Hall, an inquiry was recently held by Mr. Ingram R. Walker, on behalf of the Board of Trade, relative to an application by the Wath-upon-Dearne Gas Company for power to supply gas in Bolton-upon-Dearne, Thurnscoe, and other places outside their present area.

Mr. F. Parker Rhodes appeared for the Company, to which he is the Solicitor; Mr. J. Ellison, for the Wath and Bolton District Councils, the Brampton Bierlow Parish Council, and the Wath Main Colliery Company; Mr. F. Nicholson, Clerk to the Doncaster Rural District Council, was in attendance on behalf of that body; and Mr. A. Clegg represented Viscount Halifax, the owner of property at Hickleton.

Mr. Parker Rhodes, in opening the case for the Company, said they commenced operations about the year 1844. For a long time they carried on their business without statutory authority; but at a later period they were incorporated. At that time, the Wath urban district was not of the same dimensions as it was now. It was then under the government of one of the old bodies of Commissioners; and the radius over which they exercised jurisdiction was very limited. At a later period, when the Public Health Act was amended, the Urban District Council was constituted. Wath then endeavoured to extend its boundaries by taking in a portion of Brampton Bierlow. The Company were at that time supplying gas in Wath, and also in Brampton to a large extent. When the Wath Council took part of Brampton within their area, that supplied by the Company was outside the then new urban boundary. The population grew; and, as a matter of course, the consumption of gas increased. About two years ago the Company had become possessed of a small gas-works at Bolton-upon-Dearne, which had fallen into difficulties. They had acquired the works so as to furnish a supply of gas to the adjoining districts. A scheme had been launched which had led to the present inquiry. By it, the Company proposed to supply Wath, Brampton (if they so desired it), Bolton, and Thurnscoe. They also proposed to take powers to supply other townships, named Barmboro' and Hickleton. They were supplying gas in Bolton at the present time, and there did not appear to him to be any reason why the District Council should endeavour to prevent them from going into their district. The persons interested in this question were the consumers. With regard to Thurnscoe, mines had been constructed which caused a large increase of population which would in later years, he thought, be increased to an even greater extent. It was to supply this population that they were proposing to go into Thurnscoe; and the Parish Council supported the scheme. They could not go to Thurnscoe without passing through Bolton. This township was contemplating erecting gas-works; but the Company would be able to supply them at a lower rate than they could serve themselves from their own works. In respect to Brampton, he would like to know their requirements, and then they could have their wants supplied. There was a Gas Company at Elsecar who had parliamentary powers; and the whole of the parish of Brampton was within the limits of the Company. The proposed capital which the Wath Gas Company intended to raise was necessary to undertake future developments. The consumption of gas at the present time was 16 million cubic feet per annum, which was more than double what it was ten years ago. Gas could not be supplied at a less capital value than £1000 for every million cubic feet sent out; and it was estimated that the quantity annually consumed would be 43 millions—making a total of £43,000. The Company had supplied the township for fifty years and, as far as they knew, there had been no serious complaint.

The following evidence was then given.

Mr. *Thomas Clark*, in answer to Mr. Rhodes, said he had been for nineteen years Secretary to the Company, and for eight years a Director. The present capital was £20,000 nominal, of which amount £13,385 had been actually paid up. The capital in 1881 was £7500, when the quantity of gas consumed was 6 million cubic feet; and there had been a progressive annual increase up to 16 millions. The Company owned 3876 yards

of land, whereon the present Wath works were situate. The Company were proposing to enlarge the works, and lay a main through Bolton to Thurnscoe. The Bolton works would become auxiliary to the Wath establishment. They were cheaper and better that way than any other. The Company were asking for a maximum price of 5s.; but there was no intention of charging this amount.

Mr. ELLISON: If you get the Provisional Order, it would entirely end the question of Bolton having gas of their own?

Witness: That is so.

Mr. *W. Chapman*, a member of the Thurnscoe Parish Council, spoke as to the desire of that place to be supplied with gas.

Mr. *W. R. Chester* said the Company could not produce an increased quantity of gas without alterations to the works. The actual consumption in Bolton had been 1,620,000 cubic feet. He estimated that, at a proportionate rate of increase in population all round, the quantity of gas produced would be 26,700,000 cubic feet in excess in ten years. The present capital was £16,385, and the extent of increase applied for was £21,615 share capital and £5780 loan capital, which would raise the amount to £43,780. The Bolton Gas Company could not carry on the manufacture of gas for this place alone as cheaply as Wath could in their own urban district.

Mr. ELLISON said one could well understand the position of the Councils in opposing the application for the Provisional Order. The witnesses had proved beyond doubt that the district was most favourable for gas undertakings; and this was the reason the Gas Company had applied for the Order. The scheme was very strongly opposed by the inhabitants of Bolton. In the case of Brampton Bierlow, it was entirely a rural district, and there was no likelihood, in his opinion, that it would ever be publicly lighted.

Evidence in opposition to the application having been given, the inquiry terminated.

ELECTRIC LIGHTING NOTES.

On Thursday, Mr. H. P. Boulnois held an inquiry at Walsall with regard to an application by the Corporation to borrow a further sum of £15,000 for their electric lighting undertaking. The Town Clerk said the amount at present sanctioned was £30,350, and of this £29,385 had been expended. The margin of £1000 was for works included in previous estimates, and now in course of execution. He asked that the loan should be extended to 30 years, and pointed out that the limiting of the repayment to 25 years had seriously crippled many corporations. Mr. Boulnois intimated that he would consider the point.

At the meeting last week of the Huddersfield Town Council—when moving an addition of £100 a year to the salary of the Borough Electrical Engineer—Alderman Calvert, the Chairman of the Electric Lighting Committee, gave some interesting particulars as to the progress of the undertaking. Between 1896 and 1899, the capital expenditure had more than doubled. The consumers had increased from 385 to 1082; the lamps connected, from 28,983 to 70,178; the units metered, from 304,000 to 951,000; and the expenditure, from £3140 to £6660. The gross surplus had increased from £3728 to £9040; and in interest on loans and their repayment, the sum of £1789 had been paid.

The Maidstone District Council recently held a special meeting to consider the report of the Electric Lighting and Dust Destructor Committee, in which they recommended that, in addition to the mains provided for in the original scheme, others should be laid in certain streets specified; further, that more plant of various kinds should be procured; and that the resolution passed by the Council last October to apply to the Local Government Board for sanction to the borrowing of £30,000 should be rescinded, and application be made for £40,000 for carrying out the combined electric light and dust destructor scheme. The Mayor (Mr. E. Vaughan) moved the adoption of the report. He said some remarks had been made to the effect that the Council were not satisfied with borrowing £30,000, but wanted another £10,000. The idea of the Committee was that they should start the scheme on thoroughly good lines, and lay down plant which would do the work which was expected to come upon it. The results they had had from canvassing had been most gratifying; and this was the chief reason why the increase had been made in the sum to be borrowed. The Engineer had reported to the Committee that they had already more applicants for light than the plant could supply. Mr. Clark moved an amendment postponing the provision of the additional plant and cables until they saw whether or not the first instalment paid. The report was, however, adopted.

The Master Electrical Contractors' Association of Dublin have been pulling to pieces Mr. Hammond's report on the proposed extension of the electric light system in the city and the erection of a new generating station at the Pigeon House Fort. At their meeting last Thursday, they discussed the question all round, both from a financial and engineering point of view. For the scheme, borrowing powers to the extent of upwards of a quarter-of-a-million sterling are to be applied for. The Master Contractors are doubtful as to whether the scheme would result in that benefit to the ratepayers which Mr. Hammond's figures have led the Electric Lighting Committee to believe would accrue. They are also of opinion that the site selected is not such as will enable the Engineer to use the most suitable type of plant, or to work it at the highest efficiency; and its distance from the city means a largely increased outlay on mains, with a correspondingly heavy annual maintenance charge. As regards the distribution portion of the scheme, it is considered imperfect, as the lighting area would still be left as it is at the present time, without suitable provision for the supply of current for motors. It is further considered that the double, and possibly treble, transformation of current which forms part of the scheme will prove uneconomical, complicated, and liable to breakdown. In the opinion of the Association, the scheme is entirely overweighted by the enormous and uncalled for addition to the public lighting, which is entirely out of proportion to the revenue-earning load at present connected, and to the revenue-earning load which is likely to be connected for some years to come. To give the undertaking any chance of financial success, the extension of the public arc lighting should, it is thought, be deferred until a sufficiently large private connection has been secured to ensure that the profits accruing from the same will allow of the extension without unduly burdening either the ratepayers or the consumers of electricity.

OUTPUT OF COAL AND NUMBER OF PERSONS EMPLOYED IN COAL MINES IN 1899.

Preliminary Figures.

An advance proof has been issued by the Home Office, of the tables relating to the output of coal and other minerals, and the number of persons employed at mines under the Coal and Metalliferous Mines Regulation Acts, during 1899. The figures are subject to correction, and of a preliminary character only; and in the case of several important minerals, large quantities of which are obtained from quarries, they do not represent the total production of minerals for the year. The following figures relating to coal may, however, be regarded as substantially complete. The table shows the output, and numbers employed in each inspection district at mines, under the Coal Mines Regulation Act. It will be seen that between 1898 and 1899 the total output has increased from 202 to 220 million tons, or by about 9 per cent.; and the numbers employed, from 707,000 to 729,000, or by about 3 per cent. Owing to the great coal dispute in South Wales, the figures for some districts in 1898 were abnormal; and those for 1897 have been inserted for comparison. The increase of output in 1899 compared with 1897 is about 9 per cent., and of number employed about 5 per cent.

Districts.	Number Employed.			Total Output of Coal (in Thousands of Tons).		
	1897.	1898.	1899.	1897.	1898.	1899.
Newcastle	72,223	73,736	77,623	21,768	23,005	23,753
Durham	80,599	81,184	82,927	23,810	24,372	24,406
Yorks. and Lincs.	89,782	91,452	95,140	24,049	25,631	26,901
N. & E. Lancashire	38,945	38,732	38,965	10,439	10,897	11,034
Liverpool	54,369	53,799	54,090	15,299	16,627	16,548
Midlands	80,322	82,314	84,797	23,798	25,768	27,581
N. Staffordshire	24,639	25,272	26,404	6,434	6,652	6,799
S. Staffordshire	25,970	25,993	27,279	9,316	9,421	9,413
South Western	45,760	46,471	47,422	12,478	9,442	13,753
South Wales	92,624	94,938	97,456	25,510	19,860*	28,629
West Scotland	39,215	40,453	42,305	12,696	13,216	13,393
East Scotland	49,752	51,569	53,607	16,387	17,021	17,750
Ireland	1,013	981	993	135	130	125
Total	695,213	706,894	729,009	202,119	202,042	220,085

* Affected by prolonged trade dispute (April to September).

THE COAL CRISIS IN RUSSIA.

The difficulty experienced by a large number of gas managers in England in obtaining supplies of coal during the past winter invests with special interest the question of the supply of this material in other countries. Russia, as our readers are probably aware, has been suffering from a coal crisis; and a report thereon, and upon the main sources of native supply, has been made to the Foreign Office by Mr. H. Cooke, the British Commercial Agent in the Empire. It was issued last Wednesday as one of the series of Consular Reports; and we give the following extracts from it.

In his introduction, Mr. Cooke explains that the continuance of the coal crisis, the abnormal rise in prices, the exhaustion of available stocks, and the dearness of kindred mineral fuels, have led to the temporary relaxation or remission of the duties on foreign coal, to stern and summary measures on the part of the authorities in Poland, fixing prices and suppressing the active influence of "rings" and syndicates, and to Government Commissions now sitting to examine into, and report upon, the whole question in all its branches. He points out that as the very lifefood of all industries, and of all transport by which those industries thrive and develop, the supply of available coal, encouraged and checked in turn by artificial means, in no way corresponds to the demand that the increasing industrial activity of the country makes upon it, the more so for the reason that the coal itself is but of moderate quality; for, though the output of native coal has enormously increased of late years, the import of the foreign article has likewise steadily risen, in spite of duties, till at the present moment the import of foreign coal has become of such urgent necessity that these have had to be temporarily reduced or remitted altogether.

The mining industry, itself young, has not had time to meet the demand caused by the rapid and undisputed rise and extension of the general industrial energy of the country during the last ten years. But these industries in general are also still in their youth; so that there seems to be no prospect of the supply and demand coming more in reach of each other for some time. In the Donetz basin alone, it is estimated that this year there will be a deficit of 30,000,000 poods (483,870 tons) in the supply, as compared with the demand, and in the Dombrovski basin 20,000,000 poods (322,580 tons), or altogether close upon 1,000,000 tons. Mr. Cooke states that a host of subsidiary causes of the present scarcity, each more or less important factors in the situation, aided by speculation, are now the subject of daily contention and discussion. Before reviewing this discussion, and the measures taken by the Government to fill up the void in the supply, he surveys in general terms the main sources of native coal in Russia, and first of all shows, by a few figures, the enormous rise in the industrial movement of the country, to which the present coal crisis is chiefly attributed.

The Minister of Finance, in his Budget statement of Jan. 1, 1900, tabulates the progressive growth of the general manufacturing industry of European Russia during the last twenty years; and, exclusive of mines, the totals are as follows: The output of the manufacturing industry of European Russia in 1877 amounted to 541 million roubles; in 1887, to 802 millions; and in 1897, to 1816 millions. The average annual increase of productiveness from 1878 to 1887 was 26·1 million roubles; from 1888 to 1892, 41·6 millions; and from 1893 to 1897, 161·2 millions. In

addition to the above, taking the mining industries, we have the following outputs:—

	Millions of Poods (62 poods = 1 ton).		
	1877.	1887.	1898.
Coal	110	277	746
Naphtha	13	167	507
Pig iron	23	36	134
Iron	16	22	30
Steel	3	14	90

With this great increase in the industrial output of Russia since 1877—and particularly since 1887—we see at the same time a rapid rise in the yield of native coal, from 110,000,000 poods (1,774,193 tons) in 1877, to 746,000,000 poods (12,032,258 tons) in 1898. The output in 1899 has probably been 800,000,000 poods (in round figures, 13,000,000 tons).

At the same time, in spite of duties, there has been a continual increase in the import of foreign coal (over European frontiers)—*i.e.*, from 1,532,258 tons in 1877 to 3,161,290 tons in 1898; while the total for 1899 will doubtless be considerably larger.

The two main coal-producing centres are the Donetz basin in the south, and the Dombrovski basin in Poland. Besides these, but yielding far inferior supplies, are the Ural district (of almost illimitable possibilities), the Tula and other central provinces, the Kuznetski basin in Siberia, the Trans-Caucasian, and other districts, which, however promising, are as yet practically undeveloped.

The Donetz basin, including part of the government of Ekaterinoslav and part of the province of the Cossacks of the Don, in the south of Russia, is one of the richest in the world, with practically inexhaustible resources calculated to produce yet some 860,250,000,000 poods (13,875,000,000 tons), or, allowing for progressive output, to last for 800 years. With 254 mines, it yielded in 1897 upwards of 355,000,000 poods of coal, in addition to 59,435,600 poods of anthracite. During 1899, the increase here alone was more than 1,000,000 poods. Worked at first by numerous small companies or owners, spread in all directions, over 80 per cent. of the output now comes from 15 great mines, aided by foreign capital, mostly Belgian, which, especially of late years, has enabled work to be carried on with feverish activity, though still hindered by transport and other difficulties. The Donetz basin has to compete with Polish coal coming to Kieff, British in the Black Sea, and with naphtha fuel in the Moscow region. The coal itself is not of first-rate quality, having a high percentage of ash and sulphur, nor does it lend itself to any good kind of coke. It hardly finds as yet any extensive market abroad. In that basin the price for big coal in January, 1900, was 14 c. per pood, delivered at the nearest railway depôt. Prices have fluctuated considerably from 18 c. per pood, delivered in trucks, in 1870, to 5½ to 6 c. in 1896; while of late the rise has been very rapid. At Odessa, during 1899, Donetz coal varied from 14 to 21 c. per pood; Glasgow-Hull, 22 to 25 c. per pood; Cardiff, 24 to 30 c. per pood; and Newcastle (till July), 25 c. per pood. Freights fluctuated between 11s. 6d. and 8s. per ton. At present (February, 1900), the price of English coal at Odessa varies from 28 c. to 30 c. per pood.

The Dombrovski basin is a continuation of the great Silesian coal basin, and covers an area of some 800 square versts. Inferior in most respects to the Donetz basin, and practically producing no coke, its output has, however, considerably increased; its 20 mines yielding 230,000,000 poods in 1897, compared with 120,000,000 poods in 1880. The basin is worked by a few great mines—20 in all—and the output is distributed over Poland, and in part finds a market in Russia.

The Ural mines are of extraordinary richness, practically inexhaustible in the amount of the possible output; but the coal is of only very moderate quality. They extend mostly along the line from Perm to Ekaterinburg. The output has risen from 10,000,000 poods in 1887, to 22,500,000 poods in 1894, and 22,000,000 in 1899—poor figures compared with the industrial needs of the district, and with the capabilities of the mines themselves. About three-quarters of the output is used up by neighbouring railways. The Ural district is immensely rich in minerals, which only need greater development, further railway extension, and more abundant and more easily accessible fuel. Though the coal here is of thin inferior quality, it has its uses; and while useless for most kinds of foundry work, it can be employed for boilers, locomotives, &c. With the extension of railway communications, this coal region and its other mineral industries will enormously develop.

Among the remaining coal-producing districts—far inferior in present yield, however, to any of the above, but with all the possibilities of a great future—is the Eskibastus, on the west bank of the Irtish, south of Omsk, containing, it is estimated, a reserve of over 200,000,000,000 poods of coal, with copper and iron ores in the neighbourhood. The coal is, however, said to be of but moderate quality. The Kusnetski basin, in the government of Tomsk, Siberia, which the Siberian Railway will help to develop, the Tula and central districts of European Russia, and the Caucasian (Tkvibulski) district—all with very moderate yields—are the remaining coal regions of Russia worth mentioning.

Returning to the present coal crisis, Mr. Cooke states that the following are among the temporary measures taken by the Government to ward off the effects of the general scarcity: Odessa has been authorized to import 6,000,000 poods (96,774 tons) of foreign coal for household purposes at a reduced rate of duty (1½ c. instead of 6 c. per pood) till Jan. 1/14, 1901; and similar reductions have been made at other ports of the Black Sea and Sea of Azov for fuel for steamers, &c. The free import of foreign coal has been authorized for the needs of the population of Warsaw, as also for all the Russian railways till Sept. 1/14 next for railway uses only. At Warsaw, wholesale dealers have been summarily ordered, under heavy penalties, not to keep prices above 1 r. 15 c. the korzec of 6 poods; while it is stated that seventeen of the largest dealers have been placed under police supervision. The result, in general, has not been entirely successful; and the Government have had to send across the frontier for Silesian coal, and been unable to obtain it, owing to transport difficulties, as well as to want of surplus supplies there. A Government Commission has been sitting for some time at St. Petersburg to inquire into the whole question of the coal supply and demand, more with a view to organic measures than to any permanent relaxation or remission of duties or other temporary expedients.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 793.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 13	10½	Alliance & Dublin 10 p. c.	20½—21½	..	4 17 8
100,000	10	,,	7½	Do. 7 p. c.	14—15	..	5 0 0
200,000	100	Jan. 2	5	Australian 5 p. c. Deb.	100—102	..	4 18 0
200,000	5	Nov. 15	6	Bombay, Ltd.	6¼—6¾	..	4 8 11
40,000	5	,,	8	Do. New, £4 paid	4½—4¾	..	5 1 1
380,000	Stk.	Feb. 23	12	Brentford Consolidated	267—272	..	4 8 3
270,000	,,	,,	9	Do. New	203—208	..	4 6 7
80,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb.	118—123	..	3 5 1
220,000	Stk.	Mar. 14	11½	Brighton & Hove Orig.	250—255*	..	4 10 2
226,320	,,	,,	8½	Do. A. Ord. Stk.	180—185*	..	4 11 11
999,500	Stk.	Feb. 23	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Sept. 29	10	British	42½—43½	−½	4 11 11
50,000	10	Feb. 23	12	Bromley, Ord. 10 p. c.	24—26	..	4 12 4
79,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd.	9⅞—10½	..	5 17 1
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	99—101	..	3 19 3
150,000	20	Mar. 14	8½	Cagliari, Ltd.	25—27*	..	6 2 3
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	15—16	..	5 0 0
50,000	50	Nov. 2	6	Do. 6 p. c. 1st Mort.	56—58	..	5 3 5
550,000	Stk.	Oct. 13	13½	Commercial Old Stock	305—310	..	4 7 1
200,750	,,	,,	10½	Do. New do.	240—245	..	4 5 9
200,750	,,	Dec. 14	4½	Do. 4½ p. c. Deb.	142—145	..	3 2 1
800,000	Stk.	Dec. 14	9	Continental Union, Ltd.	170—180	..	5 0 0
200,000	,,	,,	7	Do. 7 p. c. Pref.	178—183	..	3 16 6
51,600	Stk	Feb. 23	14	Croydon A 10 p. c.	335—340	..	4 2 4
173,400	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
555,000	Stk.	Feb. 23	5½	Crystal Palace Ord. 5 p. c.	122—127	..	4 2 8
60,000	,,	,,	5	Do. 5 p. c. Pref.	132—137	..	3 13 0
486,090	15	Jan. 26	11	European, Ltd	20—21	..	5 4 9
354,060	10	,,	11	Do. £7 10s. paid	15—16	..	5 3 2
14,993,075	Stk.	Feb. 9	4 1/10	Gas-light and Coke — 4 p. c. Ord.	104—106	+1	4 12 5
2,600,000	,,	,,	3½	Gas-light and Coke — 3½ p. c. max.	97—99	..	3 10 8
3,799,735	,,	,,	4	Gas-light and Coke — 4 p. c. Con. Pref.	119—122	..	3 5 7
3,993,975	,,	Dec. 14	8	Gas-light and Coke — 3 p. c. Con. Deb.	99—101	..	2 19 5
70,000	10	Nov. 15	8	Hongkong & China, Ltd.	13½—14½	..	5 10 4
3,900,000	Stk.	Nov. 15	10	Imperial Continental	211—214	−2	4 13 6
473,600	Stk.	Feb. 9	3½	Do. 3½ p. c. Deb. Red.	100—103	..	3 8 0
75,000	5	Dec. 14	6	Malta & Medn., Ltd.	4½—5½	..	5 9 1
560,000	100	Oct. 2	5	Met. of Melbourne — 5 p. c. Deb.	110—114	..	4 7 9
250,000	100	,,	4½	Melbourne — 4½ p. c. Deb.	107—109	..	4 2 7
541,920	20	Nov. 15	3	Monte Video, Ltd.	11—12	..	5 0 0
667,946	Stk.	Feb. 23	9½	Newc'tle & Gatesh'd Con.	215—220	..	4 4 1
299,855	Stk.	Dec. 29	8½	Do. 8½ p. c. Deb.	104—107	..	3 5 5
60,000	5	Feb. 23	7	Ottoman, Ltd.	4½—5½	..	6 13 4

*Ex div.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
150,000	5	Nov. 30	8	Oriental, Ltd.	7—7½	..	5 6 8
135,000	5	,,	8	Do. New, £4 10s. pd.	6⅞—6¾	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.	1¾—1¾	..	4 11 5
500,000	100	Dec. 1	6	People's Gas of Chicago — 2nd Mtg. Bonds	102—106	..	5 13 2
851,070	10	Oct. 13	7	River Plate Ord.	11¼—11⅜	..	5 19 2
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	100—102	..	18 5
250,000	10	Sept. 15	10	San Paulo, Ltd.	12—13	..	7 13 10
135,000	Stk.	Sept. 15	10	Sheffield A.	249—251	..	3 19 8
209,053	,,	,,	10	Do. B.	249—251	..	3 19 8
447,427	,,	,,	10	Do. C.	249—251	..	3 19 8
5,600,000	Stk.	Feb. 23	5½	South Metrop., 4 p. c. Ord.	135—138	..	3 17 3
1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb.	100—102	..	2 18 10
120,000	Stk.	Mar. 14	6	Tottenham and Edmonton — A. 5 p. c.	139—141*	..	4 5 1
250,520	,,	,,	4½	Tottenham and Edmonton — B. 3½ p. c.	100—102*	..	4 8 3
55,100	,,	Dec. 14	4	Edmonton 4 p. c. Deb.	113—117	..	3 8 5
182,380	10	Jan. 12	5	Tuscan, Ltd.	8½—9½	..	5 5 3
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.	101—104	..	4 16 2
				WATER COMPANIES.			
780,399	Stk.	Dec. 29	11	Chelsea, Ord.	207—312	..	3 10 6
150,000	,,	,,	5	Do. 5 p. c. Pref.	157—162	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	145—150	..	3 0 0
175,785	,,	Sept. 29	4½	Do. 4½ p. c. Deb.	148—153	..	2 18 10
1,720,560	Stk.	Oct. 18	7	East London, Ord.	205—210	..	3 6 8
654,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb.	145—150	..	3 0 0
390,000	,,	,,	3	Do. 3 p. c. Deb.	99—101	..	2 19 5
700,000	50	Dec. 14	7½	Grand Junction — 10 p. c. max.	108—110	..	3 8 2
310,000	Stk.	Sept. 29	4	Grand Junction — 4 p. c. Deb.	131—136	..	2 18 10
708,000	Stk.	Feb. 23	14	Kent	308—313	−4½	4 9 5
160,000	,,	,,	7	Do. New, 7 p. c. max.	200—210	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.	295—300	..	3 10 0
406,200	100	,,	8	Do. 7½ p. c. max.	215—220	..	3 12 9
350,000	Stk.	Sept. 29	4	Do. 4 p. c. Deb.	132—135	−3	2 19 3
500,000	100	Feb. 23	13½	New River, New Shares	420—425	..	3 3 6
1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb.	132—137	..	2 18 5
902,300	Stk.	Dec. 14	7½	South-wark and — Ord.	200—205	..	3 13 2
126,500	100	,,	7½	South-wark and — 7½ p. c. max.	190—195	..	3 16 11
489,200	Stk.	,,	5	South-wark and — 5 p. c. Pref.	160—165	..	3 0 7
1,019,585	,,	Oct. 13	4	Vauxhall 4 p. c. A Deb.	131—136	..	2 18 10
1,155,066	Stk.	Dec. 14	16	West Middlesex	288—293	−2	3 8 3
200,000	,,	,,	4½	Do. 4½ p. c. Deb.	147—152	..	2 19 3
200,000	,,	Mar. 14	8	Do. 8 p. c. Deb.	99—101*	..	2 19 5

*Ex div.

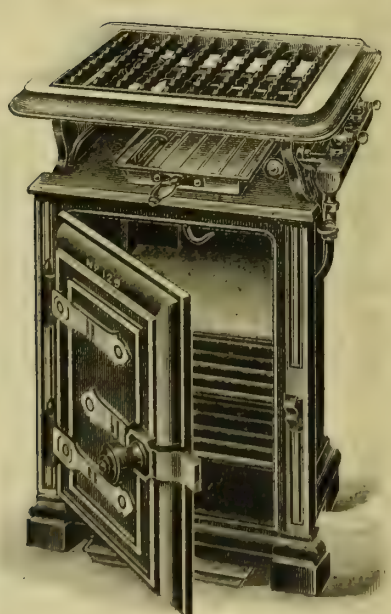
Dealing with the causes of the scarcity, Mr. Cooke says that, while the undoubted rise and development of late years in the industrial activity of Russia, and the extension of railways and navigation, have been perhaps the chief, they are by no means the only explanation of the present scarcity and high prices of coal. The coal mining industries themselves are not developed enough to meet the demand, in spite of an increasing output and of a protective tariff; while insufficient railway accommodation, difficulties of delivery, and generally defective transport arrangements play an important part in the situation. Another consideration is the dearness of naphtha and kindred fuels preceding the rise in coal prices. The activity of syndicates and "rings," by limiting production and bringing up prices, and the universal speculation and gambling attending of late the coal and other industries of Russia, are equally important factors, against which the Government have taken, as shown above, summary administrative measures—at least as regards coal. In the Dombrovski basin, the second largest coal-producing district of Russia, the mines at work are distributed among 15 or 16 owners, five of whom, it is said, produce 86 per cent. of the whole annual yield—a condition which could easily lend itself to irregularities; while wholesale dealers on their part, in a trade which in every country seems peculiarly to lend itself to abuses, could hardly fail to take advantage of the scarcity, or to promote it, so as, by limiting the stocks available, to get full command of the market, and work prices upwards to the desired point. By the end of December, dealers at Warsaw had raised prices to 225 r. the load of 660 poods, while it cost them only 100 r. The Government now force them to sell at prices not higher than 115 r. the load. The action of the railway companies, forcing the collieries to provide at original or only slightly increased prices, under previous agreements, irrespective of scarcity, has had a considerable bearing on the crisis. Other subsidiary causes, which are said to have more or less influenced the situation, have been the want of hands, the rise in wages, the decrease of hours, and the superabundance of national and religious holidays—to an extent, however, which has been much disputed. Others see nothing specially local in the state of the market, but attribute it to the more or less corresponding scarcity elsewhere, and other external causes, such as the war in South Africa. The non-use of naphtha as fuel for warming purposes, even in the Baku and other regions where it is comparatively cheap, is also brought forward; tradition and fear of dangerous results, besides a somewhat complicated apparatus, rendering hard fuel more popular to the ordinary mind.

With regard to remedies, Mr. Cooke says the Government have already, with more or less success, by temporary relaxations or remissions of duties on foreign coal, and by stern administrative measures against the action of syndicates and speculation in general, provided for the present. These are, however, but temporary expedients, not touching the heart of the matter; and it is universally recognized that organic changes and improvements all round, at the mines and in the means of transport, have become urgently necessary. There is an inexhaustible supply of coal in Russia as yet undeveloped. True, it is generally of somewhat inferior quality. While one or two papers boldly propose the permanent abolition of duties on foreign coal and coke—protesting that by fifteen years of protection the authorities have systematically ignored the interests of consumers, and helped thereby to devastate the forest riches of Russia—the Government itself, by the mouth of the President of the Commission now investigating the whole subject, emphatically declared at the first meeting that the question of the remission of duties could not enter into the programme of discussion at all. Others propose, as the only remedy, that the State itself, as a great railway owner, should have its own mines and work the railways from them.

COUNTY COUNCILS AND WATER SUPPLIES.

At the Annual Meeting of the Northumberland County Council, the Parliamentary Committee reported that they had adopted the following report of a Sub-Committee appointed in regard to the future water supply of the country: In the opinion of the Sub-Committee, a Royal Commission should be appointed for the purpose of taking evidence and reporting on the practicability and advisableness of—(1) Assimilating the law relating to percolating water with that relating to water in a defined channel, so as while adequately safeguarding the interests of others, to afford at least some protection to well owners and other persons interested in percolating water. (2) Determining the principles which should usually guide Parliament in conferring exceptional local powers on Corporations and water companies, with special regard to the sources of supply available to the particular Corporation or company. (3) Establishing with large powers a water authority in each county, or group of counties where the counties are small, or where there are more than one county dependent, or likely to be on the same source of supply.

At the meeting of the Water Committee of the St. Helens Corporation on the 14th inst., the Town Clerk (Mr. G. W. Bailey) reported that he had attended, on behalf of the Corporation, the Special Committee of the Association of Municipal Corporations, called to confer with the representatives of the County Councils on a suggestion that there should be an amendment of the law enabling the Councils to have some control over the pumping of water in the case of collieries and other authorities obtaining a supply from deep wells. The representatives of the Councils gave illustrations of various cases in which surface water supplies had been interfered with by colliery sinkings and by pumping; and they thought the condition of things demanded some action by Parliament. It was pointed out to them, however, that many boroughs derived their supply from deep wells; and they thought that, so far as Corporations were concerned, the rights of the counties were sufficiently protected. It was also intimated that they would not be prepared to support any action which would result in the authorities of large towns being more hampered than they now were in the field of water supply. If power were put into the hands of County Councils to veto local authorities, the Councils would be able to extort unreasonable terms from large towns. In the end, the representatives of the County Councils agreed to formulate their ideas, not excluding the local authorities of the towns or boroughs from the powers, at any rate making them apply in a modified form; and these ideas were to be submitted to a subsequent meeting of the Association.



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OLDHAM CORPORATION WATER SUPPLY.

History of the Water-Works.

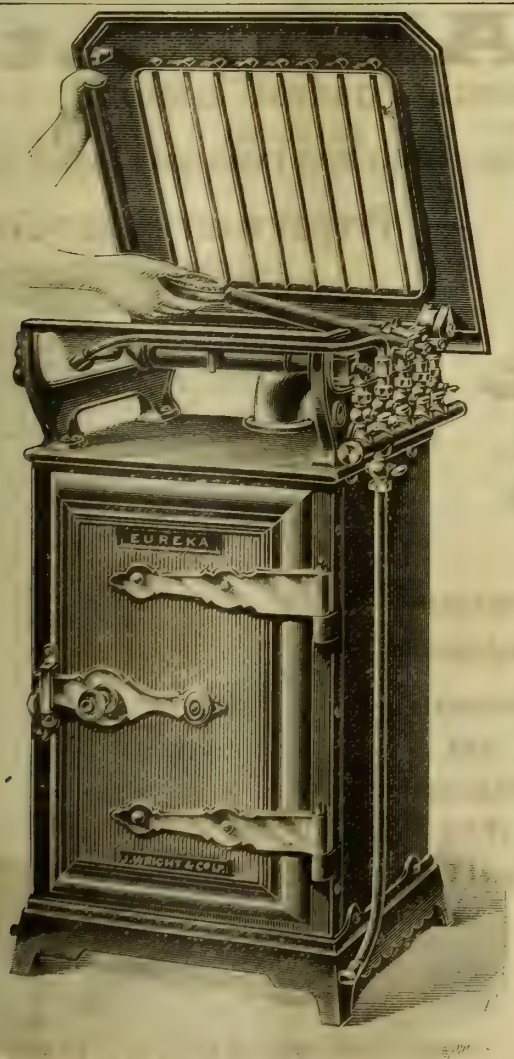
Before the members of the Oldham Municipal Officers' Guild, Mr. C. J. Batley, the Manager of the Corporation Water-Works, recently delivered a lecture on the undertaking of which he has charge. He commenced by enlarging on the necessity of a big manufacturing town like Oldham having an ample supply of pure water available for domestic, trade, and sanitary purposes, and then proceeded to give a history of the water-works from the time when the town was supplied by a private Company. The first works to be constructed were the Strinesdale reservoirs, which are partly within the borough—the upper reservoir being constructed in 1825, and the lower one in 1838; their storage capacity together being 216 million gallons. At this time, when the lands draining into the reservoirs were in a low state of cultivation, and the science of bacteriology as applied to the examination of water was unknown, the quality of the supply was unquestioned by the then consumers, so long as the commodity was not what is termed "meat and drink." Modern science, however, and a greater regard for the public health, have compelled the abandonment of these sources of supply; and the two reservoirs named are now solely used for storage, and are supplied by the surplus water from Castleshaw. In 1853 the water-works were acquired by the Corporation; and shortly afterwards parliamentary powers were obtained for the fine series of reservoirs in the Piethorn Valley, including Norman Hill, Piethorn, and Kitcliffe, as well as the Brushes Clough and Besom Hill reservoirs. In 1865 the powers for the construction of the Hanging Lees reservoirs, and in 1870 for the Ogden reservoir, were obtained. By subsequent powers obtained in 1886, the last-named reservoir was enlarged; and the Rooden reservoir, approaching completion, was constructed. The capabilities of this valley, which contains six reservoirs, are now exhausted. These reservoirs will store 961 million gallons of water from a drainage area of 1820 acres. Parliamentary powers for their construction were not obtained without great opposition. Millowners who are on the stream below the reservoirs have to be compensated by supplying them with one-third of the available rainfall, which must be stored and sent into the stream in regular quantities at certain times to be fixed by them. This compensation is one of the penalties which the Corporation have to pay for the privilege of abstracting a portion of the waters of this valley for the use of the town. In 1876 the construction of the four Denshaw reservoirs was commenced, with a storage capacity of 381 million gallons. These works were utilized for the service of the town in 1883, and were no sooner completed than, owing to the rapid increase in the population in the district of supply, it was found necessary to take steps to further augment the resources of the undertaking, and find new areas of supply. In 1886 powers were obtained for the construction of the Castleshaw works. This scheme provided two reservoirs, with a storage capacity of 289 million gallons. The surplus clean water from this drainage area of 950 acres is conveyed by a line of pipes 30 inches in diameter for 4½ miles, passing under Highmoor in a tunnel 1½ miles in length.

Having given a brief historical sketch of the water undertaking, the lecturer proceeded to explain the system adopted in the design and working of the reservoirs. They stand one above another, enabling the flood or turbid waters to be retained separately in the higher reservoirs and decanted down to the lower ones when sufficiently clarified; thus oxidizing, aërating, and ensuring constant change in the water, which helps to keep down to a minimum the growth of plant life, and breaks up the organic matter contained in it. This system allows practically the whole of the flood waters to be stored for domestic consumption; thereby utilizing to its fullest extent the resources of the drainage areas. Owing to the peaty character of the Oldham watersheds, the rainfall gathers a certain proportion of colouring matter from it; but by exposure to light and air, coupled with the drainage system adopted, the colour is bleached, and the water when supplied to the consumers is second to none as a good potable water. Means are also now being taken to prevent the water from becoming contaminated with lead when passing through the service-pipes. In the collection of the waters to be eventually distributed, the greatest care has to be given. Flood waters have to be diverted at the proper times—frequently in the middle of the night. Wreck lodges (small reservoirs constructed on the various streams, to allow any matter in suspension to precipitate) have to be regularly cleansed; and as these are very numerous, the work entailed is considerable. Drains, of which there are hundreds of miles, have to be cleansed of vegetable growth and extraneous matter. At present a population of about 235,000 persons, each consuming from 20 to 25 gallons of water per day, is being furnished with a constant supply. To do this, iron pipes of large diameter are laid from the reservoirs to the town; and the total quantity delivered is registered by meters fixed near the works.

In concluding, the lecturer expressed the hope that such a thing as a water famine might never afflict the town, and that Oldham might in the future, as in the past, be able to boast that she possesses a water supply second to none in the kingdom for purity and abundance.

The New Gas-Works for Brussels.—The daily productive capacity of the Brussels Gas-Works (about 5¼ million cubic feet) is being doubled by the construction of second works the size of the present ones; and they are expected to be opened in July. As far as equipment is concerned, mechanical appliances of the latest kinds will be employed, and they will be operated by electricity; the dynamo being of 1200-horse power. The unloading of the coal vessels, the charging and drawing of the retorts, and the conveyance, stacking, and bagging of the coke, will all be done by machinery.

The Costs of Promoting and Opposing Water Bills for Newhaven and Seaford.—A Joint Committee of the Newhaven and Seaford District Councils has been discussing the manner in which payment should be made of the bill of costs incurred in promoting and opposing Water Bills in 1898-99. The amount which the two towns will have to provide is £4925; and this is to be equally divided between them. The Committee recommended the Councils to apply to the Local Government Board for a loan, the repayment of which it is hoped to extend over ten years. The Committee's proposal has been adopted by both bodies.



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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

On Monday last, the Edinburgh and Leith Gas Commissioners held their annual statutory meeting, which was presided over by Provost Mackie, of Leith. The report of the Engineer (Mr. W. R. Herring) showed an increase in the output of gas during February, as compared with February of last year, of 14½ million cubic feet, and an increase since May 16 of nearly 82 million cubic feet. The cost of coal per 1000 cubic feet of gas is now a little over 2d. more than it was a year ago. There has been an increase in the number of gas-cookers on hire since May 16, of 856. Referring to the output of gas, Mr. Kinloch Anderson said that the normal increase was being maintained. Some people, he remarked, thought it was getting a very common phrase to hear of an increase every time; but it continued all the same, and he was very pleased that it did so. On the recommendation of the Works Committee, the Clerk (Mr. J. M'G. Jack) was instructed to advertise for tenders for coal, oil, lime, and other stores. Mr. Kinloch Anderson said that in respect of the coal and oil stores, the offers would be asked both for six months and for twelve months. They could then accept either one or the other. This method of tendering might be to the advantage of the Commission; it certainly could not be to their disadvantage.

With reference to the Edinburgh Corporation Bill, which I observe was before a Committee of the House of Lords yesterday, the Finance and Law Committee reported that they had considered the petitions against the Edinburgh Extension Bill, and the possibility of the Corporation and the Duke of Buccleuch arranging for the inclusion within the city boundaries of the foreshore and Shore Road at Granton, on which foreshore the Commissioners have right of tipping refuse, &c., and on which road there are railway lines over which the Commissioners have right of running traffic for a nominal sum, which rights largely influenced the Commissioners in acquiring the ground at Granton, and which inclusion would give the Corporation right to regulate the traffic, and might cause the Commissioners very serious loss and trouble. The Committee asked power to watch the progress of the Bill in the First House, with the view, if necessary, of petitioning against it in the Second House. This was agreed to; and in accordance with the resolution, a deputation of the Commissioners have been in London all the week. It is almost useless to write of this matter now, because by next year such inquiries will be held in Scotland; but it will not be out of place to point out that, if it had not been for this practice of compelling public men to hang on at Westminster for unconscionable periods of time, there might never have been any demand for local inquiries. Committees having five or six Bills relegated to them, put them all out together; and everyone, from the uttermost parts of the realm, requires to be present, as it is impossible to tell when their turn may come. I suppose that officials, who consider themselves overworked, are responsible for the crowding of these bothersome inquiries into as short a space of time as possible; and the Committees, also desirous of getting through with their work, silently acquiesce. It surely should be possible to put out the applications on definite days. In this case, I see that the inquiry has been postponed till Monday, which means to all the parties interested either the fatigue of a double journey between London and Scotland, or the loss of another day (to-day). Would it not have been better, about the middle of the week, to have arranged to open the inquiry on Monday? Then everyone could have returned to Scotland, which, in the words of Mr. Kinloch Anderson, might have been to their own advantage, and would certainly not have been to their disadvantage.

In the evening, the annual dinner of the Commissioners was held in the Balmoral Hotel—Provost Mackie again in the chair; the Lord Provost of Edinburgh being in London. Of late years, the gathering has resolved itself into a social function—all speaking, except in the proposing of the loyal toasts, being eschewed. The proceedings are, in consequence, rendered more pleasant. They were particularly so this year; and I desire to make mention of the excellent qualities of head and heart of the Chairman, as being the most important element contributing to the enjoyment of the evening. Provost Mackie has a happy method of dispatching business; and when pleasure is the billet on the programme, he is equally at home. His appointment as a Chief Magistrate is a distinct aquisition to the public life of Scotland.

While at one time I was disposed to look with a critical eye upon the sayings and doings of Bailie Mackenzie, of Edinburgh, in matters electrical, I have lived to learn that he is a gentleman who does not speak without book. He has done more to popularize electricity than any other public man in Scotland; and his reward, as yet, is the knowledge that the installation he controls stands first in the United Kingdom in more respects than one. It will be information to most to learn that he originally undertook the work with reluctance, at the urgent request of the then Lord Provost (Sir James Russell). When he did undertake it, he took it up in no half-hearted manner. Whatever he says upon electricity is interesting; and that is the reason why I give one or two quotations from his latest utterance on the subject, which was an address before the Edinburgh Association of Science and Art this week. He said that "during the nineties the progress of electric lighting companies and corporations had been very great; and at present six millions were invested in electric lighting in London, and about eight millions in the provinces. In London, the companies had a capital of five millions, as against three-quarters of a million claimed by the local authorities; while in the provinces the positions were reversed, the local authorities having a capital of over six millions and the companies less than two millions. . . . . The weak point in all purely electric lighting was the impossibility of having storage, in the proper sense of the term—for the so-called storage batteries were hardly worthy of the name. They might be necessary; but they were neither desirable nor economical. In the absence of a system of storage, the drawback was that machinery must be provided for the highest load, though this might only be for half-an-hour in the 24. Not only machinery, but a staff must be kept in waiting for that half hour during the other 23½ hours. If, then, a reasonably long demand for current could be obtained in other directions than

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lighting, a very low charge might prove profitable to the undertakers; while to many users the benefits would be equally great. For instance, suppose they had in Edinburgh electric traction supplied by the current from the present electric mains, personally he would be inclined to sell the necessary current for 1d. per unit, from which a profit of 30 or 40 per cent. could be made. He had many a hard struggle in the Town Council to persuade some of his friends that, while the cost of the energy at the start of the undertaking was 8d. per unit, they should sell at 6d. so as to get a large output as soon as possible. To this policy of selling cheap with a large turnover, he attributed to a large extent the position of Edinburgh in the electric lighting undertakings of the country. . . . Although it was a difficult matter to judge of the light from a particular burner or a particular lamp, electric lighting at 4½d. per unit, he thought, was about equal, light for light, to gas at 3s. per 1000 cubic feet burned in an ordinary flat-flame burner. Of course, if the gas was burned in an incandescent burner, electric lighting would not stand the comparison. But at the same time, if this were done, the upkeep of the mantles, which were exceedingly fragile, should be taken into account; and probably for a lengthened period the difference would not be at all so great as at first sight appeared." Apropos of the opening sentences of this paragraph, I may say Bailie Mackenzie has also shown that he has the capacity of learning as he goes along. He has considerably modified his views as to gas supply, and now no longer speaks as if it were a thing which is likely to become obsolete. It will be observed that he frankly admits the superiority of incandescent gas lighting. His opinion as to the relative cost of gas and electric lighting is one from which anyone may differ. I do not accept his view. I consider that a No. 4 Bray gas-burner gives a great deal more light than a 16-candle electric lamp gives when it is new, not to speak of when it is a few months old. A No. 4 Bray burner, with gas at 3s. per 1000 cubic feet, will, in 2000 hours, consume gas to the amount of £1 4s.; a 16-candle electric lamp will, in the same time, consume 2000 units, which, at 4½d. per unit, amounts to £2 6s. 10½d. So much for that "opinion." His remarks about the difficulties attending the question of storage may be commended to the notice of electricians everywhere.

The trial of the action by Mr. Christie against Mr. Craik, both members of the Corporation of Forfar, in which £1000 was sued for as damages for slander, took place in Edinburgh this week, and resulted in the pursuer getting one farthing damages. The utterances complained of had reference to transactions in hay and straw; but the animosity which led up to the accusations being made, was said to have begun in 1891, when Mr. Craik was Convener of the Gas Committee, and Mr. Christie, during the election, alleged that the gas-works were being mismanaged. Mr. Christie stated in the witness-box that Mr. Craik changed his attitude towards the Gas Manager in 1897; and the Gas Manager came to him asking his protection. It is well known that Mr. Craik, from being the champion of the Gas Manager, became one of his severest critics, both in public and in private. The trial revealed a wretched state of matters. Mr. Christie is a frequent fault-finder; and when he does so, he contrives to throw an amount of bitterness into his complaints which has an exceedingly irritating effect. This is very bad, in my opinion; but it does not justify a colleague, albeit that he may lose his temper, calling a public meeting to refute Mr. Christie, and at that meeting "before God and man" charging him with making a profit of a farthing per stone of hay or straw which the Corporation had purchased. Mr. Craik must learn to keep his temper, even although he should be nagged.

The Police Board of Greenock had before them this week the report of the Manager upon the tenders received for charging and drawing machinery at the gas-works, a high-level railway, coal-breaking plant, and other extensions of gas plant. Tenders were accepted to the amount of about £8000.

As I write, the evening newspapers announce a fire as in progress at the ammonia works in the Shotts Iron-Works. The imagination of the reporter has discovered that several explosions have occurred, and that there is, in consequence, a great panic among the inhabitants of the place. He gives it as the scrubber which is on fire; but in this he must be mistaken. He adds that as no means can be employed to extinguish the fire, all the workmen have deserted their work, fearful of a terrible explosion taking place. The reporter does not know, but surely in the works they must be aware that there is nothing which so soon extinguishes fire as ammoniacal liquor. Even a fire in a tar-tank has been extinguished by it. So far, then, from there being no means for extinguishing the fire, the probability is that the most effective instrument for dealing with it was close at hand.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *March* 24.

Sulphate of Ammonia.—The market has been quiet throughout the week; and values have been irregular—the closing quotations being nominally £12 to £12 2s. 6d. per ton f.o.b. at the ports. Continued severe weather is delaying agricultural operations both at home and on the Continent; and buyers have consequently been able to postpone their further purchasing, so that direct orders have been scarce. Hence buying has been left mainly to middle men; and parcels offered have only been disposed of at a decline. Deliveries on contracts, however, continue on a satisfactory scale. There is still very little interest in the forward position; and, makers being firm, no important first-hand business is reported.

Nitrate of Soda is also quiet, and for the same reason; and spot quotations have declined to 8s. 9d. per cwt. for ordinary and 8s. 10½d. for fine quality.

LONDON, *March* 24.

Tar Products.—Benzols are very flat indeed; and business has fallen off seriously during the last week. Lower prices are being offered; and the outlook is discouraging. Owing to the much higher rates being asked for carrying sea-borne pitch, the market value of this article f.o.b. is marked lower. The large advance in freight is likely to seriously impede business. Solvent naphtha is dull; and creosote and tar oils are not quite so firm. High prices are being paid for tar, prices which

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SALTLEY WORKS, BIRMINGHAM	2,000,000
COLCHESTER	300,000
BIRKENHEAD	2,250,000
SWINDON (New Swindon Gas Co.)	120,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000
WINDSOR ST., BIRMINGHAM (Second Cont.)	2,000,000
HALIFAX	1,000,000
TORONTO	250,000
OTTAWA	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
TORONTO (Second Contract; Remodelled)	2,000,000
BELLEVILLE	250,000
OTTAWA (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000
BUFFALO, N.Y.	2,000,000
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.,	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
LEICESTER	2,000,000
ENSCHEDE (HOLLAND)	150,000
BUENOS AYRES (RIVER PLATE CO.)	700,000
BURNLEY	1,500,000
KINGSTON-ON-THAMES	1,750,000
ACCRINGTON	500,000
TONBRIDGE	300,000
STRETFORD	500,000
OLDBURY	300,000
TODMORDEN	500,000
SALTLEY, BIRMINGHAM (Third Contract)	2,000,000

some members of the trade consider higher than the present value of products will warrant. Anthracene is moderately firm, with more inquiry.

To-day's values may be taken as: Tar, 17s. 6d. to 27s. 6d. Pitch, east coast, 37s.; west coast, 34s. Benzol, 90's, 6d.; special qualities for gas, 8d.; 50's, 9d. Toluol, 90's, 1s. 1d.; pure, 1s. 9d. Solvent naphtha, 1s. 1d. Crude, 30 per cent., naphtha, 4d. Heavy naphtha, 10d. Creosote, 2½d. to 3¼d. Heavy oils, 3½d. Carbolic acid, 50's, 2s. 1½d.; 60's, 2s. 6d. Naphthalene, 45s. to 70s. Anthracene, "A," 4d.; "B," 2½d.

Sulphate of Ammonia.—There is an absence of briskness in this market, largely due to makers being well sold, and not interested in dealers' moves to depress price. There is no important fresh business noted. For forward delivery, a shade less than the price quoted would secure contracts. The average value at the moment may be taken to be £12 to £12 2s. 6d., less 3½ per cent., all U.K. ports.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—No further change can be reported with regard to the position of the coal trade throughout this district, beyond what was stated last week. The only descriptions of fuel that do not meet with a demand more than sufficient to take away the present output are the better qualities of round coal, which, of course, are now beginning to hang somewhat owing to the lessened requirements for house-fire consumption. From some outside districts, supplies of round coal, and here and there also of engine fuel, are perhaps coming in more freely, and could be bought in isolated cases at lower figures; but this in no way affects Lancashire collieries, which have no difficulty in moving away all their output at the full list rates. These remain on the basis of 14s. 6d. to 15s. 6d. per ton at the pit for best Wigan Arley, 13s. to 14s. for Pemberton four-feet and seconds Arley, 12s. 6d. for steam and forge coals, and 9s. 6d. for medium to 10s. 6d. for best sorts of engine fuel. For shipment, the demand has not been quite so pressing. There is, however, still an active inquiry; and though the special prices recently ruling are not now being obtained, high figures are readily paid to secure supplies. The principal Lancashire collieries largely connected with the shipping trade have come to a unanimous decision not to quote less than 16s. per ton for steam coal delivered at the Garston Docks, the High Level, Liverpool, or the Manchester Ship Canal—either on current sales or for contracts. It is probable that the Lancashire coke makers will early next month further raise their list rates, as they have no difficulty in entering new contracts at an advance on the present basis, which represents about 23s. to 23s. 6d. per ton for ordinary furnace cokes, to 30s. and 31s. for best foundry qualities at the ovens.

Northern Coal Trade.—There is an improved tone in the coal trade, though not equally shown in all its branches. The collieries are now working fully; and the foreign demand is so large that it does not seem to be materially checked by the relatively high prices that are asked for gas, coking, and steam coals. For best Northumbrian steam coals, the price quoted is about 18s. 6d. per ton f.o.b., second-class steam are about 17s., and steam smalls 11s. to 11s. 6d. In the gas coal trade, there have been several contracts closed for Continental companies; and in one case, for delivery at Stettin, the price left is from 16s. 4d. to 16s. 6d. per ton f.o.b. for best Durham gas coals, after making allowance for the current rates of freight, &c. There is a disposition on the part of the owners of some gas coal collieries to ask higher prices, both for contracts and for occasional cargoes. There is a strong demand for gas coke, as well as for coke for foundries and blast-furnaces. The latter is priced at about 27s. per ton at the Teesside furnaces. Gas coke varies considerably in price; but the contracts that have been made show substantial advances on their predecessors. For export, gas coke may be quoted at about 16s. per ton f.o.b.; but the price fluctuates.

Scotch Coal Trade.—An easier feeling is beginning to be experienced. One large colliery in the Lothians has voluntarily announced a reduction in price of 2s. per ton. This was the first appreciable break in prices; and it has weakened the market. While this is so, both output and demand continue to be very heavy; and the rapidly rising exports show to what a large extent Scotch coalowners this year hold foreign contracts. The prices quoted are: Main 14s. to 14s. 3d. per ton f.o.b. Glasgow, ell 15s. 3d. to 16s., and splint 14s. 6d. to 15s. The shipments for the week amounted to 201,714 tons—an increase of 5411 tons upon the preceding week, and of 72,028 tons upon the corresponding week of last year. For the year to date, the total shipments have been 1,981,025 tons—an increase of 489,911 tons over the same period of last year.

Windsor Royal Gas Company.—The half-yearly meeting of this Company was held on the 16th inst.—Mr. Alderman Hollis in the chair. In their report, the Directors expressed regret at the loss of the Chairman (Sir G. H. Long), whose services had been of great value to the Company. With regard to the working, the quantity of gas consumed was practically the same as it was in the second half of 1898; the 2 million cubic feet then supplied for the public lighting being now used by private consumers. The accounts accompanying the report showed a balance of £5483 to the credit of the profit and loss account; and dividends at the rates of 5, 10, and 7 per cent. per annum were recommended. This was agreed to.

Monte Video Water-Works Company, Limited.—The report of the Directors of this Company for the year 1899 states that the gross revenue amounted to £79,636; being an increase of £2943, as compared with the previous twelve months. The working expenses decreased by £529; and the net revenue consequently showed an improvement of £3471; being £51,482 against £48,010. After paying interest and other charges, and providing £4000 for depreciation of old meters and fittings, there remains an available balance of £26,972 at the credit of the profit and loss account. An interim dividend of 2½ per cent. was paid on the 1st of November; and the Directors recommend a further dividend of 2½ per cent. (making 5 per cent, for the year, tax free)—carrying forward a balence of £6972. The Company's relations with the Government have been satisfactory; and the Executive have been paying the accounts with regularity.

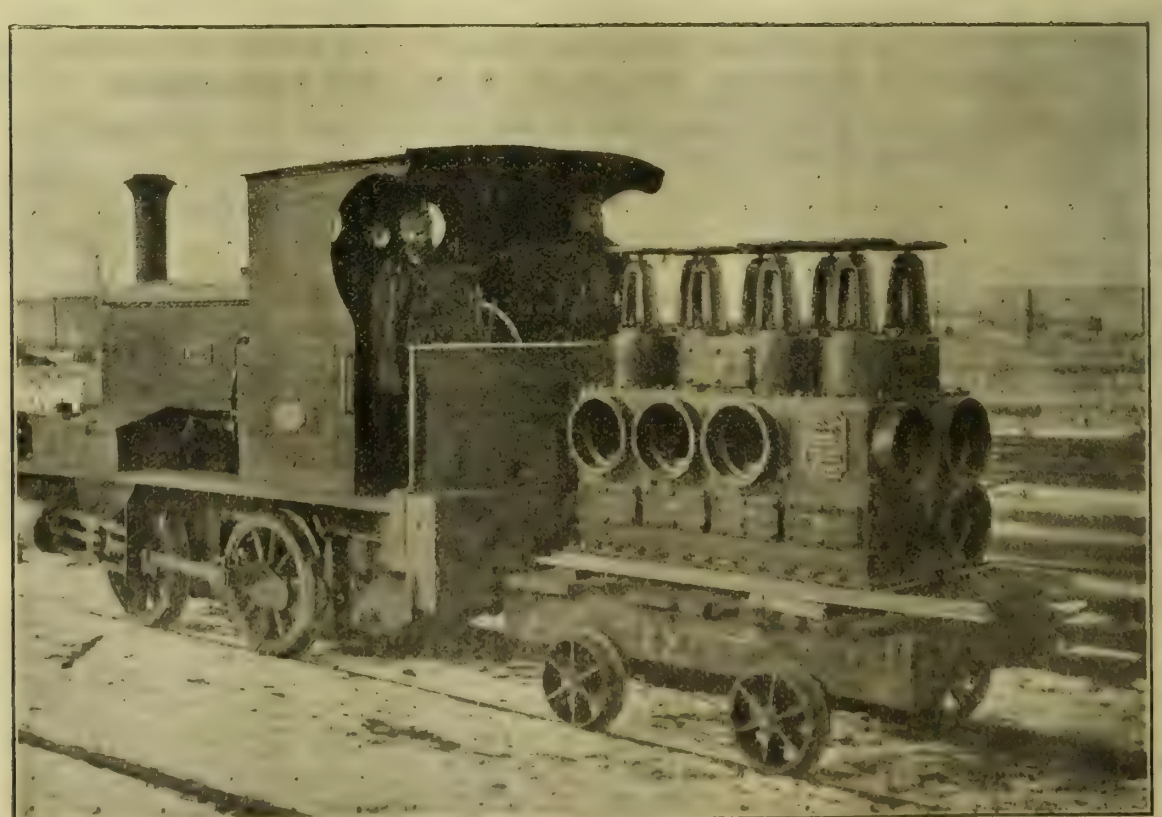
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One of a number of small Weck's Valves for immediate Shipment.

Wenlock Water Supply.—The Town Council of the Borough of Wenlock having applied to the Local Government Board for sanction to borrow £23,000 for purposes of water supply for the Broseley and Madeley divisions of the borough (including the construction of certain works in the parish of Sutton Maddock, in the rural district of Shifnal), Mr. H. Percy Boulnois, one of their Inspectors, held an inquiry on the subject last Thursday. The Town Clerk (Mr. Godfrey Cooper) stated that £15,500 was required for Madeley, and £7500 for Broseley. There was no opposition.

New Water-Works for Todmorden.—Last Friday, Mr. G. F. Deacon attended a special meeting of the Todmorden Town Council for the purpose of explaining the plans from which water-works are intended to be carried out at Gorpley, for the supply of the borough of Todmorden. The new reservoir will be 84 feet deep, have a storage capacity of 120 million gallons, and yield more than 600,000 gallons per day. Nine tenders for the construction of the works had been considered by the Water Committee; and it was now resolved, on their recommendation, that the tender of Mr. B. Lumb, of Todmorden, be accepted—the price being stated to be within the estimate given by Mr. Deacon. The works are to be completed in 4½ years.

Torquay Gas Company.—In spite of competition by the municipal electric light undertaking, the Torquay Gas Company made gratifying progress last year. The statement of accounts, presented at the annual meeting on Thursday, showed that the total revenue amounted to £28,435, compared with £27,271 in 1898, and the expenditure to £20,643, against £20,125; leaving a balance of £7791 to be carried to profit and loss account, as compared with £7145 in 1898. Receipts from sales of gas amounted to £19,768, against £19,532; and residual products yielded £6791, against £5973. The expenditure included £10,581 for coals, £2443 for distribution, £1359 for rents, rates, and taxes, and £1145 for management. In their report the Directors observed that the consumption of gas had been well maintained. The increase, though small, showed that the efforts to popularize the use of gas by means of cooking-stoves, gas-fires, and prepayment meters had met with a large amount of success. The Chairman (Mr. W. H. Kitson), in moving the adoption of the report, remarked that the chief item in the increased cost of manufacture was an addition to the price of coal, for which they had to pay 1s. 2d. per ton more than in 1898. Distribution had also cost more because of increased expenditure on the repair of mains, largely due to traction-engine traffic over the roads. The quantity of gas sold was the largest in the history of the Company, and was 1¼ per cent. more than last year. This increase, in spite of the progress of the electric light and the mildness of the weather during the winter months of last year, was very satisfactory, and showed that there was plenty of room for both sources of light. The prepayment meters entirely accounted for the additional consumption. They had been a great financial success. Another profitable source of income was cooking-stoves, of which upwards of 900 were now in use; 330 of them being employed in connection with prepayment meters. Scarcely a dozen users of the electric light had entirely ceased to burn gas. From ordinary consumers they received last year £18,208, or an average of £7 each; and from prepayment consumers £1500, or an average of £2 each. With regard to the progress of the undertaking, ten years ago the receipts from sales of gas, at 3s. 3d. per 1000 cubic feet, were £15,368; while last year, with the price at 3s. and 2s. 6d., they reached £18,521. The receipts from public lighting were almost exactly the same as ten years ago—£1246, against £1245; while the returns from residuals had almost doubled, and the reserve fund had advanced from £6887 to £8814. The report was adopted, and the usual dividends declared.

Messrs. Biggs, Wall, and Co. have received instructions from the Kirkcaldy Gas Company to supply one of their "Rapid" charging-machines, and from a Colonial company for four similar machines.

In accordance with the announcement appearing in another part of the "JOURNAL," Mr. Alfred Richards will offer at the Mart, Tokenhouse Yard, to-morrow, by order of the Directors, £10,000 of 4 per cent. preference stock of the Brighton and Hove General Gas Company, in lots of £100 each. The dividend will accrue from the 1st prox.

The cookery lectures organized by Messrs. Richmond and Co., Limited, in the Parr Hall, Warrington, in connection with the Arts and Crafts Exhibition, have been unusually well attended, and a number of ladies have subscribed and presented Miss Sarah Barker, the lecturer, with a morocco purse of gold, as a mark of their appreciation of her talent.

The Directors of Messrs. James Milne and Son, Limited, of Milton House Works, Edinburgh, in their first annual report, state that for the year ending Dec. 31 last, after payment of interest and all charges, including an allowance for depreciation, there remained a balance of £14,021. Of this, the proportion due to the vendors, in terms of the agreement of sale, was £4644, which left a net sum of £9377. The Directors recommend the payment of dividends at the rate of 5 per cent. per annum, less income-tax, on the preference shares, amounting to £2971, and at the rate of 6 per cent. on the ordinary shares, amounting to £4000; and the placing of £1000 to the reserve fund and £700 to a special reserve fund for preference dividends. This leaves a balance of £706 to be carried forward, subject to payment of Directors' and Auditors' fees.

The second of a series of articles on "Local Industries," in the "Leith Burghs Pilot," is devoted to an account of the progress of the firm of Messrs. D. Bruce Peebles and Co., of Tay Works, Bonnington. The business was established in 1866, at Fountainbridge, Edinburgh, for the manufacture of meters, burners, governors, and engines, under the direction of the late Mr. D. Bruce Peebles, and rapidly gained a world-wide reputation. There is now an electrical department in connection with the business, which, under the supervision of Mr. Arthur Peebles, has grown to a marvellous extent; and at the beginning of last year there were in hand contracts of the value of £12,000. The works are equipped with English and American automatic appliances for manufacturing steel-clad dynamos and engines up to 50-horse power; and the plant is driven electrically by 15 separate motors of various powers. The current is supplied from the generating station of the Leith Corporation, and it costs the firm upwards of £600 per annum. The electrical staff has been organized by Mr. A. Hart, the foreman.

As the outcome of a conference between the Parliamentary Bills Committee of the Bristol Corporation and the Bristol Water Company, some objections raised by the Committee have been removed. By the Bill, the Company seek powers with regard to any lands within their "drainage area," which expression is defined to mean any area within which the waters the Company are authorized to impound or take arise or flow; also to make bye-laws for maintaining the purity and preventing the pollution, contamination, or discoloration of their waters, and to prescribe the construction, laying down, maintenance, protection, and use of drains, sewers, watercourses, and all other works and conveniences necessary and proper for such purposes. The Bill, if passed as originally drawn, would have given them power to prescribe what sewers and drains should be constructed and used within the city of Bristol; and the Committee therefore approached the Directors with the view of exempting any area within the city from its provisions. The result has been that the Company have consented to alter the definition of their drainage area so as to exclude the city of Bristol as for the time existing.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

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OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale than all other Oxides combined. Purity and uniformity of quality guaranteed.
JOHN WM. O'NEILL, Managing Director,
160, 161, & 162, PALMERSTON BUILDINGS,
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ANDREW STEPHENSON, AGENT. All communications *re* Oxide to the Company as above.

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"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for use in GAS-WORKS.
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BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

AMMONIACAL LIQUOR wanted.
BROTHERTON AND CO., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM; and 45 & 47, Westminster Bridge Road, LONDON, S.E.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Addresses:
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SULPHURIC ACID.
JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

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Regenerator or other Furnaces erected to Engineers' own Designs. Best Work Guaranteed. Please write for Estimates.

BENZOL, specially made for the Enrichment of Gas.
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BALE & CO.'S Oxide of uniform quality.
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JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
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[For Illustrated Advertisement, See March 6, p. 640.]

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BROTHERTON AND CO., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

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WANTED, for Works in the North of England, a DRAUGHTSMAN, thoroughly conversant with Gas Plant and General Engineering.
Address Letters (stating Salary required) to No. 3458, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a Provincial Gas Company, a thoroughly experienced MAIN and SERVICE LAYER.
Apply, stating Age, Experience, and Salary required, to No. 3454, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CANTERBURY GAS AND WATER COMPANY.

WANTED, by the Directors of this Company, an experienced and competent ENGINEER to take entire charge of the Gas-Works Station (make about 145 million cubic feet) and the Outdoor Department of both Gas and Water Works. He must have a practical knowledge of the Manufacture of Coal and Water Gas, and Sulphate of Ammonia upon the best modern Systems, and be competent to supervise the Distribution of both Gas and Water.
Applications, marked "Engineer," stating Age, Salary required, Training, and Experience, accompanied by *copies* of three Testimonials of recent date, to be delivered at the Company's Offices, Castle Street, Canterbury, on or before Saturday, the 31st of March inst.
A Residence (with Rates, Coal, Gas, and Water free) is provided on the Works.
By order,
JAMES BURCH,
General Manager and Secretary.
Canterbury, March 12, 1900.

WANTED, two Draughtsmen, experienced in Designing, &c.
Apply, with full Particulars, to R. DEMPSTER AND SONS, LIMITED, Rose Mount Iron-Works, Elland, YORKS.

WANTED, a Working Manager for a small Works in the Midlands. Make of Gas 2 millions. Good House and Large Garden, and Gas, Water, and Rates Free.
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WANTED, for a large Gas-Works in Yorkshire, a thoroughly qualified DRAUGHTSMAN.
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WANTED, Two or Three first-class RETORT SETTERS for a few months. None but steady Men need apply. Wages 8½d. per hour, 56½ hours per week.
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(GAS DEPARTMENT.)

WANTED, a first-class Man to take charge of Exhausters, Boilers, and Pumps. Twelve-hour Shifts. None but first-class Men need apply.
State Particulars and Wages required to the undersigned on or before April 1.
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WANTED, immediately, a Man to take charge of a Works making about 8 Millions per Year. One accustomed to Regenerative Settings, Exhauster and Engine. Would also be required to fix and read Meters, and if able to do Fitting generally would be preferred. Cottage on Works, with some Garden, Gas, and Coals free.
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REQUIRED, a thoroughly qualified MANAGER for the above Works (make 10 millions per annum). Must thoroughly understand Modern Plant and Apparatus, including Boilers, Engine, Exhauster, &c. Good House, with Garden, provided.
Applications, with Testimonials and Particulars of Experience and Salary required, to be addressed to the undersigned.
H. W. WILSHERE,
Secretary.
1, Welford Road, Leicester.

TORQUAY GAS COMPANY.

WANTED, at once, a thoroughly good Man to act as FOREMAN of DISTRIBUTION DEPARTMENT. He must be well up in Main and Service Laying, and competent to take charge of, and direct, Workmen.
House Rent Free.
Applications, with *copies* of Testimonials, Particulars of Experience, and stating Age, whether Married or Single, and Wages required, must be sent to the undersigned.
ROBERT BEYNON,
Engineer and Manager.
Gas-Works, Hollacombe, Paignton.

ROCHESTER, CHATHAM, AND STROOD GASLIGHT COMPANY.

DISTRIBUTION SUPERINTENDENT.

THE Directors invite applications for the appointment of SUPERINTENDENT of the DISTRIBUTION DEPARTMENT of this Company.
Applicants must have a thorough knowledge of Main and Service Laying, Gas-Stove Fitting, &c., must be able to keep the Books of the Department, and in every respect carry out the duties appertaining to the position. The Salary will be £150 a Year.
Applications, in the Candidates' own writing, with *copies* of three Testimonials of recent date, and marked on the envelope "Distribution Superintendent," must be delivered to me not later than noon of Wednesday, April 4, 1900.
J. M. VEEVERS,
Secretary and General Manager.
Gas Offices, Rochester,
March 24, 1900.

COUNTY BOROUGH OF WALSALL.
(GAS DEPARTMENT.)

THE Corporation of Walsall require the services of a competent and experienced GAS ENGINEER and MANAGER for their Gas-Works. He must be capable of designing and superintending the carrying out of Extensions of the Works, and competent to undertake the entire control of the Works and the supervision of the Manufacture of Gas.
Salary £500 per annum. The appointment to be subject to Three Months' Notice on either side
A statement of Duties can be obtained from the undersigned, to whom applications, marked outside "Gas Engineer and Manager," accompanied by not more than three Testimonials, are to be sent on or before Saturday, the 14th of April, 1900.
Canvassing either directly or indirectly any Members of the Council will be considered a disqualification.
JOHN R. COOPER,
Town Clerk.
Town Clerk's Office, Walsall,
March 24, 1900.

WANTED, a good Gas-Fitter. One able to control Men; Main and Service Layer; and Meter Reading and Fixing. Wages to commence at 32s. per week. None but good Men need apply.
Address MANAGER, Gas-Works, SLOUGH.

CONDENSER (Morris & Cutler's), 21 ft. 6 in. by 6 ft. 6 in. by 3 ft. 6 in., 1 million per day. Equal to new. Exceptional Bargain, if sold promptly.
Address No. 3463, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

FOR SALE—Four lengths of Wrought- IRON HYDRAULIC MAIN, each 18 feet long, fitted with Covers and Dip-Pipes, and arranged for Settings of seven Retorts. The Bridge-Pipes may also be included.
For Particulars and Price, apply to
W. LANGFORD,
Engineer and Manager.
Corporation Gas-Works,
Longton, Staffs.

THE Corporation of Liverpool have for DISPOSAL a large number of Modern 14-inch Square LAMPS, Copper built throughout, with plain Glass Sides, and Opal Glass Tops, for use in Cradles or on Legs. They are in good repair; a large number of them being practically equal to new.
A Sample will be sent on application, and a Low Price accepted.
C. R. BELLAMY,
City Lighting Engineer.
Hood Street, Liverpool.

1899 Letter W. No. 9925.

IN THE CHANCERY OF THE COUNTY PALATINE OF LANCASTER, MANCHESTER DISTRICT.

WALMSLEY *v.* CLAY.

VALUABLE ENGLISH and FOREIGN PATENTS for Shock Proof Anti-Vibratory Fittings for Incandescent Gas Lighting, Tools, Accessories, Stores, and Effects at the Works and Premises 14, Johnson Street, Bolton.

LOMAX SONS & MILLS will Sell by AUCTION (pursuant to an Order of the Court dated the 4th day of December, 1899, and with the approbation of the Registrar of the Manchester District of the said Court) at the Public Sale Rooms, Bowker's Row, Bolton, on Thursday, the 5th day of April, 1900, at Seven o'clock in the Evening, subject to conditions—

LOT 1—"COILED PIPE" ANTI-VIBRATOR PATENT, being an improvement in, and connected with, the Burners for neutralizing the effects of Shock and Vibration on Mantles used in Incandescent Gas Lighting:
No. 6874, dated March 30, 1896. Also the patents in Germany, Belgium, Victoria, New South Wales, France, New Zealand, South Australia, Tasmania, Austria, Canada, Norway, United States of America, and Queensland for the same Invention.
"ARRESTER" PATENT for Bye-Pass Burners, which prevents Bearings from being pulled out of position, and also prevents the Coil from being strained:
No. 24,399, dated Nov. 2, 1896. Also the Patents in Germany and United States of America for the same Invention.
Together with the Fittings and Accessories appertaining to the said Patents.

LOT 2—"CANTILEVER" ANTI-VIBRATOR PATENT:
No. 27,827, dated Dec. 7, 1896. Also the patents in Norway, Sweden, Germany, Belgium, Victoria, South Australia, New South Wales, France, Tasmania, Canada, New Zealand, Queensland, and United States of America for the same Invention.
Together with the Fittings and Accessories belonging thereto.

LOT 3—The Tools, Stock-in-Trade, Stores, Office Furniture, Photographic Apparatus, Stationery, Fixtures and Effects comprising Bench and Brest Drilling Machines, Screwing Tackle, two Parallel Vices, Circular Saw, Grindstone, two Gas-Pressure Gauges, Foot Bellows, Joiners' Tools, Benches, Tables, Store Racks, Partitions, Packing Cases, 970 lbs. of Copper Tubing, Scrap Copper, Brass, and Lead, German Silver Wire, Pipe Fittings, Arc and Street Lamps, Works Lanterns, Fredureau Globes, Incandescent Burners, Mantles, Chimneys, Reflectors, Mahogany Pedestal Writing-Desk, Walnut Book Cupboard, Fireproof Safe, 30 in. by 22 in. by 22 in. (by John Crook) and Stand, Letter Copying-Press, Four-Lap Screen, Desk and Single Chairs, Corticine Floor Cloths, one Camera by Middlemiss, with Accessories, Books, Stationery, &c.

SCHEDULE of the Fittings and Accessories included in the Sale of the Patents and Inventory of the Tools, Stock-in-Trade, Stores and Effects will be produced at the time of sale, or may be inspected Seven Days prior to sale, and further Particulars had at the Chancery Office, Duchy Chambers, 4, Clarence Street, Manchester, on application to the Auctioneers, Central Chambers, Bolton (Telephone 181), and 54, John Dalton Street, Manchester (Telephone 3668); Mr. Samuel Greenhalgh, Chartered Accountant, Accrefield, Bolton; Messrs. Winders, Solicitors, Bowker's Row, Bolton; Messrs. Russell and Russell, Solicitors, 11, Wood Street, Bolton; Messrs. Boote, Edgar, and Co., Solicitors, 18 and 20, Booth Street, Mosley Street, Manchester; or to
Messrs. J. PHYTHIAN MONKS AND CO.,
Solicitors.
Central Chambers,
Fold Street,
Bolton.

FOR SALE—Two Lancashire Boilers, each 6 ft. diameter by 20 ft. long, with Mountings. Been in use only a short time. Made by the Yorkshire Engine Company, Limited, Sheffield.

Apply to NEWTON, CHAMBERS, & Co., LIMITED, Thorncliffe Iron-Works, near SHEFFIELD, where the Boilers may be seen.

EXHAUSTERS, 1500 to 60,000 feet per hour, with or without Engines.

LIVESEY WASHERS, CUTLER CONDENSER, SCRUBBERS, 5 feet and 6 feet diameter, METERS, GOVERNORS, PURIFIERS (Sets of 6 feet and 10 feet square), BOILER and other TANKS, VALVES, &c., J. FIRTH BLAKELEY & Co., Thornhill, DEWSBURY.

ESTABLISHED 1828.

GAS and Electrical Engineering and Gas-Fitting Business to be DISPOSED OF. Proprietor, having absolutely the best Business of its kind in London, partly Manufacturing and partly Fitting, wishes, owing to ill-health, to retire. Technical experience not absolutely essential; but business ability. Under practical Managers who would remain. Large Turnover at exceptional Profits. Present Proprietor would give assistance and introduction for a given period, thus ensuring continuity of Business.

Bankers, and Solicitors' References.

Capital necessary, about £15,000.

Principals or their Solicitors only dealt with.

Apply, BICKLIN, WASHINGTON, AND PASMORE, Solicitors, 1, Trinity Square, SOUTHWARK, S.E.

CITY OF HULL WATER AND GAS DEPARTMENT.

GAS PLANT FOR SALE.

RETORT-HOUSE FITTINGS—Retort- FITTINGS for 120 Round Retorts, 16 inches diameter, Wrought-Iron Lids, Screws, and Cross-Bars, 7 inch to 5 inch and 6 inch to 4 inch Ascension, Arch, and Dip Pipes.

One HYDRAULIC MAIN ⊔ shape, 31 ft. by 18 in. by 18 in.

One HYDRAULIC MAIN ⊔ shape, 41 ft. by 18 in. by 18 in.

Thirteen HYDRAULIC MAINS ⊔ shape, 6 ft. 9 in. by 16 in. by 16 in.

Thirteen 6-inch SEAL-VALVES.

9-inch and 10-inch CAST-IRON FOUL-MAINS.

40 yards of 15-inch STEEL FOUL-MAIN.

CONDENSERS—

Set of six Cast-Iron ANNULAR CONDENSERS Outer Tube 2 feet, Inner Tube 10 inches, with Inlet and Outlet Valves and Bye-Pass.

TAR-EXTRACTOR—

Patent CARBONIC ACID and TAR EXTRACTING WASHER, by C. & W. Walker, for 500,000 cubic feet per day, 12-inch Valves and Bye-Pass.

WASHER—

One WASHER by Kirkham, Hulett, and Chandler for 500,000 cubic feet per day, with Steam-Engine, 10-inch Valves, and Bye-Pass complete.

PURIFIERS—

One set of Four PURIFIERS, 15 feet square, 4 feet deep, with Centre-Valve, and 15-inch Connections, Columns and Girders for fixing on first floor, together with Lifting Tackle.

One set of Two PURIFIERS, 15 feet square, 4 feet deep, with Centre-Valve, and 15-inch Connections. Columns and Girders for fixing on first floor, together with Lifting Tackle.

EXHAUSTERS AND STEAM-ENGINES—

Two 30,000 cubic feet per hour EXHAUSTERS and ENGINES, nearly new, by George Waller and Co.

12-inch Automatic BYE-PASS.

3-inch THROTTLE VALVE.

3-inch improved COMPENSATING GOVERNOR.

Two patent STEAM COMPENSATING GOVERNORS.

12-inch CONNECTIONS complete.

BOILERS—

Two Steel CORNISH BOILERS, 16 ft. by 5 ft. 6 in., with Galloway Tubes, Mountings complete for 70 lbs. pressure.

GASHOLDERS—

One THREE-LIFT GASHOLDER, about 71 feet diameter by 20 feet deep. Wrought-Iron Standards, Girders, Valves, and Connections.

One TWO-LIFT GASHOLDER, about 49 feet diameter by 18 feet deep. Cast-Iron Columns, Girders, Valves, and Connections.

Two TWO-LIFT GASHOLDERS, 46 feet diameter by 18 feet deep. Cast-Iron Columns, Girders, Valves, and Connections.

STATION METER—

STATION METER, to pass 30,000 cubic feet per hour.

GOVERNORS—

14-inch and 6-inch GOVERNORS.

PUMPS—

Various STEAM, TAR, LIQUOR, and WATER PUMPS.

GAS-ENGINE—

12-Horse Power by Crossley Bros.

VALVES—

DONKIN and other VALVES.

The above-mentioned Machinery, &c., may be seen on application to the undersigned.

Offers for the whole or any part of the Plant to be addressed to the Chairman of the Water and Gas Committee, and delivered to the Office of the Town Clerk, Hull.

By order,
F. J. BANCROFT,
Water and Gas Engineer.

HAWORTH URBAN DISTRICT COUNCIL.

FOR SALE, by Tender—Second-hand CONDENSERS, comprising: 82 lengths of 7-inch Piping, each 9 ft. long; Eight Bridges, with loose Plugs; Bottom Box, 10 ft. 3 in. long, 2 ft. 1 in. deep, and 3 ft. 2 in. wide; Four 6-inch Rack and Pinion Valves (Clapham's).

May be seen on application to the Gas-Works Manager, Gas-Works, Haworth.

Tenders to be sent to me not later than the 29th of March, endorsed "Tender for Condensers."

WM. ROBERTSHAW,
Clerk.

Burlington Chambers,
North Street, Keighley,

ALDERSHOT GAS AND WATER COMPANY.

THE Directors of this Company are pre- pared to receive TENDERS for the supply of 20,000 Tons of GAS COAL and 500 Tons of CANNEL, for delivery from July 1, 1900, to June 30, 1901.

Copies of Specification and Conditions can be had on application to the undersigned.

Sealed Tenders, endorsed "Tenders for Coal," should be sent to me not later than Five p.m., May 9, 1900.

The Directors reserve the right not to accept the lowest or any Tender.

By order,
R. W. EDWARDS,
Secretary.

General Offices, Aldershot,
March, 1900.

TENDERS FOR GAS COAL.

THE Directors of the Windsor Royal Gaslight Company invite TENDERS for 9800 Tons of High-Class GAS COAL, with option of taking 100 Tons per month in addition; and also 150 Tons of New Boghead CANNEL in small quantities as required, to be delivered free to the Great Western Railway Station at Windsor during the Twelve Months ending the 31st of May, 1901.

Deliveries to be made in such quantities and at such times as may be required by the Company.

Sealed Tenders, endorsed "Tender for Coal," to be sent by post to reach the undersigned by Tuesday morning, the 1st of May. Forms of Tender not supplied.

The Directors do not bind themselves to accept any Tender.

By order,
JOHN HENRY STRANGE,
Secretary.

2, Victoria Street, Windsor,
Berks, March 13, 1900.

CARBURETTED WATER-GAS PLANT.

THE Directors of the Windsor Royal Gaslight Company are prepared to receive TENDERS, accompanied with Plans and Specifications, for the supply and fixing complete, including Purifiers, Station Meter, Gasholder, &c., required for a PLANT capable of producing 250,000 cubic feet of CARBURETTED WATER GAS per day.

Further Particulars can be obtained from the Engineer, Mr. James Wadeson.

Sealed Tenders, endorsed "Carburetted Water-Gas Plant," to be delivered at the Company's Office, 2, Victoria Street, Windsor, addressed to the Chairman and Directors of the Windsor Royal Gaslight Company, not later than the 30th day of April, 1900.

The Directors do not bind themselves to accept any Tender.

By order,
JOHN HENRY STRANGE,
Secretary.

ASCOT DISTRICT GAS COMPANY.

THE Directors of the above Company invite TENDERS for the supply, and delivery to Sunningdale and Bagshot Stations of about 2200 yards of 8-INCH SPIGOT and SOCKET CAST-IRON PIPES (weight 3.1.14) and SPECIALS.

Also 4000 yards of 6-INCH SPIGOT and SOCKET CAST-IRON PIPES (weight 2.1.14), and SPECIALS.

TENDERS are also invited for the LAYING of the above PIPES from the Company's present Mains through Windlesham to Bagshot in the county of Surrey.

Particulars may be obtained on application to the Manager, Mr. A. E. Brooks, Gas-Works, Sunninghill, Berks.

The Directors do not bind themselves to accept the lowest or any Tender.

Tenders to be delivered to the undersigned not later than the 4th of April, 1900.

W. A. SCHULTZ, F.C.A.,
Secretary.

46, Cannon Street,
London, E.C.

ILMINSTER GASLIGHT, COAL, AND COKE COMPANY, LIMITED.

TENDERS FOR GASHOLDER AND TANK.

THE Directors of the above Company invite TENDERS for the supply and erection of a steel GASHOLDER, 20,000 cubic feet capacity, and BRICK CEMENT PUDDLE TANK, with necessary Valves and Connections for same. Diameter of Holder 40 feet.

Persons tendering for same to furnish their own Plans and Specifications.

The whole of the work will have to be completed by the 31st of October, 1900, to the entire satisfaction of the Company's Manager.

Sealed Tenders, accompanied by Drawings and Specifications, endorsed "Tender for Gasholder," to be addressed to the Chairman of the Company, Ilminster, not later than Tuesday, the 10th day of April, 1900.

The person whose Tender is accepted will be required to furnish approved Sureties for the due performance of the Work.

The Company do not bind themselves to accept the lowest or any Tender.

Ilminster, Somerset,
March 22, 1900.

RADCLIFFE AND PILKINGTON GAS COMPANY.

TENDERS FOR PIPES.

TENDERS are invited for the supply of 750 yards of 4-INCH PIPES, 750 yards of 3-INCH PIPES, and a number of SPECIALS.

Particulars may be had from the undersigned, by whom Tenders will be received until Tuesday, the 3rd of April next.

JAMES BRADDOCK,
Manager and Secretary.

Gas Offices, Radcliffe,
March 23, 1900.

ROTHERHAM CORPORATION.

(GAS DEPARTMENT.)

THE Gas Committee are prepared to receive TENDERS for the RE-SETTING of Six SETTINGS of INCLINED RETORTS.

Particulars may be obtained on application to the Engineer (Mr. F. A. Winstanley), Gas Offices, Bridgegate.

Endorsed Tenders must be delivered to the undersigned on or before Saturday, April 14, 1900.

H. H. COPNALL,
Town Clerk.

March 23, 1900.

PRESCOT GAS COMPANY.

THE Directors of the Prescot Gas Com- pany are prepared to receive TENDERS for the making and erection of two WROUGHT-IRON ROOFS—one 47 ft. 6 in. span, and 40 ft. 9 in. long; and one 22 ft. 8 in. span, and 29 ft. long, at their Gas-Works.

Plans and Specifications can be inspected at the Gas Company's Offices.

Tenders, endorsed "Tenders of Roofs," to be sent to the Chairman of the Gas Company, not later than April 7, 1900.

JOHN E. HALL,
Engineer, &c.

Gas Offices, Moss Street,
Prescot, March 23, 1900.

THE Methley Urban District Council invite TENDERS for the Providing and Fixing of 92 GAS-LAMPS, and making all connections with the Gas-Mains.

General Plan and Specification can be seen at the Offices of the Engineer, Mr. W. L. Le Maitre, 5, Central Bank Chambers, Leeds, from whom Bills of Quantities and Forms of Tender may be obtained on payment of a deposit of Two Guineas, which will be returned on receipt of a *bonâ-fide* Tender.

Tenders, endorsed "Tender for Lighting Scheme," must be sent to my Office, 83, Albion Street, Leeds, on or before the 20th day of April, by Twelve o'clock noon.

Dated this 23rd day of March, 1900.

ROBT. S. WIGIN,
Clerk.

LIVERPOOL UNITED GASLIGHT COMPANY.

THE Directors of the Liverpool United Gaslight Company are prepared to receive TENDERS for the supply of a quantity (not exceeding 15,000 Tons) of OIL, suitable for the manufacture of Carburetted Water Gas.

The Oil is to be delivered between the 1st of June, 1900, and the 30th of June, 1901.

Specification and full Particulars may be obtained on application to the undersigned, to whom Tenders must be delivered on or before Wednesday, the 18th of April, 1900.

WILLIAM KING,
Engineer.

Gas Office,
Duke Street, Liverpool,
March 21, 1900.

TO ENGINEERS AND IRONFOUNDERS.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for the supply and erection of the following PLANT at their Grimesthorpe Works:—

One 9-inch CAST-IRON CONDENSER, 76 ft. long, 19 ft. high, and 11 ft. wide, with 30-inch diameter. Connections, and Supporting Girders.

30 STEEL and CAST-IRON COKE-HOPPERS for front of Retort-Bench.

Drawings may be seen, and Specifications and Quantities obtained, on application to the Company's Engineer, Mr. J. W. Morrison, on and after the 20th inst.

Sealed Tenders, marked "Condensers," "Coke-Hoppers," must be delivered to the undersigned by post not later than the first post on Monday, April 2, 1900.

The Directors do not bind themselves to accept the lowest or any Tender.

HANBURY THOMAS,
General Manager and Secretary.

Commercial Street,
Sheffield, March 10, 1900.

COUNTY BOROUGH OF HALIFAX.

THE Gas-Works Committee of the Hali- fax Corporation are prepared to receive TENDERS for the supply and erection at the Gas-Works, Mulcture Hall Road, Halifax, of (*a*) STEEL BASE and SHELL for CHIMNEY; (*b*) ELEVATOR, CONVEYOR, and GEARING for same.

Forms of Specification, Print, and Tender may be obtained on application to Mr. Thomas Holgate, M.Inst.C.E., Gas Engineer, Halifax, on payment of £1 for each set, which will be returned on the receipt of a *bonâ-fide* Tender.

Tenders, endorsed "Steel Shell" or "Elevator," as the case may be, may be sent to the undersigned before Two o'clock p.m., on Wednesday, the 4th of April, 1900.

The person whose Tender is accepted will be required to observe the Fair Contracts Clauses adopted by the Corporation.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
KEIGHLEY WALTON,
Town Clerk.

THE Urban District Council of Atherton invite TENDERS (on or before Wednesday, April 11) for the supply, during Twelve Months from the 1st of June next, of 6000 Tons of screened GAS COAL or NUTS.

Forms of Tender and further Information may be had on application to

D. SCHOFIELD,
Clerk.

Atherton, March 21, 1900.

BOROUGH OF MACCLESFIELD.

TENDERS FOR TAR AND AMMONIACAL LIQUOR.

THE Gas Committee are prepared to receive TENDERS for the purchase of the Surplus TAR and AMMONIACAL LIQUOR made at their Works during the Twelve Months commencing the 1st day of May next.

Tenders for the Tar or Liquor, separately, to be sent in not later than Tuesday, the 10th of April, 1900, addressed to the Chairman of the Gas Committee, Town Hall, Macclesfield, and endorsed "Tender for Tar, &c."

For Conditions, apply to Mr. Newbigging, Engineer, Gas-Works, Macclesfield.

The Committee reserve to themselves the right of accepting any Tender for the Tar or Liquor separately.

The highest or any Tender not necessarily accepted.

W. FREDK. TAYLOR,
Town Clerk.

March 14, 1900.

In the High Court of Justice, 1900, *F.O.* 28 *Chancery Division, Mr. Justice BYRNE, in Chambers.*

In the matter of Frank Wright's Prepayment Gas-Meter Corporation, Limited and Reduced, and in the matter of the Companies Acts, 1867 and 1877.

NOTICE is Hereby Given, that a Petition presented to the High Court of Justice, Chancery Division, on the 6th day of March, 1900, for CONFIRMING A SPECIAL RESOLUTION REDUCING THE CAPITAL of the above Corporation from £110,000 to £60,000, is directed to be heard before His Lordship, Mr. Justice Byrne, on Saturday, the 7th day of April, 1900; and any Creditor or Shareholder of the said Corporation desiring to oppose the making of an Order for the Reduction of the Capital of the said Corporation under the above Acts, should appear at the time of hearing, by himself or his Counsel, for that purpose, and a copy of the Petition may be seen by any Creditor or Shareholder at the Office of the Corporation, 62, Glengall Road, Old Kent Road, S.E., and on payment of the regulated charges for same, a copy will be supplied by the Solicitors under-mentioned.

Dated this 20th day of March, 1900.

C. BURNEY,
Master.

ADAM BURN AND SON,
6, Bell Yard, Doctors' Commons, E.C.,
Solicitors for the Corporation.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
BRIGHTON AND HOVE GENERAL GAS COMPANY.

£10,000 FOUR PER CENT. PREFERENCE STOCK,
Offering to Trustees and others an Investment of the soundest character.

MR. ALFRED RICHARDS will Sell THE ABOVE BY AUCTION, at the Mart, E.C., on Wednesday, March 28, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
HARROW AND STANMORE GAS COMPANY.

NEW ISSUE OF 800 £10 "C" SHARES.
STANDARD DIVIDEND 7 PER CENT.; LAST DIVIDEND £5 12s. PER CENT.

MR. ALFRED RICHARDS will Sell THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, the 3rd of April, at Two o'clock.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

WEST HAM GAS COMPANY.
CROYDON COMMERCIAL GAS COMPANY.
KINGS LYNN GAS COMPANY.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Tuesday, April 3, at Two o'clock, STOCKS and SHARES in the above Companies.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.

Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.

Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

NITRATE of Thorium and Cerium.
FABRIK CHEMISCHER PRAEPARATE VON STHAMER, NOACK, AND CO., HAMBURG.

GAS PLANT New or 2nd Hand Equipments for Coal Gas, Water Gas, Oil, Acetylene, Coke Oven, and Blast Furnace Gas.

POWER or LIGHT WORKS.

Also VALUATION Consultation, Inspection, & Expert Reports.

JAS. WRIGHT, M.I.M.E. BRIDGE HOUSE, BLACKFRIARS, E.C.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH N.B.

JAMES OAKES & CO.

ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts and Covers, and rendering Leakage impossible.

LONDONDERRY GAS COALS

FROM THE

LONDONDERRY COLLIERIES,

COUNTY OF DURHAM.

Available Output up to 5000 Tons per day.
Yield of Gas 11,000 cubic feet per Ton of Coal as per Analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,
SEAHAM HARBOUR,
COUNTY OF DURHAM.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY
FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.

LONDON OFFICE:
90, CANNON STREET, E.C.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD
BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

HARDMAN & HOLDEN, LD.

ESTABLISHED 1820.

SULPHURIC ACID.

GUARANTEED absolutely free from Arsenic and of excellent Purity. Specially prepared for Sulphate of Ammonia Manufacturers.

Works: BLACKBURN; Miles Platting and Clayton, MANCHESTER.

Head Office: Miles Platting, MANCHESTER.

Inquiries Solicited.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., LD.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by
Messrs. J. & H. S. PATTINSON.

Yield of Gas per Ton . .	10,500 Cub. Ft.
Illuminating Power . . .	16·9 Candles.
Coke (of good quality) . .	67·5 per Cent.
Sulphur	0·58 „
Ash	2·73 „

For Price, &c., apply to the

WEARDALE IRON & COAL Co., LD.
QUAYSIDE, NEWCASTLE-ON-TYNE.

HOLMSIDE
GAS COALS.

Present Daily Produce over 5000 Tons.

Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton . . .	11,205 Cubic Feet.
Illuminating Power	16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality)	13¾ Cwt. per Ton.
Sulphur	A little over 1 per Cent.
Ash	Under 1 per Cent.
Tar	163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor	103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR
PELTON GAS COALS.

Present Daily Produce available 3000 Tons.

Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.

Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE & SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

NOTIFICATION

To Gas Engineers & Manufacturers of Retort Mouthpieces, &c.

In order to obtain Holman's **LATEST IMPROVEMENTS** in **ECCENTRIC FASTENINGS** for the **LIDS OF GAS-RETORTS**, it is important to insert the following description in Specifications—viz., **"Retort Mouthpieces and Self-Sealing Lids, fitted with Holman's Eccentric Bar-Lock Fastenings."**

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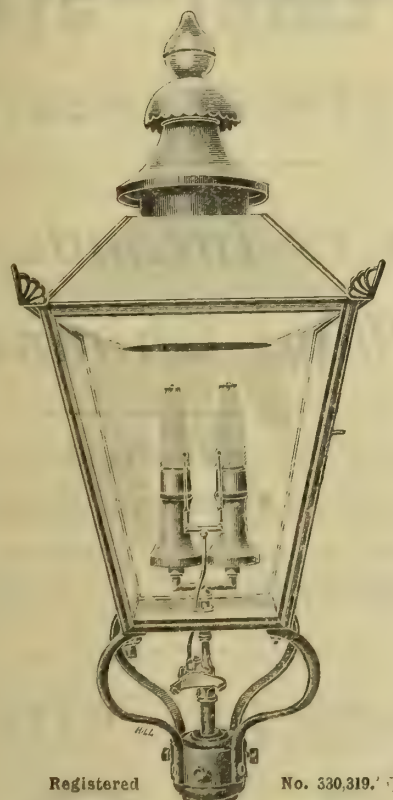
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CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE.
The Price of Coal and Gas. 855
The Precedents of Glastonbury 856
The London County Council Discomfited 856
Municipal Trading 857
A Change from "Fussiness" 857
The Problem of Housing Town Populations 858
WATER AND SANITARY AFFAIRS—
The Water Policy of the London County Council—Rejection of the Purchase and Withdrawal of the Welsh Bill. 858
The Thames as a Source of Water Supply for the Metropolis . . 859
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market 859
Electric Lighting Memoranda. 860
The Future of Electrical Supply 860
The Lawyers and the Workmen's Compensation Act. 861
Recent Publications—"The Rights of Local Authorities as Regards Private Bills" 862
NOTES:—
Zinc White Paint 863
Peat for Carbonizing 863
Working Pumping-Engines by Producer Gas 863
The Standard of Steam-Engine Performance 863
The Improvement of Lubricants 863
COMMUNICATED ARTICLE:—
The Efficiency of Steam and Gas Engines. By Ed. C. de Segundo 863
TECHNICAL RECORD:—
The Carbonization of Coal for the Production of Illuminating Gas —Mr. W. R. Herring on Inclined Retorts 865
New England Association of Gas Engineers—Annual Meeting. . 866
Dr. Bueb's Method of Preventing Freezing in Gas-Services . . 868
The Distribution of Gas of Different Qualities. 869
Determining the Combustible Matter in Coke and Anthracite Coal 869
Manchester and District Junior Gas Association 870
Painting by Compressed Air 871
REGISTER OF PATENTS:—
Incandescent Mantles—Helmecke, H. 871
Purifying Acetylene—Ernst, O., and Philips, A. 871
Production of Heating Gases, Poor in Nitrogen, from Combustible Materials Containing Hydrocarbons—Blass, E.. 872
Automatic Gas-Lighters—Trendel, F. 872
Patent Notices 873
CORRESPONDENCE:—
The Presence of Naphthalene in Coal Gas 873
The Proposed Visit of the Gas Institute to Paris 874
The Law in Regard to Underground Water 874
Morecambe District Council Gas Bill 874
The Price of Coke in the North 874
Notifying Increases in Price 874
PARLIAMENTARY INTELLIGENCE:—
Gleanings from the Committee Rooms 875
House of Lords—Progress of Bills 875
House of Commons—Metropolitan Water Supply Bills; Progress of Bills 875
House of Commons Committee—Glastonbury Corporation Gas Bill and Glastonbury and Street Gas Bill 877
LEGAL INTELLIGENCE:—
The Promotion of the Automatic Gas-Meter Company 879
The Powers of the Harrington Gas Company 879
MISCELLANEOUS:—
Commercial Gas Company—The Half-Yearly Report and Accounts 880
Alliance and Dublin Consumers' Gas Company 880
The Board of Trade Report on the Gas, Electric Lighting, and Water Bills and Orders of the Present Session 881
New Gas-Works at Cromer. 881
Proposed Royal Commission on Coal Supply 881
The New Gas-Works at Perth—Resignation of the Manager; Contractor to be Sued. 882
German Continental Gas Company—Report and Accounts for 1899 882
Colonial Gas Undertakings 883
Anglo-Romano Gas Company 883
The Powers of the Massachusetts Gas Commissioners—The Price of Gas at Haverhill 883
The Inspection of Gas and Meters in Massachusetts—Calorimetric Tests of Gas 883
Acetylene Lighting in France and Belgium 884
Electric Lighting Notes 884
The Falmouth Corporation and the Water-Works 884
The Tonbridge District Council and the Water-Works . . . 884
Notes from Scotland. 885
Gas and Water Companies' Stock and Share List. 886
Current Sales of Gas Products 887
Coal Trade Reports 887
PARAGRAPHS:—
PERSONAL: Mr. Alfred J. Kingdon; Mr. S. Dawes; Mr. R. Ashton; Mr. E. J. Sutcliffe; Mr. W. J. Dowsu; Mr. W. Spier; Mr. Edwin Platt, Mr. Frank James 862
Masonic—A Correction—The German Association of Gas and Water Engineers—Increase in the Price of Gas in South London —Eastern Counties Gas Managers' Association—Photographs of Gas-Works for the Paris Exhibition 862
Repayment of Loans for Purchase of Slot Meters and Stoves . . 871
Armagh Gas Company 874
The Cost of Coal and Increases in the Price of Gas 888
West's Stoking Machinery for the Halifax Gas-Works—Teesside Water Supply—Suffocated by Gas—The Supply of Water Gas in Dublin—Oldbury Gas Department—Guildford Gas Company—Rushden and Higham Ferrers Gas Company 889
Additional Capital for the South-West Suburban Water Company —Chorley Gas Affairs—San Paulo Gas Company, Limited—Bristol Water Company—The Heckmondwike Gas-Works and the Local Authorities—Exmouth Gas Company—Gas and Water Works Extensions at Llandudno 890
The Dangers of Electricity in New York—Wath-upon-Dearne and District Gas Supply: The Board of Trade Inquiry—Clevedon Gas Company—The Price of Gas at Stockton and the Rates—The Old Gas-Works at Hull Cease to Exist—Sales of Shares . 891
Fire at the Loughborough Gas-Works—The Hull Corporation and their Water Supply Regulations—A Medical Journal on Gas-Fires—The Recent High Rainfall and the Quality of London Water—The Shrewsbury Corporation and the Arbitration Award 892
The North Shields Water Company and the Tynemouth Corporation—Bognor Water Company—Derwent Valley Water Board—The Aberdare District Council and their Reservoir Contractor . 893

EDITORIAL NOTES.

The Price of Coal and Gas.

THE financial outlook in the gas world for the ensuing year is not a bright one, as even the most optimistic of managers must by this time realize. It is true that the largest coal contracts have not yet been concluded; but the price at which the next twelvemonth's requirements will have to be bought—unless the coalowners can be induced to adopt a more reasonable attitude than that at present assumed—can be estimated with a fair approach to accuracy. We do not think that Durham gas coal is likely, as the market stands at present, to be bought for delivery over the coming contract year at much less than 15s. 6d. per ton, free on board in the port of shipment. That is equivalent to about 19s. per ton in the Thames, and would represent a rise of from 6s. to 7s. per ton over expiring contracts. Such an increase works out at a gross addition of nearly 8d. per 1000 cubic feet to the price of gas. Assuming such a tremendous addition to the cost of manufacture (and we see little prospect of its being substantially less), the vital question has to be considered, of what compensating increase may be anticipated in the return from the sale of residuals.

In attempting to form such an estimate—a calculation of no little difficulty—sight must not be lost of the fact that Gas Companies have during the past six months been reaping a considerable advantage from the improved condition of the residuals market. Coke especially has been fetching very good prices indeed. The contract rate for the supply to the cement manufacturers, which largely controls the London market, is now not far from double what it was some three or four years ago; while tar products (pitch in particular) and sulphate of ammonia have been selling well. We should not like to put the enhanced value of residuals for the year ending June, 1901, as compared with the return during the year to the end of June next, at more than 4s. per ton of coke sold, ¼d. per gallon of tar, and 1s. per butt of liquor; and, of course, it would be dangerous to place implicit reliance upon any such figures. The market in coke, especially, might easily be "foozled" through want of co-operation among the largest makers. The higher residual values set out would be equal to about 2s. 6d. per ton of coal carbonized, or 3d. per 1000 cubic feet of gas. On these hypotheses (which are purely speculative), those Companies whose ruling prices for gas are sufficient, and no more than sufficient, to pay their statutory dividend, would have to face an increase of 5d. per 1000 cubic feet before the year is out. What would the London householder—on the hither side of the river—say to a price of 3s. 3d.?

What are the prospects of the market becoming easier? With no desire to be pessimistic, we must confess to seeing little. In fact, at the present moment the tendency is rather towards hardening, owing to the stimulus to the demand for coal and to the consumption of gas afforded by the prevailing snap of biting cold weather. Gas coal is nearly as scarce as it was in mid-winter; and, so far from the Companies having been able to replenish their stocks, some at least of them are as near bottom as ever they were. Indeed, if, as we believe, our information be correct, the continuity of the supply of gas to the Metropolis at normal pressure has been more closely threatened during the past week from failure of coal deliveries than at any time for many years past. The effect of the cold weather is, however, necessarily but temporary; and every day brings the summer within more measurable distance. The question of importance is the view taken by colliery owners and coal factors of the possible situation next winter; and there is little doubt that they fully anticipate (and, so far as it is at present possible to judge, have good ground for anticipating) that, after stocks all round have been brought up to the minimum compatible with safety, the demand for coal in the next twelve months will exceed, rather than fall short of, the supply.

In attempting a careful survey of the prospect for the near future, it is necessary to bear in mind two considerations that offer strong inducements to the colliery proprietors to ask and hold out for heavy prices for ensuing contracts. The first is the strong upward tendency of miners' wages, the full effect of which is only now making itself felt. In the Federated districts, it is true, wages have for some while been fixed at their maximum; but

in the Northumberland, Durham, and South Wales fields the rise in wages follows some time after that in coal, and has hardly yet reached top figures. The result of the last audit of the books of the South Wales owners (published on Saturday) secures to the miners in that district an increase of 13¾ per cent. on standard rates—making a pay rate of 48¾ per cent. above the wages paid in 1879 (which constitute the standard). This is far and away the highest rate paid since the end of 1891, when it stood at 53¾ per cent. above standard; the lowest interim rate being 10 per cent. at the end of 1896. Miners' wages in all districts are now practically as high as—in some cases higher than—those ruling in 1890-1. Though, of course, wages follow on prices, and not prices on wages, the fact of such increases being obtained at the present moment is certain to stiffen the backs of the owners. The other consideration tending so to do is the fact that, although collieries have done exceedingly well during the past winter, they have by no means reaped the lion's share of the profits accruing from the extravagant prices obtained for the coal actually sold in the market during that season. These profits have, in large measure, been factors', not owners', profits—especially in regard to house coal, but also in regard to much of the gas coal purchased—and the owners are now intent upon securing for themselves the benefit of the excess demand. That is why we do not see much hope of an abatement in the exorbitant prices now being asked for the fresh contract supplies.

It is some small relief to an otherwise depressing situation to learn that the Railway Companies have abandoned their projected idea of recouping themselves for the increase in their working expenses, caused by dearer coal and materials, by imposing an additional carriage rate of 3d. per ton on coal to the South. Whether the Board of Trade would sanction the higher impost upon a commodity already by no means lightly charged for carriage by rail, is doubtful; but it is satisfactory to know that, owing to the refusal of the Company which does the largest coal-carrying trade to co-operate in the movement, the proposal has been dropped. The price at the pit's mouth has risen quite high enough to render particularly unwelcome an addition of 3d. per ton to the cost of bringing the raw material into the retort-house.

The Precedents of Glastonbury.

An extremely interesting and valuable piece of legislative work has been done by Mr. Schwann's Committee on the Glastonbury Gas Bills, as reported in another column. The settlement effected is a splendid testimonial to the efficiency of the British system of legislating upon such matters on the merits of individual cases. This system combines, in a wonderful degree, elasticity in dealing with particular considerations, with fidelity to worthy precedents. Thus the way is always open to statutory improvement; while there is ample guarantee that progress shall be real. Precedents are continually being tested, year after year; and the fresh minds brought to bear on successive Bills ensure a welcome for all fair and sensible suggestions. Moreover, the system offers facilities for obtaining solutions, of the deepest significance, of problems presented by small as well as big Bills. Human nature being what it is, the average man feels greater confidence in grappling with issues of moderate dimensions. He can see them completely, and see them whole; and in connection with such projects as the Glastonbury Gas Bills, the member of a Parliamentary Committee is less liable to be deterred by the minatory finger of a leader of the Bar from giving effect to his judgment, than when Counsel can solemnly warn the Committee against unsettling interests of vast and unknown importance. These general reflections arise irresistibly on a review of the proceedings in Committee on the Glastonbury Bills. The facts are simple enough; but the dignity of their treatment puts the Act that will eventually be passed in the foremost rank of gas legislation of recent times.

The Corporation of Glastonbury have a Bill for enabling them to acquire the undertaking of the Glastonbury and Street Gas Company, who originally had a Bill of their own. This, however, was withdrawn on the passing of the preamble of the Corporation Bill—the principals having agreed upon terms of transfer. Adjoining Glastonbury is the urban district of Street, the importance of which to the gas undertaking is indicated by the name of the Company. The Street Council naturally wanted to know how they would stand affected by the proposed transfer; and the Committee postponed consideration of the clauses in order that Street might examine them in the light of a proved preamble. The first point that Street fell upon was the usual formula which allows the application of the surplus profits of the undertaking to increase the district fund of Glastonbury. It was suggested that all surplus profits ought to go to reduce the price of gas, or else Street would be worse off under the Glastonbury Corporation than it would be under a sliding-scale Gas Company. Municipalizers should take note of this observation. Next, objection was taken to too large a reserve fund; but, although reasonable enough, the criticism was not very serious, inasmuch as Corporation gas undertakings are rarely troubled with excessive reserves. Of greater moment was the proposition that Street should be recognized as having property in the sinking fund; so that, in the event of their ever purchasing their own portion of the undertaking, the amount of their share in the redeemed first cost should be credited to them. The precedent of Ossett and Horbury, of the present session, was cited in this connection.

Another matter that came up for discussion in the course of the proceedings was the effect of the period for the redemption of the loan on the price of gas. An interesting question was also put by the Chairman as to the possibility of applying a sliding-scale to a Corporation gas undertaking, for the protection of an outlying district. The Referee, Mr. Bonham Carter, said that there is such a case; but his memory must have been at fault. Possibly he was thinking of the Oldham precedent. In the end, the Committee gave Street all they asked, with the novel permission that Glastonbury might credit themselves with a profit of 1 per cent. as payment for management. The example of the London Water Companies and their debenture capital seems to have weighed with the Committee in this regard. As business men, they did not see why Glastonbury should have all the trouble and responsibility of supplying Street with gas, for nothing. It might be suggested, of course, that Glastonbury would not be doing the work for nothing, inasmuch as there would be an advantage in having such a large customer as Street. The knowledge that they are paying a small profit to their neighbour may tend to increase the desire of Street to sever the connection; but if the District Council are well advised, they will understand that severance would not tend to give them cheaper gas.

The London County Council Discomfited.

The London County Council had their delayed "innings" in the House of Commons last Thursday, when the Irish Members made handsome amends for their churlishness of the previous week, and voted as one man for the water policy of the Council. This kindness helped to break the Council's fall, and must have fully persuaded the majority at Spring Gardens that the Irish Vote ought to decide the question of the expediency of appropriating Welsh water for the imaginary needs of London half a century hence. This is obviously not the place to discuss the water policy of the London County Council, as such; but the well-merited rebuff meted out to the arrogant Progressives who wanted their own way in face of the findings of two Royal Commissions, is of more than particular significance. It is about time that somebody asked for a parliamentary return of the amount of public money spent by the London County Council in support of what the majority of this body are so fond of calling their water policy. Meanwhile, it is not a little amusing to note the scarcely articulate ravings of the "Daily News" upon the iniquity of the Government obstructing the purposes of the only sacrosanct public body in the wide world. Not a word does our daily contemporary say by way of admitting that Royal Commissions do not see eye to eye with the Progressive majority at Spring Gardens. "The second reading of the "London Water Bill was rejected in the House of "Commons yesterday afternoon by a majority of 83. If "such an insult (?) were offered to any other town in "England or Scotland, there would be serious danger of "a riot." One has heard of "bread riots," and known of popular tumults in which flags have been waved and heads broken in other causes—but not for water. But this is not the worst. The same journal bids "Londoners, please "note . . . the Tory Party, so long as they have the "power to do so, will withhold from London even 'gas and "'water home rule.'" This is the only instance that has

come under our notice of gas supply being dragged into the political question.

Well, so long as what is called the Tory Party is content to rest its action upon facts, instead of upon hollow cries and "principles," London will have no reason to complain of it. If it is to be assumed that Progressivism in municipal politics means adopting, at the public expense, a certain "programme," irrespective of the practical question of expediency, then the less London and other localities have of it the better. Oddly enough, in the "Daily News" of the 30th ult., from which we are now quoting, there are parallel columns of editorial articles. One is devoted to the adulation of the London County Council, and the other to a qualified appreciation of the London School Board. In the latter article occurs the remark: "Anything "can be proved by the use of question-begging epithets." Just so; but what is the epithet Progressive, if not of this character? Does it help anybody, or anything, to throw about "names," and impute motives to responsible Ministers of State in which the scribe himself cannot in reality believe?

This discomfiture of the London County Council is to be commemorated also for its justification of the position of other local bodies throughout the United Kingdom who have acquired their gas and water undertakings for the sake of strict expediency, and on financial bases which the London County Council have tried by every way open to them to avoid. We are told, on the high authority of Mr. John Burns, M.P., that Liverpool, Manchester, Glasgow, and Birmingham are examples of "what London "might be if the Bill were passed." As how? It is stated that "Mr. Stuart went a good deal farther than any "Provincial Council would dream of going. He accepted "the principle of the Lands Clauses Acts, which is most "unfair to the public; and he even offered that the Council "should purchase in trust for any authority to be here-"after created." Well might the impartial parliamentary reporter of Mr. Stuart's remarks punctuate his offer in this sense with the sign "(Laughter);" the truth being, of course, as everybody who has taken the trouble to read the report of Lord Llandaff's Commission knows, that only in the improbable event of Parliament sanctioning the expropriation of the Water Companies of London on far less advantageous terms than the Provincial Corporations enjoyed, could the transfer of the property be effected without throwing a very heavy additional charge upon the ratepayers.

What is the sense, moreover, of applauding Mr. Stuart's artless offer to buy the property "in trust," if the suggested establishment of a Water Board is to be scouted in the next breath as a "feeble and futile expedient"? The truth of the situation is that the small persons who have managed to get themselves into positions of unmerited influence at Spring Gardens do not understand such big affairs as the transfer of gas and water undertakings; and their flatterers in the newspaper Press are equally in the dark. Respectable newspapers, like the "Daily News," ought to be above uttering such clap-trap as that "the "spirit of reckless and unscrupulous faction which actu-"ates the President of the Local Government Board is "leading straight to a water famine of the most appalling "magnitude." This is not the way to write of a subject which has not exactly been neglected by sober-minded investigators whose conclusions have been presented to Parliament. Is the Opposition going to try and capture Office at the next dissolution with the cry of "Down with "Royal Commissions. The London County Council can "do no wrong"?

Municipal Trading.

The House of Commons has certainly not exhibited any conspicuous power in dealing with the vexed subject of municipal trading. The question of appointing a Joint Committee of both Houses, to consider "whether a Munici-"pality should supply the mere necessaries of life—such "as highways, gas, and water—or whether they should "launch out into competition with private enterprise," was discussed last Thursday night; but the debate stood adjourned in the middle of a sensible speech of Mr. J. Samuel, who denied that any hard-and-fast line could be drawn in these matters. It is doubtful what will follow; but we have not much faith in the possibility of a good issue from the muddle in which the counsels of Parliament seem to have been plunged. It looks too much as though Parliament were to be invited to deal with the matter "on "principle," regardless of the facts. This is the wrong way about. Philosophic Radicalism may have a weakness for getting up "programmes," and then looking about to see how the facts of experience and expediency can be made to fit the immortal principles of to-day, which will be obsolete to-morrow; but this is not business. The expediency or otherwise of what is called municipal trading can never be satisfactorily settled on theoretical or general lines. It is probably wise to rivet the onus of proof of expediency upon the necks of all would-be municipal traders, and make them understand that their enterprises must be demonstrably beneficial to the public good, and not merely a way of making one section of the community pay the rates of another. This point being driven home, and the reliability of the book-keeping being ensured, it is hard to see why, for example, the Belfast Corporation should not be allowed to graze sheep on the gathering-ground of their water supply and send the stock to market. The question is essentially one of fact and of degree. Some Municipalities have made a bad name for themselves by asserting their right to a monopoly of any business in which they engage; which is absurd. This pretence on one side only provokes reprisals on the other, as when last year Parliament denied permission to "manufacture" gas-fittings to Municipal Corporations desirous of letting such accessories on hire. This is a truly nonsensical limitation. Public opinion should be left to suggest how far a Municipality might be permitted to go in trading—subject always to open competition, and adequate audit of public accounts. Monopolistic leanings and a fondness for cooked balances are the bane of British Municipal Authorities of the enterprising kind. Let them play the game fairly, and then the public interest cannot well suffer; while, conceivably, it may be advantaged.

A Change from "Fussiness."

The London County Council are displaying a sudden and most salutary determination to look after their own proper business, which has so often had to go begging attention while the Spring Gardens busybodies have been spending their time in poking their fingers into political pies. We are far from supposing that the Progressive worthies have any intention of abandoning their megalomaniacal ambitions; but it is some consolation to the London ratepayer to observe signs of his getting a little more practical work done for his money. The Council have recently taken steps towards the prevention of that modern horror of our streets—the flashlight advertisement, which is so intensely irritating to the intelligent biped, and so frightening to the nervous quadruped. The decision to prohibit these nightly flauntings of Somebody's Soap before the eyes of the advertisement-wearied public will doubtless not be popular with our electric-lighting friends, but it will certainly be welcomed by everyone concerned for the appearance of our thoroughfares at night. A further suggested bye-law is designed to diminish the risk of injury to persons engaged in outside window-cleaning; but, as drafted, it is not very likely to prove effective. Gas companies are indirectly interested in this question, as window-cleaning is a favourite means adopted by lamplighters of supplementing their earnings at the muster, which are naturally less than those of a man employed throughout the day. Quite recently an inquest was held on a lamplighter who had met with his death through a fall from a window he was cleaning.

In further evidence of their new-born energy in dealing with matters strictly within their province, the Council last Tuesday agreed, at the instance of the General Purposes Committee, to convene a conference of other local authorities in London to consider how best to deal with some of the problems relating to the safety and comfort of the streets—matters in regard to many of which provincial, and especially some seaside, corporations, and many foreign cities, are very far in advance of our wealthy but unwieldy Metropolis. Among the questions to be discussed are those of removing house refuse, the cleansing and watering of the streets, the prevention of persons throwing litter or dangerous substances upon the foot or road ways, the clearer indication of the names of streets—for which purpose lamp-posts are most useful at night—and the efficient regulation of street cries and objectionable noises. It is also proposed to consider means for the better protection of the public from injury caused by building operations on frontage lines, and for prohibiting the use of carts with hoods which restrict the vision of the drivers.

This list constitutes a fair instalment of much-needed

reforms, which, from their apparently insignificant, or at least inglorious, character, have been too long neglected by a Council imbued with the ambition to undertake such little matters as the gas and water supply or the tramway services of London. We wish we could regard it as indicative of anything more than a temporary aberration from the policy of "fussiness" which begets proposals such as that for the adoption of testing by the portable photometer—which nobody asked for, nobody wants, and by which nobody would profit.

The Problem of Housing Town Populations.

A CONFERENCE of Poor Law Guardians was held last week in London, at which the pressing question of how to improve the housing of the poor and the labouring classes in towns was discussed. Some useful things came out in the course of the discussion, but not many. One guardian said very truly that there is a kind of solidarity in social questions; so that the prospects of one kind of improvement hang upon something quite different. It is largely this consideration that makes any real progress so difficult to originate and to help forward by specific design. One could wish that a kind of jury could be impanelled to try the actual facts respecting the housing accommodation of the people, and the means whereby it might be improved. It is of no use to leave the question in the hands of heedless or factious local authorities, or to encourage faddists and politicians to make "platforms" of it. People go into local governing bodies and join Boards of Guardians with set prejudices, which prevent their seeing straight. One man will ascribe all the evil of the overcrowding and bad housing of the people to "our pernicious land system." He sees nothing but the bogey of the "large landowner;" just as another wants to "take the capitalist in hand." Some politicians desire, above all things, to magnify their own particular clique or organization; others seek simply to advertise themselves. All this is, to the practical man, what the late Captain Marryatt called "flapdoodle," or food that fools are fed on. Some modern "Reformers" cry for it; and it is apparently found sustaining by Social Democrats and the Independent Labour Party.

There is, we believe, an uneasy feeling among the general, well-meaning, but helpless, because unguided, public that so far the treatment of this housing problem by local authorities has been bad. Speaking generally, the results have certainly not been economical, businesslike, or humanitarian. At the recent conference, "Mr. Cole (Kensington) admitted it was a fact that the abolition of one slum resulted in the creation of another." Surely, there must be something radically wrong with a system of which this can be truly said. Now the local authorities are desirous of legislative sanction for going outside their own limits for the accommodation of their displaced population; and those who are dissatisfied with their accomplishment in dealing with the evil of overcrowding are doubtful as to the expediency of this fresh move. It has been roundly declared that if the municipalities had interfered less, private enterprise would have done much more, and better, towards curing the worst of the mischief on ordinary commercial principles. Again, it has been argued that municipal endeavour has been ill advised in treating the problem by "areas." It is at least plausibly contended that the work of improving and increasing accommodation can be better done if one building plot is the unit, instead of an "area." A great to-do was made in London only the other day for the glorification of the County Council over their improvement of the Boundary Street "area." It has since transpired that for 5700 persons displaced, accommodation was provided for 5500. How many of the old tenants got back to the site is not stated. Possibly not ten families. Whatever this is, it is not "rehousing."

Therefore we want a jury to inquire into the facts. It is an Age of Endowment of Research; and there is need for the institution of a good deal more, and more accurate investigation of the factors of this problem of the housing of town populations than has yet been given to it. Mr. Bond, M.P., who attended the recent conference in the capacity of an expert in the work of building companies, spoke very much to the point in stating that "the right way of dealing with the question was to endeavour to reconstitute London as it now stands. At present three-quarters of the houses of the Metropolis are of the cottage type; and thus a great deal of space is wasted. They must build larger houses in the future." This is sound, practical common sense. Vast regions of South, West, and East London are covered with "small property," which is now distinctly out of place. Some economic mean must be discovered between these shanties and the huge barracks of the County Council pattern, with floors of expensive fireproof construction and walls like a fort. Decent houses, of not more than four storeys in height, with gas and water and other necessaries laid on, might surely be provided without waiting until all the organization of society and every ordinary incentive to human effort and social enterprise shall have been "Progressed" out of existence. It is quite certain the gas and water interests would willingly co-operate with practical reformers of the businesslike type represented by Mr. Bond, in the endeavour to make London and other large cities better worth living in by those who, whatever their faults, are indispensable constituents of the workaday world, and must live "on the spot" where they are wanted. A philanthropic millionaire could do much worse with some of his money than commission two or three honest and capable men—one of whom at least should be an engineer, and the others destitute of "views"—to collect information upon which a 3 per cent. house-building enterprise for poor townspeople could be adventured.

WATER AND SANITARY AFFAIRS.

IT would seem that the Irish Nationalist Party were almost justified in objecting, on a recent memorable occasion, to the time of the House of Commons being taken up by a discussion on water matters, when it had been promised to them; for if the debate last Thursday on the two Bills promoted by the London County Council had taken place on the corresponding day the previous week, there certainly would have been a good deal less time for the consideration of financial questions affecting Ireland. However, the three solid hours devoted to the above-named measures can hardly be said to have been wasted, inasmuch as the outcome of all the talk was the removal of both Bills from the paper. This result was exactly what anyone who had followed the course of events in connection with the Metropolitan Water Question would naturally have expected. When the notices for the Bills were given in November, the Council did not, of course, know (though they might have guessed) what would be the nature of the recommendations of the Royal Commissioners; but when their report appeared early in the year, its language was so unequivocal as to have deterred any other body than the Progressive Party of the Council from proceeding farther with the matter. The Commissioners were strongly in favour of the undertakings of the London Water Companies being purchased by some public authority, but not by the Council; and they came to the conclusion that the Welsh scheme was both costly and unnecessary. Notwithstanding this very definite expression of opinion, and a by no means encouraging reception by the President of the Local Government Board of a deputation from the Council, the Bills were kept alive in the hope that they would be referred to a Select Committee of the House, before whom the modified views of the Council would find expression. For these views had undergone some change; and when Mr. Stuart asked support for the second reading of the Purchase Bill, he acknowledged that the Council were prepared to make concessions. He would, he said, be willing to agree to arbitration on the lines indicated by the Royal Commission; and the Council were so anxious to secure the water undertakings that they would have no objection, if allowed, to purchase them "in trust" for any authority which might afterwards be created. The House laughed at the latter proposal, which we recently ventured to characterize as "preposterous;" and Mr. Chaplin pointed out that such an arrangement would put the Council in possession of the works, and for the time being constitute them *de facto* the water authority, in direct opposition to the recommendation of the Royal Commission. The notion was a cleverly devised one; but its object was too apparent, and the House would have nothing to do with it. Mr. Whitmore moved the rejection of the Bill; and Mr. Chaplin favoured the House with an excellent speech which contained a few pertinent extracts from the Commissioners' report. The House was convinced; and the Bill was thrown out by a majority of 83.

The Purchase Bill having been disposed of, the fate of

the Welsh Supply Bill was quickly settled. Its rejection was moved by Sir F. Dixon-Hartland, the Chairman of the Thames Conservancy Board. He pointed out that there was no necessity to go to Wales, for, with a proper system of storage, the Thames and the Lea could supply all the water that was necessary. Welsh members considered the water proposed to be taken for London was needed for Wales; and therefore they objected to the Bill. Mr. Chaplin thought the whole matter might be left for settlement by the new water authority; and as the House had just decided that the County Council should certainly not be that authority, it would be out of place to entrust it to them. This was perfectly logical. Mr. Chaplin might well have emphasized the fact that the cost of the Welsh scheme, as shown by the report of the Royal Commission, would be much greater than that of a scheme of storage reservoirs in the valleys of the Thames and the Lea, to utilize to the fullest extent the waters of those rivers. However, he expressed the opinion that it is the construction of such works as these which is the present need in connection with the Metropolitan Water Supply, and said he regretted the rejection of the East London Bill last year. Sir F. Dixon-Hartland stated that, except at certain times in the autumn, an enormous quantity of water passes over Teddington Weir; and an adequate system of storage would allow of ample supplies being furnished during all the dry months without detriment to the Thames. This statement is fully borne out by the returns of the gaugings of the river for February. In that month the average daily quantity of Thames water supplied by the Companies was 108,122,000 gallons; while the minimum flow over the weir was 925,800,000 gallons, and the maximum 10,024,200,000 gallons, after the Companies had drawn their authorized amounts. Taking the above-named daily quantity of water for the month, we have a total of 3,027,416,000 gallons, which was less by 1,093,084,000 gallons than the flow over the weir on the 16th of February, when 4,120,500,000 gallons were recorded. Before going to distant sources, therefore, let us make the best use we can of those at our very doors. The Commissioners say there is enough water close at hand to last for the next forty years, allowing for the increase in the population; but it requires conserving. They acknowledge that the resources of the Thames will be more severely tried after the above-named period, and that the question of seeking water elsewhere will then assume a different degree of importance; but it will be for the water authority of that time to carry out such a scheme as will meet the requirements of the London of that day. Meanwhile a gigantic project such as that proposed by the Bill has been proved by experts to be totally unnecessary.

In view of the general feeling expressed by the House, Mr. Buxton suggested that the Bill should be withdrawn; and this course was followed. The two measures were thus disposed of for the present session. As to the probability of their revival—or at any rate one of them—it would be idle to speculate. But it is certainly time some definite action was taken to settle the Metropolitan Water Question; for the Companies and the public must be equally tired of a condition of things which involves so much unnecessary expenditure of money. Every year the County Council vote something like £12,000 in connection with water legislation; and the outlay entailed upon the Companies by Royal Commissions and parliamentary proceedings is exceedingly heavy. As this agitation has been going on for some years, the total amount spent on both sides must be simply enormous. This waste should be stopped, and the associated Water Companies, or a Water Board, allowed to carry out the scheme of storage reservoirs recommended by Lord Balfour's Commission of 1892-3. Under the provisions of the Bill promoted by the Companies this session, there was a prospect of something being done in this direction. But, unfortunately, owing to non-compliance with parliamentary practice, the Bill, which had been introduced as a private one, had to be withdrawn on Thursday, and will have to come before the House as a public measure. It is to be regretted that a temporary check should thus have been put upon the progress of this important scheme. At the same time, it is gratifying to learn that the great undertaking at Staines is still making highly satisfactory progress. Tired, apparently, of depreciating the London Water Supply on the score of quantity and quality, the County Council inspire adverse criticism of these works, which have been stamped with the approval of the highest engineering authorities in the land, and are being carried out by contractors whose experience of such constructions is unique and whose reputation is world wide. But, as "The "Times" pointed out last Saturday, the whole controversy which it has lately been sought to "galvanize into life" by correspondence in its columns has been practically settled by exhaustive inquiry. The result of that inquiry is—and London ratepayers should be very thankful for it—that the Welsh scheme has been shelved in favour of the reservoir scheme, which is actually in progress. We can now, therefore, leave the subject; and we do so with an expression of regret that the works at Staines could not be commenced in time to allow of their being utilized for the storage of a large portion of the enormous bulk of water—about 116,500 million gallons—which flowed past Teddington during the month of February.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 886.)

BUSINESS on the Stock Exchange last week ran for the most part on very special lines. By far the greater number of departments were decidedly quiet, some for money reasons and others for war reasons; but a degree of compensation for this inactivity was as usual found elsewhere, and last week the buoyancy of the American railway market was the solace for sluggishness elsewhere. A few others followed in their wake; but the gilt-edged division, with Consols at their head, were depressed. However, the fall in prices generally is not very serious. The Money Market was very firm. The end of the quarter brought its usual strong demand. The Stock Exchange settlement, too, had its requirements; and the discount rate held very stiff. Business in general was somewhat broken in upon by sport last week, as is not infrequently the case in the Boat Race week; and this no doubt largely contributed to bring about the condition of quietude which extended far enough to include the Gas Market. Here there was a decided falling off from the rate of progress promised by the course of things in the preceding week. There were not many changes in quotation; but they are nearly all in the downward direction, and some of them are fairly considerable in degree. The extraordinary advance in the prices demanded for gas coal must naturally affect the price of gas; and all over the country substantial increases in price are being announced. These advances automatically lower the authorized rates of dividend of sliding-scale companies; and therefore so long as the present pinch for coal lasts, we may expect to see lower quotations for gas stocks. This is a thing which has happened before, and will doubtless happen again as things come round; so we must bear it philosophically while it is happening now, marshalling the full years with the meagre. Among the Metropolitan Companies, Gaslight ordinary was moderately dealt in at steady figures without much fluctuation, and the secured issues also were unchanged. There were a few dealings in South Metropolitan at good level prices. Commercials were quiet and unchanged. Business in the Suburban and Provincial group was very limited; and movements were confined to Brighton original, which was pulled down by a deal at the low figure of 242½. In the Continental division, Imperial held its position, but not strongly; European was rather weak; and Union had a smart fall, with business marked 160. The only advance registered was in Cape Town, which rose ½. The Water Companies were as quiet as usual, and rather weaker; Kent and East London receding a little.

The daily operations were: Business was quiet on Monday, with pretty fair prices ruling. Quotations did not move. Tuesday did not bring much increase in activity, nor any in strength. Brighton original fell 5, and San Paulo ½. On Wednesday, the tendency was still easy; but things kept very quiet. Continental Union dropped 5, and Brighton original 3. In Water, Kent was 3 lower. Thursday was about the quietest day of the week, and nothing moved. Friday was busier, mostly in Gaslight ordinary. Movements were unimportant; Cape Town rising ½, and Tuscan falling ½. In Water, Kent recovered 2; but East London fell 3. Business was limited on Saturday; and the only move was a relapse of 5 in Continental Union.

In the Queen's Bench Division of the High Court of Justice yesterday, before Justices Ridley and Darling, the appeal by the London County Council against the decision of the Magistrate at the South-Western Police Court (Mr. E. W. Garrett), on Nov. 14 last, dismissing their summons taken out against the Wandsworth and Putney Gas Company for an alleged contravention of the London Building Act, 1894, in respect of the erection of a new purifier-house, came on for hearing, and resulted in a reversal of the order of the lower Court; but an appeal was allowed. The proceedings before the Magistrate were reported in the "JOURNAL" for Nov. 21 last (p. 1251); and yesterday's will be given next week.

ELECTRIC LIGHTING MEMORANDA.

Subways in the City of London—Electric Railway and Tramway Returns—The Trolley System no Panacea—How the Small Provincial Towns are Treated.

ANOTHER straw has been added to the burden of the City of London Electric Lighting Company, by the provisional passing of the preamble of the City of London (Various Powers) Bill. An important part of this measure relates to the construction by the Corporation of subways for the accommodation of gas and water mains and electrical cables, which are to be compulsorily removed from the streets to the subways, on conditions to be approved by the Board of Trade. Although some of the wording of the Bill is vague, and there is a good deal in its provisions which they regard as objectionable, the Gas and Water Companies did not seriously oppose the measure; but the two Electric Lighting Companies presently and prospectively doing business in the City opposed it very strongly. The unfortunate Company above named contended that they had spent £490,000 on their distributing plant in the City; and they declared it would ruin them to be compelled to remove all their cables from the streets, and put them in subways, without any provision being made for continuing the supply during the alterations. Underground works are a sore point with the Company, since their early tussle with the Corporation over their conduits. The Charing Cross and Strand Company are not in quite so evil a case, as they have not yet done any main cable work in the City. Eventually, with an expression of opinion that the Electric Lighting Companies ought to be put upon the same footing as the Gas and Water Companies in the matter of continuance of supply during the alterations, the Committee passed the preamble. It was remarked at the same time that the Bill is one that will need to be carefully dealt with on clauses, which probably means that it may be considerably cut down before getting through the Committee stage.

Some leading results of electric railway and tramway working are published in the current number of the "Electrician," in the shape of analyses of the accounts to the end of last year of the Liverpool overhead and the South London underground lines, and the Oldham to Hyde and Blackpool to Fleetwood tramways. The Oldham undertaking had only been working for half the year; but the Blackpool tramway started at the comparatively ancient date of July, 1898. The judgment of our electrical contemporary on its own figures is that they speak for themselves, and can support only the one conclusion that "the trolley system is *par excellence* the system for tramways. It is the best remedy for the almost hopeless state of numerous existing British horse tramways, the dejected shareholders of which are most aptly symbolized by their jaded horses; and it is the only system of mechanical traction for tramways that combines in a satisfactory degree the requirements of the public, the passengers, and the capitalist, be he ratepayer or shareholder." We do not dispute the justice of this sweeping conclusion, while venturing to hint that it is rather tall for its foundation. After all, a two-legged stool is not a very stable support; and one would like some other proof before abandoning oneself to the ease of lounging on it.

This is a very busy time for promoters of electrical tramways. Some—including the London County Council—prefer to call them light railways; but the name does not matter. It may be accepted as proved by international examples that the overhead trolley-wire system of working tramways by electricity answers very well, where the tramway otherwise succeeds at all. With all respect to the superior authority in matters electrical of the "Electrician," we must enter a protest against the attempt, if such it be, to administer the system to all tramways everywhere as an infallible remedy alike for debilitude and for apoplectic conditions of the traffic. This is perilously like quackery. The trolley system can handle any amount of traffic with security and a speed which horse traction cannot approach. For the latter reason alone, where there is plenty of traffic lying in wait for improved accommodation, and where there is room for street tramways with other vehicles, the trolley system is indicated as the readiest means of improvement available. Where tramway owners are "dejected," and the line is in a hopeless condition, the question of the expediency of conversion to electrical traction is one for careful consideration—certainly not for answering off-hand. It does not appear, by the way, that there is any great competition among the controllers of electric traction interests to get possession of a vast number of these almost derelict lines throughout the country, although they might doubtless be had cheap. At the other end of the scale, where the amount of general traffic and the character of the streets do not permit of tramways at all, the overhead trolley wire and all its accessories must give place to the electrical railway, overhead or underground, as circumstances dictate. Although an electric railway is not exactly a gold mine, some of the few yet in existence pay a dividend which would perhaps be more satisfying if the claims of depreciation were better regarded.

There has been forwarded to us a pamphlet setting forth a proposed electric lighting and refuse destructor scheme for the town of Sudbury, Suffolk, which appears to have been provisionally adopted by a Committee of the Corporation. The scheme rests upon a report of Mr. W. C. C. Hawtayne, Consulting Electrical Engineer, who naturally finds that the town of Sudbury "offers a good field for electricity supply." Of how many towns has the same observation been made—and what has come of believing the flattering tale! The report goes on in the familiar way to "work out" the prospects of the demand for electricity and the means by which it could be supplied—of course, at a clear profit all along. Curious examination of the estimate, however, fails to ascertain the date of this good time to come. Mr. Hawtayne is careful only to say that he considers that "within a few years about 8000 8-candle power lamps will be connected to the mains at Sudbury; but in my report I have considered that only 6000 are connected"—what moderation! How can a cold critic cavil at such prudence? Still, the calmer-minded among the ratepayers would do well to make sure of the number of English towns which actually have about one electric lamp in use per head of the population, and whose experience bears out the Sudbury Committee's anticipation that no charge will be put upon the rates for the carrying out of Mr. Hawtayne's recommendations. "No charge!" Will the Mayor, aldermen, and town councillors who put their signature to this statement indemnify the town from any loss consequent upon the acceptance of their rash forecast? No outsider, cognisant of the nature of the business, would bet sixpence on it.

THE FUTURE OF ELECTRICAL SUPPLY.

THE Electrical Power Bills of this session, to which occasional references have been made in the "JOURNAL," stand grouped for consideration by a Select Committee, with Sir James Kitson as Chairman, early in May. They have survived the attempt of the Manchester School of Municipalizers in the House of Commons, represented by Mr. Galloway, to strangle them in their cradle, so to speak, in the avowed interest of municipal monopoly; and their ultimate fate will be decided upon their merits. It is impossible to exaggerate the importance of the idea at the back of these projects, especially to all the industrial interests for which the cheapest and most convenient supply of power that can be had is a desideratum. This idea, it may not be superfluous to state once more, is that power can be advantageously generated in large quantity in the immediate vicinity of the natural sources of energy in Nature, there converted into electricity, which can be transmitted "in bulk" to convenient centres of demand, whence it can be distributed economically in the forms required for doing useful work in existing industrial settlements. Every step in this definition requires separate examination and, if possible, proof, before the acceptability of the whole can be regarded as established. And then it must be shown that the general principle is adaptable to the areas named in the Bills, under the conditions set forth.

It has been argued in these columns, whenever the topic has been discussed, that the commercial possibility of the principle has not yet been proved for this country. The public have been confronted with Bills proposing to do for different parts of the United Kingdom something which has never been shown to be worth doing at all, there or elsewhere. The cart has been put before the horse, and is so in the present case of the grouped Bills. Let us look into the right facts of the matter, and see what conclusion may be reasonably arrived at by the soundest engineering judgment we can bring to bear on the suggestion as it stands.

So far as Parliament can do it, the way has been cleared for the realization of any meritorious electrical power "in bulk" scheme. When the generation and distribution of electricity on a commercial scale was first accorded statutory protection, it was not contemplated that any undertaking of the kind would be other than a local affair, like gas supply. It was assumed that, like gas, electricity would be generated and used on the spot. As soon, however, as it was represented to Parliament that it might be desirable to make electricity in one place for use somewhere else—involving the traversing of neutral intervening ground, as to which legal difficulties might arise—Parliament forthwith recorded the opinion that no such obstacles should be permitted to block the natural development of what might be esteemed a useful service to the community at large. This declaration of the Legislature was the charter of electrical power "in bulk" schemes. It is being relied upon with complete security, by the Metropolitan Electric Supply Company, who are laying down a huge generating station at Willesden, whence the power will be transmitted, across neutral intervening territory, to their distributing stations of Inner London. This example is one of the class of what might be styled proprietary electrical generation in bulk schemes, which are mere incidental developments of manufacturing policy common to all big supply concerns. It is not an electrical power "in bulk" scheme at all, of the order now in question.

Schemes of the kind, moreover, received further protection from Parliament, albeit informally, by the important precedent of the rejection by the Commons of the monopolistic pretensions put forward by Mr. Galloway without a division of the House. This left the way clear, as we have remarked, for the treatment of the proposed ventures on their merits, which are susceptible of being considered in the general, and in the particular. We have nothing to say about the latter; but what of the former? Has engineering judgment any grounds for accepting it as established, referring to the step-by-step definition of the subject-matter already given?

It is really remarkable how little reliable and definite information has been offered on this head. The shining lights of British electrical science have not hitherto done themselves credit in this connection. Several of these celebrities committed themselves to support of the Highland Water Power Scheme of last session, which was lost through the admission of Mr. Mansergh that the capital cost of the water-works had been much under-estimated by the promoters. It is tolerably certain, therefore, that no more will be heard of any artificial British "Niagara" power scheme. There is no available water power in this country for any such purpose. But this is not all: Reflections and aspirations based on reports of what is done by water-power electricity at Niagara, or in Switzerland, are completely beside the question as it is presented in this country. We would rather trust the Swiss examples than the American, so far as they go, and feel no hesitation in asserting that the Niagara affair is absolutely meaningless for others, even if all that one hears as to its wonderful success is true. On the other hand, it would not be difficult to pick out half-a-dozen mills in Manchester which use more power every day than all the water-power privileges of Switzerland could provide.

It has been asserted, and never controverted, that the English coal fields can supply, by the agency of Lancashire boilers, cheaper power than is procurable anywhere else. Indeed, it has been stated that Lancashire millowners actually get their power at a lower rate than the Niagara Power Company charge for power transmitted to the nearest factories. Be this as it may, it seems pretty safe to assume, without relying upon the delusive consideration of the cheapness of "waste" fuel—which has a way of becoming inconveniently dear as soon as it is utilized—that power can really be generated at the pit's mouth at least as cheaply as it could be procured by any other means known to science. The next question obviously is, whether this is worth the doing. The answer depends on the relative efficiencies of alternative means of transmitting and distributing the power, when obtained, to the places where it can be used.

What contribution towards the economical solution of the problem is made by the latest gains of electrical science? An essay on this head has been published by Mr. Alton D. Adams, in the March number of the "Engineering Magazine." This may probably be relied upon as an authoritative exposition of the newest and best electrical power engineering. Electrical engineering offers the world a system of main generating plant, with the fewest possible large, direct connected engines and dynamos, developing alternating current at high pressure. This current is carried by cables to sub-stations, conveniently located, where it is changed and adapted to all consumption requirements. Such, stripped of technicalities, is the method of working of all electricity-in-bulk schemes. Simple as it appears, it has only been arrived at through a laborious calculation of ways and means. Where electrical energy can be utilized as it is produced, there is the simple and the ideal condition of maximum efficiency. Unfortunately, if the electricity has to be made by steam power, the disturbing consideration is introduced, that steam-engines are most economical when built and operated on the largest scale. The employment of such large units of power means transmission of the energy in bulk, which again involves high voltage currents. These have to be converted and reduced before they can be used; so that the seeker after economy is presented with one of the horns of a dilemma, and has to decide between power transmission by means of electric current, and by the humble coal-bag.

When the user of electricity makes it on the spot, he can get a kilowatt of distributed energy for every kilowatt of output of the generator. When the generator is removed to a distance, several sources of intermediate loss have to be allowed for. "The simplest common arrangement of the main and sub-station system includes dynamos at the generating plant, and transformers and rotary converters at the sub-stations. A high figure for the efficiency of the rotary converters is 90 per cent., and of the transformers 95 per cent., under average conditions. These figures give a combined efficiency in operation of $90 \times 95 = 85$ per cent.; and, allowing a loss of only 5 per cent. in the lines between the main and sub-stations, there will be only $0{\cdot}85 \times 0{\cdot}95 = 0{\cdot}80$ of a kilowatt delivered to the distribution lines for each kilowatt output at the steam-driven dynamos. Taking the capacity of rotary converters as 1, that of transformers is $1 \div 0{\cdot}9 = 1{\cdot}11$, and of main dynamos $1{\cdot}11 \div (0{\cdot}95 \times 0{\cdot}95) = 1{\cdot}23$; so that the combined capacity of electrical equipment per kilowatt output is $1 + 1{\cdot}11 + 1{\cdot}23 = 3{\cdot}34$ kilowatts. The main-and-sub-station system of electrical supply . . . requires, therefore, an investment in electrical machinery of more than three times the capacity "equivalent to the useful output." This does not look particularly encouraging. Nor is it all: Such a system "demands, also, expensive transmission cables between stations, while it delivers to distribution lines only about 80 per cent. of the electrical energy developed."

The foregoing is the best that can be done for the purpose; and inasmuch as, if we interpret Mr. Adams's figures aright, at least $3\frac{1}{2}$ times the energy must be generated at the prime movers that will ever be accounted for at the consumers' terminals, electricity generation in bulk must be so much cheaper than local production, to put the two methods of working on an equality. Is this probable? Everything depends on the answer that can truly be given to the question. We shall most emphatically decline to attempt a reply. That is for the experts. Mr. Adams raises the further question of whether gas power could not be advantageously substituted for steam power in electricity generation; but here again the ground is uncertain. Curiously enough, Mr. Adams's studies, as an electrician, bring him round to the consideration of the familiar question as to whether, instead of transmitting energy by cable, it could not be better conveyed in the form of gas in pipes. As regards the technic of the two systems, there is nothing to choose. One system is as easy to apply as the other. Many factors are common to the two problems; and therefore in distinguishing between them, Mr. Adams only counts items peculiar to each method. The result is worth noting.

Mr. Adams finds that "comparing the two systems of electrical supply above described, it seems that the first cost of the complete equipment is about the same for each case; but the complete electric system is somewhat less efficient. The combined efficiency of the main dynamos, step-down transformers, transmission line, and rotary converters is $0{\cdot}90 \times 0{\cdot}95 \times 0{\cdot}95 \times 0{\cdot}90 = 0{\cdot}73$; while the combined efficiency of the gas-main and the dynamos at the sub-station is $0{\cdot}95 \times 0{\cdot}90 = 0{\cdot}85$. The system which places the gas-engines at sub-stations, while costing no more for the first investment, delivers $0{\cdot}85 \div 0{\cdot}73 = 1{\cdot}16$ times as much of their output for distribution as does the system with all the engines at a main station."

Whatever else may be the purport of this apparently detached and impartial criticism of alternative methods of power transmission, it seems to place beyond doubt the ability of gas-engine power to hold its own against distributed electrical power. At the same time, it makes decidedly heavier the burden of proof of expediency which has never yet been fairly grappled with by partisans of electrical power schemes aiming at doing a general business with all comers.

LAWYERS AND THE WORKMEN'S COMPENSATION ACT.

It would be of much interest and instruction if statistics could be compiled to show how many of the actions brought against employers by their workmen owe their inception and prosecution to the legal fraternity. Some firms of solicitors make a good thing out of taking up the cases of Trade Unionists accidentally injured in the course of their employment, and attempting to get out of the employer something more than the compensation provided by the Act of 1897. They put in a claim for a lump sum under the Employers' Liability Act, or at common law, in the hope that the employer will pay up rather than incur the cost of contesting the action—for a verdict in the employer's favour, even with costs, is often an expensive victory when the plaintiff is a labouring man. A verdict against the employer is, on the other hand, practically one for the solicitor; the costs not seldom absorbing most of the award. That actions having such origin are extremely prejudicial to the interests of the working classes is obvious; for they give rise to very natural irritation on the part of the employers towards their men, and often involve the men themselves in actual loss. An employer who would compensate without question a man who had been injured in his service, if a claim were put in by the man himself, is as likely as not to get his back-up on receiving a high-handed letter from a solicitor advancing an extravagant claim, and to fight the case right out—with perhaps the result that the man is found not to be entitled to a penny-piece under the 1897 or any other Act.

We are induced to draw attention to this objectionable practice by the report of the proceedings, before the Court of Appeal yesterday week, in the case of *Welland v. The Great Western Railway Company*. The facts were as follows: The plaintiff, a lad, met with an accident in the service of the defendants, who admitted liability, and offered to pay 7s. 6d. per week (being half the lad's wages) during the period of his incapacity. The Solicitor acting for the plaintiff declined, however, to accept this offer, and threatened proceedings unless the defendants paid his client £300 compensation and himself £20 costs. On the matter coming before the County Court Judge, Counsel on behalf of the Company having informed his Honour that they had offered and were willing to pay what was the full amount provided by the Workmen's Compensation Act, Judge Beresford refused to hear the case, which was then carried to the Court of Appeal. The higher Court decided that the plaintiff was entitled to have an award registered at the County Court, in order to give him the right to apply to that Court at any subsequent time, should he find that the injury prevented him resuming full work. They therefore remitted the case to the County Court, and allowed costs against the Company. Judge Beresford accordingly made and registered an award for the terms offered, but only granted an order for £5 to be paid to the plaintiff's Solicitor to cover the costs of the arbitration.

Application was thereupon made to the Court of Appeal, for a rule calling upon the County Court Judge and the defendants to show cause why a bill of costs for £42 put in by the plaintiff's Solicitor should not be taxed and allowed in the usual course. The Court, after some hesitation, granted the rule; and it came up for argument on the 26th ult. Lord Justice Smith found that the Court of Appeal had no jurisdiction to grant the rule, application for which should have been made to the Divisional Court. The rule was therefore discharged. His Lordship added further,

however, that, had the attention of the Court been drawn, at the time application was made for the rule, to order 33, rule 3, of the Rules of Court made under the Workmen's Compensation Act, the rule would never have been granted, as beyond doubt the County Court Judge had, under that order, discretionary power to order a fixed sum to be paid for costs under circumstances such as the present. These circumstances were that the Company never disputed their liability in full; and yet the Solicitor acting for the lad incurred expenses amounting to over £41, and was applying for an order to have this bill of costs, "so scandalously run up," taxed in the ordinary way. In discharging the rule, costs were given for the Company; and the order of the County Court Judge allowing the Solicitor only £5 was confirmed. Upon application being made for leave to appeal, leave was refused; Lord Justice Smith remarking that "he hoped the bill of costs as between solicitor and client would be very well taxed down, otherwise this unfortunate lad would not be able to pay it off for years."

Further comment from us is needless; but the attention of employers may well be drawn to the salutary provisions of order 33 of the Rules of Court. Its existence and enforcement should act as a considerable deterrent to solicitors desirous of trading upon the ignorance of the working classes.

RECENT PUBLICATIONS.

The Rights of Local Authorities as Regards Private Bills. By C. E. Allan, M.A., LL.B. (Shaw and Sons.)

The interests of gas and water undertakings touch so nearly those of Local Authorities, and the legislative proposals of one are so often opposed by the other, that it is essential for the promoters of Private Bills in Parliament to be thoroughly acquainted with the rights possessed by those who may offer their opposition thereto. The publication under notice provides, in a concise and handy form, full information as to the rights that Local Authorities possess to promote or oppose Bills in Parliament, and to use their funds for such purpose.

The Legislature has, fortunately, been somewhat chary in conferring upon public bodies the right of promoting Bills at the expense of their constituents; and when such right has been conferred, it has always been granted subject to restrictions. For many Local Authorities, the only method of procedure is by Provisional Order. With the possible but very doubtful addition of Rural District Councils, the only public bodies that have the general right of initiating Private Bill legislation at the expense of the ratepayers are the London County Council, Municipal Corporations, and Urban District Councils. The London Vestries, County, Rural, District, and Parish Councils do not possess the right. These authorities can, however, promote Bills by virtue of the general right of any individual to petition Parliament, provided that they meet the attendant expenses by means other than a charge upon the rates—such as by public or private subscription—or by inserting a clause within the Bill authorizing the payment of the expenses out of the rates. The latter course has been several times adopted, as in the case of the Uttoxeter Water Act, 1892. As to the limitations of the powers possessed by the Municipal Corporations to promote Bills, and the provisions of the Borough Funds Act, 1872, the author gives all necessary information.

The power to oppose Bills is then dealt with; and cases are quoted to illustrate the somewhat rare circumstances under which Corporations have been restrained from devoting public funds to the opposition of Private Bills. The two principal cases are those of *Regina v. Mayor, &c., of Sheffield*, relating to a Bill promoted by a Water Company supplying Sheffield, and *Attorney-General v. Swansea Corporation*, in which the Corporation were restrained from opposing a Bill which would have affected the price of gas in their district.

The final chapter deals with the subject of *locus standi*, and explains the practice of both Houses of Parliament in regard to determining questions arising as to the *locus standi* of public authorities desiring to be heard in opposition to Private Bills. Among cases cited where *locus standi* has been refused to public bodies, is that of the Chester Corporation Water Bill, 1896, against which the Rural District Councils sought to be heard, on the ground that a proposed dam would cause a period of stagnation in a river running along one side of their district, which stagnation, it was declared, would lead to silting-up and consequent flooding. The Standing Orders of the House of Commons relating to the injurious affection of a town or district by the promotion of Lighting and Water Bills are given at length, and are briefly explained.

A useful appendix contains the essential sections of the Borough Funds Act, 1872, the Public Health Act, 1875, the Municipal Corporations Act, 1882, and the Local Government Act, 1888, with some useful annotations. The book appears to have been carefully compiled.

Masonic.—Last Wednesday, Bro. Thomas Cash, of Birmingham, was installed W.M. of the Evening Star Lodge, No. 1719, in succession to Bro. Thomas E. Priestman; the Senior and Junior Wardens, subsequently invested, being Bro. W. D. Child and Bro. W. Arthur Valon, junr.

PERSONAL.

Mr. Alfred J. Kingdon, of Suffolk House, E.C., Secretary to the Colonial Gas Association, has been appointed Secretary to the Westward Ho! and District Gas Company, on the retirement of Mr. Henry de Rusett.

After thirty years' service as Manager, Mr. S. Dawes has severed his connection with the Clevedon Gas Company; and at the meeting of the shareholders last Tuesday, it was decided to allow him an annuity of £50.

Mr. R. Ashton has now retired from the post of Manager of the Barnstaple Gas Company. Last year he resigned the office of Secretary, which he had filled for more than thirty years; and the Directors will recommend the shareholders to grant him a retiring allowance.

Mr. E. J. Sutcliffe, Superintendent of the Thornton Road Gas-Works of the Bradford Corporation, has been appointed Superintendent at the Birkshall works, and Mr. W. J. Dowsu, Assistant at the Mill Street works, has been promoted to the Superintendentship at Thornton Road.

Mr. W. Spier has, for private business reasons, resigned his position as Secretary and General Manager of the Rockhampton (Queensland) Gas Company, Limited; but, appreciating his past services, and desiring to have him as a colleague in the management of the Company's affairs, the Directors have unanimously elected him to a seat on the Board.

An intimation having been given to the Gas Committee of the Oldham Corporation, by Mr. John Chadwick, the Engineer and Manager, of his desire to be relieved of a portion of his duties or allowed to relinquish his position, the Committee, at their meeting last Wednesday, appointed Mr. Edwin Platt, who is at present engaged at the Higginshaw station, Assistant-Manager, subject to the approval of the Town Council.

At a meeting of the Directors of the South Staffordshire Water-Works Company, held at their offices last Thursday, Mr. Frank James (who had at the half-yearly meeting of proprietors, on the 22nd of February last, been re-elected a Director of the Company) was unanimously re-appointed, for the twenty-seventh time, Chairman of the Board. Mr. James became a Director in 1861, and Chairman in 1874; and during that long period he has not been absent from the monthly meetings of the Board or the half-yearly meetings of proprietors excepting on one occasion, when he was engaged before a Parliamentary Committee in the interests of the Company.

[In last week's "Journal" a paragraph sent by our Edinburgh correspondent appeared stating that Mr. Frank Green, of Hamilton, had been appointed Draughtsman and Assistant-Manager of the Ceará Gas-Works. We are asked to contradict this statement, and to say that Mr. Green applied for the position of Clerk to the Company advertised in the "Journal" for Feb. 20. He has been appointed to that position, and "has no other official title in connection with the Company."]

A Correction.—Through a printer's error the output of coal per man in 1897 was given last week (p. 792) as 201 tons, instead of 291 tons.

The German Association of Gas and Water Engineers.—The fortieth annual meeting of this Association is fixed for June 9 to 13 next, at Mayence. The programme of proceedings at the gathering will be announced later.

Increase in the Price of Gas in South London.—Owing to the great advance in the cost of coal, the South Metropolitan Gas Company have given notice of an increase of 3d. per 1000 cubic feet—from 2s. 1d. to 2s. 4d.—in the price of gas.

Eastern Counties Gas Managers' Association.—The 23rd general meeting of this Association will be held on Wednesday, the 18th inst., at the Lion Hotel, Cambridge, under the presidency of Mr. Harry Wimhurst, of Sleaford. According to the programme issued by the Hon. Secretary and Treasurer (Mr. J. H. Troughton, of Newmarket), one new member will be proposed; a paper on "Incandescent Street Lighting" will be read by Mr. J. H. Sheldrake, of the Welsbach Incandescent Gaslight Company; and a discussion on "The Present Price of Gas Coal, and its Effect upon the Gas Industry," will be opened by Mr. R. G. Shadbolt, of Grantham. The business, which is of exceptional interest, will include the election of office-bearers for the ensuing twelve months; and at its close the members will dine together.

Photographs of Gas-Works for the Paris Exhibition.—In the Gas Pavilion which has been erected in the grounds of the Paris Exhibition, it is intended to have a collection of photographs of the principal gas-works in France and other countries. With the view to making it as complete as possible, the President of the Executive Committee (M. Eugène Lebon) will be glad to receive any photographs which our readers may have of their works, accompanied by a few descriptive particulars. Unmounted prints, rolled upon wood or cardboard, will be preferred; but if they are mounted on stout paper or framed they will be equally acceptable. As to size, 9½ inches by 12 inches is suggested; but the larger the better. The Committee will undertake the placing of the photographs upon the panels reserved for them in the Pavilion. M. Lebon's address is 26, Rue de Londres, Paris.

NOTES.

Zinc-White Paint.

The expert writer on paints for the "Ironmonger" recently gave some useful information respecting the nature and preparation of zinc-white paints, which are so largely used where the liability of white lead to tarnish renders this pigment unsuitable. It is remarked that pure or genuine zinc white, sometimes called Chinese white, should consist simply of the metal and oxygen. The zinc oxide has never been largely manufactured in this country; most of the supply being of foreign origin. When ground into paste, it should carry about 22 per cent. of linseed oil, or nearly three times as much oil as is taken up by white lead. There is no chemical combination between the zinc oxide and the oil, as there is in the case of white lead; it is merely a mechanical mixture, which is probably the reason why its covering power is so much less than that of genuine white lead. Besides the zinc oxide, there are also sold as pigments the sulphide of zinc, marked as lithopone, patent zinc white, &c. This sulphide is generally blended with barytes—a sample of lithopone, for example, sometimes showing as much as 60 per cent. of sulphate of barium, with only 40 per cent. of zinc oxide and zinc sulphide together. It is as well to bear in mind that barytes itself does not make a bad pigment; only it is cheaper than most of the other ingredients that go to make white paint, and should be allowed for accordingly.

Peat for Carbonizing.

It is probable that the scarcity and dearness of true coal in the eastern parts of Europe will have the effect of concentrating attention once more upon the possibilities of peat utilization. An Austrian chemist, G. Thenius, observes that the greater part of moorland peat occurring in this part of the world is suitable for distilling, after a preparatory compression in a Schlickeyson apparatus. The resulting blocks are then air and kiln dried, after which the material will yield on carbonizing 35 to 40 per cent. of good dense charcoal (superior to wood charcoal), 25 per cent. of ammoniacal liquor, 6 per cent. of tar, and 29 per cent. of gas. The last figure needs explanation. The tar furnishes on distillation 25 per cent. of crude burning oil, 20 per cent. of "solar" oil, 15 per cent. of lubricating oil, 25 per cent. of paraffin oil, and 15 per cent. of pitch. The burning oils are stated to give a good light; and the purified paraffin is also good. The resultant gas is said to be of good illuminating quality; but, as might be expected, it carries a large percentage of carbonic acid, and is tarry. Gas of this character has been profitably manufactured at Salzburg for years. Other grades of peat, not suitable for distilling, are utilized for litter, and also for making millboard. The future of gas lighting in a large area stretching from the Tyrol to the Balkans is largely dependent on the adaptability of local peat deposits to this manufacture, either directly or by way of carburetted water-gas apparatus.

Working Pumping-Engines by Producer Gas.

Motors operated by producer gas have for some time been employed to work the pumps used for the distribution of the water at Bâle. The recent addition of another pump, driven by a motor of 200-horse power, will ensure the continuity of the supply of water for some years. It was constructed at the well-known Deutz establishment, and has two cylinders, arranged tandem fashion, 22 inches in diameter with a 34-inch stroke. Its speed is 140 revolutions and 60 strokes per minute in normal work. The gas used is made from gas coke or anthracite; the former being preferred, as it is less expensive than the latter. The pumps are of the single plunger type, with pistons 12 inches in diameter and 28-inch stroke. There is also a steam-pump at the water-works; so that a comparison can be noted between the direct and indirect work of the fuel in lifting water. The pumps ran all through the year 1898, except on two Sundays, with the result that 135½ million gallons of water were distributed by the steam-pump, and 856½ millions by the gas-engine pumps. The consumption of coal by the steam-engine was 1 lb. 14 oz. for each 220 gallons of water pumped; in other words, 260 gallons were raised to a height of 286 feet per kilogramme (2·2 lbs.) of coal consumed. These figures unfortunately do not give any idea as to the cost of pumping; they simply show what duty can be obtained from motors worked with producer gas in an important installation. Coal gas would probably be quite as cheap if it were charged only at its cost into the holder.

The Standard of Steam-Engine Performance.

Dr. Robert H. Thurston, of Cornell University, has performed the useful service of registering the level at which steam-engine design and construction has been brought at the end of the century. This statement will be a useful datum from which progress in the making of prime-movers can be measured. He declares that the wastes of our best engines may be to-day taken as usually not far from 20 per cent. thermal and 10 per cent. dynamic. At the beginning of the century, there were in Watt's best engines about 60 per cent. thermal and 15 to 20 per cent. dynamic. The progress of the century in this respect has been mainly in the reduction of the internal thermal wastes; while the effort of the present is mainly to improve thermodynamic efficiency by increasing the range of temperatures worked through. This is to improve the cycle by approximating more closely to Carnot's ideal. The duty of the steam-engine has steadily risen until it marks 160 million foot-pounds per pound of pure carbon. The best return of American pumping-engines up to date is from 130 to 150 million foot-pounds; while the expenditure of dry steam per indicated horse power per hour ranges from 11·22 to 12·52, at pressures varying from 121 to 176 lbs. All these model machines are large engines, developing from 574 to 1185 indicated horse power. All have ratios of total expansion closely approaching 20, with a piston speed on the average of about 200 feet per minute. It is remarked that after a hundred years the steam-pumping engine still furnishes a record of greater extent and more representative character than does any other type of engine.

The Improvement of Lubricants.

From some expressions contained in a review by the "Ironmonger" of a book on "Lubrication and Lubricants," written by Messrs. Archbutt and Deeley, it would appear that there are some physical qualities of oils and fats which are not commonly appreciated at their full value by machinery users. The authors establish the principle that, particularly in the case of heavy, slow-running machinery, efficient lubrication does not depend wholly on the viscosity of the lubricant—as is usually taught—but rather on a quality which they call "oiliness." It is not easy to define what is meant by this word in this connection with dictionary exactitude; yet mechanics will not experience any difficulty in recognizing the quality so designated. Oiliness is that which makes a lubricant feel slippery between the fingers. Glycerine is as thick a viscid as many oils; but it is not very slippery to the touch, because it is not "oily." It might also be said that vaseline is not "oily." Oiliness of nature seems to be that property which prevents a liquid film from being squeezed or rubbed down below a certain minimum thickness, which is an important consideration in a bearing. Viscosity is the property which prevents the film from breaking or separating altogether. Mineral lubricating oils are deficient in oiliness; and accordingly it is advised that there should be added to them a proportion, not exceeding 10 or 15 per cent., of fatty oil. This is a matter that appeals especially to the users of pumps and gas-exhausters.

COMMUNICATED ARTICLE.

THE EFFICIENCY OF STEAM AND GAS ENGINES.

By Ed. C. de Segundo, Assoc.M.Inst.C.E.

It has long been recognized that the thermal efficiency of the gas-engine is much greater than that of the steam-engine; and not a few eminent men have predicted a great future for gas-engines on this account—believing, as they did, that the necessary inventive faculty would sooner or later be forthcoming to devise the means of overcoming mechanical and other difficulties lying in the way of the development of the gas-engine as a large motor. For many years the gas-engine has occupied a safe position as an economical and convenient means of developing power on a small scale; but until recently no great inducements were held out to manufacturers to build gas-engines of large power—one of the chief causes being that, beyond a comparatively low limit, the cost of power produced by town gas is greater than that of steam power.

Taking gas at 3s. per 1000, and 20 cubic feet per indicated horse power as a fair average consumption of town gas in engines of good make indicating 8-horse power and upwards, a limit is reached at about 20 indicated horse power above which the combination of steam-engine and boiler is more economical. The cost of gas would be $20 \times 20 \times \frac{36}{1000} = 14{\cdot}4$d.; and the cost of coal, assuming 3½ lbs. of coal per indicated horse power per hour, in a non-condensing engine giving 20-horse power, and taking the price of coal in towns at 20s. per ton, would be 7·5d. But the interest on the capital outlay, together with depreciation and maintenance costs connected with the boiler, and the proportion of extra wages for a boiler attendant, cannot be put at less than 7d. per hour, which would bring the cost up to that by gas-engine power. In cases where the town gas is richer or poorer in calorific value than the average, or where steam power already exists, or coal can be obtained very cheap, the limit of economical generation of power from town gas would be proportionately raised or lowered; but most manufacturers of gas-engines admit that, after about 14 nominal horse power (corresponding to about 20 to 25 indicated horse power), it is more expensive to use a gas-engine than a steam-engine under average conditions and the average price of town gas.

There can be no doubt that the introduction of producer gas in the place of ordinary town's gas for motive power in gas-engines, gave an enormous stimulus to the design of gas-engines for large powers; and in this connection Mr. Emerson Dowson's name is perhaps better known than any other—"Dowson" gas having passed into a household word. By means of Mr. Dowson's gas-producing plant and a gas-engine of any good type, a complete power-generating plant can be erected almost anywhere, provided it is within reasonable reach of coke or anthracite; and the attainable consumption of fuel per indicated horse-power-hour developed by gas-engines of 50-horse power and upwards using Dowson gas, may safely be taken at about

1 lb. of anthracite or 1¼ lbs. of coke. Such a result has so far not been attained by any steam-engine.

Gas-engines developing 100-horse power have for some years figured in Messrs. Crossley's catalogue. In 1895, a 320 indicated horse power gas-engine of the "Simplex" type was working mill machinery at the Pantin mills, in France—gas being generated in a Lencauchez producer. The mean consumption of rough coal during a trial extending over 194 hours was stated to have been 0·81 lb. per indicated horse power; and the calorific value of the producer gas was about 150 British thermal units per cubic foot. In 1896, Professor Meyer published an interesting account of the results of a test made of a 160-horse power gas-engine at Bâle, which was driven by Dowson generator gas; the consumption of gas coke being 1·4 lbs. per indicated horse power per hour. The thermal value of this generator gas was 133·28 British thermal units per cubic foot. A gas-engine of 158-horse power at Birmingham, is driven by producer gas from a Lencauchez generator; the gas having a calorific value of 185 British thermal units per cubic foot, and the fuel used being coal costing less than 3s. per ton at the pits. At Wishaw, near Glasgow, the waste gases from four blast-furnaces are utilized in driving an "Otto" gas-engine for electric lighting, the consumption being 77 cubic feet per indicated horse-power-hour; while at the Société Cockerill's works, at Seraing, Belgium, the results of the utilization of waste gases for driving gas-engines have been so satisfactory that a "Simplex" engine of 500-horse power is being constructed for the purpose. The natural gas found in many parts of the United States has also been successfully used for driving gas-engines; the consumption being 10·5 to 12 cubic feet of natural gas per indicated horse-power-hour, and the natural gas having a calorific value of about 1000 British thermal units per cubic foot.

The Westinghouse Machine Company completed a 650-horse power gas-engine early in 1898; and it is now erected and working in the central generating station of the Westinghouse Electric and Manufacturing Company. It has three cylinders, each working on a crank. It is coupled direct to a dynamo, and runs in conjunction with one or two steam units, in supplying power for electric supply. This engine will shortly be eclipsed by a 1500-horse power engine of the three-cylinder type, which the Westinghouse Machine Company are hoping shortly to bring out, and which is expected to give 1 indicated horse-power-hour with a consumption of 8½ cubic feet of natural gas. Such a result would correspond to less than 1 lb. of fuel burnt in a good producer plant per indicated horse-power-hour.

From the above examples, it will be seen that the gas-engine is about to enter upon an entirely new phase of its existence. Its use is no longer limited to small powers; and it bids fair to enter into competition with the steam-engine for a very large number of purposes for which hitherto the steam-engine has been held to be the only suitable prime mover. There can be no doubt that 1 indicated horse-power-hour can be developed by a gas-engine of large power driven by producer gas, with a lower expenditure of fuel than has been attained in a steam-engine—no matter how large, or what the design. The efficiency of the process of conversion of the heat energy of the fuel into mechanical energy must, therefore, be greater in the gas-engine than in the steam-engine combination—that is to say, starting with 1 lb. of fuel in the producer and 1 lb. in the furnace of the boiler, less waste must take place in converting the fuel into producer gas and the gas into mechanical energy, than occurs in generating steam by the heat of combustion of fuel and converting the energy of the steam into mechanical energy.

In the case both of the gas-engine and steam-engine we are concerned with three efficiencies—namely, the efficiency of the gas or steam generator, the heat efficiency of the engine, and the mechanical efficiency of the engine. With regard to the latter, the mechanical efficiency, or ratio of brake horse power to indicated horse power, is about the same in gas as in steam engines of average design for the same powers. The thermal efficiency of the gas-engine, or ratio of heat turned into work to heat due to perfect combustion of gas entering the cylinder, is certainly higher than that of the steam-engine.

The following figures are taken from a trial by Dr. A. B. W. Kennedy of an 8-horse power nominal Griffin engine, indicating 18·62-horse power at full load. The gas had a calorific value of 677 thermal units per cubic foot; and the quantity used per indicated horse power per hour, as calculated from the working stroke, was 18·92 cubic feet, corresponding to an expenditure of $18{\cdot}92 \times 677 = 12{,}808$ thermal units. The heat turned into work per explosion, calculated from the working stroke, was the equivalent of 4132 foot-pounds; and the mechanical equivalent of the total heat due to the perfect combustion of the gas consumed per explosion was 20,620 foot-pounds. The engine therefore turned into work $\frac{4130}{20{,}620}$, or practically 20 per cent., of the heat it received.

Let us now compare these figures with the results that one might fairly assume could be obtained with a steam engine and boiler of equal horse power. A steam-engine of this size would probably be a high-pressure non-condensing engine, consuming about 3½ lbs. of good coal (of a calorific value of, say, 14,500 thermal units per pound) per indicated horse power per hour. Assuming a boiler efficiency of 75 per cent., $3{\cdot}5 \times 14{,}500 \times 75$ per cent., or about 38,200 thermal units, would be supplied to the cylinder per horse power indicated per hour. Now, the thermal value of a horse-power-hour is $\frac{33{,}000 \times 60}{772} = 2565$ thermal units. Hence this steam-engine would only turn into work $\frac{2565}{38{,}200}$, or about 6·7 per cent., of the heat supplied.

The superior thermal efficiency of the gas-engine is due to the greater range of temperature through which the cycle of operations is carried on. In the gas-engine trial above alluded to, the calculated temperature at the commencement of the fall of pressure was 2155° Fahr., or 2615° absolute; and the assumed temperature of the gas and air leaving the cylinder was 570° absolute. The maximum efficiency, or the greatest amount of heat that the gas-engine could in these circumstances turn into work, would be $\frac{2615 - 570}{2615}$, or 78·2 per cent. or $20{,}620 \times \frac{78{\cdot}2}{100} = 16{,}124$ foot-pounds.

Therefore this gas-engine turned into work $\frac{4130}{16{,}120}$, or over 25 per cent., of the heat which it was theoretically possible for it to turn into work. Applying the same reasoning to the case of the steam-engine above quoted, the temperatures between which the cycle would work would be about 821° Fahr. absolute (corresponding to an initial pressure of 140 lbs. per square inch) and 660° absolute (corresponding to a back-pressure of 2 lbs. per square inch). The maximum theoretical efficiency would be $\frac{821 - 680}{821} = 17{\cdot}2$ per cent.; and the comparative efficiency of the steam-engine in question would be $\frac{6{\cdot}7}{17{\cdot}2}$, or about 38 per cent.

The steam-engine, therefore, is considerably more efficient than the gas-engine when considered from the standpoint of their respective limitations. In other words, were it possible for this 16-horse power engine to work through so great a range of temperature as the gas-engine, it would turn more than one-and-a-half times as much heat into work as the gas-engine. This would correspond to 1 horse-power-hour with a consumption of about ½ lb. of coal.

The best steam-engine performance yet recorded is that of a quadruple expansion pumping-engine working at Pittsburg. It indicates 662-horse power, and consumes a little over 1 lb. of coal per indicated horse power per hour. This very interesting result has been attained by the practical development of Professor Cotterill's suggestion as to the part utilization of the heat supplied to the engine in heating the feed water. In this instance, the feed is delivered to the boiler at about 31° Fahr. The duty of the engine, or the work done per 1,000,000 thermal units supplied to it, is about 10 per cent. greater than that recorded of any similar engine. The steam consumption was 12·26 lbs., and the pressure 200 lbs. per square inch, corresponding to a temperature of 387° Fahr.; and the lower temperature limit was about 140°. The Carnot efficiency, therefore, would be $\frac{848 - 601}{848} = 29{\cdot}1$ per cent. The heat supplied was 11,157 thermal units per horse-power-hour. Hence the maximum amount that the engine could theoretically turn into work would be $11{,}157 \times \frac{29{\cdot}1}{100}$, or 3246·6 thermal units. The thermal equivalent of 1 horse-power-hour is 2565 thermal units; and so the comparative efficiency of the engine was $\frac{2565}{3246} = 79$ per cent., which is greatly in excess of anything yet recorded in gas-engine practice.

The figures and results above quoted have been obtained from trials made under conditions which probably would not obtain in everyday practice. Moreover, one would naturally expect a better result from a steam pumping-engine than from a steam-engine supplying power for a load which varied from hour to hour, perhaps from minute to minute. For variable loads, even the staunchest advocates of gas-engines have hitherto hesitated before recommending their use, and the steam-engine has been considered to occupy an unassailable position as a power producer—for instance, in electric current generating stations. The results recently achieved by the Westinghouse Company would, however, appear to open out quite a new sphere of usefulness for the gas-engine. In their three-cylinder type, an impulse is given every two-thirds of a revolution; and the method of governing, by restricting both the gas and air supply, also aids very materially in keeping the speed constant under large variations of load.

The greatest obstacle in the way of the progress of the gas-engine as a large power producer was its unsteadiness of speed. The "Otto" gas-engine, in which one impulse is given every two revolutions, and which governs by a hit-and-miss arrangement, is, of course, hopeless where uniformity of speed under varying loads is a condition *sine quâ non*. Various attempts were made to overcome this defect, and many cycles other than the "Otto" were tried; but it is significant that, when the patent controlling the "Otto" cycle expired, nearly all makers of gas-engines immediately reverted to it. It was, however, not the cycle that was at fault; it was the system of governing, which rendered the attainment of anything like a uniform speed quite impossible under rapid variations of load. From what the author has been told by eye-witnesses of the performance of the Westinghouse 650-horse power engine, it would appear that very material progress has been made towards rendering the gas-engine, when worked by producer gas, a real competitor with steam.

TECHNICAL RECORD.

THE CARBONIZATION OF COAL FOR THE PRODUCTION OF ILLUMINATING GAS.

Mr. W. R. Herring on Inclined Retorts.

At the Meeting of the Royal Scottish Society of Arts, in Edinburgh, on Monday last, Mr. W. R. Herring read the following paper on the above-named subject.

The carbonization of coal for the production of illuminating gas may be said to be an important industry in all civilized communities; and without speculating upon the influence that improvements in artificial illumination have had upon the progress of mankind, it may be permissible to say that in Great Britain alone £96,209,668 of capital is employed in supplying one of such illuminants—namely, coal gas. This capital brings about an annual turnover of £36,946,738. During the past ten years, the consumption of coal employed in the production of illuminating gas has increased from 9,663,011 tons in 1889 to 12,841,817 tons in 1899. It may be fairly stated that this increase has taken place during the period of the commercial utilization of electricity as a means of domestic illumination. The cause of the constantly increasing demand for coal gas, in face of so much competition, is not easily explained—particularly when we bear in mind the fact that those who were formerly the largest consumers of gas are now consumers of electricity instead. Notwithstanding this fact, however, the average consumption of gas per consumer over Great Britain has only decreased from 40,218 cubic feet in 1889 to 39,196 cubic feet in 1899; and during the same period, the number of consumers has increased by 45 per cent.

The continued increase in the consumption of gas is no doubt in some measure accounted for by the introduction of gas cooking and heating appliances. But this in no way accounts for the bulk; and in the author's opinion, the increased consumption is chiefly due to the habits of the public demanding a greater degree of illumination, both in private and business premises, than was formerly customary. The introduction of the electric arc lamps for the lighting of the main streets in our cities and towns, has brought about an entire change in the degree of illumination demanded by the public. Brightly illuminated streets demand brightly illuminated shops; and the two combined necessitate better illumination in our homes. This is clearly illustrated in the case of our own gas supply. Notwithstanding the introduction of the electric light just five years ago (and bearing in mind the fact that the bulk of those who were formerly the largest gas consumers have now practically severed their connection with the gas supply), the gas consumption per consumer has increased in the period under consideration from an average of 18,522 cubic feet in 1889 to an average of 21,948 cubic feet in 1899.

The introduction of the Welsbach incandescent gas-light, if it has not already done so, will in the near future bring about almost a revolution in the conditions of gas supply. It is quite possible that very soon an incandescent burner and mantle will be procurable for the sum of 1s. complete, and renewal mantles at about 3d. each. When such is the case, this system of illumination will become universal; and the necessity of supplying an illuminating gas will cease to exist. The production of an illuminating gas of high quality is primarily responsible for the present selling price of gas in all towns. A non-illuminating gas is as efficient, when used in conjunction with the Welsbach burners and mantles, as an illuminating agent; and there is no doubt that when the time comes for the suppliers of gas to meet the altered conditions, it will be possible to do so at a cost of from one-third to one-half less than the present supply, as it will permit of many varying classes of coal being used in the production of gas which at the present time are shut out in consequence of it being necessary to select only such coal as will yield, not only a satisfactory quantity, but gas of a quality equal to the public demands.

The threatened competition of the electric light may be said to have awakened the gas industry from a long period of lethargy, coupled with which, and about the same period, the labour problem was becoming a very troublesome one with the gas undertakings throughout the country. Up to this period, there were but few works—in fact, scarcely any—where the advantages of labour-saving appliances were properly appreciated. It may be said that all these millions of tons of coal previously mentioned were handled by the most primitive methods. Competition and high-priced labour, however, put new life into the gas industry, and compelled boards of directors and gas committees to listen to the suggestions of their responsible officials, and to vote the necessary funds for the introduction of labour-saving appliances and machinery for dispensing with manual labour.

The labour costs for manipulating the total weight of coal used in gas manufacture during the year 1899, basing it upon the average of the principal gas undertakings in the country, was exactly 3s. per ton, or a total cost of £1,926,272. It will therefore be seen that any economy that can be brought about in the cost of manipulating the coal, will represent a very substantial saving to the gas-consuming public. The gas industry offers a very wide field indeed for the application of mechanical appliances for this purpose; and many brains are at work at the present time in devising new schemes, and revising the application of old methods, to this end.

Notwithstanding the fact of the introduction of machinery for the charging of horizontal coal-gas retorts into some of the largest works in the country, it has not had any appreciable effect upon the manufacturing costs of gas-works. Under the very best conditions, machinery has proved to be only capable of saving (after allowing for the excessive wear and tear of such) but a few pence per ton of coal. The cost during the year 1889 amounted to 2s. 11d. per ton, and, as already stated, in 1899 to 3s. per ton. During this period, machinery for charging horizontal retorts has been largely introduced into the principal gas-works; and the slight saving it effected has been entirely absorbed in the advance of workmen's wages in the period under review. Other methods have, therefore, had to be sought, in order to reduce the physical exertion in the carbonization of coal; and the one the author particularly wishes to draw attention to this evening is the application of the force of gravity to the charging of coal-gas retorts.

The physical properties of all solid bodies in a disintegrated state, whether in the form of powder or in a granular state, or in an irregular lumpy condition, to assume a natural angle of repose when thrown or tipped into a heap, is well known to us all; and the particular angle which various bodies assume is spoken of as its "angle of repose." It cannot be claimed that the application of this known tendency of solid bodies to assume an angle on an inclined plane, at which it will lie in repose for any length of time, is in any way novel as applied to the charging of materials into retorts or other receptacles. It appears to have been first applied to the feeding of retorts for the carbonization of coal in the year 1851, under a patent granted to one Alfred Vincent Newton. Another patent was granted in the year 1854 to a French engineer—Aristide Balthazard Berard, of Paris—who claimed to "distil the coal in a cylindrical conical fire-clay retort having its axis inclined to the horizontal to an angle of not less than 40° nor more than 60°." A further patent was granted to Robert Griffiths, in 1863. The primary object of this invention was the extraction of coal oil; the retort being "built or fixed at such an angle and elevation that, when small coals are placed upon the upper end of the retort, they will slide down the sloping bottom thereof by their own gravity."

In 1864 a patent was granted to Stephen Kerry for the calcining of bones, and for reburning and revivifying animal charcoal. In this, the inventor claimed "for the laying and setting of the retort in an inclined direction at such an angle as will allow the contents to run down the retorts by their own gravity, or by the force of supply at the upper end, the angle preferred being 32½°." Similar patents were also granted in 1872, 1873, and 1878; but it was not until 1889 that any practical installation appears to have been taken seriously by the gas engineering profession. Fate, however, was more kindly disposed to the inventor who revised the system and obtained a patent for the same in 1885—André Coze, Director of the Gas Company at Rheims. A small installation was erected at the Rheims Gas-Works, which was in successful operation for some time, and so much impressed British gas engineers who had the opportunity of inspecting it that arrangements were made by the Engineer of the Brentford Gas Company (Mr. Frank Morris) to put down a small installation at his works. This took place about the end of 1889.

In the year 1890, a large installation was also erected at one of the London works on Coze's model; but experience proved that on a large scale the system, as then existing, was not applicable to British practice. Not only were the physical difficulties experienced insurmountable, in consequence of the impossibility of keeping a tight joint between the iron shoot of the fire-clay retort buried within the red-hot brickwork, and also in consequence of the coal choking upon the bend, but the conditions under which the men charging the retorts had to work—exposed as they were to the heat, flame, and smoke from the open mouthpieces at the top—were such that no workman could be honestly put to perform the operation. The Engineer of the Brentford Gas-Works, anticipating these difficulties after experience with his own experimental installation, set to work to revise the system, and adapt the principle to the English practice; and by his labours, a very considerable advance was made in rendering the invention a practical success. Indeed, to all outward appearances, the modifications introduced by Mr. Frank Morris stand good to-day, notwithstanding the fact that many important details and simplifications of construction have been introduced by other engineers who were engaged in pioneering the system in its early introduction into the country.

At a period when labour troubles were very pronounced in the gas industry, gas administrators lent a more willing ear to any method which promised to relieve them of the increasing cost for labour, and more particularly the difficulties of dealing with it when paid at the higher rate; and it is no doubt primarily due to this fact, and also to the threatened competition of the electric light, that gas engineers were induced to really take the innovation seriously. In 1891, the author was instructed by the Huddersfield Corporation to carry out an entire reconstruction and extension of their gas-works, to carbonize 400 tons of coal per day. He naturally looked seriously into the question of the application of inclined retorts, as against the then best-known methods of setting horizontal retorts and charging them by power-driven machinery. The result of these investigations led

him to advise the Huddersfield Corporation to carry out their extensions solely on the principle of what is commonly termed the inclined retort system.

At the outset, a plant was designed for carbonizing 180 tons of coal per day, to be constructed within a then existing building. A further development of the reconstruction scheme necessitated another extension of the carbonizing plant within twelve months from the former plant being put to work. It had, however, worked in such a satisfactory manner that further extensions were carried out on exactly similar lines, with improvements in details which experience had shown to be necessary. This plant was constructed within a new building designed for the purpose; and by supporting the roof upon a circular girder construction, the plant can be conveniently erected without the side-walls being carried unusually high—the upper parts of the structure of the plant being practically above the side-walls of the building. The plant in question was designed for carbonizing 220 tons of coal per day. Since it was put to work in 1894, the whole of the coal gas manufactured in Huddersfield has been produced from inclined retorts.

Prior to the introduction of the newer system, the wages for this purpose cost 3s. 4·19d. per ton manipulated; whereas during 1899 exactly similar costs were only 1s. 9d. per ton. Brentford, as far as the author knows, is the only other works of any considerable size where the whole of the gas has been produced from inclined retorts for some years past; and upon reference to reliable statistics, he found that prior to the introduction of inclined retorts the Brentford carbonizing wages were 3s. 5·35d. per ton of coal, whereas for the last completed financial year they were 1s. 11·8d. There is thus in the case of Huddersfield a saving of 1s. 7·19d. per ton of coal, and in that of Brentford 1s. 5·55d. From these figures, it will be seen that by this method of coal-gas manufacture, as compared with the best-known systems hitherto in existence, it will be quite safe to estimate on a saving of, say, 1s. 6d. per ton of coal, which sum, upon the total coal carbonized per annum, amounts to nearly a million of money.

This figure cannot be altogether accepted as the economy brought about, unless it can be shown that the cost of construction of the newer plant is no greater than in the case of the plant it is intended to supersede. Upon this point, however, it is very difficult to arrive at comparative figures. So far as the author's experience goes, when taking into account the fact that greater producing power can be obtained from a given area of land, and that a retort-house properly constructed is less in cubical capacity for a given unit of production, the cost for inclined retorts is not greater than for a similar installation of horizontal retorts equipped with power-driven drawing and charging machinery.

At the present time, the system is in operation in many towns on a more or less large scale of working—including among others Brentford, Burnley, Coventry, Edinburgh, Hartlepool, Leeds, London, Middlesbrough, Salford, &c.

A small installation of inclined retorts was constructed at the Edinburgh Gas-Works early in 1899, and was put under fire in July of the same year. The object of erecting a small installation in the old works at Edinburgh, was to permit of careful investigations being made into the physical characteristics of Scottish coals when worked on the basis of gravity charging—the system not having been previously worked in Scotland. The plant erected is an identical unit of the multiple that is to form the carbonizing plant at the new gas-works now in course of construction at Granton. The setting was put to work in the early autumn, under ordinary practical conditions; and up to the present time every conceivable class of coal has been passed through it, with the result that valuable information has been accumulated as to the physical characteristics of the various classes of coal when charged and carbonized in inclined retorts, from which it is evident that the principle requires special modification for dealing with the different classes of coal such as are to be obtained in Scotland. The modifications, however, are mostly of a minor character, but yet of sufficient importance in themselves to make or mar success. The designs for the larger works to be erected at Granton are now in process of completion, in the light of the experience gained at the Edinburgh works; and it is anticipated that the new plant will be completed in about eighteen months' time.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

Annual Meeting in Boston.

The Thirtieth Annual Meeting of this Association was held at Boston on Feb. 21 and 22—Mr. Walter R. Addicks, of Boston, the President, in the chair.

The President delivered an Inaugural Address, in which he characterized the past year as a period of great commercial activity, which had exercised due influence in increasing sales of gas. But satisfaction with this state of things was somewhat modified by the increasing price of all materials and supplies, even the railway companies having increased their rates. This meant, for those working under close management at any rate, either reduced dividends or a rise in the price of gas; for no present or prospective increase in business would compensate for the advance in cost of materials now being experienced. Within a week, he had read that the enormous shipments to England would increase the cost of Pittsburgh coal 2s. per ton. In alluding to the New England Gas and Coke Company and the Massachusetts Pipe-Line Gas Company, he considered the circumstances of an undertaking worked on a primary coke-producing basis—the gas being regarded as a residual. The requirements of the coke trade were not so inexorable as those of gas. One could put up a notice "No coke for sale to-day;" but the gas consumer must be supplied, and the maximum demand periods for gas and coke respectively would not always coincide. The gas producer might come in to meet the difficulty; producer gas being used to heat the coke ovens whenever there was a full demand for all the coal gas. He next asked his hearers to imagine a huge works, comprising long rows of 1500 to 3000 horse power gas-engines connected to alternating current dynamo machines, triple expansion vertical steam-engines of 3000-horse power each, also connected to alternating dynamos, a long line of mechanically stoked boilers, then water-gas plant, inclined retort stacks, and coke-ovens. Appropriate condensing, purifying, and storage plant would also be required. Any surplus of producer gas, poor coke-oven gas, or coal gas could be used by the gas-engines, and thus made the means of assisting the supply of electricity. The boilers could be fired with surplus coke or gas, admitting of the retorts and generators being kept in full work independently of variations in the demand for gas. Such a set of plant would be capable of meeting very wide variations in the demand for coke and gas, and could be arranged to meet all sorts of requirements. Attention was then directed to the efficiency of the gas-engine as an agent for producing electricity. Some experiments conducted with a 10-horse power engine, with gas at 4s. 2d. per 1000 cubic feet, showed that, with a full load, the cost of electricity per unit was only 1½d., and with a variable load, less than 3d. Referring to the Gas Commission reports of past years, it would be observed that the average consumption per consumer tended to decrease. At present, it was not 80 per cent. of the amount recorded in 1892 and 1893. On further inquiry, this was accounted for by the large number of meters that registered less than 1000 or 2000 cubic feet per month. He gave one instance where 22 per cent. of the meters registered less than 1000 cubic feet during December and 61 per cent. measured less than 1000 cubic feet in July. In the face of these facts, it was fair to ask if the introduction of the prepayment meter would not only increase the sales, but also increase the average sales per meter. Referring specially to two of the papers on the programme, the President mentioned that in each case four speakers had been arranged to commence the discussion.

The reading of the paper by Mr. F. H. Shelton, which was reproduced in the "Journal" for the 13th ult. (p. 676), was followed by a long discussion. Mr. Nettleton agreed that it was a great step in advance to make a 3-inch pipe do the work of a 12-inch one; but he would be interested in knowing the result after a few years' working, especially after extremely cold weather and exposure to frost. He was rather alarmed, perhaps unnecessarily so, at the prospect of a fractured main under 20 lbs. pressure, as there certainly would be a very large loss of gas, if no actual damage. He would like to ask what coating was put on the wrought-iron pipe, and if the author had considered the use of cement for this purpose. They were all familiar with the cement-lined water pipe that was popular in New England many years ago. He had seen sections of the pipe in perfect condition after 25 years' use. Mr. Fowler said the results of some calculations he had made showed that the ordinary rules used by gas engineers with regard to pressure were correct for high pressures also. Mr. C. J. R. Humphreys asked if, in the case of consumers supplied direct from high-pressure mains, the author had considered the possibility of the service governor getting out of order and throwing the entire pressure on the house piping and fixtures, and if he had been able to provide for such a contingency. Mr. M'Kay asked whether any trouble arose in connection with reducing the high to ordinary pressure, also for details of the drip-boxes used on the high-pressure mains. Mr. Nute remarked that for some months he had been working lines of ordinary cast-iron pipe under 24-inches pressure for the supply of outlying gas-holders, and with satisfactory results. Mr. Prichard thought high-pressure mains might be all right in country districts, but would like to know if it was safe or advisable to lay them in the principal streets of a city. Mr. Ramsdell said that in the early days of natural gas, no particular attention was paid to pressure on the mains; but most communities supplied by this system had since adopted ordinances limiting the pressure. A very general rule was 5 lbs. There was a difficulty in using the ordinary mantle under such pressures; and the Welsbach Company made a special natural-gas mantle to meet the difficulty. It did not, however, secure such good results as the ordinary mantle, and eventually the use of governor burners became general. Most of the natural gas companies had found it desirable, for their own sakes, to adopt efficient governor systems.

Mr. Shelton replied to the discussion, and also to several direct questions. He would not care to put ordinary cast-iron mains under many pounds pressure, but preferred screwed wrought-iron pipe, properly protected from corrosion. As to the question of frost, raised by Mr. Nettleton, he did not attach much importance to it because he knew of some 2-inch pipe that had been in use under high pressures for ten years. Gas men in general did not appreciate the importance—perhaps because it had never been brought to their notice—of the work which Mr. Edgerton had been doing in

this direction at Danbury. As to the risks of house governors, that had all been worked out by the natural gas companies many years ago. The natural-gas districts were full of appliances for handling, measuring, and controlling high-pressure gas. Pittsburgh was full of governors that would, with an inlet pressure of 15 to 20 lbs. per square inch, deliver a steady 17-10ths at the outlet; and there was no more trouble with them than with an ordinary tap. They were all fitted with a safety arrangement that, in case of failure, opened an outlet delivering outside the house. If these things could be used with safety with natural gas, why should they not be equally applicable to artificial gas. For jointing pipes, he used a special socket more tapered than the usual make, that brought the pipe ends butt to butt, and when screwed home was more likely to be sound than the ordinary arrangement. There was no trouble due to condensation; and the deposit caused by the compression was collected mostly round the pump, and did not extend more than a few hundred feet along the pipe. He found no trouble from refrigeration at the governors. The best reply to Mr. Prichard was that the natural gas companies distributed gas under higher pressures than he proposed throughout all parts of crowded cities. The whole thing came down to the simple question, Why cannot we do with artificial gas exactly what has been done, with safety and satisfaction for quite a number of years, with natural gas? Of course, the apparatus should be in duplicate, to admit of cleaning or repair; but fortunately pumps and governors were comparatively cheap. It must also be remembered that the high-pressure main represented half-an-hour to one hour's storage; so that the compressors could, in case of any emergency, be stopped for some minutes without any trouble in the district.

In a paper entitled "Then, Now, and Later," Mr. John A. Waters, of Stamford (Conn.), traced some of the important improvements effected in the past, and considered them in connection with the possibilities of the future. The cost of water gas had been reduced not only by improvements in apparatus, but also in methods of working. The early practice was to occupy 20 to 45 minutes in blowing up, and even a longer time was devoted to gas making, and a high temperature in the superheater was thought to be a great advantage. A bright orange tint at that part of the apparatus was considered to indicate the proper conditions for a run. The troubles due to the formation of lamp black and pitch were considered to be unavoidable. Then a lower temperature and increased surface was thought to be preferable; and this led to the introduction of the double superheater setting. Another object in view in introducing this arrangement, was to be able to substitute crude oil for refined naphtha as the enricher. It turned out a real improvement—enabling the period of blowing and also that of running to be shortened. The practice of high-pressure blowing, with a gradually increasing heat from carburettor to superheater outlet, was almost reversed, and had given place to moderate pressures. The only ruffle on the otherwise smooth surface of water-gas manufacture was the price of oil, which had lead to the suggestion that the use of water gas should be curtailed and a mixed product supplied, or that a coal-gas plant should be provided as an alternative. In considering this subject, they must remember that to work with advantage the production must be near to the actual capacity of the apparatus used. They would call to mind the circumstances which led to the substitution of water gas for the then universal coal gas. Coke sheds and tar-wells were full; and there was no reason to suppose that coke and tar would sell any better now than they did then. He believed that while the limit of economical production and working had already been reached in the case of coal gas, there was a considerable margin for improvement in regard to water gas.

Mr. Louis J. Hirt, the Chief Engineer of the New England Gas and Coke Company, and of the Massachusetts Pipe-Line Company, read a paper on "Oven and Retort-House Construction and Results." He remarked that operations had already been commenced, and the whole plant would be working by March 1. The Otto coke-oven differed very little from an ordinary through coal-gas retort heated by gaseous fuel, but it took a charge of 6 tons or so. Once the coal was in the ovens the operation was practically the same; and the only difference was that it made a heavier or denser coke. He explained the lightness of ordinary gas coke by saying that it was exposed to heat in thin layers in comparatively small retorts, with the result that it was attacked on all sides and the hydrocarbons rapidly expelled. While the penetration of heat was similar, in the vertical Otto oven the action on the large mass of coal was much slower, and the coal was almost entirely carbonized from the two vertical sides. The heat crept slowly inch by inch through the coal, fluxing the coal in front of it; and as long as there was fresh coal in front the coke was heavy, but just for an inch or so in the middle the coke resembled gas coke. There was a greater amount of carbon left in the coke, and a lesser yield of rich gas than in the ordinary retort. The Otto oven was under some disadvantage, by reason of the thicker walls, which were about 1 inch thicker than an ordinary retort; but this was compensated for by the less expense in handling the material. An oven could be charged and discharged all within ten minutes. The coke was pushed out in four minutes, the doors closed in one minute, the fresh coal introduced at the top side in two minutes, and levelled in three minutes. Most of this could be done by mechanical means; and the saving of labour per ton of coal handled was one of the greatest and most important advantages of the system. The charge remained in the oven for 26 to 28 hours. The ovens were not gas-tight at first; but the porousness of the walls was gradually being stopped by deposits of carbon, and when the ovens were gas-tight there was no reason why the gas should not be equal in quality to ordinary coal gas. He was at present distributing 18-candle gas, obtained by taking the production during the first ten hours of the charge, and the remainder was required to supply the heat to the ovens. It was necessary to vary the time according to the temperature of the ovens, and also to that of the outside air, the effect of which was somewhat marked on such a large stack. They were arranging a producer plant to make producer gas from coke breeze, as a means of supplementing the production from the ovens, and leaving a larger quantity of illuminating gas available. If the whole of the gas was saved for sale, the average illuminating power would be about 12 candles, and an enriching plant would be required. The coke was the principal product; and the tar, ammonia, and surplus gas were the residuals. The coke was selling well. They had a long term contract for tar; and the sulphate plant, which was among the best of its kind, turned out a high quality article that was in large demand. There was no difficulty in keeping the gas well within the Massachusetts legal requirements as regarded purity. They were now pushing 250 ovens per day, consuming 1500 tons of slack coal, and making 1000 tons of coke, 67 tons of tar, 16 tons of sulphate, and 4½ million cubic feet of 19-candle gas. The consumption of lime was 16 tons per day.

Mr. Hirt replied to various questions. He said the smallest sized installation of coke-ovens that could be worked with a proper regard to economy would be a batch of twenty. The rate of production was very steady, but he thought it increased a little towards the end of the charge. In order to get 18-candle gas, he reckoned it would be necessary to take about one-third of the total production.

Mr. F. Mayer, of Baltimore, at the invitation of the President, stated his impressions formed by a four months' trip to Europe, for the purpose of investigating the inclined-retort system. He was building a new plant for a gas company who at present took their supply in bulk from a neighbouring company, to come into operation on July 1, and had decided to depend entirely on the inclined retort; and if the price of oil remained at its present level, or increased, this system was a step in the right direction for the future production of gas. To produce 700,000 cubic feet of coal gas per day, either twelve benches of sixes or eight benches of nines, with full-depth regenerator furnaces, would be necessary; or five benches of nine inclined retorts on the Coze system would do the work. He found the entire cost of a retort-house furnished with twelve beds of sixes complete would be about £11,000, or 11d. per 1000 cubic feet. The cost of working, including 6 per cent. interest on outlay, would be 5d. per 1000 cubic feet. With eight benches of nines, the cost would be 4½d., or with charging and discharging machinery 3¼d. per 1000 cubic feet. With the inclined retorts, he calculated the cost would not greatly exceed 2½d. per 1000 cubic feet. He exhibited a sketch plan of an inclined-retort system, worked entirely by machinery.

Mr. Ramsdell said he had studied both the horizontal and the inclined systems, and was not quite clear as to which to advise in a general way. There was a place for each; and his choice would depend upon location. He had recently decided against the inclined system because it took longer in construction than the other, and he was very short of time. From inquiries specially made, he found that, using the latest improvements in each case, the saving effected by the inclined system on the cost of operating was a mere trifle, if anything. It was misleading to figure out a cost per mouthpiece, as the cost per 1000 cubic feet of gas made was the real consideration; and no doubt more gas would be made on a given floor area with inclined retorts than with horizontals.

The next item was a discussion on experiences with prepayment meters. Mr. M'Gregor had 1336 of these in use, passing over 10 million cubic feet of gas per annum, and bringing in about £3000. He had replaced 34 ordinary meters with prepayments, and found that the result was to reduce the consumption from an average of 1663 cubic feet per month to 1181 cubic feet—a reduction of 29 per cent. This showed that the prepayment meter made the customers more careful; but without it, he would not have retained them at all. Mr. Nettleton had over 800 in use, and the income was about £2500 per annum. Many of these customers would not use gas at all without the prepayment meter. Mr. Woodward had about 300 prepayment meters in use, and the average consumption was 13,100 cubic feet per annum. Ordinary meters used by the same class of consumers averaged 16,800 cubic feet. But he was reaching a class of business that could not be got at in any other way; and there were absolutely no complaints with the prepayment meters. The Secretary said they had often remarked upon the want of intelligence and wastefulness of the average consumer; and it appeared that the prepayment meter was an educator in the use of gas. As such it would in the end prove beneficial, though at present in certain cases there was reduced consumption.

(*To be continued.*)

DR. BUEB'S METHOD OF PREVENTING FREEZING IN GAS-SERVICES.

In 1896, we called attention to a method devised by Dr. J. Bueb, of Dessau, for the prevention of the freezing up of gas service-pipes in cold weather.* This freezing is distinct from stoppages due to deposition of naphthalene, and includes the separation, not only of water, but also of benzene from the gas. Dr. Bueb's process was designed to prevent both the freezing of the condensed water and the solidification of the condensed benzene. Essentially, it consists in the addition to the gas, as it leaves the works, of vaporized spirit (alcohol). In cases where this addition is made, if water and benzene are condensed from the gas by cold, the alcohol vapour separates out also, and depresses the freezing-point of the condensed liquid to such an extent that neither the water nor the benzene freezes at any temperature to which the pipes are likely to be subjected. They remain in the liquid state, and flow into the large mains, and thence to the nearest syphon. In practice, a small evaporator heated by steam or gas is used to vaporize the spirit as it flows from an elevated reservoir in a fine stream controlled by a regulating-valve. The hot vapour of the spirit is led into the trunk main, the gas in which absorbs it without being affected appreciably either in illuminating or heating value. On the average, only 220 to 300 grains of spirit are required per 100 cubic feet of gas. Owing to the absence of much frosty weather in the winter of 1898-99, the process was first put to really practical tests during the past winter. Some particulars of trials made at various Continental works are given in a recent number of the "Journal für Gasbeleuchtung;" and from these we extract the following information.

Of the works of the German Continental Gas Company, only Potsdam had the process in operation from the commencement of the frosty weather. The results there were completely satisfactory, notwithstanding the large area covered by the distributing system. At the other works of the Company, the process was only set in action after the services to the street-lamps had become choked by a coating of ice. The coating, once formed, is not dissolved by the evaporation of spirit into the gas distributed, but only disappears when milder weather supervenes, or when the services are warmed or spirit is poured down them. The process aims at preventing freezing in the services, and must therefore be put in operation before ice has formed—that is to say, before the temperature out of doors falls below 28° or 27° Fahr. When the process is started for the first time each winter, a considerably larger quantity of spirit must be vaporized on the first day than is required on subsequent days. The drops of water clinging to the inner walls of the services eagerly absorb the spirit, and must in the first place be saturated with vapour of spirit from the gas. At the beginning of a period of frost, the evaporation of spirit must therefore be continued uninterruptedly for 24 hours, so that at least half a pint of spirit is added to every 1000 cubic feet of gas.

At some gas-works, the evaporator was not, during extreme cold, equal to the task of vaporizing the spirit completely. The evaporator ought, therefore, to have its working capacity ascertained by preliminary trial. The necessary test may be simply made by inserting in the pipe which conveys the vapour of the spirit to the main a plug of the same diameter as the pipe. This plug is removed for a few seconds when the apparatus is in full work; and thus it may be seen whether the spirit is completely vaporized, or whether liquid spirit is sprayed out along with the vapour. In one case, it was found that the pipe connecting the evaporator with the main was too narrow, and caused a great loss of pressure in the vapour of spirit passing through it. The connecting tube should not be of smaller diameter than the tube in which the spirit is vaporized in the apparatus. The apparatus must be tested from time to time for soundness; as if steam passes in and mixes with the vapour of the spirit, it completely neutralizes the action of the spirit. It is also essential that the proper amount of spirit should be vaporized. No loss of illuminating power then occurs, as exhaustive photometrical testings in the laboratory of the German Continental Gas Company have conclusively proved. When great cold supervenes, loss of illuminating power is inevitable, as the chief illuminant—benzene—then freezes out of the gas along with water. This freezing of the benzene, however, occurs whether or no spirit has been added to the gas. But when spirit is added, the benzene is thrown down in the innocuous liquid form; whereas in the absence of spirit, the benzene solidifies. It should be stated that only spirit of high strength ought to be used—such as that containing 95 to 96 per cent. of real spirit.

The good effects of the process were made evident at all the works of the German Continental Gas Company, as soon as the period of hard frost was succeeded by milder weather. With a rapid change of weather after frost, there formerly occurred bad blockages, owing to the solid deposit in the street-lamp services, thawing, and then freezing afresh in those parts of the mains which were still buried in the frozen earth. Inquiry has shown that the doubts expressed at some works as to the utility of the process can be traced to an improper and inappropriate application of it.

From other works, information has also been received with regard to the efficiency of the system. Herr C. Brodmärkel, Manager of the municipal gas-works at Hof, in Bavaria, states that he has found it answer well during the two last periods of frosty weather. The first extended from the 7th to the 28th of December, 1899; and the minimum temperature was −2° Fahr. The second was from the 7th to the 17th of January this year, when a temperature of −5½° Fahr. was recorded. After the proper proportion of spirit required had been ascertained by gradually increasing it, choking up of the public-lamp services was found only in single instances, and then only after wet meters. This result was the more remarkable as a number of ½ and ¾ inch services directly exposed to the action of the frost have been retained for both public lamps and private supplies. The consumption per 24 hours averaged, during the heaviest weeks of the year, 290,000 cubic feet; and at this time the lowest temperatures were experienced. For two or three hours before the time of maximum consumption every evening, about 350 grains of spirit per 100 cubic feet were added to the gas; but at other periods the proportion was only from 130 to 220 grains of spirit. By this addition, blockages of the services were almost completely avoided. One fault found with the process was that, where the gas had passed through many exposed mains and services, it had suffered a considerable diminution in illuminating value, owing to separation of benzene. This entailed increased expenditure on enriching material; but the efficacy of the system was so marked that the cost of both spirit and enrichment was unhesitatingly met.

Herr A. Geyer, of the municipal gas-works at Gmünd, in Swabia, is able to recommend the process from the results of his own experience. Of 290 street-lamps, only two or three were found each day during the severe weather to be obstructed by freezing. Whenever the thermometer fell to the freezing-point, the apparatus was started. The rate of consumption of 90 per cent. spirit when the apparatus was working, was about 0·07 pint per 1000 cubic feet of gas. The cost of this amount of spirit was 0·15d.

Herre H. B. Sörensen, Manager of the gas-works at Drammen, in Norway, is gratified with the working of the system. In the month from Dec. 7, 1899, to Jan. 8, 1900, he applied spirit to the extent of nearly 0·2 pint per 1000 cubic feet of gas; altering the amount used according to the cold experienced. The lowest daily temperature varied from 23° to −6° Fahr. The vapour of the spirit was introduced into the main from the evaporator by means of a T-piece, of which one end of the cross-arm was connected with the tube of the evaporator, and the other end was closed by a plug. This cross-arm was 1½ inches in diameter. The limb of the T-piece was ½ inch, and was threaded externally so that it screwed direct into a hole tapped in the main.

Herr W. Fortmann, of the Oldenburg Gas-Works, reports that the process has worked satisfactorily with him since December last. He found it necessary, however, to apply the spirit in good time and in sufficient quantity. He has had to replace by a larger one the narrow pipe connecting the evaporator with the main. Where, after the introduction of the process, the lamps were found to give but small flames, naphthalene deposits were responsible. Herr Landscheck, of Glatz, in Silesia, used the process during the winter, and found that only lamps on dead-ends of mains were ever frozen up while it was in use. Herr Happach, of the gas-works of Ratibor, in Silesia, also reports well of the system. He points out that the vapour of the spirit must enter the main at a point after the works governor. Herr J. Isler, Manager of the Winterthur Gas-Works, has had the apparatus since the autumn of 1896. During the four succeeding winters, he experienced no trouble from the freezing of street-lamps, wet meters, or services, so long as the spirit evaporator was properly applied. But when attempts were made to reduce the quantity of spirit below the proper allowance, and to delay applying the process until the temperature fell to 23° Fahr., the lamps at the extremities of the distributing system gave trouble. The process has also been used with good results for the removal of naphthalene obstructions. Herr Isler recommends his colleagues to adopt it, notwithstanding that he found the expenditure on spirit rather heavy.

Herr J. Kraisy, Manager of the municipal gas-works at Regensburg (Ratisbon), in Bavaria, reports that he has found the process satisfactory, though at times he was unable to apply it to the whole of the gas distributed. He observed that the gas to which the spirit had been added acquired a distinctive odour, which was due to the agents employed for denaturing or methylating the spirit applied. Herr Hoffmann, Manager of the gas-works at Kaiserslautern, in Bavaria, reports that not a single street-lamp was frozen (even when the temperature fell to −2° Fahr.) so long as he applied the proper quantity of spirit. Unfortunately, his supplies of spirit were deficient during one period of cold weather this winter. From the gas-works at Löbau, it is reported that only isolated instances of frozen lamp-services were found after the introduction of the system; and these could be traced to delay in putting the evaporator into operation. The greatest degree of cold was −15° Fahr.

Herr H. Madsen, Manager of the gas-works at Flensburg, in Prussia, reports that sudden cold set in on the night of Dec. 11, 1899; the temperature falling to 12° Fahr. The evaporator was not started till the following day. Consequently several of the street-lamps were frozen up before the process came into operation; but after these had been thawed, only isolated cases were reported of stoppage of supply to street-lamps, and some of

*See "Journal," Vol. LXVII., p. 461.

these were traced to naphthalene deposits. In a subsequent period of frosty weather, when the spirit was applied in good time, freezing was practically avoided. The syphons on the distributing system should be charged with spirit at the commencement of the cold weather. Herr Dellmann, of the municipal gas-works at Duisburg, in Prussia, states that the spirit evaporator did not completely prevent freezing of the street-lamp services in December. The quantity of spirit applied was, however, limited, because experience of the system the preceding winter favoured the supposition that the spirit provoked the sticking fast of dry meters and gas-taps. This winter valves on the works were found to turn stiffly when the process was in operation; but no other ill effects were observed.

With regard to the proportion of spirit which should be applied, it may be pointed out that the tables given in 1896 by Dr. Bueb prescribe an addition at the rate of 0·36 pint of 95 per cent. denatured spirit per hour to every 1000 cubic feet of gas sent out per hour, when the temperature is not lower than 14° Fahr. For temperatures between 14° and −4° Fahr., the quantity of spirit should be increased to 0·45 pint per 1000 cubic feet of gas. In some of the above reports, from various works, these proportions are referred to as the proper quantity of spirit to be used.

THE DISTRIBUTION OF GAS OF DIFFERENT QUALITIES.

In the "American Gaslight Journal" for the 19th ult., Mr. E. H. Yorke, of Portland, Maine, has an article on "The Equity and Expediency of Distributing Different Qualities of Gas throughout the Twenty-four Hours." It is short, and therefore we do not attempt to summarize it. Mr. Yorke says: The distribution of a uniform quality of gas throughout the 24 hours is the common practice among gas companies. It has been continued, from the beginning of the distribution of an enriched gas to the present time, without apparently any question as to the wisdom of it, for reasons which largely appear to be because "it has always been done that way." But that there exist some considerations for a change in the practice will be evident when an inquiry is instituted into the factors involved. These will be found to be: First, the fact that in each 24 hours there are two periods—*i.e.*, a period of darkness and one of daylight—averaging throughout the year about equal lengths, in which the requirements for the use of gas are generally speaking of a totally different character; secondly, the item of leakage. If gas companies were free from that unavoidable, continuous, and costly tax upon their resources known as unaccounted-for gas, the distribution of a uniform quality of gas throughout the 24 hours would be unobjectionable. If all the hours of the 24 were hours of darkness, a uniform quality would be an absolute necessity. But inasmuch as one-half of all the time in each year is daylight, and during this period the requirements for artificial light are but slight, and could be satisfactorily served with an uncarburetted (coal) gas, the question of the distribution of such a gas during daylight, in view of the saving in cost of enrichment which would follow, then becomes a most important one. The practical waste of all the enrichment, when enriched gas is distributed during the daylight, through leaks in mains and services, the present high price of enriching oil, and the constant demand for a lower priced gas, would serve to furnish an emphatic affirmative, especially during the summer months. Beyond this, in a broad sense, the interests of the gas company and the consumer being mutual, it follows that any economy attained by the gas company must in the end conserve equally to the advantage of the consumer. That this uncarburetted gas would have a lower heating value is conceded; but the difference to the average individual consumer would be inappreciable, while the saving to the gas company would be of material amount. The practical results and economy which follow the adoption of this plan I will omit, as the saving which may be effected in the different works would vary with the different conditions. That there are two classes of companies—*i.e.*, the small company with but one holder, and the large with widely-scattered holders which must be filled during the hours of daylight—which could not adopt this plan without difficulty, goes without saying.

DETERMINING THE COMBUSTIBLE MATTER IN COKE AND ANTHRACITE COAL.

A recent number of the "Journal of the American Chemical Society" contained the following article on the above subject by Messrs. R. K. Meade and J. C. Attix.

Some years ago a discussion arose between the consumer and the manufacturer of a coke as to its value. The user objected to the high ash, and in support of his claim gave the analysis of his chemist, in which the ash was reported at 18 per cent. The maker replied that the analysis was worthless, as the chemist who made the analysis was probably incompetent, since he had reported nearly 3 per cent. of volatile combustible matter; and that in a 72-hour coke the volatile combustible matter could not be nearly so high. The question was referred to a well-known analytical chemist. His analysis, while agreeing with that of the consumer's chemists in the percentage of ash, gave the volatile combustible matter as 0·6 per cent. The consumer's chemists then checked their work, and still found over 3 per cent. of volatile combustible matter. They used the method of heating a 1-gramme sample for 3½ minutes over a bunsen burner, and then for the same length of time over a blast-lamp; reporting the loss, after deducting the percentage of moisture (found in another sample) as volatile combustible matter. A letter to the referee brought out the fact that he used a 10-gramme sample, and heated for the same length of time. The only excuse the consumer's chemists could give their employers was that they used the method published in Blair's standard work on the analysis of furnace materials and products, and that this was the method usually published in works on metallurgical analysis.

Of the commonly published methods for the determination of volatile combustible matter in coke and anthracite coal, none reach anywhere near even approximation. The method of Heinrichs, which, by the way, he recommends for soft coal, and says nothing about coke or anthracite, gives far from true results; nor is the method even comparative. Heating first over a bunsen burner and then over a blast-lamp, drives off volatile matter and traces of moisture, and burns some carbon. The loss occasioned by the latter in many cases amounts to several times that by the two former occurrences. This burning may be prevented by heating the sample in a non-oxidizing atmosphere, such as nitrogen. The loss after such a heating will represent the volatile products driven off by a high temperature. What these products are, it is not our purpose to discuss. Probably, even when the sample has been thoroughly dried, moisture is among them.

The determination of volatile combustible matter in coke is worth doing well, or not worth doing at all. If the determination of volatile combustible matter is used for checking the coking of the coal, it is an important determination of itself; and so long as the determination of the fixed carbon depends upon a knowledge of the volatile combustible matter, it is a necessary one indirectly, for, if the volatile combustible matter is 1 or 2 per cent. above what it should be, by just so much will the fixed carbon fall short of the true percentage.

The following investigation, looking toward a more satisfactory method of determining volatile combustible matter in coke and anthracite, was undertaken by the writers over two years ago, and was the outcome of the incident mentioned in the opening paragraph of this article. The first step was to heat samples of coke in nitrogen, determine the loss, and call such loss "volatile combustible matter" after subtracting the moisture, driven off by one hour's heating at 110° C. The method of procedure consisted in weighing samples of from 3 to 4 grammes of coke into a small platinum dish, placing this in the crucible of the carbon apparatus described by Dr. Porter W. Shimer, and passing a slow current of nitrogen through the apparatus until the air had been driven out. The nitrogen used was prepared by heating together saturated solutions of potassium nitrite and ammonium chloride. The gas was kept in glass gasholders, and freed from oxygen by passing through cuprous chloride dissolved in hydrochloric acid. The gas was dried just before use by passing through calcium chloride tubes, placed in front of the crucible. The exit-tube from the crucible dipped into strong sulphuric acid, preventing any moisture or air from getting back into the crucible. After passing through the crucible for half-an-hour, the current of nitrogen was slackened, a low flame placed under the crucible, the water-cooling apparatus started, and the heat carefully raised. After heating the coke for a few minutes over the full bunsen flame, the blast-lamp was made to replace the latter, and a high temperature maintained for 10 or 15 minutes. The sample was cooled in the current of nitrogen, removed, and weighed. Below are a few results upon a sample of coke which had been dried for one hour at a temperature of 110° C.: After heating 3 grammes over a blast-lamp for 15 minutes, the loss was found to be 0·31 per cent. After again heating, an additional loss of 0·0003 gramme, or 0·01 per cent., occurred. After heating 3 grammes for 10 minutes over a blast-lamp, the loss was 0·009 gramme, or 0·3 per cent. After again heating, an increase of 0·0001 gramme, or 00·3 per cent., occurred. After heating 3 grammes over a blast-lamp for 6 minutes, the loss was 0·0095 gramme, or 0·32 per cent. On again heating, the sample lost 0·0002 gramme, or 0·007 per cent. Heating in hydrogen was also tried, and gave practically the same result. The losses from four determinations were 0·31, 0·31, 0·29, and 0·3 per cent.

At the time these investigations were undertaken, we supposed the idea of heating in nitrogen was original with us. A letter from Mr. W. H. Brauvelt, of the Semet-Solvay Company, of Syracuse (N.Y.), however, informed us that the method essentially as worked out by us was used in his laboratory, and also in various technical and commercial laboratories in England and in Germany. Hydrogen, answering apparently as well as nitrogen, replaced the latter in most of these laboratories.

Samples of coke and anthracite were carefully standardized by heating in nitrogen, and the volatile combustible matter then determined by various methods in general use. The method commonly published of heating 1 gramme for 3½ minutes over a bunsen burner, and then for the same length of time over a blast-lamp, was first investigated. A sample of Pocahontas (West Virginia) coke, losing, on heating in nitrogen, 0·61, 0·62, and 0·6 per cent., was used in the experiments. We noted the

following points. Different operators get widely varying results, as these determinations will show—

Operator.	Percentage of Volatile Combustible Matter.	True Percentage of Volatile Combustible Matter.
A	3·01	0·61
B	2·51	0·61
C	2·36	0·61
D	2·25	0·61

This variation is due to the size of the crucible, the tightness of the joint between the crucible and its lid, the height at which the crucible is placed above the flame, and the size of both bunsen burner and blast-lamp flames. A large crucible will give a higher result than a small one, because the larger the crucible the more air will be present, and consequently the more coke will be burned and the greater the loss will be on ignition. The following are some results on this :—

Size of the Crucible.	Percentage of Volatile Combustible Matter.	Size of the Crucible.	Percentage of Volatile Combustible Matter.
12 c.c.	1·96	21 c.c.	2·56
12 ,,	1·90	21 ,,	2·58
16 ,,	2·10	30 ,,	3·19
16 ,,	2·21	30 ,,	3·42

Since the burning takes place only on the surface of the sample, the shape of the crucible would also affect the result. In a narrow crucible, the loss due to burning of the carbon would be less than in a wide one. In all of the above experiments, crucibles of the usual forms were used. Of course, the fit of the lid makes a great difference. Dr. Porter W. Shimer, in order to effect a close joint between the crucible and the lid, uses a thin piece of wet asbestos paper. This lessens considerably the quantity of carbon burned.

Ignition over different burners or blast-lamps gives varying results. A large flame, other things being equal, will burn more carbon than a small one. A few results will show the variation one may expect :—

Burner No.	Blast No.	Loss on Ignition. Per Cent.	Burner No.	Blast No.	Loss on Ignition. Per Cent.
1	1	2·12	1	2	2·91
1	1	2·20	1	2	2·80
2	1	2·31	2	2	3·00
2	1	2·39	2	2	3·11

The results by this method are not even comparative, because some cokes burn more readily than others. A soft coke burns more readily than a hard one. A sample of Connellsville coke containing 0·65 per cent. of volatile combustible matter, as determined by heating in nitrogen, gave 2·31 per cent. by heating in a covered crucible. Another sample of this coke gave 0·21 per cent. of volatile combustible matter on heating in nitrogen, and 2·66 per cent. on heating in the same covered crucible, over the same burner and blast-lamp, and under as nearly like conditions as it was possible to obtain. In this instance, a coke containing only one-third as much volatile combustible matter as another gave by this method 0·35 per cent. more.

The fineness to which the sample is reduced and the percentage of ash in the coke also probably affect the result. As the size of the sample increases, a proportionately smaller loss is incurred by burning. There is a limit, however, to which the size may be carried, for, as the sample increases, the time required to heat the mass of coke to the proper temperature increases also, and a point is reached when the 7-minute heating fails to drive off all the volatile combustible matter. Below is a table showing the effect of the size of the sample on the result.

Loss on Heating for Seven Minutes a Dried Sample of the Weight Indicated in a Covered Crucible.

Sample. No.	Loss on Heating Dried Sample in Nitrogen.	1 Grm.	3 Grm.	5 Grm.	10 Grm.	15 Grm.
1.—Pocahontas coke	1·24	3·01	2·10	1·61	1·21	0·96
2.—New River coke	0·32	1·69	0·93	0·69	0·55	0·47
3.—Connellsville coke	0·37	1·49	1·03	0·81	0·52	0·42
4.—Bye-product coke	0·54	1·61	1·08	0·87	0·60	0·41
5.—Pocahontas coke	0·28	1·52	0·90	0·69	0·40	0·38
6.—Piedmont (W. Va.)	0·31	2·87	2·00	1·31	0·96	0·54
7.—Anthracite coal	2·85	5·10	4·19	3·01	1·87	1·03

The use of a large sample in some cases apparently attains the same end as heating in nitrogen; but even here the result is chance. A change of burners or crucible will affect a large sample less than a small one; but still quite enough to change the loss considerably. In No. 3, the use of a large sample in the determination shown in the table gives nearly the same result as is obtained by heating in nitrogen. But on taking a sample from the crucible and reheating it in nitrogen, an additional loss of 0·17 per cent., or nearly one-half of the total volatile matter, was experienced. In other words, of the 0·42 per cent. of volatile combustible matter found by heating a 15-gramme sample first for 3½ minutes over a bunsen burner and then for the same length of time over a blast-lamp, 0·2 per cent. was due to volatile matter expelled, and 0·22 per cent. to carbon burned.

The Committee on Coal Analysis of the American Chemical Society recommend heating the sample of coal over a bunsen burner for 7 minutes. For soft coals, this heating may be sufficient; but for anthracite or coke, the blast must be used in order to drive off all the volatile combustible matter. The Committee, of course, did not recommend their method for coke analysis, or at least failed to say so, in their preliminary report.

A sample of coke containing 0·61 per cent. of volatile combustible matter was heated for 7 minutes over a bunsen burner, then cooled, and weighed. The loss was 0·78 per cent. On heating in nitrogen, an additional loss of 0·48 per cent. was experienced. The heating over a bunsen burner in this case was only sufficient to drive off 0·13 per cent. of volatile matter. A sample of anthracite containing 2·85 per cent. of volatile combustible matter was heated in a similar way; and the loss was 2·26 per cent. On heating in nitrogen, an additional loss of 1·02 per cent. was experienced. The heating over a bunsen burner in this case drove off 1·83 per cent. of volatile matter.

It is to be regretted that the larger portion of the work involved by this investigation had been completed before the preliminary report of the Committee on Coal Analysis was published; consequently the authors were not able to apply this method upon as many samples as they would have liked.

If, after heating a sample of coke or anthracite over a blast-lamp and burner for (say) 7 minutes, and weighing, we again heat over the same burners and for a similar length of time, the second heating will give us an approximation of the amount of carbon burned in the first. If the loss, therefore, from the second heating is deducted from that of the first, the difference will agree fairly closely with the loss obtained by heating in nitrogen or hydrogen. The results, theoretically, should fall a little below those obtained by the latter method, since the volatile matter which is present in the first heating only displaces some of the air, and consequently there will be more oxygen present in the crucible during the first heating than during the second, and more carbon will be burned. To offset this, there will be slightly less carbon in the crucible upon the second heating; and the coke will be protected somewhat by a slight film of ash formed by the burning during the first. When the sample is small, this does not seem to introduce any considerable error; and the results are as apt to be higher as they are to be lower than those obtained by heating in nitrogen. Care must be taken to have the conditions of the second heating similar to those of the first. The same burner and blast-lamp must be used; the position of the crucible in the flame and the size of the flames themselves must be alike for each heating. The timing of the heats must be done with the second hand of the watch or clock; and the flames must be protected from air-currents and draughts. To show how closely those blanks agree, and the range of accuracy of the methods, some results follow.

Percentage Loss with 3-Gramme Samples Heated for 3½ Minutes over a Burner, and then for 3½ Minutes over a Blast-Lamp.

Sample. No.	1st Heat.	2nd Heat.	3rd Heat.	4th Heat.
1	2·01	0·86	0·84	0·88
2	0·93	0·65	0·61	0·62
3	0·94	0·51	0·56	0·50
5	0·90	0·62	0·67	0·66
6	1·03	0·67	0·66	0·72
7	3·47	0·85	0·89	0·83

By subtracting the second loss from the first, we have the results in the first column below :—

Sample. No.	By Subtracting the Second Loss from the First.	By Heating in Nitrogen, per Cent. Loss.
1	1·15	1·24
2	0·28	0·32
3	0·43	0·37
5	0·28	0·28
6	0·36	0·31
7	2·62	2·85

This is the only simple method we have tried which gives results approaching anywhere near those obtained by heating in nitrogen and hydrogen. The use of asbestos paper to make a close joint between the crucible and its lid is to be recommended where this method is used. The writers have tried placing a weighed sample of coke in a crucible, and covering it with a weighed amount of freshly-ignited sand. While the blank from burning does not run quite so high, it does not seem to be any more constant; and the results do not appear to justify the extra weighing. It is possible that, in a coke laboratory analyzing a fairly even product, a constant blank might be found and deduced, saving the extra heating and weighing.

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

At the February Meeting of this Association, the members visited the Stockport Corporation gas and electricity works. On their arrival, they were met by Mr. S. Meunier, the Engineer and Manager, who, with his Assistant and Chemist, conducted them through all the various departments. Mr. Meunier explained the alterations he had made in the retort-house, as well as the other extensions he had carried out, including the introduction of water-gas plant, &c. The party were also taken through the electricity generating station, where, as at the gas-works, everything was clearly explained to the entire satisfaction of the members. A vote of thanks was accorded to Mr. Meunier for his kindness. Mr. Meunier, in reply, said they were the only Association who had visited the works; and it had given him very great pleasure to receive them. In the evening, Mr. F. West read a paper on "Revivification." He commenced by briefly explaining that a gas manager has, under penalty, to supply gas absolutely free from sulphuretted hydrogen, and that

in most cases it must only contain very minute quantities of the other sulphur compounds, and then proceeded to deal at considerable length with the different methods adopted for the removal of these compounds, the purifying materials used, and the action which goes on in the purifiers. He also explained the Yeadon revolving purifier, which was described and illustrated in the "JOURNAL" for July 19, 1898 (p. 152). A good deal of discussion ensued. The members expressed their approval of the paper, and passed a vote of thanks to Mr. West for it. Some other business was then transacted, chiefly with reference to the rules of the Association. The March meeting was held last Saturday, when the members had a "question-box" evening; it being thought desirable, as it was so near the time for the examinations in "Gas Manufacture," to have a night devoted to different matters relating to these examinations. This proved to be what was wanted, as a good number of questions were brought forward. "Difficulties met with in main-laying" was the subject introduced for discussion by Messrs. Haynes and Mottram; and "Slot meters and outdoor work," by Mr. Berry. The next meeting will be held on the 28th inst., when Mr. L. E. Halliwell, of Littleborough, will read a paper on "Answering the Questions of Examination Papers."

PAINTING BY COMPRESSED AIR.

To whatever industry we turn, whether structural or manufacturing, we see the displacement of hand labour by machine work incessantly going on; and this nothing can stop if superior results and economy can be proved—these being potential forces which will eventually overcome any little obstructive action that those directly interested may evince at the outset. Painting by mechanical means is one direction in which opposition was at first encountered. But time has proved the expeditious manner in which work can be executed, the saving in labour and paint, and the durability of painting done in this way compared with brush work; and with such benefits as these, it is not surprising to learn that the system is making considerable headway. Messrs. A. C. Wells and Co., of Midland Road, St. Pancras, the makers of the "Lightning" painter and lime and colour washer, have called our attention to this progress; and the list they furnish of engineering and other industrial companies and firms of high reputation who have adopted their system is sufficient guarantee that its merits are such as to command recognition from those whose judgment it would be idle to dispute. In the list, we notice two of the London and several provincial and foreign gas companies and authorities. The outward form of the Wells apparatus, and its general principle—the spraying of the paint through a flexible tube and nozzle by means of compressed air—are well known; but the main features of the machine may be briefly described. The principal part is a cylindrical tank, constructed of sufficient strength to withstand the required air pressure, and provided with a screw-down cover. Supported on two lugs inside the tank is the pot for containing the paint, varnish, tar, limewash, or other liquid to be used. This pot being removable, can easily be replenished or changed for a pot containing a different colour. In connection with the cover provision is made for agitating the paint, in order to keep it of uniform consistency; and also affixed to the cover is the pipe for conveying the paint from the bottom of the container up to the flexible hose—this being accomplished by compressed air exerting a pressure on the surface of the paint. In works where air under pressure is already employed, special means of compression are not required; all that is necessary being the connecting up of the machine to the existing supply. But in other cases a compressor is supplied, which can be driven by a belt or any motor. For high speed work, the air must be supplied to the tank already described at a pressure of (say) 25 lbs. per square inch. From the tank run two flexible tubes—one conveying compressed air, the other the paint or other liquid to be used, and both ending in a hand-spraying arrangement. The sprayer is a very ingenious piece of mechanism, can easily be adjusted for fine or coarse work, and is readily taken to pieces for cleaning. The blocking up of the paint tube is a difficulty that has been raised; but this can be obviated by simply cleaning the tube, by means of the apparatus itself, with turpentine or paraffin. The machines are made in various sizes according to the magnitude of the work on which they are to be employed; and the larger sizes are adaptable for two operators, who can work over a space of at least 20 feet on either side of the machine. In addition to the rapidity and economy of this form of painting, there are several other claims of superiority over hand work with which engineers are cognizant, and which therefore need no reiteration here.

The Repayment of Loans for the Purchase of "Slot" Meters and Stoves.—A question having arisen as to the amount of depreciation to be allowed in the case of prepayment meters and stoves, we understand that the period usually allowed by the Local Government Board for the repayment of loans sanctioned by them to local authorities for the purchase of ordinary meters and stoves is ten years; and the Board have no information in their possession to show that this is excessive in the case of prepayment meters and stoves.

REGISTER OF PATENTS.

Incandescent Gas-Mantles.—Helmecke, H., of Hamburg. No. 8058; April 17, 1899.

In his specification, the patentee remarks: For several years attempts have been made to improve upon Dr. Auer von Welsbach's invention for manufacturing incandescent mantles from oxides of certain earth-metals mixed together, wherein it was tried to harden the mantles and render them more durable, partly by the modified chemical composition of the ingredients, and partly by exterior influences to which the mantles were subjected. But all these attempts, he says, "failed more or less to fulfil their purpose, since the augmented durability and strength has only hitherto been obtained at the expense of their brightness and illuminating capacity." While at the present time the manufacture of mantles is almost exclusively effected from a mixture of about 99 per cent. of thorium oxide and about 1 per cent. of oxide of cerium, in the form of the nitrates of these oxides, the present process is different both in its means and in the qualities of the mantles made; "rendering it possible to produce a mantle of prevalent illuminating intensity, agreeable for the eyes, and of far greater durability, without the use of thorium and cerium salts." This is done by employing a mixture of calcium oxide, in the form of calcium nitrate, with oxides used in the form of nitrates of certain earth-metals, as, for instance, lanthanum, zirconium, yttrium, and the like. It is mentioned by the patentee that in practice it is better to use the salt soluble in water of the first metals, and the nitrates are preferable to the chlorides and acetates. Pure oxide of calcium is neither practicable alone nor mixed with most of the above-named substances, because it needs too much heat to bring it to the necessary state of incandescence, and is liable to contract or retreat.

Such disadvantages to the use of calcium oxide for lighting purposes are, however, said to be entirely avoided in the present method. The light-radiating power of the mantles arranged on ordinary bunsen burners for normal pressure and gas consumption, is claimed as "excellent;" photometric measurements showing an intensity of light equal to 60 to 70 Hefner candles. The colour of the light can be modified as desired (according to the composition of the chemical ingredients), from bluish white, pure white, to golden white. The durability of structure is attained without prejudice to elasticity; and the mantle contracts far less, even after long use, than one made of cerium or thorium oxide.

The process of impregnating the cotton, silk, or the like fabric, the drying, incinerating, forming, and hardening over the gas-flame, &c., are analogous to the hitherto used methods.

It may be stated that mantles of calcium oxide and other metals hereafter mentioned after incineration (although calcium oxide is in molecular mixture with the oxide of the earth metals) are not hydroscopic.

The following solutions, for instance, are said to produce very good results:—

1.—Colour of the light, bluish white			
Distilled water		100	parts
Calcium nitrate	about	10	,,
Zirconium nitrate	,,	15	,,
Lanthanum nitrate	,,	5	,,
Yttrium nitrate		0·5	part
2.—Colour of the light, bluish white			
Distilled water		100	parts
Calcium nitrate	about	14·5	,,
Zirconium nitrate	,,	12·5	,,
Yttrium nitrate	,,	3	,,
3.—Colour of the light, pure white			
Distilled water		100	parts
Calcium nitrate	about	10	,,
Lanthanum nitrate		10	,,
Zirconium nitrate		10	,,
4.—Colour of the light, gold white			
Distilled water		100	parts
Lanthanum nitrate	about	14	,,
Zirconium nitrate	,,	9	,,
Calcium nitrate	,,	7	,,
Yttrium nitrate		0·3 to 0·5	part
5.—Colour as before, only a little whiter			
Distilled water		100	parts
Lanthanum nitrate		11·5	,,
Zirconium nitrate	about	11·5	,,
Calcium nitrate	,,	7	,,
Yttrium nitrate		0·1 to 0·5	part

The colour of the light from mantles made with the third solution is given as pure white; but if the lanthanum used is not pure (but contains traces of didymium or cerium), the colour of the light would be "gold white."

Purifying Acetylene.—Ernst, O., and Philips, A., of Hoechst-on-the-Maine, Germany. No. 11,041; May 26, 1899.

The patentees point out that, among the solid materials which are capable of purifying acetylene from its impurities (phosphoretted hydrogen, ammonia, and hydrogen sulphide), the salts of hypochlorous acid are very advantageous, on account of their acting well in the dry state and their cheapness. The calcium salt takes the first place among the hypochlorites—being easily obtainable in the form of bleaching powder. Certain obstacles are, however, incidental to the use of bleaching powder in its commercial form, and render its application to the purifying of acetylene impracticable.

The purifying material, according to this invention, is obtained by mixing the hypochlorite and some substance indifferent to acetylene with water, so as to form a stiff sludge or paste, and then spreading out the sludge or paste in a thin layer, and drying it at such a temperature that no decomposition of the hypochlorite will occur. For admixture with the hypochlorite, all substances may be used which, on the one hand, have no deteriorating influence on acetylene, and, on the other hand, yield a highly porous material when mixed with the salt and subsequently dried. In the first rank is placed slaked lime, calcium carbonate, or similar substances. Calcium chloride can also be, with

advantage, employed as an indifferent diluent, because it gives up its water of crystallization when dried—forming bubbles and pores. Most kinds of commercial bleaching powder contain, in addition to hypochlorite, slaked lime and calcium chloride, in quantity sufficient to admit of their being treated in the manner already explained without further admixture; but the following examples represent working methods of preparing the material:—

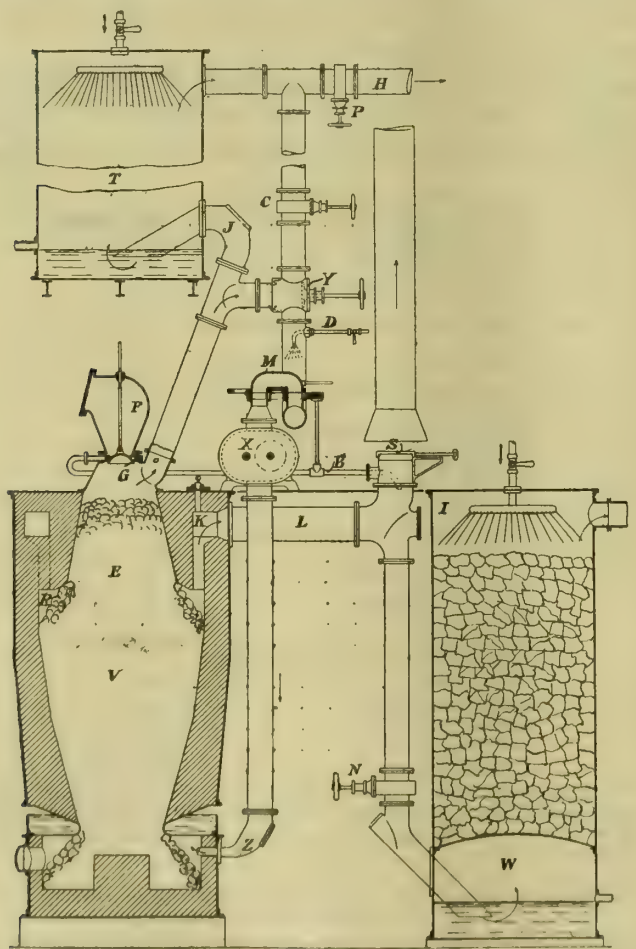
Example I.—Twenty kilos of bleaching powder are stirred with water into a uniform stiff sludge or paste, and treated with a similar sludge or paste made by mixing five kilos of slaked lime and five kilos of calcium chloride and some water. The two pastes are thoroughly mixed, and dried *in vacuo* at 100° C.; it being advantageous to spread the material in comparatively thin layers on drying trays. The mass, on drying, becomes highly porous, and sufficiently hard to allow of its being broken into pieces of convenient size without falling to powder.

Example II.—Fifty kilos of bleaching powder are stirred to a stiff sludge or paste with thirty kilos of water, and treated with forty kilos of calcined sodium carbonate, while stirring. The well-mixed paste, which now contains sodium hypochlorite and calcium carbonate as a result of decomposition, is mixed with ten kilos of calcium chloride, and then dried, preferably *in vacuo* at about 90° C. This also yields a highly porous, solid material for use in acetylene purification.

Production of Heating Gases, Poor in Nitrogen, from Combustible Materials Containing Hydrocarbons.—Blass, E., of Essen-on-the-Ruhr, Germany. No. 17,053; Aug. 22, 1899.

This invention has for its object the generation of gas from, and the gasification of, combustible materials containing hydrocarbons—such as bituminous coal and the like—in such a manner as to obtain, broadly speaking, a heating gas poor in nitrogen.

Not only is a portion of the carbon converted into heating gas poor in nitrogen, but all the hydrocarbons are obtained in the form of gas, or as tar and the like, or, after their decomposition into carbonic oxide and hydrogen, as hydrogen gas. This is effected by distilling the fresh combustible material by the aid of hot non-condensable hydrogen, and converting the coke resulting therefrom into hydrogen. In order to ensure complete distillation, a special arrangement has to be adopted for supplying the coal constantly with freshly re-heated hydrogen until the coking is complete.



The apparatus for carrying out the process consists mainly (as shown) of the following parts: A single sheet-metal cover encloses the chamber E for drawing off the gas, and the chamber V for distilling. Above the apparatus is fitted a charging-funnel F, adapted to communicate with the chamber E through an opening normally closed by a valve G. This valve serves for the purpose of cutting off the chamber E for drawing off the gases from the hopper F whenever the hopper is to be filled with fresh coal. As soon as the hopper is charged, the cover is closed and the valve G is opened, so that the coal can drop into the chamber E. To prevent the collection of any noxious and explosive gases in the hopper above the valve G, an annular passage is provided which communicates, by a pipe B, with the exit L for water gas or generator gas; so that the passage is filled with these gases, which in the absence of air are inexplosive. Below the distilling chamber is an inlet-nozzle Z for the admission of an air-blast or mixture of gas and steam. At the junction of the two chambers (about the middle of the apparatus) an annular hollow space R is arranged free of the combustible material; and the gas there collected is led off through channels and delivered into a circular channel K, and thence into the pipe L, which latter is fitted with a closed outlet S, and with a branch leading into the scrubber W. Below the charging-funnel F is an opening O, through which the gases are drawn off by the exhauster X, so as to pass either along the shortest route through the open valve Y; or when this valve is closed, they pass to the refrigerator T through the nozzle J. The pipe D is a steam-supply pipe.

The operation is as follows: The coke in the distilling chamber V (distilled coal and the like from above) is heated by the air from the inlet-nozzle Z. The gas then generated rises up into the circular channel K, and is either allowed to escape into the atmosphere by opening the valve S, or is led off to any suitable place for use. After the combustible material is sufficiently hot, the valve is reversed; and thereupon gas production commences for the generation of the heating gases poor in nitrogen. The valves S, P, and C are closed; the valves N and Y are opened; while the slide-valve M is set as shown. The fan X thereupon draws off the gases of distillation, which, together with the steam from the pipe D, pass through the nozzle Z into the coke. The mixture of gas and steam flows through the burning coke, and is decomposed into hydrogen gas. The hot hydrogen gas thus produced is drawn off through the chamber E; and during its passage upwards, it degasifies the fresh combustible material, while at the same time a certain amount of the gas travels up the passages into the circular channel K, and through the pipe L to the scrubber W, and finally into the gasholder.

If, now, the temperature in the coke-chamber sinks so far that the generation of hydrogen is very small—that is to say, that the decomposition of the steam becomes unprofitable by reason of a large portion of the steam escaping undecomposed through the coke, while the percentage of carbonic acid in the generated gases rises unduly—the steam supply is stopped; but the fan is kept working. This is the commencement of the second phase of the gas production. The circulation of the gas mixture by means of the fan-wheel X (now, however, without steam) continues; and the heat from the coke, which is still fairly high, is communicated to the circulating gases, and these in turn give the heat up to the incompletely distilled coal. This circulation proceeds until the coal has practically given up all gas; so that not only all the distillation products are made use of from the yield of gas, but at the same time all the necessary coke for conducting the process is obtained from the distilled coal. After the coking of the coal is completed, the apparatus is reversed by turning the valve M.

During the process, the tar and ammonia may be extracted from the circulation gas mixture, which contains all the products of distillation. To this end, the valve Y is screwed down; the slides S and P closed; and C and N opened. Thus the gas mixture is caused to pass through the pipe J into the refrigerator T, where it deposits tar and ammonia. The exhauster draws the gas now freed from tar and ammonia, and causes it to circulate after mixing steam with it for the first working period, or alone for the second working period.

The gas thus produced is hydrogen gas; but if it is desired to produce a mixture of hydrogen gas with non-decomposed distillation products (illuminating gas), the excess of gas is not allowed to pass off from the annular space R, but is caused to mix and ascend with the circulating gas current through the fresh charge of combustible material for re-heating, and there become further charged with the products of distillation. This is effected by closing the valves S, N, and C, and having the valves Y and P open. A part of the gas mixture is drawn up by the exhauster, and circulated; while the other portion enters through the pipe J into the refrigerator T, so as to be freed from tar and ammonia, whence it passes through the pipe H immediately into the holder. The hot hydrogen gas loses most of its heat during its passage through the generating chamber; and therefore a scrubber is not required.

If it is desired to obtain as much as is possible of the bye-products tar and ammonia, the process last described is so far altered as to secure the tar and ammonia, not only from the portion of the gas which finally passes into the holder, but from all the gas which ascends through the pipe O. For this purpose, the valve C is opened, and the valve Y closed—so that the whole of the gas must pass into the refrigerator T; any excess being led off through the pipe H into the holder.

Automatic Gas-Lighters.—Trendel, F., of Berlin. No. 20,884; Oct. 18, 1899.

The patentee describes a process for producing solid igniting bodies for automatic gas-igniters (fire-resisting material being employed), the distinguishing feature of which is that the raw material is successively treated with boiling acids, water, alcohol, and ether; then dried and heated to red heat; and evaporated with a decomposable solution of a platinum metal until dry—the platinum salt of the igniting body being then reduced in the known manner.

Having experimented with former types of automatic lighters, the patentee sums up the experience he has gained as follows: (1) The more finely the platinum is distributed (that is the looser its structure), and the greater therefore its effective surface, so much the quicker its action. (2) The more molecular the distribution of the platinum in the volume of the igniter, the more lasting its effect. (3) The less foreign elements contained in the carrier for the spongy platinum, and the more porous, and fire and acid resistant it is, the more reliably will the igniter act; and it will be the more capable of resisting atmospheric action, as from damp, nitrogen, carbonic oxide, carbonic acid, ammonia, sulphide of hydrogen, acid vapours, and the like.

With this experience as a basis, he claims to have succeeded in discovering a process for manufacturing igniters which possess the qualities just enumerated in a high degree, and therefore are quicker, more lasting, and more reliable in their action.

A fire-resisting substance—as, for example, clay, infusorial earth, meerschaum, &c.—is digested for about 24 hours in pure hydrochloric acid, having a specific gravity of 1·124; boiled therein; and then boiled again in hydrochloric acid until a sample leaves no red residue. The material is then washed with hot water until it indicates no more acid; it is then digested with absolute alcohol; then again with sulphuric ether; and after that it is placed in a platinum vessel, in which it is slowly heated to red heat. In this manner, a substance is obtained which, in regard to its chemical composition and molecular structure, is quite different to that originally employed. It is distinguished by an extraordinarily high

degree of porousness, and is free from all organic admixtures or compounds soluble in, and decomposable by, acids—it consists exclusively of durable silicates. The material, with a solution of platinum chloride or other soluble decomposable salts of the platinum metals, or a mixture of them with soluble salts of other metals which, after being reduced, leave a fire-resisting residue behind—as, for instance, the metals of the rare earths (thorium, zirconium, &c.), and other metals—is evaporated almost to dryness; then completely dried *in vacuo;* and reduced in any known manner. The igniter is thereby finished without further handling.

By this chemical treatment, meerschaum, for example, is reduced to one-half of its original weight; so that one-half the mass with the same volume is obtained, which doubles the porousness and susceptibility for the platinum salt solutions, and consequently increases the effective surface of the spongy platinum considerably—enhancing essentially its molecular distribution.

APPLICATIONS FOR LETTERS PATENT.

5205.—Burtles, H., and Sigurdsson, O. V., "Automatically turning gas on or off at predetermined times." March 19.
5249.—Sala, J., "Gas and liquid burners." March 20.
5344.—Kinnedy, R., "Prepayment meters." March 21.
5357.—Lisle, E., and Prew, G. F., "Carburettors." March 21.
5366.—Knöfler, O., "Incandescence bodies for gas lighting." March 21.
5374.—Preston, E. J., and Conway, F. L., "Intensifying and reducing fluid pressure." March 21.
5397.—Colman, H. G., "Enabling gas-meters to be used under pressures other than that of the atmosphere." March 22.
5398.—Colman, H. G., "Automatic alarm for showing excess of pressure in gas-purifiers." March 22.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Naphthalene in Coal Gas.

Sir,—I notice in your issue of this week a letter from Mr. R. W. Allen, in which he refers to my estimations of the vapour tension of naphthalene at ordinary temperatures and other matters connected therewith.

In reply, I may say that the rate at which I passed the dried air through the naphthalene was much greater than in Mr. Allen's experiment, though not so great as in another he quotes, where he found a deficiency of about 6 per cent. I found, however, that if I allowed a current of air to pass through the naphthalene for an hour, then let the experiment stand for a day or two, and afterwards passed the air through the naphthalene for another hour, I obtained a higher result than I did without the intermission. The cause of this discrepancy, I cannot say—possibly it may be due to the decomposition of some unknown impurity; but it gave me considerable trouble in my experiments.

Calculated to grains of naphthalene per 100 cubic feet, my figure for 25° C. or 77° Fahr. was 24·0; Mr. Allen's, 30·9. My figure for 15° C. or 59° Fahr. was 9·0; Mr. Allen's 19·0. Now vapour tensions at different temperatures vary according to a fairly general law; and Rankine's formula for constructing a table when three constants are known is, I believe, nearly correct. Mr. Allen's figures for temperatures over 30° C. are probably not far out; they being easier to obtain with accuracy than the low temperature results. Take the following items from his table:—

At 55° C.	Mr. Allen's figure is	317·0 grains.
45° C.	do.	132·0 ,,
35° C.	do.	57·5 ,,
25° C.	do.	30·9 ,,
15° C.	do.	19·0 ,,

According to law, $\frac{\text{VT at 45° C.}}{\text{VT at 55° C.}}$ should be slightly greater than $\frac{\text{VT at 35° C.}}{\text{VT at 45° C.}}$; and so on as the temperature decreases.

In the same way $\frac{\text{VT at 35° C.}}{\text{VT at 55° C.}} > \frac{\text{VT at 15° C.}}{\text{VT at 35° C.}}$; and supposing Mr. Allen's figures at 55° C. and 35° C. are correct, then the figure for 15° C. should be slightly less than $\frac{57{\cdot}5^2}{317}$—*i.e.*, less than 10·4.

In the same way VT at 25° C. should be less than $\frac{57{\cdot}5^2}{132}$—*i.e.*, less than 25·0; so that Mr. Allen's figures for high temperatures confirm mine for low.

It is, indeed, this very rapid decrease of vapour tension with decrease in temperature, as shown by my figures, which occasions the ready formation of naphthalene deposits in the mains and services.

My method of testing naphthalene in gas, by passing a few hundred cubic feet through benzene or toluene, and distilling through a fractionating column, may be cumbersome, and not as scientifically accurate as one would wish. But it has the merit of giving the naphthalene in the form of a crystal which can be handled and weighed; and as a comparative method it is valuable. One can also determine the other high-boiling condensable products in the gas at the same time. By it, at all events, Mr. Allen would never find a gas free from naphthalene which deposited it in the mains.

Manchester, March 28, 1900. Wilfred Irwin.

Sir,—With regard to the consideration of this subject, nothing could have been more *apropos* than the publication in last week's "Journal" of the full text of the paper by Dr. Colman and Mr. J. F. Smith, the reading of which ante-dated Mr. Allen's recent contribution. As a discussion on the naphthalene question is now going on in your columns, I should like to add a few brief remarks on the subject. Scientifically, both papers are of great interest and value; but I do not consider that the much worried gas manager will learn anything to help him to a practical solution of the old and vexed questions of naphthalene deposits with all their irritating consequences. With regard to Mr. Allen's theory of the possible and absolute formation of naphthalene *ab initio* in the mains, such an assumption seems to a certain extent to be corroborated by his figures, but so far is to my mind not absolutely proved. To establish such a theory as a fact would entail one of two proofs—

1.—That naphthalene can be formed by some interaction of the normal constituents of coal gas, or of their contact with metallic iron, demonstrated by conclusive laboratory experiments.
2.—That gas could be supplied from the works free from naphthalene, to a district fitted throughout with perfectly new and unused pipes, and yet naphthalene deposits be formed.

Leaving this question of naphthalene formation, and turning to matters of more tangible interest in the papers, I consider that the most valuable additions to our knowledge are—

1.—That the normal amount of naphthalene present in ordinary gas is so small as to range from *nil* to 1·5 grains per 100 cubic feet.
2.—That the presence of the vapours of certain compounds in limited quantity in coal gas, which have been previously considered as tending to retain naphthalene in the gas, does not exercise any such action, even when existing in abnormally large quantities.
3.—The publication of two distinct methods by which the proportion of naphthalene in gas can be fairly accurately determined.

Mr. Allen's facts with regard to No. 2, seem certainly incontrovertible; but they are utterly against all practical experience. Speaking subject to correction, I believe that the higher the illuminating power of the gas supply, the less the prevalence of naphthalene deposits, and *vice versâ*. To what is this due, if not to the solvent action of the higher hydrocarbons on naphthalene? Or is it to be explained by the higher-grade gas being produced at a lower temperature, and thus being initially charged with less naphthalene? Further, increased illuminating power may be obtained by the use of cannel gas; and this contains a different class of heavier hydrocarbons, and may contain little or no naphthalene. There would, however, still have to be explained the popular impression that the temporary use of high-grade gas (presumably derived from the employment of an abnormal percentage of cannel) absolutely removes or minimizes previously formed naphthalene deposits in any particular district. It is, I believe, found that the use of carburetted water gas very much conduces to freedom from naphthalene deposits. Theoretically, this should be the case, as I presume that such gas would not, *ab initio*, contain naphthalene. This substance would not presumably be formed during the action of superheated steam upon heated coke; neither would it be likely to be to any extent a product of the breaking up of liquid paraffins into permanent gases by the use of a high temperature.

On the questions of the presence or absence of naphthalene in ordinary coal gas, in cannel gas, and in carburetted water gas, we have now the means of forming an opinion and of obtaining experimental results, and, if necessary, of making quantitative determinations. With regard to this branch of the subject, I consider that the process advocated for the detection and determination of naphthalene by Dr. Colman and Mr. Smith is better than that of Mr. Allen. Although I have made no experiments on the subject, the details of working are I think in its favour. It is comparatively simple, and can be used on a fairly large volume of gas passing at a comparatively rapid rate. It is a volumetric method, which is also a great advantage; and the ratio of the molecular weights of picric acid to naphthalene is conducive to accuracy (one part by weight of the former representing a little over one-half of the latter). There is only one point needing a little elucidation—viz., the question of the solubility of naphthalene picrate in pure water. In the table given, where an abnormal quantity of wash water was used (over 100 c.c.), the gross error was only 0·014 gramme on 0·150 gramme taken; but the solubility of the picrate in water is stated as 0·1857 gramme at 14° C. This would equal (say) half the quantity of naphthalene, or about 0·09 gramme. How does the precipitated naphthalene picrate settle? If completely and solidly, why not titrate a portion of the clear acid solution after settlement, and avoid the possible errors of wash water? The error might be serious on a determination of (say) 1 grain of naphthalene per 100 cubic feet of gas—0·1 grain, or 0·065 gramme, in 10 feet.

Reverting to Mr. Allen's paper, there is one point which is not quite clear to me. When giving results to prove the absence of naphthalene in gas, it was found (quoting from the "Journal" report of the paper) that, at a temperature of 130° Fahr., 1·25 cubic feet of gas took up 153 grains; but referring to Table II., at a temperature of 131° Fahr. 100 cubic feet took up 317 grains. In both cases the figures refer to gas *saturated* with naphthalene.

March 30, 1900. H. Leicester Greville.

Sir,—In view of my (more particularly) practical investigations in regard to naphthalene, I cannot be other than struck with the remarkable theories put forward by Mr. Allen in his interesting paper, especially as for the most part his statements are diametrically opposed to what my experience has led me to regard as facts relating to the formation of naphthalene.

The ordinary precautions regarding the subject, as affected by the manufacture, have for many years past been taken at the Hastings Gas-Works; and I have seen evidences of naphthalene in the gas at all points of the manufacture. Indeed, although there has been nothing of any consequence in the way of deposits, naphthalene could undoubtedly be found in most parts of our apparatus.

On this subject, I have often found myself in accord with the remarks of Mr. Lacey; and I should like to emphasize what he said in the discussion on Mr. Allen's paper, in regard to the conditions under which the experiments were made by Mr. Allen being so different to those existant in the actual practice of distribution, &c., as to raise doubts in one's mind regarding the application of the same. Like Mr. Lacey, too, I have never found any difficulty in understanding why trouble from naphthalene has not been experienced in works using high-class coals; much naphthalene will be found in the tar produced by such coals.

With reference to what Mr. Butterfield said on one point, I should like to mention that some years ago, when first the carburation process was started here, a piece of service-pipe which had become choked with a deposit of naphthalene was, by way of experiment, successfully cleared by passing carburated (by petroleum) gas through it. The most convenient point at which this could be done happened to be on the supply to a jet photometer on the outlet of the carburater; and it was noted (there being

also a photometer on the inlet of the carburater) that there was a distinct increase in the illuminating power. Following this, I may say I have found gas treated by the carburation process has its capacity for naphthalene increased; and it appears just conceivable that some deposit of naphthalene existing between the points of his testing might account for what Mr. Allen states.

Of late there has undoubtedly been a great revival in the interest in the naphthalene question, a fact to which Mr. Allen's paper bears testimony, and will therefore be welcomed by myself and all others investigating the subject. There are, however, a great many points still to be cleared up—for instance, what is the reason that in certain cases the introduction of carburetted water gas has actually resulted in increased trouble from naphthalene, instead of the popularly supposed freedom?—points, indeed, to which I am only waiting time and opportunity to give careful attention; and in this connection Mr. Allen's method (or, indeed, Dr. Colman's) of estimating the naphthalene in coal gas, if found reliable in less skilled hands than his, will prove a valuable assistance, since other methods employed are much more tedious. Notwithstanding the troubles some companies still experience, it is correct to say that deposits of naphthalene in the distribution of gas (whatever the theory) can be avoided nowadays, which is proof that the attention already given to the subject has not been applied in vain.

CHAS. F. BOTLEY.

Hastings, March 31, 1900.

SIR,—From the number of letters on the subject of naphthalene of late (and some such learned ones), one may say it is on the brain just now. It is some 30 years since I came to conclusions on the subject which I have not seen cause to alter; and if you allow me, I will place them before your readers. But they must not expect a great deal of learned nomenclature.

I think the causes of naphthalene are various: 1. High heats, and consequent poor gas, where no cannel coal is used. In Scotland, where cannel coal is used, and the power of the gas is over 20 candles, naphthalene is *non est*. 2. Fluctuating changes of temperature after gas is made. 3. Sharp bends in the line of pipe. 4. Rough interiors of pipes. So much for hypothesis, now for my reasons.

1. At one of my works, we had recently lit up some new retort-settings that heated so admirably that I said to the manager: "I am afraid you will have naphthalene;" and soon we had it in the leading main from the works. This, they steamed by a portable boiler we had, with a water-tank and pump attached. This was only a temporary cure; and being there one day, I said: "Pump in some naphtha." It was no sooner in than there was a rushing noise inside the boiler that somewhat frightened the men. This was a much more effectual cure than steam; and when they pumped the syphons, the naphtha floated on the top of the water, and we got it back again for future use. The greater permanency of the naphtha over the steam cure, I attributed to the steam cleaning the interior of the pipe down to the cast-iron interior; whereas the naphtha vapour polished the interior of the pipe with a thin smooth glaze that less impeded the passage of the gas.

2. At one works the leading main from the meter to the gasholder was above ground for some 80 yards, till it reached the tank, where it sunk vertically through a T-piece with a flange on top. The hole that had been dug to get down to the pipe had not been filled in, and contained water all round the pipe. This main began to show signs of choking about the month of October or November. I concluded that naphthalene had been forming for some time, and only became troublesome as the make of gas increased. I took off the top flange of the T-piece, to jump the stand-pipe. I found some 6 or 7 feet of the pipe at the top end quite clean. I also found a crystal ring of naphthalene formed at the precise level of the water outside; and I concluded that change of temperature was the cause.

3. I knew a London Gas-Works where they had three station-meters in a line. The inlet passed behind with T-pieces for the first two of the meters. The inlet-pipe terminated at the third meter by a right-angle bend; and it was only this last meter that gave naphthalene trouble.

4. The service to my house got stopped. I had it carefully lifted—personally superintending the work. We found the whole of the service quite clean, except at one spot where there was a projecting burr at a joint; and a diaphragm of naphthalene had formed there quite beautifully.

Another cause of naphthalene is tapping mains for services on the top, instead of at the side of the main—thus requiring a bend on the top of the main just where the gas is getting cooler, and to street-lamps having to travel up the lamp-post—it may be in frosty weather. A thimble-full or two of naphtha poured down the stand-pipe will effectively clear it.

For large works everyone should have a portable steam-boiler such as I have described. For small works, something of the size of a 10-gallon oil-can could be mounted on wheels high enough to have a fire below it. It could then be filled two-thirds with water brought to boil. Then the naphtha added would pass into the pipes as vapour; or where steam is handy, naphtha might be injected into the pipes—much as we feed steam-boilers.

Just one other word in conclusion. I know that both managers and directors try for large makes of gas per ton of coal. I am of the same opinion as Mr. George Livesey. We say that more than 10,000 cubic feet of gas per ton of Newcastle coal is not desirable for either the company or the consumer. The wear of retorts, and the cost of fuel and labour, will not be compensated by the few hundred feet of thin gas that may be produced, with the chance of naphthalene to follow.

GEORGE ANDERSON.

35A, *Great George Street, S.W.*,
March 29, 1900.

The Proposed Visit of the Gas Institute Members to Paris.

SIR,—Will you kindly allow me some space for a protest against the letter of Mr. Shoubridge in your issue of the 20th inst.?

I was ever of opinion that lighting engineers and gas-lighting engineers in particular were united by the bonds of their friendship for "Light." So it ought to be. But now Mr. Shoubridge comes, alas! to cruelly disturb this illusion. Still, I keep firmly to my opinion that there exists friendship between gas engineers, all friends of light, whatever be their nationality or creed, because I have had many proofs of its existence, which will ever remain a dear remembrance to me. Who among gas managers has not had, as I have, the experience that gas managers all over the world are always ready to help their colleagues with their experience and knowledge, whenever asked for? And, even when not asked for, the results of experiments and practical experiences are always published in the periodicals all over the world for the benefit of the friends of light. Therefore, friendship does exist between gas managers, *ipso facto* that they have a common friendship—that for "LIGHT."

It is enough to be a gas manager to be sure of a cordial reception in every place where gas-works exist; and we, Dutchmen, will never forget the splendid reception by our English colleagues in June, 1898.

I hope this letter will have the effect that none of the English colleagues of Mr. Shoubridge will follow his advice; and that Mr. Shoubridge himself will, after some consideration, be convinced that his words do not suit a gas manager—a friend of "LIGHT." Further, I hope that we Dutchmen will have the pleasure of warmly shaking hands with our friend Shoubridge and with many of his colleagues in September, at the Paris Congress, and that then not one discordant note will prevent the Paris Congress being, what it ought to be—"The Festival of LIGHT, celebrated by its best friends."

C. T. SALOMONS.

Gas-Works, Rotterdam, March 28, 1900.

The Law in Regard to Underground Water.

SIR,—However much the Institution of Surveyors or gas managers may be interested in this matter, there is no doubt that mining engineers, who are sometimes called upon to pump as much as 25 tons of water per minute, have much greater reason to feel a necessity for watching all legislation or decisions in respect of it.

The decisions hitherto in such cases as are alluded to in the paper by Mr. Shiress-Will, seem to illustrate the old legal maxim, that "Common Law is Common Sense." It would never do to decide that because I was pumping a lot of water at a distance of two miles from an old building which showed a few cracks, that it was my doing. The fact is one cannot prove the identity of water; but in this or a similar case, if one makes a big hole for a gasholder on the surface, and sand and water have clearly come through the dividing wall, the conditions do allow of some proof that the damage is a result of the excavation.

But this is not why I write you. It is for the benefit of such gas managers as have similar holes to dig in sandy or bad ground. What I say is, "Do not run any risks, and try by the use of such old-fashioned ideas as piling, to prevent the sides (and what is beyond) running into your holes; but send for the workers of the Poetsch freezing process. That is the only way to stop all risk of incursion by either quicksand or water." The beauty of it is, you can not only freeze the sides of the place as far as you like, but also the floor. That seems to me to be an idea which those who have to tackle such work should not lose sight of; and I make no charge for it.

A. L. STEAVENSON.

Durham, March 29, 1900.

Morecambe District Council Gas Bill.

SIR,—In this week's "JOURNAL" there is an error in the report of my evidence on this Bill. Speaking of the rise in the price of coal, the figure I gave was not 5s. 6d. but 1s. 6d. per ton, and that had reference to last season's rise. If the advance in the price of coal is to be as serious as is generally reported, then the price of gas will have to go up also.

T. NEWBIGGING.

March 28, 1900.

The Price of Coke in the North.

SIR,—It may interest you and your "Northern Coal Trade" correspondent to know that my neighbours and myself have been selling parcels of coke for shipment at 17s. 9d. per ton, f.o.b. West Hartlepool.

E. H. MILLARD.

Durham, March 28, 1900.

Notifying Increases in Price.

Managers of gas undertakings are having unusual experiences in many parts of the country, consequent on the changed condition of affairs brought about by the abnormal rise in the price of coal necessitating a readjustment of charges in an upward direction. For instance, the Gas Engineer of an important county town writes: "Would you kindly say what notice is usually given before an increase in the price of gas is made? I believe this Company has never had to do such a thing before; but it seems now to be unavoidable." It would be interesting to learn from other managers similarly situated what their practice is in this regard.

Armagh Gas Company.—General satisfaction at the position occupied by the Armagh Gas Company was expressed at the recent annual general meeting, at which the report of the Directors, who, as mentioned in the "JOURNAL" for the 6th ult., recommended the payment of the usual dividend of 2s. per share, free of income-tax (being at the rate of 10 per cent.), was adopted. The Chairman (Mr. W. J. Best), in the course of his remarks, said he thought the shareholders should be well satisfied, as the price of coal had gone up from about 13s. or 16s. per ton, at which the last contracts of the Company were made, to 24s. Fortunately, as the result of their foresight, they had sufficient coal to keep them going till July; but should the price not fall by then, the charge for gas would have to be raised. The thanks of the meeting were accorded to the Chairman and Directors, as well as to the Engineer and Manager (Mr. James Whimster), for their attention to the Company's affairs. The Chairman remarked that when Mr. Whimster became their Manager the price of gas was 5s. 10d. per 1000 cubic feet, and the dividend to the shareholders was 7½ per cent.; now it was 10 per cent., and the price 3s. 9d. and steadily decreasing. Mr. Whimster suitably acknowledged the compliment paid to him.

PARLIAMENTARY INTELLIGENCE.

Gleanings from the Committee Rooms.

There is little to record this week in connection with the work of the Parliamentary Committees; but that little is shown in the next paragraph to be of exceptional interest. The Committee who will have to consider the group of London Gas Bills continued last week, with as pleasant countenances as it was possible for them to assume, to plod through the bewildering maze which the antagonism of conflicting interests built up around the Lea Conservancy Bill; and day after day those concerned in the London Gas Bills saw the commencement of the proceedings deferred. It is now announced that the County Council Bill will be taken to-day; but it is hardly likely that any great progress can be made with the other Bills before the Houses rise for the Easter vacation.

Small Gas Bills occasionally produce great surprises—Lea Bridge did so last year, and Glastonbury has done so this. The Corporation of the latter town have been fondly imagining that, by gaining possession of the gas undertaking, they were going to net a nice little profit for the benefit of their own ratepayers; but their visions in this direction have been, to a large extent, dissipated by the decision of the Commons Committee who have been considering their Bill. Virtually, the Bill, as now amended, places the Corporation in the position of trustees for the consumers, with an allowance of 1 per cent. on the capital employed for their trouble in managing the concern. It will be seen later that this means a limitation of the surplus profits, over and above the amount required for the conduct of the business and for the repayment of and interest on capital, to the extent of the 1 per cent.; and anything above this will go in reduction of the price of gas. Thus the interests of the consumers of Glastonbury and Street will, under the new *régime*, and contrary to the usual order of things, have precedence over those of the ratepayers of the former town in regard to the profits derived from the undertaking. This is as it should be; and the consumers of both places ought to feel greatly indebted to the Street District Council for bringing about such a happy condition. The decision may also have a wider influence, by acting as a deterrent to the profit-grasping propensities of local authorities. It will at any rate be well for local authorities who entertain the idea of becoming the administrators of the gas supply, to consider carefully the bearings upon their own position of what has been done in this case. The proceedings also brought out conspicuously a point which is generally overlooked by gas consumers who are served by a sliding-scale company; and it is this, that it is to their advantage to do their utmost to thwart all efforts on the part of the local authority to purchase the gas undertaking. Local authorities do not offer any compensating advantage to the consumer for the loss of the protection and benefit afforded by the sliding-scale; their paramount object being, in most cases, to secure, without being trammelled in any way, the greatest possible profit out of the consumers.

To understand the conditions which brought about what was obviously a great disappointment to the representatives of Glastonbury, let us recall in few words the steps which have led up to it. Both the Glastonbury Corporation and the Gas Company promoted Bills this session; the former to enable them to acquire the gas undertaking, and the latter for additional powers. The Bills were referred to a Committee of the House of Commons; but before the Bills were reached by the Committee, the Corporation and the Company agreed upon transfer terms. The neighbouring Authority of Street felt keenly aggrieved by this settlement; and they forced a contest before the Committee. It may be remembered that last week we could not admit the justice of one of their requirements; but in other respects we agreed that they had very fair grounds for fighting, seeing that the consumption of gas in their district is no mean factor in the prosperity of the Glastonbury undertaking. This being so, very naturally they objected to profits being derived from the Street consumers for the sole benefit of the Glastonbury ratepayers; and they consequently proposed the removal from the Bill of the clause giving the Corporation power to carry surplus profits to the district fund. In substitution, they submitted one providing for the application of such surpluses to the reduction of the price charged for gas; but allowing the Corporation to make good from the profits of subsequent years any deficiency that might occur in the receipts. The next proposal from Street was a clause providing for the apportionment of the sinking fund between Glastonbury and Street according to the consumption of gas in the respective areas; so that, in the event of the purchase by the District Council of the part of the undertaking in their district they might be credited with their share of the sinking fund. There is a similar clause to this in the Ossett Gas Bill of this year, in regard to the portion of the undertaking in the area of the Horbury District Council; but it was inserted by agreement before the Bill was introduced. Another requirement of Street was that the Corporation should forward to them each year a statement of the gas accounts, and that Street should have power to verify them by a competent accountant. An equality of price clause was also proposed; and to this the Corporation did not object. These suggested extensions and amendments of clauses came before the Committee last Wednesday for their final discussion; and, as will be seen elsewhere, the principal ones met with some strong resistance from Counsel for the promoters. The evidence of Mr. H. E. Jones very materially helped Street. In the course of his examination, the point was raised as to whether the benefits which the sliding-scale bestows upon gas consumers could not be secured in some way under the administration of a local authority; but it was too big a question for a safe expression of opinion on the spur of the moment. The Chairman (Mr. Schwann) was responsible for the suggestion that the Glastonbury Corporation should be permitted, after all claims had been satisfied, to appropriate a percentage on the capital to remunerate them for their trouble in managing the concern. In the result the clauses of the petitioners were accepted by the Committee, subject to the proposed addition to the clause referring to the repayment of capital being adapted so as to meet the cases of both a sinking fund and repayment by instalments. Inspection of the accounts was limited by the Committee to once annually; and, as already stated, they gave the Corporation power to credit themselves with 1 per cent. on the capital employed as remuneration for the trouble of management. Thus Street obtained practically all they asked for; and the result is a distinct recognition of the necessity for protecting the interests of consumers placed in a similar position to those at Street. Had the Glastonbury Corporation known the fate that awaited their Bill, and the narrowness of the profit to which they were to be limited, they might have taken a different course before approaching Parliament. If they did not know it before, they have now learnt that the passage of a Bill through Parliament is beset with uncertainties.

On Thursday, the Corporation of London (Various Powers) Bill was in Committee. This is an Omnibus Bill, embodying clauses authorizing the Corporation to construct subways, or "public service works" as they are styled, in the City of London, and to compel the gas, water, electric, and other Companies who have power to open the streets and lay mains, wires, &c., to put them into the subways. The Bill also contains a clause conferring upon the Board of Trade the power to act as arbitrator, to settle the question as to the fitness of the "public service works" (when constructed) for the reception of the Companies' mains, wires, &c. The only serious opposition was from the two competing Electric Lighting Companies having powers of supply in the City—the City of London Electric Lighting Company and the Charing Cross and Strand Electric Lighting Company. The New River Company practically withdrew their opposition; and the Gaslight and Coke Company (the greatest user of subways) and the London Hydraulic Power Company did not appear. After being in Committee two days, the preamble of the subway section of the Bill was proved; and at a later date the clauses are to be adjusted to meet the requirements of the Committee. It was generally recognized that the nuisance caused by the pulling up of the streets would be obviated by the provisions of the Bill.

The opposition of the East Ashford Rural District Council to the Bill of the Mid-Kent Water Company has been withdrawn as the result of certain concessions made by the Company. Of the 15 parishes included in the Bill, Chilham has been struck out. As to Wye, Kennington, Hastingleigh, Sevington, Mersham, Smeeth, Brabourne, and Bircholt, the Bill is suspended for three years, to allow of a local supply being provided. The Company are prohibited from acquiring any wells without the sanction of the Council under seal, except the well of the South Eastern Agricultural College at Wye. The Council are also protected with regard to roads and bridges; and permission is given for them to take samples of the Company's water for analysis. The Company also are to supply any parish within 18 months after being called upon to do so, or lose their powers. The Company have authority to lay pipes through Chilham for the purpose of reaching other parishes in the Bridge district; and they offer to supply water in bulk to the Council on the following terms per 1000 gallons: Not exceeding 50,000 gallons, 2s.; exceeding 50,000 gallons, 1s. 6d.; exceeding 100,000 gallons, 1s.

HOUSE OF LORDS.

The following further progress was made with Private Bills last week:—

Bills brought from the Commons, read the first time, and referred to the Examiners: Airdrie, Coatbridge, and District Water Trust Bill, Grantham Gas Bill, Hartlepool Gas and Water Bill, Morecambe Urban District Council (Gas) Bill, Ossett Corporation Gas Bill, Redhill Gas Bill, Wetherby District Water Bill.

Bill read a second time and committed: Rugeley Gas Bill.

Bills reported, with amendments: Cleethorpes Gas Bill, Falkirk and District Water Bill, Newtown and Llanllwchaiarn Urban District Gas Bill, Paignton Urban District Water Bill.

Bills read the third time and passed: Motherwell Water Bill, Newport (Mon.) Gas Bill.

The Exmouth and District Water Bill has been withdrawn.

HOUSE OF COMMONS.

Thursday, March 29.

METROPOLITAN WATER SUPPLY BILLS.

The two Bills promoted by the London County Council to enable them to acquire the undertakings of the Water Companies and carry out their Welsh scheme, and the Bill of the associated Water Companies to sanction the construction of further storage reservoirs in the Thames Valley, came again before the House to-day on the order for second reading. The London Water (Purchase) Bill was taken first; the discussion on this measure having been opened on the previous Thursday, and adjourned under circumstances which were recorded in the "Journal" last week (p. 806).

Mr. Stuart, in resuming the debate, said that when, on previous occasions, he had had to move a Bill similar to the one before the House, the main object of his remarks had to be directed towards endeavouring to establish the point that purchase was a good thing; that it was desirable, in the interests of the public, that water undertakings should be purchased by some public authority; and that the exigencies of the future supply of water would be best met by its being in the hands of such an authority. Fortunately, that which formed the largest portion of the contention about this measure on previous occasions—the desirability of purchase—now no longer needed to be argued; the matter having been definitely settled by the report of the last Royal Commission. It might be asked why the Bill was introduced at the present time. The reason was very simple. In the Staines Reservoirs Bill of 1896, there was introduced a clause, which was to be operative for seven years, providing that any concessions granted were not to be reckoned as an asset of a company if and when their undertaking came to be purchased. This clause would lapse in 1903; and, unless the purchase of this undertaking and those of the Water Companies who were working under a similar clause was effected before 1903, the object and intention of the Legislature would be frustrated. There was, therefore, urgency in the matter, because, even if the Bill were passed this session, it could not become law until towards the end of the year, and the arbitration under it could not be completed before 1902. Apart from the great governing principle of purchase, there were certain differences of opinion upon particular clauses. But the promoters were

prepared to make concessions. There was the question of separating the water supply in the sources as well as in the supply by bulk to the outside areas. The effort made to meet those areas had not been successful; and if it was the desire of the House that the clause should be modified, the promoters were perfectly prepared to agree. Another point was the arbitration clause. As to this, he was prepared to say, if they could get the Bill passed—if purchase could be secured this session—they would be willing to accept a clause which might not be so good as they could wish, but which would be on the lines indicated by the Royal Commission. If the Bill was not passed this year, then they could not give this *quid pro quo*—it would not be obtainable. As to the authority, they were perfectly prepared, in order to meet generally the wishes of all concerned, so as to secure purchase this year, to buy the undertakings in trust for any authority which might be created. The House would see that he was frankly dealing with the points at issue. It was for the Government to introduce a measure which should substitute another authority for the London County Council. The Bill could not therefore be said, as had been done, to be absolutely opposed to every recommendation of the Royal Commission. But there was this great point, that whatever body was nominated to manage the water supply of London, it must have recourse to the County Council to effect the purchase. In order to carry the scheme through, they must have some body which thoroughly understood the whole case. If they created a new body, it would have to spend years in making itself acquainted with the subject. A large number of the difficulties arose from the Water Companies themselves; and if these were out of the way, he believed it would at last become possible to construct an authority capable of managing the London Water Supply. He concluded by moving the second reading of the Bill.

Mr. Whitmore said his honourable friend made an interesting speech, but it was in support of a purely hypothetical Bill. What was the real principle of the one before the House? It was that the London County Council should be the purchasers of the water undertakings; and that, after purchase, they should remain the owners, and work them within the area of the Council, but that, as regarded the outside areas, the working should be transferred to the different local authorities. The House had previously, by large majorities, rejected measures of this kind; and the Council had recognized the futility of introducing fresh Bills. But in the summer of 1898 came the failure of the water supply in the East-end of London, and, in consequence, the Council introduced last year two Bills dealing with the question. Of these, the Welsh Supply Bill was met with an amendment that it should not be proceeded with before the Royal Commission had reported; and the Purchase Bill was ultimately withdrawn. The history of the question showed that the House had always refused absolutely to sanction the Council's main policy of purchase, and had attached great weight to the appointment and the report of the Royal Commission. At the beginning of this year, the Commission, after an exhaustive inquiry, issued a unanimous report. They came to the conclusion that the Council should not be the purchaser of the water undertakings, but that a new authority should be constituted for their acquisition and control. This report might be supposed to be absolutely conclusive against the second reading of the present Bill. But the honourable member coming to the House in a spirit of "sweet reasonableness," asked that the Bill should be read a second time in order that it might be completely transformed by a Select Committee. It was doubtful whether to read a second time a Bill which was to be completely altered was in accordance with the practice of the House; and, in any case, the future water supply of London was too important a matter to be left entirely to a Select Committee. The honourable member pleaded the extreme urgency of the question; but a year's delay could not make any practical difference. The stringent test imposed on the Water Companies last year by the exceptionally dry season proved their capacity to supply the whole of London in the most unfavourable circumstances; and as to the money question, even supposing that, in the interval, before a settlement was reached, the Companies added to their capital, and that the quinquennial valuation raised their assessment, the purchasing authority would obtain increased value for the higher price which had to be paid. The opponents of this Bill had been bitterly assailed on the ground that they were delaying the ultimate disposal of the question. He must repudiate any desire to interpose unnecessary delay into the settlement of the matter, which had too long inflamed passions in the County Council, and too long prevented the Water Companies from obtaining necessary facilities. Everyone must desire to have a settlement. He himself should have preferred to see an amalgamation of the Companies rather than the creation of a new authority; but he felt bound by the report of the Royal Commission, which declared amalgamation to be impossible. The general inclination was to accept the report of the Commission; and it only remained for the Progressives on the County Council to abandon still further their own preconceptions, and help to bring about a final settlement of the water question on the basis of that report. In the hope that the Government would soon give effect to those recommendations, he begged to move, as an amendment—"That the Bill be read a second time on this day six months."

Mr. Cohen, in seconding the amendment, said the House would not be justified in sanctioning a Bill which flew in the teeth of every one of the recommendations of one of the most strongly constituted Royal Commissions ever appointed to deal with the subject.

Mr. Buxton said he believed the County Council were practically prepared to accept the general conclusions of the Commission, and it was with this view that they desired that the Bill, the principle of which was the purchase of the Companies' undertakings, should go before a Committee. He supported the Bill because this was a matter of urgency. Next year the quinquennial revaluation took place in London, and this would unquestionably add to the income of the Water Companies and increase their capital value. He maintained that the Government had done nothing towards the solution of this question. They introduced a Bill in 1896 which was withdrawn; and last year their Bill enabling a slight amount of water to be acquired by one Company from another had been practically futile, because the Companies had been compelled to come to the House for further powers. There was no real matter of dispute between the two sides in principle; and he trusted the right honourable gentleman might see his way, even at the eleventh hour, to deal with this grave and most difficult question, and do something to redeem the pledges he had given.

Mr. Chaplin said the only discordant note in the debate had been struck by the honourable gentleman who had just sat down, when he taunted the Government with having done nothing towards the solution of the water question. The honourable member was apparently ignorant of the fact that, owing to the Bill passed by the Government last year, they were successful in preventing what would unquestionably have been the worst of all the water famines which had ever visited London. Leaving this, however, the House was in the peculiar position that it was asked to read a second time a Bill which was directly in conflict with the recommendations of the Royal Commission. The House, he thought, would require more cogent and convincing reasons than any which had been submitted to it up to the present time, before taking a course which would be extremely unusual. As to the Commission itself, the public and Parliament were much indebted to Lord Llandaff and his colleagues for their most able and exhaustive report, and for the care and attention which they had given to the subject. Neither must it be forgotten that in some most important conclusions they confirmed the findings of the previous Commission, presided over by Lord Balfour, and notably as to the sufficiency of the present sources of supply, both in regard to quantity and quality, provided adequate storage was secured. Summarizing the chief recommendations of the report, he pointed out that when the Commission came to the question of who should be the purchaser of the Water Companies' undertakings, they stated very explicitly that it ought not to be the County Council. They said the Water Board they proposed should be a permanent and not a fluctuating body; and they also recommended that the County Council should be very largely represented upon it. Further, they maintained that the present sources of supply in the valleys of the Thames and the Lea were sufficient in quantity and quality, and, with adequate storage, would continue to be so till 1941, even supposing that the population of the Metropolis continued to grow at its present rate of increase. They maintained, in the next place, that to embark just now on a scheme for bringing water from Wales would be to throw an unnecessary burden upon the present generation of water consumers and ratepayers and their immediate successors. It was obvious that to accept the Bill would be to go directly in the teeth of the recommendations of the Commission. On the other hand, the purchase of the undertakings of the Water Companies seemed at first sight so natural and reasonable, that he desired to say just one word about the chief reasons which had been given against the proposition. The fact was that the difficulty had always been what were known as the outside areas. It was in these that the great increase of population was to be looked for in the future. At the same time, those areas offered the most irreconcilable opposition to allowing the control of their water supply to be in the hands of the London County Council. No one had recognized this more than the members of the Council; so much so, that they had pledged themselves to make arrangements to hand over to the authorities of those areas the control of their own water supply. The question had been submitted to the judgment of the Royal Commission, and they reported that, although the severance of the works and the sources of supply of the several Companies, and the division of them between the Councils of the six counties within the limits, were not actually impracticable, they would be very difficult and highly undesirable. They would, the Commission said, involve needless waste and expense, and could only be carried out with constant friction in working details and at greatly increased cost of management. All the advantages and economies of concentration and amalgamation would, they said, be sacrificed; it would become increasingly difficult to deal with future wants; and no compensating advantage would be secured. This being so, and the County Council recognizing, he supposed, the difficulties of the situation, they now came forward with another proposal. They suggested that their Purchase Bill should be allowed to go forward, and that a clause should be inserted to enable the Metropolitan counties to introduce measures of their own next session, or subsequently, to constitute new authorities; or, to use the words of the honourable member opposite (Mr. J. Stuart), the Council were prepared to purchase "in trust." What he had to say to it was that it was one thing to bring in a Bill, and quite another to be able to pass it. Supposing anything occurred to prevent the passing of the Bill in the next or succeeding session, what would be the position? A good many things might happen before then. Supposing the constitution of the new water authority were objected to. The Council would be *de facto* the water authority, and the House would have made them the authority not only for London itself, but for all the outside areas. He could not believe that the arrangement was one to which the House would consent; and he could not say that there was anything in the plea with regard to urgency. It had been represented that any further delay would be injurious, especially on financial grounds. Certain clauses had been referred to, inserted in recent Bills, by which concessions were not to have the effect of being taken as further assets of the company. There was nothing to prevent similar clauses being inserted in other Bills which came before Parliament. With regard to the expiration of clauses in some existing Acts before the necessary measures could be passed, he was aware of only three cases of this sort. The clause in the Staines Reservoirs Act would expire in 1903, but not until the month of August—nearly four years from now; and if this matter could not be settled in the next four years, it was not likely, in his opinion, to be settled at all. There were provisions in two other Water Acts, one of which would expire in 1908 and the other in 1906. Surely these were times in which they would be perfectly safe. It had been contended before the Royal Commission that the effect of the next quinquennial revaluation would be to raise the worth of the undertakings of the Water Companies by £218,000 a year. It must be remembered that, although there was an increase in some cases, there was a decrease in others, and that railway and other large companies, who formed a very considerable element in the rateable value, had their water by meter. It had been shown that six out of the eight existing Water Companies would lose rather than gain by the next quinquennial revaluation. There was one question of great urgency, and that was the necessity for additional storage in the valley of the Thames. This, he considered, having given great attention to the subject, to be at the present time the most important and most urgent question in connection with the water supply of London. It was not necessarily affected by the postponement of these Bills. There were two Bills before Parliament for greatly increasing the storage for London—those of the East London and Lambeth Water Companies. The former Company had a proposal to increase their

storage by 5500 million gallons, and the latter one to increase theirs by 1000 million gallons. He regarded these proposals as of great importance. The East London Company introduced a similar Bill last year, which, to his great regret, was rejected by the House of Lords. On the question of being early in the field in Wales, so as to secure a watershed that would meet all possible requirements in a more or less distant future, he thought the matter well deserved careful consideration. Provision might easily be made for this in any legislation thought to be necessary on the subject; but it certainly was not a matter of immediate urgency for the present session. He had come to the conclusion that, in all the circumstances, there was nothing to warrant the House in taking a course so unusual as that proposed. He was sanguine that it would be possible for the Government soon to deal with this matter on a satisfactory basis; and, in conclusion, he would only express the hope that the honourable gentlemen opposite interested in this Bill would allow the discussion to be closed without going to a division.

Mr. J. W. Mellor, one of the members of the Royal Commission, referring to the lamented death of Mr. Cripps and Major-General Scott, two of his colleagues, said he knew from personal conversations with these gentlemen that, had they lived to the end of the Commission's labours, they would have agreed with the conclusion arrived at.

Mr. Burns supported the motion. He said that municipal control of the water supply had been granted to Glasgow, Birmingham, Manchester, and Liverpool, and why should it be denied to London? Until it was proved that the London County Council were incapable or dishonest, or desired to be unjust to the outside Local Authorities, there was no reason why they should not exercise the same functions in this respect as every corporate council in the United Kingdom. On all the grounds of trade, pleasure, health, and sanitation, this question could no longer be delayed.

Mr. Haldane said the question before the House was not whether the London County Council were to administer the water supply of London, but whether they were that day to take the first steps towards the execution of the policy of purchase which was recommended by the Royal Commission. What was asked was that the Government should make a beginning, and that it should be left to the future to decide who was to be the administrator. There was nothing in the speech of the right honourable gentleman which showed the Government were in earnest.

After some further discussion, the House divided, with the following result: For the second reading, 151; against it, 234—majority against, 83. The Bill was therefore rejected.

Mr. Stuart then formally moved the second reading of the London Water (Welsh Supply) Bill.

Sir F. Dixon-Hartland moved as an amendment, that the Bill be read a second time that day six months; contending that London had nothing to fear as to the future supply of water for its needs. He added that the purity of the Thames in recent years had enormously increased, and that the water was purer than could be found anywhere else.

Sir J. Dillwyn-Llewelyn seconded the amendment. He said that before the Bill was passed the inhabitants of Glamorgan should be heard, as they, at all events, ought to be supplied with water from their own hills. The County Council of Glamorgan opposed the Bill.

Mr. Stuart remarked that all the promoters asked was that the Bill might be sent to a Committee, who would consider the relative merits of the Thames and Welsh supplies, not only from a financial point of view, but on other grounds.

Mr. Burns, referring to a statement made by the honourable member for Uxbridge (Sir F. Dixon-Hartland), said that, according to the report for 1899 of the Engineer to the Thames Conservancy, proceedings had been instituted in 24 cases for non-compliance with the provisions of the Act in respect of pollution, and 16 convictions obtained against offending parties. To avoid this contamination, Londoners wanted to get their water from cloud-land in Wales, where there were no effluents from sewage farms or house-boats.

Mr. Brynmor Jones stated that the Glamorgan County Council opposed the Bill on the ground that powers so large ought not to be entrusted to one local authority, however important. They asked that the House would not give to the London County Council a first charge upon the natural resources of the Welsh counties. The second principle which operated against the Bill had reference to the case of counties and boroughs which were increasing in population from year to year, and were in close proximity to a watershed. Local authorities of such places had the first claim to the natural resources of the district. These were two broad principles on which he ventured to oppose the treatment of this great matter by way of Private Bill. He suggested that the Bill should be withdrawn for this year.

Mr. Chaplin said he wished to make a remark with regard to the observations of the honourable member for Battersea (Mr. Burns) as to the impurity of the supply from the Thames. It was very easy to quote from a report isolated passages which appeared to support one's argument; but the balance of authority was entirely against the honourable member. The whole of this question had been examined by two Commissions, both of whom came to the conclusion that, on the whole, the quality of the London water as supplied at present was admirable. Something had been said about the water authority of London being in the field in time to secure the reversion of a water area in Wales. This was a proposal for which he had a great deal of sympathy; and he thought it would be an exceedingly proper subject for the consideration of the future authority who should have charge of the water supply of London. But it would be quite out of place to entrust that duty to a body like the present, with regard to which the House had just decided that it should not be the authority in the matter.

Mr. Buxton, in recommending the withdrawal of the motion, said that the London County Council had done their best to carry out their duty by the ratepayers and water consumers, and to solve this most difficult problem. They had been thwarted by the Government, with whom the whole responsibility now lay to deal with the question. He himself was, however, not very sanguine that they would rise to the occasion and deal with the matter in a far-reaching or satisfactory way.

The motion and the amendment were then, by leave, withdrawn.

On the order for the second reading of the Metropolitan Water Companies Bill,

The Speaker said he had examined the Bill, and felt it to be his duty to advise the House that it was one which they could not properly entertain as a Private Bill. The promoters did not ask Parliament to confer any powers upon them, but invited it to bestow new and large powers upon a public department—the Local Government Board—to enable it to initiate and superintend a scheme for carrying out the recommendations of the Royal Commission on the London Water Supply, and for extending the provisions of a Public Bill of last session. These being the objects of the measure, it ought not to have been introduced as a Private Bill; and he trusted the honourable member in charge of it would withdraw it.

Mr. Boulnois, having acquiesced,

The order was then discharged, and the Bill withdrawn.

The following further progress was made with Private Bills last week:—

Lords Bills read the first time and referred to the Examiners: Higham Ferrers Water Bill, Newport (Mon.) Gas Bill.

Bills reported: Glastonbury Corporation Gas Bill, Glastonbury and Street Gas Bill [parties do not proceed].

Bills read the third time and passed: Airdrie, Coatbridge, and District Water Trust Bill, Grantham Gas Bill, Hartlepool Gas and Water Bill, Morecambe Urban District Council (Gas) Bill, Ossett Corporation Gas Bill, Redhill Gas Bill, Wetherby District Water Bill.

A petition was presented last Friday for the Portland Urban District Gas Bill, and was referred to the Examiners.

The British Gaslight Company (Staffordshire Potteries) Bill and the Wolverhampton Gas Bill were referred to a Select Committee, consisting of Mr. A. H. Brown (Chairman), Sir J. Woodhouse, Mr. Fison, and Mr. Arthur Moore; to meet on Thursday, May 3.

HOUSE OF COMMONS COMMITTEE.

Wednesday, March 28.

(*Before Mr.* Schwann, *Chairman, Mr.* Moon, *Mr.* Doogan, *Commander* Bethell, *and Mr.* Bonham Carter, *Referee.*)

GLASTONBURY CORPORATION GAS BILL AND GLASTONBURY AND STREET GAS BILL.

The object of the Corporation Bill was to enable the Glastonbury Corporation to buy up the undertaking of the Glastonbury and Street Gas and Coke Company; and the Company's Bill was to be withdrawn on the preamble of the Corporation Bill being passed. The only opposition was that of the Street Urban District Council, whose district immediately adjoins Glastonbury. The preamble of the Bill was found proved by the Committee last week (*ante*, p. 807); and the consideration of the clauses was postponed to allow the representatives of Street to formulate the suggestions they wished to make.

Mr. Balfour Browne, Q.C., Mr. Wedderburn, Q.C., and Mr. F. N. Keen appeared for the Glastonbury Corporation. Mr. J. D. Fitzgerald, Q.C., and Mr. Forbes Lankester represented the Street Urban District Council. Counsel were reserved on behalf of the Gas Company.

Mr. Fitzgerald said the first amendment was to strike out from the end of clause 52 the words "and the Corporation shall carry to the district fund so much of any balance remaining in any year of the revenue of their gas undertaking, and so much of the income derived from investments of the reserve fund when such fund amounts to one-fifth of the said aggregate capital expenditure, as may, in the opinion of the Corporation, not be required for carrying on, improving, or extending their gas undertaking and paying the current expenses connected therewith." This enabled the Corporation to carry to the district fund in relief of the rates the profits made on the gas undertaking. It was proposed to insert instead: "And, lastly, in reduction of the price of gas, when and as circumstances shall permit the same to be done; provided that the Corporation may retain in hand at the close of any financial year so much of the surplus as they shall think necessary for the purpose of carrying on the undertaking and paying the current expenses connected therewith." The effect of the clause was that the surplus profits, after paying all previous charges, should go in reduction of the price of gas. Unless some such provision was inserted, the position of consumers in Street would be changed very much for the worse. At present, under the sliding-scale, the extra profits, as soon as the standard dividend was reached, were divided between the consumers and the shareholders of the Company; there being for every increase of dividend a corresponding decrease in the price of gas. But under the Bill as it stood, the surplus profits would go, not to lower the price of gas, but to reduce the district rate of Glastonbury, in which the Street people had no interest at all. More than that, it would be to the interest of the ratepayers of Glastonbury, the majority of whom were not consumers of gas, to keep the price up, in order to increase the amount of profit to be contributed in aid of the rates of Glastonbury. What it was to their interest to do, there could be little doubt they would do. The answer of the Glastonbury Council was that, under clause 53, any deficiency in the net revenue of the Corporation on account of the gas undertaking was to be made good out of the general district rate. They said they were taking all the risk of deficiency, and therefore ought to have all the profit. The risk, however, of deficiency was of the smallest character. It was absolutely necessary, he agreed, to have the clause in the Bill, because under it the rates of Glastonbury were made the security for the money which the Glastonbury people would have to raise to purchase the gas-works; and this enabled the money to be borrowed at the lowest possible rate. But the actual risk of having to meet the deficiency out of the rates was very small indeed. To meet this point, a second amendment was proposed to clause 52, which related to the application of revenue, enabling them to make good any deficiency out of the district fund from the profits of subsequent years. It was: "In making good to the district fund any deficiency in the revenue and receipts of the Corporation on account of the gas undertaking which may at any time have been provided out of the general district rate or district fund." Thus Glastonbury was absolutely protected from any risk of the kind

suggested. There was a similar provision in the Stockport and Airdrie cases; and he contended that it did substantial justice on both sides. The only other amendment of clause 52 was with regard to the reserve fund, which the promoters proposed should be one-fifth of the aggregate capital expenditure. The ordinary proportion was one-tenth, and he knew no reason why one-fifth should be substituted. One-fifth would be an enormous reserve fund; and all the profits might be swept into it.

Mr. Wedderburn remarked that his learned friend need not worry about the proportion of one-fifth or one-tenth.

Mr. Fitzgerald said in that case he would go to clause 44, which stated: "The Corporation shall pay off all moneys borrowed by them on mortgage under the powers of this Act, either by equal yearly or half-yearly instalments of principal or of principal and interest combined, or by means of a sinking fund, or partly by one of those methods and partly by another or others of them; and subject to the provisions of this Act, the payment of the first instalment, or the first payment to the sinking fund, shall be made within one year from the date of borrowing the sum in respect of which the payment is made." Under the following sections, which it was proposed to add to clause 44, the method of repayment would be confined to a sinking fund which, speaking generally, was the most ordinary method of repaying principal.

(2) A sinking fund under this Act shall, until the completion of the purchase by the Street Council of part of the gas undertaking and works, mains, and plant of the Corporation by this Act authorized, or until otherwise agreed to by the Corporation and the Street Council, be divided into two parts, to be called respectively the Glastonbury Fund and the Street Fund; and every sum of money carried to the said sinking fund shall be apportioned between the Glastonbury Fund and the Street Fund in proportion to the gas consumed in the respective areas of the borough of Glastonbury and the district of the Street Council.

(3) In the event of the Street Council purchasing the part of the gas undertaking and works, mains, and plant of the Corporation which are situate within the limits of the urban district of Street, the price to be agreed or settled to be paid by the Street Council for such purchase shall be subject to deduction being made therefrom of the sum standing, at the date of the completion of the purchase, to the credit of the Street part of the sinking fund as hereinafter provided.

This clause would have no effect unless the Street Council purchased under the powers in the Bill the portion of the undertaking which was in their district. There was some discussion on the former occasion about inserting the "pipes" clause, which would have enabled Street to buy the works in their district without any regard to goodwill or profit; but he did not press for this. If, however, that were not given, it became necessary, in order to place Street in a fair position under the Bill, that a clause such as he had read should be inserted. Under the Bill, the sinking fund would be provided every year; and by the operation of the fund, the whole capital expended in the purchase of the works would be ultimately wiped out, so that at the end of 45 years they would have the works free of charge. Where did the sinking fund come from? It would be provided partly by the consumers in Street, and partly by the consumers in Glastonbury; and according as the consumption and the price of gas was larger in Glastonbury or Street, so the greater proportion of the sinking fund would be provided by Glastonbury or Street. Therefore he proposed that each instalment of the sinking fund should be credited in the books of the Corporation to Street or Glastonbury, in the proportion of gas consumed in the two districts in the preceding year. If ever Street wished to purchase their portion of the undertaking, they would have to pay to Glastonbury its full value as a profit-earning concern; and it was only reasonable that, when they did buy, they should be credited with the portion of the sinking fund which they themselves had provided.

Mr. Moon: Is there a precedent?

Mr. Fitzgerald: Yes; in the Ossett Corporation Bill this year.

Mr. Wedderburn: An entirely different case.

Mr. Fitzgerald said that the Ossett Corporation were purchasing; and there was another body outside—the Horbury District Council. An agreement was come to between these two authorities dividing the sinking fund in the manner he had mentioned; the only difference being that they agreed on a fixed proportion. Inasmuch as in the present case the consumption in Street was increasing very rapidly, it seemed fair to say that the actual consumption should fix the division of the fund. There would be absolutely no difficulty in dividing the fund in this way, because already, for the purpose of rating, the amount of gas consumed in the different places had to be ascertained, and the fund could easily be divided in the proportion of the respective consumptions.

Mr. Bonham Carter: The matter of the sinking fund in the Ossett case was one of agreement, was it not?

Mr. Fitzgerald: I said so.

Mr. Wedderburn: The whole thing was a matter of agreement.

Mr. Bonham Carter: The present case is one of agreement, so far as sale and purchase are concerned.

Mr. Fitzgerald: Yes; but there is no agreement so far as Street is concerned. They have never been consulted in the matter at all. The Street people are in the same position practically as Horbury was in the Ossett case. Continuing, he said the next new clause was to ask the Corporation to keep accounts in the ordinary way, which they would not otherwise be compelled to do. The clause was—

Until the District Council effect a purchase, the Corporation shall forward to the Council, on or before the 25th day of March in each year, an annual statement of accounts made up to the 31st day of December then next preceding, as near as may be in the form, and containing the particulars specified, in Schedule B to the Gas-Works Clauses Act, 1871; and the Corporation shall, at the request of the Council (if made within two months from the receipt of such annual statement of accounts), produce the books and accounts of the Corporation in verification of such annual accounts to any person duly authorized by the Council, and such person may, if the Council so desire, be a professional accountant.

Mr. Wedderburn: We do not object to that clause, down to 1871.

Mr. Fitzgerald said the second part—that following "1871"—was designed to enable the Council to see that the provisions of the Act were fairly complied with. If the provisions of the Act were fairly and properly carried out, the Corporation could have no objection to a verification of their accounts by a competent accountant. Unless they had something to conceal, or did something they ought not to do (which he did not suggest for a moment), they should have no objection. The last clause, which was as to equality, was—

The price to be charged by the Corporation for gas shall be the same to all consumers in similar circumstances throughout the limits of this Act; and no preference or advantage shall be given to consumers in the borough over consumers outside the borough.

Mr. Wedderburn: To that clause by itself we do not object.

Mr. Fitzgerald said on the last occasion he mentioned the maximum price, which was 4s. 6d. per 1000 cubic feet; the actual charge being 4s. After careful consideration, it appeared that if they granted consumers in Street the first two amendments, by which the profits were to go to reduce the price of gas and they were to have their share of the sinking fund, the maximum price of gas did not specially affect them; and therefore, if these two amendments were granted, he should not object to the maximum price remaining at 4s. 6d. But if the profits were not to go in reduction of the price, and it thus became the interest of Glastonbury to keep up the charge, he should have to deal with the maximum price.

Mr. *H. E. Jones*, examined by Mr. Fitzgerald, said it was only just that the profits should go in reduction of the price of gas, and not be carried to the district fund of Glastonbury. If the Bill were to pass in its present shape, the profits would go, not to reduce the price, but to reduce the district rate of Glastonbury; and none of the consumers in Street would receive any portion of the profit. There was practically no risk of a deficiency which would have to be met out of the district rate of Glastonbury. If there were a deficiency, the new clause would quite do away with any harshness. Moreover, the Arbitrator, in fixing the price to be paid when Glastonbury purchased the concern, would look to that risk. The whole point was met by the amendment that, if there should be any deficiency, it might be made good out of surplus profits in subsequent years. The amendment with regard to the sinking-fund clause was absolutely fair. He could conceive nothing more unfair than that the price of gas in Street should include, not only all usual expenses, but also a sum to provide interest on the capital invested and to redeem the whole of the capital over the period of 45 years, at the end of which time Street would have no proprietary interest in the concern. If the people in Street consumed half the gas, they would have purchased half the concern. To give Street credit for what it was charged with there all those years was only fair. Otherwise, if the Street Council were to purchase their share of the undertaking ten or fifteen years hence, they would pay the full value as it then stood, and get no credit for the contributions they had made to the sinking fund. Witness saw no objection to Street verifying the accounts.

Cross-examined by Mr. Wedderburn: He could give no precedent for the clause 52 amendment, except in the case of a joint board.

Mr. Wedderburn: You have said there is no possibility of loss. Are there not cases where a corporation or local authority have taken over an undertaking, and where, owing to the amount they have had to pay, they had to raise the price of gas?

Witness: I think that is only where the Local Government Board have insisted on the repayment of capital within too short a period. That was so in the case of Wokingham.

There have been instances where transfers have taken place, and the local authority have had to raise the price for some reason?—I know of no case.

Cross-examination continued: As to the maximum price, he agreed that coal was now very dear, and that there ought to be a margin for chance. In this instance, 4s. 6d. per 1000 cubic feet would not be a high maximum, if the other matters were put on a fair basis. Apart from those other matters, he would not speak as to the 4s. 6d.; but there should be some protection for Street. He could not suggest any precedent for the sinking fund proposal, except the case of Ossett; but it did not often occur that there was an adjoining area of consumption so important as in the present case—equally as important as that of the purchasing authority. He agreed that, under the Bill, Street were reserved their power of purchase; but purchase, where the concern was so small, would not be easy. It would be a pity if these two authorities split over the supply of gas. If each one supplied, they would very much increase the cost.

The Chairman: Do you know of any cases of the sliding-scale being applied to corporations?

Witness: No. The very essence of the sliding-scale is the spur to the shareholder to reduce the price of gas, in order to get the increment of dividend; and this does not arise in the case of a local authority.

Mr. Bonham Carter: There is a case, but I do not know how it worked out. There was a joint board.

Witness: I was not aware of it. I do not quite see what a local authority can get in the way of dividend.

The Chairman: Can you give us your objections?

Witness said he had no objection to it; but he saw difficulties in working it. He quite agreed, speaking off-hand, that it would be possible to devise some plan by which, as the Chairman suggested, say, 2 per cent. might be allowed the Corporation for their trouble and risk in working. He could not see why the sliding-scale then should not be made to apply so that the people should take an actual interest in the undertaking.

Mr. Fitzgerald pointed out that, under the Bill as it stood, one of the first charges on the gas revenue was the interest on the money borrowed, which included the whole capital.

The Chairman said that was true; but it did not pay Glastonbury for the trouble of working the concern, nor was there a guarantee in case of loss.

Mr. Fitzgerald said all expenses came out of revenue. The Chairman suggested 2 per cent. on the capital. Supposing the existing capital of the Company was £10,000, and that they were paying 10 per cent. on it, for this income they would probably get £26,000 from the Corporation. If the Corporation borrowed this sum, one of the first charges on the gas revenue would be 3 per cent. on that—about £700 or £800. If another 2 per cent. were added, they would be paying as much as, if not more than, the shareholders were now getting out of the concern—and that without regarding the fact that there was the sinking fund as well.

The Chairman said his idea was that they must give some remuneration to the Corporation who did the work. At present, they would have all the trouble, would find the capital, do the work, and receive nothing. If there was no profit over, there would be nothing to divide.

Mr. Fitzgerald said in the case of the London Water Companies, to meet the point there was an allowance of 1 per cent. for management trouble. In reply to Commander Bethell, he further said the reserve fund was to be built up, under the Bill, in precisely the same way as the sinking fund—by consumers in both places. When it reached the prescribed limit, the interest would go into the general revenue of the concern.

Mr. Moon (to witness): Would you be inclined to say that the Street Council clause is the nearest approximation to the sliding-scale in the case of a concern worked by a corporation, as distinguished from one worked by a company?

Witness: Certainly; so far as I have considered the subject. The Chairman has put a fresh proposition to me.

Mr. Wedderburn, for the Corporation, said they did not propose to call evidence; their view being that this was a matter for argument and common sense. The main value of the last witness's evidence was that he said there was absolutely no precedent for the two main proposals of Street. With regard to the 1 per cent. of the London Water Companies, he pointed out that they were very large undertakings, and that the matter was entirely different with them from what it was with a small concern like the present. The amount, however, he did not care to argue. The main point was the principle which the Chairman had introduced; this principle being that the Corporation of Glastonbury should not be the unpaid servant of Street—which was what Street had been struggling for all through. The proposals contained in the amendments were as unjust as any ever put forward. As to the maximum price to be charged for gas, it was absurd to suppose that the Corporation would not conduct the undertaking in a commercial spirit; and their object would be to make gas as cheap as possible, because the lower the price the greater the consumption. In order also to get the large consumption in Street, they would make the price as low as possible. Was 4s. 6d. per 1000 cubic feet unreasonable as a maximum? Glastonbury said it was not; and both Mr. Fitzgerald and Mr. Jones gave up much argument about that. It had been the price till the present Bill was introduced; and it could not therefore be said to leave much margin. As to the accountant's clause, Glastonbury objected to the Street Council having power to come in at any time and call for the books—or, in other words, to worry them. They had no power now under the general law to inspect; and Glastonbury wanted to leave them exactly as they were under the Company. With regard to the sinking-fund clause, Mr. Fitzgerald seemed to have entirely overlooked the condition of things under the Bill. Glastonbury was not absolutely bound to have a sinking fund, and was not going to have one; and the clause proposed would put upon them all the trouble and difficulty of such a fund, which the Corporation wished to avoid. Clause 44 gave them power to pay off the borrowed money by "equal yearly or half-yearly instalments of principal or of principal and interest combined." The latter was the method they would adopt, as causing the least trouble and expense. Then the clause went on, "or by means of a sinking fund, or partly by one of those methods and partly by another or others of them." Clause 45, which, like clause 44, was a usual clause, said if they determined to do it by sinking fund certain provisions should apply. So that they had power to repay in either way. But they would do it by the equal instalments; and they objected to being compelled to do it by the sinking fund. A member of the Committee asked as to what the sinking fund would involve them in. It would involve them in all the differences between the easy and convenient method and the inconvenient one. Apart from all this, there was no precedent for the proposed clause. The clause was brought forward because by agreement it was put into the Ossett Bill. Mr. Fitzgerald said Street was in exactly the position of Horbury. Well, he (Mr. Wedderburn) was Counsel for Horbury; and he held that the two cases were as different as could be imagined. The Ossett Corporation were seeking to purchase the Gas Company's undertaking, the area of which was Ossett and the outside district of Horbury. Ossett and Horbury met; and prior to the Bill coming before the House, they agreed that Horbury should support Ossett in their opposition to the Bill the Company were promoting for an increase of capital, and in the prosecution of the Ossett Bill. The combination resulted in saving Ossett the expense of a long fight, and gave them their Bill against the Company. But in this case, Street throughout had opposed Glastonbury. They had made it more difficult for Glastonbury to agree with the Company; and more difficult for Glastonbury to get their Bill. They had had every opportunity of combining, but did not do so. Then when Glastonbury had got their Purchase Bill, and agreed with the Company, they came, and, although they had opposed all along (and never helped Glastonbury as Horbury helped Ossett), they sought to gain as a matter of right what Horbury secured by agreement. Without bearing risk, or doing any work, they said they should be carried to as good a position as Horbury obtained. Anything more unjust could not be. The only parallel for the sinking fund was that it was given by Ossett to Horbury for things Horbury did. But there were other differences in the Ossett and Horbury agreement; for there was nothing to prevent Ossett making a profit. There was no such clause as was here proposed; it being provided that Ossett should carry to the district fund so much of the balance remaining in any year as, in the opinion of the Corporation, might not be needed to carry on the gas undertaking. Yet Mr. Fitzgerald said the Ossett and Horbury cases were parallel. Seeking nothing but their own selfish advantage, Street proposed that, though they might never purchase, Glastonbury should go on tying up money in the sinking fund which might be usefully employed. There was no parallel; and the fact that the clause, in quite different circumstances, and with different advantages, was given by agreement by one corporation to another district authority, was no ground for compulsorily and unfairly forcing it on Glastonbury. Turning to the alteration of clause 52, he said that again was entirely unprecedented. What was the reason Glastonbury was to make no profit? He quite admitted, of course, that this matter might be largely influenced by the Committee not making them the unpaid servants of Street.

The Chairman asked if the Corporation were prepared to make some arrangement of the kind referred to.

Mr. Balfour Browne: It does seem to me absolutely fair that our profits on gas should not be illimitable. On the other hand, I do not think Street should be put in a better position relatively to us than they would be in regard to the Gas Company. When a similar case was discussed in regard to Oldham, all that was argued for the outside authorities was: Let the Corporation of Oldham have the same profits as the Company would have had; and after that everything else is to go in reduction of price. I am perfectly willing to do that.

The Chairman remarked that the interest of the ratepayers in Glastonbury was not at all the same as the interest of the consumers of Street and Glastonbury.

Mr. Balfour Browne: The ratepayers in Glastonbury are responsible. If you give the ratepayers something for having stood the risk and racket, then I think there ought to be a reduction in price. I am willing to take 2 per cent. on the capital invested, to give me an interest and pay me for management.

The Chairman: If you were given the 2 per cent., their clauses would come into play.

Mr. Balfour Browne: No.

Mr. Bonham Carter: Having got the 2 per cent., you would have no objection to the surplus of the revenue being applied in reduction of the price?

Mr. Balfour Browne: No.

Mr. Wedderburn: But the other clauses would still remain open to the decision of the Committee.

Mr. Fitzgerald wished to point out what the position would be. Some of the Company's capital bore 7 per cent. and some 10 per cent. Glastonbury had to buy these dividends; and the result would be that the capital expenditure of Glastonbury would be very much more than the nominal capital of the Company, because a £10 share would be worth £27, £28, or £29. It was on this sum that Mr. Balfour Browne wanted 2 per cent.; and this would really be equivalent to giving him 5 or 6 per cent. for management, which would be very unfair. The precedent of 1 per cent. for management (not for expenses) would be very fair, because it would be 1 per cent. on the new capital expenditure, which would be from two-and-a-half to three times the nominal capital of the Company.

The room was then cleared while the Committee deliberated. On the re-admission of the public,

The Chairman said: We accept the clauses proposed by the petitioners, subject to clause 44 being left in its original form, and the proposed addition to clause 44 being altered to meet both cases of a sinking fund and payment by instalments; and subject to the clause relating to the keeping of accounts being amended to limit the inspection of accounts to once annually. The maximum price of gas will stand as in the Bill. The Committee decide that the Glastonbury Corporation be empowered to credit themselves with 1 per cent. on the capital employed from time to time—on the capital of the undertaking—as payment for management expenses.

The Committee then adjourned further consideration of the clauses, to enable the necessary further slight alterations to be made.

Thursday, March 29.

This morning the clauses of the Bill, as altered to conform to the decision of the Committee, were submitted and approved; and the Bill was ordered to be reported to the House.

LEGAL INTELLIGENCE.

The Promotion of the Automatic Gas-Meter Company.

In the Queen's Bench of the High Court of Justice last Tuesday, before Mr. Justice Mathew, the action brought by Mr. T. H. Sheen to recover £1125 in cash for services rendered and a similar amount in shares in the Automatic Gas-Meter (1895) Company, Limited, from Mr. John Haynes, of Liverpool, was mentioned. The proceedings were reported in the "Journal" last week (p. 815), and resulted, it may be remembered, in judgment being given for the plaintiff, leaving the parties to settle between them the value of the shares. Mr. Dodd now said Mr. Sheen was prepared to accept the 13s. 4d. per share offered by Mr. Haynes; and final judgment was entered for the plaintiff for £1125 and for £750, the value of the shares.

The Powers of the Harrington Gas Company.

In the Chancery Division of the High Court of Justice on March 24, a petition by the above-named Company was presented to Mr. Justice Stirling, asking the sanction of the Court to certain alterations in the Memorandum of Association. Mr. J. S. Parkin, who appeared for the Company, said they carried on business at Harrington, in Cumberland, and they wished that the Memorandum might be altered—first, by defining more clearly the area over which the Company could exercise their rights and privileges; and secondly, by giving them larger powers, so as to enable them to deal with residual products, supply electricity and other illuminants, carry on business as mechanical engineers, supply gas stoves, engines, &c., and embark in any other undertaking which might seem to them to be capable of being profitably and conveniently carried on in connection with the above, or likely to enhance the value and profits of the concern. By the original Memorandum under which the Company was incorporated in 1866, the area of supply was the town of Harrington, otherwise called Harrington Harbour. It appeared that the parish of Harrington was more extensive than the town; and doubts had been raised as to the power of the Company to supply gas outside the town. Counsel read the resolution which had been duly passed and confirmed, embodying the amended Memorandum, which was to the effect indicated above, but couched in the most general and comprehensive language. He also read an affidavit by Mr. J. B. Tolson, the Secretary to the Company, in support of the petition. His Lordship said he saw nothing in the affidavit which justified his sanctioning the new Memorandum, so far as it gave the Company power to supply electricity for the purposes of light, heat, or motive power, nor did he think it was intended that the Court should confer such general powers as were included in the proposed Memorandum, which practically enabled the Company to do anything they pleased.

MISCELLANEOUS NEWS.

COMMERCIAL GAS COMPANY.

Half-Yearly Report and Accounts.

The following is the report of the Directors of this Company for the half year ending Dec. 31, which, with the accounts for this period, will be presented at the meeting of the proprietors on Thursday :—

The Directors submit the accounts for the half year ended Dec. 31, 1899. The revenue account shows a net profit for the half year of £55,580 16s. 5d. This, added to the amount brought from the previous half year, makes £56,534 3s. 1d. Deducting therefrom £5679 17s. 9d. for interest, there remains standing to the credit of the net revenue account a balance of £50,854 5s. 4d. available for dividend. The Directors recommend that dividends be declared at the rates of 13½ per cent. per annum upon the old stock of the Company, and of 10½ per cent. per annum upon the new stock, both less income-tax; and that the difference between the declared dividends and the authorized amount divisible, having regard to the price charged for gas, be carried to the reserve fund. The balance of the net revenue will be carried forward to the next half year. To meet the requirements of the Company, further capital is necessary; and resolutions will be submitted to the proprietors to authorize the Directors to exercise the powers to raise additional capital conferred upon the Company by the Commercial Gas Act, 1875, by the creation and issue of £43,125 of new ordinary stock of the Company, and to authorize the Directors to dispose of the said stock, or any part thereof, in such manner, at such times, at such price, and on such terms and conditions as they may think fit. Also to authorize the Directors to exercise the powers to borrow the sum of £61,713 conferred upon the Company by the Commercial Gas Act, 1875, and the Ratcliff Gas Act, 1855, by the creation of additional perpetual debenture stock bearing interest at the rate of 4½ per cent. per annum, and to dispose thereof, or any part thereof, in such manner, at such times, at such price, and on such terms and conditions as they may think fit.

The accounts accompanying the report consist of the usual statements. They show that stock to the amount of £786,425 has been raised out of the total of £830,000 authorized; and that £238,287 has been borrowed out of £300,000 sanctioned. The receipts on capital account amount to £1,024,712 (issues of £1175 of new stock and £3167 of debenture stock having been made in the past half year); and there is £27,015 of premium capital—making together £1,051,727. The expenditure on capital account in the six months (£7921) comprised £2539 for new and additional mains, services, &c.; £3281 for meters and stoves; and £2101 for automatic meters and fittings, less £1961 written off for depreciation. The total expenditure to Dec. 31 last amounted to £1,054,330; so that the capital account had been overdrawn to the extent of £2603. The reserve fund at the above-named date stood at £42,093; and the insurance fund at £28,652. The balance-sheet shows that the value of the stores in hand at the close of the half year was as follows: Coals, oil, &c., £20,371; coke and breeze, £5619; tar, ammoniacal liquor, and sulphate of ammonia, £11,042; and sundries, £16,786—making a total of £53,818. On Dec. 31, 1898, the stores were valued at £51,351; the items being: Coals, oil, &c., £25,799; coke and breeze, £4389; tar, liquor, &c., £5146; sundries, £16,017. The revenue and profit and loss accounts, together with the statements relating to the manufacturing operations of the Company in the half year, are given below.

REVENUE ACCOUNT.

To Manufacture of gas—					By Sale of gas—					
Coals and Oil, including dues, carriage, unloading and trimming	£86,953	12	0		Common gas, per meter, at 2s. 6d. per 1000 cubic feet	£154,401	5	1		
Salaries of Engineer and Officers at works	2,624	5	0		Public lighting and under contracts, common gas	9,918	14	5		
Wages (carbonizing)	18,120	6	10						£164,319	19 6
Purification, including £3078 3s. 2d. for labour	7,204	1	11		Rental—					
Repair and maintenance of works and plant, materials and labour (less £206 19s. 6d. received for old materials)	17,209	3	9		Meters	£2,500	7	1		
				£132,111 9 6	Stoves	1,928	8	3		
Distribution of gas—					Automatic meters and fittings	3,223	3	2		
Salaries and wages of Officers (including Rental Clerks)	£1,943	16	6						7,651	18 6
Repair, maintenance, and renewal of mains and service-pipes, including labour	2,467	8	5		Residual products—					
Repair and renewal of meters	1,755	18	9		Coke, less £3548 3s. 9d. for labour	£27,779	9	10		
,, ,, stoves	1,906	18	3		Breeze, less £560 4s. 5d. for do.	1,046	13	1		
,, Automatic meters and fittings	1,961	10	8		Tar	9,833	14	11		
				10,035 12 7	Ammoniacal liquor and sulphate of ammonia	6,569	16	9		
Public lamps—lighting and repairing				3,034 5 7					44,729	14 7
Rents, rates, and taxes				7,737 14 0	Miscellaneous receipts—					
Management—					Rents receivable	£193	17	1		
Directors' allowance	£1,250	0	0		Transfer fees	27	7	6		
Company's Auditors	75	0	0						221	4 7
Salaries of Secretary, Accountant, and Clerks	1,324	19	8							
Collectors' salaries and commission	1,605	14	9							
Coin meter collection	423	18	10							
Stationery and printing	761	16	11							
General charges	544	15	11							
				5,986 6 1						
Bad debts				674 16 3						
Discount and allowances				1,066 0 4						
Law and Parliamentary charges				317 18 9						
Superannuation and allowances				210 9 6						
Official Officers				167 8 2						
				£161,342 0 9						
Balance carried to net revenue account				55,580 16 5						
				£216,922 17 2					£216,922	17 2

PROFIT AND LOSS (NET REVENUE) ACCOUNT.

Interest on debenture stock	£5,294	9	10	Balance from last account	£50,428	19 2
Interest and dividend balance	385	7	11	Less dividend for half year ended June 30, 1899	49,475	12 6
Balance available for dividend carried to balance sheet	50,854	5	4		£953	6 8
				Balance from revenue account	55,580	16 5
	£56,534	3	1		£56,534	3 1

STATEMENT OF COALS.

Description of Coal.	In Store, June 30, 1899.	Received during the Half Year.	Carbonized during the Half Year.	Used and Sold in Half Year.	In Store, Dec. 31, 1899.
	Tons.	Tons.	Tons.	Tons.	Tons.
Common coal	30,171	81,159	93,877	495	16,958
Cannel	7,666	Nil.	49*	639	6,977
	37,837	81,159	93,926	1,134	23,935

* Oil used for oil-gas manufacture, 1,507,119 gallons.

STATEMENT OF GAS MADE, SOLD, &c.

Quantity Made. Meter Register (and estimated).	Quantity Sold. Public Lights and under Contracts (estimated).	Quantity Sold. Private Lights (per Meter).	Total Quantity accounted for.	Number of Public Lamps.
Thousands.	Thousands.	Thousands.	Thousands.	
1,420,233	64,257	1,236,072	1,322,121	5,674

STATEMENT OF RESIDUAL PRODUCTS.

	In Store, June 30, 1899.	Made during Half Year.	Used in the Half Year.	Sold in the Half Year.	In Store, Dec. 31, 1899.
Coke—tons	70	57,499	16,694	34,372	6,503
Breeze—tons	1,100	8,775	—	8,394	1,481
Tar—gallons	494,500	1,099,176	—	1,121,697	471,979
Ammoniacal liquor—butts	2,439	26,924	17,873	—	11,490
Sulphate of Ammonia—tons	200	542	—	339	403

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

Half-Yearly Report and Accounts.

At the Half-Yearly Meeting of the above-named Company last Saturday, the accounts presented showed that the revenue for the six months ending Dec. 31 last amounted to £156,138, while the expenditure came to £119,791, inclusive of £5993 for debenture interest; leaving a balance of £36,347 to be carried to the profit and loss account. Adding the £5079 brought forward, there was produced a sum of £41,426. The Directors recommended the payment of the usual dividends at the rates of 10½ and 7½ per cent. per annum on the respective shares. This would absorb £33,567, and leave £7859 to be carried forward. The accounts further showed that £34,274 had been laid out for capital purposes; £21,314 being for manufacturing plant, £4745 for new mains and services, and £3022 for automatic cookers, fittings, &c. The total expenditure of capital up to the close of last year amounted to £1,006,067, as compared with £999,906 called up; showing an overdraft of £6161. The revenue from the sale of gas came to £119,590; the rental of meters and fittings, to £7600; and the sale of residuals produced £28,485. Gas manufacture cost £87,318 (coal figuring for £42,796, and cannel and oil for £17,968); distribution, £9665; and management, £4230. There were 77,163 tons of coal and cannel carbonized, and 784,002,000 cubic feet of gas made, of which 697,135,000 cubic feet were sold and 709,880,000 cubic feet accounted for. The estimated quantities of residuals were: Coke, 93,230 chaldrons; breeze, 6370 chaldrons; tar, 712,406 gallons; and ammoniacal liquor, 1,564,282 gallons.

BOARD OF TRADE REPORT ON GAS, ELECTRIC LIGHTING, AND WATER BILLS AND ORDERS OF THE PRESENT SESSION.

The Board of Trade report on the applications for Gas, Electric Lighting, and Water Bills and Provisional Orders for the present session was issued last Wednesday. It shows that the number of Bills relating to the supply of gas is 27, of which 26 relate to England and Wales and one to Scotland. The capital proposed to be raised is £4,585,686—£1,327,500 by shares and £3,258,186 by loans; the latter amount including £10,500 proposed to be authorized for gas expenditure by a Bill classed among the Electricity Bills, and £12,534 by a Water Bill. There are 14 Bills relating to the supply of electricity, two of them being for Ireland and the rest for England and Wales. In only nine cases is the proposed capital stated; but it amounts to £7,845,166—£5,840,000 by shares and £2,005,166 by loan. There are 47 Bills dealing with the supply of water, 42 of which are for England and Wales and 5 for Scotland. The total capital asked for is £23,979,347—£1,193,215 by shares and £22,786,132 by loans. Provisional Orders to the number of 21 have been applied for in respect of gas and water supply, and 108 in regard to electric lighting schemes, as compared with 20 and 109 last year. The capital proposed to be raised under these Orders is: Gas, £267,625; water, £370,000; gas and water, £34,375 (making a total of £672,000 for gas and water); and electric lighting, £1,791,241. Compared with last year, the capital required for gas purposes by Bills is £1,867,896 less, for electric lighting £1,720,166 more, and for water supply £14,303,820 less. For Gas and Water Orders, the capital proposed is £152,834 more, and for Electric Lighting Orders £2,203,060 less than in 1899.

NEW GAS-WORKS AT CROMER.

An interesting programme was provided for the shareholders of the Cromer Gas Company on the occasion of their annual general meeting last Thursday. In the first place, the Chairman (Mr. Benjamin Rust), under the guidance of the Engineer (Mr. Percy Griffith, Assoc.M.Inst.C.E.), conducted a party of about 40 gentlemen on a tour of inspection round the new gas-works, after which he opened a valve admitting the gas from these works to the town main for the first time, and amid much enthusiasm declared the works open. The company then adjourned to the Hotel Metropole, where an excellent lunch was provided by the Contractors, Messrs. R. Dempster and Sons, Limited, of Elland. After the usual toasts had been honoured, a further adjournment took place to the Town Hall, where the annual general meeting was held.

It may be remembered that in 1898 the Company applied to Parliament for a Bill giving them increased capital powers, and enabling them to extend their works. This Bill was opposed by the landowners, on the ground that the prominent position of the works was a serious check to the development of the town, and considerably depreciated the value of the land in this part of Cromer. This contention was so obviously correct, that the Directors of the Company at once opened negotiations with the landowners as to the terms upon which they would consent to remove the works to another part of the town where the same objection would not exist. The outcome of these negotiations was that the landowners agreed to give a new site containing 4 acres adjacent to the Midland and Great Northern Railway, and about a mile to the west of the Cromer Beach Station, together with a sum of £2000, and to allow the Company to continue in occupation of the existing works for a period of five years. Early last year, the Company let the contract for the construction of the new works to Messrs. R. Dempster and Sons; and the work was immediately put in hand. The works are now practically completed; and gas making commenced last week in time to allow of the opening ceremony on Thursday. The works form the first instalment of a scheme which, when fully carried out, will give a capacity of 2 million cubic feet per day, or half a million cubic feet per day per acre of ground occupied. As this has involved very liberal provision being made for extensions, a heavy initial outlay (about £20,000) has been incurred for the first section of the works, which has a capacity of about 150,000 cubic feet per day, or 30 millions per annum; and the capital of the Company will for a time be proportionately high, especially as the original 10 per cent. and 7 per cent. capital has at the same time been converted into 5 per cent. stock. But as the works are gradually enlarged, the capital expenditure on extensions will, of course, be much less than it otherwise would be; and the Directors are confident of very shortly being in a position to write off the capital represented by the old works, now about to be abandoned, without unduly sacrificing the interests of the shareholders for the time being. The Directors' report just issued recommended the payment of a dividend of 4 per cent. on the consolidated stock; and this will allow of £455 being carried forward, compared with £377 last year. The Engineer (Mr. Percy Griffith) stated at the meeting that he had carefully calculated the prospects as to dividend for the current year, and felt confident that, in spite of the sudden and heavy increase of capital involved by the cost of the new works having to be met during this year, the dividend would be maintained without any necessity of encroaching upon the reserve fund; and in each succeeding year the prospects would certainly improve proportionately to the increase in the sale of gas. This increase had been in the past year 22 per cent. on the sale of gas in 1898; and as an important extension of the mains to Overstrand is now being carried out, there is little doubt of this rate of increase being at least maintained, if not largely exceeded, nduring the current twelve months. The rapid development of the tow now taking place is a sufficient guarantee of the future growth of the gas undertaking.

The following is a brief description of the new works. The retort-house is 45 ft. long by 35 ft. wide, and is very lofty; provision having been made for stoking machinery being adopted as soon as the make of gas is sufficient to justify the capital outlay. It is furnished with four arches, each containing six retorts, which are estimated to produce 7500 cubic feet of gas per mouthpiece per day, and are set on Chester's system of regenerative firing, with all the most modern improvements in the way of fittings. The coal-store occupies the space between the retort-house and the railway siding, and is 50 ft. by 25 ft. in plan. Adjacent to the retort-house is a building including exhauster-house, with accommodation for four small exhausters or two large ones, boiler-house, with space for three boilers, workshop, store, weighbridge, stokers-room, large water, tar, and liquor tanks, with a well and pump for water supply. Underground storage is also provided for tar and liquor, with a pump to fill the overhead tanks, from which railway trucks can be loaded direct. The purifying plant comprises a Livesey washer and tower scrubber, also four purifiers, 12 feet square (for oxide), and two purifiers 10 feet square (for lime). The purifier-shed is a light and roomy structure, giving ample floor-space for revivifying the oxide, and includes a large meter-house at one end. The gasholder is constructed with Cutler's patent guide-framing, and is 60 feet diameter, with two lifts of 20 feet each; provision being made for a third lift being subsequently added, when the capacity will be 116,000 cubic feet. A handsome building provides residential accommodation for the Manager, a spacious governor-room, office, and photometer and board-room. Two cottages have also been erected on the works for the use of the stokers. Twelve-inch mains have been laid all over the works, and into the heart of the town.

PROPOSED ROYAL COMMISSION ON COAL SUPPLY.

A short time ago, Mr. A. D. Provand, the member for the Blackfriars and Hutchesontown District of Glasgow, asked the First Lord of the Treasury whether it would not be advisable to appoint another Royal Commission to inquire into the question of the coal supply. Mr. Balfour replied that he thought it would not, unless there were some practical issues to place before it. Mr. Provand has since addressed a letter to Mr. Balfour briefly calling his attention to some facts which have arisen since the last Commission reported, in 1871, on the output, export, and probable duration of the coal supply. He says:—

It is 29 years since the report of the Commission was issued; and some of their estimates and conclusions are already shown to be much astray. They estimated that our population in 1901 would be 35,000,000, while it will really be about 41,000,000; and they also estimated that our total consumption of coal in 1901 would be 162,400,000 tons, and the export 12,000,000 tons—making a total output of 174,400,000 tons. The foregoing figures are very different from the actual facts. Our output of coal in 1899 was 220,000,000 tons, of which the export was 41,000,000 tons. Of coal and cinders, there were exported about 2,000,000 tons; and the bunker coal for steamers' use was about 12,250,000 tons. Two years hence—that is to say, in 1901 (the year for which the Royal Commission made their estimate)—the production of coal will probably be several millions more than last year. Taking this at only 4,000,000 tons, the difference between their estimate and the actual output in 1901 will be as 174,000,000: 224,000,000; making a difference of 50,000,000 tons in excess of what the Royal Commission estimated. In 1879, the export (not reckoning bunker coal, coke, or cinders) was 10,300,000 tons. The Royal Commission did not expect that it would ever exceed 13,000,000 tons, on the ground that the development of coal in North America, India, China, and other countries, would check it. But our export is already 41,000,000 tons—about 3½ times what the Royal Commission estimated; and it is steadily increasing year by year.

In regard to the probable duration of our coal supply, the Royal Commission dealt with three estimates—(*a*) according to Professor Jevons, showing that it would probably last about 110 years; (*b*) another one by Mr. Price Williams, estimating 360 years; and (*c*) by the Commissioners themselves, taking 276 years as the probable duration. Mr. Geddes, who reported on the Scottish coalfields, considered 12,000,000 tons, which was the total output in 1866, as likely to represent the future annual output in Scotland; and he based on this the assumption that our supply in Scotland would last for 820 years. But the output in Scotland is now 35,000,000 tons—nearly three times Mr. Geddes' estimate; and it is annually increasing. Within the last few years, several fresh estimates have been made, more particularly directed to the question of how long our coal supply would be commercially valuable. Fifty years have been stated by competent experienced engineers as the probable period when the principal seams will be exhausted; but in certain parts of the country a much shorter estimate than this has been arrived at. For example, in a paper read before the Philosophical Society of Glasgow in 1893, on the "Recent Developments of the Hamilton Coalfields," by Mr. R. T. Moore, mining engineer, Glasgow, he stated that at the then output of 11,000,000 tons per annum the field would last only 24 years. This opinion he confirms by a letter to myself a few days ago. The time is therefore now only 17 years until the cheaply-worked coal of Lanarkshire, by which Glasgow and its industries have been largely created, will come to an end. The manufacturing population of Glasgow and the neighbourhood supplied by Lanarkshire coal is more than one-fourth of the whole population of Scotland. No doubt, after the exhaustion of these cheaper coals, there are others obtainable from a greater depth, and Ayrshire and the East of Scotland will be able to supply Lanarkshire; but it will be at a considerably increased cost, and must therefore materially affect manufacturing industries. The extreme possible duration of our coalfields is a matter of little practical value. The question of importance is to ascertain for how long, having regard to our output, to our export, to the increasing cost with us, and to the output and cheapness in other countries, we shall be in a position to compete as hitherto in those industries requiring the consumption of considerable quantities of coal.

There are other facts besides those above referred to which ought to be considered. For example, we have in Wales the most valuable steam coal for naval use in Europe. Of this the supply is limited. It is an important arm of defence; but it will not remain so permanently unless we reserve it for our own use. This is a question for a Royal Commission. Another point which was absent from the minds of the Royal Commissioners in 1871 was the coal development of the United States. This is rapidly increasing, and will probably equal or excel our own output within a few years. This increase of output has been accompanied by a declining price until the average cost at the pit is lower than in this country. The recent rise in price with us will probably not be maintained; but few expect that it will go back to the figure of a year ago.

There are other matters to which I might draw attention; but I believe I have said enough to show the necessity for the appointment of a new Royal Commission, in regard to which I suggest that the terms of reference be wider than those to the former Commission. I append a copy of

these to show that what our commercial competitors were doing was thought so little of that it was not even referred to. The case is now very different. There are many new factors to be considered, not only in regard to our own output, export, and the duration of our coal supply, but also in regard to the same matters in other countries.

The following are the terms of reference to the Royal Commission of 1871: To investigate the probable quantity of coal contained in the coal-fields of the United Kingdom, and to report on the quantity of such coal which may be reasonably expected to be available for use. Whether it is probable that coal exists at workable depth under the permian, new red sandstone, and other superincumbent strata. To inquire as to the quantities of coal at present consumed in the various branches of manufacture, for steam navigation, and for domestic purposes, as well as the quantity exported, and how far, and to what extent, such consumption and export may be expected to increase. And whether there is reason to believe that coal is wasted by bad working, by carelessness, or by neglect of proper appliances for its economical consumption.

THE NEW GAS-WORKS AT PERTH.

Resignation of the Manager—Contractor to be Sued.

A Special Meeting of the Perth Gas Commissioners was held on Monday, the 26th ult., to consider and dispose of a resolution of the Commissioners in Committee to accept the resignation of the Gas Manager. Lord Provost Macgregor, who presided, called on the Clerk to read the minute of the meeting held in Committee on the 19th ult.

The minute was read as follows: "Lord Provost Macgregor stated the Clerk had received a communication from Mr. Wilson, Gas Manager, which he desired the Clerk to read. The Clerk thereupon read a letter of this date (19th) from Mr. Wilson resigning his appointment as Gas Manager to the Commissioners. Agreed, on the motion of Councillor Watson, seconded by Lord Provost Macgregor, that the resignation be accepted, and the Clerk be instructed to write Mr. Wilson accordingly."

Mr. Watson formally moved that they accept Mr. Wilson's resignation in the terms indicated in the minute.

The Lord Provost seconded.

Mr. M'Vicar said that if he was in order, he wished to enter his dissent.

The motion was unanimously agreed to with one dissentient.

The meeting next had under consideration the resolution of the Commissioners in Committee on the 19th ult. to adopt legal proceedings against the Contractors in reference to the defective wall at the new gas-works. The minute of meeting was read by the Clerk as follows: "Read memorial to Counsel as to Commissioners' legal position with reference to defective condition of wall at new gas-works, and their remedy, and against whom, with the queries attached, and Counsel's opinion thereon; also read a letter of date 27th ult. [February] written by the Clerk to each of the Gas-Works Engineer and Inspector of Works, and the replies to each of their letters. After due consideration, the meeting agreed, on the motion of Councillor Watson, seconded by Councillor Chalmers, that an action of damages and for payment should be raised by the Commissioners against Messrs. Symington and Son, the Contractors for the wall. Remit to a Committee consisting of the Lord Provost, Councillors Brand, Chalmers, Ritchie, and Watson, to have the necessary steps taken for the institution of this action and with power to obtain the evidence of two skilled men as independent witnesses."

Mr. Watson moved approval of this minute, and that they take up the case against Messrs. Symington and Son as far as regards the defective work at the new gas-works. This had occupied their attention for some considerable time; and they had been reluctantly compelled, in their own interest, as well as in the interest of all corporate bodies, to see that a case of this kind should not be allowed to pass. The work had been found to be very defective in many respects, both in quantity and quality. Some of the work had not been done at all, and had been charged for; and in many other respects it was very deficient. Consequently, as the amounts charged for this work had been overpaid, it was desirable that they should get to the bottom of it, and to demand a remedy. They had consulted Counsel, and were assured that they had a good case; and he thought it desirable the Commission should see the case through.

Lord Provost Macgregor seconded the motion. It was impossible, he said, that they should allow such a grave matter as this to pass without getting redress; and this was the only manner evidently in which they could obtain the satisfaction to which the Commission were entitled. They would not enter into the question at large. It was simply a glaring fact that this extraordinary work they were asked to take as good and sound work was found to be so defective and so unsatisfactory that it was impossible to pass it as it was.

Mr. M'Vicar said he would make the same suggestion as he made in Committee—that this question of raising an action against the Contractors should be reconsidered in Committee. If his suggestion was not agreed to, he would move an amendment. His reason was that if they talked over the matter again, perhaps an action might be raised against others.

The Lord Provost: I think you should be satisfied with the Committee appointed to deal with the matter.

Mr. Ritchie said the reason why they had not entered into certain details that night, so far as they dealt with the question, was not any desire to keep the public from knowing, because it would be known in due time, but that it was desirable that the matters should not be known too soon.

Mr. M'Vicar: I move, as an amendment, that we raise an action, not only against the Contractors, but also the other parties implicated in this question—viz., Mr. Wilson and Mr. Wynn.

The Clerk (Mr. Begg) said this had been under discussion with Mr. Watson and himself, and Mr. M'Vicar and himself; and he stated that Mr. Watson objected to Mr. Wilson and Mr. Wynn being spoken of in this matter, and being included in any amendment to the resolution agreed to the previous Monday. He advised Mr. M'Vicar to move disapproval of the resolution and to remit the matter back to the Commission in Committee to consider whether any action should be taken against the Manager, along with the Contractors. That he thought would be a competent amendment.

Mr. Hardie seconded the amendment.

A vote was taken, with the result that 23 voted for the motion and 2 for the amendment. The motion thus became the finding of the meeting.

The "Perthshire Constitutional," in its issue of last Wednesday, contained the following editorial comment upon the meeting: "It was well that the Gas Commissioners of Perth kept their mouths sealed on Monday night when they agreed first of all to accept the resignation of the Gas Manager, and also take steps to receive from the Contractor for the wall which is alleged to be defective, that redress to which the Commissioners claim to be entitled. At one stage of the meeting it appeared as though the Commissioners would break through their resolve to say no more than was judicious; but, fortunately, better sense gained the day, and nothing out of place was said, though it was quite apparent that feelings were strong. To have entered into the merits of the case on Monday would simply have led to the washing of dirty linen before the public; and to have indulged in such an objectionable practice would not have been dignified, nor would it have been wise under the circumstances. If the case be as bad as it is hinted to be, the Commissioners acted wisely in taking steps to have it cleared up in the manner agreed upon."

GERMAN CONTINENTAL GAS COMPANY.

Report and Accounts for 1899.

We have received, as in past years, a copy of the annual report and balance-sheet submitted, on the 30th ult., to the forty-fifth general meeting of the above-named Company, of which Dr. W. von Oechelhaeuser is the Managing-Director. We extract the following particulars.

The general expansion of trade which prevailed during 1899, no less than during 1898, was reflected in the business of the Company by an increase in the annual production of gas of 7·87 per cent. This was attended by an increase of 68,258 in the number of burners in use, indicating the marked progress of the Company's business, since in the early years of the present decade the annual increase was not more than one-fourth that number. Of the new burners installed for lighting purposes, 91·64 per cent. were of the incandescent type, 7·95 per cent. were flat flame, and only 0·41 per cent. argand. Such figures clearly show that the incandescent system now constitutes the normal method of using gas for lighting; and this fact must be recognized when comparisons of the cost of lighting by gas and other illuminating agents are made. The Company's statistics prove that only the incandescent burner now has to be taken into account in gas lighting; and the advances in its manufacture which are continually taking place constantly increase its efficiency, and place gas in a still better position to compete with other means of illumination. Prepayment meters have been responsible for a considerable part of the increased sales of gas during the year. The number in use rose from 4652 at the close of 1898, to 8092 at the end of 1899. They are now giving great satisfaction; and the number of failures is no greater than would occur with the same number of ordinary meters.

At the Erfurt works of the Company, a water-gas installation commenced work only late in the autumn; and the results of its adoption have not been felt in the year's accounts. The advantages to be derived from this method of producing gas have, however, already been realized, in the ease with which the make can be quickly increased or diminished by its aid. The water gas at Erfurt is carburetted by means of benzol. The rise in the price of coal which has been witnessed during the year favours the spread of the water-gas process. The Company have been able, however, under their contracts to secure nearly the whole of the coal required during the year at the prices which prevailed before the recent rise; and fortunately the term of these favourable contracts does not expire until April 1, 1901.

The total gas production in the year amounted to 53,111,605 cubic metres (1,875,721,309 cubic feet). Of this quantity, 19·99 per cent. was sold for heating, cooking, and power purposes; while the unaccounted-for gas, which in 1898 had risen to 4·42 per cent., fell to 4·09 per cent. of the total make. The average consumption per burner fell, however, from 3313 to 3164 cubic feet. The number of burners in use at the close of the year was 595,859. The length of mains served by the Company considerably increased. Of gas-engines, 967, affording 5133½-horse power, were supplied. The carbonizing returns show that the make per ton of coal increased from 10,847 cubic feet in 1898 to 10,869 cubic feet last year; while the coke used for firing the retorts dropped from 16·78 to 16·72 per cent. of the weight of coal carbonized. The output of the Company's electricity supply works at Dessau increased by 36 per cent. The gas-engines used at these works showed a greatly improved duty; the consumption of gas during the past year averaging only 17·58 cubic feet per effective horse-power-hour.

A new contract has been made for the supply of gas to Jonitz, a suburb of Dessau, until the end of the year 1925.

The report contains obituary notices of Herren W. Conrad and F. A. Neubauer, who had served as Directors for 37 and 32 years respectively.

The gross profit for 1899 amounted to 4,030,907·24 marks (about £196,630), and the net profit to 3,208,849·13 marks (about £156,530). After the customary contributions have been made to the reserve and contingency funds, the balance admits of the payment of a dividend of 13⅓ per cent. for the year. The dividend for 1898 was at the rate of 12½ per cent., and that for 1897 only 11 per cent. The balance carried forward to this year's account is 29,028·47 marks (about £1416). The finances of the Company consequently are at the present time in a highly satisfactory position.

Twelve towns or districts are now served by the Company. Among these, the more important are Frankfurt-on-Oder, Potsdam, Dessau, Warsaw, Erfurt, Nordhausen, Gotha, and Ruhrort. In most cases, numerous suburbs and outlying townships are also furnished with the Company's gas.

The Water Committee of the Liverpool Corporation have ordered the Water Engineer to prepare plans and specifications for the construction of an additional filter-bed at Chorley. They have also agreed to recommend the purchase from the Earl of Derby of 32 acres of land at Prescot, at £120 per acre, for the construction of additional storage works.

COLONIAL GAS UNDERTAKINGS.

In the "JOURNAL" for the 13th ult., we gave a report of the proceedings at the half-yearly general meeting of the Australian Gaslight Company, at which the accounts for the six months ending Dec. 31 were presented. The accounts of other Colonial gas undertakings have recently come to hand, from which the following particulars are extracted.

The Brisbane Gas Company had in the six months ending Dec. 31 last a revenue from the sale of gas, &c., of £21,693; and the balance of £2348 brought forward made a total of £24,041. The expenditure on manufacture, allowance for depreciation, &c., came to £12,382; £1000 was placed to the reserve; £432 was paid for interest; and there was left a balance of £10,227. The Directors recommended a dividend of 5 per cent., which, with the tax (£347), amounted to £7345; leaving £2882 to be carried forward. It is satisfactory to find that the Company's mains are being extended in many localities, and that there is a steady increase in the output of gas.

The profit realized by the Maryborough (Queensland) Gas Company, Limited, in the half year ending Dec. 31, with the balance brought forward, was £1047. After deduction of the dividend tax (£38), there was left £1009 to the credit of the profit and loss account. The Directors recommended that £771 of this sum should be used in paying a dividend for the six months at the rate of 6 per cent. per annum; and that the balance of £238 should be carried forward.

The North Shore (Sydney) Gas Company made a net profit of £3049 on the sale of gas in the second half of last year. Adding the balance brought forward (£59), there was a sum of £3108 available for distribution at the ordinary general meeting on the 29th of January. Out of this, the Directors recommended the following appropriations: A dividend of 3 per cent. for the six months, free of income-tax, £2844; payment to the officers' fidelity guarantee fund, £200; interest suspense account, £10—total, £3054. This would leave a balance of £53 to be carried forward. The recommendation was agreed to.

At the half-yearly meeting of the Rockhampton (Queensland) Gas Company on the 26th of February, the Directors reported that the result of the operations in the six months ending Dec. 31 had, on the whole, been satisfactory. The demand for gas was largely on the increase, and the general consumption was assuming the proportions of former and more prosperous years. The gas operations resulted in a profit of £2225; but the Company's electrical undertaking entailed a loss of £149. After providing for interest on debentures, &c., and dividend duty, the profit and loss account showed a credit of £1551. As this was not quite sufficient for the usual dividend, the Directors recommended appropriating £133 from the reserve, and paying a dividend at the rate of 7 per cent. per annum upon the ordinary shares, and of 9 per cent. per annum upon the preference shares, free of duty. This was sanctioned.

The revenue from the sale of gas, coke, tar, &c., by the Wellington (N.Z.) Gas Company last year amounted to £36,764. As there was a balance of £3889 brought forward, there was a total of £40,653 to meet the expenditure and the dividend. The former included £16,187 for coal, wages, purifying, renewals, &c.; £2844 for interest; a sum of £2000 was written off plant; and taxes, Directors' fees, salaries, &c., came to £3856. The interim dividend paid in July last took £5000; and there was left a balance of £10,518 on the profit and loss account. The Directors reported a satisfactory increase in the Company's business; and they recommended the payment of a dividend of 10s. per share on the fully-paid shares, and of 5s. per share on those partly paid up—being similar amounts to those paid in July.

ANGLO-ROMANO GAS COMPANY.

The report read at the last meeting of this Company furnished the following details: The quantity of gas sold was 14,644,171 cubic metres (about 517 million cubic feet), 4,024,552 cubic metres of which went to the Municipality, and 10,619,619 cubic metres to private consumers; the increase, as compared with the previous financial period, being 594,691 cubic metres for private consumers. This augmentation, due to reduced rates and other concessions, is the more deserving of note as many consumers have adopted electric lighting, which has also become cheaper. There was an increase of 2100 metric tons in the amount of coal carbonized, with a corresponding improvement in the sale of bye-products, for which better prices were obtained, but not sufficient to compensate for the dearness of coal, which was, on an average, 2 lire more per ton than before. The mains were increased by 3996 metres (4395 yards), and the total length is now 206,350 metres (226,985 yards). There were also laid on 160 rising pipes, bringing up the total to 482. Interior fittings to the number of 813 were put in, making a total of 3430, of which 2766 are in operation. Fittings with prepayment meters attached were also increased. A sum of 237,496·64 lire was expended on this work during the year. On Dec. 31 last, there were 8300 public-lamp burners, 7609 of which were in use; being an increase of 139 as compared with the number at the corresponding date in 1898. There were also 15,295 meters of all kinds employed by private consumers, representing 122,286 burners—an increase of 1110 meters and 4012 burners as compared with 1898. In electric lighting, there was an augmentation, as in gas, though in greater proportions. Last year the consumption was 17,854,017 hectowatts—an increase of 2,441,878 hectowatts as compared with 1898. Besides this, 4,479,272 hectowatts were sold for motive power, or 4,408,022 hectowatts more than in the preceding year. Lastly, 24,174,933 hectowatts were supplied to the Tram and Omnibus Company more than in 1898. This enormous increase, due to new lines, greatly helped to compensate for reduced rates. The profits last year were 1,195,125 lire, making, with the 3079 lire brought forward, a total of 1,198,204 lire available for distribution according to the Company's statutes, as follows: To the shareholders, 5 per cent. on the capital, 700,000 lire, and 85 per cent. of the remainder, 420,000 lire; 10 per cent. to the reserve fund, 49,420 lire; 1 per cent. to the Manager, 4942 lire; 4 per cent. to the Vigilance Committee, 19,768 lire; and to the inspectors, 2000 lire. These amounts totalled up to 1,196,130 lire; leaving to be carried forward to the new account 2074 lire. As in October last the shareholders received 420,000 lire as interim dividend, the coupon payable on the 15th inst. will be 25 lire per share.

THE POWERS OF THE MASSACHUSETTS GAS COMMISSIONERS.

The Price of Gas at Haverhill.

We learn from the "American Gaslight Journal" that interest in the question of the price of gas at Haverhill (Mass.), which, it may be remembered, was ordered by the Board of Gas and Electric Light Commissioners of that State to be reduced from $1 to 80 c. per 1000 cubic feet as from the 1st of February last (see *ante*, p. 417), continues unabated; and it is now expected that the decision of the United States Circuit Court will be given early in the present month. The bill of complaint filed by the Company is a voluminous document, which contains many specific statements regarding the entire controversy which has arisen since it was started last year for lower rates. The bill was to be returned on the 2nd inst.; and in it the Company recite that the actual cost of gas production, including the amount allowed for depreciation and a fair return for money invested, is 91 c. per 1000 cubic feet. They also state that the price of $1 per 1000 feet would never have been made if it had been known that the cost of materials would increase as it has done. The Company also contend that at the present time $1·10 would be a fair charge for gas at Haverhill. When interviewed early last month at the Massachusetts State House, the Commissioners said they had no remarks to make regarding the action of the Company in refusing to abide by their order for 80 c. gas; and it has been rumoured that the Commission intend notwithstanding to take steps to enforce it. Nothing will, however, be done until the matter has been settled in the Courts.

Referring to the above, our contemporary's correspondent "Observer" says: "As predicted, the Haverhill Gas Company decided to contest the legality of the order of the Board of Gas and Electric Light Commissioners requiring them to furnish gas at 80 c. per 1000 cubic feet, and a petition was filed in the United States Circuit Court on the 1st of March to restrain the Commissioners from enforcing their order. The bills are being sent out at $1 per 1000 feet; and a good 25-candle water gas is being distributed. It is not believed, however, that furnishing good gas and good service, or proving to the Court that gas cannot be made and sold at a profit in Haverhill at 80 c. per 1000 feet, will suffice to allay the disturbance. The discontent appears to be based upon the belief of both the public and the Commission that the Haverhill Gas Securities Company intend, in one way or another, ultimately to make the people of Haverhill pay interest on $1,000,000, while the actual capital invested and accumulated does not amount to over $400,000. Until some assurance is given to the Haverhill people that the fixed charge due to capital shall be a reasonable one, it is not believed that any satisfactory peace can be assured, and further conflict will only make the matter worse. The mistake of over-capitalization, and extreme reduction by the Commission of the selling price to a point below cost, at existing prices of materials, have wrought havoc among the gas companies of the State, and they are prayerfully asking that no further mistakes shall be made. Some form of action looking towards lower prices is being taken in practically every large city in the State, and in many of the towns."

INSPECTION OF GAS AND METERS IN MASSACHUSETTS.

Calorimetric Tests of Gas.

We have received the annual report of the Inspector of Gas and Meters in Massachusetts (Mr. Charles D. Jenkins). It shows that in the year ending Dec. 31 last, there were 687 gas inspections made, 30,445 gas-meters examined, 5 meter-provers graduated, and a number of gas analyses carried out, in addition to the regular office work. The gas supplied by the big companies in the State was tested at regular intervals by Mr. Jenkins or his assistant without notice; and the results were furnished to the Board of Gas and Electric Light Commissioners from time to time during the year. The average illuminating power of the coal gas, supplied by 36 companies, was 18·23 candles, as compared with 18·43 candles in 1898; of the water gas, supplied by 16 companies, 23·88 candles, against 23·72 candles; of the gas sent out by the ten mixed coal and water gas companies, 20·22 candles, against 20·21 candles; and of the petroleum oil gas supplied by 7 companies, 40·97 candles, against 38·02 candles. The average quantity of sulphur found in the gas of all the companies except those supplying oil gas was 10·57 grains per 100 cubic feet, against 9·61 grains in 1898; the ammonia averaging 2·52 grains, against 2·06 grains. There were 64 violations of the law last year—rather more than usual. Eudiometric analyses of the gases were made for various reasons, and the results are recorded in a table from which the following figures have been extracted:—

Company.	Candle-Power of Gas.	Specific Gravity.	Illuminants.	B.T.U. Calculated.
Cambridge	16·9	..	4·07	602·0
,,	17·0	..	5·60	629·0
Chicopee	22·2	..	12·61	633·0
Jamaica Plain	13·4	..	3·83	..
Fitchburg	14·5	·397	3·81	..
Attleborough	14·8	..	4·83	..
Jamaica Plain	18·9	·507	5·75	724·9
,, ,,	17·4	·501	5·92	676·4
Boston	27·1	..	14·83	691·2
,,	27·0	..	16·13	714·3
,,	26·2	..	14·33	684·9
,,	25·0	..	14·07	689·4
,,	23·3	·582	13·07	659·4
,,	26·2	..	13·43	661·4
,,	23·9	..	13·09	661·6
Brookline	25·0	..	13·61	654·1
,,	26·6	..	13·36	655·3
,,	26·9	..	12·49	629·2
,,	24·5	..	14·20	674·4
,,	26·8	..	14·93	706·1
,,	24·4	..	13·43	679·7
,,	23·0	·524	8·88	647·6

The first two analyses are of gas of low candle power; the third is an

analysis of medium candle-power gas; the next three relate to coal gas below the standard; the next two are of Jamaica Plain gas after being taken from the Massachusetts Pipe-Line Gas Company. The remaining analyses were made in response to the request of the Board of Gas and Electric Light Commissioners. In the table, the calorific powers are calculated for gas at 60° Fahr. and 30 inches of the barometer, and include the latent heat of the steam formed. The heat-units, on this account, will be from 35 to 50 B.T.U. higher than the usual "net" units.

Mr. Jenkins points out that more attention should be paid to burners, both for lighting and heating, in order to develop the best results from the gas used, and at the same time not to waste it. The burner tested gave, on proper regulation, 23·1-candle power when burning 5 feet of gas; but by simply opening the cock and supplying more gas, an illuminating power of only 21·2 candles was developed, although 10·2 cubic feet were being consumed. By using burners of this sort, the amount of gas burnt would be more than twice as much as in the first case, and the light actually obtained upwards of 8 per cent. less.

With regard to gas-meters, during the past year there were 30,445 inspected; 29,960 were new ones, or those which had just been repaired, and were examined and sealed, if correct, before being used. Very few required adjustment before passing inspection. The remaining 485 meters belong to the class of "complaints." By the provisions of section 12, cap. 61, Public Statutes, "meters in use shall be tested by the Inspector or by his assistant or deputy on the request of the consumer or of the gaslight company." Meters so tested are called "complaints;" and the results of these tests follow. One meter would neither pass gas nor register; while 11 meters would pass gas, but not register. The average error of the remaining 473 meters was 0·64 per cent. fast. The law allows a meter to be stamped as correct that does not vary more than 2 per cent. either way from the standard measure. There were 199 meters—41·04 per cent. of the total number re-inspected—which were fast, the average error being 4·64 per cent.; 49 meters, 10·10 per cent. of the total, slow, the average error being 13·52 per cent.; and 225 meters correct within the legal limits. Of the fast meters, 118 were between 2 and 5 per cent., 73 between 5 and 10 per cent., 7 between 10 and 15 per cent., and 1 between 15 and 20 per cent. Of the slow meters, 19 were between 2 and 5 per cent., 17 between 5 and 10 per cent., 5 between 10 and 15 per cent., and 1 between 15 and 20 per cent.; and there was 1 each 20, 25, 30, 35, 60, 105, and 160 per cent. slow.

ACETYLENE LIGHTING IN FRANCE AND BELGIUM.

Recent French publications have furnished particulars of the progress of the Urban Acetylene Lighting Company, gathered from the report lately issued on the working of the undertaking from its formation on May 25, 1898, to Dec. 31 last. The capital is 2,000,000 frs. (£80,000), in 20,000 shares of 100 frs. each; and it has all been paid up. There are 4000 founders' shares, which entitle holders to 50 per cent. of the profits as soon as these allow of the payment of a dividend of 10 per cent., or 10 frs. per share. In the period under notice, the Company have been able to clear off more than 10 per cent. of the preliminary expenses, which amounted to 668,874 frs., and pay a dividend of 15·83 frs. per share; representing practically 10 per cent. per annum. The Company have acquired, and are working the Turr patent, which was briefly described in the "Journal" for Feb. 16, 1897. The special features of the system are claimed to be the absence of movable parts and the use of a generator which furnishes increased guarantees of safety. Without entering into the merits of the system, it may be mentioned that the Company obtained the gold medal—the highest award—at the Acetylene Congress at Buda Pesth last year for their plant. They attribute their success to the fact that the system allows of the utilization of acetylene not simply alone, as a naked flame, but in conjunction with some incandescing material, such as a mantle, whereby the light of 10 candles is produced, it is stated, at the very low cost of 0·5 c. per hour. In Paris, the Company have obtained the contract for lighting the Rue des Archives, the Passage St. Pierre-Amelot (near the Place de la Republique), and the hundred pontoons of the Bateaux Parisiens along the Seine, from the Pont National to the Point du Jour—the entire length of the city. The object for which the Company was formed, however, is the lighting of places considered to be too small to justify the establishment of gas or electricity works; but they have succeeded in practically applying their system at Mouzon (Ardennes) and La Clayette (Saône-et-Loire)—towns of 1200 inhabitants. Contracts and negotiations are now being made with 150 communes for concessions of twenty to forty years. The Company are now completing plant for lighting the town of Courneuve, near Paris, for which they have secured the concession for forty years. In Belgium and the Grand Duchy of Luxembourg, they have, among other installations, lighted the railway stations of Yvoir and Seraing; and in Luxembourg itself, arrangements for illuminating the Hollerich Station are being completed.

ELECTRIC LIGHTING NOTES.

The Local Government Board have sanctioned the borrowing by the Hanley Town Council of £5019 for electric lighting purposes, repayable in 25 years.

A report submitted to the Exeter Town Council last week showed that the adverse balance on the electric lighting accounts had been reduced to £581, which is £685 less than at the beginning of last year. The income for the twelve months was £6202, and the expenditure amounted to £5517.

The Watch Committee of the Newcastle Corporation have resolved to make immediate application to the Local Government Board for permission to borrow £10,000 for the purpose of fitting up the electric light in those streets through which the tram-lines run. The annual cost will, it is expected, be somewhat more than at present.

During the past year, the Dover Electricity Supply Company had an increase to the extent of 20 per cent. in their output, as compared with 1898. The gross profit amounted to £2739. After paying debentures and other interest charges, there remained £1325, out of which the Directors recommended the payment of a dividend at the rate of 3 per cent. This would absorb £1313; the balance being carried to the credit of suspense account. At the recent annual meeting, a resolution was passed empowering the Company to raise £25,000 of additional capital, in 5 per cent. preference shares, although it is only proposed to put a few of them on the market this year.

Last Wednesday, Mr. E. A. Sandford Fawcett held an inquiry, on behalf of the Local Government Board, relative to an application by the Rotherham Corporation to borrow a sum of £27,969 for electric lighting purposes. The Borough Comptroller (Mr. J. G. Thurgarland) stated that the Corporation had received numerous inquiries as to the supply of electric light in the borough, and felt that the time had arrived when they should take steps to provide it. In the year 1898, they obtained their Electric Lighting Order, and shortly afterwards called in Professor Kennedy to advise them as to carrying out a scheme. His report, which was received in January last year, was adopted by the Council; and it was also decided to appoint him Engineer. The land proposed to be utilized for the station was purchased by the Corporation in 1896, and was intended for extensions of the gas-works. Contracts to the amount of £15,138 had been entered into in connection with the scheme. In answer to questions, Mr. Thurgarland said the whole site comprised 22,110 yards, and the amount paid was £2664. The Corporation had also spent £305 on road-making; bringing up the total to £2969. Mr. B. Jenkin (Professor Kennedy's partner) said the system of generation was the three-wire continuous one—230 volts. The pressure on the mains would be 460 volts. There would be about 35 ordinary 10-ampère arc lamps for public lighting, which number would practically cover the area of the mains. With regard to private lamps, the plant would be 10,000 wired and 5000 alight of 8-candle power. The extent of the mains would be about 5000 yards. Four engines would be fixed—viz., two of 50-horse power each, and two of 150-horse power apiece. The dynamos would be six in number. The two large ones would have a capacity of 90 kilowatts; and there would be four balancing dynamos, each of 14½ kilowatts. The total capacity of the generating station would be slightly over 200 kilowatts. It was estimated that the energy would be about 105,000 units per annum in about two years. Two storage batteries, with a capacity of 250 ampère-hours each, would be provided. The Mayor (Mr. G. Gummer) said the routes which would be covered by the cables included all the important buildings in the town as well as the premises of the most prominent tradesmen. He had reason to believe the introduction of electric lighting would be a financial success.

THE FALMOUTH CORPORATION AND THE WATER-WORKS.

There was another discussion on the question of the water supply at the meeting of the Falmouth Corporation last Thursday. The Water Committee reported that they had had a conference with Mr. Amos, the Chairman, and Mr. Cox, the Manager, of the Falmouth Water Company, and as the result these gentlemen had promised to lay before the Directors the questions—referred to in the recent report of Dr. Buchanan, one of the Medical Inspectors of the Local Government Board—of giving the town a constant supply of water, large new mains through the principal streets, fixing valves for shutting off the water in separate districts, and the periodical analysis of the water. The Mayor (Alderman Bowles) said the Committee had a very friendly and businesslike talk with Mr. Amos, and the matter would be at once laid before the Directors of the Company. Mr. T. G. Mead said they pressed Mr. Amos for his views on the question of the purchase of the undertaking by the Corporation; but they had no definite answer. A resolution was passed directing the Committee to put a series of questions to the Company. These asked whether the Company were prepared to double the capacity of the reservoir pool, convert the high-level reservoir into an exclusive service reservoir, make bye-laws for the rigid supervision of the watershed, construct new and enlarged filter-beds in place of the existing ones, and cleanse and scrape the whole of the mains—supplying new ones where necessary. Mr. Mead thought that, after the friendly discussion they had had with Mr. Amos, such questions would be most inopportune. Some of the suggestions were impracticable. The Mayor said that at present the filter-beds were being enlarged. Mr. J. W. Buckley said the majority of the members wished the water-works to become the property of the Corporation; but the questions suggested would not promote an amicable settlement. If they were going to purchase, the sooner they set to work the better; and they could carry out the necessary improvements themselves. The Company wished to know what the Corporation were prepared to give. It was decided to postpone consideration of Mr. Grose's questions until the reply of the Directors is received.

TONBRIDGE DISTRICT COUNCIL AND THE WATER-WORKS.

Board of Trade Inquiry.

At the Central Hall, Tonbridge, on the 22nd ult., Mr. Ingram B. Walker held an inquiry, on behalf of the Board of Trade, into the terms of the Provisional Order applied for by the Tonbridge Water Company to enable them to enlarge their existing works, reservoirs, and limits of supply, increase their capital, and purchase additional land for the purpose of extending their gathering-ground.

Mr. Reader Harris, Q.C., conducted the case for the Company; Mr. W. P. G. Boxall opposed the application on behalf of the Urban District Council.

Mr. Reader Harris, said the Water Company was formed as far back as 1852, was registered as a joint-stock undertaking in 1856, and had since been incorporated under the Acts of 1862 and 1867. In 1885, the Tonbridge Local Board approached the Company with a view to purchasing the concern; but the Directors declined to accede to the request. As a consequence, the Local Board having made allegations as to the quality of the water and the sufficiency of the storage, the Directors considered it advisable to apply for a Provisional Order for further powers and additional capital. At the inquiry, the application was strongly opposed by the Local Board; and, as the result, a clause was inserted in the Order giving them the option to purchase the works, at £19,750, in the course of three years. But they never exercised it, as there was considerable opposition. Under the Order of 1886, new works were duly carried

out; and now the Company found it necessary to apply for another Order to give them authority to raise more capital and confer further powers to meet the increasing demands made upon them. The only serious opposition was that of the District Council; and the grounds of their objections were practically two. The first was that the water supply should be in the hands of the Local Authority, and therefore that the Order should contain a clause enabling the Council to purchase the Company's works. The simple answer to this was that in 1886 they had the option of purchasing, but did not avail themselves of it; and he submitted that it would be unfair and unjust to the Company to include such a clause in the present Order, while there was no reason whatever why the Company should not continue to supply the town and neighbourhood. Then, secondly, the Council objected to the extension of the limits, because they said the Company had not taken any steps to supply the authorized portions of Leigh and Shipbourne. In answer to this, the Company said they had not supplied these districts, with the exception of the Powder Mills, because they had not been asked to do so. Under the new Order, they would be able to provide these places with water when occasion required; and he did not think that part of the Council's objection was worthy of serious consideration. Reverting to the question of purchase, Counsel stated that no public meeting had been called by the Council to ascertain the wishes of the inhabitants. There was in the town a strong Ratepayers' Association; but, as far as he knew, no report had been made by the members to the Council, urging them to acquire the water undertaking.

The following evidence was then given:—

Mr. *James Lees*, the Secretary and Manager of the Company, said the maximum quantity of water pumped in a single day in February, 1886, was 216,000 gallons; while at the present time it was 400,000 gallons. The minimum quantity in 1886 was 168,000 gallons, as against 300,000 gallons now. The number of houses supplied had risen from 1208 to 2260; and the persons supplied, reckoning five to a house, had similarly increased from 6040 to 11,300. In this calculation, the seven schoolhouses, containing about 300 people, were only reckoned as single houses. The estimated population of the urban district had increased from 9900 to 12,500; and the total population in the limits of supply, from 13,000 to 15,800. The quantity of water furnished to the town for watering streets and flushing sewers in 1886 was 1,408,286 gallons; while that supplied last year was 2,501,000 gallons. In the former year the machinery could pump 576,000 gallons in 24 hours; and now the power had increased to 1,344,000 gallons. With regard to the efficiency of the supply, witness said that at present there was an abundance of water, but that, owing to the greater consumption in the summer months, they had been somewhat strained to keep a proper store. He considered it most essential that the Company should acquire some further gathering-ground; and an ample supply of water was to be obtained from the Racecourse meadows. Four trial borings had resulted very satisfactorily—in fact, they had exceeded anticipations. The total estimate of the proposed new works was £30,000; the items being as follows: New service reservoir, £6200; water-tower, £5400; cost of Racecourse meadows (including £200 incidental expenses), £5500; wells, conduits, and branches, £4000; new pumping-engines, £2300; mains, meters, and services, £5350; contingencies, £1250.

Mr. *Baldwin Latham* said he was conversant with the district, and knew the position of the water-works. It was a difficult district from which to get a good supply of water, and the works were favourably located. He described the character of the Racecourse fields as a gathering-ground, and said it was impossible for the flood water to permeate through the clay to the underground river in the gravel bed, even after the trench had been opened and filled in again. The acquisition of the land was quite necessary for the protection of the works. He held that the Company's proposal to extend their plant was a proper and judicious one. The purchase of the water-works would cost the town an added rate of 1s. 6d. in the pound (besides the present water-rate) spread over thirty years, for the Company would be entitled to the new capital and to all their back-dividends; while there was a likelihood of further dividends being earned. He did not think the insertion of a purchase clause in the Order would be to the interest of either the town or the Company; and if one were inserted, it should not apply for more than twelve months.

Mr. *John Fagg*, Chairman of the Company, said they had no wish for the Council to take over the works; and the Directors were not authorized to agree to a purchase clause. Questioned as to the attitude of the town in 1886, witness said that during the agitation about the proposal of the town to take over the works he was elected Chairman of the Local Board by a large majority of votes. There was a strong feeling at the time in favour of the Water Company; and there was not now such a feeling in favour of the purchase of the works. The town was very well satisfied with the purity of the supply. The Company had never been in a more efficient state than they were at present; and therefore he considered the Council could not reasonably and fairly acquire the undertaking.

Mr. *C. E. Warner*, Solicitor to the Company, said that when the negotiations took place in 1886 for the purchase of the works, the Local Board offered £19,000, and the Company wanted £20,000. The offer was subsequently extended to £19,500; and the Inspector, to whom it was left to set a fair price, put it at £19,750. With regard to the present attitude of the town, witness said he was a member of the Ratepayers' Association, and he had not heard the slightest rumour that it was the wish to purchase the water undertaking—in fact, he knew the town did not want to have it. In answer to the Inspector, witness said the negotiations in 1886 went off on the question of price. The Local Board opposed the Company's application *in toto*, as the Council were now doing.

Mr. Boxall then addressed the Inspector in opposition to the application. He said the Local Authority had a right and a duty to supply the district with water; but at the present time he frankly admitted that the District Council stood at a disadvantage, inasmuch as the period for buying the works had lapsed. It was, however, a very narrow majority which settled the matter.

Evidence having been given on behalf of the Council,

Mr. Boxall urged that, if the Order were allowed, it should contain a purchase clause similar to that included in the Order of 1886; and he asked that the matter should be delayed so as to give the Council time to present their case to Parliament. With regard to the details of the Order, he objected to the proposed site of the new gathering-ground; and he further argued that the Company's rate of charge was excessive, that the proposed new capital was unnecessarily large, that the qualification of the Directors was not sufficient, and that the dividends should be reduced.

Mr. Reader Harris, in reply, said the only point for the Inspector to decide was whether or not the Local Authority should have a clause inserted in the Order, giving them the option of purchasing the undertaking. To succeed in this, the Council must prove two things—first, that it was the wish of the inhabitants; secondly, that the town would be better for the acquisition of the works. As far as his experience went, the inquiry was singular from the fact that those two most important points had been carefully avoided by the opposition.

The inquiry, which had lasted nearly seven hours, then closed.

The Board of Trade have granted the Order, with a few modifications. The Company are authorized to raise £23,000 additional capital, with further borrowing powers to the extent of £5750. The Board have not inserted the purchase clause applied for by the District Council, as they found there was no general wish on the part of the town to acquire the undertaking. The Company have therefore secured all the powers they asked for.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

There are words which, when once uttered, the speaker feels would have been better left unsaid. There are not a few items which appear in this column that, even before writing, I have a feeling that I would gladly pass by. One of these comes before me this week, in the resignation by Mr. Andrew Wilson of the post of Engineer and Manager to the Perth Gas Commission. The closing of a chapter in the life of a young man of great promise, such as this is, cannot be contemplated with any other feeling than that of extreme regret, and a dislike to dwell upon it. But personal feeling cannot be allowed to weigh against the accepted duty of chronicling events of interest; and this being one of great interest to many, the story must be told. Happily, the spirit in which the "Journal" is conducted enables me to deal with this subject in a manner which, in the result, I hope, will be found to be just to all parties, and satisfactory to the readers.

Mr. Wilson was appointed Manager at Perth at the end of 1895, in succession to Mr. T. Whimster, who had then resigned the post, after holding it for many years. Mr. Whimster's retirement occurred at a time when the Commissioners had just resolved to transfer the city gas-works to a new site; and in seeking for a successor, regard was had to the selection of one who would be able to prepare plans and specifications for the new works. Mr. Wilson was unanimously appointed, out of 43 applicants. His tenure of office has not been happy. This has been entirely owing to the difficulties in the arrangements for the new works. There was sufficient to occupy a Manager in the ordinary duties of the existing works, without the addition of all the labour connected with re-modelling the undertaking. The works were considered to be too small in Mr. Whimster's day; but since then—or, to be precise, during the last five years—the output of gas has increased by 50 per cent. How to work under such conditions as Mr. Wilson was obliged to face, would have puzzled many a man. Yet the gas supply has all along been satisfactory; complaints having been fewer than before. But with reference to the new works, it has been otherwise. Mr. Wilson found time to prepare plans for them, which were adopted. When, however, tenders were invited, it was found that, instead of the Commissioners being able to erect the works for £50,000, the cost would be over £70,000. The Commissioners called in Mr. W. Foulis, of Glasgow, to advise them; and under his guidance fresh plans were prepared, in accordance with which the new works are in process of erection, under the direction of Mr. A. Gillespie, of Glasgow. All this has given occasion to a good deal of angry discussion. I have never been able to hold the Commissioners free from blame for the bungling which occurred. They appointed a man but a few years out of his teens to one of the hardest of all the gas manager posts in the kingdom, and, in effect, asked him to utilize his spare time in preparing plans and specifications for new works, capable of producing a certain quantity of gas, and which were to cost no more than £50,000. The Commissioners gave him no assistance in the work, neither inside the office by the increase of the staff, nor outside in the form of visits to other places to procure information, which is almost always resorted to. I think it is undeniable that the Commissioners did not do their part. Whether Mr. Wilson did his part, is a question which is not unattended with difficulty. The Commissioners believed that he did not. In June of last year, a motion was duly brought forward in the Commission, which proposed that his appointment be re-considered. The motion was defeated by 17 votes to 2. With the exception of the two who spoke in support of the motion, the tone of the meeting was not antagonistic to Mr. Wilson. The Commissioners seemed to be inclined to share the blame for the mistake about the first plans, seeing that they adopted them. One of the points complained of by the opposition was that, on account of the changes in the plans, a great deal of excavation, and the erection of boundary walls, had been rendered unnecessary. I mention this, because it seems to be over the erection of a wall that Mr. Wilson's resignation has been sent in. It was stated at the meeting that the Commissioners have had the question of the sufficiency of this wall under consideration in Committee for five months. This would correspond with the period of the municipal election, at which time ex-Bailie Cuthbert ceased to be Convener of the Works Committee, and his place was taken by Mr. Watson. The new *régime* seems to have been more exacting than the old. At all events, to use the words of Mr. Watson, the work upon this wall "had been found to be very defective in many respects, in quantity and quality. Some of the work had not been done at all, and had been charged for; and in many other respects it was deficient." The Commissioners had consulted Counsel upon the subject; and had been advised that they had a good ground of action against the builders. Instructions have accordingly been given to institute such an

action. This was agreed to at a private meeting, which was held on the 19th of March. At the same meeting, Mr. Wilson's letter of resignation was read, and it was agreed to accept it. One gentleman—a Mr. M'Vicar—dissented; and, curiously enough, he was the seconder of the motion in June last for the reconsideration of the appointment. This little incident leads me to the conclusion that everything is not known about the circumstances which have led up to the resignation. Indeed, at a meeting of the Commissioners last Monday, at which the proceedings of the private meeting were confirmed, it was mentioned that the public would know in good time what was going on. Immediately afterwards, there cropped up a remark about actions being also raised against Mr. Wilson and the Clerk of Works; but the suggestion was not taken up, as it was felt that they must adhere to the advice of Counsel. It, however, looks ominously as if what was referred to as "going on" is this matter of further litigation. The Mr. M'Vicar whom I have alluded to as dissenting from the acceptance of the resignation, moved that these further actions should be raised; but he received the support of only one colleague. Thus the matter stands. No reason has been given for Mr. Wilson's resignation; no time has been announced at which he is to cease his duties; and no resolution has been come to with regard to the filling up of the vacancy.

The resignation is the topic of the hour. There is a desire for information as to what has led to so serious a step being taken by Mr. Wilson. I am afraid that upon this point everyone will require to make up his mind for himself, from the facts which I have been able to give. I have no information on the subject; and in view of threatened litigation between the parties, my opinion is that it would be unwise to press for a fuller knowledge of the circumstances. If the actions go on, the conduct of both parties will be subject of inquiry, and curiosity will then be satisfied to the full. Any opinion one might form meantime would virtually be a judging of questions before hearing the evidence, which would be worse than useless. It is not, however, inconsistent with the keeping of an open mind upon the subject, to say that our sympathies are with Mr. Wilson in his trying present position.

Mr. W. R. Herring, of Edinburgh, has favoured me with a draft copy of his paper read at a meeting of the Royal Scottish Society of Arts on Monday; and I have forwarded it to you for publication. The subject was the general one of "The Carbonization of Coal for the Production of Illuminating Gas"—a field which was wide enough to have afforded material for a variety of communications. By judicious selection and condensation, Mr. Herring not only brought the subject down to the compass of a single evening's topic, but he did so in a manner which made it easily comprehensible to hearers who were not familiar with the details of gas making. Gentlemen contributing papers upon scientific subjects frequently crowd too much detail into them, with the result that time is wasted, and the audience get befogged, and cannot follow the speaker. Mr. Herring avoided this pitfall; and, as a consequence, his hearers went home from the meeting with a far clearer conception than they ever had before of the problems which are at present engaging the attention of those who take an interest in gas supply. A great deal of the information which is conveyed to members of such societies must be of the academic sort; but in this instance, the subject being one in which the whole community of Edinburgh are interested, the paper will doubtless bear fruit. Members of such societies exercise an influence upon public questions; and the better educated they are, the more beneficial will be their influence. The communication was thus most appropriate. Whether Mr. Herring intended it or not, its educative effect will be as I have said. Specially noticeable in this connection were the two items dealt with, of incandescent gas lighting and the use of inclined retorts. The first of these brings, almost startlingly, before us the possibility of our being within a few years of a vast revolution in gas production, in which high-grade illuminating gas will almost disappear. When inclined retorts are spoken of, the subject becomes of interest to a much wider circle than that to which the paper was addressed. If a saving such as Mr. Herring speaks of can be effected by the use of inclined retorts, they are likely to become much more general. I suppose, in the matter of saving, a great deal lies in the working of them; and the results stated may probably be taken as the best which can be obtained. But much less would be sufficient reason for adopting the system in preference to other methods of producing gas. Mechanical stoking would go to the wall; and enrichment processes would have a hard struggle to maintain their existence alongside the cheapened coal gas. The new Edinburgh and Leith works will not be a great experiment, because the experimental stage is past; but they will be a big step out of the common. Their working results will be awaited with eagerness. Unfortunately, it will be two years before these will be available. The vista is full of possibilities. Who can tell what the effect would be if, with a combination of inclined retorts and incandescent gas lighting, it were possible to sell non-illuminating gas at 1s. per 1000 cubic feet? For one thing, the industry of gas production and supply would be established on a much firmer basis than ever; but what about the capital accounts of corporations or companies supplying electric light.

The fire at the ammonia works in the Shotts Iron-Works, to which I referred last week, was extinguished by the use of steam and water. A scrubber, 120 feet in height, was rent by the explosions of gas; and it fell, causing great destruction. The total damage is estimated at over £10,000. One workman was fatally injured.

The accounts relating to the electrical installation belonging to the Paisley Corporation, show, including a sum of £681 placed to reserve fund, a deficit of £1888. The deficit is chargeable to the local rates. This is what the Paisley Provisional Order says; but the Corporation are to meet it out of the surplus in the accounts of the gas undertaking.

The Lancaster Town Council have, in reply to a letter from the Morecambe District Council, expressed their willingness to supply the district with an additional 300,000 gallons of water per day, at 8d. per 1000 gallons. This will double the quantity that Lancaster is at present under contract to supply. The agreement is subject to a four years' notice of termination from either side.

The Gas Committee of the Bradford Corporation have passed a resolution agreeing, in accordance with a request of the City Council, to undertake the lighting of the added districts on the same principle as that which applies to the districts in the old city area which are not included within the Corporation gas-supply area. The Committee have also instructed the Gas Engineer to convert the whole of the ordinary street-lamps in the city into incandescent lamps.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 859.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 13	10½	Alliance & Dublin 10 p. c.	20½—21½	..	4 17 8
100,000	10	,,	7½	Do. 7 p. c.	14—15	..	5 0 0
800,000	100	Jan. 2	5	Australian 5 p. c. Deb.	100—102	..	4 18 0
200,000	5	Nov. 15	6	Bombay, Ltd.	6¼—6¾	..	4 8 11
40,000	5	,,	6	Do. New, £4 paid	4¼—4¾	..	5 1 1
880,000	Stk.	Feb. 23	12	Brentford Consolidated	267—272	..	4 8 3
270,000	,,	,,	9	Do. New	203—208	..	4 6 7
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb.	118—123	..	3 5 1
220,000	Stk.	Mar. 14	11½	Brighton & Hove Orig.	242—247	−8	4 13 1
226,320	,,	,,	8½	Do. A. Ord. Stk.	180—185	..	3 16 11
999,500	Stk.	Feb. 23	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Mar. 29	10	British	41½—42½	..	4 13 0
50,000	10	Feb. 23	12	Bromley, Ord. 10 p. c.	24—26	..	4 12 4
79,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd.	9⅜—10½	..	5 17 1
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	99—101	..	3 19 3
150,000	20	Mar. 14	8½	Cagliari, Ltd.	25—27	..	6 2 3
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	15½—16½	+½	4 17 0
50,000	50	Nov. 2	6	Do. 6 p. c. 1st Mort.	56—58	..	5 3 5
550,000	Stk.	Oct 13	13½	Commercial Old Stock	305—310	..	4 7 1
200,750	,,	,,	10½	Do. New do.	240—245	..	4 5 9
200,750	,,	Dec. 14	4½	Do. 4½ p. c. Deb.	142—145	..	3 2 1
800,000	Stk.	Dec. 14	9	Continental Union, Ltd.	160—170	−10	5 5 11
200,000	,,	,,	7	Do. 7 p. c. Pref.	178—183	..	3 16 6
51,600	Stk	Feb. 23	14	Croydon A 10 p. c.	335—340	..	4 2 4
173,400	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
555,000	Stk.	Feb. 28	5½	Crystal Palace Ord. 5 p. c.	122—127	..	4 2 8
60,000	,,	,,	5	Do. 5 p. c. Pref.	132—137	..	3 18 0
486,090	10	Jan. 26	11	European, Ltd	20—21	..	5 4 9
854,060	10	,,	11	Do. £7 10s. paid	15—16	..	5 3 2
14,993,075	Stk.	Feb. 9	4%	Gas-light & Coke and Coke	4 p. c. Ord.	101—106	..	4 12 5
2,600,000	,,	,,	8½		3½ p. c. max.	97—99	..	3 10 8
3,799,735	,,	,,	4		4 p. c. Con. Pref.	119—122	..	3 5 7
8,993,975	,,	Dec. 14	8		3 p. c. Con. Deb.	99—101	..	2 19 5
70,000	10	Nov. 15	8	Hongkong & China, Ltd.		13½—14½	..	5 10 4
3,800,000	Stk.	Nov. 15	10	Imperial Continental		211—214	..	4 13 6
478,000	Stk.	Feb. 9	8½	Do. 3½ p. c. Deb. Red.		100—103	..	3 8 0
75,000	5	Dec. 14	6	Malta & Medn., Ltd.		4½—5⅛	..	5 9 1
560,000	100	Oct. 2	5	Met. of & Suburbs	5 p. c. Deb.	110—114	..	4 7 9
250,000	100	,,	4½	Melbourne	4½ p. c. Deb.	107—109	..	4 2 7
541,920	20	Nov. 15	8	Monte Video, Ltd.		11—12	..	5 0 0
667,946	Stk.	Feb. 23	9½	Newc'tle & Gateah'd Con.		215—220	..	4 4 1
299,865	Stk.	Dec. 29	8⅝	Do. 3½ p. c. Deb.		104—107	..	3 5 5
60,000	5	Feb. 23	7	Ottoman, Ltd.		4⅛—5½	..	6 19 4

* Ex div.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
150,000	5	Nov. 30	8	Oriental, Ltd.	7—7½	..	5 6 8
135,000	5	,,	8	Do. New, £4 10s. pd.	6¼—6¾	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.	1¼—1⅝	..	4 11 5
500,000	100	Dec. 1	6	People's Gas of Chicago	2nd Mtg. Bonds	102—106	..	5 13 2
851,070	10	Oct. 13	7	River Plate Ord.		11¼—11⅜	..	5 19 2
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.		100—102	..	3 18 5
250,000	10	Sept. 15	8†	San Paulo, Ltd.		11¾—12⅛	−½	6 8 0
185,000	Stk.	Sept. 15	10	Sheffield A.		249—251	..	3 19 8
209,053	,,	,,	10	Do. B.		249—251	..	3 19 8
447,427	,,	,,	10	Do. C.		249—251	..	3 19 8
5,600,000	Stk.	Feb. 23	5⅛	South Metrop., 4 p. c. Ord.		135—138	..	3 17 3
1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb.		100—102	..	2 18 10
120,000	Stk.	Mar. 14	6	Tottenham and	A. 5 p. c. B. 3½ p. c.	139—141	..	4 5 1
250,520	,,	,,	4½			100—102	..	4 8 3
55,100	,,	Dec. 14	4	Edmonton	4 p. c. Deb.	113—117	..	3 8 5
182,380	10	Jan. 12	5	Tuscan, Ltd.		8—9	−½	5 11 1
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.		101—104	..	4 16 2
				WATER COMPANIES.			
780,399	Stk.	Dec. 29	11	Chelsea, Ord.		307—312	..	3 10 6
150,000	,,	,,	5	Do. 5 p. c. Pref.		157—162	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75		145—150	..	3 0 0
175,785	,,	Mar. 29	4½	Do. 4½ p. c. Deb.		145—150*	..	3 0 0
1,720,560	Stk.	Oct. 13	7	East London, Ord.		202—207	−3	3 7 8
554,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb.		145—150	..	3 0 0
890,000	,,	,,	3	Do. 3 p. c. Deb.		99—101	..	2 19 5
700,000	50	Dec. 14	7½	Grand Junction	10 p. c. max. 4 p. c. Deb.	108—110	..	3 8 3
310,000	Stk.	Mar. 29	4			130—135*	+1	2 19 3
708,000	Stk.	Feb. 23	14	Kent		307 312	−1	4 9 9
160,000	,,	,,	7	Do. New, 7 p. c. max.		200—210	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.		295—300	..	3 10 0
406,200	100	,,	8	Do. 7½ p. c. max.		215—220	..	3 12 9
850,000	Stk.	Mar. 29	4	Do. 4 p. c. Deb.		130—133*	..	3 0 2
500,000	100	Feb. 23	13⅛	New River, New Shares		420—425	..	3 3 6
1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb.		132—137	..	2 18 5
902,300	Stk.	Dec. 14	7½	South-wark and	7½ p. c. max. 5 p. c. Pref.	200—205	..	3 13 2
126,500	100	,,	7½			190—195	..	3 16 11
489,200	Stk.	,,	5			160—165	..	3 0 7
1,019,585	,,	Oct. 13	4	Vauxhall	4 p. c. A Deb.	131—136	..	2 18 10
1,155,066	Stk.	Dec. 14	10	West Middlesex		288—293	..	3 8 3
500,000	,,	,,	4½	Do. 4½ p. c. Deb.		147—152	..	2 19 3
200,000	,,	Mar. 14	8	Do. 5 p. c. Deb.		99—101	..	2 19 5

*Ex div.

† Next dividend will be at this rate.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *March* 31.

Sulphate of Ammonia.—There has again been a quiet market; and quotations have declined to £11 17s. 6d. to £12 per ton, delivered f.o.b. at the ports. There has been more inquiry. But, requirements not being urgent, there has been no hurry to cover; and buyers have only been induced to purchase by concessions in prices. There has also been more interest in the forward position; and speculative sales have been made abroad at a decline on recent quotations. Makers, however, maintain a firm attitude.

Nitrate of Soda is steady; the spot quotations being 8s. 9d. per cwt. for ordinary, and 8s. 10½d. for fine, quality.

LONDON, *March* 31.

Tar Products.—Pitch continues to enjoy a steady market. A good deal of inquiry is going on for next season's delivery; and considerable business is reported in that position. It is not unlikely that the actual production of pitch for this season will be less than anticipated. The value of liquid creosote is well maintained; and tar oil is commanding a better price than creosote containing salts. Salty creosote, however, is a little steadier, with a somewhat better outlook. Benzols are very dull; and lower prices are being named, especially for 90's quality. There is no change in naphthas; and anthracene is only in moderate request. The relapse in carbolic acid has apparently stopped; and the tendency is rather to better prices. There are no stocks either in producers' or consumers' hands.

Prices obtaining during the week are: Tar, 17s. 6d. to 27s. 6d. Pitch, east coast, 37s.; west coast, 34s. Benzol, 90's, 6d.; special qualities for gas, 8d.; 50's, 9d. Toluol, 90's, 1s. 1d.; pure, 1s. 9d. Solvent naphtha, 1s. 1d. Crude, 30 per cent., naphtha, 4d. Heavy naphtha, 10d. Creosote, 2¼d. to 3¼d. Heavy oils, 3½d. Carbolic acid, 50's, 2s. 1½d.; 60's, 2s. 6d. Naphthalene, 45s. to 70s. Anthracene, "A," 4d.; "B," 2½d.

Sulphate of Ammonia.—Quite an unexpected drop in prices has come over this market during the week, and at all ports it is quoted less money. It is felt, however, that the relapse is only temporary; there being no stocks, and certainly no urgent sellers. The backwardness of the season no doubt has a good deal to do with the present position. Although sellers would probably not accept the price, the average market quotation to-day is £11 17s. 6d., less 3½ per cent. at all ports.

The Newhaven District Council are carrying out a little experiment with incandescent gas-burners; and at the last meeting, one of the members stated that the lamps were giving a splendid light. He also mentioned that the Manager of the Gas Company had told him that, during the recent heavy gales at Brighton, only two out of eight mantles on the West Pier required to be renewed.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Perhaps, if anything, taking the market all through, the position is not quite so strong. Lancashire collieries do not give way in the least on their full list rates; but supplies of both round coal and engine fuel continue to come in from outside districts at lower figures, and this has necessarily a somewhat weakening effect. Buyers not only show a disposition to keep back orders from Lancashire collieries at the full rates to which the latter are holding, but they are able to purchase more freely elsewhere; so that the general pressure of demand is not quite so great. Lancashire collieries are, however, still moving away all they are raising, unless it is that here and there some of the better classes of round coal are hanging. Nothing is going down to replenish the stocks, which, for the most part, are almost entirely cleared away. List rates are unchanged; best Wigan Arley remaining at 14s. 6d. to 15s. 6d. per ton at the pit, Pemberton four-feet and seconds Arley 13s. to 14s., steam and forge coals 12s. to 12s. 6d., and engine fuel from 9s. 6d. for medium to 10s. 6d. for the best sorts. The advance on gas coal for next season's contracts, referred to recently, has now not only been definitely confirmed by the leading collieries throughout Lancashire, but a similar undertaking has been come to in Yorkshire; and both these important gas-coal raising centres will co-operate in maintaining the full prices when the contracts are sent in. These prices, as previously stated, will represent an advance of 5s. per ton on last year, which will bring the minimum pit prices to 12s. 6d. and 13s. for the lower qualities, and 14s. 6d. for the best screened gas coals. The shipping trade is scarcely so brisk; and although the collieries that do a shipping trade are still holding to their minimum basis of 16s. for steam coal, delivered at the Mersey ports or the Ship Canal, business is not being obtained freely at this figure. Coke makers have withdrawn present list rates, pending a substantial advance to come into operation this month.

Northern Coal Trade.—There is a fair demand for most classes of coal; but that for steam coals is rather limited for immediate shipment. Hence best Northumbrian steam coals are now rather weaker, at from 17s. 6d. to 18s. per ton f.o.b., though higher prices are asked when the delivery is over the shipping season. Steam smalls are 11s. to 11s. 6d. per ton f.o.b. In the gas coal trade, attention is directed to the great contracts for the Metropolitan Companies, the negotiations for which have now begun. It is said that some of the collieries have decided to ask an advance of 7s. per ton on last year's price, and thus bring the general quotation to something like 16s. per ton. f.o.b.! It remains to be seen how far the expectation that such a quotation suggests will be fulfilled. The contracts for the supply of one or two of the northern boroughs are now in progress of ratification; and that for Darlington shows a price somewhat equivalent to the one named for the larger supplies. In the gas coal trade, the price is not altered for occasional cargoes. Coke is extremely firm; and blast-furnace coke is higher at 28s. 6d. at the furnaces. Gas coke shows no change in price this week; but it is rather scarcer.

Scotch Coal Trade.—There is a quieter tendency in the market; but

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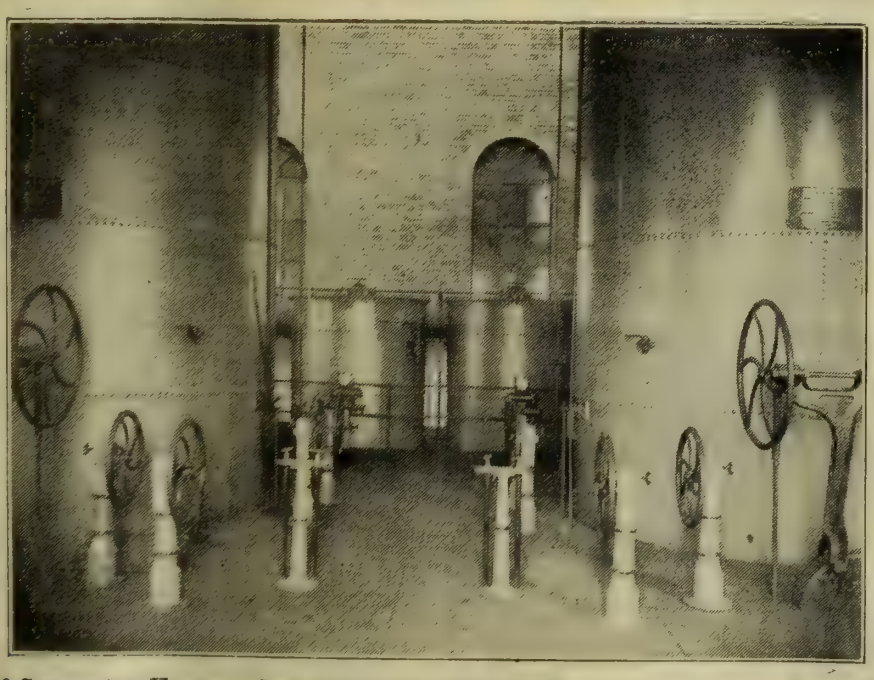
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prices are not appreciably easier. The demand is still heavy, and is likely to continue so, if for no other reason, because of the great demand there is for iron, both in this country and out of it. The season for contracting for gas coal has begun. So far, it has been the reverse of encouraging for managers of gas-works. It is now quite evident that there will be a general rise in the price of gas; and that if any managers are able to avoid this step, they will have a hard struggle. The prices quoted are: Main 14s. to 14s. 3d. per ton f.o.b. Glasgow, ell 15s. to 16s., and splint 14s. 9d. to 15s. The shipments for the week amounted to 186,397 tons—a decrease of 15,317 tons upon the preceding week, but an increase of 75,150 tons upon the corresponding week of last year. For the year to date, the total shipments have been 2,166,424 tons—an increase of 551,288 tons upon the same period of last year.

The following remarks on the London Gas Companies' coal contracts and the price of gas appeared in the "Financial Times" last Thursday: "The important contracts for supplying the two great London Gas Companies with gas coal always excite particular interest in the coal trade, and with some reason, for they are the largest contracts that come into the British coal market. The contracts, according to a well-informed northern correspondent, are now offering in the Newcastle market, and will shortly be concluded—if buyers and sellers can come to terms. It is scarcely necessary to explain that the Companies indicated are the Gaslight and Coke Company and the South Metropolitan Gas Company. The former annually consume about 2 million tons, and the latter about a million, which quantities are, of course, mainly—indeed, almost solely—drawn from the Durham coal-field; and to transport the fuel from the Tyne or Wear to the Thames keeps in regular employment a large fleet of steam colliers. Both Companies, we understand, have now opened negotiations with the leading Durham coal firms to renew their contracts for the ensuing twelve months—in the case of the Gaslight and Coke Company from July next, and in the case of the South Metropolitan Company from April. How the negotiations will conclude in the light of the present extraordinary strength of the coal market, is a matter about which there is a good deal of speculation. So far as we are able to learn, we believe that several of the Durham colliery firms have already intimated to these Companies that their price will be 16s. a ton f.o.b. Tyne or Wear. Certainly this figure, and more, has already been secured for large gas coal contracts. In several instances lately 16s. 6d. to 17s. a ton has been realized—a case in point being that of the Imperial Continental Gas Association, which, little more than a week ago, contracted for about 200,000 tons, to be delivered at Swinemünde and Stettin at about these figures f.o.b. Of course, the London Gas Companies are large and influential buyers; and they may be able to purchase their requirements at something less than smaller consumers have been compelled to pay, though this remains to be seen. In bad times these Companies undoubtedly get the full advantage of low prices, and in good times, like the present, they must, we suppose, expect to pay up. Should the actual price turn out to be in the region of 16s., which the north country coalowners say they are quoting, it will mean an advance of about 7s. a ton on last year's contract rate. Such an advance on so large a quantity of coal would represent an increased expenditure on the part of the Gas Companies, which the poor London householder must shudder to contemplate, for does it not portend a rise in the price of gas? One thing is certain, and it is this—that the London Gas Companies have not been called upon to pay such prices for their coal as they will have to pay this year since the great 'boom' of the early seventies. How far they will be able to work the market in their favour, and by what process of financing they will recoup themselves for a greatly increased expenditure on coal account, are matters which the next few weeks will, no doubt, reveal. They are matters, too, in which the average Londoner cannot fail to have a pocket interest."

The "Iron and Coal Trades Review," referring, last Friday, to the coal question as affecting the price of gas, said: "The general attitude of the public in relation to coal prices was probably accurately reflected in some remarks made recently by the President of a leading Gas Association, when he stated that none would object to pay a remunerative price to the coalowner, so long as it was a reasonable and equitable one, if it was uniform and steady. It is the extremes of depression and sudden abnormal increases that are so much to be deprecated. The policy of gas authorities of late has been to reduce the price of gas to the lowest possible limit, until there is now no margin left for such an unlooked-for rise in the price of raw materials as we have recently seen. What the effect will be upon prices at present ruling, time will show. Already it has had an appreciable effect in some quarters; and unless coal prices come down to a reasonable figure before new contracts are entered into, an increase in the price of gas will be inevitable. If trade remains good, an increased output of gas, and augmented prices for coke and other residual products, may help gas companies. Gas authorities may also go in wholesale for installations of carburetted water-gas plant. If so, when the 'boom' has passed, coalowners must not be surprised if they find the demands of many of their customers diminished. What with depleted stocks, the difficulties of getting supplies, and the troubles caused by the railway companies in dealing with the transit of material, many gas authorities have been seriously handicapped of late, and more than ordinary difficulty has been experienced in keeping up the supplies of gas."

The Cost of Coal and Increases in the Price of Gas.—The Corporation of Nottingham have decided, "in consequence of the increased cost of coal and other materials," to raise the present charge for gas by 4d. per 1000 cubic feet from the end of March. For the same reason, the Fenton District Council have resolved to advance the price of gas by 6d. per 1000 cubic feet, and to rescind the resolution of the Gas Committee of March 20, 1899, with respect to the reduction of public lighting by £200 per annum. The Truro Gas Company have raised their price to 4s. per 1000 cubic feet, subject to the usual discounts for prompt payment. The quantity of gas supplied to "slot" consumers has been reduced to 18 cubic feet for 1d. The Darlington Corporation have decided to raise the price of gas to 3s. 3d. per 1000 cubic feet, with the usual discount of 6d., at the close of the present quarter.

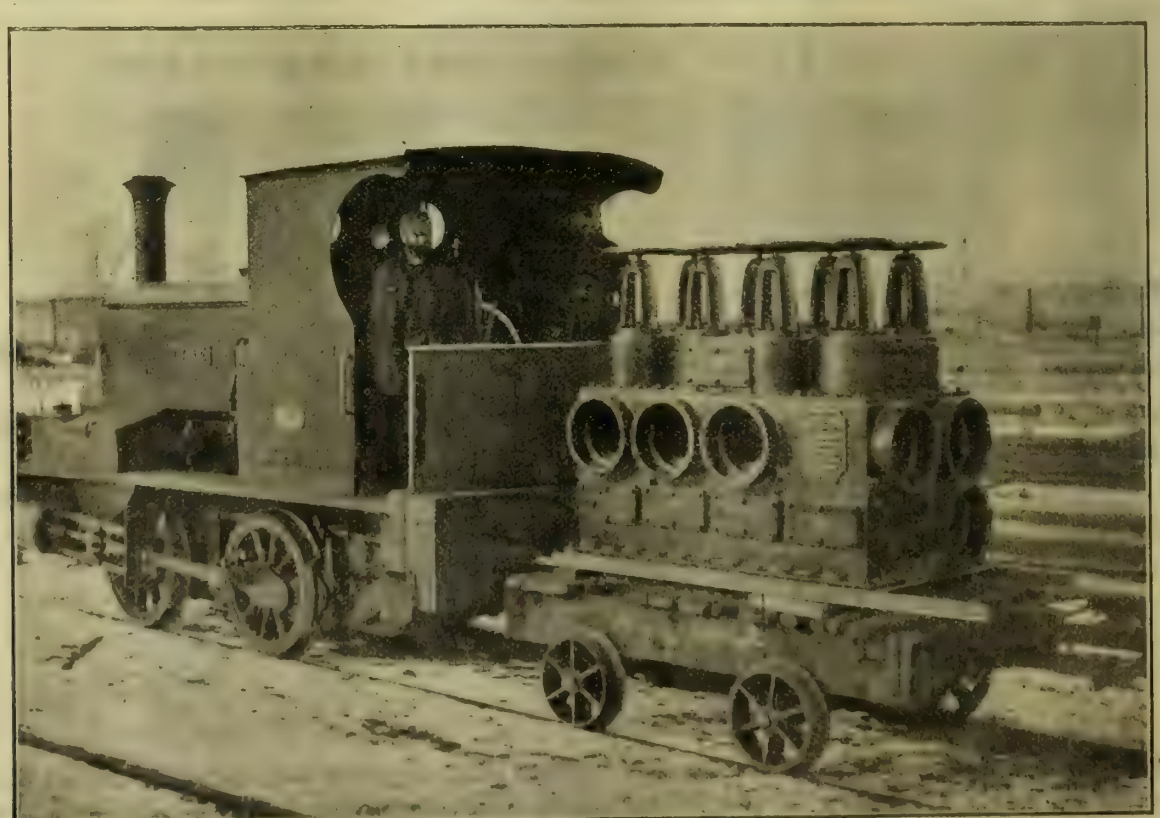
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West's Stoking Machinery for the Halifax Gas-Works.—The Halifax Corporation Gas Committee have decided to adopt power stoking machinery in their works; and they have placed a contract with West's Gas Improvement Company, Limited, for the supply and erection of complete installations of their compressed air stoking machinery, in a twin retort-house containing a double line of benches.

Teesside Water Supply.—The Tees Valley Water Board have arranged to inspect a site for a new reservoir at Long Newton, near Stockton-on-Tees. Already the plans have been prepared. The work will be let to contract within the next two months; and it will, it is expected, be completed in the course of two years. It is estimated that the enterprise will entail a cost of something like £80,000 or £100,000. Within the next twelve months it is proposed to make a start with the Grassholm reservoirs, the construction of which will take about ten years. This scheme, with interest and redemption, will cost upwards of £250,000.

Suffocated by Gas.—A naval stoker named Bennett, of Her Majesty's ship *Vivid*, at Devonport, and Thomas Ash, aged 79, a naval pensioner, were suffocated in a lodging-house at Stonehouse last Sunday morning. The men occupied separate beds in the same room, which had no fireplace. About noon yesterday the landlord went to call the men for dinner; and on opening the door was driven back by a rush of gas. A constable was called in, and found both men dead. Close to one of the beds was a gas-bracket, the tap of which could be turned by the sleeper's foot. It is stated that both men were sober when last seen by the lodging-house keeper.

The Supply of Water Gas in Dublin.—At the annual meeting of the Dublin Sanitary Association last Thursday, reference was made to the high mortality in the city, which is being investigated by a Committee appointed by the Lord Lieutenant; and the new President of the Association (Dr. C. F. Moore) said they hoped good would result from the labours of the Committee. He drew attention to what he characterized as the "danger to public health" caused by the gas now being produced by the Alliance and Dublin Gas Company, which, he said, contained a very large amount of carbon monoxide, which was very poisonous. Sir Charles Cameron informed the Association that the Company had agreed not to exceed 20 per cent. of water gas.

Oldbury Gas Department.—The statement of accounts in connection with the gas undertaking of the Oldbury District Council for the year ending Dec. 31 was issued last Saturday by Mr. A. Cooke, the General Manager. It shows that the cost of gas manufacture was £7959, against £7443 in 1898. The total expenditure was £11,063, against £9621. The net income from the sale of gas amounted to £12,265—an increase of £445; residuals produced £3812, as compared with £2915; sales of gas-fittings realized £241; and discounts on purchases £58—the total income being £16,376, or £1371 more than in 1898. This gives a gross profit of £5313. After paying £2972 for interest on loans, transferring £600 to the general district rate, and voting £50 towards the new Technical Schools, there remains a net profit on the year's working of £1713 17s. 2d.

Guildford Gas Company.—The ordinary half-yearly general meeting of this Company was held at the offices, Guildford, on the 29th ult.—Mr. D. Williamson, J.P., the Chairman of the Company, presiding. The accounts for the six months ending Dec. 31 showed a balance carried from revenue to the profit and loss account amounting to £2916, against £2504 in the corresponding half of 1898; and after payment of full dividends, there remains to the credit of that account a sum of £1976, while the reserve fund has a balance of £7814. During the last two or three years, rapid progress has been made by the Company. In 1897, the annual make of gas was 120 millions; while last year it had risen to more than 139 millions—being an increase of nearly 16 per cent. One of the chief causes of this has been the adoption of prepayment meters; more than 400 having been fixed since their introduction two years ago. Great strides have also been made in letting out cooking-stoves on hire. The Town Council have given the Company orders to alter the whole of the lamps in the town from ordinary flat-flame burners to incandescents; making something like 400 lamps which have been changed to the latter system during the past two years.

Rushden and Higham Ferrers Gas Company.—The annual general meeting of this Company was held last Friday—Mr. Paul Cave in the chair. The Secretary (Mr. G. S. Mason) read the report, in which it was stated that, notwithstanding the increased cost of coal and the reduction made in the price of gas, the profits available for distribution had been maintained. The Directors therefore recommended the declaration of a dividend at the rate of 10 per cent. per annum on the ordinary stock, free of income-tax, and the setting aside of a sum of £200 to form an insurance fund to meet any extraordinary claim or charge which might fall upon the Company. They felt they could confidently state that the works, under the supervision of Mr. Thomas Watson, were maintained in the highest state of efficiency, and that every reasonable provision was being made to meet the ever-growing demands of the two towns. When the draft of the Company's Bill of last session was before the shareholders, care was taken to insert a clause conferring on the Company power to enter into special contracts with consumers, and thereby give the shareholding consumers the benefits corresponding to the bonus previously paid. When, however, it came to be worked out, it was found that the complications arising from such contracts would be so great that the Directors, with much reluctance, had no alternative but to abandon them; and in lieu thereof they resolved to reduce the price of gas for motive power by 2d. per 1000 cubic feet, applicable to shareholders and non-shareholders alike. After some remarks on the matter, the report was adopted. Referring to the admirable way in which the accounts had been kept, Mr. W. H. Wilkins pointed out that the record of the gas made and the coal consumed was carried out with such detail that the Manager accounted for the whole of the gas made with the exception of about 5 per cent., whereas most companies reckoned anything within 10 per cent. as a high state of efficiency. He must compliment him on the great care and accuracy he had shown. The Chairman expressed his gratification at hearing the compliments paid. The Manager was pleased to do his best; and there was no doubt his heart and soul were in his work. Mr. Watson briefly returned thanks.

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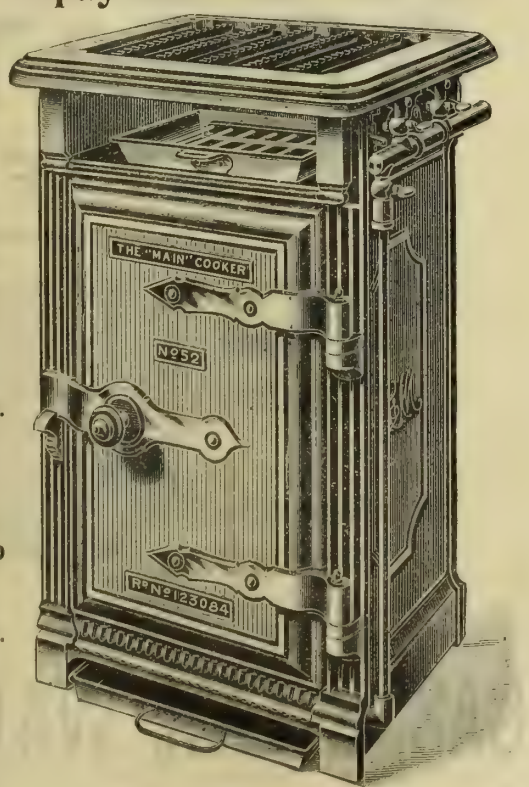


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Additional Capital for the South-West Suburban Water Company.—The Board of Trade have granted, subject to the approval of Parliament, the Order applied for by this Company to enable them to raise additional capital not exceeding £50,000.

Chorley Gas Affairs.—In proposing the confirmation of the minutes of the Gas Committee at the meeting of the Chorley Town Council last Thursday, Mr. Critchley stated that there had been a large increase in the consumption of gas during the past year, amounting to more than 8 million cubic feet. The receipts from sales were £15,968—an increase of £1360. The gross profit was £7597; and there was £840 available for reducing the rates. The balance-sheet was considered satisfactory.

San Paulo Gas Company, Limited.—At the annual meeting of this Company next Friday, the Directors will report a profit of £21,571, to which has to be added the balance brought forward, £1376; making a total of £22,947. After deducting £1500 for debenture interest, there remains a disposable balance of £21,447. An interim dividend of 5 per cent. (£12,500) was paid in September; and the Directors recommend the declaration of a final dividend at the rate of 6 per cent. per annum, free of tax—making a total distribution for the year of 8 per cent. This will absorb a further sum of £7500; leaving £1447 to be carried forward. The reports of the Manager and Engineer show that the Company's works, buildings, and plant generally have been maintained in good working order. Having had to abandon their electric lighting scheme, the Board are doing their best to popularize the use of gas, and to this end have acquired the Welsbach agency in San Paulo; while the new Railway Station is to be lighted by an installation of intensified gas.

Bristol Water Company.—The report of the Directors of this Company sets forth that the revenue from water-rates for the past year was £122,858, exceeding that of the previous year by £5079. The net sum shown by the revenue account (including £6829 brought forward) to be applicable for dividend on the ordinary capital of the Company is £57,441. Out of this the Directors paid, on the 14th of October, an intermediate dividend at the rate of 7¼ per cent. per annum on the ordinary £25, £20, £6, and £4 10s. shares, and £5 1s. 6d. per cent. per annum on the 7 per cent. maximum consolidated ordinary stock, leaving a balance of £33,680 applicable for dividend on the ordinary capital. The Directors recommend the payment of final dividends at the respective rates of 7¾ per cent. per annum on the ordinary shares, and £5 8s. 6d. per cent. per annum on the ordinary stock of the Company, leaving a balance of £8078 to be carried forward. The increase of revenue is again very satisfactory. The progress of the works in the Yeo Valley, already described in the "JOURNAL," had so far advanced last November as to permit the impounding of water; and the order for pumping-engines to utilize this source of supply will be executed next year. A contract has been entered into for the construction of two more filter-beds at Barrow Gurney, in order to meet the growing consumption of water. At the Clifton pumping-station, an additional engine is in course of erection, capable of pumping 3 million gallons daily. The Bill for granting further powers to the Company for the purpose of maintaining the purity of the supply is proceeding unopposed in Parliament. The capital expended during the year was £63,050. The length of mains laid was about 7½ miles.

The Heckmondwike Gas-Works and the Local Authorities.—The Finance Committee of the Heckmondwike District Council have decided to recommend the Council to apply jointly with the Liversedge Council for parliamentary powers, empowering them to acquire the Heckmondwike Gas Company's works, which are situated within the area of the Liversedge Council, and supply both towns with gas. In the event of Liversedge declining, the question of Heckmondwike applying for powers separately will probably be taken into consideration.

Exmouth Gas Company.—From the report submitted to the annual meeting of this Company last Wednesday, it appears that the past year was one of great prosperity. There was a good average augmentation in the number of consumers, the make of gas increased by 9·93 per cent., and the balance available for dividend was £2361. Mr. G. Palmer, who presided, said that £1251 had been spent on capital account; and, in order to provide for the extension of the Company's business, £2000 had been raised on 5 per cent. preference shares. The profit for the year was £1647—an increase of £387. The gross receipts were £782 in advance of 1898, and £414 of this was from the sale of gas. Mr. H. A. Willey, in seconding the motion for the adoption of the report, commented upon the improved position of the Company, and expressed the opinion that the proposed introduction of the electric light would be an advantage rather than the reverse. The report was adopted.

Gas and Water Works Extensions at Llandudno.—A Local Government Board inquiry was held at Llandudno last Tuesday with reference to an application by the District Council for power to borrow certain sums of money, among them being £12,104 for gas-works purposes, and £4216 for water supply. Touching the question of the extension of the gas-works, the Clerk (Mr. W. Conolly) said that at present there were three gasholders with a capacity of 190,000 cubic feet, which was only about half the maximum daily make; and the Council were advised that this storage capacity should be increased to a day or a day-and-a-half maximum make. The increase in the daily make of gas last year, compared with that of the previous year, was 45,920 cubic feet; and it was calculated that the daily make in 1906 would be 536,990 cubic feet, for which provision was made by the present scheme. The Council's Engineer (Mr. E. Paley Stephenson) stated that it was important that the work should be commenced without delay. Mr. Caralier, a former member of the Council, wished to call attention to the fact that the gas-works were yearly depreciating in value. The returns for the year 1897 showed the profit to have been £1147, which last year had come down to £245. Mr. Conolly observed that, on the contrary, the profits were becoming more annually. The reason for the apparent decrease was that the Council had taken in hand many additional works for the benefit of the gas concern generally. They had also during the last three years reduced the price of gas—thus giving a direct benefit to the consumers; and they had moreover abolished meter-rents, which meant £400 a year. The Clerk and Surveyor then gave particulars as to a water supply scheme for the Great Orme, which was an amendment on a scheme put forward two years ago. It was proposed to construct a reservoir on land leased from Lord Mostyn. The other matters for which money was required were next inquired into.

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CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE.
London Gas in Parliament . . . 915
Bradford Gas Politics . . . 916
The Meeting of the Commercial Gas Company . . . 916
The Wandsworth Building Act Case . . . 916
The Informal Meeting of Scottish Gas Managers . . . 917
Coal and Iron Profits in 1899 . . . 917
The Liability of "Undertakers" and Contractors under the Workmen's Compensation Act . . . 917
WATER AND SANITARY AFFAIRS—
The Meeting of the East London Water Company—The Cost of Last Year's Drought . . . 918
Disinfecting the Maidstone Water-Mains . . . 918
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market . . . 919
Coal Prices and Railway Rates . . . 919
Architects on the Building of Small Houses . . . 919
A Popular Account of Carburetted Water Gas . . . 921
Parliament and the Coal Question . . . 921
NOTES:—
Cross Breaking Tests of Concrete . . . 923
Tenement House Building in New York . . . 923
The Sampling and Analysis of Coals . . . 923
Motor Waggons, Gas-Mains, and Soft Roads . . . 923
The Fireproofing of Wood . . . 923
The Progress of Electro-Chemistry . . . 923
TECHNICAL RECORD:—
Informal Meeting of Scottish Gas Managers . . . 924
New England Association of Gas Engineers—The Annual Meeting 928
Gas-Engines in Practice . . . 929
The Disinfection of Water-Mains . . . 930
REGISTER OF PATENTS:—
Condensers—Kirkham, Hulett, and Chandler, Limited (F. D. Marshall) . . . 931
Apparatus for Charging Retorts and for Stirring and Withdrawing the Charge from Retorts—Foulis, W. . . . 931
Regulating Gas Pressure in Incandescent Lighting—Sugg, W. T. . 932
Gasholders for Equalizing Intermittent Gas Production and other Purposes—Glasgow, A. G. . . . 933
Hydraulic and Foul Mains, &c.—Robus, H. J. . . . 933
Incandescing Media—Nielsen, R. A. . . . 933
Patent Notices . . . 933
CORRESPONDENCE:—
Naphthalene in Coal Gas . . . 934
The Future of Electrical Supply . . . 934
The Price of Gas and the Value of Residuals . . . 934
PARLIAMENTARY INTELLIGENCE:—
Gleanings from the Committee Rooms . . . 935
House of Lords—Progress of Bills . . . 936
House of Commons—Progress of Bills . . . 936
House of Commons Committee—The Gaslight and Coke, Commercial Gas, and South Metropolitan Gas Companies Bill . . 937
LEGAL INTELLIGENCE:—
High Court of Justice—Queen's Bench Division—London County Council *v.* Wandsworth and Putney Gas Company . . . 950
The Delivery of Petroleum to the Dublin Gas-Works . . . 952
The Committal of Infringers of Welsbach Patents . . . 953
The Charge of Falsifying Books and Embezzlement . . . 953
The Fatal Explosion at the Lillie Bridge Oil-Gas Works . . . 953
A Public Lighting Charge at Exmouth . . . 953
Stealing Gas at Stalybridge . . . 953
Tampering with a Gas-Meter at Cardiff . . . 953
MISCELLANEOUS:—
Meeting of the Commercial Gas Company . . . 954
Meeting of the Alliance and Dublin Consumers' Gas Company . 955
Meeting of the San Paulo Gas Company, Limited . . . 955
Incandescent Gas Lighting in Southwark . . . 956
Manchester Corporation Gas and Electricity Supply . . . 956
Leeds Corporation Gas Supply . . . 956
The Rotherham Corporation and Carburetted Water Gas . . . 957
The Gas Poisoning Case at Plymouth . . . 957
The Oldbury Gas Undertaking . . . 957
Electric Lighting Notes . . . 958
Meeting of the East London Water-Works Company . . . 958
Gas and Water Companies' Stock and Share List . . . 959
Notes from Scotland . . . 960
Current Sales of Gas Products . . . 962
Coal Trade Reports . . . 962
PARAGRAPHS:—
PERSONAL: Mr. J. Gibb; Mr. J. Donaldson; Mr. Arthur Lloyd; Mr. Frank Tomlinson; Mr. W. Gorse; Mr. J. W. Helps; Mr. Neil J. Peters; Mr. Edwin Platt; Mr. and Mrs. J. W. Restler; Mr. John Lees Cocker; Mr. J. E. Kenshole; Mr. G. Williams . 922
OBITUARY: Herr H. B. Geinitz; Herr E. Blumer; Mr. W. P. Bodkin . . . 922
Professor Lewes on Incandescent Gas-Mantles—The Waste of Energy by Artificial Lights . . . 920
Combined Increase in Prices in the Meter Trade—Waverley Association of Gas Managers . . . 922
The Supply of Artificial Illuminants in France . . . 923
Sale of Shares . . . 933
The Heckmondwike Gas-Works Purchase Question—A Cornish Gas-Works—The Increase in the Price of Gas at Nottingham . 934
Monte Video Water-Works Company, Limited—Failure of the Teignmouth Gas Supply—The Halifax Corporation and their Water Reservoirs Contract . . . 936
The Aldeburgh Corporation and the Water-Works . . . 949
The Public Lighting of the City of London—Incandescent Gas Lighting in Lincoln . . . 953
Darlington Gas and Water Supply . . . 956
Dorking Gas Company—The Condition of the Water Supply of Pudsey . . . 957
Divining for Water . . . 962
Kingsbridge Water Supply—Gas and Electricity Profits at Southport—St. Anne's-on-the-Sea Gas Company—Cape Town Water Supply—Plymouth Corporation Water Supply . . . 963
The Dukinfield Gas Committee and Carburetted Water Gas—Antwerp Water-Works Company, Limited—West Gloucestershire Water Company—Bristol Water-Works Company . . . 964
Leeds Corporation Water Supply . . . 965

EDITORIAL NOTES.

London Gas in Parliament.

THE work of Parliament last week in relation to gas was very heavy, and of first-rate importance. The Committee to whom the four London Gas Bills have been remitted, Mr. Oldroyd being the Chairman, began with the Bill of the London County Council on Tuesday, and continued the hearing on Thursday and Friday, after which they rose for the Easter holidays. The inquiry will be resumed on Tuesday, the 1st prox. Progress has been made with the development of the promoters' case; but it has not been finished. The objects of the Bill, as most of our readers are doubtless aware, are two in number. One is to make further provision as to testing the illuminating power of the three London Companies' gas, by legalizing the use of a portable photometer; and the other is the regulation of the Companies' slot meter business. The latter question is held over for the present—the promoters having addressed themselves solely to the proving of their preamble relating to the testing of gas; and this is a very serious matter indeed for the parties concerned. The task which the London County Council have undertaken to perform is to satisfy the Committee that the illuminating power of the gas supplied by the Companies in their districts generally "cannot be satisfactorily or sufficiently tested by "tests made only at certain prescribed testing-places;" and, further, that it is expedient, right, and fair that the operations conducted at these fixed stations should be supplemented by "surprise" penalty testings made anywhere with the instrument named, or any appliance of the same character which the Gas Referees may prescribe.

The position taken up by the promoters was defined, with his usual force and pointedness, by Mr. Worsley Taylor, as being nothing more than the statutory ground that the consumers of London have a right to be supplied with 16-candle gas. There is no question that the illuminating power of the gas supply of London has been fixed by law at this figure; but there seems to be a most profound and irreconcilable difference of opinion as to what is the precise obligation laid upon the Companies. The words of the Acts of 1876 and 1880 are that the gas "supplied" by the Company, and in the latter Act with the qualification "at such testing-place," shall be as stated. The controlling authority, now the London County Council, argue that this implies the obligation upon the Companies to maintain this illuminating power in all parts of their districts; and the Companies dispute it. The Council contend that their view of the extent of the obligation is supported by the fact that Parliament, when enjoining upon the Companies the measure of illuminating power, and setting up a Board of Referees to see to its observance, gave the Referees unlimited discretion as to how many testing-stations they might require, and where these should be located. Consequently, the promoters of the Bill think they have only to bring sufficient evidence to show that gas can be found anywhere in the whole of the Administrative County of London which is not of 16-candle power, in order to prove that the Gas Companies are not fulfilling their statutory obligation in this respect. This is the sole alleged justification for the Bill.

Obviously, the claim of the controlling authority is very plausible. It is just the case to catch the popular fancy, merely to plead that the consumer should have the gas the Companies contracted to supply. Also, it looks very mysterious, to say no more, that surprise tests of gas should show, on the oath of reputable witnesses, that, as a matter of fact, while 16-candle gas is being registered in the official way at the fixed testing-stations, outside these places the town's gas is poorer by several candles. If what has already been stated as the controlling authorities' view of the obligation of the Companies is a correct reading of the law, and the obligation is disregarded in this flagrant and "chronic" degree, as the Chairman of the Committee has remarked, it would appear to be the natural inference that the actual system of testing is a delusion and a snare, the Gas Referees weak triflers with their duty, and the Gas Companies barefaced frauds. The reform of introducing a variety of the existing photometrical methods would seem to be a milk-and-watery remedy for so scandalous a state of things.

Happily for a good many reputations, however, there is another aspect of whatever may ultimately appear to be

the facts of the matter. The promoters of the Bill themselves shrink from imputing fraud to the Companies. We cannot discuss the evidence yet given; but, for the sake of those who desire to think well of a number of gentlemen hitherto esteemed as respectable members of society, and no fools in their vocations, it may be suggested that the evidence itself is open to the interpretation that there must be a question about the obligation. It is to be regretted that the promoters have not had the courage of their opinions. If what Mr. Worsley Taylor says is the law, and the facts are to be interpreted in the light of it, then there should be no squeamishness about drawing the logical inference. But the Companies, so far as can be gathered from incidental observations of Mr. Pope and other Counsel, challenge the promoters' reading of the Acts of Parliament. London is to be "supplied"—the testing-stations are to be supplied—with 16-candle gas. What is 16-candle gas? And why testing-stations for ascertaining whether this so easily-said requirement is satisfied? Whether it is the law or not, the sense in which persons "having practical knowledge and experience in the manufacture and supply of "gas," such as were originally held to be peculiarly eligible for the office of Gas Referee, understand the word "supply" in this connection, is to "furnish." That is to say, gas of this quality must be sent into the town. Even Mr. Worsley Taylor admitted that there might be conditions, as "dead-ends" of pipes, where it would be unfair to test the gas "supplied;" but this is to open a door that cannot be swung by degrees. It must be either open or shut. Mr. Vernon Harcourt, as was to have been expected, told the Committee that the extent of the Companies' obligation is a matter for dispute. Obviously, if testing for illuminating power is to be co-extensive with the consumers' internal gas-fittings throughout the whole of London, then 20 or 20,000 fixed testing-stations would be inadequate to give the consumers the "protection" which such institutions are capable of affording.

Enough has been said to inform our readers of the enormously important issue which Mr. Oldroyd's Committee, in the first place, are called upon to try. Parliament is powerful; and if it chose, it could enact that if a barrel of ale or a jug of milk turn sour in any house, then the brewer or the milkman, as the case may be, shall answer for it. But the Bill for making so valuable an improvement on the ordinary conditions of dealing in perishable commodities would need careful drafting to prevent its operating in restraint of trade and to the increase of the price of necessaries of life. The London County Council Bill is *not* a Bill to increase the price of gas; but some of the witnesses who have supported it professed complete indifference to such a consideration. At this time, too!

Bradford Gas Politics.

The Bradford Corporation Bill has been in Committee all the week, and the proposals relating to gas have been keenly criticized. In the event, the Committee left the matter in suspense over the holidays, in the hope that the parties would agree, and so spare Parliament the painful proceeding of ordering compulsory expropriation. This is the long and the short of the matter. Bradford is a Municipality driven by circumstances to expansion, which has already gone far, and to which there is no apparent limit. It so happens that, incidentally to this continuous growth of the borough, there is unavoidable trespass upon a number of suburban districts hitherto supplied with gas, more or less profitably, by local Gas Companies. Many large centres of population are differently situated in this regard; but in the neighbourhood of Bradford, for economic reasons, gas is and has long been supplied by several isolated Companies with no common bond among themselves, and certainly with no relationship to Bradford. Last year Bradford went to Parliament with a scheme of partition for certain of these undertakings, which failed to enlist the sympathy of the Legislature. It was proposed to take only such portions of these properties as actually lay within the borough limits for the time being; but the difficulty of buying pieces of a gas undertaking at a fair value, and the sentimental objection to the principle, constituted a stumbling-block. Learning by experience, Bradford this year has proposed to purchase outright such of the undertakings as it coveted; and in some cases this proceeding was not seriously objected to. On the other hand, certain Companies did object; and Bradford was rather ill-advised in trying to "rush" the Committee into a belief that the compulsory expropriation of gas companies is one of the commonest of municipal experiences. Consequently upon this strategical blunder, matters did not progress very smoothly. The Committee exhibited a remarkable spirit of hostility to anything that might look like an intention on the part of Bradford to reduce the outlying gas undertakings to a "scrap value;" and accordingly the ardent Municipality had to go slow. In all probability, the parties will return to the scene of what at one time looked perilously near to a desperate misunderstanding, with an agreed programme which the Committee will sanction without difficulty. Meanwhile, it is a distinctly satisfactory reflection that Parliament is very properly jealous for the rights of small and poor suburban Gas Companies threatened with rivalry by big inner centres of population. It is natural and inevitable, of course, that large and growing municipalities should extend their protection, and also their government, over the inhabited regions to which their boundaries approach from time to time. An independent suburb, especially if it is of an industrial character, is apt to be a place where noxious trades are carried on, and many things permitted which the better-governed centre does not sanction. At the same time, the suburban Gas Companies, although their circumstances may never have been very fortunate, have kept the light of gas going when no better service was to be had; and they deserve fair treatment when their day is past. We do not charge the central municipalities with conscious oppression of these outlying and sometimes indifferently successful undertakings. But they have their point of view; and it is not always possible for them to rely upon the support of their own ratepayers in doing spontaneously what Parliament will certainly require when all the facts are known.

The Meeting of the Commercial Gas Company.

The Commercial Gas Company held their ordinary general meeting on Thursday, when the Chairman, Mr. J. Blacket Gill, had a satisfactory tale to tell of business increasing at a rate which a few years ago would have been regarded as beyond the possibilities of the Company's situation. After briefly setting forth the results of the past half-year's working, the Chairman had to make a clean breast of the new state of the Company's affairs consequent upon the doubling of the price of coal. He boldly, and as we are inclined to think very wisely, took the step of announcing an increase of 6d. per 1000 cubic feet as from Lady Day. True, the South Metropolitan Company are only raising their price by 3d.; and the Chartered have not made any general announcement. But the facts are plain, and they cannot be denied. Everybody knows that coal is dearer; and nobody will expect Gas Companies to work miracles. Companies with large reserves may elect to temporize until they see what warmer weather will do. There was a brief time, we must confess, when we fondly believed the price of coal was about to topple; but the cold weather and foreign greediness for English coal at any price hardened the market again. If the price of gas must be raised on this account, it will be a mistake to make two bites of the cherry. Besides, the second might have to be taken at a season of the year when the householder does not burn coal, and consequently has not the higher price brought home to his inner consciousness. Another important incident of Thursday's meeting was the unanimous adoption of the Directors' proposal to sacrifice the right to issue the remainder of the capital stock of the Company at par to the proprietors, and to sell it by tender or at auction. The Board and the Company generally are to be congratulated on their statesmanlike decision, which will strengthen them enormously if they should ever have to defend themselves against an enemy.

The Wandsworth Building Act Case.

The Wandsworth and Putney Gas Company have failed to maintain their legal position in regard to the London Building Act, as stated by the Metropolitan Magistrate before whom they were summoned by the London County Council, as reported in the last volume of the "Journal" (p. 1251). It was a case of building over the frontage-line, as defined by the Act, of a by-way near the river; and the question of law was as to whether the Company's Private Acts empowered them to contravene the public enactment in this regard. The Magistrate said "Yes;" and now the Divisional Court have said "No." Our report of the hearing by the higher Court is worth studying as a lesson in the mutual bearing of General and Special Acts. It is

not surprising that the Court should have come to the conclusion now recorded. Rather was it remarkable that the Magistrate found the other way. The present decision is more in accord with others of older date. The only important question in such cases is which is the first and chief obligation. The judgment draws a sharp distinction between the statutory powers of a Gas Company for erecting such works "as" they think fit, and the General Acts which may forbid them to erect the works "where" they please. You may build gas-works under the powers of a Special Act, but the work must not be done regardless of every other—and possibly conflicting—law of a superior order. This was the moral of the Hull gasholder case also. There does not appear to be any room for a different rule. In this Wandsworth case, there were particular considerations which, as the Court allowed, rendered the elucidation of the general principle difficult; while the hardship to the Company of being prevented from putting their own land to the only use for which it is of any good to them is patent.

Informal Meeting of Scottish Gas Managers.

It is questionable whether a greater surprise is in store for gas managers this year than will be experienced on reading the announcement made at the customary Informal Meeting held in Glasgow last week, of the almost wholesale conversion of gas managers in Scotland to the policy of supplying low-grade gas. It is but a few years ago that the only tangible movement among managers on the other side of the Border was towards enrichment, with a view to keeping the illuminating power of the gas at the high standard which has always prevailed in Scotland. Mr. T. D. Hall, of Montrose, was the only one who ventured to express an opinion favourable to low-grade gas; and his was as a voice crying in the wilderness. The support he received was not merely scant; it was *nil*. When, however, at the Informal Meeting in Glasgow last Wednesday, Mr. J. W. Carmichael, of Barrhead, in his very thoughtful and well-reasoned presidential address, gave his opinion as being in favour of a reduction in the standard of illuminating power to at least 20 candles, the managers present seemed almost to tumble over each other in their haste to announce their adhesion to the President's views—some going down as far with their proposed standard as 15 candles. Mr. James M'Gilchrist, of Dumbarton, the doughty champion, for many years, of high-grade gas, while not joining in the consensus, was obliged to admit that circumstances have changed, and that the maintenance of a high illuminating power is now of less importance. It is probable that Scotsmen were, in time, bound to come to the view which was almost the unanimous feeling of the meeting. What surprises is the suddenness of the adoption of the new front—not to call it change of front, for there is nothing to indicate that the new doctrine may not have been held by many in secret, though not divulged, seeing that the "circumstances" did not require it. But the probability is that the circumstances have developed rapidly, and that the new doctrine is in reality new with many who now hold it firmly. One of these circumstances has been the great expansion of the use of gas fires and cookers; and another has been the popularization of incandescent gas lighting—for both of which uses a poor gas is quite as good as a rich one. But the prime-mover has been, of course, the great rise in the price of coal; and we all know that it has taken, not only gas managers in Scotland, but the whole world (outside coal circles) by surprise. This is a truism; but there is hanging on, as it were, to this matter of dear coal, the feeling that we may be nearer the exhaustion of the richer coals for gas making than has hitherto been believed. This view was almost, indeed, openly expressed at the Informal Meeting. So far from this not being the probable state of matters, it is by no means improbable, because coalowners, though they might form a ring, and raise prices for a time, could not eliminate a coal from the market so effectually as to convince a whole industry that it could not be got. Were it possible to entertain the opinion that this is what has been done here, then the other view arises, that the coalowners will have overdone their part, and that there will very speedily be a reaction. The subject is one not to be lightly put out of mind. The exhaustion of first-class cannel would have a far-reaching effect upon the manufacture of gas. The Scotch managers probably spoke under the influence of panic; but they are not the likeliest people to be led away by any such reason. That they have been led away is probably the weightiest reason why the whole subject should receive early and earnest attention. This matter overshadowed every other. It is, however, a great pleasure to learn that the meeting was unusually well attended; that the President gave an admirable address, introducing many subjects for discussion; that the discussion was largely taken part in; and that the speaking was of so high an order. There is a "shoulder-to-shoulder" feeling in the whole proceedings that is quite refreshing.

Coal and Iron Profits in 1899.

In a recent issue of the "Economist," there was a very interesting tabulation of the dividends declared by the principal colliery and iron and steel companies of the United Kingdom during 1899, compared with those paid during the previous nine years. The table is eloquent of the prosperous times through which these industries are passing; the dividends declared last year being, with only a few inconsiderable exceptions, at much higher rates than had been earned in recent years, though not in any but a very few cases exceeding those paid in 1890—the crowning year of the previous period of prosperity. As is observed, however, dividends alone give only a very general indication of the character of a year's working in the case of collieries and iron-works, as the question of provision against depreciation is in their case of the utmost importance. An examination of the reports of some of the principal undertakings affords striking proof of the great prosperity enjoyed by the coal, iron, and allied trades last year; the sums written off for depreciation, and expended on extensions of works and plant, amounting in several instances to more than the dividends distributed. We may give one instance of a colliery's and one of an iron-works' profits during the year: (1) The Welsh firm of D. Davis and Sons not only paid two years' preference dividend, amounting to £12,000, out of the profits for 1899, but also cleared off a debit balance of £16,844 brought forward from 1898, redeemed £40,000 worth of debentures, placed £10,000 to reserve, and paid 8¾ per cent. ordinary dividend—or equal to £49,375. (2) Messrs. Bolckow, Vaughan, and Co., out of their profits last year (calculated after providing for depreciation) bought a complete iron-works for £215,000, and spent £48,135 on other extensions and new plant, besides distributing an ordinary dividend amounting to £219,704. Other instances could be multiplied; but the two given are sufficient to demonstrate the fact that, for shareholders in coal and iron companies, 1899 was a golden year. The effect, so far as holders of gas stocks are concerned, is unfortunately likely to be the reverse of satisfactory during the present year; and the outlook is not lightened by the fact that most of the reports referred to above speak of the future as "very promising"—it being anticipated that the close of the war will be followed by a demand for iron and steel goods sufficient to ensure the continuance of activity at least for the remainder of the current year. The prices of meters, stoves, and fittings are already being raised by the makers; while machinery and constructional ironwork jumped up months ago, and have not shown any signs of falling. Proprietors of gas stock must resign themselves to the inevitable, and wait for easier times.

The Liability of "Undertakers" and Contractors under the Workmen's Compensation Act.

Just before Parliament rose for the holidays, the Leader of the House of Commons took an opportunity, while answering a question, of repeating the opinion expressed by the Home Secretary that the amendment and extension of the Workmen's Compensation Act will not be long delayed. Oddly enough, this declaration has been pounced upon by a newspaper more or less identified in politics with the Opposition, and used as a "stick" for the belabouring of the Government in general and of Mr. Chamberlain in particular. The political motive of this is tolerably obvious, but does not concern us. What does interest our readers, however, is the onslaught which some newspapers and politicians continually make upon those employers who are constrained to seek the protection of the Appeal Court against what they regard as miscarriages of justice in the Courts of First Instance. This is done by picking out a few doubtful cases, in which the employer has either lost or has been made to figure as a hard man, and exhibiting them as proofs that the masters are set upon taking "every "possible point, good, bad, or indifferent." The testimony of representative employers and workmen that the Act, as

a rule, works well, and with remarkably little friction, goes for nothing against such prejudiced statements.

When the Act has been amended, and extended to the fullest practical limits, there will still be some litigation—perhaps more than ever; because most of the appeals at present are upon questions of limitation. Give every workman the benefits of the Act, and it will still remain to be decided in numerous instances who is a workman, when he is doing his proper work, and who shall pay him his compensation. It is a simple faith that some people seem to have, that an extension of legislation in any direction will ever tend to reduce litigation. Quite the contrary result is to be expected. One of the latest of the appeals out of which it has been sought to make a grievance, is a case in which a painter, working for a general contractor for building repairs, failed to recover from a Railway Company for injuries he received from an engine. The man was working at a railway station when he was hurt; and he sued the Company under section 4 of the Act, which makes the undertaker liable to men working for a contractor. This enactment, as is notorious, was made for the purpose of getting over the difficulty of sub-contracting, which it does completely. At the same time, however, it was provided that the section shall not apply to men engaged in merely ancillary or incidental work, which does not form a part of the ordinary business of the undertaker. Here, again, the object of the Legislature is conspicuously clear. It is designed to meet cases of the very kind in question, where the men work for a contractor engaged in another line of business altogether from the undertaker.

The point is of great importance for gas companies and all "undertakers," in the language of the Act; because without it every man working for a contractor for ordinary building or engineering work and repairs would have a distinct claim, not on his own master, but on the master's employer. "The practical consequence of the "decision is that no railway company can be sued "under the Act by workmen not in their own immediate "employ." That, of course, depends upon circumstances. These sweeping generalizations are extremely dangerous, where the interpretation of an Act of Parliament is concerned. The case of *Pearce v. London and South-Western Railway Company* is quite valuable and significant enough as it stands; and those of our readers who are interested in the matter, are not likely to misunderstand it. Much of the litigation that has occurred under the Act is due to attempts to put the saddle on the wrong horse; and although it is possible to sympathize with the hard cases that inspire this attempt to make bad law, the line of responsibility must be strictly drawn, in the interest of the workpeople themselves. Meanwhile, a prudent undertaker may feel justified in taking some assurance from his contractors that he shall not be liable to be thus gibbeted.

WATER AND SANITARY AFFAIRS.

The proceedings at the meeting of the East London Water Company last Thursday consisted practically of the address of the Chairman, Colonel Lockwood, M.P. It was shorter and of a more cheery character than the one he delivered this time last year, when, owing to the retirement of Mr. Banbury, he had to present to the shareholders an account of the difficulties through which the Company had passed owing to the extraordinary drought of the previous summer. That those difficulties should have pressed so heavily upon the Company was in large measure due to the persistent opposition of the London County Council; and that they were eventually removed was the result of the policy adopted by the Directors, and of the untiring service of the Engineer and other officials. Colonel Lockwood's first address was a masterly vindication of the course pursued by his colleagues; last Thursday's was couched in somewhat different terms, owing to the changed circumstances. True, the Company had had to bear the great strain of yet another period of drought; but thanks to the intercommunication scheme, they came triumphantly through it. During the whole of the long spell of dry weather last year, a continuous supply of water was furnished throughout the Company's district. But at what cost? Nearly £31,000. This large sum was expended in the purchase of water from other Companies; and the effect upon the accounts for the half year was to leave only £359 to be carried forward, after the payment of the dividend. No shareholder rose to complain of this outlay, as it was manifestly necessary in order that the needs of the 200,000 consumers in the Company's extensive area should be fully supplied. In fact, if the additional expenditure entailed by the drought had compelled the Directors to recommend a slight reduction of dividend, it would no doubt have been agreed to, in view of the satisfactory results which had attended it. For, notwithstanding all attempts to sow discontent among them, the consumers are beginning at length to realize that water delivered in their houses for a trifle over 4d. per 1000 gallons is not a very dear commodity; and the consequence is that the relations between the Company and their large body of customers are now of the pleasantest character. The Directors are naturally gratified at recognizing this happy result of their policy; and their feeling is evidently shared by the proprietors. It was not to be supposed that Colonel Lockwood would pass over the report of the Royal Commission; but as the Directors regard it as most satisfactory, he did not dwell upon it. He, however, very properly pointed out that, while the cost of the incessant agitation kept up against the Water Companies is in one case spread over three-quarters of a million of ratepayers, and therefore is not felt individually, in the other it comes in a concrete form upon the parties attacked. It cost the Company last year nearly £6000 to defend themselves against charges which, as in the cases of the other Companies, had always been disproved when investigated by an impartial tribunal. But comparative peace may be now expected.

It is to be hoped that no water engineer will have to pass through such a time of anxiety as did Mr. W. J. Ware, the Engineer of the Maidstone Water Company, on the occasion of the serious epidemic of typhoid fever with which that town was visited towards the close of the summer of 1897. But should his district ever be similarly afflicted, he will do well to profit by the experience gained by his colleague, as recorded in the paper read at the meeting of the Society of Engineers on Monday last week, and given in abstract form in another column. It may be remembered that very shortly after the outbreak, Dr. G. Sims Woodhead was called in to make a thorough inquiry into the matter, and advise the Company as to the cause of the epidemic, and as to what steps, if any, should be taken to prevent its increase. The conclusion was arrived at that, if the water had anything to do with the dissemination of the disease, all that was necessary was to sterilize the reservoirs and mains in which the high-pressure water was collected and distributed. After a careful study of the method of sterilizing with dilute milk of lime, as carried out, under the advice of Professor Dewar, at Worthing, and comparing it with experiments made with the various chlorine compounds, it was decided to fill the mains and service-pipes with a quantity of chloride of lime solution of about 1 per cent. strength. The total length of mains in the high-pressure area was 25,937 yards, and their capacity rather more than 76,000 gallons; and the way in which their disinfection was carried out is indicated in our abstract. Those who desire additional particulars will, of course, consult the full text of the paper, which, accompanied by a map, will appear later on in the Society's "Transactions." It is the combined production of Dr. Sims Woodhead and Mr. Ware. The result of the treatment adopted was the removal of all possibility of the continued existence of any typhoid organisms in either the mains or the service-pipes. In fact, the authors were satisfied that no micro-organisms of any form that could have obtained access to the pipes from the high-pressure service could remain alive. The reason for deciding upon chloride of lime was its great efficacy as a disinfectant and its comparative cheapness. As shown by the paper, it answered admirably in this respect. The only drawback to its use was its destructive action upon the leather washers of the taps and valves, as well as upon the articles of clothing worn by those who carried out the operations. Apart from this, however, no ill-effect was traceable to the employment of the chlorinated lime solution. The paper is of special interest from the fact that it records the results of a thoroughly successful experiment in the disinfection of a water-distributing system on an unusually large scale, and in the face of many difficulties; and the thanks of water engineers and sanitarians generally are due to the authors for preparing it, and to the Council of the Society of Engineers for enabling them to bring its subject-matter before those who are likely to profit by its publication.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 959.)

Business on the Stock Exchange was not very good last week. Such activity as there existed was limited closely to one or two lines (the American being again the busiest), while most departments were decidedly dull. The approach of the settlement and the ensuing Easter break caused a considerable amount of realization and closing down for the holidays, and took the top off some of the advances in value which had been run up. So that in result few prices have gained much by the week's operations, while a good many are decidedly the worse. The Money Market was very easy, especially in the earlier portion of the week; and discount rates also fell at once, though they hardened up before the finish. Business in the Gas Market was more abundant than in the preceding week. Movements in value have naturally been adverse, as was pointed out last week. The announcements made during the week of unavoidable increases in the price of gas have prepared shareholders for a reduction in the dividends to be declared for the current half year. And, in the case of those foreign undertakings whose concessions bind them down to a price without the power of raising it, the increased cost of coal will probably work a similar reduction. Each of the Metropolitan Companies was more or less affected. In Gaslights, the ordinary opened at about 105½, and stood to it steadily until Friday, when a sharp fall set in, and 102 was marked; the quotation dropping a couple of points. The secured issues also weakened; but only the debenture receded. South Metropolitan was similarly moved. After touching 137½, it fell on Friday, and the closing mark on Saturday was 134; but for some reason the quotation was not varied in accordance. Commercials were very lightly dealt in, and had a moderate fall. At the Company's meeting on Thursday, the Chairman announced an increase of 6d. in the price of gas, which will take 1½ per cent. off the authorized rate of dividend. But the most important incident was a resolution that all future capital shall be raised on the cheapest possible terms. This strengthens the Company by removing a source of weakness which has handicapped them in the past. Suburbans and Provincials were very quiet; and they, too, underwent the lowering treatment—Brentford and Brighton receding. Among the Continental Companies, European and Union were the most freely offered, and commanded only easier figures. Imperial was unchanged. The remoter undertakings were unaffected. Business in Water was much the same as usual; and here too lower prices ruled.

The daily operations were: Business in Gas on Monday was mostly in Gaslights at the old prices. Brighton original fell 2; and European ½. Things were very quiet on Tuesday. Continental Union moved back 5. Wednesday, too, was rather inactive; and Gas quotations were unchanged. In Water, East London fell 2. Thursday was no busier; and prices were still shrinking. Brentford old relapsed 4½; and Brighton original 3. Friday was the most active day, and had most changes. Gaslight ordinary dropped 2, Commercial old 3, ditto new 5, and South Metropolitan ½. Saturday was very quiet; but Gaslight debenture fell 1, and Brentford new 3. In Water, New River was 2 lower.

COAL PRICES AND RAILWAY RATES.

The abnormally high prices which are, and for months past have been, ruling for coal and all iron and steel goods, are having far-reaching effects upon industrial economics generally, as was, of course, inevitable from the fact that the trade in these commodities forms the backbone of the commerce of the country. With their immediate effects on the gas industry, our readers are only too familiar from actual experience. Their influence upon another group of undertakings to which coal and iron are vital necessities is already beginning to make itself manifest. We refer to the Railway Companies, who may be said to be born of iron, and kept alive by coal. As with gas companies so with railways, owing to the contract system for obtaining coal supplies, the increased prices which fuel has reached during the past winter are only now beginning to take full effect; yet, speaking at their recent half-yearly meeting, the Chairman of the Great Northern Company said that "the increase in the price [of coal] during last year represents about ½ per cent. on railway dividends generally." In other words, an increase in the train mileage of less than 5 per cent. had been accompanied by an increased charge for fuel of about 22 per cent. over 1898, while wages and materials—largely metal goods—also rose to an extent out of proportion to the increased business. As the coal contracts will have to be renewed at much higher prices, and materials continue dear, the working expenses of the railway companies this year will inevitably be heavier than during 1899.

Apart from its general interest, this prospect is of direct concern to the gas industry; for it is obvious that the railway companies will endeavour to provide for this expanding cost of working by raising their rates for the conveyance of goods and passengers. They would, further, be more than human if they did not endeavour to get back some of the cost of their fuel by means of a higher impost upon the carriage of coal. Fortunately, as we said last week, the suggested addition of 3d. per ton to the rates charged for the carriage of coal from Scotland and the North to London has not as yet been imposed, owing to the opposition of the London and North-Western Company; but other increased charges are reported to have been agreed upon, which must of necessity add to the cost of carrying coal from the pit to the consumer. The charges for weighing coal, and for the hire of coal waggons, are to be raised; as also those for delivering coal and coke to blast furnaces; while additions are to be made to the present rates charged for rent of sidings, demurrage, &c. What increase in the cost of carriage per ton of coal these changes will entail, it is impossible at present to say. But one thing is certain, which is that whatever the increase may be, it will fall upon the consignee rather than upon the colliery. The railway companies will, therefore, in effect, be shifting some of their heavier fuel bill on to the shoulders of those who are already suffering from the abnormal price of coal.

In commenting at length upon the steps which are understood to be in contemplation by the railways, having for their object the approximate maintenance of dividends, "The Times" speaks of these companies as preparing to "enter upon a doubtful and dangerous course of policy. They cannot," the writer proceeds, "afford to place themselves in an attitude of indifference, if not hostility, to public opinion, or to encourage the growth of such a feeling as that which prevails in the United States against the working of monopolist corporations. Hitherto, they have, on the whole, shown much good sense and moderation, sometimes under rather trying conditions. But they must not forget the lessons that experience has already taught them. They must bear in mind that to strain legal rights up to the highest permissible point, and to ignore long usage and general understandings, is not the part of practical wisdom." Therein is much sound common-sense; but it appears to us that the policy outlined in the article quoted, scarcely falls within the category of "doubtful and dangerous." We naturally regret that the policy entails a further burden upon the coal buyer; but it is impossible to contend that the shareholders in the great railways of the kingdom—who have never received extravagant dividends—should, any more than the shareholders in gas undertakings, be expected to bear the full cost of the abnormal condition of the coal and iron trades. That cost must inevitably spread itself over the bulk of the inhabitants of this country. Whether the prices now ruling in those trades can then be maintained will depend entirely upon the extent to which those prices are due to lasting or to temporary prosperity of trade in general.

ARCHITECTS ON THE BUILDING OF SMALL HOUSES.

It is a coincidence that within a month of the first appearance of the "Journal" essay of Feb. 20 last, entitled "In the Cause of Intelligent House Building," Mr. C. E. Bateman, of Birmingham, contributed a paper on "Small Houses" to the Architectural Association. The paper, which was illustrated by many plans and elevations of houses built by the author, chiefly in Warwickshire, was published in the "Builder" of the 17th ult., with a good report of the discussion. Those of our readers who are interested in the subject should not fail to procure this number of our contemporary. The author recognized that his auditory was composed of brother professionals, and as such "knowing all about domestic architecture." It is to be hoped that there was no satire hidden in the observation; but we are not sure of this. Mr. Bateman himself started his statement of works accomplished from what he called the "lower limit" of a dwelling-house costing £750 to build, and letting at £45 rental. This is altogether beneath the scope of London architects, one of whom admitted in the discussion that "there was not the slightest chance of competing with speculative builders in London, because the £750 house, which Mr. Bateman had referred to, if built by the speculative builder, with the same number of rooms, possibly larger, could be bought for £450." That is an acknowledgment of the truth of the impeachment of the profession of the modern architect contained in our February article—that the vast bulk of the dwellers in houses of from £25 to £50 rental have nothing to hope for from architects; but are left to the tender mercies of the speculative builder, who has the house "market" all to himself.

Let us pause for a moment to ask whether this state of things in the house building trade is right. We make bold to declare that it is not; inasmuch as it deprives the small householder of these times of all the benefits, of every kind and degree, which the accomplishments of the architect might confer upon him. The householder—90 per cent. of him—is subject to the unrelieved commercialism of the speculative builder; while the professional architect has no interest in the suburb except as providing a site for a new church, and a Board school or two. Modern architecture does not clear itself of responsibility for this exclusiveness, by giving the speculative builder best, as was done at the recent meeting of the Association. Why has the tradesman been able to dispense with the architect? Architecture itself he cannot escape from. The worst speculative builder who ever spoilt a green field with bad brick boxes must be as much of an architect as his necessities and resources,

mental and material, permit. As soon as he has the smallest opening for it, the builder blossoms out with pathetic tributes to the call of human nature for art. Not knowing, his results are usually deplorable; but this is not his fault.

The root and origin of the evil lies in the modern and artificial separation of the occupations of building and architecture. There ought never to be another "articled pupil" in the profession. If the architect cannot stoop to the service of the mass of the community, as the builder does, let him begin as a builder himself, and so learn how it is done by actually doing it. Something like this seems to be in vogue in provincial practice; and Mr. Bateman was able to talk of architecture as a study not restricted to mouldings and sky-lines. It is refreshing to read his straightforward defence of the place of the architect in house-building. He knows the speculative builder, too; but his idea of this person is of a "genius" who is able to get more than 6 per cent. on the outlay on building. For himself, he appears to be able to maintain his own position as the professional adviser of those who are content to build for 5 or 5¼ per cent. This disclosure seemed to be a revelation to the London architects he addressed, one of whom was humorously inclined to commiserate with the Birmingham professional because "the London architect whose houses cost 10d. per foot received half as much again in fees as did architects in Birmingham and the Midlands at 6½d. or 7d. per foot." But if the Midland professional gets two or more commissions to the London man's one, which is the better business? And the point for the consideration of the "profession" is that, whereas people wishful of building houses for themselves, or for investment, at a reasonable and remunerative outlay can go to the Bateman type of architect with a confident hope of getting what they require, the usual London professional owns his inability to work within twice the cost that pays the ordinary tradesman.

Our interest in the subject was sufficiently expounded in February. Small house occupiers are gas consumers to a man, where a supply can be had; and if there were higher intelligence directed to the provision of such dwellings for the enormously increasing suburban populations of the United Kingdom, the advantages of gas would be much more freely enjoyed by those who are ready and willing to pay for them. As it is, to whom should the most enterprising of our gas distributing engineers address himself, in order to explain how greatly the familiar "servant difficulty" can be minimized by the adoption of gas for cooking and heating? The architectural gentlemen have nothing to say in the matter; and the speculative builder is more concerned to let his houses than to make them economical to keep afterwards.

Mr. Bateman is almost alone in insisting upon the advantage to an architect of having to study economy. As we have remarked, this is one of the best and strongest of all influences to produce good engineering; but Mr. Bateman is bold enough to declare that "more houses are spoilt by having too much money badly spent upon them than too little." This is a great truth, and opens up the prospect of getting good work done at a reasonable outlay. It is not our intention to follow Mr. Bateman's remarks, nor to uphold his own practical applications of his architectural ideas. His paper is a capital exposition of the things a house designer should think about beforehand; and many of his ideas and suggestions are very good. His practical mind is shown in the remark that Willesden paper is a good substitute for boarding on roofs. This particular suggestion leads one to mark one reason why the speculative builder is able to beat the professional architect as a cheap constructor. It is that, always having his hand in, he knows better what materials come cheapest and most advantageous to himself season by season. If the architect were as thoroughly up to his work as the builder is, he, too, would have this kind of knowledge, and would apply it to his client's advantage.

It is scarcely a digression; but to prove how completely some professional architects are out of the way of builders' business, the present writer knows of an instance where an architect, having planned a house for a friend, told the latter that if he could find a respectable builder to estimate for the building to his own specification, the job would probably cost 30 per cent. less than it would on the architect's specification, and still be quite as satisfactory.

A valuable observation, in which Mr. Bateman is supported by the Editor of the "Builder," is that there is not much to be learnt from the study of old and "picturesque" houses in respect of bedroom planning or even construction; while sanitary arrangements are, of course, distinctively modern. The seduction of half-timbered elevations is particularly dangerous. There is much reason for the complaint that "architects, even when they can see that such methods as half-timber are anachronisms, seem to be still afraid of making use of modern materials in country houses still in pursuit of some imaginary picturesque." An obvious illustration of this weakness is the shyness of architects towards steel joists and coke-breeze concrete, as modern aids to good building. Mr. Arnold Mitchell approves of this method of construction as a means of preventing the smells of the kitchen from penetrating to the upper rooms. Even the ordinary fir joists can be filled in with coke-breeze concrete, with good effect. Curiously enough, not one of the architects who took part in the discussion of Mr. Bateman's paper mentioned the pioneer work of another Birmingham man, the late Dr. Lawson Tait, in the adaptation of gas-fires to dwelling houses; although there was much said as to the sufficiency of 9-inch pipe flues for chimneys.

A remarkable side-light was thrown in the course of the discussion on the bent of the professional architectural mind, by some complimentary references to the work of Mr. Nesfield, who was qualified as "one of the first designers of the century." This gentleman, on being asked "where he got his motive for his Queen Anne buildings," is reported to have replied "from the Sussex farmhouses." Alas! the ordinary suburban resident does not live in the reign of Queen Anne; nor are his surroundings those of Sussex Down pastures. Why should domestic, like church architecture be ever "Looking Backward?" Let it be accepted that the good master-builder is a man of his own time—an age of steel, concrete, steam wood-working, good bricks, ample sheet glass, the water-closet, the bath, the circulating boiler, and gas. It is for the architect to redeem the use of these things by the saving grace of art; and it is both cheap and cowardly to shuffle off the responsibility by affecting to ignore their existence. Different aspects and branches of this study of practical building construction on modern lines have been dealt with from time to time in the "Journal." We welcome all worthy contributions to the advancement of the art and industry of house-building, including the paper of Mr. Bateman and the observations of his critics; and hope the best for the practical realization of the aspiration of the Editor of the "Builder," that the desirable homelike effect shall be produced "with the best modern materials and construction."

In this respect, satisfaction may be felt at the growth of the fashion of doing away with the bad old method of building houses with hollow spaces everywhere which can never be got at or cleaned out. Solid brick walls, solid breeze concrete floors, solid skirtings, solid partitions, solid framed windows, tight roofs—all these possibilities of modern building construction are to be accepted, not with a groan because they are not "Queen Anne," but gratefully and enthusiastically as gifts of modern science to the genius of architecture. Mr. Statham says truly that what is interesting and picturesque to us moderns in the work of the old artificers was not recognized as such by the men who built it. They simply did the best they could with the means they had at hand; and if we wish to emulate them it will be done not by slavishly copying their performances, but by working in the same spirit. House-building in steel and concrete can be as pleasing to the eye as any work in less excellent materials, if it is inspired with a true feeling for art; and where this does not exist, it is only a mockery of it which so-called architectural "learning" is competent to supply in its place.

Some gentle advice was given at the architects' meeting about the proper placing of outdoor and indoor pipes, for different purposes. Rain-water pipes were discussed with greater confidence, because there is plenty of "authority" for the due treatment of these appliances of civilization; but most of those who mentioned indoor piping did so with bated breath, as those who consented to the perpetration of a convenient iniquity. Why should not the convenient location of telephone wires be as well studied by living architects as the gas and water pipes that have been indispensable in houses these fifty years, but which the ordinary architect is not at home with even yet? Where is the practising architect who has mastered the fact of the enormous convenience of a domestic telephone service for all but the very smallest houses? It would be hard to say which is the less open to the reception of fresh ideas in building—the matter-of-fact speculative builder, or the architect so highly educated that his learning and his taste have become a "temperament." This is a great pity; and, as Mr. A. T. Bolton said at the meeting, it would be much better if young architects would devote themselves to the improvement of house-building on strict commercial principles, instead of preparing ambitious competition drawings which would come to nothing. After all, a suburb of good houses is a better monument than a half-finished church.

Professor Lewes on Incandescent Gas-Mantles.—Early in the present session of the Society of Arts, arrangements were made by the Council for the delivery by Professor Fleming of a course of Cantor Lectures on "Electric Oscillations and Electric Waves." Owing, however, to the lecturer having been unexpectedly summoned to America, Professor Vivian B. Lewes will give three lectures on "The Incandescent Gas-Mantle and its Use," on the 7th, 14th, and 21st prox.

The Waste of Energy by Artificial Lights.—"Nature" points out that all artificial lights, even the best, are extravagantly wasteful of energy, inasmuch as they lavish it in the infra-red, and not in the visible spectrum. Mr. C. G. Abbot, who has charge of the Astrophysical Observatory of the Smithsonian Institution, has examined the light emitted by the Welsbach and other incandescent mantles by means of the bolometer, with a view to comparing their efficiencies. Though the illuminating powers differ considerably, the distribution of energy is much less diversified than would be supposed, and shows clearly the wastefulness even of the Welsbach light as a source of illumination. The infra-red in each case includes by far the greater portion of the energy, and not the visible spectrum, as is the case with the sun, and still more with phosphorescent substances. Excluding infra-red radiation, the Welsbach mantle was found to be superior in light to the others experimented with, especially in the red, orange, and yellow parts of the visible spectrum.

A POPULAR ACCOUNT OF CARBURETTED WATER GAS.

Everyone who has watched the progress of literature during the past few years cannot fail to have been struck with the large number of new illustrated magazines which have made their appearance and appealed for the support of the public. One of the most recent arrivals is "Feilden's Magazine," which is claimed by the proprietors to be "the world's record of industrial progress." We need not stop to consider how far this claim has been justified by the nine numbers which have already been issued, but will simply call attention to one feature of the publication—viz., a series of articles on particular departments of industry, written by gentlemen specially qualified to deal with these subjects. In the first numbers we found Professor Vivian B. Lewes discoursing on "Acetylene Generators;" then followed some articles on "Modern Appliances in Gas Manufacture," commenced by the late Mr. G. Ernest Stevenson, and continued by his brother, Mr. Fletcher W. Stevenson; and in the current issue there is an article on "Carburetted Water Gas," by Mr. S. Cutler, jun. The author, as most of our readers are aware, is a member of the firm of Messrs. S. Cutler and Sons; and he has given special attention to the development of the new system of gas manufacture, which he has personally studied in many of the principal gas-works in the United States and Canada.

Mr. Cutler at the outset of his article shows the great progress which has been made with water gas in this country in the past decade. Ten years ago, no gas of this kind was produced in England; whereas now it is manufactured in upwards of sixty important gas-works in the United Kingdom, and the number of installations is rapidly increasing. The plants already either at work or under construction are capable of producing upwards of 100 million cubic feet of gas per diem—a quantity equal to two-thirds of London's maximum daily consumption, and four times as much as is required to supply Manchester. Though carburetted water gas has now been established on a firm footing, it has had a long and chequered history. Its potentialities were early recognized by English gas engineers; but the impossibility of securing a suitable carburetting material long delayed its successful utilization. It was the discovery of petroleum which aroused new interest in carburetted water gas. Mr. Cutler describes, by the aid of illustrations, the method of producing this gas, and points out, for the benefit of those who have not had experience with the plant, that it is most essential that dry high-pressure steam and a hot generator should always be maintained, as with too low a temperature in the generators the carbon consumed is not wholly converted into carbon monoxide, but forms some carbonic acid, until a point is reached at which the latter is formed to the entire exclusion of the former. The temperature necessary in the carburetter and superheater for volatilizing and fixing the oil is much less than that required in the generator; and variations are at times desirable to suit particular descriptions of oil. Too great heat produces lamp-black; too low a heat, an undue proportion of tar. The object of the operator should be to avoid both extremes. Mr. Cutler mentions the absence of residuals as a striking feature of the carburetted water-gas process. He gives analyses by Mr. W. J. A. Butterfield, F.I.C., F.C.S., of gas and tar produced by plants made by his firm, and remarks that the proportion of sulphur impurities present in the crude gas will vary according to the description of coke and oil used in its manufacture; but he emphasizes the fact that, as the percentage is invariably far below the quantity present in coal gas, purification is more simply and cheaply effected.

Of course, from a gas manager's standpoint, carburetted water-gas plant is, as Mr. Cutler remarks, a most useful auxiliary to a coal-gas plant. With its assistance, low-priced coals can be used; the price and stock of coke can be controlled; and labour difficulties are decreased—fewer men being required, and those employed quickly learning the mode of operation. Facility of production reduces the necessity for having the large amount of storage accommodation required in districts subject to sudden demands for gas. Furthermore, there are but few points in carburetted water-gas manufacture which can cause nuisance or difficulty; but some of those which are incidental thereto are indicated by Mr. Cutler. For instance, during the "blow," fine coke dust is frequently carried through the vessels with the air-blast, and is liable to deposit upon surrounding property, and may cause nuisance. This dust can, however, as he shows, be intercepted by a suitable appliance. Another matter which has engaged a good deal of attention is the separation of the water from the residual tar; but this is effected without difficulty by the use of a proper apparatus.

The last point dealt with by Mr. Cutler is the probable effect upon the public health of the extended use of carburetted water gas. He refers to the long investigation made by the Departmental Committee appointed by the Home Office to consider the subject, and to their limitation of the percentage of water gas allowed to be supplied for illuminating purposes. He shows that, for several reasons, the American system of sending out undiluted water gas is not likely to be followed in England; the interests of the gas companies being best served by the use of a moderate proportion only in conjunction with coal gas. This part of the article is illustrated by two striking reproductions of photographs showing the difference between the old and the new method of gas making.

PARLIAMENT AND THE COAL QUESTION.

Last week (p. 881) we reprinted a letter which Mr. A. D. Provand, M.P. for the Blackfriars Division of Glasgow, has addressed to the First Lord of the Treasury on the subject of the coal resources of the country. In reply to a question previously put by Mr. Provand in the House of Commons, Mr. Balfour had stated that, unless there was some practical issue to place before a Royal Commission on Coal Resources, he saw little use in appointing one. That appeared to us, at the time, to be the inevitable reply to the question as put. In reviewing recently*, in the light of subsequent events, the findings of the Commission that reported in 1871, we defined the only practical question that seemed to call for the appointment—not of a Royal Commission, but of a less ponderous machine of inquiry, a Committee of Experts, who could be appointed under the auspices of the Home Office. The extent of our coal resources was made the subject of exhaustive investigation by the 1866 Commission; and their report needs little revision in that respect. The contents of the coal seams since discovered could be easily ascertained from the Inspectors of Mines, and added to the estimates of the Commissioners. The probable duration of these resources was calculated in the report on each of two hypotheses; and, as we showed in the articles referred to, one of those bases of calculation—judged by the past thirty years' statistics—is very little wide of the mark.

Mr. Provand, in his letter, only deals with the calculations supplied by Mr. Price Williams to the Commissioners which were based upon the other, and much more inaccurate, hypothesis. He says: "Two years hence—that is to say, in 1901—the year for which the Royal Commission made their estimate, the production of coal will probably be several millions more than last year. Taking this at only 4 millions, the difference between their estimate and the actual output in 1901 will be as 174 millions is to 224 millions, making a difference of 50 million tons in excess of what the Royal Commission estimated." No mention whatever is made of the fact that, upon the alternative basis used by the Commissioners—which put the production for the 30 years just ended at 4605 millions, whereas the actual was 4788 millions, or barely 4 per cent. more—the estimated quantity to be raised in 1901 would be 203, not 174 millions. The question of the probable duration of the supply of coal lying at depths not exceeding 4000 feet, is, we submit, one that can be decided, for all practical purposes, by the aid of the 1871 report, the subsequent mining statistics, a set of logarithm tables, and a careful study of the history of the coal trade and the cognate industries.

What does call for inquiry is, as we have said before, "the fact that we have, at present, no official estimate of how much of the coal lying in the strata of moderate depths exists in easily (and therefore cheaply) worked seams, and how much in seams so situate or so thin that the cost of 'winning' the coal will be considerably higher than the present cost of production. Upon this point more information is desirable, and should not be difficult to obtain. The present is a time when the authorities might well be approached with a view to the appointment of a Committee of Experts to determine and report the actual facts of the case. Those facts must have an important bearing upon the possibility of this country maintaining its ground in the commercial competition with other countries—in particular with the United States."

The importance of this question is fortunately recognized and set out by Mr. Provand in his letter; and it is a pity that he somewhat weakened his case by suggesting, what is not the case, that the Royal Commission estimate was hopelessly inaccurate. The fact that the figures he quotes were those supplied to the Commission by Mr. Price Williams, and not, as he says, those calculated by the Commissioners themselves, is just the sort of mistake upon which the official mind—anxious to avoid trouble—fastens in replying to a demand for inquiry such as is now made. Other points to which attention is rightly drawn are the importance of a supply of coal for our Navy, and the rapidly growing production—from practically unlimited resources—of coal in America, which combined we may add with the fact that, owing to the use of coal-cutting machinery, coal is raised more cheaply in the States than in our own country, must enter increasingly into the question of the coal trade and the general commercial position of Great Britain.

Another aspect of the coal question, to which public attention is being drawn, and which it has been—and is being—sought to bring before Parliament, is that which is presented by the growth of the exports of coal, and the desirability or otherwise of prohibiting such exports or of imposing a duty thereon. This is a very interesting question, and one upon which very divergent opinions are being emphatically expressed in the daily Press. The case for putting a duty upon coal exports has been taken up by Mr. George Harwood, the Member for Bolton, who sought to move an amendment to the Budget substituting such a duty for the increased tax of 2d. per pound on tea. This motion was, as might have been expected, ruled out of order, as being a proposal by a Member, other than a Minister, to impose a new tax. It is stated that Mr. Harwood intends, if he find an opportunity, to move a resolution on the subject; and, should he be able so to do, a very interesting debate ought to ensue.

* *Ante*, p. 528.

The question of imposing a duty on coal, with the idea of obtaining therefrom a considerable revenue, is quite distinct from, though frequently—and by Mr. Harwood himself—confounded with, that of taxing exports in order to reduce or prohibit them. For it is obvious that the latter purposes cannot be attained except at the expense of foregoing the revenue which would accrue from a tax not heavy enough to be prohibitive. The tax cannot be "patriotic" and productive at one and the same time. The case urged by the prohibitionists is based upon the necessity of a supply of cheap, home-produced coal to the maintenance of our commercial superiority; the vital importance of coal to the Navy; and the unwisdom of supplying the navies of potential enemies with the coal they need. On the other hand, it is pointed out by a writer in the current number of the "Nineteenth Century" that, although the possession of coal is vital to our home manufactures, yet it is further true "that the rate of increase of our coal exports is the measure of our commercial prosperity. Besides affording a medium of exchange in dealing with other countries, coal is practically the only heavy article of cargo that can serve as ballast for vessels freighted with lighter merchandise; and if outward-bound vessels could not obtain sufficient cargo, there would be a serious increase in the cost of imported foodstuffs and iron-ore." In fact, all the details of our complicated system of commerce are so bound up together and inter-related, that to remove therefrom a trade of the annual value of over twenty millions sterling, would entail the most wide-reaching and, at first consideration, unforeseen consequences.

It is further asked: If it be wise and necessary to prohibit by State regulation the export of coal in order to provide for the distant future, why should not the home consumption be so regulated? That is to say, if it be improvident to realize our capital as represented by coal, is it not also improvident to deplete our supplies of iron by exporting both the crude pig iron and the finished hardware or machinery? For it must not be forgotten (as some appear to quite forget) that we are not disposing of our national capital—in the shape of coal and iron—and receiving nothing in exchange. The rapid growth of prosperity in this country in the past half century is due in no small measure to the turning of those minerals into exchangeable forms of wealth; and it is scarcely exaggeration to say that, in return for thus giving the world coal and iron, we are becoming, financially, the owners of the world. The amount of British capital invested in foreign countries is enormous, and is steadily increasing. It will, in truth, be difficult, nay impossible, to persuade the British nation that they must materially reduce the rate at which they are, by selling their coal and iron to other countries, accumulating wealth, in order, by so doing, to benefit posterity a century or so hence. As Professor Jevons truly said: "If we lavishly and boldly push forward in the creation and distribution of our riches, it is hard to overestimate the pitch of beneficent influence to which we may attain in the present. But the maintenance of such a position is physically impossible. We have to make the momentous choice between brief greatness and longer continued mediocrity." The British nation has chosen the "brief greatness," which, however, will be of sufficiently enduring briefness to outlive the present, and immediately following, generations. We shall not live to see how the accumulated wealth possessed by these islands when their coal-fields have been commercially exhausted, will either be distributed, or will in some manner unforeseeable now, maintain the supremacy of Britain.

So far as the imposition of a tax upon exported coal for purely revenue purposes is concerned, the question is really one of political and economic expediency. Whether, as has been suggested, Germany, France, and Russia would resent it as an unfriendly act, we think is very doubtful. They, at any rate, are not remarkable for considering their neighbours' interests before their own, so far as either import or export duties are concerned. We are, however, strongly of opinion that the problematical advantage to be gained by the substitution of an export duty on coal for an import duty on tea, is not sufficient to warrant such a change in our fiscal system. But should it at some future time be determined upon—which is by no means probable—coal consumers, as such, in this country would, if affected at all, not be adversely affected. If the duty restricted the export, the tendency would be to a fall in prices at home. On this ground, gas managers would at present be disposed to fervently pray for a total prohibition of foreign shipments.

Combined Increase in Prices in the Meter Trade.—It was rumoured last week that the meter makers have decided to increase their prices by 5 per cent., excepting upon prepayment meters, the rise to take effect as from yesterday. There was, we believe, some talk of going to the extent of 7½ per cent.

Waverley Association of Gas Managers.—The 78th half-yearly meeting of this Association will be held in the Station Hotel, Selkirk, next Thursday, under the presidency of Mr. W. B. M'Lusky. According to the programme issued by the Hon. Secretary (Mr. Alex. C. Young, of Kelso), the business will consist of a short address by the President, to be followed by an informal discussion, and the appointment of office-bearers for the ensuing year. At the close of the business dinner will be served; and in the afternoon there will be a drive.

PERSONAL.

Mr. J. Gibb, of Lanark, succeeds Mr. Duncan Jeffrey (who has resigned) as Manager of the Kirkintilloch Gas-Works.

Mr. J. Donaldson has resigned the Managership of the Sandwich Gas-Works on his appointment to a similar position at Sittingbourne.

The position vacated by Mr. W. Spier as Secretary and General Manager of the Rockhampton (Queensland) Gas Company will be filled by Mr. Arthur Lloyd, one of the Company's staff.

Mr. Frank Tomlinson, formerly Assistant-Manager of the Rochdale Water-Works, and for six years in the service of the Conservators of the Thames, has been appointed Managing Water Engineer to the Northampton Corporation.

Mr. W. Gorse, who was appointed, towards the close of last year, Engineer and Manager of the Walsall Corporation Gas-Works, in succession to Mr. John Tindall, who was about to retire, has sent in his resignation, which has been accepted.

At the meeting of the Institution of Civil Engineers last Tuesday, it was announced that Mr. J. W. Helps, of Croydon, had been transferred from the class of associate members to that of members; and the monthly ballot resulted in the election of Mr. Neil J. Peters, of the Water-Works Department, Southampton, to the former class.

At the meeting of the Oldham Corporation last Wednesday, the minutes presented by the Gas Committee notified the appointment of Mr. Edwin Platt to the position of Assistant-Manager, as mentioned in the "Journal" last week. The Chairman (Mr. Letham), in moving the adoption of the minutes, spoke highly of the 42 years' service of Mr. John Chadwick, the Manager, who, he said, had expressed the opinion that Mr. Platt would make a most capable successor.

On the occasion of the silver wedding of the Engineer of the Southwark and Vauxhall Water Company, Mr. and Mrs. J. W. Restler were presented with a handsome silver tea and coffee service and tray of George III. pattern, by the officers, staff, and employees of the Company—the subscribers numbering over 200. The presentation was made by the Secretary, Mr. Montague Watts, last Friday week (the anniversary of the wedding being the following day), in an appropriate speech, and in the presence of representatives of all departments of the Company's service. Mr. Restler acknowledged the gift in a few well-chosen words.

Some important changes in the management of the Merthyr Tydfil Gas Company have just been decided upon. At the meeting of the Directors last Wednesday, the Engineer and Secretary, Mr. John Lees Cocker, tendered his resignation of these appointments, owing to failing health, after the long service of 43 years in the dual capacity. The Directors desired him to reconsider the matter; but he felt he was unequal to bearing the responsibilities of the position, and his resignation, which will take effect on the 1st of July, was reluctantly accepted. In a minute entered in the books, the Directors expressed their great regret at the step taken by Mr. Cocker, and placed on record their sense of the valuable services he had rendered to the Company during his long connection with it. The growth of the undertaking is shown by the fact that when he took charge of it in 1856 the mains were only 2 miles long, whereas they now extend 32 miles; and the works have been proportionately enlarged and improved to meet the increased demand for gas. Consequent upon Mr. Cocker's resignation, there has been a re-distribution of offices. In order that the Company may still have the benefit of his invaluable knowledge of the works and district, he will be retained in the capacity of Consulting Engineer, while Mr. J. E. Kenshole, who is at present Deputy-Manager, will become Manager, and the Accountant, Mr. G. Williams, will receive the additional appointment of Secretary. Thus the duties relinquished by the General Manager are divided between present members of the staff, who will still have the benefit—it is to be hoped for many years—of the ripe experience of their respected chief.

OBITUARY.

We learn with regret of the death, in his 86th year, of Herr H. B. Geinitz, of Dresden—an eminent geologist, who collaborated with Herren Fleck and Hartig in the production of an exhaustive work on "The Coals of Germany and other European Countries." Though published in 1865, this work is still the recognized authority on the subject. We regret also to record the death on Feb. 25 of Herr E. Blumer, Manager of the Municipal Gas-Works at Thun, in Switzerland.

We regret to record the sudden death, early last Wednesday morning, at his residence, West Hill Place, Highgate, in his 87th year, of Mr. W. P. Bodkin, J.P., the Chairman of the Hornsey Gas Company. Deceased had been enjoying very good health; but he was unable to stand against the effects of the last of several operations he had had to undergo. Mr. Bodkin was a member of a family long connected with the practice or administration of the law. His father (Sir W. H. Bodkin) was for many years Chairman of the old Middlesex Sessions, and Sir Harry Poland is his near relation. He became a Magistrate in 1854, and held for many years his father's office;

but when other arrangements were made for the Middlesex Sessions, he transferred his energies to the Highgate Bench, of which he became Chairman in 1893. He resigned this position, owing to defective hearing, in 1898, though he sat on the Bench as recently as the 19th ult. In addition to his connection with the Hornsey Gas Company, he was on the Boards of the Colney Hatch Gas Company and the Chelsea and West Middlesex Water Companies. He was also a Deputy-Lieutenant for Middlesex. Deceased leaves a widow; and one of his sons is Mr. A. H. Bodkin, the Treasury Counsel.

NOTES.

Cross-Breaking Tests of Concrete.

Referring to a remark in the "Engineering Record" on the dearth of records of cross-breaking tests of cement concrete, Mr. Robert Moore, of St. Louis, gives details of some tests of the kind carried out by himself during 1890 for the Viaduct of the Merchants' Bridge Terminal Railway. These are described as having been carefully made, and possessing considerable value. The concrete used in all the foundations was made of portland cement, river sand, and broken limestone, in the proportions respectively of 1, 3, and 6 parts. With these proportions, it was found that a barrel of cement made 0·96 yard of concrete. To ascertain the strength of this concrete, a number of beams, 30 inches long and 9 inches square, were made from batches actually used in the work. These blocks were buried in the ground for periods of 8, 9, 10, and 11 months. At the end of the time, they were broken transversely, by means of a lever apparatus so arranged as to give a gradually increasing known load. The results went to show an unexpected uniformity of tensile strength, the average breaking load being 354 lbs. per square inch, with a minimum of 307 lbs. and a maximum of 412 lbs. The average strength of the neat cement tested in the usual way by seven-day briquettes was 437 lbs. per square inch. It varied, however, from 307 lbs. to 567 lbs., which means that while the variation of strength of the neat cement ranged as much as 85 per cent., the variation in the concrete was only 34 per cent.

Tenement House Building in New York.

In connection with the present discussion of the housing problem of the poorer districts of towns, it is stated in the "Engineering Record," of March 3, that Mr. R. Thomas Short, of New York, has won the first prize in a competition for tenement-house planning instituted by the Charity Organization Society of that city. The journal gives a sketch plan of Mr. Short's solution of the problem, which is to be acted upon by a New York Company. The chief conditions of the competition were that the tenements should embody improvements upon those in existence, preserve economy of construction, convenience of arrangement, good light and ventilation, and cheerful outlook. They were to be at least as commodious, for the ground occupied, as those in actual habitation. It would be out of place to reproduce the premium plan here; but as illustrating a recent editorial argument of ours, it may be noted that the unit of treatment is the ordinary "city lot," which is 100 feet square. This unit is easily multiplied so as to fill a whole "city block" of 200 feet by 400 feet. The proposed building is six stories high; and the tenements are of two, three, and four rooms. It is interesting to note that all the tenements have their own gas cooking-range; while steam heat and hot water are to be laid on. It is claimed that the designer has succeeded in exceeding the average rentable floor-space of this class of building by about 5 per cent., while providing room for perambulators or bicycles. Much space has been saved and simplicity of planning secured by dispensing with chimneys.

The Sampling and Analysis of Coals.

An important report on coal analysis has been presented to the American Chemical Society by a Committee appointed to investigate the subject. The object of the inquiry was to ascertain how far uniformity and reliability in this matter of coal analysis could be promoted by systematizing the sampling and other details of the procedure; it being well understood by coal users that the usual advertised analyses are not invariably corroborated in practice. The Committee go into the question very thoroughly. They recommend the taking of samples by shovelfuls thrown aside at regular intervals during the loading or unloading of the truck. The sample should be of considerable amount; and after being turned over and broken, if necessary, it is to be reduced to the final sample by the process of quartering on a hard, dry floor. This must be done quickly, and the result put into a sealed jar. Directions are given for the determination of the moisture. The volatile matter is to be determined by heating one gramme of the fresh, undried, powdered coal in a covered platinum crucible for seven minutes in a strong bunsen flame. From the result thus ascertained, the proportion of moisture otherwise found has to be deducted. It is admitted that this determination of volatile combustible matter is an arbitrary one, and does not show what compounds existed in the coal before heating. The Committee think, however, that their simple prescription agrees fairly well with commercial coking results. Directions for testing for ash, sulphur, and fixed carbon are given. The report has been reprinted from the "Journal of the American Chemical Society,' and forms a useful pamphlet for a works laboratory.

Motor Waggons, Gas-Mains, and Soft Roads.

The judgment of the Irish Master of the Rolls in the Dublin Gas Company's steam-roller case, giving protection to gas and water mains in roads from damage by steam rollers and other extraordinary traffic, lends particular importance to the movement actually in progress for amending the Light Locomotives Act, 1896, in the sense of increasing the tare maximum of motor vehicles. This Act exempts from the restrictions imposed by previous Acts all road motors under 3 tons in weight. It has been declared repeatedly by Mr. Thorneycroft and other experts that it is impossible to build steam waggons to carry useful loads of from 3 to 5 tons with this tare limit. The question arises therefore as to how the limit can be removed without rendering the motor vehicles dangerous to gas and water mains; and the suggestion is made that this is a matter of width of tyre. For the sake of the tractive efficiency of the vehicle itself, the rule is laid down that the wheels should never be so narrow as to make a rut, which increases the tractive resistance enormously. Here, again, the effect of hardness of road surface becomes of great importance. All experience of the work goes to show that the familiar traction engine is more like what the steam road-waggon of the future will be than the flimsy creations that began to be seen on the roads when the Act of 1896 first came into force. Unexpectedly great tractive power is required for self-propelled road vehicles; and it is hoped that for their part highway authorities will make their roads harder, and not use so much soft filling stuff as they have got into the habit of putting on a so-called macadam surface.

The Fireproofing of Wood.

Mr. Sherard Cowper-Coles expounded to the London Section of the Society of Chemical Industry, the different processes by which wood is rendered uninflammable. It was stated that, by modern methods of treatment, wood can be made to withstand ignition at the temperature of the bunsen flame (1820° C.). There is still some difficulty in effecting this object without injuring either the strength or appearance of different woods, and at a reasonable cost. Apparently, one of the best processes is that of Simpson, now being worked by an English Company at Fulham, which consists in impregnating the timber with a solution largely composed of phosphate of ammonium. The soluble matter of the wood is previously extracted with methylated spirit; and the subsequent treatment takes about four hours. Wood so treated is not so good a conductor of heat as untreated wood. On the other hand, fireproofing by ammonia compounds makes the timber corrosive of metals; and the filling does not stand the weather. Mr. Cowper-Coles has tried the effect of modifying the treatment by the addition of other salts, without much positive advantage. It was admitted that the process is still susceptible of improvement, mainly in respect of the correction of the undesirable consequences of using ammonia salts. It appeared to be conceded that, while wood itself cannot be made other than inflammable, its pores can be filled with something that will prevent it from bursting into flame. Salts of ammonium, including the sulphate, do this by producing nitrogenous charcoal which only burns with great difficulty. Unfortunately, these preparations will not stand water.

The Progress of Electro-Chemistry.

In a recent number of "Nature," a summary was given of the modern development of the science of electro-chemistry and its application to manufacturing industries. Text books of chemistry only ten years old scarcely refer to the use of electricity in metallurgy, and still less to its adoption as a means of producing metallic salts or the non-metals. During the last thirty years, the processes of electro-deposition of metals made little progress before the advent of the dynamo and the storage battery. The industrial production of absolutely pure copper is an electrical process, which also lends itself to the manufacture of weldless copper tubes. Zinc galvanizing by electrolysis is at present practised to a very considerable extent; one advantage of this method being that the inside of tubes and fittings can be properly protected. It is scarcely necessary to discuss the manufacture of calcium carbide; but it is noted that the expansion of this trade is hampered by the restrictions which it has been deemed necessary to place on the storage of the carbide. One of the most interesting of the latest applications of electrolysis is in the production of large accurately-reflecting mirrors. Such mirrors, made of metal, have hitherto been only successfully made for small reflecting lamps. Large reflectors, for powerful lights, have always been made of glass; and the risk and loss by breakage were necessarily considerable. Now, by the new process which is credited to Mr. Cowper-Coles, large reflectors can be made of metal, the reflecting surface being palladium, which does not tarnish in the atmosphere. Many artificial light effects may be modified in consequence of this invention.

The Supply of Artificial Illuminants in France.—The sale of gas in France last year is estimated to have produced about £20,500,000; of petroleum, £4,500,000; and of electricity, £2,000,000.

TECHNICAL RECORD.

INFORMAL MEETING OF SCOTTISH GAS MANAGERS.

The Seventeenth Annual Informal Meeting of Scottish Gas Managers was held in the North British Station Hotel, Glasgow, last Wednesday. Mr. J. W. CARMICHAEL, the Manager of the Barrhead Gas Company, presided; and there was a larger attendance than there had been for some years.

The proceedings having been formally opened,

Mr. CARMICHAEL delivered the following

CHAIRMAN'S ADDRESS.

My first duty on this occasion is to thank you for the honour you conferred on me last April, when you elected me Chairman of this meeting. I felt a considerable amount of diffidence in accepting the post. But I know you will forgive any shortcomings on my part; and I hope this meeting will be as interesting and instructive as any of its predecessors.

I think it will be admitted by all that the past year has been exceptionally trying to most gas managers. This has arisen from several causes—first, the ever-increasing demand for gas; secondly, the difficulty in procuring the required weekly quantities of coal, said to be on account of the railway companies' inability to provide waggons (this may be partially the explanation, but I am afraid more fault is to be found with colliery owners, who give the greatest attention to those who pay the biggest price); and, thirdly, the fact that the closing weeks of last year were very dark. This last-named factor was experienced especially in the West, where for successive days darkness reigned supreme. One manufacturer in Barrhead informed me that for two days the gas was kept burning in all the flats of his mill from 6 a.m. to 6 p.m.—a thing that had never occurred before. Of course, some will say that this was a good thing for the Barrhead Gas Company. I answer, "Yes" and "No;" for one is hardly prepared, at a moment's notice, to supply gas night and day, more especially when one is hampered by want of storage. This was my difficulty. Our present gasholder capacity only amounts to 120,000 cubic feet, as against a maximum make of nearly 190,000 cubic feet. I am glad to say this state of matters will soon be remedied as far as we are concerned, as the Contractors have nearly finished the erection of a telescopic gasholder, which will give us additional storage amounting to 240,000 cubic feet, making 360,000 cubic feet in all, or two days' supply—a very comfortable position for a gas manager to be in, as far as storage is concerned.

Another thing which has tried gas managers during the past year has been the increased price paid for gas coal; the advance being at the rate of 25 to 28 per cent. Some of us raised the price of gas. I think, however, I am right in saying that the majority of corporations and gas companies are selling their gas at the same rate as in the previous year. And why? Because they thought the price of coal would fall before long; and they were willing to face a year of diminished profits rather than raise the price to the consumer. I regret that their expectations are not likely to be realized, as the selling price of coal at present is 25 per cent. over last year's quotations. The consequences, I expect, will be that all round there will be a sharp advance in the price of gas. In view of the great economy already prevailing in all gas-works, it will be impossible to make both ends meet without having recourse to such means, if the present inflated prices for coal are maintained. However much or little the price may be increased, vigilance will have to be exercised by every manager, so that nothing may go to waste. I know that of late years the demand has been for cheap gas. To meet this demand, economy has been the order of the day; and it would be very difficult to suggest anything whereby further economy could be secured.

Allow me just to say that there is no excuse for a manager working retorts on the old system of settings. Let him have the new, which can be built in as cheaply as the old, and he will find an improved make per ton and a large saving in fuel. Further, there are very many little things about a gas-works which, if attended to, materially help the finances. There are three points of very great importance which any gas manager should strive for, if a gas undertaking is to be a financial success—viz., plenty of retort power, coal storage, and gas storage. It is useless for me to enlarge on these. You all know the difficulties to be overcome, and the anxiety caused to every gas manager not adequately equipped in these respects. Of all the difficulties a gas manager has to contend with, the want of adequate storage must rank as the first. In looking over the statistical report for last year, I find that there are nearly 100 gas-works whose storage is under the maximum make. This is far from being a satisfactory state of matters; and it is, without doubt, one of the greatest obstacles to successful management. It means great loss in many ways; but the greatest loss of all is the diminished sale of gas caused by the reduction of pressure. This is not what ought to be. If gas companies are to please the public, a sufficient supply of gas at all hours must be provided.

In Scotland, the quantity of gas manufactured amounts to 12,637,620,000 cubic feet. Of this quantity something like 1,200,000,000 cubic feet, or about 9½ per cent., is unaccounted for. Of course, we all know that this is not all loss through defective mains and services. Lamps have a great deal to do with the apparent loss of gas. Commissioners are a body of people you can never satisfy, especially if it is a private company that is supplying the gas. I remember a gentleman remarking at one of our meetings that he, for one, would be glad if the Commissioners would light all the streets by electricity, as it would be a saving to the Gas Company. I sympathize a great deal with that opinion. Commissioners may say what they please about the charge for gas, but companies do not benefit a great deal from gas consumed in this way. I have heard it said that the more meters you have fixed, the better the average per lamp. The idea of fixing a meter on every lamp, or laying a separate main for the lamps, the gas to pass through a meter at the works, must be dismissed as too expensive I believe a better way than the average meter system is to calculate the number of hours the lights burn; and if care is taken to have each lamp fitted with a governor to pass no more than the requisite quantity of gas per hour (of course, after the pressure has been ascertained), a very near statement of the quantity of gas consumed should be got. Station meters may have a great deal to do with leakage if the temperature of the gas is high when measured. Defective mains and services assuredly account for the greatest proportion of the loss. Systematic examination of the mains and services ought to be made, so that the whole distributing plant could be overhauled once in five years; and consumers' meters should all be tested now and again. If these matters were attended to, a very great saving would result.

I think the present a very opportune time to put before you the question of reducing the illuminating power of the gas to (say) a uniform standard of 20 candles. I must say, speaking for myself, I favour the reduction; believing, as I do, that gas of this standard will give quite as good results for all purposes as that of higher quality. If this standard were to become general in Scotland, the price of gas could be substantially reduced. At one time it was necessary to maintain the illuminating power of the gas at a high standard, in face of a strong competitor like the electric light; but this state of things has been changed somewhat by the introduction of the Welsbach burner, and latterly by the intensified gas-light. In Scotland, the increase of gas manufactured over the previous year amounted to 8·20 per cent. A very large proportion of this increase has been caused by the use of gas for other than illuminating purposes. I dare say more of it would be employed in this way were it cheaper; and this result could be attained if the illuminating power were reduced to 20 candles. Some one might be inclined to question the expediency of lowering the quality for a class of consumers whose united consumption of gas is very small as compared with that used for illuminating purposes. That is so; and I would not recommend the reduction but for the fact that the introduction of the Welsbach burner has been one of the greatest advances in regard to lighting. The incandescent burner is being adopted very extensively by ordinary consumers; and its use would become general were it not that the price is prohibitive. I believe, however, that in a few years, as the patents expire, the market will become flooded with mantles, good, bad, and indifferent, at a price within the reach of the poorest. What I say, therefore, is that gas of 20-candle power will be found as serviceable for lighting and for other than illuminating purposes as 24-candle gas. With the present price of splint and third-class cannels, very little advantage would accrue from making the change now—something like 1½d. per 1000 cubic feet; but if coals should fall to (say) 10s. 6d. per ton for splint and a small mixture of third-class cannel, then I say the time would be ripe for advocating the change. With the above mixture of splint and cannel, gas of 20 candles could be got at a cost of 1s. 0·60d. per 1000 cubic feet. If, however, the gas is kept up to 24 candles, then a mixture of splint, &c., with first-class cannel would require to be made, at a cost per 1000 cubic feet of 1s. 5d.—a difference of 4·40d., or fully 1d. for every candle over 20. By lowering the illuminating power of the gas, a very substantial reduction in price could be made, which, I am sure, would be appreciated by most people, and would extend our business as gas suppliers. Another remark I would make is that, if we are to still farther widen the difference between the cost of electricity and gas, it will only be by a change of this kind.

In large squares or workshops, the intensified gas-light can be used with advantage; and when placed beside the electric light the latter is not in it. I expect soon to see a small installation fitted up in one of our large works in Barrhead; and I have every confidence its adoption in this particular class of works will become general. In Barrhead, we have the electric light in use in two of the works—one an engineering shop, where it is used for general lighting, while it was introduced into the other because a naked light could not be used owing to explosive gases accumulating from certain chemicals. In both cases the gas account shows very little difference. It is needless, however, to shut one's eyes to the fact that electric lighting is steadily on the increase. Not many years ago, the opinion of most gas managers was that paraffin oil was our greatest opponent. We have not that opinion now. And why? Because prepayment meters have come in as the opponent of oil, and a very successful opponent too. The progress of the electric light last year was steady. From a statement which I have somewhere read, there are 2,700,000 incandescent lamps now in use in London alone, and

4,100,000 in the Provinces; making a grand total of nearly 7,000,000. Ten years ago, there was very little public supply of electric lighting in the Provinces; now there are 152 towns in Great Britain in which such supply is given, and 42 other stations are in preparation. In 1899, there were 89 grants for Provisional Orders for electric lighting supply—70 for municipal corporations, and 19 for companies.

Electricity is being used for many purposes, especially for motive power. In Barrhead, it is used in connection with a large foundry crane. Many of you would observe that the Bradford Corporation have commenced the hiring-out of electric motors from ½ to 10 brake horse-power. The rental per annum is the very moderate one of 30s. to £8, according to size. This is a new departure, and should, I think, bring many gas managers to consider the question of hiring-out gas-engines as well as stoves. Again, it is admitted that the electric light is becoming cheaper; but when compared with gas, it is still a long way behind as far as cheapness is concerned. I am not one of those who speak lightly of the electric light—a mistake some gas managers are apt to fall into. We console ourselves with the thought that if we have lost the gas supply of a mill, consuming (say) a million cubic feet per annum, through the introduction of electricity, we have an increase from other sources amounting to 3 million cubic feet, and we are very apt to ask what harm has been done. Very great harm, to my mind; for whereas you have had 3 million cubic feet of increase, you would, in all probability, have had 4 million cubic feet had the electric light not been in your town. Moreover, we never know the moment when some new discovery might be made whereby the cost may be materially reduced. Gas managers, however, have no cause to fear. There will always be a large demand for gas; and, meantime, we can hold our own as far as light and price are concerned. Still, the great advance in the cost of coal is an opportunity for the electrician, of which he will not be slow to take advantage.

In passing, we might ask ourselves what is the cause of the great rise in the price of coal? We thought last year's figures were too high, or at least sufficiently high to give miners a fair day's pay and at the same time a large return to the colliery owners; and yet we find the prices quoted since October last have gone up and up until they now stand at a figure which is unjust to the people of this country. Miners' wages, which get the blame of many of the rises in the past, have not advanced for some months now. The secret, I suppose, is good trade. Our Government of late years have been making large additions to the fleet of war vessels. This and other things have caused the iron and steel industries to be exceptionally busy; and as they consume large quantities of coal, the supply for the gas and other industries has been severely taxed. But I do not think that the good trade we are experiencing all over the country, or even the largely increased quantity required for gas-making purposes, accounts wholly for the enormous increase in the price of coal. I am inclined to think restricted output has a good deal to do with it. The miners, as you know, are averse to seeing stocks at the pit heads, more especially when wages are good; and so, the demand and output being about equal, the owners are using their opportunity to advantage.

The system of regenerative firing has become general, not only in large, but in small works. I believe that no part of the apparatus of a gas-works has received more attention than that given to heating retorts; and as a result, different systems have been adopted with equally good results. By the substitution of gaseous firing, and taking advantage of the waste gases for heating the secondary air, very decided advantages have been obtained as compared with direct firing; the amount of fuel used being something less than half, in addition to a considerable increase of gas per ton of coal, while the heating of the retorts being regular, the wear and tear is reduced. The great saving in fuel, and the increased quantity of gas per ton, have helped very materially to reduce the price of gas.

It has been often said, and we know it to be a truism, that with all our care and attention in the retort-house, any advantage gained may be partly lost by lack of care as to the requisite temperature of the gas as it issues from the condensers. I am afraid, however, that, although every gas manager knows that the gas should issue from the condensers at from 60° to 65° Fahr., with the atmosphere ever changing and various quantities of gas passing from hour to hour, it is almost impossible for managers of small and medium-sized gas-works to regulate the temperature of the gas. Of course, some use sprinklers, and others have valves so arranged that part of the condensers can be bye-passed in cold weather; but you seldom come across the one or the other in small works. I am sure many will be pleased to have the opinion of gentlemen present on this matter; and if any simple method could be suggested it would certainly be of help to many a one, for there is no doubt that in winter we require a larger percentage of first-class cannel than we do in summer, which is clearly traceable to the temperature of the gas being low.

Considerable economy has resulted from the admixture of a little air with the crude gas. Several gas managers in Scotland have tried it, and are still continuing it, with gratifying results. Differences of opinion exist as to whether the gas should flow downwards or upwards through the lime. I do not think it matters very much which way it goes, providing you have purifiers of ample size. In my works, the gas goes in at the bottom and comes up through the lime; and I find the top layer of lim is hardest (the other two being quite easily broken up), and have no extra back-pressure. Distribution of gas requires care and attention on the part of a gas manager, more especially at the present day, when the demand for gas for heating, cooking, and other purposes necessitates an increased day pressure. I find, in my experience, that if large service meters are fixed, the pressure need never be more than 11-10ths to 12-10ths. There is no necessity for having a greater pressure on the distributing plant during the day than is actually required for all purposes. In Barrhead, we have done very little with the prepayment meter. One difficulty in the way is that proprietors purchase and keep in repair all meters. There are very great objections to this system, particularly when the meter comes to need repair or a new meter is wanted. We communicate with the proprietors, who object to the expense, and tell the tenant to get a penny-in-the-slot meter. Until this arrangement is cancelled, and the Company supplies and repairs all meters free, very little progress will be made with prepayment meters.

Sulphate of ammonia, as you are aware, has firmed in price during the last twelve months. Tar has also improved, and so has coke, which should help to compensate for the extra outlay on coal. Makers of sulphate will be in the happy position this year of being able to show a considerable increase in money arising from the enhanced value of sulphate—the profit from this product being close on £6 per ton, after allowing for all expenses in connection with its manufacture. Most of you would receive a pamphlet bearing on the Dalmeny experiments with sulphate *v.* nitrate of soda as applied to certain crops, showing how very superior sulphate has proved as a fertilizer. These experiments are opening the eyes of farmers to the superior value of this product. As time goes on the demand for sulphate will increase, and this residual will yet recover something of its former value. Sellers of crude liquor have not benefited so much as they ought to have done; and the sooner all works making over 20 million cubic feet erect sulphate plant, the better it will be for the companies owning the works.

In Barrhead, our stokers have eight-hour shifts all the year round. The men did not ask for the change; but when informed that the Directors were agreeable, they were, as you may suppose, highly pleased. We have had now nearly a year's experience of the new arrangement, and I must say I would not care to go back to the twelve-hour shifts. Strikes among gas-workers have been few, although some trouble has certainly arisen from the men demanding more money. This has been mostly confined to the larger works. It is pleasing to know that in almost all cases the men were met in a generous way by their employers. Unionism seems to be gaining ground in Scotland among gas workers. I for one have no objection to such a movement if the men will only use their new powers so as not to encroach on the rights of their employers, as I am sorry to say they too often do.

There is one other question on which I would like to say a word or two—viz., the standardizing of meter unions. It is now nearly five years since Mr. Myers read his paper on this important subject. At the meeting at which the paper was read, there appeared to be complete unanimity of opinion that steps should be taken to carry the proposal into effect. The Committee of the North British Association of Gas Managers took up the matter with energy, a meeting with the manufacturers was called, and they consented to co-operate with the Committee in carrying out the idea. Pattern unions were made, and a second meeting was held with the manufacturers, who expressed satisfaction with the couplings, and agreed to adopt them as the standard. The couplings were to come into use on Jan. 1, 1897. In 1897, the Committee, for the first time, discovered that standard couplings had been made some years before for the Board of Trade. The Committee endeavoured to arrange a meeting with one of the representatives of the Board of Trade, but failed. In 1898, it was reported that a circular had been sent to all the Associations of Gas Managers in the United Kingdom to take common action on the question. The idea was received very favourably indeed; and Mr. Carlow was requested by the Gas Institute to read a paper on the subject. After a time, the Associations, one after another, dropped the subject. I do not think, however, that we in Scotland should allow the matter to die a natural death after all the time and labour that have been expended. I have mentioned the matter to-day in order that you might have the opportunity of expressing your views as to whether or not we should carry out the first idea in Scotland only. If you are still of opinion that this desirable change should take place, I have no doubt the Committee of the North British Association of Gas Managers will see it carried through. I have refrained from saying anything regarding the advantages likely to result from such a change. These advantages are so well known to you all that any further remarks on my part would be quite uncalled for.

Discussion.

Mr. W. Ewing (Hamilton) said they were greatly indebted to Mr. Carmichael for his able address. At the present time, the happiest faces he saw were those of gentlemen engaged in the coal trade. He could not help observing that there was a funereal aspect in the faces of the gas managers present. The price of coal, he supposed, had something to do with it. In the previous week, they were engaged upon their coal contracts

in Hamilton. Comparing prices with those entered into last year, there was an increase of fully 4s. per ton; and they had yet the dearer class of coal to contract for. This meant an increase for the year of fully £4000. It would, of course, have to be met by more rigid economy, if they intended to keep the price of gas as it was—which he had no doubt they would manage to do, being situated in the heart of the coalfield. Many would have to pay as much as 18s. for what they were paying 15s. 6d. There was also a great loss to gas companies and corporations in connection with street lighting. A meter attached to each lamp would be useless. The proper thing to have was a "Peebles" clock in the centre of each district. He had found this method to work, not in Hamilton, but elsewhere, with the utmost accuracy; but it was important that the clock should be watched. He had purified gas both by sending it up and sending it down through the purifiers. He had never experimented in the matter; but, so far as he could remember, it was about six to half-a-dozen with the two methods. Day pressure was another important item referred to. They could only have a low pressure during the day, if they had large enough gas-mains. Regarding the manufacture of sulphate of ammonia, they were in the unfortunate position at Hamilton of having passed plans for sulphate works, but not having erected them; and during the last year, they had lost, he should say, as compared with what they would have had if they had been manufacturing sulphate, something like £1600 or £1700.

Mr. J. Napier Myers (Saltcoats) congratulated the President on his appearance that day. He congratulated him also on his return to health; and he congratulated him on the very large programme he had brought forward for their consideration. One thing especially commended itself to him. That was his recommending a lowering of the standard of the illuminating gas supplied in Scotland. The President advocated—and he thought rightly—that the gas they manufactured in Scotland should not be of more than 20-candle power. He himself had had some experience in making 16-candle gas in England, for about ten years. Previous to that, he had some experience in Scotland in the manufacture of gas of considerably higher illuminating power. He had returned to Scotland, and was again making gas of higher illuminating quality than was obtained in England; and his experience had been that there was less occasion for grumbling in England—or rather, to put it another way, less grumbling took place in England about the quality of the gas supplied, than was the case in Scotland. Whether this was due to a difference in the characteristics of the people, or whether it was due to defects in the maintenance of an equable illuminating power, he was not prepared to say; but his experience in Saltcoats was that he had had very much more complaint there, in attempting to maintain 22-candle gas, than he even had in England, where the people were content with 16-candle gas. He would impress upon every gas manager that he should endeavour to obtain, and to maintain, a gas of 20-candle power. He had heard the case for higher quality gas, as stated there, to be that what the people wanted was light, not gas; but he thought that, since the introduction of the Welsbach gas-burner, what the people wanted was heat, not light. Mr. Ferguson Bell, in his Inaugural Address to the Midland Association of Gas Managers, said that his experience was that he failed to see any difference in the quality of gas as between 16 and 20 candle power, when used with the Welsbach mantles. More recently, Mr. Herring had said that the time was coming when they would not require to make illuminating gas at all. The same idea had occurred to him; and he thought that if Mr. Samson Fox had been a little later with his water gas, he would have met with much greater success than he did. If the Welsbach burner had been brought to the same perfection then as it had been now, and he had depended upon it for use with water gas, instead of on the Fahnehjelm comb, he believed the success of water gas would have been much greater than it had been.

Mr. W. R. Herring (Edinburgh) said that he came there as a listener, and had not the slightest intention of saying anything; but Mr. Ewing had raised a question, and Mr. Myers had mentioned a matter, which had a close bearing the one upon the other, and on the question of coal. He was quite sure the question was uppermost in all their minds, what they were to do during the coming year. There was no doubt they would have to face a substantial increase in the price of gas throughout the country. They knew that residual products were fetching a very high price at the present time; but they were not enhanced so much in value as coal happened to be. The question of dear coal was of importance, particularly when they bore in mind that the cannels upon which most of them were dependent for the high quality gas they supplied were now being worked out. It was a question whether they should not seriously take in hand the point which had been raised by the President as to the quality of the gas they supplied. He did not see how it was possible that they could continue to send out the high quality gas they did at the present price; and he would suggest that they should put to their respective committees or boards—or rather to the public—the question: "Will you have a lower quality at the same price, or the enhanced quality at an advanced price?" There was no doubt that the quality of gas at the present day was not so important as it used to be. He had been associated with works that supplied 14-candle gas, with works that supplied 18-candle gas, and now with a works that supplied 25-candle gas. He might say that, notwithstanding what Mr. Myers had stated as to English people not grumbling, he had found there was just as much grumbling as regarded the one quality as the other. In fact, it was not a question of quality—it was a question of how the people burned the gas when they got it. Take their case in Edinburgh. They went to the expense of making a high-quality gas, and then they consumed 2 cubic feet of it per hour in the public lamps, which gave a visible candle light sufficient to guide one by the wayside, but which, as an illumination, was a sham. It would pay much better to make a low-quality gas, and to burn about twice as much of it—particularly in regard to the incandescent burner, although a high-quality gas did give a better result than a low-quality gas. With an ordinary "C" burner, they consumed $3\frac{1}{2}$ cubic feet of 16-candle gas to obtain the best result; but he found that with 25-candle gas he attained the best result with $2\frac{3}{4}$ cubic feet. The initial difference was, however, so small that the people would be better with a low-quality gas than with a high-quality gas such as was common in Scottish towns. He was seriously thinking of raising the question, within a few months, of whether they should not reduce the quality and continue to supply at the present price of 3s. per 1000 cubic feet. There was still another point bearing upon this question. It would probably be known to all of them that Messrs. Bray had recently re-classified their burners. They obtained now from Nos. 1 and 2 burners what they used to secure from Nos. 3 and 4; and the public were asking for what they were used to. The consequence was that they were burning more gas, and getting more light, with somewhat larger gas bills. But they were always grumbling. He did not think they should take that seriously, because it showed a healthy state of mind.

Mr. T. Lighbody (Renfrew) said that his experience was that there were far fewer complaints regarding the quality of the gas than there were as to the amount of the gas bills. He thought they had a good deal to do themselves with the matter of the standardizing of meter unions. He had used something like six different makers' meters; and every one had the same union. He specified for one coupling, and he got it; and it was done without extra cost.

Mr. T. Douglas Hall (Montrose) said it had given him very great pleasure to be present that day to support Mr. Carmichael, who was an old friend of his, having been brought up in the same office with himself. He thought the subject which was most important to gas managers to-day was that of reducing the illuminating power of the gas. Like some of the former speakers, he had had experience of all qualities of gas—from 14 candles up to the old-fashioned 30 candles; and he must say that grumbling seemed to be less with the low illuminating power gas, as usually supplied in England, than it was in Scottish towns. He thought that some of the reasons for this were that, so far as he could see, the fittings in England were more modern, and the mains and service-pipes were larger. In English towns, burning 5 cubic feet of 15-candle gas per hour, the street lighting was most marked; but in Glasgow, for example, they would find old-fashioned, rat-tail burners, consuming about $1\frac{1}{2}$ cubic feet of gas per hour. These gave a light which simply let them see the lamp; there was no illumination at all. In his case, the average rise in the price of all classes of coal—first and second class cannel and splint—would be between 4s. 6d. and 5s. per ton; and he really did not see any other way out of his difficulty except to reduce the illuminating power of the gas to (say) 20 candles. With gas of this quality, and with care, and proper fittings and burners, he thought they would be able to give their consumers as much satisfaction as they were doing just now with 25-candle gas, and with possibly smaller service-pipes, defective fittings, and bad burners. Of course, he did not suppose that in Scotland—especially in the north, where they had to pay a very high rate for the carriage of coal—even if they did reduce the illuminating power from 25 to 20 candles, they would be able to tide over and pay dividends with the present price of gas. But he believed that gas consumers were quite prepared for a rise, because everything, without exception, was up in price. Who was benefiting by the rise in coal, he did not know; but he marked, like Mr. Ewing, the happy faces of the coalmasters.

Mr. D. Robertson (Dunoon) said that, although he might be considered rather extreme in his views, he thought it was not fair that coal should be exported from the country in such large quantities as was being done at present. Last year, he believed, there was exported from Great Britain 41 million tons of coal, out of a total production of 200 odd million tons. This coal could never be replaced. They were exporting what could not be renewed; and at home they were paying enhanced prices for coal in order to enable the foreigner to compete with them in British markets. He would put a duty upon coal, or prohibit its export altogether. In about 200 years, the British coal supply would be exhausted. None of them would be here to see that time; but it would be very hard on those who were alive then. He considered that they should look forward, and try to prevent this waste. Until some other motive power were secured, he thought they ought to conserve what they possessed. Unaccounted-for gas was a very sore point with most of them. Let them do what they might, they could not reduce it below a certain percentage. It was accounted for to a great extent by long stretches of mains and service-pipes; and he thought that the Committee of the North British Association, in compiling their statistical report, might put in a column showing the mileage of mains along with the percentage of leakage. He could not say that he was in favour of reducing the illuminating power below

20 candles; but he knew he had complaints when, as a matter of fact, the gas was very good. He observed that, if he could keep the gas of regular quality, even supposing it was not so good, there were fewer complaints.

Mr. J. M'Gilchrist (Dumbarton) said that to him the outstanding feature of the President's Address was the reference to illuminating power. Circumstances had changed; and no doubt they must meet the altered conditions by changing their modes of working. But to say that they were to maintain the present price of gas, with a reduction of the illuminating power, he thought was not going on right lines at all. He did not see how, by reducing the illuminating power, they were going to give the consumer better value. He thought that the present was an excellent opportunity for raising the price of gas to meet the increased cost of coal. So far as he knew, the coal producing lower illuminating power gas was relatively as dear as, or dearer than, the coal producing gas of higher illuminating power. The question for them was how they could give their consumers, per unit of light, the cheapest illuminant. He did not think that, by reducing the illuminating power of the gas, they could reach that. No doubt the incandescent burner had made the question of high illuminating power gas of less importance; but still there would not be 10 per cent. of the gas produced which would be consumed in incandescent burners. The other 90 per cent. would be consumed in ordinary Bray burners; and they ought to cater for that too. He knew that illuminating power was a great question; and they could not but see that the trend of public opinion among gas managers was in the direction of a reduction. He did not think they would be doing the best for their consumers by reducing the illuminating power, unless it could be shown—and that had never been attempted—that they could reduce the price of gas by doing so. It seemed to him strange that in England they had even less complaint about illuminating power than they had in Scotland. It appeared to some of the speakers to be of no importance whether they reduced the illuminating power 4 or 5 candles. To him, this was incomprehensible; he could not understand it at all. No one could dispute Mr. Robertson's remark about keeping the quality of the gas uniform; but he was sure that if Mr. Robertson had kept the high quality regular, there would have been no occasion whatever for finding fault. The same thing would happen as Mr. Robertson said he had experienced, if he were to reduce the illuminating power, and then on odd nights reduced it further. He thought it was all a question of cost. He did not see how they could meet the increased cost of coal without raising the price of gas; and he thought it would be an exceedingly unwise recommendation to give to their boards to reduce the illuminating power in order that they might keep the price as at present. Hamilton seemed to be a wonderful place. Mr. Ewing had told them that he could see his way to going on without increasing the price of his gas. This was to him incomprehensible. There must have been something very far wrong before, if he could go on now, with an increased cost of £5000, without raising the price of gas. Mr. Hall told them that if the fittings were put right they could supply low-quality gas with advantage. Surely it was of more importance that the fittings should be in good order for 25-candle or higher power gas. He thought the remark was begging the question, because the fittings ought to be right, no matter what the quality of the gas supplied. The exportation of coal was a question for Parliament, rather than for them; but there was a great deal of good sense in what Mr. Robertson had said in regard to it. He thought that the subject of the standardizing of meter unions had resulted unfortunately, because the North British Association had unanimously agreed to adopt the standard unions. It was a great pity that they had anything to do with the English Associations in regard to the matter. If they had continued in their own way—and more especially seeing that the six manufacturers of meters in the country were agreeable to give them the standards without extra cost—he thought that by this time they would have been proving to their English friends that the proper thing to have was one standard. He was very pleased to say that, out of seven Associations who were consulted on the subject by the Council of the Gas Institute, five were favourable to the standardizing of meter-unions. It occurred to him that there was something wrong in the action of the Gas Institute in not recommending to the members that the standardizing of the meter-unions should take place forthwith, seeing that so many Associations supported it. He would be very glad to support the North British Association if they again took up the subject of adopting standard meter-unions for Scotland alone.

Mr. D. Vass (Airdrie) said that he had had twice to raise the price of gas to meet difficulties; and his experience was that, immediately the price was raised, there was a falling off in the consumption of gas. If, on the other hand, they lowered the illuminating power, the opposite would be the result.

Mr. R. S. Carlow (Arbroath) thought it would be better to keep the illuminating power of the gas up to 24 or 25 candles, because, in places such as Arbroath, where there were mills, if there was the least reduction in the illuminating power they were at once rung up and asked what was wrong at the gas-works. Last year they went to Parliament, and got power to limit the illuminating power to 20 candles; but if he were to lower it to that figure, and were to tell the millowners that they had the power to do so, and had done it, but that the fittings in the mills were not proper, there would be grumbling all round. Electricity would then be introduced; and they would lose their gas consumption altogether. Certainly there was a spurt in the coal trade in the meantime; but he had passed through a similar situation before, and it might be done again. It was not so many years ago since they were paying 30s. and 40s. per ton at the pit for first-class cannel. That time passed by; and let them hope that the present high prices would, before long, do the same. Let them tell the consumers that they must raise the price of gas to meet the increased cost of coal, but that when the price of coal came back, there was the expectation that the price of gas would do the same. This, he thought, was the kernel of the whole affair.

Mr. W. Fairweather (Kilmarnock) said that for some time back he had been getting increased illuminating power by using shale, which he could purchase at 3s. or 4s. per ton cheaper than he could buy splint. He did not know, if he were to reduce the illuminating power, how he would get on. He was hedged in by Act of Parliament, and could not reduce the quality below 24 candles. Of course, it would not be a difficult matter to get sanction from Parliament to lower the illuminating power; but, at the same time, he did not see that he could make much by it. He was very pleased to hear chemical works mentioned. This was a matter of interest to everyone who had a consumption of over 20 million cubic feet. Two years ago, they put up a new sulphate plant at Kilmarnock, with the result that they had had an increased yield of something like 12 per cent. over what they had from the old apparatus. If anyone were going in for such plant, the more modern and substantial he put it up the better.

Mr. T. Wilson (Coatbridge) said that the increase in the price of coal was certainly something considerable. In his own case, it amounted to 25 per cent. over what he was paying a twelvemonth ago. He was not like Mr. Ewing; he could not go back on rigid economy, because his works had been very well conducted in the past. He thought the only thing he could do was to add to the price of the gas. Unfortunately, in Coatbridge they had only 2½d. to rise before they reached their maximum. He thought they ought to reduce the quality of the gas. It was a great loss to the community that they should be supplying gas of 20 or 25 candle power when, for the great bulk of the consumers, 16 candles would be quite sufficient. The limit in Coatbridge was 20 candles, and he would like it reduced to 16 candles. He thought this would suit the majority of their people. He had supplied in England gas of 14 candles, and in Scotland of 25 candles; and really he had had as many complaints in Scotland as in England. Perhaps the Scotch were not so easily pleased as the English. He knew that, if he were allowed to supply gas of 16-candle power, he could make it much cheaper. His neighbour, Mr. Vass, raised the question of the increasing of the price affecting the consumption. With him, that was not so. He raised the price, as from Jan. 1 last, from 2s. 6d. to 2s. 8½d. per 1000 cubic feet; and in the two months of January and February, there was an increase of over 4 million cubic feet in consumption. He thought they should combine and get their standard in Scotland reduced to 15 candles. This would be in the interest, not only of gas companies and corporations, but of the community at large.

Mr. F. Waddell (Forfar) remarked that they supplied gas of 23 or 24 candle power in Forfar. It was, he believed, difficult to keep up a high standard of (say) 25 candles. He had not been making gas anything like that. His quality had been about 23 candles; and the people were perfectly satisfied. He had had far fewer complaints than when he supplied gas of higher quality. Notwithstanding that some of the mills in the town were lighted by electricity, the gas seemed to be quite able to look after itself. He must congratulate the President on the way he had put matters in his address. With regard to sulphate of ammonia, this was a sore point with him. His neighbour, Mr. Carlow, received about £1000 for his tar and liquor; and he (Mr. Waddell) got about as much for his tar and liquor as he should get for his tar alone. He could understand it; but the Corporation could not.

Mr. W. Blair (Helensburgh) said he thought he would be inclined to raise the price of gas to enable them to meet the extra cost of coal. If they were to make such a rapid change as to reduce the illuminating power of the gas by 4 or 5 candles, they would certainly increase the amount of grumbling, as well as the gas bills. Not many years ago he paid £2 10s. per ton for first-class cannel. They got over the difficulty then; and he did not see why they should not do so now. In a few years, coal would be back to its old price. He did not think that in Helensburgh he would be in the fortunate position of being able to economize sufficiently to meet the increased price of coal. He was rather afraid that they would have to raise the price of gas. So far as distributing plant was concerned, he was sorely hampered. He had a large mileage of mains per million cubic feet; and the leakage was, in consequence, very high. He believed it would be an advantage to have a column in their statistical report giving the mileage of mains. At Helensburgh, the gas passed down through the lime in the purifiers; and they had never been properly connected so as to drain away any liquid that might lie in the bottom. He had tested this frequently, and had found it standing at about 1° Twaddel. He thought they could always make cleaner gas by passing it up than by passing it down through the purifiers.

Mr. J. M'Nair (Wishaw) said he was in favour of reducing the

illuminating power of gas to 20 candles. His experience at Wishaw was that when he produced gas of 25 candles, there was always a good deal of grumbling; but if he made it of 20 or 21 candles, grumbling usually subsided. He thought it would be a very wise plan to reduce the quality perhaps 4 or 5 candles, if it were possible to taper it down. His opinion about purification was that the gas should go up through the lime, because, as it went up, it helped to keep the sieves moist, but when it was going down it dried up.

Mr. A. Yuill (Alloa) thought they ought to congratulate themselves upon having had so successful a meeting. The chief topic of discussion appeared to have been that of illuminating power. It did not seem to be a question of enrichment. They would all recollect the unique position he occupied in past years with regard to enrichment. When the point was oil *versus* coal, it was a question of how far up they ought to go; now it was a question of how low they were to go. He thought that if they were to reduce the illuminating power of the gas below what was supplied in London, they would find more difficulties than they had at present. In the paper which he read at the last meeting of the North British Association, he mentioned that about 90 per cent. of the gas consumed in the United Kingdom was of from 16 to 20 candle power. His opinion was that in places where they had a high standard of from 25 to 26 candles, no harm would be done to consumers in bringing it down to about 20 or 22 candles. They must all admit that circumstances had changed during the last five years or so. Gas cookers and fires, and incandescent lighting, had materially altered the situation; and they would be forced to the conclusion that a lower illuminating power gas was better suited for everyday requirements. At Alloa, he had two purifiers in which the gas passed up, and two in which it passed down; and he might tell them candidly that he could not see any difference whether it went up or down. But he was rather inclined to favour its passing up. For one thing, with the gas passing down, they had got all the resistance of the gasholders; and if there was any stoppage or back-pressure, it was thrown back on the point of entry of the purifiers, and there was a probability of the water being blown through the lutes. With the gas going up, they had the pressure behind the purifiers.

Mr. H. O'Connor (Edinburgh) said that the time he had spent about gas-works had always been where the illuminating power was less than it was in Scotland. From his experience, he found that the appearance of gas lighting in London was certainly better than it was in Scotland. The larger burners in use had the distinct effect of giving the appearance of a higher quality. If the illuminating power was to be lowered, the fittings in the houses would be too small, and the burners distinctly so. For a very long time after the lowering of the illuminating power, there would be a considerable number of complaints, owing to the smallness of the burners. It seemed to him that if a change were to take place it would be necessary, not only to issue, but to fix new burners free, so as to overcome the difficulty of the consumer wishing to retain and use the old burners. When he came to Scotland, he was particularly struck with the very small size of piping which was used in dwelling-houses. The pipes leading to gas-brackets and gasaliers were distinctly smaller than he had been accustomed to. He thought that, if the troubles there would be with these small fittings and the smallness of the burners could be got over, there would be no complaints from consumers if a lower quality of gas were sent out. The question of meter-unions, which he might be expected to touch upon, was not quite dead. It was still receiving consideration in certain quarters; and he could only repeat the remark of the late Mr. Bruce Peebles, at a meeting with the Committee of the North British Association of Gas Managers a year or two ago, when the question was in full swing: "It does not lie with meter makers; it lies with gas managers themselves. If you give me an order for a gross of meters, with any size of couplings you like to name, any number of threads per inch, any particular pattern you choose to decide upon, I shall certainly not refuse the order." He thought that this was really the point of the question. If a gas manager wanted his meters all with one union, he would have no difficulty in getting them; and he, for his part, having to manufacture meters, would have no objection to the standardizing of meter-unions.

Mr. M'Gilchrist said he would like to know from Mr. Wilson, if he were to reduce the illuminating power of his gas to 15 candles, where he would get coal with which to make so low a quality. Would he send to the South of England for it?

Mr. Wilson said that the first and second-class cannel fields in Scotland were almost exhausted; and they had only the third-class cannel, splint, and some other gas-making coals left. They might get an analysis of a section of coal giving (say) 20 candles; but he was never able to get 20-candle gas out of any of these coals—about 16 candles was the quality they produced. Some of them, in the near future, might have to introduce water gas, which would help them considerably, because they would employ less oil. For low-quality gas, they would get delivered in their works coal at possibly 10s. per ton; but coal to produce 24-candle gas would cost perhaps 20s. per ton. The 10 candles were not worth double the cost. It was only a question of educating the consumers.

Mr. Ewing, in reply to remarks which had been made since he spoke, said he had always been an advocate of low-quality gas, because he considered it more economical. He had supplied gas of 30 candles, of 15 candles, and of 10 candles. He had also supplied gas they could not see by at all; but that was abroad. He supported Mr. Wilson in advocating 15-candle gas as the standard for Scotland, because it was his opinion that, within five years, they would have to adopt it generally. They would probably have to use water gas, *plus* enrichment. At Hamilton, they were so situated financially that they were in a position to reduce the price of gas below 2s. 1d. per 1000 cubic feet, assuming a fair increase on the present year—and this notwithstanding that they were paying 115 to 120 per cent. more for coal than they did seven years ago.

The President, in closing the discussion, said that Mr Fairweather might well enrich cheaply with shale, because it was at his door. He did not think, with Mr. Carlow, that the lowering of the illuminating power of gas would cause electricity to be introduced into mills. He believed that if burners were properly looked after, gas would be as favourably looked upon as electricity. He never for a moment thought, when he came there to advocate 20-candle gas, that he would carry so many of them with him; but the very fact of the larger towns going in for the power to reduce the quality, showed that in a short time it would become general. He thanked them for the support they had given him in the chair.

Mr. Yuill proposed that Mr. J. Wilson, Manager of the Tradeston works of the Glasgow Corporation, be appointed President of the meeting to be held in April of next year.

The motion was agreed to.

Mr. T. Wilson proposed a hearty vote of thanks to Mr. Carmichael for his services in the chair, which was also agreed to.

Mr. Yuill was re-appointed Convener of the meeting.

This closed the proceedings.

A large company of the gentlemen who had attended the meeting, and their friends, afterwards dined together in the hotel, under the presidency of Mr. Carmichael.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

The Annual Meeting in Boston.

(*Concluded from p.* 867.)

The subject of underwater gas-main construction was next announced for consideration. Mr. John A. Coffin, of Gloucester (Mass.), described, with the aid of drawings, a pipe-line carried under a tidal river which connects Ipswich Bay with Massachusetts Bay. It was a run of 12-inch cast-iron pipe, about 90 lbs. per foot lineal, with 4-inch sockets and ordinary lead joints. The pipe was securely strapped to a strong baulk of 10 in. by 14 in. pine timber, to protect it from being injured by the keels of passing vessels. The water went down to 2 feet or so at low tide; but the current was so rapid that a man could not work in it. A trench 2 feet deep was dredged out by means of a plough worked by a steam traction engine; and the pipe was joined up, slung on derricks on each bank, and lowered into place. In cutting the trench, a large boulder was encountered, which had to be removed by blasting. The pipe was laid with a fall, and a drip-box at the lower end, with a suction pipe carried through the rising pipe to the surface. But there was really nothing to pump up; the work proving bottle-tight after some months' use. Mr. Neal described a line of 4-inch flange wrought-iron piping, which was laid on the bottom of a tidal river 20 feet deep. The pipes were simply lowered to their place from a bridge; and a diver descended and made the joints under water. A level bed was first made for the pipes. This line had been in use for many years, and it hardly ever contained any condensation.

Mr. Gould gave particulars of a run of 20-inch cast-iron pipe, including an inverted syphon of 24-inch pipe, laid across, and under, Fort Point Channel, for the purpose of conveying gas to South Boston, from the city proper. The channel at that point was 700 feet wide; but was spanned by a bridge with a draw opening 36 feet wide, and the pipe was laid on piles above the surface of the water, except at the draw, where it descended 35 feet, extended 51 feet horizontally under the channel, and rose again. The whole extent of the syphon was enclosed in a very strong case of pine timber, 12 inches thick at the sides, and 6 inches top and bottom, 5 ft. by 4 ft. outside dimensions, and strengthened with iron bands. The space surrounding the pipe was solidly packed with cement concrete. There was a drip-box under one of the uprights; and a 4-inch wrought-iron pipe extending to the surface, in which an artesian well pump was fixed. But although this collected the condensation from the whole 700 feet run of pipe, it did not require pumping oftener than once a month. The joints were first caulked with cold lead, and some of them were further protected by cast-iron rings or sleeves caulked with tarred oakum and cement.

Mr. Slater produced drawings of a line of 16-inch cast-iron pipe carried across the Seekonk River. The nature of the bottom rendered it necessary to dredge out a channel 12 feet wide, drive piles in pairs at intervals of about 16 feet apart, and fix cross-pieces joining each pair of piles, to which the pipe line was strapped. The whole had to be kept more than 25 feet below low tide, as the river is dredged to that depth. The line was laid in sections of three pipes each; every third joint being made with one of Falcon's patent double strength ball

joints, which was as strong as the pipe itself, easy to connect under water, and perfectly tight when caulked. Each section of pipe was lowered into place, and jointed and strapped down by a diver. The drip-box was 29 feet below low water; but the condensation was very slight, and the job was quite a success. Mr. Sherman had 800 feet of 16-inch pipe laid in exactly a similar manner; using the Falcon ball joint on every third pipe, and it was perfectly satisfactory. Another flexible joint was the Ward joint, which had been adopted with success for a 20-inch main laid under Haarlem River at New York, a width of 600 to 700 feet, and which could be put together on a raft, and paid out or lowered into place. Mr. Gould had laid 3600 feet of 6-inch cast-iron pipe, for water, using the Ward joint. The pipes were put together on a large raft and then allowed to slide off behind in four-length sections. Mr. Allen quoted a case where a line of pipes had been jointed by means of the Ward joint, on one bank of a river, and then pulled into place with the aid of a wire rope and a winch worked by horses. The joints were not caulked subsequently; but a diver descended and made the connections to the uprights on each side. Mr. Hirt had lately put down some very large pipe syphons—viz., one 54-inch on the Malden Bridge, one 48-inch at the River Street Bridge, and one 42-inch at the Charleston New Bridge. These were laid in wood-lined tunnels carried through the solid material below the bed of the river. The cast-iron pipes were laid concentrically, and the intervening space solidly filled up with cement; and he felt he had a job that would not be disturbed by ice or boats. The Malden Bridge tunnel was 850 feet long, and the Charleston Bridge tunnel was 260 feet long.

At the invitation of the President, Mr. A. B. Slater, junr., gave some details of a retort-house as re-constructed on the original site. The walls had to be taken down on account of failure in the foundations. The building, or rather the portion re-constructed, was 110 feet long and 65 feet wide, and contained two transverse stacks having ten beds of sixes in each, which were not disturbed. The form of building adopted was a steel-frame construction, with brick filling so arranged as to preserve a uniform appearance in relation to adjacent buildings. The roofing comprised four main trusses between the gables, 22 feet centre to centre, and trussed purlins 9½ feet apart; and the covering was the Melan principle of expanded metal and breeze concrete, about 4 inches thick, slated outside to match the other buildings. A wood centreing was used in the erection of the roof, forming a floor flush with the top surfaces of the framing, and covered with oiled paper to prevent the cement from adhering. The expanded metal sheets were laid on this and strongly fastened together, with a large lap, and a layer of concrete was worked in underneath them. The top surface was also covered and finished off smooth, and the slates nailed on in the usual way. He did not believe the slates would require repair; but if any were broken by accident, after some years, when the cement had set hard, there would be no difficulty in nailing fresh slates on.

Mr. B. J. Allen, of Alston (Mass.), read a paper on "Liquid Fuel," including illustrations of several burners suitable for consuming oil or tar. These were all on the injector principle, requiring steam or compressed air. The liquids were stored in a tank 20 feet above the level of the burner. He could maintain good, uniform heats and fix 100,000 cubic feet of carburetted water gas per retort per 24 hours, using ¾ gallon fuel oil per 1000 cubic feet of gas produced; and one man could attend to the set of 22 fires, and also adjust the feed to the 66 retorts. The oil thickened at about 15° above zero; so that, in cold weather, it was necessary to warm the storage tank by means of a steam coil. The lighter portions only of the water-gas tar could be used with nearly as good results; the heavier parts contained too much water, and he got rid of them by mixing with bituminous coal and burning under the boilers. He had also used a very heavy grade of fuel oil. This was stored in a tank 14 ft. by 16 ft., heated by means of a coil, comprising 190 feet of 1¼-inch steam-pipe. It was found necessary to keep this oil at a temperature of not less than 100°, and to deliver it to the burner under a pressure of 15 to 20 lbs. He also tried ordinary coal tar in the same apparatus, with varying pressures from 5 to 25 lbs. on the air supply, and also with steam at 100 lbs. pressure. The steam was adopted on account of trouble from clogging at the burner. The best results with tar were obtained with a simple injector burner made of ordinary wrought-iron fittings.

Discussion being invited, Mr. M'Kay said he had in one year consumed 500,000 gallons of tar for boiler fuel; using one of the burners referred to by the author—the Parson burner. Using three burners under a Hazelton boiler, he raised all the steam required on the works, and consumed 1000 gallons per burner per 24 hours, or ⅔ gallon per minute. This worked out to ¾ gallon per 1000 cubic feet of gas made; and the pressure of steam in the boiler was 110 lbs. His water-gas tar was practically free from water; and he found that the way to effect this result was to raise the mixed liquids to boiling point by means of steam coils. The tar and water would separate completely in 24 hours. The vent pipe of the heating tank was connected to the scrubber, so that any light hydrocarbons given off were returned to the gas. With the older imperfect apparatus the tar would stratify; but with the Lowe apparatus it was uniform. Mr. Sherman said he was successfully using oil-gas tar under retorts; and three barrels of tar were equivalent in fuel value to 72 bushels of coke. With coke at 3d. per bushel, the tar would be worth 6s. per barrel as fuel. He had a good demand for coal tar, but was only offered about 2s. per barrel for the oil-gas tar, which was made from a heavy oil of ·35 gravity. Mr. Prichard had used oil-gas tar under boilers, and found it worth about ½d. per gallon, compared with steam coal at 12s. per ton. He was not successful, however, in separating all the water from the tar. Mr. A. B. Slater, junr., remarked that stratification of tar was due to incomplete fixing of the gas, and was therefore not experienced with modern apparatus.

After discussing the contents of the Question Box, the usual votes of thanks were passed, and the meeting was closed.

GAS-ENGINES IN PRACTICE.

In an article which appeared a short time since in the "American Manufacturer," the above subject was dealt with by Mr. J. D. Lyon, as follows.

In districts where natural gas prevails, the power user has at his command in the gas-engine one of the most economical and convenient forms of power generator in existence. The rapid increase in the number of gas-engine plants being installed is ample evidence of the great practical value of the machine; and while the best estimate of the operating cost in any case can only be had from actual results in similar installations, a consideration of some of the conditions controlling the fuel consumption may be interesting.

The gas consumption in a properly constructed engine is very nearly proportional to the work being done—the friction load of the engine being always included. It is therefore the average useful work done *plus* this friction load that governs the gas consumption during any given period; and in estimating the cost of doing certain work, the average power required must be known with reasonable accuracy, if a close approximation is desired. In general, if a = friction load (I.H.P. − B.H.P), b = average useful work done in horse power, and c = gas consumed per I.H.P. hour, the gas required for any number of hours $x = n\,c\,(a + b)$ where n = the number of hours running.

Suppose in an actual plant with which the writer is familiar a 14 B.H.P. (17 I.H.P.) engine had a constant load equal to the full capacity of the engine. The consumption in this case is about 12 cubic feet of natural gas per I.H.P. hour; and the hours run monthly average about 300. The total amount of gas consumed would then be $12 \times 300 \times 17 = 61{,}200$ cubic feet, which, at $0·225 per 1000 cubic feet, amounts to $13·77 per month. As a matter of fact, the engine mentioned uses less than one-half this amount—the average monthly cost during 1898 being $5·65; the small quantity of gas consumed being due to the nicety with which the engine regulates the fuel admitted to correspond with the load. This engine is occasionally required to work very nearly up to its limit, furnishing power for electric lighting and for a heavy freight elevator, beside some light machine tools. Many other gas-engines are in use which show a fuel economy far beyond their owners' expectations; but, as a rule, these plants have been estimated upon maximum capacity, and it is the small average load that accounts for the low cost of running.

The figure given—12 cubic feet per I.H.P. hour—is a safe one when natural gas of about 1000 heat-units (B.T.U.) per cubic foot is employed; and a good gas-engine well adjusted should do somewhat better. On account of its cheapness and high calorific value, natural gas is an ideal fuel for the gas-engine; but the efficiency of the engine is so high that, even with higher-priced coal gas of lower calorific value, it remains cheaper to run in many cases than any other available motor. Average coal gas may be safely assumed to have a calorific value of 700 B.T.U. per cubic foot. With the same efficiency as before, and with gas at $1 per 1000 cubic feet, the running of the engine previously mentioned would cost approximately $36 per month, which is still a low price for service rendered.

As to the comparative cost of gas and gasoline for fuel (neglecting the cost of handling), 5·5 gallons of 0·76° gasoline very nearly equal in effect 1000 cubic feet of 700 B.T.U. coal gas. The cost of fuel only has been considered; but, of course, to this must be added attendance, lubricating oil, depreciation in value, repairs, and interest on investment.

When the average load is light in comparison with the maximum, and the latter is carried for a fixed period each day, it will sometimes prove economical to use two engines in order to reduce the friction load to be carried. For instance, supposing a plant in which 25 B.H.P. is required for two hours each day, and 5 B.H.P. for ten hours. With one engine of 25 B.H.P. (or 29 I.H.P.), the consumption of artificial gas would be 2426 cubic feet. If an additional engine of 5 B.H.P. (6 I.H.P.) were used to take care of the light load, the gas consumption would be about 1916 cubic feet; effecting a saving of $2426 - 1916 = 510$ cubic feet in 12 hours, or 5½ c. per day if gas cost $1 per 1000 cubic feet. With low-priced natural gas, the argument in favour of a separate engine loses its force, unless the difference in power required at different fixed times is very considerable.

For years the noise-making proclivities of the gas-engine constituted one of the most serious drawbacks to its use in many localities. The modern engine has been much improved in this direction; but an observation of almost any plant in use will show there is still much to be done. The most objectionable

noises emanating from a gas-engine are air suction, exhaust, gear-wheels, snap of igniter, and opening and closing of poppet valves. The air suction causes a hoarse coughing noise during the charging stroke, and is not easily eliminated. Most engines are arranged to draw in their supply of air from a hollow base casting. The space between the base and foundation forms an air-reservoir communicating with the atmosphere of the room through a number of small holes or slits. The air passing through these small apertures makes less noise than when it is simply drawn into the cylinder through a plain pipe. It will be found best in many locations to carry the air-pipe to the outside of the building; and in this way the air suction will be made noiseless as far as the engine-room is concerned. When this is done, however, care must be taken to increase the diameter of the conducting-pipe, so as to allow for friction between the air and the walls of the pipe. Some English makers have secured fairly satisfactory results by making an air reservoir of the entire sub-base; the air velocity being reduced by means of a series of baffle-plates placed transversely in the base of the engine. When it is desirable to secure the same results in an engine not provided with such a base, it is, of course, easy to substitute for it a separate box arranged in a similar manner. As there is a possibility of an accumulation of a small quantity of an explosive mixture in the air-chamber, care must be taken to avoid danger from this cause. Since the quantity of air passing through an engine is considerable, caution should be exercised to provide an ample air-inlet to the engine-room. The writer has seen a case where a 25-horse power gas-engine in the basement of a building, by varying the air pressure, caused the front windows to rattle at every induction stroke when all the doors and windows were closed. It would be rare for annoyance to occur from such a cause, and it would indicate a state of ventilation calling for immediate attention.

Inconvenience arising from the air-inlet, however, is confined to the engine-room; but the exhaust-outlet, if not properly arranged, may become the subject for an injunction, and justly so. Several plans for minimizing this effect of the hot-air gases have been discussed. The sounds are due to the high velocity of these gases at the moment of leaving the exhaust-pipe; and all methods of silencing aim at a reduction of this velocity. As the pressure of the gases is due to their high temperature, it is best to employ some means of reducing the temperature rather than to obstruct their passage in any way. Expansion into large vessels immediately after leaving the engine is the common method; and if they are large enough, with large outlets, it is effected entirely. As the use of very large exhaust vessels is sometimes inconvenient, a part of the cooling water turned into the exhaust-pipe will be found to be an excellent substitute. The heat absorbed in raising a small quantity of cooling water to the boiling-point and converting it into steam greatly reduces the temperature and volume of the exhaust gases, and secures a practically noiseless exhaust. The method is not new; and it seems strange that it is so little in use, as it adds practically nothing to the cost of installation. The lowest point in the exhaust system must have a drain to carry off any excessive water when this method is used. The idea of reducing the velocity of the gases by means of baffle-plates, or any method depending wholly upon friction, is not so good; and unless they are placed upon the pipe at a considerable vertical distance above the engine, they will generally produce back-pressure.

The elimination of the other noises lies with the manufacturer, and all are working hard to improve in this direction. Buyers of gas-engines should note carefully the cause of all sounds coming from an engine; for although it is rare that the slight noise of the igniter and the valve opening in a modern engine is found serious enough to prevent its use, it may indicate excessive wear if it is not well designed.

THE DISINFECTION OF WATER-MAINS.

At the Meeting of the Society of Engineers on Monday last week—Mr. Henry O'Connor, the President, in the chair—a paper prepared by Dr. G. Sims Woodhead, M.A., and Mr. W. J. Ware, on "The Disinfection of the Maidstone Water-Service Mains," was read by the latter, who is the Engineer of the Maidstone Water Company.

Our readers will probably remember that towards the close of the summer of 1897 a serious epidemic of typhoid fever occurred at Maidstone; and on the 11th of October one of the authors was called in to make a thorough inquiry into the outbreak, and to advise the Water Company as to its cause, and as to what steps, if any, should be taken to prevent its increase. It was considered advisable that certain precautions should be at once taken to prevent any further dissemination of the disease through the agency of the water supply, should it be found, after due investigation, that this was contaminated. The authors came to the conclusion that sterilization of the mains was necessary, in order (1) to do away with the possibility of any infective material that might have made its way into the mains remaining in any of the pipes, especially in the dead-ends; and (2) to restore public confidence, which could only be done by rendering it absolutely impossible for any such infective material to remain.

Owing to the arrangements for the distribution and supply of the water, it was a comparatively easy matter to disinfect one part of the system alone; but there were certain drawbacks in connection with the very steep gradients and high pressure at which the sterilizing solution had to be thrown in. After a careful study of the method of sterilizing with dilute milk of lime, as carried out at Worthing, and of Professor Delépine's experiments on chlorine disinfection, it was decided that the mains and service-pipes should be filled with chlorinated lime solution of a strength of at least 1 per cent., or ½ per cent. of the available chlorine.

Chloride of lime was used because (1) of its comparative cheapness; (2) of its efficiency as a disinfectant, especially in solution—the double action of chlorine and oxygen being of special importance; (3) under the conditions presented, it could easily be obtained in a clear solution of the required strength; (4) it exerted comparatively slight action on lead; (5) its action on leather was supposed to be less than was afterwards found to be the case; (6) the odour could not be mistaken, and there could be no doubt when the chloride of lime had reached its destination; and (7) after the pipes had once been washed out there could not be the slightest danger of any ill effects following from the use of chlorinated water.

The high-pressure water was supplied from the Farleigh water (Kentish rag or lower greensand formation), with which surface relations appear to be easily brought about. It was decided to carry out the disinfecting operations in two sections, A and B. Section A included the Company's high-service pressure reservoir and the whole of the distribution mains of the high-pressure area north-east of this reservoir, including about 14¾ miles of mains with a capacity of a little over 76,000 gallons. In order to obtain a sufficient amount of solution, 180,000 gallons of water was left in the reservoir. To this was added 10 tons of chloride of lime, containing ·33 per cent. of available chlorine, which gave a strength of 4·04 grains of available chlorine per cent. The chloride of lime was thoroughly mixed with the water, and then allowed to settle for a couple of hours. The whole of the mains in the high-pressure area were then emptied, and the mains of each of the four districts of the section were in turn filled with the chlorinated liquor; the full pressure being maintained for half-an-hour in each. The entire mains and services of the high-level area were thus charged.

After this operation had been completed, the remaining solution was used to wash down the roof, walls, and piers of the service reservoir. Then, by means of constant stirring, the lime was mixed with the fluid, and a milk was formed which was pumped out of the reservoir by means of a fire-engine and run to waste. The operations commenced at six o'clock on Saturday evening, Oct. 16, and at six o'clock on Sunday morning, or twelve hours after starting, the chlorine solution was pumped back from the 12-inch trunk main from the town; the fire-engine being again brought into requisition. So long as chlorine water was returned, it was removed; and by eight o'clock the reservoir was being filled with bright, clear water, free from anything but the merest trace of free chlorine.

In most cases, the householders were thoroughly satisfied that the chlorinated solution had passed through their service-pipes; but there were a few streets in which the occupants of certain houses were not satisfied that they had received their full share of the disinfectant. In each of the streets from which complaints were received, the water supply was suspended and the mains emptied. The mains were then charged from the highest point with chlorinated solution stored in water-vans. The sluice-valve was opened, and the normal pressure was brought to bear so as to force the solution through the services and fittings of the selected houses.

Apart from some damage to washers, clothing, and pump-buckets, no ill effect of any kind was traceable to the use of the chlorinated lime solution. As the result of the treatment, everyone was satisfied that, so far as the mains and service-pipes that conveyed the high-pressure water were concerned, there was no possibility that any typhoid organisms could continue to exist in them.

In section B there were a little more than two miles of mains, of a total capacity of over 32,000 gallons, with a reservoir capable of holding 100,000 gallons. This section was treated in exactly the same way as section A; 3 tons of chloride of lime being added to 50,000 gallons of water left in the reservoir The process of disinfection was very similar to that adopted in connection with the other section.

In conclusion, the authors expressed the belief that this was the only instance in which disinfection of water-mains had been carried out on anything like so large a scale; and, although the difficulties to be surmounted were by no means small, they were thoroughly satisfied with the results. It was thought desirable to place on record their method of working in some detail, as they fully anticipated that similar operations might from time to time be necessary in connection with other outbreaks of typhoid, cholera, &c. As soon as it was announced that chlorinated lime solution was to be used, they received advice and offers of assistance from a considerable number of manufacturers of various antiseptics; and without denying that certain of these might have been used, probably with success, the authors were satisfied that with no single substance with which they were acquainted could they have felt equally certain that the disinfection could have been so thoroughly, quickly, and harmlessly carried out. The very fact that chlorine has an easily and well-recognized pungent odour was all in favour of the success of the undertaking.

REGISTER OF PATENTS.

Condensers.—Kirkham, Hulett, and Chandler, Limited; a communication from F. D. Marshall, of Copenhagen. No. 6225; March 22, 1899.

This is a water-tube condenser, the elements of which (arranged one above the other) are composed of a series of sections secured together and so connected that "the cooling water introduced into the section at one end of one element will have to flow through all the sections of that element, from the other end of which it flows into the second element, after traversing all the tubes of which it flows into a third element, and so on—the cooling capacity of the apparatus being dependent upon the number of superposed elements, and the number of sections which such elements contain."

Fig. 1 is a side elevation of the condenser. Figs. 2 and 3 are a front and side elevation of the condenser with certain parts removed. Fig. 4 is a horizontal section on the line 4 of fig. 2. Fig. 5 is a sectional elevation of the means for feeding the condenser with ammoniacal liquor or water.

The casing of the condenser is preferably built up of wrought-iron plates and angle-irons, and provided with openings A^1 A^2 for the inlet and outlet of the gas and a pipe A^3 for the discharge of the tar and the like; B are the multitubular elements arranged in the casing, and C are the sections composing the elements. In practice, each section consists of a pair of water-tubes preferably more or less of oval shape, and connected at each end to cast-iron boxes D. These boxes have openings E at the sides and plane faces F, connected by tie-bolts G and box nuts; so that, when the boxes of the several sections of an element are all placed together, the cooling water will flow (for instance) through the tubes of the first section, as indicated by the arrow 1, thence into the tubes of the second section, thence through the tubes of the third section, and so on, whereby a zig-zag course is imparted to the water.

Fig. 1.

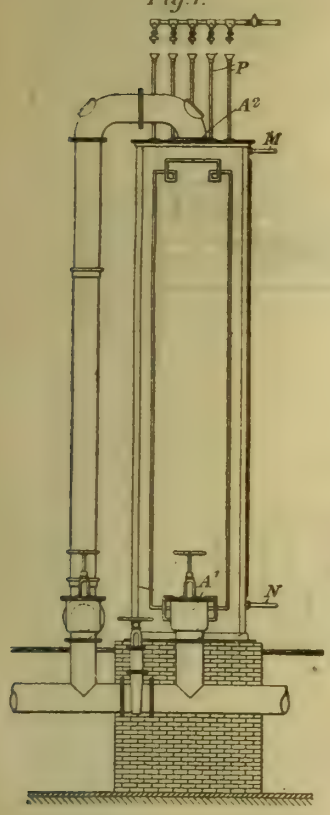


Fig. 2.

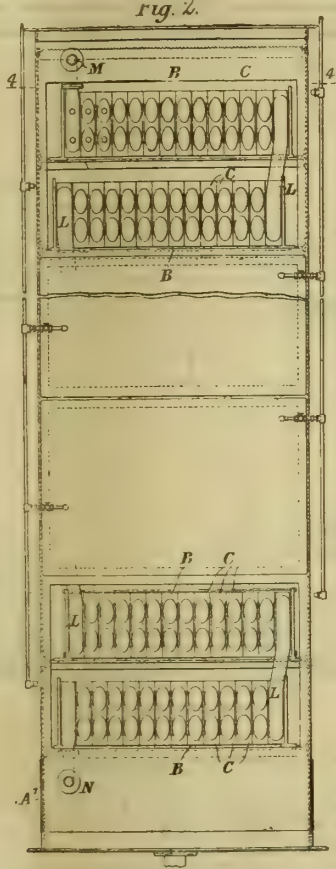


Fig. 3.



Fig. 4.

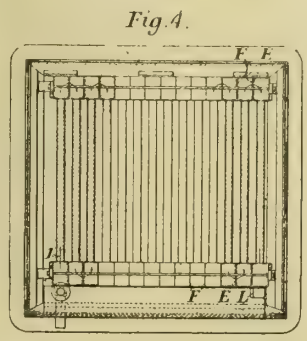
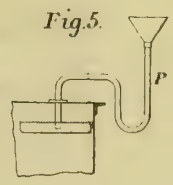


Fig. 5.



The elements are connected together by the pipes L (fig. 2), so that the water entering at M at the top will pass through the topmost element, and thence through the successive adjacent elements—finally emerging at N. The gas at the same time is caused to enter at the lower part, passes between the cooling-pipes of the various elements, and emerges through the outlet at the top.

In order to assist in the extraction of the ammonia from the gas, and remove the tar deposited in the condenser upon the tubes of the elements, there is an arrangement for passing a continuous stream of ammoniacal liquor or water through it. This comprises a series of tubes P, fixed to the top of the condenser, and provided at their upper ends with funnels for the reception of the ammoniacal liquor or water from pipes connected to the source of supply. The pipes are each furnished with a bend to form a seal; and their lower ends discharge into troughs having serrated edges, whereby the ammoniacal liquor or water is caused to fall through the condenser in the form of rain or spray.

Apparatus for Charging Retorts and for Stirring and Withdrawing the Charge from Retorts.—Foulis, W., of Glasgow. No. 8486; April 22, 1899.

This invention relates to apparatus of the type described in patents No. 12,016 of 1890, No. 14,440 of 1891, No. 12,385 of 1892, No. 16,749 of 1893, and No. 13,867 of 1895; the principal object being "to improve the apparatus so as to simplify its construction, and render it easily operated, very efficient in action, and not liable to readily get out of order."

As regards the apparatus for charging retorts: The patentee provides an arrangement by which, instead of tilting the whole frame to elevate the pusher, by which the charges are forced into the retort, the pusher and its rod only are elevated; and the operation is effected in such a manner that the leverage through which the power is applied to elevate the pusher is largely increased during the first portion of the movement. To effect this, the end of the pusher-rod nearest to the retort rests upon a roller or pulley, preferably grooved to fit the rod. This roller or pulley is suspended by levers secured to a cross-shaft mounted in bearings on the beam along which the longitudinally moveable parts travel; the shaft also having secured to it a lever to which is attached a rod operated by the plunger of a hydraulic cylinder, by means of which the shaft is rocked. When the roller or pulley is in its lowest position, the levers carrying it are perpendicular to the point of suspension, and therefore the leverage to lift the pusher is effectively applied.

The hydraulic cylinder is preferably arranged as follows: The ram of the cylinder is made so as to present a larger surface to the water at its rearward face than it does at its forward face; and the water is constantly in communication with the space of the cylinder forward of the ram. A valve (preferably a rotary valve, operated by a lever) is provided, so that, when the valve is in one position, water is admitted to the space in the cylinder to the rear of the ram to move it forward—owing to the surface of the ram at that side being larger than at the other side; and, when the valve is in another position, the rear space is opened to the exhaust, and the pressure of the water on the forward face of the ram moves the ram back, and the rod and lever and the roller on which the pusher-rod rests are operated to elevate the pusher for the back stroke.

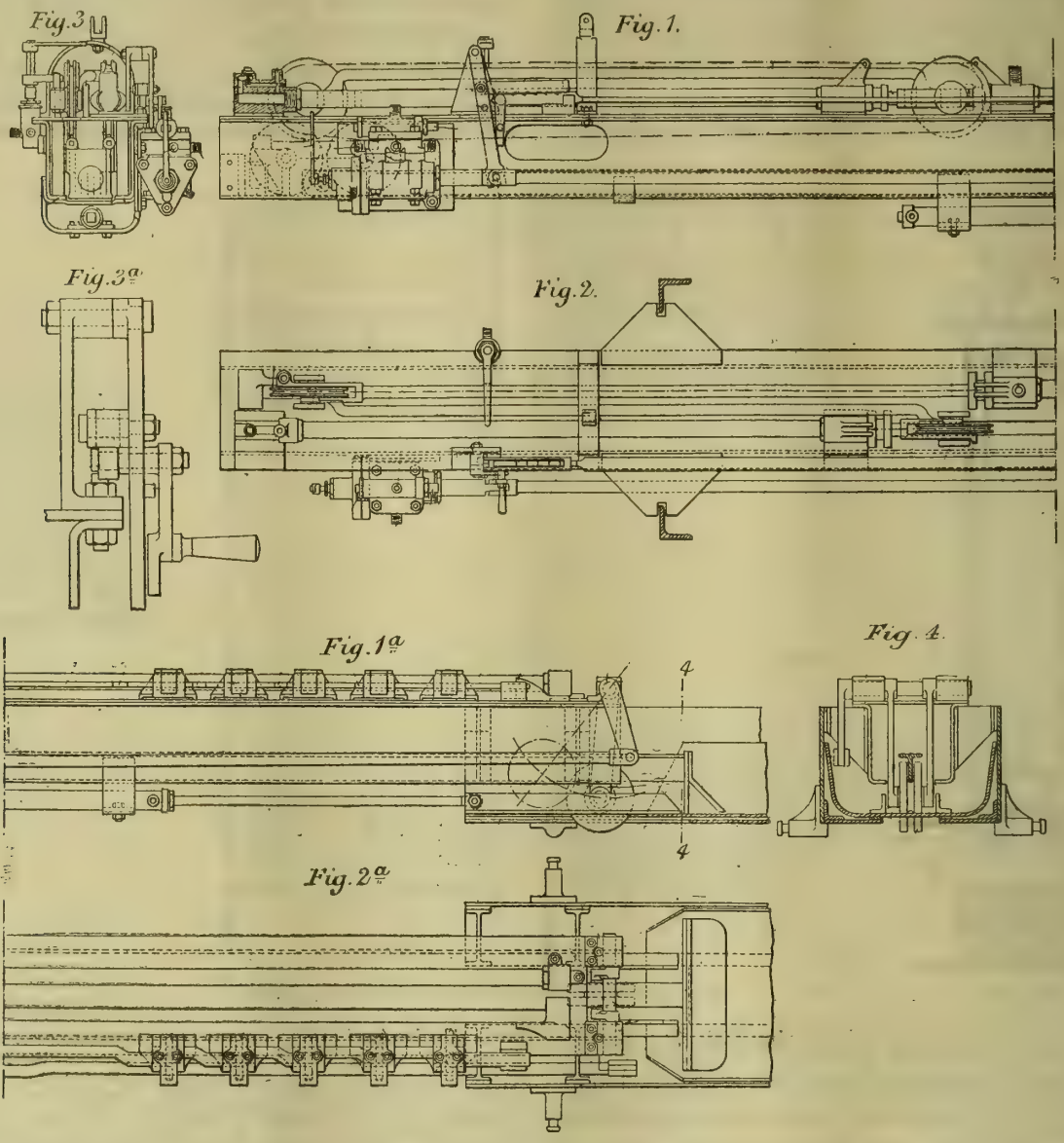
In connection with the cylinder, it is preferred to provide a second cylinder with a similarly constructed ram operating a slide-valve controlling the passage of water to the hydraulic cylinders for actuating the rams connected to the pusher. Thus, when the rotary valve is operated in one direction, the pusher is lowered and moved forward into the retort; and when it is operated in the other direction, the pusher is raised, and then withdrawn.

The stroke of the pusher has to be less at each succeeding stroke, as the first charge has to be put in at the far end of the retort, the next charge further forward, and so on, till the retort is charged. In order to effect this, a pawl is provided, carried by a lever which is moved by the rod which operates the roller or pulley which raises the pusher, and which pawl engages with notches or projections in, or on, a rod, and at distances apart corresponding to the stroke of the pawl. This rod at its forward end is provided with inclines, which are arranged so as to successively act upon stops to project them in the requisite order to stop the pusher, so as to allow it only to take the successively shorter strokes. The first stroke of the pusher may be stopped by a fixed stop. At the next stroke, the pawl engages with the forward notch or projection in, or on, the rod, and the forward incline projects the forward moveable stop, and at the next stroke the pawl engages with the next notch or projection in, or on, the rod, and the next incline projects the next moveable stop, and so on. When the retort is charged, the rod is drawn back by a hinged handle, supplied for the purpose; the rod being provided with other inclines, which then withdraw all the moveable stops ready for the next operation. The hinged handle is furnished with a cam or nose, which lifts the pawl, and also with a projection which rests on a stop on the lever carrying the pawl, and holds up the handle (and consequently the pawl) till the first stroke of the next charging operation is commenced.

The guide or beam along which the reciprocating parts travel is preferably formed like a hollow girder (or of box form, in cross section), with a longitudinal slot at its underside; and the travelling parts are provided with rollers which run along in, or on, the girder or hollow box. Apparatus for stirring or drawing the charges of retorts can have the reciprocating parts and the guides or beams on which they travel similarly arranged.

The hydraulic cylinders and rams by which the pusher is operated are preferably provided with a cushioning arrangement, which confines a certain amount of water in the cylinder at the rear of the ram, for the forward stroke in retort chargers, and at the rear of the ram for the back stroke in apparatus for drawing retorts, and prevents shock. This arrangement consists of a passage for the water having two branches, one opening into the rear end of the cylinder, and the other into the cylinder at a short distance in advance of the rear end; a valve being arranged between the two branches, which closes the passage for water in the direction from the rear to the forward branch, but allows of the free passage of incoming water through the rear branch. When the ram approaches the end of its back stroke, and after it passes the forward branch passage, water is confined between its end and the end of the cylinder, and can only pass slowly between the ram and the cylinder, or by a restricted passage provided for the purpose. But, when water is admitted to the cylinder, it can pass through the valve to the rear of the ram to start the stroke.

Fig. 1 is the left-hand end, and fig. 1A the right hand end, of the apparatus above described, partly in side elevation and partly in longitudinal vertical section. Figs. 2 and 2A are similar portions of a plan of the apparatus. Fig. 3 is an elevation of the left-hand end of fig. 1. Fig. 3A is a view of a detached portion of fig. 3. Fig. 4 is a transverse section on the line 4 of fig. 1A.

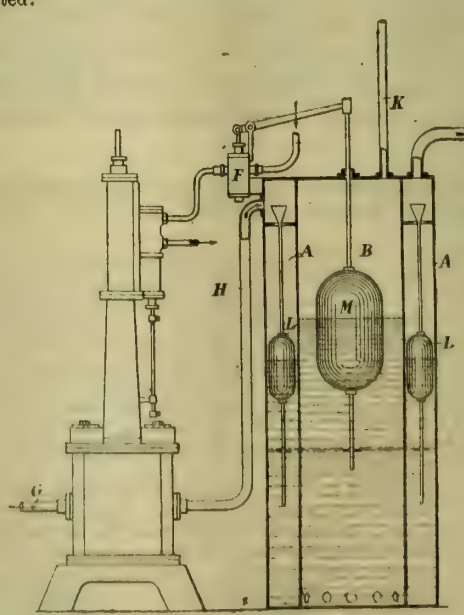


Regulating Gas Pressure in Incandescent Gas-Lighting.—Sugg, W. T., of Regency Street, Westminster. No. 9126; May 1, 1899.

This invention relates to means for regulating gas pressure in incandescent gas-lighting by employing two gas-tight vessels of equal area, to contain water, and connected at the bottom—one vessel to receive gas under pressure, and the other to contain a float connected to a cut-off device—an excess of pressure in the gas-vessel forcing the water into the other vessel, so as to raise the level of water in it, and lift the float, which thus operates the cut-off device. The arrangement was referred to, and illustrated, in the "JOURNAL" for March 13 last, p. 680.

The gas enters the compressor, shown in the engraving, by the pipe G, and passes out to the regulating device by the pipe H. The gas enters the vessel A near the top, and passes out at J to the installation. K is a pipe by which any gas that might "blow" through the water in the vessels A and B may escape to the outer air. L are two floats (with guide rods) placed in the vessel A. The lower rods are steadied by guides, while the upper ones pass through openings in a horizontal partition, forming seats for conical valves carried by the float guide-rods. M is a single float, with suitable guide-rods, contained in vessel B. The upper rod passes through a gland in the top of the vessel, and is connected to a lever intended to operate the cut off device for the water supply.

When it is desired to work the apparatus, both vessels will be filled with water to a certain height, and the gas-cocks to the several burners of the installation turned on. The apparatus at once commences to work, because the pressure will be relieved, the float M will descend, and, by its weight, open the cut off device F for the water supply. When, owing to the continuous pumping, the pressure in the vessel A exceeds requirement, the water therein will be forced into vessel B, the float of which will rise, and turn off the water supply F to the pump more or less, or entirely. At the same time, the gas floats in A will descend, and the conical valves will more or less (or entirely) cut off the gas supply to what may be termed the gas-float chamber of A; and thus all risk of "blowing" from the vessel B, through any great excess of pressure, will be obviated.



By the expression "means for regulating gas-pressure," the patentee says he wishes to be understood, in the present connection, "a device, or series of devices, which will automatically throttle the supply of power to a motor so soon as the pressure in a reservoir into which the gas is

being pumped by the operation of the motor exceeds a certain limit, and which will automatically operate to open the supply of power to the motor, so soon as the pressure decreases."

Gasholders for Equalizing Intermittent Gas Production and other Purposes.—Glasgow, A. G., of Victoria Street, Westminster. No. 9493; May 5, 1899.

In explanation of the object of his invention, the patentee remarks that in plant which produces gas intermittently—in order to practically equalize the rate of subsequent treatment (as, for example, purification and measurement), and to avoid frequently stopping or adjusting the exhauster which drives the gas forward to the main gasholder—there is sometimes interposed in the gas-main, between the generator and the exhauster, an equalizing gasholder or reservoir in which gas accumulates during the period of production, in order to supply the exhauster when gas making has ceased, as during the time the generator is being blasted. With such an arrangement, there is the danger, if the generator be shut off too long, or the speed of the exhauster be too great, that the exhauster will empty, and tend to create a vacuum in the equalizing holder, and so cause its collapse. The object of the present invention therefore is to obviate this danger, for which purpose a valve is provided adapted to close the outlet-pipe of the holder as soon as it has descended, owing to the gas being exhausted, to a given position in the tank.

Fig. 1. *Fig. 2.*

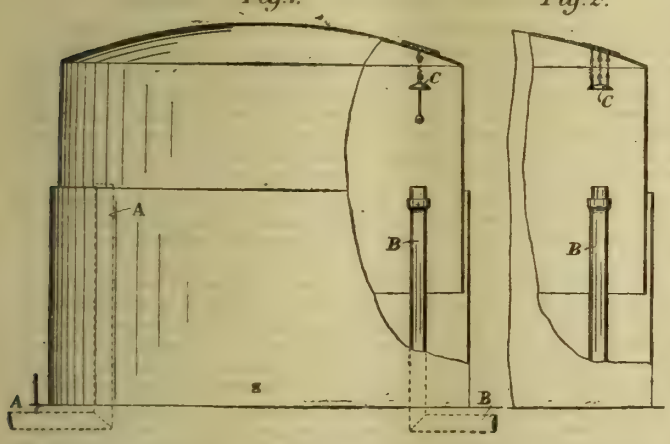


Fig. 1 illustrates (in section) an equalizing gasholder, provided with a valve adapted to close the outlet therefrom when the holder has descended to a given position. The holder is provided with a gas inlet-pipe A, in communication with the generator, and with a gas outlet-pipe B, connected to the exhauster. C is a valve or lid provided with a central eye, whereby it is attached, through a chain, to the cover of the manhole usually formed in the crown of the holder above the outlet-pipe. This valve or lid is faced on its underside so as to rest upon, and make a tight joint with, the open end of the outlet-pipe, when the holder has descended to a given position, and is provided with a weight to ensure it seating properly upon the pipe.

Fig. 3.

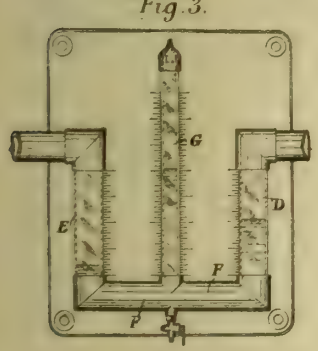


Fig. 2 shows a modified arrangement, wherein the valve or lid is connected by three or more chains instead of by only one chain; or it may be attached in any manner that prevents the weight of the holder being upon the pipe, and enables the valve to properly seat itself.

In some cases, a single pipe serves as both the inlet to, and the outlet from, the equalizing holder; since the valve or lid being loosely connected to the holder, will be lifted from the closed pipe by the pressure of the incoming gas, whereupon this pressure will act upon the entire area of the crown, and cause the holder to rise.

In the event of the valve or lid not making a tight joint, the exhauster might so far reduce the pressure in the holder as, in the course of time, to cause its collapse. In order to prevent such an occurrence, there is provided in connection with the holder, an arrangement whereby gas is automatically admitted to the holder, from the mains or elsewhere, upon the pressure in the holder being reduced below a predetermined point. Fig. 3 illustrates such a device in which D E are a pair of vertical tubes, communicating at their lower ends through a tube F. The tube D is connected by a tube to the gas-store or distributing-main, and the tube E is connected by another pipe with the holder, as, for example, by the inlet-pipe. G is a pipe the lower end of which is connected to the tube F; while its upper end is open to the atmosphere through a perforated cap. The tubes D, E, F (and G, when used) are partly filled with liquid—say, coloured glycerine. On the pressure in the holder being reduced to, for example, two or three ounces below atmospheric pressure, the liquid will be forced out of the pipes D, E, F into the inlet-pipe by the pressure of the gas, thereby allowing gas from the main to enter the holder, and prevent the pressure therein being further reduced. By combining suitable scales with the tubes D, E, G, the device will serve as a gauge for indicating the pressures in the holder and distributing main or vessel.

Hydraulic and Foul Mains, &c.—Robus, H. J., of Bucklersbury, E.C. No. 25,374; Dec. 21, 1899.

This invention relates to hydraulic mains, foul gas-mains, and other pipes and vessels situated above retort-settings in gas-works; and it has for its object to cool and regulate the temperature of these pipes and vessels by water-jacketing them, and automatically actuating and controlling the flow of jacket water so as to regulate the temperature of the contents of the mains. The invention further consists in supplying a water-jacket for cooling purposes to the bottom and (if desired) the sides of coal-bunkers, which may then be placed directly above the retort-setting, and also in automatically actuating and in controlling the flow of this jacket water. An illustrated abstract of the specification appeared in the "Journal" for Feb. 27 last, p. 540.

Incandescing Media.—Nielsen, R. A., of Copenhagen. No. 2672; Feb. 10, 1900.

The patentee points out that, in the manufacture of the ordinary type of incandescent mantles, the attempts which have been made to impart to the particles of ash of the rare earths such a degree of cohesion that the mantles will bear transport, have not led to satisfactory results; and the attempts which have been made to provide the incandescing substance with a firm support of refractory material have been "equally unsatisfactory." Supports or carriers of platinum wire do indeed, as he remarks, give a durable network; but, by reason of the high thermal conductivity of platinum, the illuminating effect of such mantles is far inferior to those which have no platinum support. Other trials have been made with supports or carriers of a number of naturally occurring refractory bodies—such, for example, as quartz and asbestos; but the inventors of these mantles have, he says, omitted to observe that while these substances, when they are in pieces of considerable size, will easily and for a long time withstand such a temperature as is produced by the bunsen flame, yet they are nevertheless acted upon injuriously when they are exposed thereto in the form of threads. He claims to have found, by experiment, that even tolerably thick asbestos threads will melt as soon as they are brought into the bunsen flame. Threads 0·3 mm. in diameter of rock crystal, which (as is known) only melts in the oxyhydrogen flame, will soften in the bunsen flame, and after about 50 hours are burnt through. The reason that these refractory substances are so little durable is that they soften and volatilize, which, in the case of rock crystal, has been shown by Professor Henri Moissan to occur at a temperature of about 1200° C.

The specification continues: "Until the most recent times, the oxides of the rare earths and of the metals of the alkaline earths, as well as of the elements zirconium, thorium, molybdenum, tungsten, uranium, titanium, vanadium, niobium, and tantalum, have been regarded as infusible. These oxides, which must be produced in the laboratory in order to be of the necessary purity, can only be fused by the enormous heat of the electric arc in the electric furnace; and they are not influenced chemically by the electric current. Shortly before they reach their melting point, they soften; and I have found that if, while they are in this condition, they are touched with a solid body, and this be then quickly withdrawn, a fine thread of the fused oxide will adhere, and be drawn out by the solid body, which thread instantaneously sets, and can be wound. A characteristic feature of my invention consists in the employment of these threads for the manufacture of mantles and other incandescing media for illuminating purposes. In order to increase the radiant surface of the mantle or other incandescing medium composed of these smooth threads, and thus increase the illuminating power, the threads of the network are preferably coated with a pulverulent coating of one, or it may be with mixtures of two or more of the oxides above enumerated; this being effected by immersion in a solution of a suitable salt or salts, and subsequently drying and raising to incandescence. If this operation be carried out several times with a dilute solution, greater resistance and solidity will be imparted to the coating."

APPLICATIONS FOR LETTERS PATENT.

5626.—Rowbotham, W., "Generating acetylene gas." March 26.
5663.—Edgar, W., "Street-lanterns." March 26.
5688.—Mundy, C., "Gas and like engines." March 27.
5711.—Klein, O., "Manufacture of acetylene gas." March 27.
5738.—Gunning, J., "Gas-cocks." March 27.
5767.—Stanley, E., "Globes." March 28.
5769.—Bernt, J., and Cervenka, E., "Gas-burners." March 27.
5774.—New, A. G., "Internal combustion engines." March 28.
5780.—Bray, J. W., "Incandescent gas-burners." March 28.
5783.—Edgeworth, T. F., "Gas heating-stoves." March 28.
5817.—Javal, E. A., "Generating acetylene gas." March 28.
5821.—De Léry, J. B., and Richardson, C. G., "Incandescible elements." March 28.
5822.—Walker, S. S., "Reducing and controlling the flow and pressure of gases." March 28.
5863.—Scaife, R., and Ride, S., "Drilling and tapping machines." March 29.
5926.—Marks, G. C., "Incandescent gas-burners." A communication from the firm of Julius Pintsch. March 29.
5945.—Whitehead, T. L., "Diminishing or increasing the light of a gas-jet from a distant position." March 30.
5969.—Bryant, C. H., and Roessler, A. C., "Compressing gas and other fluids." March 30.
5979.—Billing, M. B., "Low-pressure gas-governor." March 30.
5989.—Thompson, W. P., "Incandescent mantles." A communication from W. Karsten. March 30.
6016.—Mander, G. G., and Gill, A., "Anti-vibration devices for incandescent gas-burners." March 31.
6019.—Moore, J., "Street-lamps." March 31.
6038.—Rathenau, W., "Manufacture of calcium carbide." March 31.
6050.—Wegener, C., "Production of heating gas." March 31.

Sale of Shares.—At the Mart, Tokenhouse Yard, last Tuesday, Mr. Alfred Richards sold some £10 "C" shares in the Harrow and Stanmore Gas Company (last dividend at the rate of £5 12s. per cent. per annum) at prices ranging from £11 10s. to £12 each. Some original stock of the King's Lynn Gas Company, carrying 10 per cent. dividend, fetched £200 per £100 of stock; the purchaser taking the dividend from the beginning of the year. A small parcel of consolidated "C" stock of the Croydon Gas Company (last dividend 9 per cent.) was sold at the rate of £217 per cent.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

Naphthalene in Coal Gas.

Sir,—May I be permitted a few last words in reply to the several letters on the above subject in the "Journal" for the 3rd inst.?

Careful consideration of my experiments at 15° C., has led me to think that Mr. W. Irwin is perhaps right in claiming that his figures for the vapour tension between 15° and 25° C. are nearer the truth than my own. His, however, I still think are too low owing to the much too rapid passage of his gas, and perhaps to the impurity of his naphthalene. The experiments I made at 15° C. were too few in number to satisfy me altogether. The accuracy, however, of the values actually observed at and above 30° C. is amply assured by the great number of completely concordant experiments made. Any errors detected by differentiation in the V.Ts. at temperatures intermediate between those of experiment, are due solely to the inevitable error incident to reading such large numbers off any diagram on however large a scale. Mr. Irwin's method of testing for naphthalene is, I think, more cumbersome, tedious, and inaccurate than my own, which, in turn, seems inferior to that of Dr. Colman, if it be as accurate and easily carried out as he claims.

Mr. Leicester Greville is quite right in stating that my theory is not absolutely proved until it has been experimentally demonstrated that naphthalene can be formed by the interaction of the constituents of coal gas in a way possible under the conditions existing in gas-mains. That I had reason to believe that this was possible, I stated when reading the paper. Within a few months I hope to settle this point definitely. If I cannot then substantiate it, I shall be ready to acknowledge my error. I should, however, like to point out that never have I said that all naphthalene deposits were formed in this way. I was careful to claim only that it would satisfactorily account for the otherwise inexplicable deposits that are often formed (as, for instance, in the case of the Auckland gas).

I have also to thank Mr. Greville for again pointing out an error in the "Journal" report of the paper, which had already been detected by Mr. Leather. The 1·25 cubic feet should, of course, be 100 cubic feet; and the temperature 113° Fahr., instead of 130° Fahr.

In conclusion, I can only thank my numerous critics for the kind way in which they have discussed a theory so opposed to their own views and practical observations, and for the benefit I have received from their experiences.

R. W. Allen.

Guy's Hospital, April 6, 1900.

Sir,—In his letter published in your last week's issue, Mr. Leicester Greville points out an apparent discrepancy as to the solubility of naphthalene picrate in the paper recently published by Mr. J. F. Smith and myself. The matter is capable of ready explanation. The figures for the solubility of naphthalene picrate were obtained by allowing water to stand over an excess of the finely-powdered substance for several days, with frequent shaking; and the amount of naphthalene picrate in the saturated solution was then determined. When washing the picrate on the filter with water, the latter is in contact with the crystals for so short a time that it does not become nearly saturated; and hence the actual amount dissolved is much less than that calculated from the maximum solubility of naphthalene picrate. The latter compound separates from the hot solution on cooling in long, very thin needles, which frequently extend through the whole mass of liquid, and would render difficult the carrying out of the modified method proposed by Mr. Greville.

With regard to Mr. Greville's statement that "the normal amount of naphthalene present in ordinary gas is so small as to range from *nil* to 1·5 grains per 100 cubic feet," I would point out that no such statement occurs in our paper. It is there stated that this was the amount found during the last few months—*i.e.*, the winter months, in which the temperature of the gas has always been below 60° at some point of the plant. It is probable that the amount will rise as the average atmospheric temperature rises, and that it will be considerably higher in the summer. Moreover, I do not think that any such general conclusion can be safely drawn, even for winter months, from tests made in one place only.

Mr. Greville states, also, that it is not likely that naphthalene would be formed to any extent by the breaking up of liquid paraffins into permanent gases at high temperatures. I am unable to agree with this statement, as Russian "Solar" oil does yield large quantities of naphthalene if the temperature is sufficiently high; and the resulting gas may give trouble from separation of naphthalene. The Russian oil consists chiefly of naphthenes; but I have very little doubt that the paraffins would behave in a similar manner, except in so far as a rather higher temperature would be necessary.

Harold G. Colman.

City Gas-Works, Saltley, April 5, 1900.

The Future of Electrical Supply.

Sir,—In the comment upon the future of electric supply in your issue of this week, you have inadvertently misinterpreted the figures in the article from which you quote as to the efficiency of the distribution of electrical energy. You say: "If we interpret Mr. Adams's figures aright, at least 3½ times the energy must be generated at the prime-movers that will ever be accounted for at the consumers' terminals." What Mr. Adams pointed out in his article was that, for unit-energy sent out from a distributing station, you would need an electrical equipment—namely, generators, transformers, and rotary converters—representing a total capacity of 3·34 units; but the energy *generated* by the main dynamos for unit-energy sent out from the rotary converter at the distributing station would be 1·23 units, not 3·34 units.

The basis of comparison adopted by Mr. Adams is not complete. Clearly his gas-engine and dynamo at a sub-station take the place of the rotary converter. Hence the gas delivered through the pipe to his sub-station plant must be considered analogous to the electrical energy transmitted through the transmission line. Thus the gas generator must be taken as representing the main dynamos. But Mr. Adams only compares the combined efficiency of the gas-main and gas-dynamos with the combined efficiency of the main dynamos, step-down transformers, transmission line, and rotary converter. The efficiency of the gas generator should be introduced in the first combined efficiency, which would apparently turn the scale in favour of purely electrical transmission.

But Mr. Adams does not carry his comparison back sufficiently far to reach a common basis. Efficiencies are all very well as mathematical concepts; but if the prime source of energy in one set of circumstances is twice the price of that in another set, it will take a large saving in efficiencies to make up the difference. Mr. Adams's figures should be reduced to the basis of coal at the pit mouth (let us say), which is the starting point in your leading article. In these circumstances, the following efficiencies have to be considered in addition to those referred to by Mr. Adams:—

Gas Power.	*Steam Power.*
Efficiency of generator.	Efficiency of boiler. Efficiency of engine.

And in the computation of relative capital outlay per unit distributed, the following further items would have to be taken into account:—

Gas Power.	*Steam Power.*
Cost per unit of generator, plant, and buildings. Cost per unit of gasholder.	Cost per unit of boiler, engines, buildings, and accessory plant.

Ed. C. de Segundo.

28, *Victoria Street, S.W., April* 5, 1900.

The Price of Gas and the Value of Residuals.

Sir,—Your editorial on the price of coal and gas is well-timed, and calls for the careful consideration of all gas producers. With the present high price of coal, and the probability of further firmness, the difficulty seems to be to estimate the advance that should be asked for gas, so that the consumer may be as leniently dealt with as circumstances permit, and still due regard be paid to the interests of shareholders and ratepayers. In such an estimate, it is perhaps unwise to calculate too freely on the value of the residuals (which are a fluctuating factor); but in the case of coke—the value of which is, to a large extent, regulated by the price of coal—it may be hoped, and reasonably expected, that, while coal remains high, coke, which after all is the most important residual, is not likely to fall.

But, is the most being made of the coke, especially where the production of water gas is installed? It would be interesting and instructive were some of your correspondents having experience in the manufacture of water gas to give some facts and figures as to the cost of it at to-day's prices of coke and solar oil, as compared with coal gas pure and simple, or the product of an extra yield of low-illuminating power enriched by benzol. Where the gas-producing plant is inadequate, there can of course be little choice; but many who may be considering the erection of water-gas plant would be glad of such a comparative statement. Even with coal at its present high price, it seems open to question whether carburetted water gas can be produced as cheaply as coal gas itself, or as low-power coal gas otherwise enriched.

Lux.

April 6, 1900.

The Heckmondwike Gas-Works Purchase Question.—It was reported to the Liversedge District Council yesterday week, that the Sub-Committee who had been appointed to consider the question of the purchase by the Liversedge and Heckmondwike Councils of the undertaking of the Gas Company favourably entertained the proposal. It was decided to confer with the Heckmondwike representatives with a view to ascertaining, without prejudice, what terms, if any, the Company would be prepared to accept for the concern. The Heckmondwike Council have unanimously ratified the decision of the Finance Committee to take preliminary steps, in conjunction with Liversedge, to acquire the works.

A Cornish Gas-Works.—A meeting of the shareholders in Messrs. Lawry, Hawke, and Venning, Limited, general merchants, was held at Callington, Cornwall, on Thursday. Among other businesses carried on by the Company is that of manufacturers of gas. In regard to this, it was reported that a large demand had arisen for gas cooking-stoves at Gunnislake, and about 50 were provided, with the result that the consumption of gas had increased about 20 per cent. This involved an expenditure of £300, which had been borrowed. Further outlay for the same purpose was required, as well as for putting in new retorts and replacing some of the mains. In view of the fact that the Company were trading largely on borrowed capital, the Directors recommended that the gas-works should be disposed of, if a satisfactory price could be obtained. The Chairman (Mr. J. W. Lawry) stated that the stock of coal was valued at Christmas at £120 more than it cost. But for this fact, there would have been a loss on the year's trading. The report was adopted.

The Increase in the Price of Gas at Nottingham.—An inquiry was made, at the meeting of the Nottingham City Council yesterday week, as to whether it was true that the price of gas had been raised from 2s. 6d. to 2s. 10d. without notice to the consumers. Alderman Ford replied that this was so. The Gas Committee were very reluctant to advance the price of gas; but in consequence of the very high price of coal and other materials, they were compelled to do so. Otherwise for 1901 they would have had to add 8d. to the district rate. As they had a great number of consumers outside the city whom they could not charge the differential rate, they thought it advisable to advance the price of gas. The explanation appeared to give satisfaction. A correspondent in a local paper writes: "The small consumers of gas will get a great deal the best of the bargain by the raising of the price 4d. per 1000 cubic feet, instead of increasing the rates by 8d. I have a gas-cooker, and my gas bill comes to about £7 a year. I am rated at £16. Through the increase in the price of gas, I am called upon to pay 56 fourpences. If the rate had been increased, I should have had to pay only 16 eightpences—excess difference 8s. (18s. 8d.—10s. 8d.). I suppose I can have a penny-in-the-slot meter, however." This letter suggested the reflection to a note writer in the same paper "that the automatic gas measurer will give the consumer an advantage of a farthing on every twopence. There were, not so long since, about 2000 prepayment meters in the city. Probably there are more now. At a pennyworth of gas a day for each meter, this would mean a loss of £375 a year."

PARLIAMENTARY INTELLIGENCE.

Gleanings from the Committee Rooms.

In Committee Room No. 13, the greatest struggle of modern times in connection with gas legislation commenced last Tuesday. Big Ben had barely finished striking eleven, when the Committee Clerk announced the measure for consideration, the names of the promoters and opponents, and the Counsel engaged. The Bill was the first of the London group—that introduced by the London County Council for the purpose "of making provision as to the testing of the illuminating power of the gas" supplied by the Gaslight and Coke, the Commercial, and South Metropolitan Gas Companies, and to regulate "the supply by those Companies of prepayment meters, and fittings in connection therewith." The Committee to whom had been consigned the task of considering this and the other London Bills is composed of Mr. Oldroyd, as Chairman, and Mr. Stanley Leighton, Mr. Emmott, and Mr. Nicol. The last-named gentleman comes to the work well instructed concerning the gas supply of the Metropolis, he having been a member of the Select Committee who sat last year to inquire into the powers of charge of the London Companies. His knowledge should be very valuable—it has already been helpful—to the present Committee in the work they have in hand. The other members, so far as we are aware, have had little or no experience in connection with gas legislation; but on Tuesday they quickly disclosed their ability to intelligently grasp the complexities of the technical subject with which they were confronted, though they, as well as the opposition, appear to be somewhat confounded by the peculiarities in the County Council's case. However, in view of the importance to the gas industry of the questions with which the Committee have to deal, it is pleasing to be able to make this complimentary recognition of their adroitness in investigation, as, though the decisions may not prove exactly what well-wishers of the gas industry would desire, there is the assurance that all that is brought before the Committee will receive due consideration.

Reverting to the opening proceedings on Tuesday, a strong line of legal talent faced the Committee to conduct the cases for and against the Bill. Of the fourteen Counsel retained, no less than eight are wearers of the silk. The County Council were represented by Mr. Worsley Taylor, Q.C., and two juniors; and the eleven remaining Counsel appeared for the opposition—the Corporation of the City of London, and the Gaslight and Coke, the South Metropolitan, and the Commercial Gas Companies. It was a strange spectacle to see these three Companies for the nonce arrayed together as allies, showing a united front to a threatened danger. But though meeting on common ground in a common cause, a cold exclusiveness appeared to be maintained throughout the sittings by the official representatives of one Company towards those of the other two. Intermingling with the officials of the parties interested, were eminent Doctors and Professors of chemistry, photometrists, and engineers, some of whom recalled to memory priceless work in the scientific advancement of the gas industry. In another room the Bradford Corporation Bill was proceeding; and many of the professional witnesses there engaged could not now and again restrain a natural curiosity to see and hear what was going on in connection with what will be a memorable measure. It is a pity that the continuity of the proceedings has been broken by circumstances which no one concerned in the Bill could control. The protracted sittings on the Lea Conservancy Bill, it will be remembered, were in the first place responsible for delay; and the discussion of clauses in connection with the same measure caused a gap the whole of Wednesday. Thursday was a short sitting, presumably on account of important business engaging attention in the House. Then on Friday the proceedings came to a close, with the promoter's case still unfinished, for the Easter recess; the Chairman announcing that the consideration of the measure would be resumed on the 1st of May.

The opening speech of Mr. Worsley Taylor occupied about one-and-a-half hours on Tuesday morning; and Mr. Dibdin's evidence was spread over the remainder of the sitting. Wednesday, as already stated, was a blank so far as the Bill was concerned. On Thursday, on the request of the Chairman, Mr. A. G. Vernon Harcourt, one of the Gas Referees, presented himself for examination; and Dr. Frank Clowes, the Chief Chemist and Superintending Gas Examiner to the London County Council, was the only other witness. On Friday more progress was made—the evidence being taken of Mr. Otto Hehner, Mr. B. H. Gerrans (one of the Council's Gas Examiners), Dr. Percy Frankland, and Mr. Isaac Carr. The promoters have additional evidence to tender when the proceedings are resumed; but it is not expected that it will require any great length of time.

Of course, the most serious and controversial part of the Bill is that relating to the testing of gas, and the proposed legalization of the portable photometer. This, on the suggestion of Mr. Worsley Taylor, it was decided to discuss first, leaving the portion referring to the application of regulations to the supply of prepayment meters and fittings to be taken up at a later stage. Dealing then with the testing part of the Bill, the case of the promoters is this: That the present method of testing gas in the Metropolis is inefficient and unsatisfactory; that it was the intention of the Legislature that at any point at which it is reasonable to make a test, there should be found gas of 16-candle power; that unfortunately this intention is not under existing conditions secured; that fortunately for the consumers the County Council are alive to this fact, and intend to remedy it, if possible, by the present Bill, so that the consumers may know that what they pay for they get. The instrument by which this is to be ensured is that variously known by the appellations "portable," "peripatetic," "perambulating," and "detective" photometer. That there is any intention on the part of the promoters to act unfairly to the Gas Companies, or to put any new burden upon them is disclaimed—in fact, one was inclined to feel, in listening to the Counsel opening the case, that it was only an earnest desire on the part of the Authority at Spring Gardens to keep the Gas Companies from straying from the path of rectitude in the future (as, we are asked to believe, on the evidence of a wandering photometer, whose virtue is doubtful, they have done in the past) that had brought about the promotion of the Bill. The supposition that it is intended to test the gas in back streets and on dead-ended mains it appears is quite unfounded; it is, indeed, an unworthy act to even think that such an idea has ever crossed the minds of the guileless County Council. Under the Bill, it would have been quite possible to make such tests; but Mr. Worsley Taylor has since committed himself to insert a clause, if desired, to the effect that testings shall not be made in a place evidently improper. But such a clause would have to be very specific, or there would be endless trouble. To impress upon the Committee that such unwarrantable motives as those imputed to the Council were far from their thoughts, it was frequently pointed out that it was intended that the testing by portable photometers should be under the control of the Gas Referees; but no one explained why, if portable photometers were the one thing required for the protection of the gas consumers, the Referees had left it to the London County Council to take the initiative in suggesting their introduction. However, Mr. W. J. Dibdin, who will be remembered as the former Chemist and Superintending Gas Examiner to the County Council, and the father of the portable photometer proposal, assured the Committee that it had met the Referees' approval. Some time ago, he submitted one to them; and he states that he was informed that "they considered it a proper and correct instrument, and such as they would certify for testing in the way proposed." In cross-examination, too, he emphatically declared that the Referees had "over and over again" suggested that this should be done. But no letter or document vouching for the accuracy of Mr. Dibdin's memory was put in; and he could not refer to a single print where the Referees had found fault with the present system of testing.

Now let us see from the evidence how this portable photometer idea has been worked up. Mr. Dibdin became the Superintending Gas Examiner in 1882; and two years later he commenced testing with the portable photometer. He says that this method of testing suggested itself to him in consequence of complaints as to the quality of gas, and an instruction to investigate the matter. Later in his evidence, we see that the portable photometer showed there was no justification for the complaints; for at the outset he obtained a return by it of 16·4 candles. But this result did not satisfy Mr. Dibdin; and he continued the peripatetic testing. With the development of the idea, there came about a deterioration in the quality of the gas—according to the portable photometer. But the official tests were at the time fairly constant, and up to the standard. Further on, Mr. Dibdin says that comparative tests made in a properly fitted testing-station with a portable and a fixed instrument gave concordant results—as near in fact as 0·1 candle; and yet, when the portable photometer was taken to a building a few yards distant, there was a serious deficiency in illuminating power. A still more startling assertion of Mr. Dibdin's is that between a testing-station at which uniform results were obtained with both instruments and the works supplying the gas—*between* those two points be it noted—he had found a deficiency of as much as 4 candles. How this happens, Mr. Dibdin does not attempt to explain; but he will not admit that the difference in the conditions surrounding the tests had anything to do with the matter. Most of his tests were made in school-rooms, fire-brigade stations, and other public institutions where the conditions which are generally accepted as requisite for accurate testing can hardly be expected to prevail. But Mr. Dibdin scoffs at the notion that those conditions are necessary to exact testing; and he characterizes them as "coddling." But if the dissimilar conditions are not responsible for the wondrous results laid before the Committee, then what is? The whole thing is too mysterious for Mr. Dibdin to explain; but most men will have little difficulty in coming to a decision on the subject. Liverpool was cited as a place where there has been experience with the portable photometer; and this raises another inexplicable point. The promoters admitted that in Liverpool the tests by the instruments showed a remarkable consonance with those made by a fixed photometer. Then why did they not do so in London? Another remarkable assertion by Mr. Dibdin was that the Gas Companies were responsible for the introduction of all the gas-testing "paraphernalia," and not the Gas Referees. It may also interest some readers to learn that Mr. Dibdin's opinion is that it would be more economical for the London consumer to have gas of higher illuminating value than they have now at an extra cost of 4d.; but men of equal and higher eminence than Mr. Dibdin think otherwise. Counsel, in cross-examining Mr. Dibdin, had difficulty at times in getting direct answers to some of the questions.

The evidence of Mr. Vernon Harcourt must, of course, be taken as coming from an independent witness. He was of opinion that consumers throughout a district were entitled to the standard quality of gas; and he considered that a test made with a portable photometer, *if rightly used*, would be a fair one. But if such photometers were adopted, there should be limitations. Many of his other statements were also accompanied by qualifications. Dr. Frank Clowes put in a large number of tests, showing some curious defections in illuminating power, detected by both roving and fixed photometers. But outside those tests he could not be induced to depart; nor would he express any opinion as to why the official tests gave higher values. In his opinion, however, the fixed testing-station did not ensure that the consumers got 16-candle gas. Mr. Otto Hehner confessed that, when he formerly tested as an official examiner, he found a remarkable concordance in the results; and Mr. Gerrans stated that the general average of his official tests over five years (excepting on three or four occasions) had not fallen below 16 candles. But some of the special tests that Mr. Hehner had made for the purpose of supporting the Bill showed remarkable and rapid changes in illuminating power. In one instance, at the Blackfriars Road testing-station, he got the low result of 11·3 candles, and in about two hours there was an ascent to 17·3 candles. It is extraordinary that a strange occurrence of this kind should have happened at this critical time for Mr. Hehner's edification. The tests quoted by Mr. Gerrans did not show any remarkable divergencies. In the judgment of Dr. Percy Frankland, the portable photometer is a trustworthy instrument. Some interesting experiments were also described by him; and his evidence indicated that his opinion was that, by use of enrichment processes, the illuminating power of gas could be quickly raised and varied, and that this might account for some of the discordant results. The most pertinent part of Mr. Isaac Carr's evidence showed that he shared similar views. This was the nearest approach to anything like a reason for the abnormally wide differences in illuminating power found by means of the portable photometer. The Council were too wise to impute fraud on the part of the Companies, or manipulation of the supply to the testing-stations; but, after hearing the evidence, one has a feeling that some of the witnesses are not altogether sure there is not

a little "diddling" going on somewhere. If one of the effects of portable photometers is to produce disordered imaginations, then the sooner their use is discontinued the better.

The line which the opponents will take against the Bill is indicated in their petitions. They are, among other points, apprehensive that the Bill will increase the price of gas to the consumers; that the substitution of a rough and less accurate instrument will fail to find the full illuminating power of the gas tested; that it is absolutely necessary the tests should be safeguarded by the conditions obtaining in the testing-stations, and prescribed by the Referees; that, if the Bill is passed, increased enrichment of the gas will be necessitated; and that, in these days of improved burners, and heating and cooking by gas, the use of gas of high illuminating power is wasteful. Mr. Worsley Taylor's laconic comment on some of these points was "I cannot help that," which hardly squares with an earlier boast that it was not the County Council's desire to inflict any additional burden on the Gas Companies. More will be heard from the opponents after the Easter vacation.

The gigantic scheme of gas-works absorption contained in the General Powers Bill of the Bradford Corporation looks as though it is going through; and it is pretty safe to predict that, within a few years, the Yorkshire section of the returns relating to gas undertakings other than those of Local Authorities will, in consequence, be shortened by the omission of the statistics of at least half-a-dozen concerns. This proposed wholesale annexation of gas undertakings has come about by the extension of the boundaries of Bradford, and in fulfilment of a promise by the Corporation just prior to that event that steps should be taken to secure equality of gas prices throughout the entire area. Last year the Corporation commenced operations by trying to obtain parliamentary powers to buy up the portions of the Pudsey and Shipley Companies within the city boundaries; but dismemberment of this kind was obviously unjust to the Companies, and Parliament would not hear of it. For the present, those Companies remain undisturbed; but what has happened in the last few days foreshadows their dissolution within a few years. In regard to the other Companies supplying gas in the limits of the city, the Corporation this session included in their General Powers Bill more reasonable proposals than those which they put forward in connection with Pudsey and Shipley. They asked for power to acquire the Clayton, Allerton, and Thornton Company, the North Bierley Company, the Eccleshill and Bolton Company, and the Airedale Company; and to purchase gas in bulk from the Drighlington and Gildersome Gas Company. Provision was also made for the re-sale to the Local Authorities concerned of the extra-mural portions of the undertakings if desired. The price of gas in the part of the city supplied from the Bradford works is 2s. 1d. per 1000 cubic feet; and the Companies supplying within the extended parts charge from 5d. to 1s. more. But with the levelling down of the price of gas in one district—North Bierley—there will be a levelling up of the rates to the extent, we believe, of 1s. 4d. in the pound; so that the reduction of price there will be a doubtful blessing to the ratepayers. The Bill was before the Police and Sanitary Regulations Committee of the House of Commons, presided over by Lord E. Fitzmaurice, from Wednesday to Friday last. No allegations were made by the promoters as to any deficiencies in the supply by the Companies, and it was very fairly admitted that, considering the character of the Companies' districts and the moderate consumption, the prices charged were not excessive. The whole case, in fact, was based on the desirability of a gas-works-owning municipality having the gas supply of their entire area in their own hands, in order to secure uniformity of charge and absolute control of the streets, &c. The Companies all appeared in opposition; but it was the opinion of the Corporation Gas Engineer (Mr. Charles Wood) that they were only there to secure better terms of purchase, and would, in fact, be much disappointed if the Bill did not pass. But the legal and expert force which the Companies had present hardly supported the latter part of that view. On the other hand, references to correspondence which had passed seemed to indicate that the Companies were not altogether unwilling to sell if what they considered adequate terms were offered; but nothing acceptable had been arrived at. The question of compulsory purchase, of course, bulked largely in the discussion; and in this instance, as in numerous previous cases, the promoters were embarrassed by not being able to produce a single precedent for the compulsory purchase of gas-works which has been fought through both Houses. The case for the gas section of the Bill was completed just before the adjournment on Friday; and the Committee then had a private consultation. This resulted in an announcement by the Chairman, that he and his colleagues could not help thinking that the parties might come to terms of agreement; and they had therefore decided to reserve the further consideration of this part of the Bill until after the Easter holidays. Previous to this, however, a bargain between the promoters and the North Bierley Company had been struck for purchase by a lump sum; and after the expression by his Lordship of the views of the Committee, a close conference was observed to be going on between the experts of the other parties. There is, we are informed, every probability of a speedy conclusion of terms in their cases also. It is understood that the North Bierley Company have come down a little in their original ideas as to the terms on which transfer should take place; but it is said that they could hardly have hoped to obtain a larger sum than they have secured if they had gone to arbitration, and, of course, in this direction, heavy expense has been saved. A report of the evidence laid before the Committee will be published next week; but, in the meantime, it may be stated that among the witnesses called to support the promoters' case were Mr. Charles Wood, Mr. Corbet Woodall, Mr. E. H. Stevenson, Mr. W. A. M'Intosh Valon, and Mr. Charles Hunt. The Engineers retained on the opposition side were Mr. T. Newbigging, Mr. H. E. Jones, Sir F. Bramwell, Mr. R. Porter, and Mr. T. Bower.

The petition of the Wolverhampton Corporation against the Gas Company's Bill has been withdrawn; the parties having agreed upon the insertion of a clause under which the Corporation may, if they so desire, apply in a future session for powers of purchase. It is suggested that they may do so next year; but a recent resolution on the question rather points to the conclusion that the Corporation are not of one mind as to the advisability of acquiring the concern. The insertion of a purchase clause in the present Bill, however, looks as though there is to be a reconsideration of the matter. It is understood that Mr. Corbet Woodall has been advising the Company in connection with their Bill; and Mr. W. A. Valon was consulted by the Corporation.

Our readers are aware that the Dorking Water Company have promoted a Bill to enable them to raise further capital, to the extent of £16,000 by shares and £4000 by loan, and construct additional works; and the Local Authorities sought to have a clause inserted giving them power to purchase the undertaking within ten years. This proposal was strongly resisted by the Directors of the Company, and the District Council accordingly presented a petition against the Bill, which recently came before the Committee of the House of Lords. Although the terms of the clause which their Lordships sanctioned give the Urban and Rural District Councils, or either of them, the privilege they desire, the period in which it may be exercised has been restricted to two years. On the other hand, the Water Company are limited to an expenditure of £5000 of additional capital; while the clause further stipulates that the Company shall, on the passing of their Bill, pay one-half of the costs of the petition.

HOUSE OF LORDS.

The following further progress was made with Private Bills last week:—

Bills brought from the Commons, read the first time, and referred to the Examiners: North Warwickshire Water Bill, Southport Water Bill, Spalding Urban District Council (Water) Bill.

Bills read a second time and committed: Grantham Gas Bill, Hartlepool Gas and Water Bill, Redhill Gas Bill.

Bills reported, with amendments: Dorking Water Bill, Exmouth Urban District Water Bill, Fishguard Water and Gas Bill, Glyncorrwg Urban District Council Gas Bill, Hemel Hempstead Corporation (Water) Bill, Kingston-upon-Thames Gas Bill, Mountain Ash Water Bill, Rugeley Gas Bill.

Bills read the third time and passed: Cleethorpes Gas Bill, East Stirlingshire Water Bill, Falkirk and District Water Bill, Great Berkhampstead Water Bill, Kingston-upon-Thames Gas Bill, Mountain Ash Water Bill, Newtown and Llanllwchaiarn Urban District Gas Bill, Paignton Urban District Water Bill.

The South Essex Water Board Bill and the South Essex Water Bill were referred to a Select Committee, consisting of the Earl of Lauderdale (Chairman), Earl Carnwath, Lord Barnard, Lord Sudley, and Lord Farquhar; to meet on Wednesday, May 2.

The Rotherham Corporation Bill was referred to a Select Committee, consisting of the Earl of Jersey (Chairman), the Earl of Yarborough, Lord Lawrence, Lord Northbourne, and Lord Ludlow; to meet on Wednesday, May 2.

The Walsall Corporation Bill has been referred to the Select Committee on the North-Eastern Railway and other Bills.

The Morecambe Gas Company have petitioned against alterations in the Morecambe Urban District Council (Gas) Bill.

HOUSE OF COMMONS.

The following further progress was made with Private Bills last week:—

Bill read the first time, and ordered for second reading: Portland Urban District Gas Bill (to empower the Council to acquire the undertaking of the Portland Gas Company, Limited).

Lords Bills read the first time and referred to the Examiners: Cleethorpes Gas Bill, East Stirlingshire Water Bill, Falkirk and District Water Bill, Great Berkhampstead Water Bill, Motherwell Water Bill, Newtown and Llanllwchaiarn Urban District Gas Bill, Paignton Urban District Water Bill.

Bills read a second time and committed: Higham Ferrers Water Bill, Menstone Water (Transfer) Bill, Otley Urban District Council Water Bill.

Bill reported with amendments: Maidenhead Gas Bill.

Bills read the third time and passed: North Warwickshire Water Bill, Southport Water Bill, Spalding Urban District Council (Water) Bill.

The Shoeburyness Urban District Council have appiled for leave to deposit a petition for a Gas Bill.

Monte Video Water-Works Company, Limited.—At the ordinary half-yearly general meeting of this Company on Monday last week, the report of the Directors, which was noticed in the "Journal" for the 27th ult., was adopted, and a further dividend of 2½ per cent. (making 5 per cent. for the year) declared.

Failure of the Teignmouth Gas Supply.—Teignmouth was practically without a supply of gas on the night of Friday, the 30th ult. At a meeting of the District Council last Tuesday, the Gas Manager explained that he was turning the gas into the new holder, and instead of driving out the air through the crown he drove it into the main, hoping that the gas and the comparatively small quantity of air would mix and burn. The result was that it was practically impossible to get a light. The gas ought not to have been turned into the holder until Sunday morning, when all the trouble would have been avoided.

The Halifax Corporation and their Water Reservoirs Contract.—At the meeting of the Halifax Town Council last Wednesday, a resolution passed by the Water Committee, to the effect that tenders be invited for the execution of the works in connection with the construction of three reservoirs at Walshaw Dean, came up for confirmation. Mr. J. Parker moved that the minute be referred back, with a view to the Corporation carrying out the work themselves. He said that by constructing their water-works under their own supervision, the Corporation would be able to do the work better than it could be done by contract. The scheme was to involve an estimated expenditure of from £150,000 to £160,000. Mr. J. Wade, the Chairman of the Water Committee, said that if the Corporation undertook the construction of the works they would have to purchase plant which it was estimated would cost from £15,000 to £20,000; and when the reservoirs were finished, they would most likely not get more than half this price for it. The work could be quite well carried out by contract, for there would then be effective supervision. Mr. Parker's proposal was defeated, and the minutes were confirmed.

HOUSE OF COMMONS COMMITTEE.

Tuesday, April 3.

(*Before Mr.* Oldroyd, *Chairman, Mr.* Emmott, *Mr.* Nicol, *and Mr.* Stanley Leighton.)

THE GASLIGHT AND COKE, COMMERCIAL GAS, AND SOUTH METROPOLITAN GAS COMPANIES BILL.

This Bill, which is promoted by the London County Council to make further provision with regard to testing the illuminating power of the gas supplied in the Metropolis, and to confer power on the Board of Trade to regulate the charge for, and the supply of prepayment meters and fittings, came to-day before a Select Committee constituted as above.

Mr. Worsley Taylor, Q.C., Mr. Talbot, and Mr. B. Wilkinson appeared for the County Council. The other Counsel engaged were: Mr. Littler, Q.C., and Mr. H. A. Rigg, for the Corporation of the City of London; Mr. Pope, Q.C., Mr. Claude Baggallay, Q.C., Mr. Danckwerts, Q.C., and Mr. R. J. Neville, for the Gaslight and Coke Company; Mr. Littler, Q.C., Mr. Baggallay, Q.C., and Mr. Snagge, for the Commercial Gas Company; and Mr. Balfour Browne, Q.C., Lord Robert Cecil, Q.C., and Mr. L. W. S. Rostron, for the South Metropolitan Gas Company.

Mr. Worsley Taylor said that the Bill was "for making further provision as to testing the illuminating power of gas supplied by the Gaslight and Coke, South Metropolitan, and Commercial Gas Companies in the Administrative County of London." This was one part of the measure; but another object was "and for regulating the supply by those Companies of prepayment meters and fittings in connection therewith." He thought his learned friends who appeared for the Gas Companies would agree with him that the most convenient thing for everybody would be to deal with the first part of the Bill at once, and leave the penny-in-the-slot matter, because the Bill of the South Metropolitan Gas Company, to be dealt with later, bore upon this subject; and it would be well that the two proposals should be considered together. He would therefore only deal with the illuminating power of the gas.

Mr. Pope objected to the South Metropolitan Gas Bill being dealt with out of its order on the list.

Lord R. Cecil also objected.

The Chairman said there seemed to be some difficulty in regard to the South Metropolitan Gas Bill. Was it suggested that that Bill could not be taken at present?

Mr. Worsley Taylor said he was of opinion, and Mr. Pope agreed with him on the main point, that the second part of the Bill should be dealt with separately. Assuming that the first part was disposed of, the Committee would then proceed to consider the second part; and all the three Companies would have to be heard. Then would come on the Bill of the South Metropolitan Company, which would not be reached before Friday. He doubted whether the Committee would have disposed of the first part of the present Bill before Friday.

The Chairman said that one of the members of the Committee was interested in another Committee, and wished to take an active part in connection with its business. He could not enter upon the consideration of any Bill which they had not a prospect of finishing before Easter.

Mr. Worsley Taylor said that the slot meter part of the Bill would affect all three Gas Companies. All of them were opposing it; and one of them had a competing Bill on the subject. Therefore the Committee would have to deal with three oppositions to the County Council Bill, and one other substantive Bill. If the Committee said that one member of their body could not sit after Easter, it disposed of the possibility of dealing with the subject involved before Easter. He did not know what would be the position under the circumstances. The Bill was an omnibus one; and the two parts he referred to were separate. He did not know what the practice of the House of Commons was when a question arose as to different Committees dealing with different parts of the same Bill.

The Chairman said the Committee had the clauses of the Lea Conservancy Bill to consider; and he did not suppose that the present Bill would be dealt with in the time which would remain that week. It would be better to postpone the Gas Bills until after Easter.

Mr. Worsley Taylor said that the Committee would have to deal with exceedingly technical matters; and it was impossible to say what subjects might not crop up in the course of the discussion which would have a bearing on the Bills that were to follow. One of the members of the Committee (Mr. Nicol) had had experience in connection with these gas questions; and he would support the view that it was desirable that one and the same Committee should deal with all the Bills.

Mr. Nicol remarked that, having regard to his experience last session, he anticipated that there would be considerable discussion on these Bills; and he failed to see how one could be separated from the others.

Mr. Worsley Taylor said that might well be the case. The Bills were really separate. The discussion on each might be disposed of separately; but, at the same time, he was not prepared to say that matters would not arise on one Bill which would throw light on another. It was desirable that they should have the same Committee throughout the inquiry.

Mr. Pope said the only other question was that there were a number of very important inquiries which had been fixed to be taken immediately after Easter, in which most of the Counsel would be heavily engaged. He did not think the testing question would be long; and the Committee might reasonably dispose of it before Easter. But then there was the difficulty of substituting a new member of the Committee.

Mr. Worsley Taylor said that was his point.

Mr. Nicol remarked that in all probability there would only be that day and one other before Easter for the consideration of the Bill.

Mr. Worsley Taylor thought that was very likely.

Lord R. Cecil said he was instructed to say, for the South Metropolitan Company, that it was extremely desirable the same Committee should hear the County Council Bill and the South Metropolitan Bill.

The Chairman (after consultation with his colleagues) then said: It seems we have got over the difficulty with regard to the change of *personnel* of the Committee; and therefore I think we may go on.

Mr. Worsley Taylor then proceeded to open the Bill. He said in 1875 there were nine Companies supplying gas in London, each having its own separate Act in which there were various conditions and various charges; the result being that there was serious discontent among the consumers. The Metropolitan Board of Works therefore, in 1875, promoted three Bills dealing with the districts of the Companies; and though these Bills did not pass, there was a discussion on them which led to amalgamations until the Companies were reduced to three. Then the sliding-scale and certain other regulations—notably those dealing with the question of the illuminating power—were introduced. Previous to 1875, the illuminating power of the gas varied; but by the legislation of 1875 and 1876, it was fixed at the uniform figure of 16 candles—the prices chargeable being fixed on this basis. Having to pay for 16-candle power gas, regulations were put in the Bill to secure that to the consumers. He read sections 26 and 28 of the South Metropolitan Act of 1876, to show the manner in which the gas was to be tested—there being similar provisions in the Acts of the other Companies. The Gas Referees, he pointed out, were gentlemen appointed by the Board of Trade, and were therefore independent arbiters between the consumers and the Companies. Section 26 said the gas to be supplied (clearly to the consumer) was to be of 16-candle power when tested by a certain burner; and by section 28 the Gas Referees were to have the power to prescribe from time to time the mode of testing. He called particular attention to section 35, under which the Referees might prescribe and certify the situation and the number of the testing-places, and the apparatus and materials therein for testing the illuminating power. The Referees were, therefore, given the widest power to appoint from time to time such number of testing-places as in their sole judgment they deemed to be necessary as between the consumers and the Companies; to say at what points they were to be placed; and to prescribe the mode of testing the gas—provided always that the specified description of burner (viz., a Sugg argand) was used. Counsel went on to quote at length the various provisions of the General Act of 1880, which applied to all the Companies. The testing-places were to be provided by the Companies; and the Act gave power to the Referees to examine them to see that the apparatus was in working order. By section 14, it became clear that it was the intention of Parliament that at every point in any district where it was reasonable to make a test, there should be found 16-candle power gas. No one he thought would dispute this obligation. But unfortunately the intention had not been carried out, and it was not secured by the Act; and it was to remedy this grievance, which was very serious for consumers, that the present Bill was brought in. Mr. Dibdin, who was very well known in his profession, was Chief Gas Examiner to the Metropolitan Board of Works, and subsequently to the London County Council, from 1884 to 1897, and in that time he made a series of tests. The same course was followed by Dr. Clowes, who succeeded him; both being careful to make the tests at fair points, because fallacious and unfair results would be obtained if the gas tested had stood for some time in the pipe or at a dead-end, or even if it were taken from a small service-pipe. They therefore tested at places where there was a large consumption—such as board schools and fire-stations. In 1896, Mr. Dibdin found that, instead of the gas being of the average of 16-candle power, it was only 15·1 candles—practically 1 candle less than it should have been. Dr. Clowes made experiments in his own way, in places selected to the best of his judgment, and quite independent of Mr. Dibdin; and the results bore out those of that gentleman. He found that the gas under 16-candle power amounted to about 82 per cent. of the total quantity supplied to London. In 1893, Mr. Dibdin found the average of the South Metropolitan Company was even lower than 15·1 candles—viz., 14·3 candles—and in certain other cases (where, however, Counsel agreed the circumstances were not such as would give fair results), the quality got down to between 11 and 12 candles. But suppose the quality was 15·1 candles, they would see what this would mean when they recollected how large the consumption of gas in London was, and that the Gas Companies themselves reckoned a difference of 1-candle power meant to them 1d. per 1000 cubic feet. As a fact, the County Council put the equivalent of the difference at nearer 5d., which, if it were at all approaching the fact, would mean an enormous loss to the consumer, not only directly, but indirectly, because if, instead of 16-candle gas, gas of 15, 14, or 13 candles were burnt, being less dense, more gas would rush through the burner which would be used for 16-candle gas; and therefore double loss would follow. The people were entitled to 16-candle gas. They did not get it; and the present Act did not give them the means of knowing whether they obtained it. The Council said they ought to have it, and to have the means of knowing they had it. They did not, however, seek to increase the obligations of the Companies, but merely to obtain facilities to see that they carried out existing obligations. How it was the people did not get 16-candle gas, was a mystery he could not fathom. They could go to the official testing-place, and, as a result of independent testing, find the gas was of 16-candle power; but if they went to houses between that same testing-place and the works, they would not get it of as high power. He had inquired how this was; but the answer he received was: "I cannot tell you." One could only conjecture. Not merely, however, at the testing-places, but in the houses also ought they to get gas of 16-candle power. The object of the Bill was to secure, by means of reasonable tests at reasonable places, that the consumer should get at his burner 16-candle gas. At present, the test was made at a certain fixed place with a fixed photometer; but that test was absolutely fallacious. It might be asked why the Council did not go to the Gas Referees and ask them (say) to require the Companies to put a testing-station in the remoter parts of the district. The answer was that while there was power to require, which meant to request, there was no power to compel. There was power to prescribe; but the Companies were not obliged to take the prescription, because there was no penalty. There were testing-places now, but they were useless. Who knew where the gas came from? There might be several mains passing the testing-station door, with different qualities of gas in each. What good was it to the consumer to know that from one main there came 16-candle gas, when from the same supply within ten yards of the station where this result was obtained there came gas of 15, 14, or 13 candle power. The Act had failed; there had been grievous loss to the consumer which ought to be remedied; and the only question was whether the proposal of the Bill was fair. The Council thought there was a way of ensuring the supply everywhere of 16-candle gas, by means of the portable photometer, which was an apparatus of the same kind as the ordinary photometer, except that it could be

carried about and fixed to a gas-pipe anywhere. Mr. Dibdin had taken every precaution to secure a just and perfect instrument for testing; and the one he had produced was said by Messrs. Sugg and by the Gas Referees to be fair. The instrument had been tried in Liverpool; and there the results obtained from it showed considerable discrepancy, as compared with the tests made at the fixed testing-places. The Company objected at first, but finding that it gave accurate results agreed to it; and it was now in general use there—the result being that gas of the proper quality was supplied all over Liverpool, and both the Company and the public were satisfied. Clause 3 of the Bill provided—

Any gas examiner may at any time make, at any place within the district supplied by any of the Companies, tests for ascertaining whether the illuminating power of the gas supplied by such Company at such place is that required by law. The apparatus to be employed in such tests, and the mode of conducting such tests and recording the results thereof, shall be from time to time prescribed by the Gas Referees; and the Gas Referees shall from time to time make regulations with respect to those matters, and shall send to the Council, the Corporation, and each of the Companies a copy of such regulations.

What the Council proposed to use was the portable photometer—that being to their mind a fair and just instrument. But the portable photometer was not prescribed by the Bill; the apparatus and mode being left in the hands of the Gas Referees, who were an independent body. Then section 4 of the Bill said—

Sections 11, 12, 13, 14, 17, 18, 19, and 20 of the Act of 1880 shall, so far as they are applicable and with the necessary modifications, apply to the tests by this Act authorized; the expression "testing-place" in the said sections being taken for the purposes of such application to refer to any place at which a test by this Act authorized is made.

This brought in all the machinery and penalties of the previous Acts. It was complained by one of the petitioners that section 8 of the previous Act had not been incorporated, which said the average of the tests, and not an individual test, was to be taken. He agreed that it would not be just to take an isolated case; and if the clause did not cover the point, the promoters would insert the necessary provision. Clause 5 said—

At least 24 hours before any test is made under this Act, the Council or the Corporation, as the case may be, shall give to the Company interested notice that tests are about to be made under this Act; specifying in such notice one of the testing-places prescribed and certified by the Gas Referees, and the hour at which it is proposed to start from such testing-place in order to make tests under this Act. No person shall disclose to such Company by such notice or otherwise the place at which any such tests are to be made. Any officer of such Company who may attend at the time and place specified in such notice, shall be entitled to be present at the making of such tests, but shall not interfere therein. Any notice under this section may be sent by post.

This carried out the principle embodied in all Acts of this nature dealing with the relations between Gas Companies and the public, and enabled a surprise visit to be paid. There was clearly no hardship, because the Companies were bound to supply continuously 16-candle power gas. The Bill was a fair one. It simply enabled the County Council to go before a body of experts appointed by Parliament, and give that body an opportunity, if they were satisfied that the existing means were not a proper security for the due carrying out of the Companies' obligations, of prescribing fair and just means. If the present means were fair, the County Council would be content to be bound by a decision of the experts to that effect. Why were not the Companies? He was curious to know what their answer would be. Turning to the petitions, he said the first was that of the City Corporation, who said they were at present the sole authority for gas-testing in the City, and that the concurrent jurisdiction proposed in the City was unnecessary and uncalled for, and ought not to be sanctioned; and further they were apprehensive that the proposals of the Bill might increase the price of gas in the City. That, however, was clearly impossible. Then they objected to the giving of 24 hours' notice of the intent to test, on the ground that it would tend to nullify any useful results that might be anticipated from the tests proposed. Although the City therefore differed from the County Council as to who was to be the authority in the City, they thought the Bill ought to be strengthened. He did not think, however, they quite understood the proposal in this respect. The next petition was that of the Commercial Gas Company, who said: "Your petitioners have spent large sums of money in equipping proper testing-places, selected by the Gas Referees, with the delicate and accurate instruments prescribed by them, and under the existing system have always met their parliamentary obligations. The substitution of the rough and less accurate instruments suggested by the Bill would fail to find the full illuminating power of the gas, and so would work injustice. Moreover, the taking of tests in any places selected by the County Council would be unfair, because it would be impossible to maintain the conditions of temperature, ventilation, and freedom from cross lights which are secured in the existing testing-places under the prescriptions of the Gas Referees." He would quite agree with that if the Bill asked the Committee to stereotype an instrument, or gave to the County Council power to prescribe any instrument they liked. But both these matters were to be in the hands of the Gas Referees. Then they talked about "the vagaries of an uncertain test taken by an unreliable instrument under improper conditions." But could they believe the Gas Referees would allow a test to be taken in that way? Further, they complained that "the Bill constitutes a vexatious breach of the conditions as to testing laid down by Parliament." Well, Parliament would remedy an injustice, even if carried out under an Act. They went on: "These conditions were prescribed after careful inquiry into the whole subject; and your petitioners, in common with other London Gas Companies, have every right to regard that Act as a settlement of a very important and delicate point going to the very root of a Gas Company's business, and one that should only be disturbed on the strongest evidence of its imperative necessity." He agreed that, unless the Committee were satisfied that there was strong public necessity to make the change, they should not do it. If he did not prove the necessity, the Bill would fail. They referred to "careful inquiry." This was the best Parliament could do at that date; but they had not the experience of the twenty years which had elapsed, in which great changes in the gas world had taken place. The petition went on to state that "the general use of improved burners which greatly increases the illuminating power obtainable from gas makes the quality of the gas anywhere else than at the burner a matter of secondary importance." That the consumer only cared what the gas was at the burner, he agreed; but he was at issue if they meant to say that they could supply gas of 13 or 14 candle power which would appear better in a burner which had been purchased at increased cost, because they were bound to supply gas of 16-candle power. Then they said the competition of electric light (which was not tested at all) was a great protection to those requiring light in the district. The logical conclusion from that was that all tests were unnecessary and should be abolished. The 20th paragraph commenced: "A very large proportion, and an increasing one, of the total quantity of gas consumed within your petitioners' district, is used for the purposes of heating and cooking and power, for which purposes the use of gas of high illuminating power is wasteful." This seemed to go very far towards admitting the case for the Bill; just as though the petitioners had said that, though they were bound to supply 16-candle gas, they did not consider it necessary for heating or cooking purposes, and as the illumination did not depend on the gas so much as the burner, they went on supplying 14-candle gas. The petitioners said, in the latter part of paragraph 20: "If, however, your petitioners are to be put under the new conditions proposed by the Bill, your petitioners may be compelled to enrich their gas by the employment of petroleum spirit, or by other means. This must necessarily increase the cost of the gas; and an increase in the price charged will be inevitable." Well, if they should have to enrich their gas, he really could not help that. If they were bound to enrich it, they must do so. The consumer had nothing to do with the matter. And as to their "necessarily increasing the price of gas," he could not help that. The petition then proceeded: "(21) Your petitioners respectfully submit that this would be a hardship to poor consumers. Gas is so extensively used in your petitioners' district for cooking and heating purposes, that the use of coal for these purposes has been largely discontinued. There is a great advantage, therefore, to the poorer classes in your petitioners' district in having at hand a fuel at a fixed low rate of charge, as compared with the fluctuating and arbitrary price of coal. (22) As an increase in the cost of gas of 1d. per 1000 cubic feet is equal to £10,500 per annum, and it would only cause the shareholder a loss of ¼ per cent. dividend on £784,000, or £1960, it will be seen that of the total sacrifice of £12,460, more than five-sixths fall on consumers of gas; therefore, he loses nearly the whole of any additional cost, and gains similarly nearly the whole of all savings." He failed to see what this argument meant. It seemed to be this: "If you put this charge on us, though it is necessary to carry out our original bargain, we shall have to enrich our gas, and shall be compelled to increase our charge; and the whole of the cost will fall on the consumer." If this were the effect—and he did not admit it for a moment—there would be no hardship on the Company. They seemed to him to put themselves out of court in every way. The Gaslight and Coke Company, in paragraph 7 of their petition, said: "The present system of testing the gas supplied by your petitioners was settled after a long and careful inquiry, and has from time to time been revised by the Gas Referees as occasion required, and has now for a long time worked well daily and without complaint, and affords every reasonable protection to the public against any deficiency in the illuminating power of such gas; and your petitioners respectfully submit that the Gas Referees, under the existing statutes, have ample powers for correcting any imperfection in the system of testing as occasion may require." This was just what they would not do. The petition continued: "and that no case has been made out, or can be made out, for giving the Gas Referees or Gas Examiners the additional powers proposed by the Bill, or for altering in any way the present method of testing." They went on to define the requisites for gas-testing, which would be matter of evidence. They then said: "Furthermore, your petitioners allege that it is a well-known and admitted fact among gas experts, that gas which has remained stagnant in a main or pipe for a considerable time, or which has become condensed, does not always preserve the illuminating power which it originally possessed; and they contend that, in order to obtain a fair and proper test of the illuminating power of their gas, it is essential that the same should be taken from a main or pipe in which such gas at the time of the test is freely circulating, and your petitioners submit that it would be grossly unfair and prejudicial to your petitioners to authorize, as the Bill proposes, that tests should be made of your petitioners' gas irrespective of whether the portion of gas so tested is or is not a fair sample of your petitioners' gas taken under fair conditions." Well, if the Bill proposed what the petitioners there indicated, their adjective "grossly" unfair would be justified; but it was proposed to leave this matter to an independent body.

Mr. Nicol: Under the control of the Board of Trade.

Mr. Worsley Taylor: Not under their control.

The Chairman: Appointed by them.

Mr. Worsley Taylor said the petitioners alleged that the Bill did not make provision for the average; and this was right. In paragraph 13, the petitioners drew attention to the expenditure in connection with the maintenance of the testing-stations and the salaries of officials, and said that the Bill would cause an increase in these respects. The Commercial Company did not say anything of the kind. The South Metropolitan Company, in their petition, in paragraph 16, said: "The Bill is ill-conceived and illusory as regards its apprehended benefit to the consumers, because the illuminating power of gas in the main, owing to the improved burners now generally in use, is no criterion of the illuminating power of gas issuing through the consumer's burner." This was the curious argument he had already referred to—namely, that, because the consumer might buy burners that give a better result, therefore the Gas Company were to be at liberty to supply a lower quality of gas than had been bargained for. Paragraph 2 of the same clause said: "Upwards of 50 per cent. of the total quantity of gas consumed within your petitioners' district is used for purposes other than lighting—such as heating, cooking, manufacturing, and power—for which purposes the use of gas of high illuminating power is sheer waste." But that meant that, whereas they were supplying 16-candle gas, they ought to be supplying 10 or 11 candle power gas, or what they liked. If it did not mean that, he failed to see what it did mean. The remainder of the paragraph he had dealt with already. Paragraph 17 went on to say that the Bill was unjust to the petitioners, and proceeded to give the cause of that alleged injustice; but all that was a matter of evidence. In the third

paragraph of 17 they said: "Because, in order to protect themselves from the results of a possible deficiency by the proposed new test, your petitioners will have to raise the quality of gas as sent out from the works to at least 18½ candles, and even then there will be the constant risk of a possible default when tested in the manner proposed." He should not care if this allegation were true. Their obligation was to maintain 16-candle gas; and whether they had to turn out 18 or 18½ candle power mattered not a row of pins.

It having been agreed that the Committee should inspect a sample of the proposed photometer during the luncheon hour,

Mr. *W. J. Dibdin* was examined by Mr. TALBOT.

Witness said that from 1882 to 1897 he had held the position of Chemist and Superintending Gas Examiner to the London County Council, and before that to the Metropolitan Board of Works. He had been one of the Gas Examiners before 1882; and since then he had been Superintending Gas Examiner. He had studied the Bill, particularly the part of it which related to the testing of gas. The Bill was to authorize an improved method of testing the illuminating power of gas. At present, the illuminating power of the gas was ascertained by a method prescribed by the Gas Referees. They appointed certain stations; and they prescribed a certain area within which the Gas Company had to provide a station. The Company had to find a house or room, and submit it to the Gas Referees; and this being done, the Referees prescribed the apparatus which was to be provided and fitted in the room by the Company. When the Company had provided the apparatus, the Gas Referees inspected it; and if they approved of it, they certified it as fit and proper. Then it was the duty of the controlling authority of the London area to appoint two Examiners to test the gas. A report was submitted to the Gas Referees, to the Chief Gas Examiner, to the controlling authority, and to the Company, communicating the result of the test which was made each day. The methods to be adopted by the Gas Examiner were laid down minutely. The Gas Referees and the Chief Gas Examiner were appointed by the Board of Trade; and neither the County Council nor the Corporation had any control or voice in the matter. The Gas Referees had power to prescribe a testing-place anywhere they pleased; but as the Companies found the instruments, the matter was entirely in their hands. The arrangement worked fairly well in the majority of cases; but there had been serious difficulties. For instance, in one case the Company flatly refused for about three years to provide a station; saying it was not wanted. It was only on the friendly offices of the Board of Trade being invoked that the station was established. Frequently, a station would be closed for eight or nine months for alterations; and during this time, there was absolutely no safeguard to the public as to the quality of the gas. There was always considerable delay between the request to erect a station and its establishment; and it was therefore necessary to have some addition to the power of testing. In consequence of frequent complaints as to deficiency in the illuminating power, in 1884 he was instructed to ascertain whether or not it was possible to test the gas in various parts of London independently of the official testing-places. Complaints had often come from districts where there was no testing-place. He consulted Messrs. Sugg and Co., the makers of the apparatus prescribed by the Gas Referees, whose experience of photometric apparatus was unique, and other gas engineers, with the result that forms of photometers were devised which met the requirements of the Gas Referees in regard to the official testing-places, but which also were of a portable character. They could be put in boxes and taken from place to place.

Mr. TALBOT: I understand that the portable photometer in its essence is the same as that used as a fixture at certain stations?

Witness: Yes; that was a condition—that it should be identical.

Before using it, in addition to consulting the people you have named, you submitted the instrument to the Gas Referees themselves?—Yes. I asked the Referees if they considered it a proper instrument to employ in testing the gas. I fortified myself in that way; and I was assured by them that they had had it in their place under inspection, and that they considered it a proper and correct instrument, and such as they could certify under their powers.

Mr. TALBOT (to the Committee): As the Gas Referees are officers of a Government Department, it would have been impossible for us to have called them here as witnesses for the Bill; but if the Committee wish to hear their views, and will convey a request or intimation to that effect to them, I have no doubt they will come to be examined.

Mr. LITTLER: If we have this evidence at all, it should be at first-hand, and should not be given through this witness.

Mr. TALBOT (to witness): Having made all these inquiries, you proceeded to use the instrument?

Witness: Yes; and I have used it ever since.

In your judgment, is it a true and satisfactory instrument for testing gas?—Undoubtedly.

Do you see anything in it unfair, from the point of view either of the Company or consumer?—I believe it to be perfectly fair to both.

In conducting your experiments, you were careful, were you not, to go to places where there was a good consumption of gas?—Yes; it would have been folly to have taken the instrument to a place where there was practically no gas consumed—say, to the dead-end of a small bye-street. I selected public institutions, as far as possible, the town hall, the fire-brigade stations, the police stations, but mainly small board schools, as being the most convenient places in which gas would be burning every hour. The mode in which the tests will be carried out under the Bill will be supervised by the Gas Referees.

Examination continued: In 1897, he submitted a report to the Control Committee embodying the results of certain tests he had made. It was dated Jan. 29, 1897. He had a tabulated statement attached to it, and it showed the quality of the gas of the three Companies as tested by the instrument. The general result was that from 1884, when the tests were commenced, to 1889, the gas supplied by the Gaslight and Coke Company and the Commercial Gas Company showed an average illuminating power of 16·4 candles. This was an admirable result. There were occasions when the isolated tests were different; but that was the average—it fluctuated from 15 candles. If this state of things had been uniform, there would have been nothing to complain of; but depreciation of illuminating power was shown as the result of further tests. In the case of the South Metropolitan Company, the gas, which showed an average of 16·4 candles in 1884, in 1885 went down to 15·2 candles, and continued at this figure in 1886 and 1887. It went down to 15 candles in 1888; it was 15·3 candles in 1889; and then in 1892 it came down to 15·2 candles, and in 1893 down to an average of 14·2 candles. After this date it went up, and became 15 candles; and since that there had been another deterioration.

One of the Counsel for the petitioners here observed that there had been no deterioration in the official tests.

Witness said that was so. The official tests had given uniform results.

The CHAIRMAN: Did you make any alteration in your method of procedure down to 1889?

Witness: No.

Mr. TALBOT: During the whole period the official tests gave substantially uniform results?

Witness: Yes.

Whereas there was great difference in the tests conducted by you in the same manner throughout?—Yes.

Now as to the effect of enriching the gas. In 1894, or before, you conducted experiments as to that, did you not?—Yes; it was an experiment carried out at the suggestion of Mr. Livesey himself.

In reply to further questions, witness stated that the proposed mode of testing the gas was said to be unfair because the gas lost in illuminating power while it travelled along the mains.

Counsel for the petitioners remarked that there were a lot of other objections.

Mr. TALBOT said he was aware of that. He asked witness whether, in his view, gas lost in illuminating power at all, or to a great extent, in travelling along the mains.

Witness said it did not lose to any material extent. There was no quibbling as to half-a-candle, or even a whole candle, of illuminating power. It was a matter of 3 or 4 candles; and in such a case no question of depreciation in the mains could enter into account at all. Asked as to the result of his experiments in regard to enrichment of gas, witness said that enrichment meant that when a gas was made from coal according to the quality of the coal used, and the temperature at which it was distilled, so would they have greater or less illuminating power. It was the duty of a gas company to so blend the gases as to give as uniform a gas as possible. If a sufficiently rich gas was not procured, it became part of their duty to add something to enrich it. In consequence of a suggestion made by Mr. Livesey in 1894, as to the possible effect of unenriched gas, an experiment was made in the South Metropolitan district, with the sanction of the Gas Referees, for a fortnight during which unenriched gas was supplied by the Company to the whole of the district. It was arranged that they should ascertain, by careful tests conducted in the usual way, what would be the effect; and it was also arranged that if there was any appreciable difference during the period when the gas was unenriched, it should be indicated by the complaints received from consumers of gas, just as, when gas was not delivered at proper pressure, people wrote to say that something must be wrong. His report* was as follows:—

In accordance with the order of the Committee of the 13th of April last, I arranged with Mr. Livesey that the enrichment of the gas supplied by the South Metropolitan Gas Company should cease on the 24th of April and be resumed on the 6th of May. During the interval, the gas was carefully tested as usual at the official stations, and also by means of the portable photometer at various points from Battersea to Plumstead; this instrument being taken into the official testing-stations from time to time for comparison with the legalized photometric apparatus. I now beg to submit the following outcome of the testings so made, together with a consideration of the results of the adoption of such an alteration in the existing standard, should such be further entertained, and recommendations with respect thereto. Table No. 1 contains the results of the tests of the illuminating power of the gas during the supply of uncarburetted gas from the 24th of April to the 5th of May.

Then Table I. followed, giving the tests of the illuminating power of the uncarburetted gas supplied between the dates named. The tabulated results might be thus summarized: Average of portable photometer tests at board schools, 15 candles; average of official examiners' tests, 15·1 candles. The report proceeded as follows:—

The higher result of the official examiners' tests is caused by the fact that, while the average at all stations was 15·1, the returns from the Clapham station alone gave an average of 15·8 candles. The remarkable agreement between the indications afforded by the portable photometer and the official instruments is worthy of note, and is well shown by the following comparison: (1) Candle tests on portable photometer at the official stations, 15·70; (2) candle tests on the official photometer at the same time as the above, 15·75; (3) candle tests by the official examiner on the same days, but at different times, 15·75. Many other features of interest present themselves on the careful examination of the details of the testings; but the above are the essential points in connection with the scope of the present inquiry. It may now be assumed, from the results of the testings as thus set out, that the quality of the gas *when uncarburetted* is fairly uniform at the testing-stations and in the districts away from their immediate neighbourhood. The high results at the Clapham station were probably due to a special quality of coal employed at the Vauxhall works, so that the conditions in that case were exceptional, and somewhat complicate the general question. But, even with this case included, the main point is practically unaffected—viz., that with uniform manufacture there is uniform quality. The question then naturally arises, "What are the conditions of the supply when the gas *is* being enriched?" For the purpose of answering this, a series of tests were conducted on precisely the same lines as the foregoing, immediately following the resumption of the process of enrichment by the Company.

The results so obtained were tabulated, giving the tests of the illuminating power of carburetted gas supplied by the Company from the 8th to the 19th of May; being the two weeks following the experimental supply of uncarburetted gas. The report went on as follows:—

From these results the following summary is obtained: Average of portable photometer tests at board schools, 14·85 candles; average of official examiners' tests, 16·5 candles; average of portable photometer tests at official stations, 16·6 candles. As the former set of testings, made when the gas was supplied *un*-carburetted, indicated a fairly uniform supply, so these later tests, made after the resumption of the enriching process, most clearly demonstrate that the effect of that process is limited in its operation to the official testing-place and its near proximity. This remarkable result is the chief outcome of the experiments, and will explain any

* See "JOURNAL," Vol., LXIV., p. 95.

failure on the part of the consumers to detect any difference in the quality of the gas supplied to them during the two weeks in question. The importance of the prescribed quality of the gas being fully maintained throughout the whole district is more than ever fully evident. For the purpose of elucidating this fact as clearly as possible, I have made the following series of experiments to determine the quantity of gas of different illuminating powers required to produce a uniform light when consumed in either of two of the most generally employed forms of gas-burners.

Mr. TALBOT: You had the gas enriched at the testing-places up to the legal standard?

Witness: Yes.

And whereas the tests taken by your photometer at the testing-places coincided with the official test, at the board schools they fell considerably below it?—Yes.

The gas was enriched, but the enrichment observable at the fixed test had disappeared before the gas reached the consumer?—Yes; it disappeared as soon as we went into the district away from the official station. The average by the photometer at the board schools was 14·85 candles. That was some distance from the testing-stations.

The CHAIRMAN: Are the testing-stations referred to in the report in proximity to the board schools?

Witness: Not necessarily. I tried to get the average of the gas supply in the district. The result was that the uncarburetted gas was practically the same as the carburetted gas, so called, when it arrived at the consumer's burner.

Mr. TALBOT: It has been suggested that gas of high illuminating power is not better than gas of lower power for purposes other than lighting—take heating, for instance.

Witness: That question will be dealt with by others, as it refers to a special point. In my report, I dealt more particularly with the effect of the supply of poor gas as bearing upon light. I gave Table III. showing the consumption of gas required to yield a certain constant light; and the report said:

From these results it appears that, in order to obtain the same quantity of light from a batswing burner consuming 14-candle gas as would be obtained with 16-candle gas, about 5 cubic feet per hour must be consumed, instead of 4 cubic feet, or 37 per cent. more. With 15-candle gas instead of 16, the increase is from 4 to about 4¾, or 18 per cent. With a fishtail burner, the increase in the quantity of gas, when 14-candle gas is employed, is about 33 per cent., and when 15-candle gas is used about 18 per cent.

Some people would contend that these figures are too high.

Mr. TALBOT: Can you speak as to economy to the consumer?

Mr. BALFOUR BROWNE: Cases can be cited where 16-candle gas has been reduced to 5 candles by the use of bad burners.

Mr. TALBOT: It is argued that it does not matter to the consumer what candle power he gets, because he can improve his gas by using a good burner.

Witness: That, of course, is not a sound argument, because if the gas is poor when burnt in the ordinary way, it involves a great loss to the consumer. He has to burn more gas to get the light he would have with gas of a better quality.

The CHAIRMAN: If he uses the gas with the burner you have employed in your experiments.

Witness: I have given in a statement of loss with a certain burner. But whatever standard of burner you adopt, there must be a provision for protecting the consumer.

Cross-examined by Mr. POPE: What is the necessity for erecting and fitting a testing-place—what do you provide in a proper testing-place?

Witness: Apparatus for testing the illuminating power of the gas.

What is the nature of the apparatus. You must first of all have personal supervision?—The Gas Referees specify a certain area within which the Company must find a suitable house. The house is provided, and the room; but some rooms are different to others. If the room is not satisfactorily supplied with ventilation, very often a ventilator is found.

The ventilation of the room is an essential condition to correct testing?—Clearly.

What is the next condition?—In an official testing-station, the test extends over 24 hours. The gas is being burnt in the room all the time; and you must provide for that.

What has to be provided to secure an accurate testing-station? Has the room to be darkened?—Yes.

Painted black? Did you ever know one that was not painted black?—It is only within the last few weeks, so to speak, that they have been painted black.

Why have they done that?—Because of the introduction of a new photometer—Harcourt's pentane photometer.

A fixed station and appliances are necessary?—A great many things that are done in the station are absolutely unnecessary.

Do you mean to represent to the Committee that, in your judgment, the fittings of the station must be brought to the fixed station before you can get a really accurate test?—I do not think so. A great deal of that which is done at an ordinary gas-testing station I look upon as an excuse for delay.

That is the getting ready?—When everything is ready. They have the key of the testing-station for months.

Your portable photometer does not test as you test at a fixed station?—Yes; we use it alongside the instruments at the stations.

I am not talking about the accuracy of the photometer, but of the test. Do you think that your peripatetic photometer would test accurately without any of the conditions necessary according to the Gas Referees?—The Gas Referees prescribe the instrument to be employed; but all the paraphernalia is looked on as unnecessary. We test the quality of the gas first of all by putting up a photometer in any convenient room where the gas is laid on, and where it is not open to daylight.

Mr. POPE: Assuming you are using a board school, having found the place, what would you do to test the gas?—Say we were testing in this room. We should bring the portable photometer, and put it on this table (*pointing*). I submit that the conditions as to temperature and ventilation in this room would entirely meet the requirements of the Gas Referees, so far as they have any requirements. I should wait until the room had been emptied for a few hours, and I had normal conditions as to purity of atmosphere.

Is your photometer independent of the consideration of draughts, ventilation, darkened room, or the ordinary conditions that affect gas testing?—You ask me a question covering an enormous area of ground, and you want me to say "Yes" or "No."

Do you suggest that the photometer you employ in this casual way is independent of these conditions of darkened rooms, draughts, ventilation, and so forth?—I say you are putting a question which covers a large area. My answer is that the instrument, whether it be good or bad, is an instrument which is true, and is designed by the Gas Referees themselves; and they are the responsible authority under Parliament for certifying as to the quality of the gas.

I am not disputing the accuracy of the instrument *qua* instrument; but I say that the accuracy of the result derived from it must depend on the conditions under which it is used?—The instrument and the conditions under which it is used give fair and accurate results between the Company and the consumer.

Do you assert that the instrument is independent of the conditions I have referred to in its manner of use?—Well, no flame of any kind can be altogether independent of atmosphere.

Would your instrument be useful in the open air?—No. The flame would be blown out.

The CHAIRMAN: Is your instrument as sensitive as the fixed instruments?

Witness indicated a reply in the affirmative.

The CHAIRMAN: I do not understand the witness to imply that, if you took his instrument into a hurricane, it would work satisfactorily.

Witness: No. It would work in this room with ordinary accuracy.

Mr. POPE said the portable photometer was practically the same instrument as that used at the fixed stations; and when witness said that it could be employed under circumstances in which the ordinary conditions required at the fixed stations were absent, he implied that those conditions were unnecessary.

Witness said that was so. It was the Companies who had introduced all the paraphernalia.

The CHAIRMAN: Do the Referees lay down any conditions as to the blackening of the ceiling and walls?

Witness replied that the Referees had done so.

The CHAIRMAN: In your opinion, would it make any difference whether the walls of the room were black or not?—I do not think so.

Cross-examined by Mr. LITTLER: You know that the City Authorities are absolutely and diametrically opposed to your scheme.

Witness: It is the first time I have heard of it.

Then, do I gather that this Bill has been brought in without consulting them?—I do not know. I no longer hold an official position under the County Council. I resigned it some three years ago.

The reason you give for promoting the Bill is that it will enable you to obtain better illuminating power for the consumers at the same price?—We do not think that it will come to a question of price at all. But the consumer would be better off with 16-candle gas at 4d. than he would with 11, 12, or 13 candle gas at 3d.

Would he?—Clearly.

Do you know that a large proportion of the burners now supplied are not of the old pattern, but are either of the incandescent or the regenerative type?—I have considered that question; and I want evidence, if it can be obtained, to show that the quantity of gas used in any of these new burners bears any proportion at all to the vast volume of gas consumed in London for illuminating purposes.

Mr. LITTLER: That want will be supplied.

Witness: I have been about London a great deal; and from what I see, it appears that the great bulk of the gas is burnt in the ordinary flat-flame burners. The other, and more economic, burners have hardly touched the fringe of the matter, though I cannot say what may happen in ten or twenty years' time.

For cooking purposes, you will agree that 14-candle gas is as good as 16-candle gas?—I have no evidence to that effect; and I do not think it is so.

Was this Bill brought in on your advice?—I have had nothing to do with the County Council for some time; but I presume the measure is brought in as the result of work I did years ago.

Questioned as to the tests which he had made with the portable photometer, witness said they were generally conducted in board schools—three or four of them between 6 and 10 o'clock at night in the winter, and later in the summer.

Mr. LITTLER: According to the Bill, there is nothing to prevent you going with your testing apparatus to the back bedroom of a working man at the dead-end of a gas-main?

Witness: It is intended that the testings shall be effected under the control of the Gas Referees; and I should think that such a suggestion as you make would be unworthy of them.

Have they ever made a suggestion that the tests you propose should be applied?—Yes; over and over again.

In any published report?—I do not think so.

I do not refer to what somebody may have said when smoking a cigar with you. Is there any suggestion of the kind to be found in any published records?—I know of no printed matter in which they say so.

In reply to further questions, witness said that the photometer he had used was made in 1884 by Sugg. It had had over 3000 cab journeys; and was in good working order. The portable photometer could be put together in ten minutes; and he entirely differed from the view that it took two hours to do it properly. All the measurements were tested with rods after fixing the photometer. There was no extraneous light in the room; and he did not think it necessary that the ceiling and the walls of the room should be blackened.

Further cross-examined by Mr. LITTLER: He agreed that if the proposal were adopted, the Companies would have to send out at the starting point better gas than they did at present. He could not tell whether it would cost more to send out the higher quality of gas—nor that every candle above 14 meant an extra 2d. per 1000 cubic feet.

Mr. LITTLER: If it does, and if we are required to add 2 candles in order to comply with the obligations of this Bill, do you know that that means half a-million of money to the consumers?

Witness: I am not concerned with that at all.

Cross-examination continued: As to whether it would be a good thing for the consumer if the Companies were compelled to add 4d. to the price of every 1000 cubic feet of gas sold, he held it would be more economical

to the consumer that he should pay the extra cost, whatever it was, and have the gas up to standard, rather than receive the gas he was getting now. If a man were supplied with 14 instead of 16 candle gas, he would burn 25 per cent. more; and the difference in the light would be very considerable. A great change had of late years occurred in regard to the higher illuminating powers of gas in connection with such burners as the Welsbach; but it was not a question of what light a particular burner would give, but of what the consumer paid for and was entitled to. He agreed that, as soon as one left the main and entered the consumer's premises, the management and control of the supply-pipe—whether it was in proper order or not—was entirely in the hands of the consumer. If the Bill provided that the tester could go to a back room (say) it should be revised, because that was not fair to the Company. Gas deteriorated in small branch mains, especially if they were not kept in repair; but that was a very limited condition in relation to what the County Council proposed.

By the CHAIRMAN: In the worst circumstances, the depreciation might amount to a candle; but that would be in very small mains. In large mains supplying a district, the diminution would not be more than half-a-candle, which was allowed for under existing conditions.

Further cross-examined by Mr. LITTLER: He had heard something of skin-friction in smaller pipes. He would not say it did not take place. Stagnation in the pipes might bring about like effects; and the same would occur if the test were near a dead-end.

Cross-examined by Mr. BALFOUR BROWNE: The object of the Bill was to allow testing anywhere, instead of at certain fixed places. Gas lost illuminating power if it passed through a pipe where there was a small flow; if it was exposed to cold; by the deposit of naphthalene in passing through a service-pipe; and by passing through a pipe in which naphthalene had been deposited. It would not lose power in passing through a wet meter in which the water was saturated with gaseous products. In a dry meter, to prevent the gas escaping, the leather was saturated with oil; but this did not lessen the illuminating power. The wet meter was the only one which the Gas Referees said could be used to test. To a certain extent, also, gas lost power by travelling long distances through pipes or mains. So that in six cases there was a potential loss of illuminating power between the manufacturer and the consumer.

Mr. BALFOUR BROWNE: These losses are not due to the action of the maker of gas, but may be due to the default of the consumer?

Witness: Yes.

Do you think it fair, when we have bargained to supply gas at 16-candle power in one place, that you should have a right to demand it, after all these conditions had been put upon us, at another?—There must of necessity be a certain limit to all these causes of reduction; and this limit I will grant the Companies. It is conceded to them by a concession of half-a-candle; and I would give them another half-candle.

It depends whether that is fair. If, for instance, I can show that the gas tested at one of these stations is 16-candle gas, and I can prove that, by no fault of mine, but merely by travelling through the pipes, it had lost 2 candles before it had reached the extremity of any district, I should have 2 candles allowed?—But at the same time that the official testing is going on at a station, at another point between that station and the works there is a difference of 3 or 4 candles. I cannot understand it.

Mr. BALFOUR BROWNE said the witness might not be able to understand it; but that was no reason why, having bargained to give 16-candle gas at one place, the Companies should be bound to give it at another.

Witness remarked that there was another thing he could not understand—viz., why at a testing-place the gas should be 15·8 candles and then drop down to 14·6 candles.

Cross-examination continued: At present, in the tests the gas was not always protected from the atmosphere. In some cases it was exposed to cold. The Companies at the testing-stations did not pass the gas through a consumer's meter. If there was anything in the points raised, they might safely be left to the Gas Referees. Such matters as a mirror in the room where the test with the portable photometer was made, and the having of walls some polished and some dark and absorbent, were microscopical questions, which would affect the test to the extent (say) of a tenth of a candle. The keeping of the temperature at the testing-places up in the winter with hot-water bottles, and down in the summer by means of ice, were coddling things used to get even results.

Re-examined by Mr. TALBOT: There was nothing in the requirements of the Gas Referees for the current half year which could not be met by the portable photometer.

By Mr. NICOL: The selection of the testing-places was by the Gas Referees, not by the Companies.

In further re-examination, witness said he had taken tests between the works and the testing-station, which showed that there was less power in the gas at the works than there was at the station.

Mr. POPE: Do you allege fraud?

Mr. TALBOT: There is no suggestion of fraud.

Mr. POPE: Do you secretly allege that gas is fraudulently brought up to the requisite quality at the testing-place, which, before it reaches the testing place, is below it? What do you allege?

Mr. WORSLEY TAYLOR: I do not know that we are bound to allege anything more than the fact. We state the facts. We say the consumer is entitled to 16-candle gas; and he does not get it. He is entitled to be sure that he gets it. What inference my learned friend chooses to draw, we cannot help.

Mr. POPE: I should like to know how it is done.

The CHAIRMAN: I suppose that witness would say he does not know.

Witness, in reply to Mr. EMMOTT, said, curiously enough, some of the tests had given better results when taken at the end of the district than nearer the works. He knew nothing about the pipes. There was no means of getting gas direct from the mains, except by breaking up the road. He made a suggestion to some of the Companies years ago that they should have an investigation on this subject, there being some discrepancies which were very inexplicable; but his suggestion was not adopted. For all the variations mentioned, the allowance of half-a-candle was sufficient.

By the CHAIRMAN: He wished to make no insinuations against the Companies, because there were such things as careless workmen and other circumstances which might explain a great deal. He could only say that gas at a certain point, at a certain time, had a certain value. He did not wish to draw inferences against the Company.

The CHAIRMAN said he was not asking whether he imputed fraud to the Companies. Did witness know, from the construction of the mains, whether it was possible that the Companies might divert from any one of the given stations the gas which was made at the nearest works, and bring into that station gas produced a considerable distance away?

Witness said they had an illustration of that in regard to sulphur in gas. To come within the Act, there must be an excess on an average of three days at one testing-station. Evidence was given that gas was found at one station with a high quantity of sulphur in it; but they managed to drive this gas in such a way that it was tested one night at one station, the second night at another, the third at another—so that, although there was a high average of sulphur at three stations, there was not a high average at one.

The CHAIRMAN: So that the test at a given productive works must not necessarily correspond with the test at the nearest testing-station?—I understand that that is so.

Because the gas supplied at a testing-station may come from another works?—Yes.

Thursday, April 5.

The CHAIRMAN said he had arranged for the attendance of Mr. Vernon Harcourt, one of the Gas Referees; and he proposed to take his evidence first. He would obtain a general statement from him; and then, in conformity with the usual practice, Counsel would not cross-examine. But if there was any point on which Counsel would like further light, and they submitted the question, he (the Chairman) would use his discretion as to putting it.

Mr. *A. G. Vernon Harcourt*, examined by the CHAIRMAN.

Witness said the principal duties of the Gas Referees were to prescribe the degree of purity of the gas supplied by the Companies, and the places, methods, and apparatus for testing the illuminating power.

The CHAIRMAN: What is the apparatus which is now generally used for testing the illuminating power?

Witness: There is a photometer newly introduced into most of the testing-places, of a form called a table photometer, on which the comparison is made between a standard light of 10 candles and the gas supplied by the Company. The comparison is made by burning the gas supplied by the Company in a standard burner, known as the "London" argand burner, at such a rate as will produce a light of 16 candles. The actual illuminating value of the gas is decided upon by the rate at which the gas has to be burnt to produce this amount of light.

In practice, does an inferior gas of (say) 14 candles require a certain increase in quantity to give an illuminating power equal to 16 candles?—It would be on an exact proportionality between the two; so that 14-candle gas in relation to 16-candle gas would be gas which would need to be burnt at the rate 8, when 16-candle gas would need to be burnt at the rate 7. Continuing, he said he had only a small knowledge of the portable photometer now being used by the promoters of the Bill in making their tests. He believed that, as used side by side with the fixed photometer, and under the same conditions, the portable instrument was satisfactory.

Is it more subject to interference with its action than the one you used—the table photometer—by such things as draughts or conditions of temperature?—The instrument, I think, is the same, except that portions of it are so made that they can be folded up, and so made more portable. When set up in a room, you may take it there is no appreciable difference. The photometer Mr. Dibdin used is of the type known as the open-bar photometer; and when that was employed, the photometers at the different testing-places were more or less enclosed. It was, therefore, probably more likely to be affected by draughts than screened instruments. The open-bar photometer is not, however, now used.

Then, in an ordinary room, with the windows closed and not subject to more draught and currents of air, do you think that the testings made by the portable photometer would fairly represent the illuminating power of the gas?—I think it may happen that, in a room much larger than those which form the testing-places, even if the windows and doors were closed, the currents of air would be greater than in a smaller room; but I do not see why these currents of air should more affect the gas burning in the standard than the gas burning in the "London" argand burner. I should have answered the question differently at the time candles were used for testing, because they were very liable to draughts; but as between the burners now being used, I see no reason why one should be more prejudicially affected by draughts than the other. Some candle testings are still going on; but by now the greater part of the testing-places have been fitted with the new apparatus. The location of the testing-places is determined by the Referees. Each station had come into being in consequence of the original provision that for each centre of gas manufacture there should be a testing-place, not less than, but as near as might be, 1000 yards from the works. At present, and for many years past, the policy of the Gas Referees has been to place a testing-place in each centre of gas consumption, at something like regular intervals, and to arrange that the number of these places should bear some proportion to the amount of gas supplied by each of the Companies.

Can you give us any information as to the difference between the illuminating power of a given gas immediately proceeding from the works, and the illuminating power of the same gas when tested at a distance of 1000 yards?—I have no knowledge first hand. It was stated at the time the Beckton works were established 10 miles out of London, that the gas made there, and travelling with great velocity through mains 4 feet in diameter, did not lose in transit, but was of the same quality when it arrived as it was when it started.

Then you would not anticipate that there would be a difference in the illuminating power of a given gas tested 1000 yards from the works, and then tested again 3000 or 10,000 yards distant?—I think much might depend on the size of the pipe through which the gas travelled. If, in place of this large main from Beckton to London, gas had travelled 10 miles through a number of smaller mains or service pipes, it seems to me that the gas would have lost in quality.

Can you give us the reason why you would expect it to lose?—No; I find it rather difficult to assign any other reason than this—that it was so. Continuing, witness said he did not understand, as a matter of physics or chemistry, how any deterioration of the gas could take place. The effect of leakage would not diminish the illuminating power. The

illuminating power would not, he thought, be affected directly in travelling long distances by going up hill or down hill. The explanation of gas at high altitudes being supposed to be purer than gas at lower heights, was that the great bulk of the complaints of gas being bad meant that it was not supplied at a sufficient pressure to enable the consumer to get the light he needed. This was by no means necessarily due to fault on the part of the Gas Companies, but might—and often did—arise from a consumer putting in fittings, and then increasing his use of gas without adopting larger fittings; so that, although the pressure was sufficient in the mains, it would not be sufficient for the small pipes, and thus the consumer complained. On the higher level, the pressure would be greater; and there would be far fewer complaints from the top than the bottom of a hill.

Then the illuminating power of gas is, in your judgment, frequently affected by the service-pipes which are controlled and provided by the consumer?—That is so. I do not know a scientific reason why the gas should suffer in passing through the pipes.

The illuminating power of the gas may be affected by the insufficiency of the service-pipes?—The amount of light obtained from gas; but that is generally distributed into two parts—the actual quality of the gas, and the pressure at which the gas is supplied. I think you must exclude gas pressure from the illuminating power.

But the ordinary man in the street, who had supplied his house with service-pipes under the conditions you have named, would naturally think the gas was inferior, when he himself was to blame, because the service-pipes were not sufficiently large?—Yes, he probably would. He would be wrong in thinking the gas deficient in illuminating power.

Might the testing with this photometer be seriously affected by being applied on premises where the local service-pipes were inadequate to the consumption?—I do not think that is a real danger.

Would the illuminating power be affected by the fact that the gas passed through a wet or dry meter?—Not permanently. If the water in the meter were clean, for a short time before that water became saturated with the gases forming coal gas, the gas would suffer in passing over the water; but this would be limited to a week or two.

Would there be any difference in testing with the portable photometer on the sub-mains of 2 or 3 inches diameter, as compared with the main supply mains of 2 feet diameter?—I should not expect it. I cannot say positively, because I have not tried it; but I do not suppose, if gas passed through some distance of pipes after leaving the main, the quality would be affected. At any rate, it is under those conditions the consumers receive their gas.

Have you found any variation in these testings at different distances from the sources of supply, in the case of an enriched gas as compared with gas not enriched?—A great difference, I think—meaning now, by enrichment, the mixing of the vapour of petroleum with gas. I think it is a point of very great importance. The mode of enriching gas is now, I believe, to inject petroleum in some form into it.

Does the testing vary when the gas is at a lower or at a higher temperature?—I should think, under the present conditions of supply, it must be more likely that the gas would be poor in quality, owing to the condensation of some of this enrichment, when the temperature is lower, than when the temperature is higher; but I do not suppose the range of temperature in mains buried underground would be very large. It might certainly happen that, if a portion of the service-pipe bringing gas from that main travelled near the surface of the ground, in cold weather there might be a loss of illuminating power in the gas passing through the pipe. On the other hand, it seems likely that that which is condensed when the pipe is cold, will be again given up to the gas when the pipe is warmer. Therefore, I do not think there can be any permanent loss.

Then, in making a test, would the temperature of the room in which the test was performed affect the results?—I think not. The higher temperature of the air increases, no doubt, by a little the brightness of any flame burning in the air; but I think there is no likelihood that the standard light and the gas light would be affected to a material degree.

Turning to the subject of the installation of testing-places, you say you appoint the areas within which the testing-stations shall be situate?—Yes.

Have you had any experience of delay on the part of the Companies in providing these places?—There has often been a long gap; but it is difficult to say who has been responsible for the delay. We have received letters from the Companies regretting that those who had to supply the apparatus had been so long in their operations.

Have you known cases in which, after the testing-places have been appointed and furnished, delay has taken place in handing over the keys?—I do not think there has ever been any long delay in that way. We have had letters from one or other of the Companies asking that they should have the opportunity of testing the apparatus before it was brought into official use; and I think we have acceded to applications of this kind. The officials of the London County Council would know more about that than we should, as they have had more to do with these matters. So far as we are concerned, we should receive from the Secretary of the Gas Company an intimation that the testing-place we had prescribed was in readiness for our examination; and we should then go down and examine it. We might find one or two things not satisfactory, and require them to be remedied, when we should go down again.

Is it, in your judgment, a matter of importance that the walls and ceilings of the testing-places should be coloured in any way?—I think not, if the room is well darkened. You can provide, with black screens on the photometer itself, for the shutting out of extraneous light from the surface of the instrument.

Using such precaution, is it not a matter of importance that the walls and ceilings should be darkened?—Personally, I have never thought it of importance. The walls become black when the room is darkened.

In the South Metropolitan district, there appears to be a large area where no testing station is provided. Do you think it necessary that further testing-stations should be established in the outlying districts, in order that the consumers may be assured that the gas supplied to them locally is of the quality prescribed by the Act of Parliament?—Yes; I think there should be a testing station not very far from the places where gas is supplied. We are sometimes asked that testing-places should be supplied; and sometimes we have, on our own motion, prescribed additional testing-places. So far as my knowledge goes, I should not like to say that the testing-stations are sufficiently numerous. There might be room for another; and I should not like to say that we have reached finality in the matter. It is our duty to prescribe fresh testing-stations when they are required; and we do so from time to time.

Mr. Nicol: You say that the first testing-stations selected were not 1000 yards from the works, and that that policy of yours was under powers now repealed?

Witness: I am not sure whether that is right. I think it is as nearly as may be 1000 yards. That is now repealed.

By Act of Parliament or by the Board of Trade?—I believe the change was made in an Act of Parliament.

When the change was made, were future stations put in the power of the Referees?—Yes.

So that you have the power of selecting additional stations wherever you think them desirable?—Yes. If there are not sufficient testing-stations, it is our fault, and we are responsible.

The matter is one for your discretion?—Yes. The reason for not being always ready to comply with suggestions, is our knowledge of the considerable expense thrown on the Gas Companies by the provision of these testing-stations.

Do you think it would be desirable that testing-stations should be established anywhere, at any point, over the areas covered by the three Gas Companies—that they should be allowed, if applied for?—I do not think it desirable that there should be a large multiplication of testing-stations such as now exist; but there is the other question to consider—viz., whether it is desirable that testing at other places than at the stations which now exist should be allowed.

Have you read the Bill?—Yes.

In part 2, there is a section which says that any Gas Examiner may at any time make, at any place within the districts supplied by any of the Companies, tests for ascertaining whether the illuminating power of the gas supplied by such Company at such place is that required by law. To a large extent, the Gas Examiners, if that clause is accepted, at any place over the whole area, could go with their portable instrument, and set up a testing-station?—I should not describe it as setting up a testing-station, but as making a test.

Do you think it would be desirable and just that a policy such as this should be adopted?—I think that, if it were adopted, there should be a limitation. I do not think it fair to a Gas Company that tests should be made at the extremities of a district, or at places where the gas supply is very small, and where there is a possibility of the illuminating quality becoming vitiated. The power is one which might be abused if it was as large as the Bill proposes. I do not say that it would be abused, because I consider that the officials of the London County Council would consider it unfair to take extreme cases. Short of that, I do think that testing from place to place would give useful information as to the quality of the gas supplied that cannot be obtained by the present system.

Do you think these testing-places should be at reasonable distances in the area, so that you should not crowd the district with them?—Yes. For example, I think that the system of going to board schools is a good one. These seem well-chosen places. They are generally in populous parts and leading thoroughfares, where there are large gas-mains.

A town hall would be a good place?—Yes; anything of that kind.

Take the works at Beckton, which are comparatively new, do you think that the gas supplied through large new mains from such works would be more likely to retain its illuminating power than gas supplied through the old mains of the Gaslight and Coke Company and from old works?—No. I do not think that the gas travelling, in the short time that it takes it to travel, would be different coming through old mains than it would if it came through new mains. I am not aware of any difference in the quality of gas being due to the age of the mains it passes through.

Mr. Stanley Leighton: Are the testing-stations intended to secure 16-candle gas for all the consumers?

Witness: That is a question for the Committee.

Do you think that the test made by a portable photometer is a fair one?—Yes; if the instrument is rightly used—that is to say, if it is used in a place free from draughts, and under proper conditions as to light.

Is the expense of the moving photometer trifling?—Quite.

Is the exaction of penalties in the discretion of the Gas Refereès or the County Council?—The County Council have to sue for penalties before the Magistrate.

But it is in their discretion whether they shall sue or not?—Yes.

Therefore it is not obligatory to penalize the Companies, even if the gas is below the standard?—It rests with them to take proceedings.

Mr. Nicol: What are the powers of the Gas Examiners—they get instructions from you?

Witness: Yes. We lay down rules that are printed and published.

From time to time you vary the instructions?—Yes.

And are the changes based on the reports you receive from the Gas Examiners?—The changes we make are changes intended to improve the system of photometry. The system of testing by candles was very imperfect; and we have been making efforts recently to substitute the new mode, and with it some other things that we thought desirable. Our object has been to ascertain more accurately the quality of the gas at the testing-places. Our instructions have had this object in view. As to our authority, it is limited to prescribing the modes of testing. We have nothing to do with the results of the testing.

Your tests are in the interest both of the Companies and of the public?—Yes. Our object is to make the testings as perfect as possible.

For the protection of the Companies and the consumer?—Yes. An improvement in the testing would have both effects, and the gas would be more truly returned.

By Mr. Emmott: He saw no reason, in physics or chemistry, why, over a long period of time, the illuminating material should have less effect if passed through a small main some distance from the gas-works than if passed through one near the works. No doubt temperature might have an effect on the hydrocarbons in the gas. It might for a short period of time, in the cold weather, cause a temporary depreciation of the gas, owing to its being passed through small pipes; but in the warm weather, the condensation would be dispersed, and the enriching of the gas might be more than was necessary. Chemical analyses of the gas might be made; but he thought that the photometric test was a better method of ascertaining the quality. Different methods of

enriching gas might lead to variations in its illuminating power. It had been stated that the gas supplied at the fixed testing-stations was better than that furnished to the rest of the districts; and this would seem to be borne out by the results taken from particular photometers. He had, however, not investigated the matter. He should not expect to find any difference in tests which were made of gas coming from a small main and that coming from a large one.

The CHAIRMAN: In your opinion, the present testing-stations are not really a guarantee that the gas all over the area of supply will be up to the parliamentary standard?

Witness: That is my opinion.

Examined by Mr. TALBOT, through the Committee, witness said that section 17 of the Act of 1880 provided that if the Chief Gas Examiner was satisfied on appeal that a defect in the gas was due to unavoidable cause or accident, the Company would be held blameless. This, he thought, would meet any difficulty which might arise through deterioration of the gas in consequence of temporary cold weather.

By the CHAIRMAN: It was possible for a deterioration in the illuminating power of gas to take place in cold weather, owing to condensation of the richer parts of the gas.

Mr. BAGGALLAY: The Gas-Works Clauses Act Amendment Act of 1871, section 12, prescribes the number of candles illuminating power, does it not?

Witness: The Gas-Works Clauses Act has only to do with testings made in connection with other than the London Gas Companies. London cannot be regarded as being under that Act.

Do you know this question has come before the Courts?—I do not.

You do not know what the decision of the Courts has been as to the applicability of that Act to the London Gas Companies?—I do not.

Mr. BAGGALLAY: Then you may take it from me that the Act does apply to the London Gas Companies. That being so, is it not the fact that the illuminating power of the gas has to be ascertained at the testing places prescribed in the Act?

The CHAIRMAN: That goes beyond the Referees' province.

Mr. BAGGALLAY: I want to see what they test for. My point is that the Gas Companies are bound to give the illuminating power at the testing-place, and not at the point of consumption.

The CHAIRMAN: The witness, I think, has said that that is a matter which rests with the Committee.

Witness: I did not understand that it was a question I declined to answer. I should like to say that I think the question is of the highest importance, and one that I hope the Committee will decide—namely, whether the obligation resting on the Companies is only to supply gas of the prescribed quality to the testing-station, or whether their duty is to supply it throughout their entire district. I give no opinion upon the point; but I think it is a question of the greatest importance.

Mr. BAGGALLAY: That will be a question as to the proper construction of the law.

Witness: Quite so.

You would not ask the Committee to decide a question of law?—I would not ask them to do so.

The Gas Referees are not restricted as to the number of testing-places they shall prescribe?—No. I do not know whether or not they are compelled to see that one is established in each gas district; but if there is one, they may have as many more as they like.

Do you attach any importance, in making your tests, to darkness of the room, freedom from draughts, and temperature?—I should in extreme cases attach some importance to these considerations. For instance, it would be impossible to take any testings at all in some conditions of the atmosphere.

Lord R. CECIL: Take the question of the possibility of the deterioration of the illuminating power of gas, owing to its passing through small pipes rather than large ones, is it not the fact that naphthalene is deposited in small pipes in certain conditions of temperature?

Witness: Naphthalene is deposited; and I have no doubt the temperature of the pipe is one of the conditions affecting the deposit.

If it is deposited, does that diminish the illuminating power of the gas?—Not generally. The minimum amount of naphthalene that can remain at an ordinary temperature is not such as to affect the illuminating power.

Does it not absorb the hydrocarbon which constitutes the illuminating power of the gas?—I do not know that that is the case. I should doubt its being so.

In reply to further questions, witness said that the entry of air through a leaky gas-pipe would affect the illuminating power of the gas.

The CHAIRMAN asked, as to the treatment of the delicate instrument by which gas tests were made, whether the Examiner would not protect it from draughts as much as he would protect himself.

Witness replied that they would need to take more care in avoiding draughts, for the sake of photometry, than they would take for their own comfort.

Lord R. CECIL asked if all the walls were blackened in the rooms used for testing purposes.

Witness replied that he did not think so; but he was not quite sure.

Lord R. CECIL: Do you not know that all the rooms used as testing-stations in the South Metropolitan Company's district have their walls blackened?—Perhaps so. The rooms are blackened in some cases; but I do not think the blackening is universal. We—the Gas Referees—never prescribe the blackening of the room as a condition of the test.

Have you ever taken part in testings with a portable photometer?—No; I have not.

The CHAIRMAN: Have you, as Gas Referee, the power to require the Gas Companies to give you information as to their method of laying the mains, and of diverting the mains and the flow of gas from one district to another? What I mean is, have you the power of making inquiries so as to enable you to protect the consumers from manœuvres of this kind?

Witness: Practically, no. No one knows precisely where the gas comes from.

Lord R. CECIL: Do you think that, under the Bill, the testing arrangements would result in requiring the Gas Companies to furnish a higher illuminating power than they do at present?

Witness: That, again, must depend on the accuracy of the information which has been obtained on the subject.

Assuming that the gas which travels through small pipes does lose in illuminating power, then, apart from all questions of the manipulation of gas, the provisions of the Bill would require the Companies to furnish gas of a higher illuminating power than they are at present required to do. Is that not so?—I see no reason to think that the service-pipes through which the gas would travel to be tested (say) at a board school, would be smaller than the service-pipes through which the gas now travels to the testing-places.

Do you think that the pipes that go through the board schools are of the same size, and the gas is brought in under the same conditions, as in the case of the testing-stations?—I know of no difference between the mains at the board schools and those at the testing-stations.

Do you think enrichment is or is not a desirable thing?—That touches another large question which, I think, the Committee will have under consideration later on.

The CHAIRMAN: Does not your right to instal a testing-station at any part of the district involve the obligation on the Companies to provide, in all portions of their area, gas up to the parliamentary standard?

Witness: If we could reasonably very largely multiply the number of testing-places, I think it would be so—if there were not some economical objections which I sympathize with on behalf of the Companies. If we could put five times as many testing-places on the map as there now are, I think we should go a long way towards meeting what is now desired.

Would not the enriching of the gas by a Company in such a way that the enrichment would be condensed, and therefore fall, after it had travelled 5000 yards (causing the gas supplied beyond the 5000 yards to be of an inferior quality), be an injustice to the consumer at the greater distance?—If the consumer is entitled to gas of the quality named. It must turn upon that. It would not be an injustice if the Company are correct in the contention that their obligation is only to supply gas of the right quality at the testing-station.

Would it not be a delusion to say that 16-candle gas was being supplied when, as a matter of fact, it was only 16 candles at a distance of 5000 yards—when, to the knowledge of the Company, at a distance of 10,000 yards condensation would have taken place and the quality deteriorated?—I think so, on this supposition. It all turns on the obligation of the Companies.

By Lord R. CECIL: He thought enrichment was necessary, while the Companies were under their existing obligations.

Lord R. CECIL: Supposing you were creating a new system, would you provide for enrichment?

Witness: That must depend on whether in the future the Companies are to be required to supply gas of the same quality as at present.

You assent to the view that, if they are required to supply 16-candle gas in this way, it must be done by enrichment?—Yes.

Do you think that is a desirable thing?—It is a necessary thing.

By Mr. DANCKWERTS: He could not say certainly what would be the candle power of gas produced from ordinary coal; it would be about 14, or rather lower. Very likely it would cost more to enrich gas by a second candle power than to increase it by the first, and still more to add a third candle.

Mr. DANCKWERTS: Would it not be more in the public interest to get a cheap gas produced without enrichment, and to use a better class of burner, and so get a higher degree of light?

Witness: That is the object of the South Metropolitan Bill. I am inclined to think so.

This question of candle power is closely bound up with the cost of production and price of gas?—They are all connected.

Did the illuminating power form part of the settlement of 1876?—Yes.

When the question of the standard price, and all that sort of thing, was considered, and the price was fixed?—No doubt, the price fixed would have been different if the illuminating power agreed upon had been different.

Then, I take it, your view is that anything which would compel the Company to supply a higher quality of gas would necessarily affect the settlement come to as regards price?—Provided the Companies are now fulfilling their entire obligation. It would really depend upon whether, when this agreement was arrived at, it was intended that the Companies should supply gas of the prescribed quality throughout the district. If the only effect of the change is to secure that the Companies do so, I do not think any cause would have been made out.

The real practical effect of the Bill is that, if the testings are made as proposed by the measure, then the Companies can be penalized?—As upon the official results now.

At present, there is nothing to prevent the London County Council or any other person testing the gas?—That is so.

But they cannot get a penalty—that is the sole object of the Bill?—I do not think it would fairly represent the object of the Bill to say it was to penalize the Companies.

This peripatetic photometer would penalize the Companies for defective quality of the gas supplied at any point which the Examiner chose to select?—If the gas at such a point were found to be below the quality prescribed by the Companies' Act.

Would not the effect of this peripatetic testing be always to ascertain the quality of the gas, not as made and distributed by the Companies, but as made by the Companies after undergoing the effects of local influences?—The effects of distribution—not as made, but as distributed.

Supposing that, in the mains of any Company, the gas was really of the statutory quality, after passing through the consumers' service-pipes, and by other accidents, it may lose its power?—It might; the consumer might get less pure gas.

Are you aware that the settlement of 1876 was not that 16-candle gas should be supplied to every consumer, but that 16-candle gas should be made and supplied at the testing-stations?—I have never understood that to be the intention.

But supposing that is the law, the effect of this Bill would be to completely unsettle that?—The effect would be to provide more complete security for the supply.

The result would be that the Companies would have to be prepared with gas at every point where there might be a possible testing of it?—If the obligation of the Companies was to supply gas of the prescribed quality only at the prescribed testing-places, this would increase the obligation.

Do you know, in regard to every increase of price that six parts of the

increase are borne by the consumer and one part by the shareholders of the Companies?—I do not think that is a complete account of the matter. When inferior gas is supplied, the consumer uses a larger quantity. Gas of 14-candle power could be supplied more cheaply than 16-candle gas.

If 14-candle gas, with an improved burner, will give the consumer as good results as enriched gas with an inferior burner, such as is now in common use, is it not best for the consumer that the 14-candle gas should be supplied?—I think so; but there is more to be said about it than that. There is a question of the initial price of the improved burner, the stability of mantles, &c. The old-fashioned method of enriching was by cannel gas; the modern plan is by using carburetted water gas. The three present Gas Referees are chemists.

Counsel was proceeding to cross-examine witness with regard to the qualifications of the Referees, when

The Chairman informed him that he was not entitled to inquire further on the point.

Mr. Danckwerts said that, by the Acts under which the Referees were appointed, it was the duty of the Board of Trade to select three competent and impartial persons, one at least of them having practical knowledge and experience in the manufacture of gas. He wanted to call attention to the fact that the Board of Trade had continuously honoured that enactment in the breach.

The Chairman: That is entirely a question for the Board of Trade.

Mr. Danckwerts: It is one of the difficulties the Companies have to labour under.

By Mr. Nicol: It was quite impossible for the Companies to supply 16-candle gas from ordinary coal. The Companies adopted petroleum for enrichment purposes because of its cheapness; and gas so enriched lost its illuminating power as it travelled along.

Mr. Danckwerts: Cannel coal, I may say, is worked out. There is none.

The Chairman: I know places where it is being got now.

Mr. Danckwerts: The supply is so limited that you cannot obtain any quantity.

Dr. *Frank Clowes*, examined by Mr. Talbot.

Witness said he had been Chief Chemist and Superintendent Gas Examiner to the London County Council since 1897, when he succeeded Mr. Dibdin. He considered the present system of testing at fixed stations insufficient. It did not afford any satisfactory indication of the quality of the gas supplied over the County of London; and certainly it did not guarantee a uniform supply. He continued, on attaining to his present position, the work in which Mr. Dibdin had been engaged; and he also agreed, without having had knowledge of testing by the portable photometer, to undertake that work also. In stations, the result of the work had been, generally, to show that the gas furnished had been of the standard power, or even slightly above it; but his experience with the portable photometer, in by far the majority of the tests outside the fixed stations, showed that, not only was the gas below 16-candle power, but below 15·5 candles—the limit not implying forfeiture. The tests were all according to the requirements of the Referees, and were almost invariably at places where the consumption was large. Taking the tests over the whole district, there was a constant depreciation in the gas. The falling off in quality shown by the portable photometer had gradually increased. Out of a total of 162 tests, 82½ per cent. were below 16 candles. Taking the whole results for the year 1899, the total number of tests was 200, of which 90 per cent. were below 16 candles, and 88 per cent. below 15·5 candles.

By Mr. Nicol: There were twenty fixed testing stations in the County of London.

By the Chairman: The South Metropolitan Company in 1899 stood in regard to tests in a very different position from the Gaslight and Coke Company. In that year, the number of tests of the South Metropolitan gas above 16 candles, or between 15·5 and 16 candles, were none; between 15 and 15·5 candles, 5, or 11 per cent. of the total number of tests; between 14 and 15 candles, 22, or 50 per cent.; between 13 and 14 candles, 15, or 33 per cent.; between 12 and 13 candles, 3, or 6 per cent.

Examination continued: At the same time that they were making these tests at various places, they were also comparing the results with those of the official tests; and he did not remember a case where the gas was found, officially, to be below 15·5 candles. The portable photometer, when worked beside the fixed instrument at the testing-station, gave the same results as the fixed instrument. A number of gentlemen who would be called as witnesses had the previous night been given experience in regard to testing. An ordinary fixed station was selected; and, at three board schools in the near neighbourhood, between the station and the gas-works, portable photometers were stationed. The fixed station was at No. 99, Blackfriars Road, in the South Metropolitan Company's area; and the Examiner gave notice that he would make the official test not before 6.45. The instrument was prepared in the usual way; and at 6.30 the test was made—the result being to indicate gas of 14·9-candle power. At 6.50—five minutes after the official time for testing—the illuminating power was 16·4 candles. The party then went to the board schools, where the portable photometers were used, and returned to the fixed station, where, at 9.15, a test gave 15·9 candles, and another, at 9.30, 17 candles. The report which witness had received from the Gas Examiner (not of the whole tests, but of the earlier ones) showed 16·4 candles. Going to the board schools, the first visited was that at Marlborough Street, where, at 7.15, the test showed 13·9 candles. At that test, the room was closed, and, in his opinion, in the most suitable condition for testing. As some suggestion was made that draughts might seriously upset the reading of the instrument, all doors and windows were opened; and ten minutes after, the other test—when there was a sort of hurricane blowing, the party having to put on their overcoats and hats, and turn up their collars—showed 14 candles. At 7.35, at Pocock Street School Room, the test gave 14·8-candle power. He explained that by "test," he meant a series of which the average was taken. At Holland Street, at 8.0, the test showed 14·2 candles; and another in the same room, but with all the windows and doors open, gave 14·6 candles. These figures he could personally vouch for. Between the 19th and 24th ult., experiments were made with regard to the statement that gas lost in illuminating power as it travelled from the works. They selected Brixton Road—that being, according to the best information they could obtain, supplied by one continuous main of the South Metropolitan Company. The first test made was at Hackford Road School, 1 mile from the works, and 0·2 mile from the main; the second, at Stockwell Road Board School, 2 miles from the works, and ¼ mile from the main; the third, at New Park Road Board School, 3 miles from the works, and quite close to the main; and the fourth at Edgington Road Board School, 5 miles from the works. Tests were made each day; and the averages were as follows: Hackford Road, 12·5 candles; Stockwell Road, 13·3 candles; New Park Road, 13·8 candles; and Edgington Road, 13·8 candles. Therefore, according to these tests, the gas did not depreciate in travelling 5 miles.

The Chairman: Can you give us the tests taken at the station at the same dates. This is worth nothing——

Mr. Balfour Browne: And it can be worth nothing, because these gases came from entirely different works.

Mr. Talbot: That is one of the difficulties we have with regard to the whole subject—there is no reason why the official testing gases should come from different works.

The Chairman: Can we get to know from what works the gas was supplied in this main road on these days and hours, and the result at the testing-station where the test was applied to the same gas?

Mr. Balfour Browne: I am told the Company cannot tell you, and do not know.

Witness: I can say what the station test was. There was no forfeiture attached; so that it was over the standard. Continuing, witness said in some cases they had had 12 or 13 candle gas almost under the walls of the producing works, and immediately round the fixed testing-station, and then had 16-candle gas at the extremity of the district. It was this sort of result which had led the County Council to promote the Bill. Stations were sometimes closed for considerable periods. One, with the consent of the County Council, was closed in June last, and not opened again till March 29. There might be explanations; but he held it to be desirable there should be some method of testing to supplement a closed station. The method suggested in the Bill would enable the consumer to have tests made. Under the proposed condition—viz., that the Gas Referees should make themselves responsible for the methods to be used—there would be absolute fairness. The County Council did not say the testing-stations should be largely increased if the portable photometer were adopted.

Cross-examined by Mr. Balfour Browne: The Bill did not propose to supersede fixed stations altogether. The suggestion was that they should serve as centres; and that in each there should be a photometer of the new description.

Mr. Balfour Browne: Do the tests you have made, to your mind, show that the Companies have been fraudulently manipulating the gas?

Witness: I make no allegations. They are facts.

I want to know what inference you draw?—I draw no inference.

What inference are the Committee to draw?—The Committee will draw their own inference.

I concede two things—that if the gas was sent out of the works of the right illuminating power, it may either depreciate by something between the works and your test, or that you might suggest that the test at the works or near the works was fraudulently got. Which are you suggesting?—Our tests I am prepared to stand by.

Are the tests at the testing-places also accurate?—Yes.

I want to know the different circumstances to account for that?—I cannot account for it. On it being suggested that if the gas were exposed in a small pipe to cold that would make a difference, witness said he was not prepared with any explanation.

Do we understand that the present system of testing is, in your view, entirely illusory?—I am quite sure that the gas consumers round the testing-stations are not usually getting the gas which the station is furnished with at the time the official test is made. The portable photometers and the other testing photometer were said by the Gas Referees to be both accurate.

Cross-examined by Mr. Danckwerts: The results of the tests were much more in favour of the Gaslight and Coke Company than of the South Metropolitan Company. His position was that of Superintending Gas Examiner; but he could indicate no Act under which his appointment was directed to be made. He agreed that the Examiners had to be impartial persons. He could not give the number of times the Gaslight and Coke Company's gas had been found deficient at the fixed testing-stations. It was put to him that in five years there were only sixteen such occasions; appeals being lodged in each. The result was that two only were sustained. Witness said it was quite possible; but he did not know.

Mr. Danckwerts: Do you suggest that the gas which is supplied to the testing-stations is a different gas from that supplied to the places where you test with your travelling photometer?

Witness: I have absolutely no knowledge.

Is it possible?—I cannot say what the Companies do.

Supposing your testings are what you say they are, and supposing the official testings of gas are what they are, what causes for the difference can you suggest beyond these: (1) that a better gas is supplied to the testing-stations than is supplied to the rest of the district; (2) that there are some local conditions which vitiate the test; and (3) that there is something wrong with your travelling photometer and the conditions under which it is used. Is there any fourth suggestion you can make?—I have no suggestion to make.

You are a practical man. Is there any fourth way of accounting for the difference?—I am not prepared to account for it.

Supposing those are the only three possible things you can consider, does it not occur to you that it is very likely something takes place between the main and your photometer, which affects the quality of the gas, or that the conditions under which your travelling photometer tests the gas do not give real results?—I am quite prepared to say the portable tests are as accurate as any photometer tests can be.

Further cross-examined: In one case, whether there was a hurricane or not made no difference to the tests. Asked to account for this, witness said again he could only report the facts. It being suggested that, with this delicate instrument, if once the conditions necessary to get an accurate test were disturbed, it did not matter how much the conditions were worsened, witness said the results he reported were arrived at with the greatest possible care. The test made with the "traveller" was with gas which had come through a service pipe. He had made no application to the Company for permission to test gas from the mains direct.

Mr. Danckwerts said he suggested that the whole of the experiments witness had made with the travelling photometer were vitiated by the fact that the gas tested was not gas as it existed in the mains, but after it had passed through a consumer's pipes.

Mr. Rigg then put a number of questions to witness, with the view of showing that the Bill would give the County Council powers in the City, and as to the conditions in the City; but witness said he knew little or nothing about the City. He was prepared to maintain that very often the best gas might be the cheapest. He knew there were 7000 gas-engines in London—1500 of them in the City alone.

The Chairman, replying to a question by Mr. Danckwerts, said that the authorities had the power to test *ad libitum*.

Mr. Pope remarked that the Companies had the right to be present at the tests, if they chose, and to know where they were to take place. If they intended to be present, the Companies could insist on having notice given.

The Chairman: Notice is only given when the Company require it?

Mr. Danckwerts: That is so.

Mr. Talbot said there was no intention in the Bill to give the County Council power to examine gas in the City, as was shown by clause 5. But if clause 5 was not sufficient, it should be altered, or a proviso should be inserted to show that the County Council did not mean to trench upon the domain of the Corporation. But the Bill was only permissive in that respect. It would not hurt the Corporation to say that the County Council Examiners should have power to examine the gas in the City whenever the Corporation chose to allow them.

In reply to Mr. Nicol, witness said he was largely responsible for the preparation of the Bill. As to the discrepancy which had been found to exist between the results of the testings at the fixed stations and those with the portable photometer, he said he had not been prepared to find it. The discrepancy was found by all the Examiners, and it was pretty usual to discover it.

Mr. Nicol: In your report to the County Council, you did not make any comment on that?

Witness: Absolutely none.

Should not you have done so?—The only suggestion I made was that evidently the testing at the fixed stations did not ensure to the consumers gas of 16-candle power.

How can you account for the same kind of instrument at the two classes of testings giving different records?—Because, as I say, the consumer is not receiving gas similar to that burning at the fixed testing-station.

Can you give no other reason?—I gave the Council no reason; and I wish to give the Committee no reason. I think the Committee should form their own conclusion.

There is running through this evidence nothing certain, but an amount of, I will not call it insinuation, but construction thrown on it, that for some reason or other different gas is sent over the areas you tested to that sent into the fixed testing-stations; the latter giving the same results as regards illuminating power, whether tested by the photometer of the fixed station sanctioned by the Referees or by your portable photometer?—The results at the fixed station are given as the outcome of statutory requirements. Other tests have been made; and it seems to me desirable that a Parliamentary Committee should know the result of them. I have stated what the results are; and there I leave it.

Do you suggest that the gas tested at the board schools is different gas to that tested at the fixed stations?—I do not suggest anything. I do not know anything. I am told that I am wrong when I venture an opinion as to underground mains; and I cannot pretend to have any knowledge as to underground gas.

Then you only came here to speak as to the accuracy of the figures you have given us?—That is all.

Mr. Stanley Leighton: The Companies say they are not bound to give the same gas at the testing-stations as they do to the public.

Witness: I believe they say so.

By the Chairman: He thought the discrepancy in the quality of the gas as shown by the two testings was greater now than it was in the time of his predecessor.

The Chairman: The portable photometer used in former tests, which, on comparison, you find to give the same results as the official photometer, is the one you have used in recent investigations at the board schools?

Witness: Yes; it has been in use with others. I took one over from Mr. Dibdin; and we have had three more made.

It is the same class of machine?—Yes.

Equally reliable?—Yes. We have used two of the old bar type, and two of the table type.

Do you concur with the evidence of the previous witness that the atmospheric conditions in the room in which the test is conducted, and the temperature, would not be likely to affect your peripatetic photometer?—Yes. The temperature we can correct; and the atmosphere in the room would not vitiate the test, I should think.

Then you maintain that, for practical purposes, the tests you have made at different times in the board schools and other public buildings have been conducted under as safe and secure conditions as those made at the fixed testing-stations?—I quite maintain that.

That is to say, the difference in conditions as to draughts and atmosphere would be infinitesimal in their influence on your tests?—I should think so.

We had it from the last witness that rich gas might be impoverished during its progress from the centre of production to the centre of the supply area. Do you agree with that?—I can form an opinion on that as an outsider; and I have conferred with those who know. They have told me that they have known gas to travel 6 miles through the pipes without any loss of illuminating power. I must leave it to others to give the Committee the details.

The Chairman asked whether, that being so, witness could explain the phenomenon spoken to—that in a certain case the gas rose in illuminating value as it progressed from the works.

Witness said he could not explain it.

[During the evening the Committee availed themselves of an opportunity afforded by the parties to inspect the gas-testing appliances spoken to by the witnesses. The photometer was put up in one of the apartments of the House.]

Friday, April 6.

Mr. Talbot handed in figures of testings at the official testing-stations in the Brixton Road and Blackfriars Road, corresponding to the times at which the peripatetic tests referred to by Dr. Clowes were taken.

Dr. *Clowes* re-called.

Witness explained a cartoon giving a rough diagrammatic representation of the tables furnished to the Committee the previous day. The cartoon showed the various producing works, the testing-stations, the places where tests made by the portable photometer satisfied the statutory requirement, and other places (indicated by red dots) where the tests were below 16 candles. The red dots, however, did not all represent cases where a forfeiture would have been exacted from the Companies; about 2 per cent. represented tests between 16 and 15·5 candles, which were not subject to forfeiture. He pointed out that the red dots were generally pretty close to the testing-stations and the works of the Companies, and not by any means unfairly chosen by being on the confines of the gas districts.

Mr. *Otto Hehner*, examined by Mr. Worsley Taylor.

Witness said he was one of the Gas Examiners originally appointed by the Board of Works, and subsequently by the London County Council. He had made frequent use of the apparatus prescribed by the Gas Referees, and subsequently of the portable photometer. They were identical instruments, and gave identical results. He was clearly of opinion that, with the portable photometer, under reasonable circumstances, accurate results could be obtained. He had read the photometer under ordinary conditions, in a whitewashed school room, and then with black boards put up so that there should be no influx of light from the outside; and he found these conditions made no difference. He had also made experiments with the instrument in a room in the ordinary way, and then after the doors and windows had been opened; and the results were practically the same.

The Chairman: What do you mean by "practically"?

Witness: In one experiment, I found two-tenths of a candle less.

Further examined by Mr. Worsley Taylor: Under conditions in which a fair-minded man of experience would use it, the portable photometer was to be relied on to give a trustworthy test—just as much as any station.

Mr. Worsley Taylor: Does gas lose seriously in passing a considerable distance through mains?

Witness: I have made some tests in that direction in North London on the mains of the Gaslight and Coke Company, and in South London on the mains of the South Metropolitan Company; and I found no material loss. I have, if anything, found a small gain, but within the limits of experimental error, when following a main for 5 miles.

You found no loss in following a main 5 miles?—No. If anything, there was a small gain. One evening, starting with the mains not far from Kennington, I found 13·4 candles, and tracing the main as near as I could to Streatham (about 5 miles distant), I found 13·6 candles, which was practically the same result.

The Chairman: How did you get to these mains?

Witness: By photometers fixed up in board schools, following as near as we could the main, and taking gas presumably from the same main.

Mr. Worsley Taylor: Do you say that the conditions for testing secure to the public uniformity in illuminating power?

Witness: From recent experience I have had, I think they do not. I formerly thought they did.

So that, in your view, assuming that the object be to protect the consumers, some fresh legislation of some kind or other is necessary?—It is. I have also made experiments in conducting gas through 200 feet of ¾-inch pipe. I found that there was no difference between the gas so conducted and that carried through a larger pipe; but when I immersed the 200 feet of pipe in ice, it did make a difference. The illuminating power fell from 16·8 to 16 candles. With the ice, I froze some of the illuminant out of the gas.

The Chairman: Was the whole of the 200 feet of pipe in the ice?

Witness: Yes; in the shape of a coil. I also made an experiment by passing gas through ordinary gas-meters, to see if it loses anything. I tried both wet and dry meters. I found it made no difference whatever, whether the gas was taken into a dry house-meter or a wet. I afterwards put an additional wet meter to the photometer, so that the gas passed through three meters—the dry house-meter, the photometer meter, and this additional wet meter. It made no difference whatever.

Mr. Worsley Taylor: What meter did you use—a new one containing fresh water?

Witness: No; one which had been used before. If the meter was freshly filled with water, it would make a difference; and if a perfectly new dry meter were used, it would go against the Company.

By the Chairman: As to the freshness of the water in a wet meter, the question was one of saturation of the water with the gas.

Mr. Worsley Taylor: Of course, all possible sources of error are perfectly well known to yourself, and to everybody else equally conversant with gas testing?

Witness: Yes. If it were known that a new meter had been fixed at a certain house, it would be unfair to pass the gas through it for testing purposes.

And, as a fair man, you would be careful to eliminate all sources of error?—Certainly. I should inquire myself as to when the meter was put up, and as to the pipes. I should see that the pipes did not go too far over ground, and that they were not immersed in ice.

The Chairman: If you were going to new premises, you would do that?

Witness: Yes.

If you were going to a board school where you had been before, and the conditions were the same as before, you would feel no hesitation in making the test?—That is so.

Mr. Worsley Taylor: Do you think it right that security should be taken against errors?

Witness: Yes; I think so.

You said you had followed as well as you could the gas from the works to the testing-station?—Yes.

Give us the result?—I made an experiment on April 3. I followed out as nearly as I could the flow of the gas from the Bankside works of the South Metropolitan Company. I did not go alone, but was accompanied by Dr. Frankland, Messrs. Grimwood, senior and junior, and Mr. Dibdin—

all experienced Gas Examiners. I took the first test at 7 o'clock, at the Marlborough Street Board School. We had a portable photometer of the bar type; and we found that the gas was of 14·2-candle power.

What sort of room was it?—A nice board school room, fairly high, with good air in it, and no unreasonable draught.

Do you know when the room had been last used?—I do not. It was about ¼ of a mile from the Bankside works.

Where did you get your gas from?—From a pendant in the room, joined with metal tubing. It is known that india-rubber, especially if new, absorbs some of the illuminating power of the gas.

What did you do next?—I went to the official testing-station close by—No. 99, Blackfriars Road. We made a test there at about 7.25, or a few minutes later. There we found the gas had an illuminating power of 11·3 candles. The testing-station was fitted up in accordance with the Gas Examiner's requirements. We all took readings. The flame which was burning was quite small. Anybody without a photometer could see that the gas was vastly deficient in illuminating power. Continuing, witness said the illuminating power was extraordinarily bad; he never saw anything like it. They naturally, therefore, made a further test. An official test was due about 8 o'clock; and while waiting till then, the illuminating power increased. At 8.8, when the test was made, the illuminating power was 15·82 candles. This was the figure of the official Examiner—witness being behind him, and checking his readings of the photometer, so that he knew they were correct. To make quite sure, witness then tested the meter and clocks, and found that the meter registered correctly, or within ¼ per cent., which was nearer than was necessary under the regulations of the Gas Referees. The party then went to the Holland Street Board Schools, which were in the shadow of the Bankside gas-works; and there, at 8.55, the reading was 15·8 candles—practically the same as at 8 o'clock. Thence the party went to Pocock Street Board Schools, which were within a stone's throw of the testing-station at No. 99, Blackfriars Road. A test with a bar photometer was made at 9.20, which gave 14·6-candle power; and another, made after the doors and windows had all been opened, showed 14·4 candles. On returning to the official testing-place at No. 99, Blackfriars Road, at 9.45, the gas looked very feeble, and gave 15·2 candle power. The gas between 9.45 and 10.10 underwent a remarkable change. At 10.10, the official test—checked by Professor Frankland and witness—gave 17·3 candles; and another, at 10.25, gave 17·6 candles. The latter was an independent test, made with the official instrument.

The Chairman: All these places are close to the producing works?

Witness: Yes.

Examination continued: In witness's opinion, further measures in regard to testing were necessary. The testing provided for in the Bill, if the conditions were fair, and if the testing was done at reasonable places, was proper to ensure that the public obtained 16-candle gas, or something approaching it.

Cross-examined by Mr. Baggallay: There must be some check on the Companies. The question of a surprise visit should have nothing to do with the matter. If a gas company bargained to supply 16-candle gas, they should do so without notice being given of an intention to test. He agreed that there was a limit in the choice of places at which testings should take place, and that conditions should be observed as to the time and the pipes through which the gas was conveyed to the buildings. In ordinary circumstances, the meter would not materially affect the illuminating power of gas passed through it, as distinguished from the gas in the main before it passed through the meter.

Mr. Baggallay: What is your suggestion with regard to the irregularities found to exist between the testings at the places where the portable photometer has been tried, and the testings in the stations?

Witness: I have the greatest difficulty in explaining them to my own mind, but they were fairly obtained. Possibly the gas did not come from the same main, though we tried to obtain it as far as we could from the same main.

Is it your suggestion that the Companies have separate mains to take the gas to a testing-place, but from which they do not supply gas to the consumers?—I do not know.

That is rather suggesting something. However, you have no evidence?—I have no evidence.

Unless there is something of that sort to explain it, you are unable to account for it at all?—I think Counsel can draw their own conclusions as well as I can.

I ask you straight, Mr. Hehner, do you, or do you do not, suggest fraud on the part of the Companies?—Not in the least.

Do you, in this particular instance which you have been going into in the Blackfriars Road, suggest any fraud?—Not in the least. I take it that the Gas Companies really say to themselves: "We are obliged to supply at the testing-stations 16-candle gas"—and they do.

Mr. Pope: That is a proposition I assent to at once.

Witness: I believe these gentlemen to be perfectly honourable. I suggest a reading of the Act of Parliament which does not commend itself to me; and I do not think it is a fair reading. They say: "We bargained to supply at the testing-station 16-candle gas; and we do it."

Mr. Baggallay: Actually, in the one station, tested with the same apparatus, under the same conditions, there was a great difference of the readings in a very short period of time?

Witness: Yes; there were 6 or 7 candles difference.

If you are not suggesting fraud, or if there is no suggestion of fraud, how could this possibly happen, unless it was due to accident?—Of course, it might be due to accident.

If it is not due to accident, must it not be due to fraud?—It is a question of fact, checked by myself and five competent colleagues. I have no conclusion whatever to form.

On the question being repeated that, if the difference in the results obtained in that short period was not due to accident must it not be due to fraud, witness was understood to reply that he would not and could not answer the question.

Cross-examined by Lord R. Cecil (who remarked that these facts had come as a great surprise to the South Metropolitan Company), witness said the test at 8.8 gave 15·82 candles; at 9.45, 15·2 candles; and at 10.10, 17·3 candles.

Lord R. Cecil: Do you, or do you not, intend the Committee to draw from that the conclusion that a change was made in view of the official test about to take place.

Witness: There was a change between 7.25 and 8.8 which was visible, not only on the delicate instrument, but to the naked eye of all——

I wish to know exactly the case that the Company have to meet. Is it your suggestion that this was done intentionally and deliberately by the Company?—I do not know.

Is that your suggestion?—I suggest nothing.

Has your evidence any relevancy to the inquiry, unless that is so?—I give the facts; and I give them as unbiassed as I can.

The Chairman: He has stated the fact.

Mr. Pope: It does seem to me to be of very great importance. You say that these tests are unsatisfactory, and that a change should be made to some extent in the system of testing, so as to arrive at a satisfactory result. The facts are very important, and we ought to consider them, and deal with them as best we may. Probably we shall be able to deal with them after the recess better than we can now, because we shall have made experiments of our own to ascertain what the actual facts are. But it is important we should know whether the inference which the skilled witness draws is that there was a change made in the gas pending the test at that testing-station, because it might turn out that such a suggestion is impossible. I do not know. If it were impossible, we might satisfy you that it was impossible. It does seem to me that, if this means anything, it means that, wilfully or accidentally, a change was made in the gas pending the official test at the station.

Witness: A change was certainly taking place in the gas.

The Chairman: I think I must rule that the witness is a skilled witness—that he is skilled in the demonstration made by the gas when it comes out of the pipe. But he finishes with the burner; he does not go down to the main. He has nothing to do with the sources of supply.

Mr. Pope: I quite agree that his investigations have nothing to do with the sources of supply.

The Chairman: The witness has given the Committee the benefit of his investigation in testing the light. I do not think he can be expected to go beyond that.

Mr. Pope: I do not think he could complete his statement by saying: "I have seen, and know, that the mains are so and so; and the thing can be done." That is a different matter. But I should like to know whether, in his mind as a skilled witness, any other explanation is possible.

The Chairman: I think it is quite competent to ask the witness what conditions, in his judgment, may possibly have caused this change.

Mr. Pope: Yes.

The Chairman: But to go as far as the motives——

Lord R. Cecil: I did not wish to go to motives.

The Chairman: I think your question does go to motive. You raised the question of fraud. Of course, motives are involved.

Lord R. Cecil: I think I did not use the expression fraud; and I certainly did not intend to do so. My point is: Does he suggest, with his knowledge of gas manufacture, that this was done purposely—that this was the act of the Company?

Witness: I cannot say in the least. I was there, and watched the flames, and saw a great change.

Can you suggest to the Committee any way in which it could have happened?—No; it may have been an accident. Continuing, witness conceded that draught, temperature, and the presence of air in the pipes might affect the illuminating power. A leak, in theory, might admit air to a main; but practically, when a leak occurred, the gas escaped, and no air entered.

Re-examined by Mr. Worsley-Taylor: In his view, there should be conditions with regard to the control of the Gas Referees, as to apparatus, the mode of taking the tests, and prescribing a certain reasonable class of places, so as to exclude parts where there were dead-ends, and so on. If a Company thought a particular test, even made under the conditions laid down by the Gas Referees, was unfair, there would be an appeal, under section 12 of the Act of 1880, to the Chief Gas Examiner; so that there would be double security.

The Chairman said he had made a note on the Bill that the promoters were prepared to give security that a class of places evidently improper should not be included. (To witness:) Are you prepared to give the Committee your idea of the cause of the changes you have observed in the testings?

Witness: I do not know what the causes were.

Do you think it possible or probable the change arose from a momentary deflection from the correct attitude, so to speak, of your instrument?—I think not. It was not a momentary observation, but the volume of flame could be seen to be altogether deficient; and the rise in the illuminating power took place quite suddenly.

Your experiment was made on the 3rd of April?—Yes.

On what other occasions have you observed so great a rise and fall?—Well, I have not been a Gas Examiner for some years now. When I was in practice, I found the gas of excellent quality from an illuminating point of view.

Might it have been caused by some incident at the manufactory?—I cannot conceive that.

Would you conceive it possible that, by any intentional act on the part of the Company, they would give a supply of gas of the quality of 11·3 candles at a testing-station, to be followed in a quarter of an hour or twenty minutes by a supply of 17·3-candle power?—I think so.

You think that could be managed?—Yes.

Your practical experience enables you to suggest that, with sufficient *mala fides*, you could produce such a result?—If you asked me to do it, I could.

Lord R. Cecil: You said you did not know how it was done.

Witness: And I do not know. But now I am asked whether I could bring about such a result; and I say I could.

Mr. Worsley Taylor: My learned friend Lord Robert Cecil asks witness if he knows how the Company could do it; and he says he does not. If anything is to turn on this hereafter, I should like the witness to have the matter clearly before his mind.

The Chairman said he had not regarded the witness's statement in the light of indicating how the Company could bring about the change which had been referred to.

Lord R. Cecil: If there is a charge brought against us——

Mr. Worsley Taylor: There is no charge.

Lord R. Cecil: Not specifically; but if there is an implied charge, it is

desirable that we should have the view of the witness put plainly before the Committee. (To witness:) Do you know how it would be possible for the Company to change the quality of the gas from 11 to 17 candles in the course of an hour?

Witness: I do not know; but I was asked whether I could do it, and I replied that I could. That is a question as to my being able to conduct an experiment; but when you ask me whether the Company have done that, my answer is I do not know.

Witness was pressed by the learned Counsel on this point, as to his view of the means by which the discrepancy had been brought about; but he said it was possible, although he did not know how it had really occurred. Witness asked the learned Counsel to put a concrete case. He wanted the question put in such a way that he could answer it.

Lord R. Cecil: I admire your caution. Take this hypothesis. I supply ordinarily at this testing-station gas of 11-candle power?

Witness: Yes.

At 7.30, I supply gas of that power. I know that the Gas Examiners are coming at 8 o'clock to make a test at that station. I desire to continue to supply gas of 11-candle power up to 7.30, and at 8 o'clock to supply gas of 16-candle power. Tell me how I can do it?—I should say this. Pass the gas through pentane; then you can get 10 or 11 or even 20-candle power.

Where should I pass the gas through pentane?—Anywhere before it reaches the photometer.

It could not be done, I presume, at the works themselves?—I do not know.

If I did it, then, at the works themselves, how could I be certain that the gas would reach the testing-station at the proper time?—I do not know; but I should say that, by putting a particular pressure on, you could make the gas reach a particular place at a particular time.

How would you do that?—I do not think I should do it at all. If I were asked, I should decline the job, and should leave the Company to do it on their own account.

Lord R. Cecil: Well, I have done my best to get an answer to this question; and I am sorry I have failed. I must leave the matter there.

The Chairman (to witness): I understood you to say to me that, with the limited practical knowledge you have of gas manufacture, you could, if necessary, produce gas of 11·3-candle power, and then in another hour produce it of 16 or 17 candle power?

Witness: Yes.

In order to do that, you would simply alter your process of manufacture—you would put your enrichment in at the hour you wanted the higher illuminant?—Yes.

That is a simple proposition, is it not?—By the increase or decrease of enrichment, you can alter the quality of the gas produced at a given time.

It is the intention of the Act of Parliament, according to your interpretation, that enrichment should take place?—Yes.

The gas could not be maintained at 16-candle power without that?—That is so.

And therefore this artifice of enriching, to maintain equal quality, should be persistently continued from day to day, and from hour to hour?—Yes.

And if you wished to secure an extra profit on your trade, you would make the condition of the gas fluctuate from time to time?—Yes.

Having that power of manipulation in your hands, could you so manipulate that you could produce the desired result for the deception of an inspector at a given hour at a given station?—I am not sufficiently practical to be able to speak with certainty as to what a manufacturer could do; but personally I do not think there would be any difficulty.

When there is a certain amount of consumption going on, and you know the speed at which the gas from your works travels to the stations, you would be able to calculate, within a reasonable limit of time, as to when you could produce these results?—I think so, although, as I say, I am not a practical gas engineer.

That is the line of action, however, that you are contemplating in your replies to my questions?—Yes.

Lord R. Cecil: This is very important to us; and I would ask to be allowed to follow it up. (To witness:) You suggest that this alteration takes place at the works?

Witness: No; I understood that a hypothetical case was put to me how the thing could be done.

And you think that an alteration from 11-candle power to 17-candle power could take place at the works?—I think it could.

Do you think it might also have been done by the manipulation of the gas in the pipes at the testing-station?—It is possible.

It might have been done practically at every one of these places?—I should think so.

The Chairman: There is no suggestion, I take it, that there has been any manipulation of the gas proceeding from the main for the purpose of examination?

Lord R. Cecil: I do not know.

The Chairman: I have not heard anything of the kind from witness.

Witness: I have not made any such suggestion. I have only given evidence as to the facts which actually came to my knowledge.

The Chairman: The witness makes no suggestion as to what was the originating cause of the variation of illuminating power in this specific case. I took him away from that subject to his limited experience as a gas manufacturer and chemist, and so on, and asked him, with his limited knowledge, whether he could say that any manipulation could take place to produce that result. He says it could.

Lord R. Cecil: And I want to ask you, in order to meet that charge——

The Chairman: There is no charge.

Lord R. Cecil: Then we want to meet the suspicion of the statement. We say nothing more than that; and we want to know from the witness exactly where he thinks this alteration could have been brought about—whether at the works, at the testing-place, in the mains, or where.

The Chairman: I think his answers all centred in the manipulation taking place at the works.

Lord R. Cecil: I want to get that clear, and whether he suggests that it could take place at the testing-stations.

Witness: I would tell you how it takes place, if I knew; but I do not know. I give you the facts that I have discovered.

We leave the facts you have discovered, and deal with you as a gas manufacturer. Do you tell me that the variation from 11-candle power to 14, 15, or 16 candle power can be produced in process of manufacture?—I think so.

And the difference can be sharply produced from one period of time to another?—I believe so; but I do not know.

And from the knowledge you would derive from inquiry as to the speed at which gas travels through the mains, you think you would be able to make the alteration in the quality of your production at the time that would just meet the requirements of the test?—Yes.

The Chairman: There is no allegation that such a thing took place. I would go farther, and say there is no insinuation of it.

Mr. Worsley Taylor: We say, in the preamble of the Bill: "And whereas it has been found that the illuminating power of the gas supplied by the said Companies in their districts generally, cannot be satisfactorily or sufficiently tested by tests made only at certain prescribed testing-places; and whereas it is desirable that powers should be given to the Gas Examiners to make additional tests of the illuminating power of gas elsewhere in the districts of the said Companies, in manner to be prescribed by the Gas Examiners;" and so on.

Lord R. Cecil: Do you think such alteration could have taken place at the gas-works, or partly at the works and partly by manipulation of the pipes at the testing-station, or wholly by that manipulation? Do you know of any practical manner by which it could be manipulated at the testing-station?

Witness: If you asked me to do it, I think I could.

Could you advise means of doing this which would elude the vigilance of people coming to inspect?—I have not made the experiment.

Mr. Worsley Taylor: All the witness comes to state is that there has been a variation at the testing-station. He comes to give the results of his experiments.

The Chairman: I do not think this important, as he is giving evidence from the limited basis of partial knowledge of gas manufacture.

Lord R. Cecil: You were dealing with a new photometer; and that at Blackfriars Road is a new one?

Witness: Yes; the reading of the new photometer is undoubtedly sharper than the old one. But I think that half-a-candle power will fully meet the difference.

Mr. *B. H. Gerrans*, examined by Mr. Bernard Wilkinson.

Witness said he was a Gas Examiner of five years' experience under the London County Council, at the Blackfriars Road station of the South Metropolitan Company. He described the duties of a Gas Examiner, and the method of making tests.

Mr. Wilkinson: It is possible, is it not, to judge of the candle power of gas merely by eyesight?

Witness: Approximately. In the series of three tests we have to make, the first very often is slightly below 16-candle power, and the two subsequent ones are above it. I have noticed the variation in the results. One may be high, and another may be low. They do not all show the same result, though the average may be 16-candle power. Between the taking of the official tests, I have seen the volume of the gas both increase and decrease. On April 3, I had to make two tests—one at 8 o'clock at night, and the other at 10 o'clock—and a third at 8.45 on the morning of April 4. The test at 8 o'clock showed 15·391-candle power. Between the 8 and 10 o'clock tests, I measured the height of the flame. At 9.15, it was $2\frac{1}{2}$ inches, at 9.25 $2\frac{7}{8}$ inches, and at 9.55 $2\frac{3}{4}$ inches. The second test was taken at 10.10; and the candle power was 16·723. I made no further measurements; and the next test was an official one at 8.45 in the morning, when the candle power was 15·876, uncorrected. The corrected average for the legal day was 16·5 candles. Judging by my observations with the eye, and the measurements I took between 8 and 10 o'clock, it was clear to me that the flame decreased in height between the two official tests. It is my experience that when I remain at the station between two official testing hours, the flame decreases. I have noticed it before. I should not say that the decrease I noted on the day I have mentioned was an average occurrence; but I have noticed such a decrease before.

Cross-examined by Mr. Pope: He did not admit that the tests were left uncorrected to save himself trouble. The tests were made according to the printed instructions supplied to the Examiners. He did not act as he had done to scamp the work.

The Chairman (examining the Book of Instructions): The number I see is arrived at by the manipulation of the barometer and the thermometer indications at the time of the test; and a number is given to be used as a divisor. This is a method devised by the Official Referees to accelerate the work of the Examiners.

Mr. Pope: Is that the book of the County Council or the instructions of the Referees?

The Chairman: It is the County Council book—an abbreviated method of doing the same thing.

Mr. Pope: Yes; a method to save trouble. (To witness:) Did you make any other tests than by measuring by a piece of paper?

Witness: Yes; by general indications. I could see by the height of the flame on the glass that it was not as high as in the photometer.

Why did you not make the experiment with the photometer?—I had to use the instrument at my hand.

You had the photometer?—It was no part of my official work to make the test between the hours of 8 and 10 o'clock.

Re-examined by Mr. Worsley Taylor: His business was only to make official tests. Between the official tests, the gas-flame was burning; and when there was considerable variation in the height of that flame, and consequently variation in the candle power, he could distinguish the fact with the naked eye, without regard to the photometer.

By Mr. Stanley Leighton: The Gas Companies were entitled to have a representative present when the official tests were made. He could not account for the variations in the light. Possibly they were due to variations in the illuminating constituents of the gas.

By the Chairman: The fluctuations he had mentioned in the height of the flame were not the rule; but he had noticed variations before. Generally the gas kept fairly constant. On other occasions, he had taken photometric tests, apart from the observation of the eye; but they were unofficial, and he had kept no record of them.

The CHAIRMAN: Can you, by memory, give us some idea as to the divergence from the standard?

Witness: Speaking purely from memory, I have found 13-candle gas, and I have found 18-candle gas.

Have you ever found 11·3-candle power?—I do not remember a case.

Have the variations been sudden—coming within the range of a few minutes or hours?—They have varied. I have seen the flame come up within (say) five minutes, from being a low flame to a very high one, and I have known it go back again, sometimes, between my official tests.

Mr. NICOL: In your experience of five years, taking these tests, can you tell us roughly what the general average candle power has been?

Witness: The official average has been over 16—probably considerably over 16 candles. There had not been more than three or four times in the five years when the official average had been below 16-candle power.

Dr. *Percy F. Frankland*, F.R.S., was next called.

He said that for 20 years he had given a great deal of attention to the chemistry of illuminating gas, and was acquainted with the portable photometer. In his opinion, it was a trustworthy instrument, and capable of giving just as accurate results as the photometer ordinarily fixed at the testing-stations.

Mr. TALBOT: You are familiar with the objections stated against it? Do you think these objections afford any reason why the portable photometer should not be used?

Witness: No. I think that attention has been drawn too much to minutiæ which have been greatly exaggerated as to the effect they have on the result. As to draught, while I admit that a violent draught would have an appreciable effect, I believe that ordinary draughts—such as occur in rooms of the character of those in which these tests are made—have no effect whatever. There cannot be the slightest doubt that the tests made with the instrument are perfectly safe and reliable. I have made experiments as to the transmission of gas through mains. I assisted at the tests to which reference has been made in the course of this inquiry, and have followed the mains and made tests from them at intervals on the way; and the result is set forth in a schedule produced. On March 22, I made a test a mile away from the Vauxhall works of the South Metropolitan Company; and I found that at that distance the illuminating power of the gas did not decline, but rather rose.

Does gas lose by travelling?—The evidence is that there is no diminution of illuminating power as gas passes through the mains. Some companies carry their gas through miles of mains from the works, which they would not be likely to do if experience showed that there was a loss of illuminating power caused thereby. We heard yesterday that one Company—the Gaslight and Coke Company—carried their mains from the Beckton works to their supply district, a distance of 10 miles; and that there is no loss of illuminating power along that distance. I believe, indeed, that the Company who carry their gas the longest distance have the best results; but I do not know that of my own knowledge. All the results that were obtained in our series of experiments (extending from March 19 to March 24) showed that the gas was below 15 candles. I have made experiments to elucidate the point as to whether the gas supplied in the neighbourhood of the fixed testing-stations is of lower illuminating power than that at the testing-stations. I went with Mr. Hehner, Mr. Dibdin, and the two Mr. Grimwoods on the evening of the day on which Mr. Dibdin gave his evidence, and made tests at the places referred to by Mr. Hehner. I made examinations of the illuminating power of the gas at all the stations.

You were in the room and heard Mr. Hehner's evidence?—Yes; I followed it, and I can say that it is absolutely correct. I made observations which closely agreed with those stated by Mr. Hehner and the other gentlemen. By the observation of my own eye, I saw the phenomena he describes at the fixed testing-station.

Has the result of the experiments you made, and which you saw made, convinced you that the present system of gas-testing is insufficient?—That is the only conclusion that can be drawn. Not only does the present system not guarantee 16-candle gas within the district, but it does not give a guarantee of 16-candle gas within the testing-station.

It merely guarantees a supply of 16-candle gas at a particular time and a particular place?—Yes.

Now as to the effect on the illuminating power of gas by passing it through an ordinary domestic meter, wet or dry; what do you say as to that?—Passing gas through a new meter, wet or dry, is calculated to diminish its illuminating power; but my impression was that passing it through an old meter would have no effect. I therefore made experiments; and they confirmed that view. And here I must say that I plead guilty to having defrauded the Gas Company, in a small way, by having taken some of their gas from the main before it had passed through the meter. We attached a pipe to the supply pipe.

The CHAIRMAN: I suppose you detached the meter, intercepted the gas, and passed it through your apparatus?

Witness: No; we did not actually detach the meter, we put in a T-piece. We found that the illuminating power of the gas taken direct from the main was 16·7 candles; and that the gas passing through the dry meter also had a power of 16·7 candles. Subsequently, we passed the gas not only through the house meter (which was a dry one), but also through a wet meter, and the meter of the photometer, with the result that we got gas of the illuminating power of 16 candles. Some time, however, elapsed between that result and the 16·7 candles result. We switched off the wet meter; and again the result was 16 candles. Then we made experiments by passing gas through 65 yards of ¾-inch piping and there was no alteration in the result. Then we placed the coil of pipe in ice—reducing the temperature to 32° Fahr.; and we got the result which has been stated.

Mr. BALFOUR BROWNE (in cross-examination): How did you get the gas from the main.

Witness: We got it from a service-pipe off the main; but before it had passed through the meter.

Distance has no effect on the illuminating power?—That is so.

On what experiments do you rely for that statement?—So far as the tests I made along an exposed line of pipes in the South Metropolitan district were concerned, there was no alteration in the illuminating power. That was the specific result I got; and besides that, I have the general knowledge that it is the practice of the Gas Companies to carry their gas through long lengths of main.

You mean when the gas is passing in large quantities. You do not mean if the gas is passing through a long length of ¾-inch pipe?—No, but 65 yards of that makes no difference.

I suppose that naphthalene would be deposited at the temperature of 32° Fahr.?—Yes.

Naphthalene itself would absorb illuminating power, would it not?—Yes, to some extent.

Your experiments were only recently made?—Quite so.

Therefore they are not the reason for the promotion of this Bill?—No; the experiments were made in order to confirm results previously arrived at.

To confirm them in their good opinion of themselves. (Laughter.) You got a result of over 16 candles in one house?—Yes; that was in the district of the Gaslight and Coke Company. Witness went on to say, in reply to further questions, that it was no use giving theories as to the discrepancies between the tests, unless they had facts to support them. He had never before this time used a table photometer. He had used the bar photometer, and had always thought it a good instrument.

As good as the table photometer?—I cannot say that. The table photometer is a much more pleasant instrument to work with. The result is arrived at much more rapidly, without the same strain on the eyes in the hands of a competent examiner, though there might be a small variation owing to the minutiæ that I referred to; but the difference in results would never amount to as much as 2 candles.

Mr. STANLEY LEIGHTON: If you tapped the gas-mains as soon as they left the works, would you not get better tests?

Witness: I should be more likely, perhaps, to get a high illuminating power result. There are methods of enriching gas which do not carry to any great distance; so that to test just outside the works would not be a guarantee that the Company were making good gas. I cannot tell you whether or not the testing-stations are connected with one another. I have no knowledge as to whether the mains go from one station to another.

You say you know from what source the gas comes to the testing-station?—I do not know it, but it was stated here yesterday that, whereas the Companies do not know where the gas comes from to the various places in the schedule, they do know where it comes from to the testing-stations. There might be a variation in the quality of the gas made at one station and at another.

Mr. NEVILLE: There is nothing to prevent the Referees ordering continuous tests (say) from 12 o'clock at noon to midnight?

Witness: I do not know that they have that right. It is arranged that there shall be three tests at a minimum distance of one hour apart; and if the average result is below the standard, the Examiners have to make a fourth test.

The Referees have power under the Act to prescribe continuous tests. Should that not be sufficient to secure a good and proper supply of gas?—I say the present system is no guarantee.

Then your complaint is not against the Gas Companies, but against the Referees for not specifying a larger number of tests?—I say that the present three tests afford no guarantee.

You do not suggest that the Referees show that they do not know their business by prescribing an insufficient number of tests?—No; I do not suggest anything.

By Mr. SNAGGE: I do not think that the fixing of a specific hour for a test is a good thing; but if a test can be taken without the knowledge of the Company you may have a guarantee.

Mr. SNAGGE: Under section 10 of the Act of 1880, there is no obligation on the controlling authority, unless a request is made by the Company, to say at what hour the test is to be made. (To witness:) Do you know that the Commercial Gas Company have never asked as to the time of the tests, and have never been told?

Witness: No, I do not.

Mr. TALBOT: That is contrary to the fact, I understand. A representative of the Company is told every day, when he comes round, about the time the test will take place the next day.

Mr. SNAGGE: I am told a man does not go round every day.

The CHAIRMAN: There are three Companies; and it is clear the practice may differ.

Mr. BALFOUR BROWNE: I shall give the Committee evidence on that point.

Mr. SNAGGE: And I shall do the same.

Mr. NEVILLE: And so far as we are concerned, we have waived our right to be present at the testing in the City; and our gas is tested at all times.

The CHAIRMAN (to witness): Have you any knowledge of the methods pursued for enriching?

Witness: Only a general knowledge.

You know the methods pursued in the trade generally?—Yes, I have a general knowledge.

You said it was possible to adopt a method of enriching which would only continue to a limited distance from the centre of production. I presume there are other methods for enriching that would continue for miles away—that is to say, that would not be condensed in process of travelling?—Yes.

Is it possible to have a system of enriching at intervals so as to produce irregularity in the gas supplied in 24 hours—different degrees of enrichment?—The amount of enrichment can be regulated at will. Continuing, witness said that at large gas-works enrichment was constantly going on, and the enriched gas could be turned on to one or other gas-holder as required.

Would it be practically possible to produce an enrichment of the gas (say) up to 7 o'clock to the extent of 14 or 15 candle power, and then from that time forward to enrich it to 16 or 17 candles at will?—Well, I have no experience of how that can be done; but I imagine that it can be done.

Could it be done so promptly and systematically as to produce the desired result at a station a considerable distance from the source of supply?—That I do not know. There was no necessity to send gas out through a holder. As it left the works where it was manufactured, or any other premises, gas could be carburetted. He knew of no gas-works in London where they had carburetted water gas, or of any instance of carburetted water gas being turned straight into a main and not into a holder.

Mr. *Isaac Carr*, examined by Mr. TALBOT.

Witness stated that at Widnes the average of the official testings of gas for the last five years showed that it was of 18½-candle power; and the price was the lowest in the world. He had had considerable experience in the examination of gas with both the portable and the table photometer, and had never been able to distinguish any difference between the results obtained with the two. In 1895 he was instructed by the Toxteth Council to take tests, with the portable photometer, of the gas supplied in the district by the Liverpool Gas Company. The gas travelled six miles, and the standard was 20 candles; and the result of his testings with the portable photometer, which extended over several weeks, showed that the gas was of 21½-candle power.

Mr. TALBOT: You do not agree with the statement that has been made by a high authority that gas suffers considerable loss in traversing long mains?

Witness: I might say that our storing-station is 1¾ miles from the manufacturing station. The gas, after it is made, and before it is distributed to the consumers, travels 3½ miles—to the storage place and back again; and testings on the outgoing and returning gas have not shown any appreciable diminution in the quality.

And in order to confirm that still further, have you made experiments at the extremity of your district of supply at Widnes?—I have, with various qualities of gas; and after it has travelled from 5½ to 6 miles, I have not found any practical diminution. Before commencing any tests with the portable photometer, it was always put beside the fixed photometer, and tests made off the same pipe, so that I knew the two were giving identical results.

Supposing it was desired to enrich gas suddenly at any particular point at any specified time, would there be any difficulty in doing it?—None whatever.

By the CHAIRMAN: At Widnes the tests were made at his house from a 3-inch main after the gas had travelled 2½ miles. The tests under these conditions showed substantial uniformity over the whole district.

In further examination by Mr. TALBOT, witness said he enriched his gas with cannel, benzol spirit, or petroleum. At present, because of its cheapness, he used benzol. Every gas engineer knew perfectly well that with a carburetter the quality of gas could be increased in a very few minutes by 3, 4, or 5 candles.

Mr. EMMOTT: The whole of the supply for the time being?

Witness said it could by having the carburetter in proportion to the work it had to do. His carburetter was fixed at the works. If the gas were going into the town of 15-candle power, in five minutes' time, by the use of the carburetter, it could be brought up to 20 candles. The length of time occupied in completely changing the gas in the mains would depend on their capacity, and the velocity at which the gas passed through them.

Mr. TALBOT: Suppose you wanted to get gas of one quality at one part of the system, and of a different quality at another?

Witness: That could only be done by two series of mains.

The CHAIRMAN: Having enriched the gas as you do, does it, from the moment of production and enrichment, maintain that enrichment up to the moment of consumption—supposing it is consumed a week later?

Witness: If you take a day—yes. Gas is usually consumed within 24 hours.

In cross-examination by Mr. BALFOUR BROWNE, witness said he was Manager of the Widnes Corporation Gas-Works, and had hostile testing by an officer appointed by the Corporation.

Mr. BALFOUR BROWNE: But it is the Corporation's gas-works and the Corporation's own tester. Have you any testing-places at all except at the works?

Witness: No.

And when you talk about 18½ candles, that is a test made at the works. Your district is not a large one?—Well, for the consumption, it is very large. There are about 50 miles of mains at Widnes; the farthest being 7 or 8 miles from the works. Witness went on to say that the portable photometer with which he tested was one of Dibdin's, supplied by Messrs. W. Sugg and Co. No appreciable loss of enrichment, within a certain range, took place when gas passed through mains.

But we heard from Dr. Frankland that certain kinds of enrichment would not carry in the main?—I do not know what kind of enrichment he referred to. I can tell you what I refer to.

And you have not found any loss with benzol and petroleum?—That is so.

Water gas is of a very permanent character?—Yes; so the results show.

Therefore enrichment is not a mere temporary matter; it continues throughout the district?—I have found it so. The carburetter at Widnes is upon the main leading to the station meter, and therefore it deals with the whole of the gas made.

Supposing there is a main having in it a lot of dead gas, not enriched, of 14-candle power, and you then put in enriched gas of 18 candles, and the consumption is not going on, would the two gases mix?—If there was no consumption, no. Continuing, witness said the coal he used was the cheapest form of coal—slack—and it produced 10,000 cubic feet of gas per ton carbonized. He used cannel to enrich the gas.

I thought cannel was a thing of the past?—Oh, no; there is a new seam at Wigan.

I think you use the Dinsmore process?—The tar process—what is known as the Dinsmore process.

What, in your opinion, is the average quality of the gas produced by Newcastle and Durham coal?—15½ candles.

Will you tell me, if you have made any tests, what is the illuminating power of the gas you supply, not at the works?—I have already said the tests made at the works are identical with those made at my house. I made tests at various points in the district ten years ago with a portable photometer, but it was not one of Dibdin's. There was no water gas then. Witness went on to say he had also very recently tested the gas as it went from the works to the storing station, and returning, and then at his own house 2½ miles off. The make per year was 225 million cubic feet, and the coal used was 24,000 tons. He could not give exact figures as to the enrichment. By the Dinsmore process, the gas was enriched from 16 to 18½ candles.

The CHAIRMAN: Would it be possible to suddenly raise the standard of quality of the gas which was being sent out?

Witness: I do not think any gas engineer would deny that.

That is to say, this admixture of enrichment is a thing that can be brought to bear upon the supply from the retorts and purifiers at any moment, and produce an instantaneous result?—Yes. There are engineers in this country who do nothing but manufacture carburetting apparatus. Many of these are in possession of the gas companies and local authorities to-day; and their specific purpose is to improve the quality of the gas. You can put it up 2 or 3 candles at will.

Therefore at eight minutes past three you can be producing 14-candle, and at nine minutes past three 20-candle gas?—Yes.

Could that instantaneous or that very rapid effect be produced on such a large scale as to manifest itself over a large area?—That must greatly depend upon the circumstances—the consumption. You enrich the gas; but before the effect can be felt over the area the gas that is already in the mains must be displaced by the carburetted gas. The effect might be produced in an hour, or half an hour, when there was rapid consumption—say, at 9 o'clock in the evening.

Would it be possible to deceive the Corporation inspector, who is set to watch you so that the Corporation know you produce good gas, in that way, if you knew the hour at which he was going to take a test?—I have already said it is perfectly within our control to make the gas anything we like at a moment's notice.

Mr. NICOL: Do you mean to represent to us that by enrichment, and assuming you have twenty fixed stations which are subject to an official test of 16 candles, you can, within a few minutes, switch an amount of enrichment to any one of those stations—take the Gaslight and Coke Company?

Witness: That would entirely depend upon local conditions—as to how the mains were connected, the distance the testing-station was from the works, and the amount of consumption going on at the time.

Take the case we had here. There was one case in which at 7.25 p.m. at the official testing-station 11·3-candle power was arrived at. Do you mean to say (I only ask your opinion as a gas engineer) that in a few minutes the enrichment produced from the central works could raise that to the legal standard of 16 candles?—I could not answer that question without knowing the velocity of the gas in the main and the capacity of the main leading to that point.

By the CHAIRMAN: Having regard to the position of the testing-stations and works in connection with which the experiments referred to had been made, it would be quite possible to have gas supplied of 11·3-candle power, and 43 minutes later gas of 14·8-candle power.

The CHAIRMAN: With regard to the cost of enrichment, can you give us any figures?

Witness: The enrichment in my case I consider costs about 1⅜d. per candle per 1000 cubic feet—that is, with gas beginning at 16-candle power and cannel at the present price. If we took benzol, having just completed a contract at 8d. a gallon, I could enrich gas at ⅜d. per 1000 cubic feet.

You heard the evidence given before the Committee two or three days ago as to the experience in London of a difference chronically existing in the illuminating power of the gas supplied by any given Company as tested at the official testing-stations and at the board schools in and around the district?—Yes.

Can you, as a practical gas engineer, suggest to us any cause for that deviation between the testing-station and the board schools, outside the irregularity of production?—I know that gas at the works, as manufactured, is of varying quality. Unless care is taken to maintain the quality at one equal standard, it will rise and fall. I find this in my own case. I have to keep a careful watch, day and night, on the gas being made. A little carelessness on the part of the men in charge of the engine-room will reduce the quality—and the time of the charges, too.

Can you account for the peculiar phenomenon in the evidence that at the testing-stations there seems to be, on these officially reported examinations, a regular steady illuminating value of 16 candles, and not less, while at the same time, and taken from the same sources of supply, at different parts of the district there is a chronic and persistent lower level of value?—If it occurred in my own case I should say it came from different sources—that it was gas that was differently treated; but I do not know. In my own case, I should have no hesitation in saying that the gas of 11 or 12 candle power was treated differently from that of 16-candle power.

Mr. POPE: I do not follow what you mean by "treated."

Mr. EMMOTT: Enriched differently?

Witness: Yes.

Mr. POPE: It might not have been enriched at all.

The CHAIRMAN (to witness): Then in order to produce the remarkable phenomenon which has been brought before the Committee, you suggest that there must be some particular arrangement of the service-pipes, so that the better gas, when it is produced, towards the moment of testing, should be diverted to the station, whereas the bulk of the people are being served with the other sort of gas from the mains generally?

Witness could only repeat what he had already said. Under the circumstances, he did not see how the effect could otherwise be produced.

The Committee then adjourned until the 1st prox.

The Aldeburgh Corporation and the Water-Works.—At a recent special meeting of the Aldeburgh Town Council, the Town Clerk (Mr. H. C. Casley) read a letter from the Town Solicitors to the Water Company, in which they stated that the Directors were prepared to accept the offer of the Corporation to purchase the undertaking for the sum of £5000. The Mayor said he should like to add, with regard to this letter, that he had met the Directors on one or two occasions, and had been received with the utmost courtesy, and every desire was shown to come to terms with the town. The following resolution was carried unanimously: "That it be communicated to the Local Government Board that the Water-Works Company are prepared to sell their undertaking for the sum of £5000, subject to the approval of the Board; that it is the firm intention of this Council to take steps to provide a proper supply of water; and that the Mayor and Mr. Mansergh will wait upon the Board and explain the Engineer's views for providing such supply, and the cost of the necessary works."

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Monday, April 2.

(*Before Justices* RIDLEY *and* DARLING, *sitting as a Divisional Court.*)

London County Council v. Wandsworth and Putney Gas Company.

This was an appeal by the London County Council against the decision of the Magistrate at the South-Western Police Court (Mr. E. W. Garrett), on Nov. 14 last, dismissing a summons taken out against the Wandsworth and Putney Gas Company for an alleged contravention of the London Building Act, 1894, in respect of the erection of a new purifier-house. The proceedings before the Magistrate were reported in the "JOURNAL" for Nov. 21 last (p. 1251).

Mr. HORACE AVORY and Mr. F. DALDY appeared for the London County Council. Lord ROBERT CECIL, Q.C., and Mr. SNAGGE represented the Company.

Mr. AVORY said this was a special case stated by Mr. E. W. Garrett, Magistrate of the South-Western Police Court; and the question raised for their Lordships' decision was whether a Gas Company were empowered, by their Special Act, to erect buildings in contravention of the General Act relating to London. The respondents appeared in answer to a summons charging that they, at certain highways, Water Side and Worple Road, in Wandsworth, did, for 28 days after service of notice, neglect to comply with the requirements of that notice—namely, to set back a new building so that every part of the external walls should be at a distance in every direction, not less than the distance permitted under part 2 of the London Building Act, 1894, from the centre of the roadways. The proceedings were taken under section 13 of the Act. It was admitted that both these roads were carriage ways; and the complaint was that the Gas Company's buildings were within 20 feet of the centre of the roads. At the hearing of the information, the following facts were proved or admitted: Respondents were originally a Joint-Stock Company, which in 1856 was incorporated with parliamentary powers. They subsequently obtained two other Acts in 1866 and 1880. By section 4 of the Act of 1866, it was provided "that the Company may on the land specified in the schedule to the Act erect such gas-works, whether for manufacture, storage, or the supply of gas, as they think fit; but shall not, under the powers of the Act erect or make any works for the manufacture, storage, or supply of gas, except on the lands specified in the schedule. The works in question were not erected upon any lands specified in that Act. By section 2 of the Act of 1880, it was provided that both Acts—1880 and 1866—were to be construed together, in so far as they were not inconsistent. Section 29 said the Company might from time to time, for the purpose of their undertaking, purchase land, in addition to the lands held by them, not exceeding 10 acres; but the Company should not manufacture gas except on the lands described in the schedule to the Act. Section 30 said the Company may upon any lands belonging to them erect dwelling-houses and cottages for the residence and accommodation of their workmen and families; and they may also make and maintain any roads and approaches to such dwellings as were necessary, provided that they shall not be exempted from any of the provisions of the Metropolis Management Act, 1855, and the Acts amending same." In February, 1899, respondents began to erect the building referred to in the information, and persisted in its erection notwithstanding the objection of the District Surveyor, and completed it. The dimensions of the building were shown by the plans. The external wall towards the street called Water Side was at a distance of 15 feet less than the prescribed distance from the centre of the roadway, and the external wall towards Worple Road, was only a foot or two less than the prescribed distance. It was admitted for the purposes of the case that the building, which was a purifier-house containing four purifiers, was built on land acquired by respondents in 1875. The land was very limited in extent; and in order that the Company might be in a position to carry on their business and meet the demands on them, it was necessary that they should have this building in use. The appellants in May, 1899, while the building was in course of erection, served a notice on the respondents; but they refused to comply with the requirements. They contended that, by reason of the provisions of their Special Acts, they were not (in respect of the building in question) subject to the provisions of the London Building Act, upon which the information was founded. Appellants contended that the land in question was subject in the hands of the respondents to the ordinary law, including the provisions of the Metropolis Management Act and the London Building Act. Secondly, that the provisions relied upon by the respondents did not confer any right, power, or privilege in them as they alleged. The Magistrate was of opinion that the contention of the respondents was right; and he dismissed the information subject to a case stated. The question resolved itself into this: Whether there was in the Company's Special Acts anything so inconsistent with the London Building Act, 1894, that they could not be read together. There were a number of authorities on this question; but the principle of them all resolved itself into what he had stated—viz., was there something enacted by the Special Acts so inconsistent with the General Act that the two could not stand together. If the provisions of the Special Acts were not inconsistent with the General Act, then the General Act, of course, applied to the Gas Company as well as to everybody else. For this purpose, he would in the first place call attention to the provisions of the General Act which affected this question; and then he would examine the Special Acts to see whether there was anything so inconsistent that they could not be read together. The proceedings here were taken under section 13 of the London Building Act, 1894; and by the first sub section no person was to erect any building in such a manner that the external wall should be at a distance less than the prescribed distance without the consent, in writing, of the Council. That was a general enactment that no person should erect. By sub section 6, it was provided that nothing in the section should affect the exercise of any powers conferred upon railway companies; but there was no exemption in favour of gas companies. Again, by section 31 of the General Act, there was a provision that "nothing in this part of the Act shall affect the exercise of any powers conferred upon any railway company by Special Act of Parliament." That related to building frontage again; and there was an express saving of railway companies, but no saving of gas companies. In section 75, there was a saving clause for gas companies; but it only related to party walls in buildings of certain dimensions. By section 121, there was another saving for the benefit of gas companies, which said "the provisions of this part of this Act relating to dangerous and obnoxious businesses shall not apply to any public gas-works." The next important section was 205, which was set out in the case. It said: "In addition to any exemption referring to gas companies contained in this Act, nothing in this Act contained shall in any way take away, alter, prejudice, or affect any of the powers, rights, and privileges conferred upon the gas company by any Act of Parliament as existing immediately before the passing of this Act." This carried them no further, unless they could show by the Special Act that power had been conferred upon them of doing that which was complained of. This brought him back to the general proposition. He was going to submit that this question was precisely on all-fours with the case their Lordships decided some little while ago—the *Uckfield District Council v. Crowborough District Water Company*—which referred to a water-tower erected without the sanction of the District Surveyor, and which their Lordships decided against the Water Company. It could not be said there was anything in the General Act exempting the Gas Company from the provisions of section 13. On the contrary, there was a general enactment that they, and all other persons, were not to build within the prescribed distance of the highway. Dealing with the Special Acts on which the respondents relied, he would show that there was nothing which authorized them expressly to build within the prescribed distance of the highway. The first Act was 1856; but that Act gave them no power to put up works on the land in question.

In reply to an interpolation from Justice Ridley,

Lord R. CECIL said he thought there existed a little misapprehension. This was not a case of gas-works in the middle of a highway. The land in question was the property of the Gas Company from 1875; and they took down old buildings and rebuilt. It was not a case of putting out in the highway. This was their own land, and not a highway at all.

Mr. AVORY replied that he was not suggesting they were building on a highway; but they were building within the prescribed distance of the highway.

Justice DARLING: It comes to this. They say: "This is our bit of land; and because we may put up gas-works on our land, we may put up gas-works on any part of it, notwithstanding any General Act of Parliament.

Lord R. CECIL replied that that was so.

Justice DARLING said what he was wondering was whether they would come to any enactment which said that in putting up the gas-works here, there, and everythere the Company were not to be bound by the law relating to highways.

Mr. AVORY replied he was going through the Special Acts for the purpose of proving the negative proposition, and of anticipating what his learned friend would say. There was nothing authorizing them to build within the prescribed distance of the highway. In the Act of 1856, there was nothing, because the land was not acquired until 1875. The next Act was that of 1866. Section 4 said: "The Company may, on the land specified in the schedule to this Act, erect such gas-works as they think fit, but shall not, under the powers of the Act, erect or make any works for the manufacture, storage, or supply of gas except on the lands specified in the schedule." That gave them no authority to do this, because this land was not specified in the schedule. In passing, he remarked that there was a difference between the provisions relating to the land on which they might carry on the manufacture of gas, and the land which they might acquire for other purposes of their business. By the Gas-Works Clauses Act of 1847, which was incorporated, and to which they were subject, there was an express provision that they were not to carry on their business in such a way as to amount to a nuisance; and Parliament, while enacting that limited the area upon which the Company might manufacture gas. Section 25 of the 1866 Act said "Nothing in this Act shall extend to prejudice, diminish, alter, or take away any rights, powers, or authorities vested, or to be vested, in the Metropolitan Board of Works, District Boards, and Vestries." The next Act was 1880; and it was under this Act that the Company could find the power, if any, which they relied on. Section 29 said "the Company may from time to time, for the purposes of their undertaking, purchase, take, and hold by agreement, in addition to the land now held by them and described in the schedule to this Act, any lands not exceeding 10 acres; but the Company shall not manufacture gas or residual products except on the land described in the schedule." It was found by the case that the land upon which the building in question was erected was land described in the schedule, which they had acquired in 1875 before the Act of 1880; and the only thing therefore upon which the Company could rely in this Act of 1880 as conferring upon them the power to erect this building in the manner complained of, was this negative proviso—"that the Company shall not manufacture gas or residual products except on the lands described in the schedule to the Act." It was for this reason he called attention to the distinction made in the earlier Acts between land which they might acquire and land upon which they might manufacture gas. A limit was put by Parliament upon their right to manufacture gas upon a certain area; and the same limitation was introduced into the Act of 1880—not for the purpose of conferring upon them an express power to build upon a piece of land, but for the purpose of limiting the right they would otherwise have upon any land they might afterwards have acquired. Therefore he did not see how a negative proviso could take them out of the General Act.

Justice RIDLEY: It says: "You shall not manufacture gas except upon that land." They must say they can manufacture anywhere on the whole of the land —

Justice DARLING: Even though it does not say: "Because you may manufacture there, you may manufacture just as you please, or within a space where naturally there should be a certain distance from the highway." If you can do that, and observe the Building Act as well, I do not see any difficulty.

Mr. AVORY said the point was—was there such an inconsistency that they could not carry out the objects of the Special Acts without infringing the provisions of the General Act? In the case of the *Uckfield District Council v. Crowborough District Water-Works Company*, which was before

their Lordships in October last, the question was whether the Special Act, which gave the Company power to erect a water-tower upon certain land specified in the Act of Parliament, exempted them from the general provisions of the Public Health Act relating to buildings, which required them to give notice to the Surveyor or Local Authority before commencing to erect their buildings; and their Lordships held that, notwithstanding they had power to erect a building upon land specified by Act of Parliament, the Company were still liable to the provisions of the General Act, and were bound to give notice to the Local Authority before commencing to erect.

Justice RIDLEY: There is more reason here why the authorities should have power to interfere.

Justice DARLING asked on what the Magistrate based his decision.

Mr. DALDY said it rather went in this way: The Gas Company based their contention upon certain authorities stated in the case. He argued that these authorities had not much to do with it; and he urged it upon the same lines as Mr. Avory was now proceeding on—though perhaps not so fully. But the Magistrate thought the case was covered by the authorities quoted.

Mr. AVORY said he had a shorthand note of the judgment; and it was precisely to that effect. The Magistrate said he was much impressed by Mr. Daldy's argument; and he should have felt himself bound to give effect to it, but for the cases quoted. There was no reason, he submitted, in the nature of things, why a gas company should have the right to build so as to encroach upon the highway. It was quite clear they did not know better than the Local Authority as to what was the proper position for their buildings. The Local Authority were the best judges of whether the buildings should be within the prescribed distance or not. There was nothing in the powers conferred upon the Gas Company to show that they had any right to build in advance of the general building line. Unless they had that power, nothing in the exemption contained in section 205 of the General Act referred to would help them, because the utmost they amounted to was that nothing in the General Act was to take away any powers, privileges, or rights conferred upon them by their Special Acts. For these reasons, he submitted the Magistrate was wrong and the appeal should be allowed.

Lord R. CECIL said he should like, first of all, to call attention to the exact phraseology of the general exemption clause in section 205 of the General Act (set out above). The effect of that was this: If before the passing of the Act of 1894, it was lawful to erect this building, then this Act did not make it unlawful. The Gas Company were in precisely the same position as they were before the passing of the Act of 1894—"Nothing in this Act is to alter or affect any of its rights, powers, and privileges as existed immediately before the Act." The real question was not what were the provisions of this Act, but what the position of the Gas Company was before the passing of the Act of 1894, because it did not put them in any worse position than they were before. He did not himself quite follow the argument his learned friend attempted to base upon the fact that certain exemptions were given to railway companies and not to gas companies. The real question, and the whole question, was whether the Gas Company could have erected works on this land before the passing of the Act of 1894. This Bill was drafted by a Private Bill Committee of the House of Commons, and all sorts of persons appeared for various people and petitioned for exemptions; but the Railway Companies had no such general exemption as that given to the Gas Companies.

Justice RIDLEY said it was a very different matter for Railway Companies.

Lord R. CECIL said, at all events, he submitted that the Gas Company were precisely in the same condition as before the Act was passed.

Justice RIDLEY: You have got to argue that they could do as they liked before the Act.

Lord R. CECIL said this was not a case of building out into a highway—of projecting beyond the building line—but of building on their own land, within their own fence; and the only question was whether they were entitled to put a building so near the edge of their own ground as to be within 20 feet of the highway. Whatever was the result of this case, the land would still remain the property of the Company, though they might not be allowed to build on it.

Mr. AVORY said the Act expressly provided that they should not bring the forecourt or fence within 20 feet of the highway.

Lord R. CECIL: We are not bound to take it away when it is there. You do not suggest that the effect of this will be to throw the land into the highway.

Mr. AVORY: Of course, I do. That is the whole object of the Act—that the width of the roadway shall be 40 feet.

Lord R. CECIL: If that is your object, I am afraid you will be out of court, because these proceedings will not have that effect. All they will do, will be to prevent us utilizing our land within 20 feet of the road. There is nothing to compel us to throw the land into the highway; it will remain our private property. There is no power to confiscate our property, which, if my friend's contention is right, it would have the effect of doing. We are entitled to retain the land; but we may not build up to the edge of our own property, if it is within 20 feet of the centre of the road. In this case, there was a wall marking the edge of the roadway. That will remain; and we are not bound to take it down. The learned Counsel (continuing) said that, coming to the powers conferred on the Company by their Private Acts, he did not think the Act of 1856 affected the case. Section 2 of the Act of 1880 provided that the Acts of 1866 and 1880 were to be read together; and section 4 of the Act of 1866 was the important one. It said: "The Company may, on the land specified in the schedule to the Act, erect such gas-works, whether for manufacture, storage, or supply of gas, or otherwise, as they think fit." This, he submitted, gave them power to erect on the scheduled land such gas-works as they thought fit.

Justice DARLING: You say it means, erect them as they think fit?

Lord R. CECIL said it was two-fold. It first gave them power to erect such works as they thought fit; and it provided that they should not erect gas-works at all, except upon the lands specified. There was a reason why gas companies were forbidden to erect works except on land scheduled. By the Standing Orders of Parliament, everyone who lived within a certain distance of the gas-works had the right to petition the Committee to which the Bill was referred, and notices had to be served on all those so that they might be heard. Therefore it was provided that the Company should not erect works except upon scheduled land. His learned friend admitted, in answer to this section, that, as far as the Act of 1866 was concerned, they might build on the land scheduled in the Act, but said this did not refer to any land scheduled in the Act of 1880. He submitted it did impliedly refer both to the land scheduled in 1880 and that in 1866; and this was why he relied on section 2 of the Act of 1880, which made all the provisions of the Act of 1866 to be read with the Act of 1880. If that were not so, there was no power given to erect gas-works in the Act of 1880 at all, except in this way. Therefore, the right way of reading these two Acts was to take clause 4 out of the Act of 1866, and read it as part of the Act of 1880. If they did so, then the provision was perfectly clear that the Company were entitled to erect such gas-works as they thought fit on the land scheduled to the Act.

Justice DARLING: Upon such part of the land as they think fit, notwithstanding any General Act to the contrary that does not expressly forbid.

Lord R. CECIL assented. He submitted it gave them power in spite of any General Act; and he should have to refer to some decisions, as he contended that the case came within those decisions, and gave them power to make such gas-works as they thought fit, notwithstanding the erection itself infringed the conditions of the General Building Act. He quite conceded that the whole question was whether the Special Act was inconsistent with the General Act.

Justice RIDLEY: Your argument seems to be answered by our decision in the Crowborough case. Section 49 of the Gas-Works Clauses Act seems to be the same as section 93 of the Water-Works Clauses Act; and we decided that the provisions of that section did not prevent the General Act applying. Section 49 says: "You shall not be exempt from any General Act for improving the sanitary conditions of towns."

Lord R. CECIL submitted the Act of 1894 had nothing to do with this case, because of section 205, which was inserted to put the Gas Company in precisely the same position as they occupied before the Act was passed.

Mr. AVORY said this would only throw them back to the earlier Building Act of 1878, which contained exactly the same conditions.

Lord R. CECIL submitted that, by section 205 of the Act of 1894, any power, right, or privilege which the Company possessed at the passing of the Act was preserved to them. If they had the right to cover this land with purifiers, that was preserved to them by the section, and could not be taken away by the Act of 1894. Under the Act of 1880, they were entitled to erect such works as they thought fit. It was said that was not so, because by the 49th section of the Gas-Works Clauses Act it was provided that "nothing herein or in the Special Act contained shall be deemed to exempt the undertakers from any General Act relating to gas-works, or any Act for improving the sanitary condition of towns and populous districts, which may be passed in the same session in which the Special Act is passed, or any future session of Parliament." The effect of this, he submitted, was that nothing in the Act of 1880 was to exempt the Company from any Sanitary Act passed in 1880, or subsequent to 1880. If it were not for section 205 of the Act of 1894, he admitted at once the Company would be subject to the Act, because of this section 49. He said they were not subject to section 13, because of this section 205; and section 47 did not render them subject to any sanitary legislation, except that passed after 1880. He admitted that, under the Building Act of 1878, there were provisions similar to section 13 of the Act of 1894; and he agreed that they were in force in London at the date of the passing of the Act of 1894, and that, so far as the Company were subject to the Act of 1878, they continued subject to it. But the Act which he said exempted them from this was their Special Act of 1880, which incorporated the Gas-Works Clauses Act of 1847. This only rendered them liable to Sanitary Acts passed in the same session, or in any subsequent session; it did not render them liable to anything passed before then. The effect of the legislation of 1880 was, he submitted, to exempt them from all the General Acts relating to building.

Justice RIDLEY: Although they were subject to them up to that time.

Lord R. CECIL: They were not subject.

Justice RIDLEY: Oh, yes, they were. You cannot get out of that.

Lord R. CECIL submitted they never were subject, as far as this land was concerned.

Justice RIDLEY repeated they were subject. He did not see how they could escape from the judgment in the case of the Crowborough Water Company.

Justice DARLING: Do you admit that the Act of 1878 would have prevented you doing this, and that the Act of 1880 cleared you from all the restrictions of the Act of 1878?

Lord R. CECIL: That is my contention.

Justice DARLING: And then, being cleared by the Act of 1880, they could in 1893 have done this, though they could not have done it after 1894, except for section 205; and section 205 kept them in the same position as they were before. Then the whole of your argument depends upon your showing us that the Act of 1880 exempted them from complying with the Act of 1878.

Lord R. CECIL: That is the whole of my argument. If I can show that the effect of the Act of 1880 was to exempt them from the Act of 1878, then, I submit, they are now exempt from 1894. Section 4 of the Act of 1866 is, in my opinion, the covering section that, in strong words, gives to the Company power to make such works as they think fit on the scheduled land.

Justice RIDLEY: That was all subject to the provisions of any Act passed in any future session; and therefore it included the Act of 1878, which was passed in a future year. I do not think the matter is arguable. You had no powers under the Act of 1878; and you have got to find them in the Act of 1880.

Lord R. CECIL: But in the Act of 1880, it says the provisions of the Act of 1866 shall be part of the Act of 1880.

Justice DARLING: But the Act of 1866 does not thereby become an Act of 1880.

Lord R. CECIL: I submit it does for this purpose. The Act of 1880 incorporates the provisions of the earlier Acts. It must have been intended, otherwise the Company, under the Act of 1880, would have no power to erect gas-works at all.

Justice RIDLEY: I still think it is unarguable.

Lord R. CECIL submitted that if they read section 4 of the Act of 1866 into the Act of 1880, the Company had power to erect gas-works wherever they liked on their own land. Section 205 was put in the Act of

1894 to preserve whatever rights the Company had. If his contention were correct, section 30 was excellent common sense; if he were wrong, it was nonsense. Section 30 said, so far as the cottages and dwellings were concerned, they were to be subject to the Metropolis Management Act and the Metropolitan Building Act, 1878. If the contention of the other side were right, the whole of the buildings of the Company were always subject to the Act of 1878. If this was so, why should these cottages be expressly mentioned by section 30? Counsel then quoted the cases which were cited in the Court below, including *Limehouse District Board of Works v. London and Blackwall Railway, and London County Council v. City and South London Railway.*

Mr. Daldy, replying upon the whole case, said, in answer to his learned friend's remarks about section 30, in which the cottages and houses of the Gas Company were expressly made subject to the Metropolis Management Act, there was a sufficient explanation of this. Cottages and roads were not things which came within the ordinary business of gas companies, and so would not come within the purview of such an Act as the Gas-Works Clauses Act, 1847. Therefore, as there might be a doubt whether the provisions in that Act extended to such things as cottages and roadways made on the Company's property (an exception altogether from the ordinary course of a gas company's business), it was probably for this reason they were made expressly subject to the Metropolis Management Act by section 30. As to section 4, which said the Company might erect such gas-works as they thought fit, the nature of the buildings was left to the discretion of the Company; but nothing was said as to the buildings being put on all or any part of the land. Moreover, the section was not like one in a Railway Act or a Water Act, where they found an express direction to build the railway or water-works on some particular part of the land. The object of the section was to divide the land which the Company might use for the manufacture of gas from the other parts which they might not use for this purpose; and the section was solely devoted to dividing off the land in that manner. Supposing it could be read in the way Lord R. Cecil said, what was the result? The whole of his argument was this—that when the two Acts were to be construed together, one must take section 4 of the earlier Act and make it into section 4 of the combined Act, and do the best one could with it. But if they looked at section 2 of the Act of 1880, it said the Act and the Acts of 1856 and 1866 should be construed together as one Act, except in so far as such construction would be inconsistent with, or repugnant to, the provisions of the later Act. Was there not an inconsistency, when they found expressly incorporated in the Act of 1880 the Gas-Works Clauses Act, which provided that the provisions of the Public Sanitary Acts were not to be affected? This section 205 of the London Building Act, 1894, could not possibly be read as widely as his friend wanted to read it, and as to succeed he must read it. There was nothing in the section to show that the Company were not to be subject, like any other individual or landowner, to any progressive changes in legislation. It could only have meant, where there was some clearly expressed privilege or right particular to this Company, that it should be preserved to them; and though, like other individuals, they had to suffer from further legislation to some extent, they were not to lose any such particular rights.

This concluded the arguments.

Justice Ridley, in giving judgment, said: I think the decision of the Magistrate is wrong, and that the Gas Company are subject to the provisions of the London Building Act, 1894. It appears to me that the case is difficult to distinguish from the decision in the *Uckfield District Council v. Crowborough District Water Company.* Not that the facts are precisely the same, but I think this case is on all-fours with it so far as this, that it was there said that, although the provisions of the section of the Act of Parliament only referred to the Acts of Parliament to be passed for the improvement of the sanitary conditions of towns and populous districts to be passed in the same session, or in any future session, and therefore did not in its terms preclude past Acts of Parliament on the same subject, still the beneficiaries under a Special Act like the present must be held to be subject to the general provisions of Acts of Parliament on the same subject, unless there was something inconsistent with their own Act, and so inconsistent with the provisions of the General Act as led to the opposite inference that it was not intended to give powers which were inconsistent and contrary to those which anybody else would possess. I think that principle is certainly stronger in its application to the present case. The Gas Company contend that they are to be treated as having the power to put their buildings where other persons cannot. They have to satisfy us there is nothing in their Act of Parliament inconsistent with the powers contained in the General Act. I cannot find there is any expression in their own series of Acts which leads to that conclusion. The chief expression relied on by Lord R. Cecil is the words, "as they think fit" contained in section 4 of the Act of 1866. Those words occur in the section which is directed to this subject, where shall the gas be manufactured? and one must remember that in the case of gas companies it must be always of great importance to specify where, and in what place, the gas manufactories can be put up as opposed to the place where the storage and other works connected with them can be erected. The section says: "The Company may, on the land specified in the schedule, erect such gas-works as they think fit, but shall not, under the powers of the Act, erect or make any works for the manufacture of gas except on the land specified in the schedule." I think that means you may put up such gas-works as you want—whether it be for manufacture, or supply, or storage of gas—but you shall not put them up anywhere except on the land specified in the schedule. It does not say you may put them up wherever you please, independent of the Act of Parliament. So long as you put them on the land specified in the schedule, you have a discretion to say what they shall be. If we are to say that the words "as they think fit" were ever intended to give them a discretion to put them wherever they pleased, independent of the provisions of other Acts, one has got to remember there is a section in the same Act which embodies clause 49 of the Gas-Works Clauses Act of 1847, which expressly includes all regulations of Acts of Parliament relating to the sanitary conditions of towns. I think they were subject at that time to all such legislation as was then in existence in the year 1866 relating to the sanitary conditions of towns. It is true, as Lord R. Cecil says, that the provision now contained in the London Building Act, 1894, relating to the distance within which buildings must be placed from the centre of highways, did not come into existence until 1878; but the state of things is this: The Gas Company are subject to all legislation passed in a general way for the sanitary condition of towns. As that changes so do the Company's powers. They are subject to it; and therefore, when the Act of 1878 was passed, which imposed this limit as to buildings being put up within a certain distance of the highway, they became subject to it, as hitherto up to 1878 they were to all other conditions. In 1878, the Building Act was passed; and I understand that its provisions were similar to those of the Act of 1894. At that time therefore, in 1879, it must be conceded that the Gas Company were subject to this law—that they could not put their buildings within 20 feet of the highway. But it is now contended that, by reason of the passing of their Act of 1880, a different meaning was put on the Act of 1866, and not only that the powers of the Gas Company were extended, but they then became able to do that which they had not hitherto done, and that, having got into that position, section 205 of the London Building Act preserved that to them, as a privilege which belonged to them before the Act was passed. That is a very strong contention to put forward, because I can find nothing in the Act of 1880 which gives them more privileges than they had before. The Act included section 49 of the Gas-Works Clauses Act, and it left them subject to the general legislation on the subject. Therefore, I think all the powers they got are subject from time to time to the general law of the land. If that is the rule we are to apply to the construction of this Act of Parliament, they were throughout subject to the provision now in the London Building Act, 1894, and formerly in the Metropolis Management Act, which says buildings are not to be put within a distance of 20 feet from the highway. Whatever the buildings are, they are subject to that. Where are we, in the Act of 1880, to find any extended powers? I find in section 2 nothing except that the two Acts are to be read together. Section 205 of the Act of 1894 says: "In addition to any exemption referring to gas companies contained in this Act, nothing in this Act contained shall in any way take away, alter, prejudice, or affect any of the powers, rights, and privileges conferred upon the gas company by any Act of Parliament, and as existed immediately before the passing of this Act." That is an enactment in general terms saving the existing rights of a gas company. They may be of various kinds and sorts, but it does not, it seems to me, by giving them that saving, give them any more power than they hitherto possessed. It does not give them any right to say we will do something inconsistent with the General Acts of Parliament relating to the subject. The section may have been inserted because it was thought there were some particulars in respect of which their rights ought to be preserved; but I do not think it can bear the strong meaning put upon it by the respondents. I think the appeal ought to succeed, and I do not think it necessary to add anything as to the cases quoted by Lord R. Cecil.

Justice Darling: In this case, I cannot say I think it is free from difficulty; and I go a very long way with Lord R. Cecil in the argument he addressed to us. The way in which the case strikes me is this: It seems to me building upon this particular piece of land was not possible until it was authorized by the Special Act of 1880. It would have been forbidden unless it complied with the Building Act of 1878. But by section 2 of the Act of 1880, which incorporates the Act of 1866, and therefore incorporates section 4 of that Act, it says the Company may, on the land specified on the schedule, erect such gas-works as they think fit. It does seem to me, if the matter had stopped there, they might have erected gas-works without paying any attention to the Building Act of 1878. So far, I am with Lord R. Cecil. But the Act of 1880 does not stop there. It goes on, in section 3, to incorporate not only the Acts of 1856 and 1866, but the Gas-Works Clauses Act of 1847, and that Act says this: "Nothing herein, or in the Special Act contained, shall be deemed to exempt the undertakers from any General Act relating to gas-works, or any Act relating to the improvement of the sanitary conditions of towns or populous districts in the same or future session." I do not take any notice of the word "future" because the Act of 1847 is incorporated in the Act of 1880, and therefore it is enacted again. It is there Lord R. Cecil's argument fails. It seems to me the Act of 1847 is re-enacted by the Gas Company's own Special Act of 1880; and it is by that means distinctly applied and becomes part of the Special Act. Now I take the words of section 49 of the Gas-Works Clauses Act, and it seems to me when we get to the words "future session," we have now to see what is done, not after 1847 or not after 1878, but after 1880, as the Act of 1878 is by that preserved in 1880. In 1894, is passed the Building Act, which contains provisions just as restrictive upon the Gas Company as the Act of 1878. The Act of 1894 was a future Act; and as a future Act was preserved by section 49 of the Act of 1847, and was preserved by the section incorporated into the very Special Act of the Company itself. Therefore the future Act to which we have to look to is 1894. Section 205 provides that "in addition to any exemption referring to gas companies contained in this Act, nothing in this Act contained shall in any way take away, alter, prejudice, or affect any of the powers, rights, and privileges conferred upon the gas company by any Act of Parliament as existed immediately before the passing of the Act." That section, instead of having the result which Lord R. Cecil contended for, and giving them absolute freedom to do as they pleased, preserves them their liberties under section 4 of the 1866 Act, but it also preserves the restrictions upon them. Therefore, I do not think there ever was a moment when this Gas Company, who acquired all their rights by virtue of Special Acts, were exempt from the duties imposed by the Building Act, of 1878, until the place of the 1878 Act was taken by the Building Act of 1894. Therefore they are bound by the restrictions of the Act of 1894. For these reasons, I think the appeal must be allowed.

The case was accordingly ordered to be remitted back to be dealt with by the Magistrate.

Mr. Snagge asked for leave to appeal further.

Justice Ridley said he had no objection to granting leave; but there was no appeal from their decision in a matter of this kind, which was in the nature of a criminal proceeding.

The appeal was allowed, with costs.

The Delivery of Petroleum to the Dublin Gas-Works.

In the High Court of Justice (Ireland) last Saturday week, before the Master of the Rolls, Mr. Matheson, Q.C., applied on behalf of the Dublin Port and Docks Board for an order that the Gas Company, their servants, agents, and workmen might be restrained by injunction from discharging

or accepting delivery in bulk of a cargo of petroleum about to arrive in the harbour in the tank-steamer "Ballaclime," by means of tubes or pipes laid across the quay or walls of the plaintiffs, or from discharging such a cargo in any manner other than should be approved of by the plaintiffs. Counsel explained that some time ago the Gas Company began the manufacture of water gas; and for this purpose large quantities of petroleum were imported in tank-steamers, and pumped from the vessels by means of pipes to the gas-works. Some months ago when a tank-steamer arrived, the plaintiffs allowed defendants to connect their underground pipes with a flexible tube laid across the quay to the vessel's side; about the same time informing them that they would not permit them to use such a tube in future. The plaintiffs now heard that a tank-steamer was coming to defendants' order (on the morrow); and in order to prevent a breach of the peace, they asked for an injunction. Mr. Gordon, Q.C., for the defendants, said the whole question was one of wayleave, for which the plaintiffs wished to charge defendants £200 a year for the short distance a pipe would be laid under their quay. Defendants disputed the plaintiffs' right to the land there, and contended they were empowered to lay this pipe there as they were to lay gas-pipes in any part of the city, and submitted that the discharge by the flexible tube was a reasonable and proper means of discharging the vessel. The Master of the Rolls adjourned the motion pending the trial of the action to be brought to decide the defendants' rights; they to abide any question of damage to be raised in the meanwhile.

The Committal of Infringers of Welsbach Patents.

In the Court of Appeal, last Wednesday, Lords Justices Collins, Vaughan Williams, and Romer concluded the hearing of an appeal of one Reimer, of Stourbridge, from an order of Mr. Justice Day, committing him to prison for contempt of Court—he having, it was alleged, disobeyed an interim injunction granted in the action to restrain certain persons from infringing two of the Welsbach Company's patents. The order was made on Dec. 19, 1899; and the first Mr. Reimer heard of his being committed for contempt was on the 14th of February last. After he had obtained leave to appeal from the learned Judge's order, he was it was stated, arrested at Birmingham by an agent of the Company, and detained there until he was taken to Holloway Gaol. Mr. Frank Dodd and Mr. Disturnal appeared for the appellant; and Mr. T. Terrell, Q.C., and Mr. A. J. Walter for the Company. On the conclusion of the arguments, Lord Justice Collins gave judgment. He said he was of opinion that all the necessary steps had been taken by the Company to entitle them to obtain a committal order against Mr. Reimer. If an injunction were granted against a defendant, restraining him from doing certain wrongful acts, and he, having knowledge of the fact, broke with impunity that injunction because he had not been served with a formal order, then the plaintiffs, without doubt, were entitled to move for a committal order against him. He must, therefore, hold in this case that Mr. Justice Day had exercised his jurisdiction rightly in committing Mr. Reimer to prison; and the appeal would be dismissed, with costs. Lords Justices Vaughan Williams and Romer concurred. On the application of Counsel, the Court directed that, as Mr. Reimer had been imprisoned from the 27th of February last, he should be released at once. An order was made accordingly.

The Charge of Falsifying Books and Embezzlement.

It may be remembered that, after several remands, Frank Fairfield Norris was, on the 14th ult., committed for trial at the Central Criminal Court on a charge of falsifying the accounts and embezzling the money of his employers, Frank Wright's Prepayment Gas-Meter Corporation, Limited. The accused would, in the ordinary course, have been brought up at the sittings which commenced on Monday last week; but, at the request of his Counsel, a postponement of the trial was granted by the Recorder (Sir Forrest Fulton, Q.C.) till the next sessions.

The Fatal Explosion at the Lillie Bridge Oil-Gas Works.

At the Brompton County Court, last Thursday, before Deputy-Judge Clement Lloyd, Mrs. Grace Clements, the widow of a gas maker, brought an action, under the Workmen's Compensation Act, 1897, against the District Railway Company, for compensation on account of the loss of her husband, who met with his death on the 23rd of December last, while in the Company's employ, under circumstances already recorded in the "Journal" (*ante*, p. 40). Mr. Turrell appeared for the applicant; Mr. Disney represented the Company. Mr. Turrell explained that, if his client was entitled to recover under the Act, the amount would be £273 odd—being three years' salary. The question, however, which his Honour would have to decide was whether the man met with his death through "serious and wilful misconduct," as mentioned in the first section of the Act. It was for the other side to prove that the man had been guilty of such misconduct, and therefore he did not propose to call any evidence. Mr. Disney stated that it was part of Clements' duty to get into an oil pit, by means of a ladder, to read a gauge indicating the quantity of oil which had been allowed to run in. There was a certain amount of danger connected with this work, because the oil gave off an inflammable gas. Accordingly, a notice was placed in a suitable position warning the men against the use of naked lights. Clements went to read the gauge, and almost immediately afterwards there was a loud explosion. Subsequently his remains were found in the pit. The day in question was very dull, and it was contended that the man, in order to see the numbers on the gauge, must have struck a match, and so caused the explosion, for his Davy safety-lamp was afterwards found in his locker. Mr. G. Estall, the Resident Engineer and Locomotive Superintendent to the Company, produced a copy of the rules posted up on the works. One of them ran: "No light of any description must be taken into the purifying-rooms or engine-rooms under any circumstances." Besides this notice, all the men had a copy of Pintsch's rules, which also warned persons against the use of naked lights. Mr. Turrell read the verdict of the Jury at the Coroner's inquiry, which was to the effect that the death was accidental, but that there was no evidence to show how the naked light which caused the explosion came to be used. In cross-examination, witness maintained that neither the gas from the oil nor the gas manufactured at the works could explode spontaneously, or without coming in contact with a naked light. Other evidence of similar nature having been given, his Honour said he could come to no other conclusion than that the accident occurred through the man's own carelessness; and therefore there must be a verdict for the respondents.

A Public Lighting Charge at Exmouth.

At the Exeter County Court last Thursday, before his Honour Judge Woodfall, an action was brought by the Exmouth District Council to recover from the Exmouth Gas Company the sum of £14 8s. 9d., alleged to have been overpaid for gas consumed in one of the public lamps. The lamp is one with three lights, and is situated on the Esplanade. The charge made was for the gas consumed. For the winter quarter of 1894, it was for 15,900 cubic feet, and for the corresponding quarters of the following years 25,600 cubic feet. In April, 1899, the Surveyor discovered that there was no meter attached to the lamp; and he refused to pass the account. Some negotiations passed between the Council and the Company, and it was agreed that the account for April, 1899, should be taken as 15,500 cubic feet; but the parties could not agree as to the previous period. The Council computed that the amount paid in excess was £14 8s. 9d.; and they asked for a verdict for this sum. Mr. W. Harding, Surveyor to the Council, said he was appointed in May, 1898, and refused to certify the account when he found there was no meter to the lamp. He was informed by the Secretary of the Company that the meter was removed at Christmas, 1894. For the defence, it was stated that a meter was originally fixed to the lamp, and for the quarter ended January, 1895, it registered 25,600 cubic feet. The following April, it was found that the index of the meter was broken; and it was agreed between Mr. Foster, the Secretary and Manager of the Company, and the Surveyor at that time that the amount charged should correspond with the previous quarters. Subsequently the matter was explained to Mr. Harding, the present Surveyor, and he assented to the arrangement. The case was tried by a Jury, who, in the end, found for the plaintiffs for £7 8s. 9d. His Honour gave judgment for this amount, and said it was a pity that there had been any suggestion of fraud in the matter. Mr. Foster and Mr. Harding were in hopeless conflict; and it was evident that one of them was mistaken.

Stealing Gas at Stalybridge.

At the Stalybridge Police Court, yesterday week, James Beard, pianoforte and music dealer, was fined £5 and costs, or a month's hard labour, for illegally tapping a service-pipe, and using gas without the permission of the Corporation. Evidence was given to the effect that defendant had been refused a supply of gas by the Corporation because he could not find security; but he took an empty house, and was there seen by a police-sergeant burning gas. He had inserted a brass tube into the service-pipe, and carried the gas to an upper room by means of a rubber tube, so that the gas did not pass through the meter.

Tampering with a Gas-Meter at Cardiff.

At the Cardiff Police Court, last Tuesday, before the Stipendiary Magistrate (Mr. T. W. Lewis), John Williams, of 139, Castle Road, was summoned for fraudulently preventing a meter of the Cardiff Gas Company, at 176, Inverness Place, from duly registering the quantity of gas supplied to him. Mr. Spencer appeared for the Company; Mr. Lloyd Meyrick represented the defendant. An inspector of the Company described an appliance which he found attached to the meter on the occasion of a visit paid to the premises on the 28th ult., and which prevented the meter from registering all the quantity of gas supplied. Mr. Meyrick admitted that the defendant attached the appliance, but said it was only put on temporarily for a job on which his client was engaged as a cycle repairer. Defendant went down to the Company's office and apologized for what he had done, and offered to make any reparation in his power. There was no attempt at disguise. The Stipendiary strongly censured the defendant's conduct, and imposed the maximum penalty of £5.

The Public Lighting of the City of London.—The Engineer to the Corporation of London (Mr. D. J. Ross), in the course of his report on the works executed in his department last year, gives, as usual, some particulars in regard to the public lighting. It appears that the number of gas-lights now in use is 1906, and 192 were defective in the past twelve months. The electric lights number 507. The question of lighting the side streets by electricity is still under consideration.

Incandescent Gas Lighting in Lincoln.—At the meeting of the Lincoln City Council last Tuesday, the Chairman of the Highways Committee (Alderman Pratt) read a report from Mr. John Carter, the Gas Engineer to the Corporation, on the subject of the use of incandescent gas-burners for the public lighting. Experiments had been made upon two roads, on one of which the lamps were re-adjusted on the 1st of November, and had been burning 1871 hours. All the mantles originally fitted were still in use, with the exception of three—one renewal having been necessitated by the lamp having been run against; another, by an accident while cleaning; and the third, to allow of a comparison being made between an old and a new mantle. The experiment was undertaken to test the desirability of using mantles, and to ascertain whether it was possible to adapt the existing lanterns to the incandescent system of lighting; and practically only one mantle came to grief. The lamps in the second road were fitted on the 1st of December, and the only renewal was in consequence of an injury which certainly was not accidental—for the mantle was maliciously damaged. The lights had been burning more than half the total lighting hours of the year, and they could speak with authority on their value. Three mantles a year would be ample provision. The only desire of the Committee had been that the experiments should be of the severest possible character; and he expected they would soon begin to place incandescent gas-lamps where the electric lamps stopped.

MISCELLANEOUS NEWS.

COMMERCIAL GAS COMPANY.

Increase in Price—Further Capital to be Issued by Auction or Tender.

The Half-Yearly Meeting of this Company was held last Thursday, at the Cannon Street Hotel, E.C.—Mr. J. Blacket Gill in the chair.

The Secretary (Mr. H. D. Ellis) read the notice convening the meeting, and the Directors' report and the accounts, of which the principal portions were published last week, were taken as read.

The Chairman said he presumed the proprietors would be as pleased as the Directors were satisfied with the working of the half year ending December last. The gross income from gas had increased by £11,536, in comparison with the corresponding half of the preceding year; and when he told them that the Gaslight and Coke Company showed an increase of just upon 5 per cent., and the South Metropolitan Company 8·25 per cent., he thought the proprietors would consider their own increase of 7·9 per cent. particularly satisfactory. The meter-rents gave an increase of £94, stove-rents £150, and coin meters £826. At the present time, they had 11,778 coin meters out in the district; and these had been the means of considerably increasing the consumption. On one day during the half year (in November, he thought it was), they had the record send-out of 14½ million cubic feet—figures that had not been exceeded in the history of the Company. On the other side of the account, of course, they had had to spend more money to do more business; and their coal, cannel, and oil had cost an additional £11,235. Residuals had yielded more by £6487; so that the net cost of coals showed an increase of £4748. Purification showed an increase of £1800. The end of it was they had earned their dividends of 13½ per cent. and 10½ per cent., with interest on debentures. For this purpose they required £55,155; and after paying this sum, they had a surplus of £425. As he had said before, he thought they must be well satisfied with these figures; but naturally he was afraid they could hardly look for quite such good results for the current six months. It would be quite understood that this had not been achieved without a great deal of labour and anxiety, especially on the part of the staff, because the past winter had been an exceptionally trying one in the matter of coals. Wherever they went now, and whenever they took up the papers, they always heard and read of the war; and it put everything else out of their thoughts. So it was with gas companies; all their thoughts ran upon coal. The proprietors were as much aware as the Directors were of the great rise there had been in the price of coal. The matter rested on very many things. Possibly the war might have had something to do with it; but he thought it had mainly been brought about by the good state of trade in the country generally. He was told that coal owners preferred to sell their coal in the North, and turn it into foundry coke at 35s. a ton to make steel, than send it to London to make gas. Some months ago the Directors began to get rather anxious about the coal supply, because the collieries had been backward in their deliveries. This occasioned a great amount of anxiety to the Board, and more especially to the Engineer (Mr. H. E. Jones), as to how they should keep up a proper supply of gas during the dark and foggy days of winter. It was a trying time indeed. They were, however, getting rapidly over the trouble now, as fortunately the days were lengthening. But when he told the proprietors that the price of coal was practically double what it was this time last year, they would at once see (though the Company was only a small one, they used something like 200,000 tons of coal a year) it meant a very great demand upon them. Under these circumstances, what could the Directors do, but raise the price of their gas? There was nothing they could do that gave them greater regret. The Commercial Company had always been one that endeavoured to move with the times. They had always aimed at supplying gas at as reasonable a figure as possible, because they were perfectly convinced there was nothing better for their immediate and ultimate advantage than to supply gas at as low a figure as possible. The public were partners with the proprietors. As the price was reduced 1d., the Company were enabled to pay ¼ per cent. more dividend; and if they put up the price to the public, they lost dividend at the same rate. The Directors had determined to raise the price, from last Lady-day, by 6d. per 1000 cubic feet. There had been some talk of dividing it. He believed Mr. Livesey had thought right to raise his price only 3d. or 4d.; but, in their own case, the Directors had thought it better to grapple with the thing at once, and have done with it. Sixpence, no doubt, would be sufficient for their purposes. He hoped so; and so far as they could tell, it would be. They determined to "take the bull by the horns," and at once raise the price the whole 6d. to the private consumers. Unfortunately, however, the consumers would probably talk about fat dividends, and that sort of thing, and would consider they were hardly dealt by. It seemed to be an impossibility to make the consumers realize that, when the shareholders of a gas company got their 12 and 13 per cent., it covered the immense premiums that had been paid for shares and stock for many years, and that the shareholders did not really get more than 4 or 5 per cent. It was a most distasteful thing for the Directors to have to raise the price of gas; but they must do it for the good of the Company. All he could say was that he trusted the rise might be temporary. He hoped that, this time next year, they would get coal at something like a reasonable figure again; and then the Directors would be only too glad to lessen the price of gas to the public. He had another resolution relating to the raising of capital to lay before the proprietors; but he thought it would be better to finish the first part of the business before he touched upon this matter. He therefore moved that the report and accounts be received and adopted.

The Deputy Chairman (Mr. W. G. Bradshaw) seconded the motion, which was unanimously carried.

The Chairman next proposed that a dividend at the rate of 13½ per cent. per annum on the old stock and 10½ per cent. on the new stock, both less income tax, be declared. He remarked that the proprietors were aware that the authorized dividend was 13¾ and 10¾ per cent.; but ¼ per cent. went to the reserve fund.

The Deputy Chairman seconded the proposition, which was agreed to.

The Chairman then proposed that the Directors be authorized to exercise the powers to raise additional capital conferred upon the Company by their Act of 1875, by the creation and issue of £43,125 of new ordinary stock; to exercise the powers to borrow £61,713 conferred upon the Company by the Act of 1875 and the Ratcliff Gas Act of 1855, by the creation of additional perpetual debenture stock, bearing interest at the rate of 4½ per cent. per annum; and to dispose thereof in such manner, at such times, such price, and on such terms and conditions as the Directors may think fit. He remarked that the proprietors might recollect that, at the meeting six months ago, they had a little conversation upon this matter; but no resolution was proposed. He then mentioned it to them in order that they might turn it over in their minds before meeting again. He did not wish to weary the proprietors by going into a long tale about their case; but he must recall the circumstances of their 1875 Act when they amalgamated with the Ratcliff Gas Company. At that time, the charge for gas to the consumers was 3s. 9d. per 1000 cubic feet. This was the initial figure Parliament gave them in their Act; and they were, at that price, allowed to pay 10 per cent. on their old stock, and 7 per cent. upon any new stock created. As the proprietors knew, in those times, while they were very different from what they were to-day, the coal market was kinder, the Company had very large undivided profits, and they were doing a good business. Therefore, when Parliament sanctioned the issue of the stock to the proprietors at par, the Directors fell in with that view; and the proprietors were pleased to receive stock which commanded a very nice premium on the market. So they went on in a very happy condition for many years. This was now changed; and the proprietors were well aware that, if the Company had to compete with other Companies who got their capital at about 3¾ or 4 per cent., it was a perfectly impossible thing to do if they had to obtain their capital at between 7 and 8 per cent. The consequence was that the gist of his remarks on the previous occasion was the same as now—that they must give up the pleasure of allotting the stock to the proprietors, and must sell it at the best possible figure, and get the highest premium they could for it, to help them to carry on the war. A great deal of their stock had been allotted in the agreeable manner he had described; and they had now unallotted £43,125 of new stock, £41,713 of debenture stock, and also an odd amount of £20,000 which belonged to the Ratcliff Company, and which they could allot, at interest of 5 per cent., on mortgage or bond. These sums made a total of £104,838 unallotted. If they put this out in the market for sale by auction, or issued it to the proprietors by tender, whichever was deemed advisable, he hoped they would get a good premium for it. Supposing they got another £100,000 for it, they would have £200,000, which would carry them on for a considerable time. He thought this was a matter for congratulation. He was more grateful than he could say that they were not in Parliament this year; and they would be able to see how their friends and neighbours got on. For his own part, he thought it was a good thing they had got this money. It would last them for a considerable time; and so, he hoped, they would not have to go to Parliament for some years to come. Before that time arrived, their circumstances would no doubt get easier—coal would be cheaper again, and things would be more cheerful than they were at the present moment. Of course, the proprietors would see that their Engineer had been for many years past terribly handicapped by having to pay so dearly for his capital; and he (the Chairman) thought it redounded very greatly to his credit that there had been such a good dividend for the proprietors for so many years. There was no doubt they would have a good dividend in the future; but to get it they must have capital cheaper. This was the reason the Directors asked the proprietors to pass this resolution to give the Board authority to raise this capital, when, and at such times as, they thought fit. He might say that they were not thinking of raising any capital just at the moment, and that they had not even discussed the matter among themselves. All the Directors wanted on this occasion was to have the authority of the proprietors to issue the capital. On previous occasions, they had given the Board authority to raise £35,000 of each. This had been a little inconvenient, because they had had to call a meeting for the purpose; and he thought the proprietors had sufficient confidence in the Directors to know they would not raise money until they were absolutely compelled to do so. They had always prided themselves on being a Company that had a specially low capital per ton of coal carbonized; and they would endeavour to do in the future as they had done in the past. Certainly what he proposed was for the good and benefit of the concern; and he felt quite sure the proprietors would not hesitate to grant the Directors the power they asked for. He should like to say a few words upon another question. At the present time, the London County Council Photometer Bill was before a House of Commons Committee. They were fighting this Bill, because, if passed, it would make the inquiries into the illuminating qualities of their gas more irksome and troublesome than they had been during the past twenty years. Mr. Livesey had written a most excellent paper, which he (the Chairman) had read with a great deal of pleasure, advocating what he himself had often ventured to suggest at these meetings—that, if they could only get people to see the advantage of using gas of lower illuminating power, it would be of the greatest possible benefit to the community in general. Mr. Livesey's paper (it was put in much better language than he could express it in) pointed out quite plainly that the amount of saving to the community would be very large. Of course, if they were allowed to supply 14-candle gas instead of 16-candle gas, there would be some considerable saving in point of enrichment; and the Companies would not want the money saved. It would at once be given to the consumers in reduction of the price of gas. This was what Mr. Livesey had endeavoured to enforce in the paper he had lately published. He (the Chairman) merely mentioned it so that, if the proprietors had any power or influence with Members of Parliament or others who could help them to obtain such a desirable change, they might know they could endeavour to use it with great advantage. Abroad they might see cities far better lighted than were their own towns at home, and they were all supplied with gas of not more than 14-candle power. One satisfactory advantage was that the ceilings of the houses were not made so dirty as they would be by high illuminating gas. He could not see why the authorities still insisted upon this high illuminating quality, unless it was with the idea of making themselves as unpleasant as they possibly could. People did not seem to have much sympathy with gas companies. They had had to raise the price of their gas; and perhaps they would now get still less sympathy.

The Deputy Chairman seconded the motion.

Mr. J. Melton Gunn said a year ago, when the Directors last issued

to the proprietors new stock at par, a remark was made by the Deputy-Chairman that, although it was a good day for the proprietors, it was a bad day for the Company. He (the speaker) then made a few remarks rather objecting to that. It seemed to him the interests of the proprietors and the Company were identical. The proprietors were part of the Company; and since the Company in the present state of affairs—the very high price of coal and various other circumstances—could not afford to issue their stock at par, he thought the proprietors ought to acquiesce cheerfully in the proposal to issue it at a premium. He heartily supported the resolution on that ground.

Mr. Beard suggested that it would be much better if the Directors decided upon a price at which they would issue the stock.

The Chairman said they could not do that.

Mr. Beard added that he had bought some of the 7 per cent. stock at £150; and, as he was quite in the dark, he asked the Secretary whether he had not given too much for it. The Secretary's reply was that he had not given enough. Therefore, he thought it would be much more satisfactory to the whole of the shareholders if a price was fixed.

The Chairman: We could never fix a price that would be agreeable to all the shareholders.

The Deputy-Chairman: It will be issued by auction or tender.

Mr. Ennis observed that apparently the sole reason for issuing the stock in the manner proposed was that it would keep the Company out of Parliament some time. To his mind, in a great many senses, the proprietors were thoroughly entitled to the privilege accorded to them by Act of Parliament—that was, the distribution of this stock among them at par. He understood that the last proprietor who spoke had given a high premium for stock, and that premium was partly given as consideration for the benefit of having stock allotted to him at par. What was proposed was that they should present to the consumers, who were partners with the proprietors (by reductions, the Chairman showed, at a recent meeting, they had received an immense sum as against only a small fraction in the case of the proprietors), something like £100,000; which the shareholders ought to have as a sort of let-down for the high price they gave for their stock. The proper thing to do was to go to Parliament, when they had allotted the present stock to the proprietors, and ask them for an extension of the capital. They would have to do so some day; and then, even if they had done as the Directors proposed, Parliament would not give them the slightest credit for it. They would cut them down in price in every possible way. Perhaps the Chairman could inform them how far the £100,000 and the £200,000 would carry them. The capital account was now overdrawn to the extent of between £2000 and £3000. He thought it unreasonable to deny themselves the privilege they possessed.

Mr. Quick suggested that, if the stock was offered to the shareholders by tender, it would give them something in the nature of a *quid pro quo* for what they lost.

The Chairman pointed out that they took power to either offer it by tender or auction, whichever they might consider the best at the time. Latterly, better prices had been obtained by auction.

Mr. Quick pointed out that Mr. Livesey suggested, at the last meeting, that the Company should appeal to Parliament and try to get an equivalent for what the proprietors were giving up.

The Chairman replied that they might go to Parliament with the £100,000 in their hands; and they would only get it taken from them. As to Mr. Ennis's remarks, they could not bind themselves as to the time the £200,000 would last; but it ought to suffice for a considerable period. Really the whole question was just as broad as it was long; for if they had to work with high-priced capital, they would not get anything like the 10 or 13 per cent. that they had been enjoying for years.

Mr. Neville inquired whether the Directors' proposal was legal.

The Chairman assured him that they had satisfied themselves on that point. Mr. Hollams—than whom there was no better authority in the City—had gone thoroughly into the matter.

On being put to the vote, the resolution was adopted.

A vote of thanks having been passed to the Chairman and Directors,

The Chairman responded; and, in the course of his remarks, he stated that, had Mr. Livesey been present, he would have entirely endorsed the policy of the Board in regard to the issue of further capital. He concluded by proposing a vote of thanks to the chief officials and their staffs.

The motion having been cordially agreed to,

Mr. H. E. Jones, in reply, said there had never been a time when the staff so much needed a little encouragement such as had just been given for the past half year. But that had been a comparatively easy period compared with the six months in front of them. They were in a tight place with these high prices for coal—higher prices than they had given for the last eighteen or twenty years. There were, too, a good many considerations to restrain them from increasing the price of gas. It encouraged the competition which was threatening them; and it was also essential that they should keep their best friend and customer in good humour. They would certainly have to sit tight and ride hard during the next six months. As an old parliamentary hand, he congratulated the Directors and the shareholders on having done something which would prevent them being obliged to meet a Parliamentary Committee for a few years longer. These Committees were most uncertain tribunals, although the general disposition was to act fairly and with good commercial sense and prudence. Gas companies, however, were not the highest favourites of Parliament. The popular supposition was—and it was only a supposition—that gas companies were wealthy and plethoric concerns, who could be easily bled a little without doing much harm. That being the atmosphere, he was happy they would not have to breathe that atmosphere for some time yet, owing to the proprietors' prudence. They had enjoyed the privilege of having stock allotted at par for 25 years now. It was an almost exclusive privilege so far as gas companies were concerned. It had not been given to another gas company after the Commercial Company got it; and they only obtained it by striking a quick bargain—by taking the sliding-scale from Mr. Forster's Committee. While the proprietors had enjoyed this privilege, it had not been nearly such a matter for enjoyment to those of the Company's officers and servants who had had to provide the dividend, and at the same time sell gas 6d. lower than it was sold at the present time in the City, and with the very active spur in their side to catch up to Mr. Livesey, who supplied gas at 4d. lower on the other side of the water.

Mr. Ellis, in replying, also congratulated the proprietors upon having passed the resolution in regard to the issue of future capital. It was, he said, a subject to which he had given a great deal of attention for some years past. He was perfectly certain, by resolving to issue capital on the cheapest terms in the future, the proprietors had added to the strength of the existing capital they held; and therefore they had to a certain extent guaranteed the continuation of the dividend so far as it might be maintained, having regard to the price of gas. He for one would leave the meeting with the comfortable conviction that, through the proprietors' action that day, his stock was well worth more to him. He did not say the price was going up on the Stock Exchange; the Stock Exchange did not always look at the true inwardness of things.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

The Half-Yearly General Meeting of this Company was held on the 31st ult.—Mr. C. Lawler, J.P., in the chair.

The notice convening the meeting having been read, the report of the Directors, with the statement of the accounts, the principal items in which were given last week, was presented.

The Chairman, in moving the adoption of the report, said the Company had carbonized 5146 tons of coal more in the six months covered by it than in the corresponding period of 1898, and made 36,314,000 cubic feet more gas; they receiving £6441 8s. 10d. more for the quantity sold. The Directors attributed this to the increased number of cookers, heaters, &c. (1800 additional appliances being fitted during the year, and the demand continuing), and to the dark, cold weather of December. Residuals maintained their price. The Company received £4244 14s. 1d. more for coke than in the corresponding period of 1898. Sulphate of ammonia had brought in £760 5s. 6d. more, and tar £1876 16s. 1d. more. In common with other gas companies, they had experienced some difficulty in obtaining their monthly deliveries of coal from their contractors in the time agreed. The contractors said it was impossible to get it owing to the exceptional demand for manufacturing and other purposes. As the result of the non-delivery of their coal, the Directors had to purchase some cargoes at a much higher price than the contract figure. The Company's new premises in Grafton Street, for the sale of cooking and heating apparatus of every description, also gas-fittings and incandescent mantles, had been open for some time. They were handsomely fitted up, and were well worthy of a visit from the public.

Mr. J. R. Wigham seconded the motion.

Mr. Crean asked the Managing-Director to make a statement on the subject of water gas, about which so much had been heard.

Alderman Cotton, J.P., in complying with the request, said in the first place there was evidently an attempt being made to create a scare in Dublin over the matter; and it would seem that it was being done by parties interested either in electric lighting or in acetylene. It was alleged that the introduction of water gas was something new. He granted that it was, because Dublin had been behind the times for some years. In London, however, an installation was started in 1891; and from the first the plant they put up was capable of making 12 million cubic feet per day. At present, London was supplied at the rate of 35 million cubic feet per day. The apparatus of the Alliance Company was only capable of producing a million cubic feet daily. In order to show the extent to which this manufacture was carried on in other places, he would give a few statistics. In Belfast, for instance, they were capable of supplying, and did supply last winter, up to 5,300,000 cubic feet per day; and in Liverpool, 8,000,000 cubic feet per day. In Birmingham, where the gas-works were corporate property, they supplied as much as 8,000,000 cubic feet daily; and in Edinburgh, 2,000,000 feet. The Alliance Company were the last to take it up. As he had stated already, there was nothing new in water gas. The Company sent their plans to the Corporation previous to starting it; and before they obtained permission to erect their works, the Electric Lighting Committee of the Corporation submitted their plans to the Public Health Committee, and there followed a long correspondence on the subject. The matter was put into the hands of Sir Charles Cameron, and he reported in favour of allowing the Company to supply water gas that would not contain more than 20 per cent. of carbon monoxide. Although it was stated on the previous day, at the proceedings in the City Hall, that they had not the sanction of the Corporation, they certainly had it, and had the correspondence in their possession to prove it. The use of water gas was now universal. The President of the Board of Trade stated a few days ago that in America they were using 70 per cent. of it; while up to the present they in Dublin were not sending out 6 per cent., notwithstanding all the cry that was being got up about it.

The Chairman said that, after the statement of Alderman Cotton, he need scarcely add anything. In London, Manchester, Birmingham, and Plymouth—the last-named being one of the most healthy towns in the kingdom—they used water gas largely, and the death-rate was gradually going down, instead of increasing. He did not suggest that this was caused by the use of water gas; but it showed, at all events, that the effect of using it was not to increase the death-rate.

The report was unanimously adopted, and the dividends recommended were declared.

The resolution passed at the last meeting, increasing the salary of the Secretary to £600 per annum, was confirmed without discussion.

A cordial vote of thanks was passed to the Chairman, Directors, and staff, and the proceedings closed.

SAN PAULO GAS COMPANY, LIMITED.

The Annual Meeting of this Company was held last Friday, at Winchester House, Old Broad Street, E.C.—Mr. D. M. Fox presiding.

The Secretary (Mr. G. H. Rogers) read the notice calling the meeting, and the report and accounts, referred to last week, were taken as read.

The Chairman, in moving the adoption of the report and accounts, said that for some years prior to 1897 the Directors had considerable anxiety in connection with the negotiations for the new contract; but the difficulties they had had to contend with during the period under review had, perhaps, been even greater, owing to changes made in the laws

regulating the electric light and the depression existing in San Paulo consequent on the unsatisfactory condition of the coffee trade. As to the receipts, an increase of £689 was shown in public lighting, owing to 94 additional lamps having been erected; making the total at Dec. 31 last 3214. In the sale of gas for private lighting, there had been a falling off of £6814. This decrease was not owing to the competition of the electric light, except to a small extent. The main cause was the temporary falling off in the prosperity of the City of San Paulo. The actual number of private consumers was 4784 against 4876 in 1898, a reduction of under 2 per cent.; but it was apparent that economy had been exercised in the use of gas, as the quantity consumed was less by 6 per cent. With the revival of the coffee trade, of which there were already indications, there would be a return of prosperity to San Paulo. The item of residual products was practically the same as in the previous year, £417. On the expenditure side, coal showed a reduction of £3242; the sale of gas to the private consumers having fallen off, 1583 tons less were carbonized. Repairs and maintenance, including materials and labour, stood at £3416, against £2747 in 1898. The £3416, however, included £1062, the expense of moving a coal-store. The old store was 400 yards distant from the retort-houses; and this involved continual expense and inconvenience in the transport of the coal. The cost of the land for the new store, £2444, had been carried to capital account. Under the head of distribution, there was an increase of £1330. For some time the State Authorities have been carrying on extensive works of sewage and drainage in the city, causing a considerable disturbance of the gas-mains, with a consequent increase in the gas unaccounted for. To remedy the defects in the mains, a larger number of men had been employed than usual, with the result that the leakage had, during the past year, been reduced by 2½ per cent., as compared with 1898. For the first time in the Company's history, the Government had for the period under review, imposed an income-tax on the dividend; and there was no alternative but to pay the £970 demanded. For some time the Board had been anxious to push the incandescent burner, but had been hampered, because the patent rights for the State of San Paulo were held by a Brazilian firm, who imported mantles and burners that did not give satisfaction. After some negotiation, the Directors had acquired for the Company those patent rights for £622; and the Welsbach Company here had agreed to supply them with their improved burners and mantles on advantageous terms. A store had been opened in San Paulo for their sale; and the Directors had every reason to be satisfied with the result of the first four months' business. They believed that, with the proper use of these burners, gas would hold its own against the electric light. In connection with this department, the use of gas-stoves for cooking and heating was also being introduced. After referring to the capital expenditure, amounting to £5192, and to the effect of the rate of exchange on the remittances from Brazil, he said that the electric light question had caused the Board much anxiety. It was mentioned in last year's report that, having the offer of lighting the new railway station at San Paulo by electricity, the Board had decided that it was a favourable opportunity for starting an electric light works. This business was approached with the greatest caution; and it was not until they were assured by their legal adviser that the Company had the right to supply the electric light under their contract, and that the President of the Camara Municipal was favourable to their doing so, that the Directors would in any way entertain the idea. Within six months of entering into the contract, and when the plant was nearly ready for shipment, the Camara Municipal passed a law for regulating the supply of the electric light in the city, the conditions of which were so onerous that the Company had no alternative, but to cancel the contract and throw up the business. The Board paid £2200 to get rid of the Company's liability under the contract; and he thought they acted wisely in cutting the loss. As it was important that the new railway station should be efficiently lighted on its completion, the Railway Company had arranged to light it on the intensified gas system. With regard to the coal supply, they had contracts which would carry them nearly through the current year; but it was alarming to think that the present price was 16s. 6d. per ton for coal for which they were now paying 9s. 3d., and which in 1896 cost only 6s. 6d. The Directors' attention had been directed to improvements in the producing plant with a view to cheapen the cost of manufacture, and the Consulting Engineer (Mr. A. F. Phillips) had in hand the alteration of the retort-settings, so as to bring them up to the most modern standard of efficiency. As to water gas, there were difficulties in the increased cost of oil, and of duties, and of the storage and transport of the oil that appeared insuperable; and, therefore, for the present, this projected improvement had been postponed.

Mr. J. R. Tyndale seconded the motion.

Mr. W. C. Fowler felt it was a misfortune that the shareholders were to receive only 8 per cent., as against 10 per cent. in the previous year. In a foreign Company like this, the shareholder had a right to expect 10 per cent. The Company had been shamefully managed in former years; but he considered it was well managed now.

After further discussion, the motion was unanimously adopted.

The proposed final dividend of 3 per cent. per annum, free of income-tax, making, with the interim distribution, a total of 8 per cent. for the year, was approved.

The retiring Director (Mr. John Barker) and the Auditors (Messrs. Cash, Stone, and Co.) were re-elected.

The usual complimentary votes concluded the proceedings.

Darlington Gas and Water Supply.—At the meeting of the Darlington Town Council last Thursday, Alderman Barron, in presenting the accounts of the Gas Department, said the Committee had determined to hand over, in relief of the rates, the whole of the balance of profit on the year's working, amounting to £5900, or £726 more than the previous year. This mostly arose from an increase in the number of consumers; but it was also very satisfactory to find that they had brought their loss by waste down to 3½ per cent., which practically meant that they were paid for all the gas they were making with the exception of this percentage. It was an interesting fact that since the gas-works had come into the possession of the Corporation, they had contributed something like £75,000 towards relieving the rates. The profit had gone on steadily increasing; and he hoped it would continue to do so. The minutes presented by the Water Committee showed that the profits had been £7811; being £653 more than before.

INCANDESCENT GAS LIGHTING IN SOUTHWARK.

At the Meeting of the St. Saviour's (Southwark) District Board of Works last Wednesday, it was reported that the Secretary of the South Metropolitan Gas Company (Mr. Frank Bush) had written stating he regretted to receive complaints from the Board as to the mantles of the incandescent gas-lamps in the streets being defective. The Company's lamp inspector had been instructed to inquire into the matter. Several members expressed the opinion that the Company did not renew the mantles as promptly as they might do; and one said the lighting was worse now than it was before the incandescent system was introduced. (No, no.) Mr. Puxty said he did not think it would be seriously contended that there had not been an increase of light through the introduction of the system. At the same time, the Company should be kept up to their contract, and an allowance should be made for any lamps that were out. Mr. Southerell generally agreed with the last speaker; remarking that there could be no two opinions as to the value of the change from the old burners to those now in use. The Surveyor thought the mantles were generally broken by children fixing ropes on the lamp-posts and swinging round them. In the result, it was resolved to communicate with the police as to this practice; and it was further decided that the officers of the staff should endeavour to keep a record of the time lamps were left extinguished at night. On the same occasion a letter was read from the Company notifying that, owing to the great increase in the cost of coal, the price of gas had been raised from 2s. 1d. to 2s. 4d. per 1000 cubic feet. Owing, however, to the Board having entered into an agreement with the Company with respect to incandescent lighting, the charge for gas for the street-lamps in St. Saviour's district would not be raised.

MANCHESTER CORPORATION GAS AND ELECTRICITY SUPPLY.

At the Meeting of the Manchester City Council last Wednesday, the minutes presented by the Gas Committee were adopted without discussion. These consisted chiefly of the acceptance of tenders for new plant required at the various works, including two Lancashire boilers and a station meter at Bradford Road, fire-clay goods for the Droylesden works, and two standard test gasholders. Tenders were also accepted for the maintenance of the photometers at the several works, and for the purchase of the spent oxide produced during the ensuing year.

The minutes of the Electricity Committee, which were also adopted without amendment, contained a resolution to the effect that the corporate seal should be affixed to the agreement with the Urban District Council of Audenshaw, transferring their Electric Lighting Order to the Corporation, and that the Town Clerk be instructed to take the necessary steps, and give the requisite notices, for obtaining the approval of the Board of Trade. In a further resolution, the Finance Committee were requested to make application to the Public Works Loan Commissioners for a further instalment of £35,000 on account of the loan of £181,610 for electricity purposes.

LEEDS CORPORATION GAS SUPPLY.

The Coal Difficulty and the Quality of the Gas.

At the Meeting of the Leeds City Council last Wednesday, on the presentation of the minutes of the Gas Committee, Mr. Henry called attention to the illuminating power of the gas, as shown by the report of the Justices' Inspector (Mr. C. Buckley). He complained that, according to this gentleman's tests, the illuminating power of the gas had been below the standard for the past four months. The present, he said, was not an exceptional time, to account for such a state of things; and he would like to hear what explanation the Chairman of the Gas Committee had to offer. The standard required by the Council, in accordance with a resolution passed in 1893, was 18½ candles; the minimum not to be below 18 candles. From figures available, it appeared that during the past month Mr. Buckley had made 46 tests, of which only 15 were within the standard—one test, it appeared, being actually below 16 candles. He submitted that it was unfair to the ratepayers and to the gas consumers to allow the illuminating power of the gas supply to be lower than the required standard. Alderman Lowden remarked that Mr. Henry knew and appreciated the reasons for the low illuminating power of the gas. He was perfectly well aware that, under the circumstances of the last few months, it was impossible to maintain the 18-candle standard. The whole kingdom knew the trouble there had been in producing gas of the required standard, and in some cases in making the requisite quantity. Every large city and town in the country—Sheffield, Manchester, Liverpool, London, and other places—had experienced the same difficulty as Leeds, and even in a much greater degree. In Leeds they had been most fortunately situated. As far as he knew, no city in the kingdom had shown the foresight of Leeds in having so large a stock of coal in hand. They had done everything that was humanly possible. Of the eight Liberal members of the Gas Committee, not one raised his voice in criticism of the management of the Gas Department; and he cordially thanked them for their loyalty. There were various reasons for the deficiency in the illuminating power of the gas. The first was the difficulty of obtaining cannel coal. By their contracts, no less than 11,000 tons were due in December, but they were able to obtain only 4500 tons; in January, close upon 11,000 tons were due, and they received 6354 tons; and in February, 8060 tons were due, yet they had only 4822 tons. In other words, just about half of what was due during those three months was actually delivered. Then there was a difficulty in procuring cannel hub, 7000 tons of which were due; but until the last week or two they were unable to obtain deliveries, as the seam had run out, and the colliery proprietors had been to see what terms they could make with the Committee. There was another reason. The Corporation had during the last few years built large stores, capable of holding 40,000 or 50,000 tons of coal. For the cost of those buildings, the Corporation had already been recouped

in consequence of their having been able to stack coal bought at a low price compared with that they would have to pay to-day. During the past few months, they had not used any of the coal in those stores; they had used some which had been stacked in the open—some of it for years—and which, having been exposed to the weather, had considerably deteriorated in quality. In the three months of December, January, and February, 24,701 tons of this coal had been carbonized. It had been tested, and it was found that its illuminating power was 14½ candles at the New Wortley works, 14 candles at Dewsbury Road, and 13½ candles at York Street. Moreover, there had been the scarcity of coal, and the Committee had been obliged to accept that which was not equal to the samples, though, of course, they had made claims when it was below the stipulated quality. These reasons, he contended, were satisfactory; and, under the exceptional circumstances, censure was unjustifiable. He added that during the six months ending June 30, 1893, when the Radicals were in power, and when the standard was 19 candles, the average illuminating power was 0·93, or nearly 1 candle, below the standard; while of the six testing-stations, the worst results were at Meadow Lane, which was under the control of the Committee of which Mr. Henry himself was Chairman—the illuminating power of the gas being 17·84, instead of 19 candles, and this at a time when there was no difficulty in getting adequate supplies of coal in regard to either quantity or quality. The minutes were confirmed.

THE ROTHERHAM CORPORATION AND CARBURETTED WATER GAS.

At the Meeting of the Rotherham Corporation last Wednesday, a recommendation of the Gas-Works Committee, that the Consulting Engineer be instructed to report on the advisability of providing more storage accommodation at the gas-works, and further on the desirability or otherwise of putting down an installation of carburetted water-gas plant, gave rise to some discussion. Alderman F. Mason, with the consent of the Mayor, and without moving a special resolution, criticized the recommendation. He said the reason he did not move the striking out of the latter part of the proposal was that the conditions now were different from what they were three years ago, when the subject was discussed by the Council, and abandoned. A Government Department had since proposed restrictions. He did not object to a report being submitted, but, so far as he was concerned, anything that would affect the public health would be opposed. He had no doubt the Engineer would take cognizance of the fact, and would not recommend the putting down of plant where the mixture of the two gases would exceed the regulations. He thought the time had come when something should be done to improve the supply of gas. They had expended enormous sums for this purpose, and the gas was still unsatisfactory and universally condemned. The smell was offensive, and the illuminating power grossly inadequate to the requirements. He knew he was treading upon dangerous ground, because the Mayor (Mr. G. Gummer) had taken the initiative, and the Council had decided to spend no more money until present schemes were completed. They had, however, voted gas profits to provide Turkish baths; but he thought if the money had been spent in improving the quality of the gas it would have been better. He hoped the Engineer's report would not seriously prejudice the health of the community, or more would have to be said upon the question. Mr. Cox said the subject had been investigated by a competent authority, and he did not see why Alderman Mason should get up and suggest that the Corporation were going to commit a breach of the law, or do anything that would run counter to orders. So far as he could see, the only object of Alderman Mason was to discredit what in his (Mr. Cox's) opinion was a most justifiable, economical, and wise course of the Gas Committee in regard to the condition of their plant. The Mayor said the debate was rather out of order; but he had given Alderman Mason permission to make a few remarks without moving an amendment. He had not for one moment anticipated that their object had been what it had turned out to be. He took it that the Alderman was not the only gentleman in the Council desirous of looking after the health of the people; and it was not necessary therefore for him to say he should oppose the introduction of carburetted water gas, if it were detrimental to the health of the borough, any more than the other members of the Council. The health of the inhabitants was not altogether in the keeping of the Chairman of the Health Committee. So far from carburetted water gas being prejudicial to health, since the matter was discussed by the Council three years ago plant for making the gas had been installed in many places which were really health resorts. Further, Alderman Mason seemed to have had another object, and that was to make an attack upon the management of the gas-works. He (the Mayor) saw no reason why that gentleman, in referring to the Committee's minutes, should have spoken about the enormous sums spent, and the inadequacy and poor quality of the gas supply. These were general statements of which there were no proofs. Defending the action of the Gas-Works Committee, he said he believed they were entirely of opinion that when the improvements were thoroughly carried out, they would have model works which would serve the requirements of the town for some little time. The extensions and the great demands on the department necessitated either more storage or the installation of some method of producing gas quickly, as proposed. Additional storage would incur an expenditure of from £20,000 to £25,000; and with the present high prices of materials and labour, the Committee were of opinion that it would be better to defer the construction of more gasholders for a time, and put in some other kind of plant. The recommendations were approved.

Dorking Gas Company.—The 58th half-yearly meeting of this Company was held on the 27th ult., when it was reported that there was a balance available for distribution of £2573. The recommendation to pay the maximum dividend on all classes of the shares was agreed to. This absorbed £1039, and left a balance of £1534 to be carried forward. Mr. William Cash, of London, was appointed Auditor, in place of the late Mr. F. Durant. At an extraordinary general meeting, the Directors were authorized to issue 144 additional "C" shares of £25 each, at a premium of £10, to be allotted to applicants from among the shareholders.

THE GAS POISONING CASE AT PLYMOUTH.

An Inquest was held last Tuesday, at East Stonehouse, by Mr. R. R. Rodd, on the bodies of the two men—Frederick Bennett, 27, stoker in the Royal Navy, and Thomas Ash, 77, naval pensioner—who, as reported in the last number of the "Journal," were suffocated by gas at a refreshment-house where they slept on the previous Saturday night.

William Henry Colwill, the keeper of the house, said that Ash had lodged with him for five or six months. He went to bed about nine o'clock on Saturday, the 31st ult., and Bennett, who came in about 12.30 a.m., was put in a spare bed in the same room. He was sober. There was no light in the room when Bennett went to bed, but there was light enough from a gas-jet outside to enable him to see. Witness did not light the gas. There was no fireplace in the room, which was about 10 feet long, 8 feet wide, and 8 feet high. The gas was laid on to the room about six or seven years ago. The fittings were gas-tight; but the tap turned easily. Before going to bed, witness went round the house, and saw that all the lights were out except those in the passages. They did not call the lodgers on Sunday mornings, and it was after twelve o'clock when witness went to the room occupied by the two men. On opening the door, he found the place full of gas and both men dead. There was a window in the room; but he believed it was closed. Those who occupied the room often closed the window; and Ash generally did so.

The Coroner commented on the smallness of the room, which was, he said, a mere box of a place.

Witness said there was space for two men to sleep, according to the regulations.

The Coroner also pointed out that the gas-tap was very loose. A stranger might turn it off and partly on again without knowing it.

Witness said that, to his knowledge, the gas was not lit on the night in question. It was possible Bennett caught the tap with his clothes in undressing. He could not have touched it with his foot after going to bed.

A private in the Royal Marine Light Infantry, who occupied the next room, said he did not hear any noise in the night, nor did he smell gas.

Mr. *W. H. Waterfield*, surgeon, said he was called to the house at 12.40 p.m. on Sunday, and saw the bodies of the two men in the bedroom. There was a strong smell of gas in the room. The men had been dead from four to five hours. There was no leakage of gas if the tap was properly turned. There was a stop on, but the tap worked loose. The window of the room was closed, and with the door shut there was no outlet whatever for the gas. A *post mortem* examination showed that both men were healthy. Death was due to asphyxia, caused by coal-gas poisoning. The burner would give out about 5 cubic feet of gas per hour. If there were an amount of water gas, death would take place sooner; but if there had been only coal gas, the result would have been the same. The room was about 8 feet square, and its cubical contents 640 feet. He did not know what the authorities in East Stonehouse considered necessary; but sanitarians said that for two people sleeping in one room there should be 3000 cubic feet of fresh air per hour. If the room had been two or three times as large as it was, the pouring into it of so much gas would have produced death, but it would have been slower. The room was practically air-tight.

The Coroner said that, as the room had no fireplace or other means of ventilation, it was very questionable whether gas should have been laid on; but, a supply having been provided, care should have been taken to see that the fittings were perfect. The tap, however, worked very easily indeed; and it was probable that Bennett by some means turned the gas on.

A verdict of "Accidental death" was returned; and, on the recommendation of the Jury, Colwill promised to take down the wall between the room in question and the next, and to discontinue the use of gas in that part of the building.

OLDBURY GAS UNDERTAKING.

The Monthly Meeting of the Oldbury District Council was held last Friday—Mr. W. T. Davies presiding. Mr. J. W. Wilson, M.P., moved the adoption of the annual statement of the gas accounts, some extracts from which were given in the "Journal" last week. In doing so, he congratulated the Council, as well as the Manager and the Gas Committee, on being able to show a statement with so substantial a profit as £1700, considering the circumstances. The year had been a good one, from a manufacturing and selling point of view. During the past three years, the gas consumed had risen from 91 to 106 million cubic feet; coal cost more; and the manufacture of gas showed an increase of £500. The expenses of distribution had been somewhat heavier, by reason of their having to take up mains and put down new ones; but, on the other hand, the £1400 more on the manufacturing side was balanced by £1400 on larger sales and returns from residuals, which enabled them to realize the same amount of profit as in the previous year. They had not paid the full increase on their coal, owing to the policy they had adopted of having heavy stocks in hand; for while some works had been with only two weeks' supply, they at Oldbury always had two or three months' stock. The profit and loss account showed £300 less net profit; but this was because they paid £200 more in relief of the rates, and gave £50 towards the Technical Institute. They did not at present propose to raise the price of gas, as had been done in many places, but to apply £300 at once in reduction of the rates, and £300 more in the autumn. It was the aim of the Committee to maintain a moderate grant like this, which was better than going into four figures one year and dropping the next. The motion was carried.

The Condition of the Water Supply of Pudsey.—The Medical Officer of Health of Pudsey (Dr. W. L. Hunter) makes some startling statements as to the impure condition of the water supply of the town during last year. He says the supply was so unsatisfactory that, if an equally dirty effluent were turned into a stream from sewage treatment works, the Yorkshire Rivers Board would not accept it. The impurity of the water is illustrated by photographs, which are said to show the difference between Bradford water and clean water.

ELECTRIC LIGHTING NOTES.

The Electric Lighting Committee of the York City Council have advised the extension of the electricity works at a cost of £20,000; and the Council have authorized an application for the sanction of the Local Government Board to the borrowing of that sum.

An increase of from £20 to £22 10s. per annum is to be made by the Torquay Electric Lighting Committee in the charge for the lighting of the arc lamps in the streets. In spite of this and some other economies, the estimate for the current half year is that the undertaking will only barely pay its way.

In connection with the Lancashire Electric Power Bill, the Town Clerk of St. Helens has been instructed to write to the Lord Mayor of Manchester, pointing out that, if the clauses are inserted in the Bill for the protection of boroughs, which it was understood as the result of the debate on second reading would be inserted, making the Council's consent a condition in respect of the route of "through" cables and the supply within the boroughs, the Corporation of St. Helens would be satisfied not to oppose the preamble of the Bill.

At the meeting of the West Hartlepool Town Council last Tuesday, the Electric Lighting Committee were authorized to increase their borrowing powers by £19,000, for the purpose of carrying out extensions of mains, &c. It was stated that the Free Library had been equipped ready for the installation of the electric light. The Engineer is to report upon the cost of lighting by electricity the Municipal Buildings, County Court, Market, and Abattoir; and hopes were expressed that before long the Town Hall and the Technical Schools would be included in the scheme.

The Epsom Urban District Council have adopted a somewhat novel method of raising a loan of £16,100 for the purpose of meeting the cost of the introduction of the electric light. When the question was first under discussion, it was calculated that the money could be obtained at the rate of 3 per cent. or less. Owing to the changes which have since taken place in the Money Market, the rate of interest has increased; and, with a view of keeping the expenditure at the lowest possible figure, the Council have obtained the sanction of the Local Government Board to the issuing of 322 debentures of the nominal value of £50 each, on the security of the rates. These are to bear interest at the rate of 3¼ per cent.; and their redemption will be made within 23 years from the date of issue by means of 23 annual drawings of £700. The matter came before the Council at their meeting last week, when the members unanimously approved of the scheme.

Last Friday, deputations from the Vestries of St. George-in-the-East, Limehouse, and Mile End Old Town attended before the Board of Trade to have their Electric Lighting Provisional Orders confirmed. They were opposed by the County of London and Brush Provincial Electric Lighting Company, who already have an Order to enable them to supply electricity in those Vestries' districts, but have not begun to do so. The three Vestries argued that in November next they would be joined with Whitechapel, which had an Order, and would form the new borough of Stepney, and that this private Company should not be allowed to compete. Sir Courtenay Boyle, after hearing the parties, reserved his decision; saying that, supposing the Orders were granted, they should all conform to the provisions of the Whitechapel Order, so that, under the London Government Act, the new Municipality of Stepney should have identical provisions over the whole borough.

According to a report presented by M. Toukoff to the Congress of Electricians which was recently held in St. Petersburg, the first electric light installation in the city was put up in 1882; and now there are 284 private ones and 10 central stations working under contract with the Municipality according to authorized rates, and with the exclusive right to utilize the streets for power-distributing purposes. Four of these stations belong to the first Electric Lighting Company (the Belgian Company) and the Helios Company. They supply 587 private and 387 public arc lamps, and 212,000 incandescent lamps belonging to 5000 customers, along a length of cable extending 491 miles. The 294 stations comprise 408 steam-engines and 98 gas-motors, having altogether 50,906-horse power, and working 502 dynamos. The total number of arc lamps is 3317, and of incandescent lamps 451,951, half of which are supplied from private stations. The total number of employees in connection with the electric lighting is 1212.

The works erected by the Doncaster Corporation for supplying the centre of the town with the electric light and to furnish the motive power for driving the tram-cars to the outlying places were opened yesterday week. The first engine was started by the Mayor; and the light was switched on by the Mayoress. His Worship made an interesting little speech in the course of the proceedings, tracing the development of artificial lighting in the borough. He said that in 1764 the Corporation decided to illuminate the town with oil-lamps; and the cost of oil, lighting, &c., was £131 per annum. In 1827 the old Gas Company was formed, the Corporation being shareholders. They erected works at a cost of £11,600; and the undertaking was subsequently purchased by the Corporation at a cost of between £16,000 and £17,000. In 1899, the same works —of course, with enlargements—were put down in the Corporation accounts as worth £66,000. But the old Company was not the first to introduce gas in Doncaster. In 1814 an enterprising whitesmith named Elliott manufactured gas on his own premises; and in 1815, on the reception of the news of the victory at Waterloo, and also on the declaration of peace, he illuminated his house. What they were witnessing that day was only a portion of the Corporation scheme. In the entirety the Corporation would spend about £100,000. The works had been so constructed that they would be able in the future to command any supply. The remaining £70,000 was proposed to be expended in the provision of electric trams.

A rather warm discussion took place at the meeting of the Salford Town Council last Wednesday, on the proceedings of the Electric Light Committee coming up for consideration. Owing to certain alleged irregularities which had occurred in connection with the placing of the contracts for the electric light station, the Chairman of the Committee (Mr. A. Haworth) decided to resign his position. On the matter being referred to by the Mayor (Alderman Rudman), the Town Clerk explained that the plans for the new station, with regard to which the dispute had arisen, were in the hands of an expert, and would be back by the following Monday, after which the whole of the facts would be prepared, and a General Purposes Committee meeting could be called to consider them. It was decided to suspend the standing orders, so that Mr. Haworth might have an opportunity of giving some explanation to the Council. This he did, and concluded by moving that the Electrical Engineer (Mr. C. L. Turner) be forthwith requested to send in his resignation. Mr. Bates having seconded the motion, Alderman Phillips said they had to consider the dignity of the Council, and to do justice. They had heard a very grave statement from the Chairman of the Committee; and the question was whether or not Mr. Turner was faithfully discharging his duties. He thought the best course for the Council to take was to appoint a Special Committee to thoroughly investigate the whole matter; and he moved an amendment to this effect. Alderman Mandley seconded the amendment. Alderman Snape characterized the amendment as practically a vote of censure upon the Electric Light Committee. After some further remarks, Mr. Haworth withdrew his motion, and the amendment was carried; the Special Committee being appointed.

Alderman T. B. Sanderson presented, at the meeting of the Newcastle Town Council last Wednesday, a report from the Watch Committee, recommending that certain streets should be lighted by electricity, and that application should be made to the Local Government Board to sanction the borrowing of £10,000 to meet the necessary capital expenditure. He moved the adoption of the report; but this was objected to—several members claiming that it should stand over till next month. It was resolved, however, that the report should be taken. Alderman Sanderson said that to light the whole of the tramway routes with electricity they would require 373 lamps, at £18 per lamp, amounting in all to £6714. The charge for gas being £2541, the extra cost of electricity was £4173. To light the centre of the city they would need 180 lamps; but they would put out 380 gas-lamps and 18 of the electric-lamps, and would get four times the amount of light, at an extra cost of £1726. The total cost was £7750; but they desired to provide for extensions, and they asked the Council to give them permission to apply for sanction to borrow £10,000. Several members complained that the outskirts of the city had been neglected in the lighting scheme; but it was replied that it would be well to experiment in the centre of the city with the electric lamps, before considering a scheme for the lighting of the whole area. Mr. Gillespie said that, if the lighting in the proposed streets was successful, no doubt the Committee would recommend its extension to the other parts of the city. Alderman Sanderson stated that the streets in which they proposed to put the 180 lamps were now lighted by 380 gas-lamps, at an annual cost of £758, and the 18 electric lamps which cost £756; making a total annual cost of £1514. The illuminating power of the existing lamps was 47,000 candles; the power of the electric lamps would be 180,000 candles. The report was adopted.

At the recent annual meeting of the Folkestone Electricity Supply Company, Limited, the Chairman (Alderman G. Spurgeon, J.P.) said the capital expenditure during the year had been £21,400, increasing the total outlay to over £64,000. The capital was only £54,000, and the Directors had decided to issue £25,000 of debentures at 4½ per cent. They had had an unprecedented number of applications for electric current during the year, and found they were unable to go on satisfying the demand unless they made provision for additional new machinery, and for the extension of the buildings. The Directors had not expected to have to make arrangements for extensions so soon. When they started, they considered that provision for supplying the equivalent of 10,000 or 12,000 8-candle lamps would be sufficient for some time; but during last year their business had increased by more than 7000 lamps—from 10,089 to 17,834. During the present year they had put in 1111 additional lamps; and there was every indication of the demand increasing. They had applications in hand for another 500 odd lights; and therefore they must make provision for the future. Of the lamps wired last year, more than half the total increase (4540) was connected in the second half, and 1500 in September. The number of units sold was 209,931, and the revenue was £4156, giving an average cost to the consumer of about 4¾d. per unit. This was their first year of working, and they proposed to pay a 4 per cent. dividend. In connection with the item of £2709 for installation work for consumers, on which a profit of only £20 had been brought into the year's accounts, some shareholders might think this a small profit on such an outlay; but the Company were anxious to get as much business as they could, and a great many people said they would like to have the electric light but could not face the initial cost of the installation. The Company had, therefore, put in installations at practically cost price. By this means they had gained many consumers, on the supply of current to whom they made a profit. The report was adopted.

EAST LONDON WATER-WORKS COMPANY.

The Half-Yearly General Meeting was held at the Company's Offices, St. Helen's Place, E.C., on the 5th inst.—Colonel A. R. M. Lockwood, M.P., presiding.

The Secretary (Mr. I. A. Crookenden) having read the notice convening the meeting, the report and accounts were taken as read.

The Chairman stated that it was a good many years since they had had so small a sum as £359 to carry forward after paying the dividend; but he might remind the proprietors that, for the Midsummer half year of 1896, his colleague, Mr. Banbury, the late Chairman, had to meet them with a still smaller sum—namely, £261—after paying the same rate of dividend. His own case, he therefore ventured to hope, was better than his friend's, as the accounts for the past half year had had to bear the burden of £30,615, entirely owing to the drought. This large sum was expended in the purchase of water from other Companies through the intercommunication mains which were now permanently available; and it was with considerable satisfaction that the Directors emphasized the fact that, during the whole of the past dry period, with an abnormally light rainfall, a continuous and unlimited supply of pure water had been furnished throughout the whole of the Company's district. This large extra expenditure was the sole reason why the Company's funds were drawn down to so low a figure of reserve. In connection with this subject, he might mention that, although such large quantities of water were purchased for the Company, they never drew down the reservoirs below 600 million gallons; and the pressure throughout the district was higher

last year than at any time in the Company's history. The other side of the accounts presented a bright and hopeful prospect. The percentage of increase of water-rates for the past year had been greater than had ever happened before in their history; and it would be manifest that, given a fairly normal rainfall, the vitality of the Company, by the rapidly increasing population, justified the expectancy of better times to come. The number of supplies at Christmas last was 204,671. The water-rate per house for the year ended at that date was £1 3s. 7¾d., as compared with £1 3s. 4½d. a year previously. This improvement of 3¼d. per house on the total number of the Company's supplies represented an increase in the water-rents of £2771. Apart from the uncertainty of the elements, the vast machinery necessary to carry on so extensive a business as the Company's was in the most satisfactory working order. When he said "machinery," he alluded to the human machinery—inspection, collection, and the enormous correspondence which naturally arose from a *clientèle* of over 200,000 customers. There was no doubt that the consumers began to realize that the water supplied by the East London Company was not only good and plentiful, but also cheap; and when he told the proprietors that the price at which the water was delivered at the consumers' doors for domestic purposes was a fraction over 4d. per 1000 gallons, the customers might come to the conclusion that East London water was about the cheapest commodity with which they had to deal in their daily life. From whatever cause the fact arose, the relationship between the Company and their enormous body of consumers was most pleasant and satisfactory; and the Directors were gratified in recognizing this happy result of the policy of conciliation and fair treatment which they had always pursued. He would not closely analyze the figures before the proprietors, but he might assure them that the business of the Company was in a most sound and satisfactory condition; and, as there had already been an excess of rainfall of upwards of 3 inches over that of last year, the Directors felt justified in hoping that the Company would be able to supply the whole of their customers in the current year from their own resources. The works were maintained in an efficient condition. The Board were satisfied with the progress that had been made with the new reservoirs; while the new works at other points of the Company's stations were being most satisfactorily prosecuted. The principal engineering works in hand during the half year ended Dec. 31 were the Banbury and Lockwood reservoirs, which were calculated to hold 1200 million gallons of water. The Directors kept urging Messrs. Pearson and Sons to use their utmost energy to complete these works as soon as possible. Fair progress had already been made with them; but during the present crisis of the war, the Contractors had had considerable difficulty in obtaining a large supply of labour. The report of the Royal Commission had been published, and was, as the Directors had stated, most satisfactory. One would almost suppose that the authorities would become tired of hammering at the water interest as they incessantly did, and they no doubt would if the costs came out of their own pockets; but as they were spread over the three-quarters of a million of ratepayers of the Metropolis, the expenses were not felt individually as they were by the Companies, where they took a more concrete form. For instance, this Company's charges for the year amounted to nearly £6000, and without any practical good results; for whenever the Companies had appeared before an impartial tribunal, they had invariably come off conquerors in the fight. As he told the proprietors at the last meeting, the Directors decided to re-introduce the Company's Bill which was so unfortunately rejected by a Committee of the House of Lords. This had been done; and the Bill was read a second time in the House of Commons on the 13th ult. The Directors would get it before the Committee of the House immediately after Easter; and they would use every effort to get it through both Houses of Parliament with the least possible delay. Of course, in great works of this kind, much had to be done in a preparatory way after the Bill became an Act. The Bills introduced by the London County Council were rejected by a majority of 83 on the 29th ult.; and with respect to the joint Bill which was introduced by the Companies, as alluded to in the Directors' report, this was withdrawn at the suggestion of the Speaker as being informal. Another measure which the Directors had thought it right to oppose in the interests of the stockholders, was the Bill promoted by the Lea Conservancy Board—practically to reconstitute the Board. The decision of the Committee was given on the 30th ult., approving the preamble, subject to any slight modifications that might arise on consideration of the clauses in order to make the preamble consistent with the clauses that should be finally adopted. He then explained the Committee's decision as to the manner in which the Lea Conservancy Board should be constituted; and remarked that the London County Council, with their habitual modesty, claimed the right to eight members, and hinted that they would take seven, whereas the Committee only allowed them two out of the total Board of fifteen. The Committee also decided that the annual payments asked for by the promoters—namely, £8000 for general purposes and £2000 for sanitary purposes—should be granted. This was more than double the existing contributions by the Water Companies. This decision the Directors looked upon as a violation of the parliamentary compact made in 1855; and they determined to take no further proceedings before the House of Commons Committee. Therefore, on the previous day, they withdrew from the room, intending to oppose the Bill before the Committee of the House of Lords. The Board had lost two of their colleagues—Mr. Nix by death, unfortunately, and their old friend Mr. Gadesden by impaired health. Both these gentlemen devoted very great zeal and intelligence to the best interests of the Company. Mr. George C. T. Bartley, M.P., had accepted one of the seats thus vacant, and he offered himself for re-election that day. The Directors thought that Mr. Bartley's great financial experience would be of considerable assistance to the Company. He concluded by moving the adoption of the report and accounts, and the declaration of a dividend at the rate of 7 per cent. per annum, less income-tax, on the ordinary stock for the half year ended Christmas last, payable on the 12th inst.

Mr. George Banbury seconded the resolution, which was carried unanimously.

Resolutions were afterwards passed re-electing the retiring Directors, Mr. Bartley (in the room of Mr. Gadesden) and Mr. Banbury, and the retiring Auditor, Mr. Daniel Hill.

The proceedings then terminated.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 919.

Issue.	Share	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 18	10½	Alliance & Dublin 10 p. c.	20½—21½	..	4 17 8
100,000	10	,,	7½	Do. 7 p. c.	14—15	..	5 0 0
800,000	100	Jan. 2	5	Australian 5 p. c. Deb.	100—102	..	4 18 0
200,000	5	Nov. 15	6	Bombay, Ltd.	6½—6¾	..	4 8 11
40,000	5	,,	6	Do. New, £4 paid	4½—4¾	..	5 1 1
380,000	Stk.	Feb. 23	12	Brentford Consolidated	260—270	−4½	4 8 11
270,000	,,	,,	9	Do. New	200—205	−3	4 7 10
80,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb.	118—123	..	3 5 1
250,000	Stk.	Mar. 14	11½	Brighton & Hove Orig.	237—242	−5	4 15 0
226,320	,,	,,	8½	Do. A. Ord. Stk.	180—185	..	4 11 11
999,500	Stk.	Feb. 23	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Mar. 29	10	British	41½—42¾*	..	4 13 0
50,000	10	Feb. 23	12	Bromley, Ord. 10 p. c.	24—26	..	4 12 4
70,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	Oct. 13	8	Buenos Ayres (New) Ltd.	9¾—10¼	..	5 17 1
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	99—101	..	3 19 3
150,000	20	Mar. 14	8½	Cagliari, Ltd.	25—27	..	6 2 3
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	15½—16½	..	4 17 0
50,000	50	Nov. 2	6	Do. 6 p. c. 1st Mort.	56—58	..	5 3 5
550,000	Stk.	Oct. 13	13½	Commercial Old Stock	302—307	−3	4 7 11
200,750	,,	,,	10½	Do. New do.	235—240	−5	4 7 6
200,750	,,	Dec. 14	4½	Do. 4½ p. c. Deb.	142—145	..	3 2 1
800,000	Stk.	Dec. 14	9	Continental Union, Ltd.	155—165	−5	5 9 1
500,000	,,	,,	7	Do. 7 p. c. Pref.	178—183	..	3 16 6
51,600	Stk.	Feb. 23	14	Croydon A 10 p. c.	335—340	..	4 2 4
173,400	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
555,000	Stk.	Feb. 23	5½	Crystal Palace Ord. 5 p. c.	122—127	..	4 2 8
80,000	,,	,,	5	Do. 5 p. c. Pref.	132—137	..	3 13 0
400,000	10	Jan. 26	11	European, Ltd.	19½—20½	−½	5 7 4
354,080	10	,,	11	Do. £7 10s. paid	15—16	..	5 3 2
14,993,075	Stk.	Feb. 9	4½	Gas-light and Coke	4 p. c. Ord.	102—104	−2	4 14 2
					3½ p. c. max.	97—99	..	3 10 8
					4 p. c. Con. Pref.	119—122	..	3 5 7
					3 p. c. Con. Deb.	98—100	−1	3 0 0
2,500,000	,,	,,	3½	Hongkong & China, Ltd.	13½—14½	..	5 10 4
3,799,735	,,	,,	4	Imperial Continental	211—214	..	4 13 6
3,993,375	,,	Dec. 14	3	Do. 8½ p. c. Deb. Red.	100—103	..	3 8 0
70,000	10	Nov. 15	8	Malta & Medn., Ltd.	4½—5½	..	5 9 1
3,800,000	Stk.	Nov. 15	10	Met. of 5 p. c. Deb.	107—111*	..	4 10 1
473,500	Stk.	Feb. 9	8½	Melbourne 4½ p. c. Deb.	105—107*	..	4 4 1
75,000	5	Dec. 14	6	Monte Video, Ltd.	11—12	..	5 0 0
500,000	100	Apl. 2	5	Newc'tle & Gatesh'd Con.	215—220	..	4 4 1
260,000	100	,,	4½	Do. 8½ p. c. Deb.	104—107	..	3 5 5
541,920	20	Nov. 15	3	Oriental, Ltd.	7—7½	..	5 6 8
667,946	Stk.	Feb. 23	9½	Do. New, £4 10s. pd.	6½—6¾	..	5 6 8
299,956	Stk.	Dec. 29	8½	Do. do. 1879, £1 pd.	1½—1¾	..	4 11 5
150,000	5	Nov. 30	8		* Ex div.		
135,000	5	,,	8				
15,000	5	,,	8				

Issue.	Share	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
60,000	5	Feb. 23	7	Ottoman, Ltd.	4¾—5¼	..	6 13 4
500,000	100	Dec. 1	6	People's Gas of Chicago 2nd Mtg. Bonds	102—106	..	5 13 2
851,070	10	Oct. 18	7	River Plate Ord.	11¼—11¾	..	5 19 2
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	100—102	..	3 18 5
250,000	10	Sept. 15	8†	San Paulo, Ltd.	11½—12¼	..	6 8 0
135,000	Stk.	Sept. 15	10	Sheffield A.	249—251	..	3 19 8
209,053	,,	,,	10	Do. B.	249—251	..	3 19 8
447,427	,,	,,	10	Do. C.	249—251	..	3 19 8
5,600,000	Stk.	Feb. 23	5⅓	South Metrop., 4 p. c. Ord.	135—137	−½	3 17 10
1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb.	100—102	..	2 18 10
380,940	Stk.	Nov. 30	5	Southampton Ord.	117—122	..	4 2 0
70,825	,,	Dec. 29	4	Do. 4 p. c. Deb.	120—125	..	3 4 0
120,000	Stk.	Mar. 14	6	Tottenham and Edmonton A. 5 p. c.	139—141	..	4 5 1
250,520	,,	,,	4½	B. 3½ p. c.	100—102	..	4 8 3
55,100	,,	Dec. 14	4	4 p. c. Deb.	113—117	..	3 8 5
182,380	10	Jan. 12	5	Tuscan, Ltd.	8—9	..	5 11 1
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.	101—104	..	4 16 2
				WATER COMPANIES.			
780,399	Stk.	Dec. 29	11	Chelsea, Ord.	307—312	..	3 10 6
150,000	,,	,,	5	Do. 5 p. c. Pref.	157—162	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	145—150	..	3 0 0
175,785	,,	Mar. 29	4½	Do. 4½ p. c. Deb.	145—150*	..	3 0 0
1,720,560	Stk.	Oct. 18	7	East London, Ord.	200—205	−2	3 8 4
654,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb.	145—150	..	3 0 0
390,000	,,	,,	3	Do. 3 p. c. Deb.	99—101	..	2 19 5
700,000	50	Dec. 14	7½	Grand Junction 10 p. c. max.	107—109	−1	3 8 10
310,000	Stk.	Mar. 29	4	4 p. c. Deb.	130—135*	..	2 19 3
708,000	Stk.	Feb. 23	14	Kent	307—312	..	4 9 9
160,000	,,	,,	7	Do. New, 7 p. c. max.	200—210	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.	295—300	..	3 10 0
406,200	100	,,	8	Do. 7½ p. c. max.	215—220	..	3 12 9
350,000	Stk.	Mar. 29	4	Do. 4 p. c. Deb.	130—133*	..	3 0 2
500,000	100	Feb. 23	13½	New River, New Shares	418—423	−2	3 3 9
1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb.	132—137	..	2 18 5
902,300	Stk.	Dec. 14	7½	South-wark and 5 p. c. Pref.	Ord.	200—205	..	3 13 2
126,500	100	,,	7½		7½ p. c. max.	190—195	..	3 16 11
489,200	Stk.	,,	5			160—165	..	3 0 7
1,019,585	,,	Oct. 13	4	Vauxhall 4 p. c. A Deb.		131—136	..	2 18 10
1,155,066	Stk.	Dec. 14	10	West Middlesex		288—293	..	3 8 3
200,000	,,	,,	4½	Do. 4½ p. c. Deb.		147—152	..	2 19 3
200,000	,,	Mar. 14	3	Do. 3 p. c. Deb.		99—101	..	2 19 5
						*Ex div.		

† Next dividend will be at this rate.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

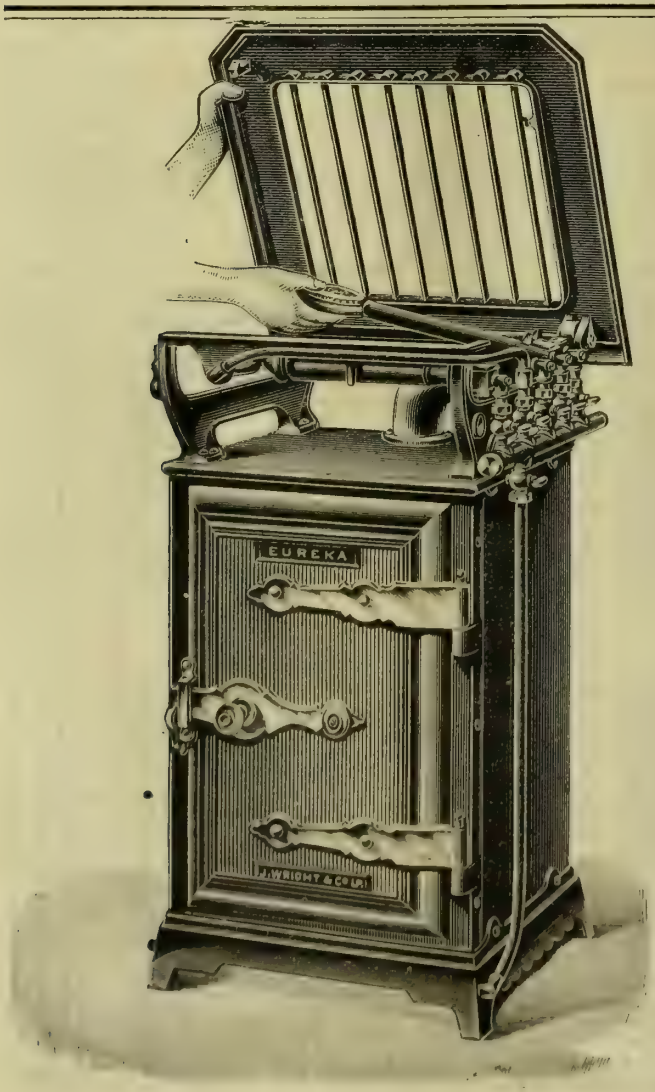
Astronomers begin their year on the 20th of March. Gas managers in Scotland, I suppose, have come to look upon the first Wednesday in April as the determining point from which to date events. It is then that they first emerge from their winter's seclusion, and meet in conference and enjoyment. I had the pleasure of being present at the Informal Meeting in Glasgow this week. My opinion of it is that it was the best of all these meetings I have known. It was the most numerously attended, for one thing, the reason for which I attribute to two causes—first, to the popularity of the President (Mr. J. W. Carmichael, of Barrhead); and, secondly, to the bond which makes all gas managers "wondrous kind" at the present moment, the high price of coal. To speak to the first, men came from far and near because Mr. Carmichael was in the chair—from Montrose because he started in life at St. Andrews with Mr. Hall, and from Kilmarnock out of respect arising from the feeling of neighbourhood. Mr. Carmichael has not been a prominent man in the public sense of the word; and it will be matter of regret that, now he has come to the front, he should decline to go forward to higher honours. He ought to be the next President of the North British Association of Gas Managers; but I understand that he declines the office. This is to be regretted, because the address he gave to the Informal Meeting was of so high a character, so full of matter, so well put, and altogether so apposite, that, if he had allowed himself to become the President of the Formal Meeting of Gas Managers, he would, at the gathering in 1901, judging by his appearance at the Informal Meeting, have added lustre to the office. His address, given in another column, was in reality a weighty communication. It had the faculty of bringing out discussion, which is the first requirement of a Presidential Address at an informal meeting; but it had more within it—it contained the essence of much that lies underneath the surface of current thought in gas managers' circles. The price of coal, the illuminating power of gas, and the questions flowing from these, were all brought forward in appropriate sequence, and were dealt with in a masterly way. The address testifies to Mr. Carmichael being an enlightened, and a highly practical, Gas Manager. Were further testimony to his ability asked, it is to be found in the fact of Major Pollock, a Queen's Prizeman, and one of his Directors, attending the dinner which followed the meeting, and giving expression to the high esteem in which the President is held by his Board.

Having laid the foundation for a good discussion, the discussion followed. As it proceeded, I could not help noting that I have never attended a meeting of gas managers in which less was said in congratulation of the author; but the reason for that, I presume, was that there was so much in the address that there was no time for platitudes—the speakers wanted to get at the merits at once, and the usual courtesies were held to be "understood."

The chief point discussed was the question of the lowering of the illuminating power of the gas. Hitherto, Scotland has held a unique position in gas supply, because of the cannel coal which could be had at the door of the gas-works, by means of which gas managers were able, at small cost, to supply a high-quality gas at a low price. But the times are changing. The cannel is believed to be approaching exhaustion; and other methods of getting light out of gas are being developed. The question of high-quality gas is being bombarded on two sides. On the one, the gas manager is being plied by the man who has oil to sell, who says that he can give the elements which will keep up the illuminating power; and, on the other, he is confronted with the fact that, owing to the development of the incandescent mantle, he can dispense with gas of high illuminating power. There is a big cross in the situation, or a big "if." If the cannel fields are giving out? If they are, then the supply of gas in Scotland will become what it is in other parts of the world. If they are not—but "there's the rub"—then those who prefer, like Mr. M'Gilchrist, to supply light and not gas, will find it to be to their benefit to continue a high illuminating power, and not join in a reduction. Judging from the tone of the meeting, cannel is giving out; and therefore the distinguishing feature of Scotch gas is likely to be lost. Gas in Scotland must be what it is elsewhere. As in other parts of the world, the question will be how, with a given coal—a coal of no pretension—to supply a gas which will suit the consumer. And it must be borne in mind that the consumer is not only the man who wants to see, but the man who wants to use gas for working as well. It must be confessed that the outlook for what may be called Scotch gas is not very promising. The bombardment on the side of those who want cheaper gas for all purposes is undoubtedly heavier than that on the side of those who want a richer gas for illuminating purposes only.

Thus Scotch gas comes down to the level of the world's supply; and Scotland loses her distinctive position. This is the chief lesson which is borne home by the meeting. Are Scotch gas managers likely to accept the lesson? That cannot be foreshadowed. But it is a curious circumstance—and one not to be left out of account in this connection—that in the matter of illuminating power there has existed in Scotland an element which has never before been reckoned with, or even known to be in the land. The number of gas managers in Scotland who have had experience in England of low-grade gas is, to say the least of it, amazing. The general belief has been that Scotch managers went South, and secured situations which they could the better fill because of their knowledge of how to supply the higher quality of gas; now we have it, on the testimony of ever so many speakers at the Informal Meeting, that they are Gas Managers in Scotland only after having served a term in England. Instead of the rush having been South, as it was believed to be, it has actually been North. The way has thus been paved, unseen, not to say insidiously, for the sudden development of the low-grade gas phalanx. That they have lain low till now has, of course, been due to circumstances; but the time having come—of dear coal and incandescent lighting—they have raised their heads with surprising swiftness. And it may take a good deal of negotiation to get them to turn aside from the movement now begun. It may be taken for granted that low-grade gas is bound to be promoted in Scotland in the very near future.

The only other subject before the meeting which I will comment upon



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is that of the standardizing of meter-unions. On this question Mr. O'Connor's remarks were to the point. He first of all cited the remark of the late Mr. D. Bruce Peebles, to the effect that if he got an order of a certain description he would not refuse it; and then he said something which I could not quite follow, but which was to the effect that in a dry meter the union was one of the first things which was fixed, and that to alter it would mean taking the meter almost to pieces. He therefore advised, so I understood him, that it would be better to have the standard unions applied to new meters, instead of altering existing ones. This puts a new complexion upon the movement for standardizing meter-unions. The life of a meter is anything up to fifty years. If, therefore, a manager—to take a small works—resolved to, or was concussed into, adopting standard unions, he would still require, for fifty years, to give orders for differential sizes, and only about that time be in a position to work out his differentials and work in his standards. The question is whether the game is worth the candle. It is two or three years since the subject was raised. Standard unions have been made, and are now available. They have been adopted by the North British Association of Gas Managers. Have they been adopted by any member of the North British Association? Mr. Lighbody, of Renfrew, said that he had induced about six meter makers in Scotland to supply him with uniform couplings, at no extra cost; but he did not state that they were the standard couplings. Neither did any other Manager say that he had ordered the standard couplings. On the other hand, though these standard couplings have been available for about three years, there is not an instance of any of the meter makers having advertised that they are prepared to supply meters according to them. These remarks are not intended to throw cold water on the question, but to point out the difficulties in the way. As an academic subject, there can be only the one opinion—that the change should be made; but as a concrete subject, it turns out that while the large gas-works might make the change in a year or two with little loss, the small undertakings, for whom the reform is chiefly intended, would have to get along for about fifty years before they could reap benefit by the alteration. And with them the question is, seeing that they get willing service from meter makers, which suits them, whether they would be any better if they were to adopt a uniform coupling. Generally speaking, a uniform coupling would be an advantage; but considering that a multiplicity of couplings are already in existence, it might arise, in a small works, that a uniformity of couplings would cause trouble and expense, because uniformity of stocks would not suit variety of circumstances. It would appear as if the subject required more looking into. The question is for every gas manager to consider how much it would cost him to transfer to the uniform system, and how much he would save afterwards. If the subject, having been put aside by the Associations of Gas Managers in England, is to be again raised in Scotland, this is the point to be put before gas managers. Theoretically, no one can dispute the position of the advocates of uniformity. In practice it may be different; and that is the first matter to be ascertained, because an abstract resolution of the North British Association would be of no consequence if travellers for meter makers continued to go their rounds and get orders for meters on the old lines.

The Town Council of Hamilton, on Thursday, unanimously agreed to advance the salary of their Gas Manager (Mr. W. Ewing) by £75 per annum. In making the proposal, Bailie M'Hale, the Convener of the Gas Committee, said that, in regard to ability, few gas managers in Scotland ranked higher than did Mr. Ewing. The Hamilton Gas-Works were the most economically managed in Scotland. Bailie Pollock, who is not on the Gas Committee, seconded. He remarked that during the last few years he had said many hard things of the Gas Committee and the Gas Manager; but, notwithstanding this, no one in the Town Council appreciated the services of Mr. Ewing more than he did. It would thus appear that all trace of opposition to Mr. Ewing, which has hitherto lingered in the bosoms of a few councillors in Hamilton, has disappeared, and that he now has the undivided support of the Council. Mr. Ewing has been long enough in Hamilton to show his worth; and anyone who should endeavour to hold out against him now would, I suspect, find it hard to give a reason for his action. No fair-minded person could find any such reason. As a matter of fact, Mr. Ewing has closed another working year with results which will surprise everyone. The Town Council last year would not reduce the price of gas, as he recommended; and the result is that they have made too much money. One effect of this is, as stated by Mr. Ewing at Glasgow, that they will be able to go on without raising the price of gas—a circumstance which will make Hamilton highly favoured indeed among the towns in the United Kingdom. There is another effect which I may mention. Too large a profit will lead to a raising of the valuation of the works, and thereby to the imposition of increased taxation. To this intent, the councillors of Hamilton should now realize that it will in future be to their profit to follow the advice given them by their Manager.

The Corporation of Glasgow, on Thursday, agreed, by 33 votes to 15, to a resolution requiring contractors to pay fair wages. The opposition to the resolution was put forward by the Gas Committee, on whose behalf it was contended that it would be impossible to carry out such a resolution. For instance, the Committee buy large quantities of coal; and they have no means of knowing whether those from whom they purchase do or do not pay fair wages. That is so; and therefore the resolution will be a dead letter generally. It will, however, be available for resurrection whenever it suits the labour leaders in the Council to challenge any particular contract.

On Monday, the Town Council of Aberdeen agreed to a motion proposing a remit to the Water Committee to inquire and report as to the practicability and cost of obtaining an additional supply from the River Dee or its tributaries, in order that a comparison may be made with the cost of the Avon scheme. It is admitted that the Avon scheme, if it be proceeded with, will be bitterly opposed by the landed interest; and its cost will be very great. If a tributary of the Dee could be impounded, it would—were the quality satisfactory—be a cheaper and more easily worked scheme. The Corporation cannot afford to delay much longer arriving at a conclusion upon the subject, because the city is expanding rapidly, and the present water-works have nearly reached the limit of their capacity.

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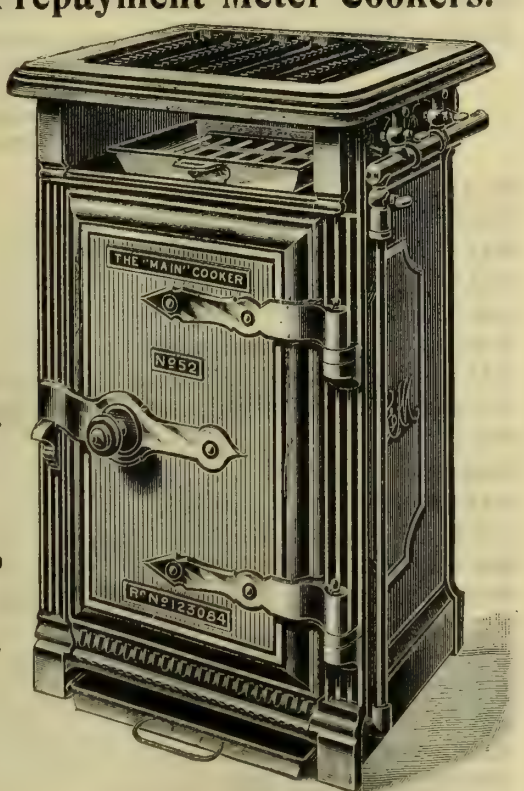


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CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April 7.*

Sulphate of Ammonia.—In the early part of the week, prices, under the influence of second-hand selling, became very irregular and declined; but, makers for the most part refusing to follow, a steadier tone was seen towards the close—the quotations being £11 13s. 9d. to £11 15s. per ton f.o.b. at the ports. Home demand in England is making itself felt; but in Scotland it has so far, owing to the lateness of the season, been altogether disappointing. Exports continue on a satisfactory scale; but new business has been rather scarce, although there has been good inquiry for the near months. London is quoted at £11 15s. per ton, Beckton terms, for May-June delivery; but Scotch makers are mostly off the market in the forward position. There was "bear" offering early in the week at a discount on prompt prices; but later the quotations were advanced to spot level.

Nitrate of Soda is steady at 8s. 9d. per cwt. for ordinary, and 8s. 10½d. for fine, quality.

LONDON, *April 7.*

Tar Products.—There is no improvement in this market. Pitch, however, maintains its increased value; but other products are more or less easier. Benzols are extremely dull; and very low prices are being taken for early delivery. There is a steadier outlet for naphthas at the lower figures quoted. Creosote and tar oils are not so good. Carbolic acid continues to find buyers at prices quoted; and makers are remarkably free from stocks of it. Naphthalene is moving freely; and it is said that business in it is likely to be better. There is no change in anthracene, which still continues at a nominal quotation.

The average values obtaining during the week are: Tar, 17s. 6d. to 27s. 6d. Pitch, east coast, 37s.; west coast, 34s. Benzol, 90's, 6d.; special qualities for gas, 8d.; 50's, 9d. Toluol, 90's, 1s. 1d.; pure 1s. 9d. Solvent naphtha, 1s. 1d. Crude, 30 per cent. naphtha, 3¾d. Heavy naphtha, 10d. Creosote, 2½d. to 3¼d. Heavy oils, 3¼d. Carbolic acid, 50's, 2s. 1½d.; 60's, 2s. 6d. Naphthalene, 45s. to 70s. Anthracene, "A" quality, 4d.; "B," 2½d.

Sulphate of Ammonia.—The determined effort to depress this market has been more or less successful, but not to the extent which "bear" operators had hoped. The absence of stocks in makers' hands, and the undoubted good inquiry for foreign account, as well as for home consumption, has prevented a further drop in prices than is recorded. £11 15s., less 3½ per cent. is the value in all positions.

Divining for Water.—The art of water finding has again been employed in Scotland. The estate of Colonel Gammell, in Perthshire, suffered from an insufficient water supply; and the services of Mr. Leicester Gataker, the "diviner," were requisitioned. Acting on his advice, a very strong spring has been tapped, which will doubtless be of immense value to the property.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Here and there reports come to hand from collieries that the position is perhaps not quite so satisfactory as it has been of late; and in isolated cases fuel is accumulating in small quantities. Generally, however, throughout Lancashire pits have still no difficulty in disposing of all they are raising, which, for the most part, is a good deal below the average, owing to the restriction of the get by the miners; and prices are being fully maintained at late rates. The backward state of the season is keeping up, perhaps, more than an average demand for house-fire purposes, and this is preventing any accumulation of stocks in the better sorts of round coal. The lower qualities are in as brisk request as ever, for iron-making, steam, and general manufacturing purposes; and the same applies to engine fuel—the principal Lancashire collieries being short to meet requirements. The leading coalowners of Manchester, Salford, and the surrounding districts, including Tyldesley and Leigh, who have all along been very pressed for supplies of all descriptions of steam fuel, yesterday advanced their list prices 10d. per ton on engine fuel and steam nuts, and 5d. per ton on burgie. There is no further advance so far as other descriptions of fuel are concerned; and at present no intimation has been forthcoming that the upward move in the Manchester and surrounding districts is being followed in the other important Lancashire mining centres. But the action that has been taken by the leading Manchester coalowners will no doubt have a considerable effect upon prices generally. Quoted list rates may now be given as 14s. 6d. to 15s. 6d. per ton at the pit for best Wigan Arley, 13s. to 14s. for Pemberton four-feet and seconds Arley, 12s. 6d. for steam and forge coal, and from 9s. 6d. and 10s. for medium sorts to 10s. 6d. and 11s. for best slack. Following upon the decision of the Lancashire collieries with regard to the advance in gas coal prices referred to last week, the locomotive fuel contracts have been under consideration; and in some quarters as much as 6s. per ton over last year's rates is being strongly advocated. But it is doubtful whether the advance will exceed that which has been resolved upon with regard to gas coal. It seems probable, however, that it will not be less than 5s. per ton over the 1899 prices, which would bring locomotive fuel up to 13s. per ton at the pit. Shipping is not so brisk as it has been; and although Lancashire collieries are holding to their minimum basis of 16s. for steam coals, delivered at the ports on the Mersey, this figure is not being readily obtained. Coke manufacturers have advanced their list rates 2s. per ton on both foundry and furnace qualities; quotations now averaging 29s. to 32s. according to quality for foundry, and 24s. to 25s. for furnace cokes—these prices being at the ovens.

Northern Coal Trade.—The coal trade has shown a little improvement in the last few days, as is usual shortly before holidays, when consumers have to enlarge the stocks they hold. Best Northumbrian steam coals are quoted at about 17s. 6d. per ton f.o.b., which is perhaps 6d. above the lowest rate last month, but is still considerably below the prices that prevailed earlier this year. Steam smalls are from 11s. to 11s. 6d. per ton. In the gas coal trade, the price that is quoted for best

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WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	WINNIPEG, MAN.	500,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	COLCHESTER (Second Contract)	300,000
COLCHESTER	300,000	YORK	750,000
BIRKENHEAD	2,250,000	ROCHESTER	500,000
SWINDON (New Swindon Gas Co.)	120,000	KINGSTON, ONT.,	300,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	CRYSTAL PALACE DISTRICT	2,000,000
WINDSOR ST., BIRMINGHAM (Second Cont.)	2,000,000	DULUTH, MINN.	300,000
HALIFAX	1,000,000	CATERHAM	150,000
TORONTO	250,000	LEICESTER	2,000,000
OTTAWA	250,000	ENSCHEDE (HOLLAND)	150,000
LINDSAY (Remodelled)	125,000	BUENOS AYRES (RIVER PLATE CO.)	700,000
MONTREAL	500,000	BURNLEY	1,500,000
TORONTO (Second Contract; Remodelled)	2,000,000	KINGSTON-ON-THAMES	1,750,000
BELLEVILLE	250,000	ACCRINGTON	500,000
OTTAWA (Second Contract)	250,000	TONBRIDGE	300,000
BRANTFORD (Remodelled)	200,000	STRETFORD	500,000
ST. CATHERINES (Remodelled)	250,000	OLDBURY	300,000
KINGSTON, PA.	125,000	TODMORDEN	500,000
PETERBOROUGH, ONT.	250,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
WILKESBARRE, PA.	750,000	YORK (Second Contract)	750,000
ST. CATHERINES (Second Contract)	250,000		

Durham gas coals for occasional cargoes is from 16s. 6d. to 17s. 6d. per ton f.o.b. Deliveries are heavy, including some on account of old orders that had got behind. As to the contracts for the large gas companies of the South, it is believed that one portion has been allotted; but no details are yet procurable. In another case, deliveries of "shorts" will extend the supply over this month. Coke is very firm on all hands, and prices higher. Gas coke is now not quite so abundant; the output being reduced. The figure that is most frequently quoted is about 16s. per ton f.o.b.; but in a short time new contracts will probably be made, and a nearer approach to a fixed price will be obtainable.

Scotch Coal Trade.—There is little change to record, either in demand or prices. It is said that the miners are not working so steadily as they did during the winter, and that the output is being thereby affected, with its inevitable result upon prices. The miners are averse to accumulations of coal being made at the pit-heads, which explains their unsteady working. The prices are: Main 14s. to 14s. 3d. per ton f.o.b. Glasgow, ell 15s. to 15s. 9d., and splint 14s. 9d. to 15s. The shipments for the week amounted to 216,496 tons—an increase of 30,099 tons upon the previous week, and of 38,891 tons upon the corresponding week of last year. For the year to date, the total shipments have been 2,378,921 tons—an increase of 586,180 tons upon the same period of last year.

Kingsbridge Water Supply.—More than ordinary difficulty is being experienced by the Kingsbridge Urban District Council in obtaining a supply of water for the town. After much consideration and negotiation, a scheme was put forward a year ago, only to be condemned by the Local Government Board on the ground that the District Council were not obtaining sufficient control over the source of supply. As the purchase of the watershed was impracticable, the Council consulted Messrs. Taylor, Sons, and Santo Crimp, and another scheme was prepared. The Board have now intimated that it will be necessary for the Council to obtain the consent of all the riparian owners, and that until this is done they cannot recommend that a Provisional Order be granted. The Engineers pointed out to the Board the impossibility of doing as suggested, and asked for an interview. To this the Board replied that they could not see that any good would result therefrom, as it was essential to get the consent of the riparian owners before further steps were taken. In communicating this reply to the Council, the Engineers said they considered it hard that the Local Government Board should have allowed them to go so far before putting in the condition. The Council would either have to obtain a Provisional Order, which was costly, or abandon the scheme. At a meeting of the Council on Thursday, when the correspondence was read, the Chairman (Mr. Hurrell) said he considered it perfectly useless to attempt to get the consent of all the riparian owners right to the sea. The Council had done everything in their power to promote a water scheme for the town; but the Local Government Board had apparently been endeavouring to put every obstacle in their way. Consideration of the correspondence was adjourned to a future meeting of the Council.

Gas and Electricity Profits at Southport.—The Gas Committee of the Southport Corporation have decided to make a grant of £8000 out of the profits of the gas estate in relief of the rates of the coming year; and the Electricity Committee will make one of £1500 for a like purpose.

St. Anne's-on-the-Sea Gas Company.—At the recent annual meeting of this Company, the balance-sheet presented showed a total expenditure of £4087, or £662 more than in the previous year. There was a profit, after meeting all outgoings, of £2208; and the Directors recommended the declaration of dividends of 10 and 7 per cent. This was agreed to.

Cape Town Water Supply.—The Water Committee of the Cape Town Municipal Council have had under consideration for some time a comprehensive scheme for the better distribution of the water supply of the city. Inasmuch as the expenditure involved is very much greater than the Council could at present meet, the Committee are of opinion that only such works as are absolutely necessary should be undertaken; and in this connection they have specially considered representations with regard to the need for laying the eastern high-level main, the length of which would be approximately 13,000 feet, and is estimated to cost £7000. By means of this main, it will be possible to supply the whole of the higher levels of the city in the eastern district, which is impossible under existing circumstances; and the Committee consider it desirable that this important work should be undertaken without further delay. Owing to the increased expenditure on capital account in connection with the large reservoirs on Table Mountain, the Council propose to raise the charges for water. Hitherto the rate has been £1 10s. per annum for a supply of 100 gallons per day; and this is to be increased to £2 per annum for the like quantity. It is claimed that, even at the advanced rate, the supply will still be one of the cheapest in South Africa, while it is among the most constant and abundant.

Plymouth Corporation Water Supply.—Mr. E. Sandeman, the Water Engineer of the Plymouth Corporation, has presented a report on the progress of the undertaking during the year ended Dec. 31 last. The total length of new mains laid was 6 miles 1485 yards, and 810 yards of mains were renewed. In recent years, owing to greater attention to the renewal of old mains, the number of bursts of pipes has considerably decreased. In 1899 the total was 13, as compared with 26 in 1898 and 57 in 1895. The new domestic supplies connected last year numbered 768; bringing up the total to 16,175, of which 5300 have been connected in the past ten years. Of trade supplies by meter there are 332, of which 113 were added in the past twelve months. The supply for trade purposes exceeded 711 million gallons in 1899—an increase of 138 per cent. on the quantity supplied for this purpose in 1889; while the income from this source, amounting to £7581, has risen in the same period at the rate of 142 per cent. The estimated revenue for the financial year ended March 31 is £22,500; and the charges for maintenance and salaries, £5383. A diagram illustrating the quantity of water used shows that in the September quarter of last year, when the weather was very hot and dry, the consumption rose to 220 million gallons. In the June quarter, it had only been 160 million gallons; and the highest previous consumption was 170 millions, in the summer quarter of 1898.

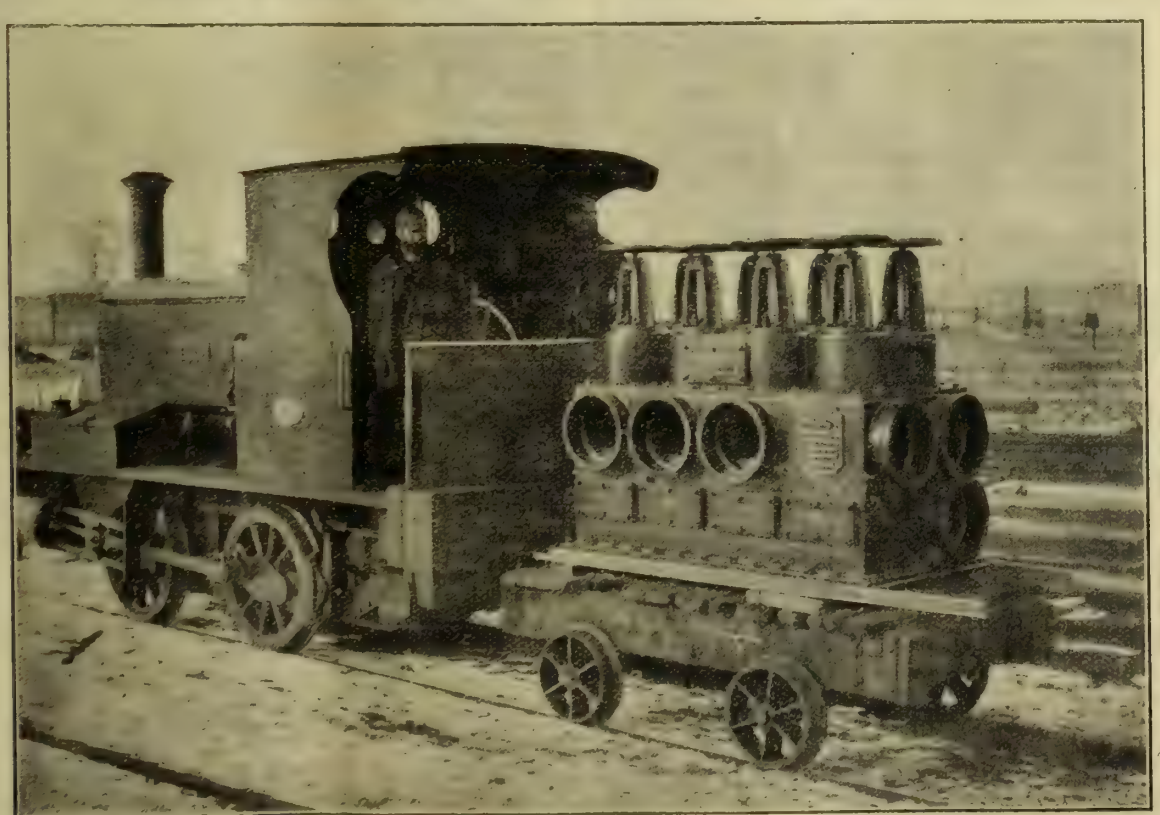
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The Dukinfield Gas Committee and Carburetted Water Gas.—A Sub-Committee of the Dukinfield Corporation Gas Committee have been visiting, accompanied by the Engineer and Manager (Mr. Harrison Veevers), four works in which carburetted water gas is made, with the object of inquiring into its economical advantages for furnishing additional manufacturing power as compared with the provision of extra storage. They came to the conclusion that, as an auxiliary in the carbonizing department of a gas-works, there could be no question of the value of carburetted water-gas plant; but that as a substitute for sufficient gasholder capacity, it was of very limited benefit. They thought, however, that in any future scheme for the extension of the works, the new system should have serious, if not favourable, consideration. The Gas Committee approved of the conclusion come to by their Sub-Committee; but they decided not to take any action at present for the provision of additional holder capacity. The Council have passed the minutes.

Antwerp Water-Works Company, Limited.—The annual meeting of this Company was held on March 30 at the Cannon Street Hotel. Mr. David Evans presided, and moved the adoption of the report, which stated that the income from all sources amounted to £43,793, as compared with £40,971; and after deducting expenses, and adding the undivided profit of £662, a sum of £28,593 remained. Against this had been charged the debenture interest and income-tax for 1899, the contribution to the reserve fund of 5 per cent. on the net profits, the interim dividend of £9000, £5000 for the sinking fund, and £464 extra remuneration for the Directors. A balance of £10,839 was then left for distribution; and out of this the Directors proposed a dividend at the rate of 7 per cent. per annum—making a total of 6½ per cent. for the year. It was also stated that a new duplicate trunk main had been nearly completed, and that more than three-quarters of it was in use; this having brought about a most satisfactory improvement in the pressure in the town. To keep pace with the continually increasing consumption, certain extensions were necessary at the pumping-station at Waelhem; and upon these, it was estimated, the outlay would be £10,000. The Chairman, having explained the differences in some of the items in the accounts compared with the preceding year, announced that the Belgian Government had relinquished their claim for income-tax on the money appropriated to the sinking fund; and the Directors were again making an appeal to the Income-Tax Commissioners here in regard to the same matter. With respect to the extensions, the Directors hoped that, when the work was completed, it would be some little time before any serious expenditure was again required. Referring to a proposal of the Board that the amount appropriated as sinking fund for the share capital, instead of being accumulated, should be annually divided among the shareholders as a return of capital, he said the Directors felt that, unless they invested the money in first-class and low-interest yielding securities, they were taking an unnecessary responsibility; while if the shareholders had the money, they would be able to make their own selection of investments. The report was adopted; and a resolution was passed consenting to the discontinuance of the sinking fund. It was explained that the amount already accumulated would be retained, and the fund continued to the extent required for the redemption of the debentures.

West Gloucestershire Water Company.—The report submitted at the half-yearly meeting of this Company showed that there had been a normal increase in new connections, and that extensions of works had been proceeding. It was also stated that since the last meeting £1710 of fully-paid shares had been applied for and issued at £1 premium. The total amount now issued under the 1887 Act was £60,000; and under the Act of 1899 £7800 of shares had been disposed of by tender at a premium of above 30s. per share. The accounts for this half year showed that, after paying all working expenses and interest on debenture stock, there was a net profit of £1932, which, together with £194 brought forward, made a total of £2126. The declaration of a dividend was recommended at the rate of 4 per cent. per annum on the 1884 shares, and £2 16s. on the 1887 shares. The Chairman (Mr. Enoch Horton), proposing the adoption of the report, congratulated the shareholders on the fact that the number of customers and the amount of the revenue continued to steadily increase. The estimated revenue was just under £7000 per annum; and, as a matter of fact, the amount actually received for the past half year was £3550. The report was adopted.

Bristol Water-Works Company.—The report and accounts of this Company, which were noticed last week, were presented at the annual meeting of the shareholders by the Chairman (Mr. Edward Bush). In the course of his address, he stated that the net revenue (£122,850) exceeded that of the previous year by £5079. The result had been better than ever before. The sum brought forward was £6800; and they would carry over a rather better balance, after paying ½ per cent. more dividend, notwithstanding that they had had to pay additional money during the year on unfinished work. When this was completed (it was chiefly in connection with the Yeo Valley reservoir), more would be available for distribution among the shareholders. Already water had been impounded in the Yeo reservoir, which was two-thirds full; the amount gathered being 1200 million gallons, or half as much again as that in the other three reservoirs. Difficulty had been experienced in getting anyone to make the engines for pumping; but they were now being constructed, and were expected to be finished in about twelve months. The consumption of water continued to increase. Although there was duplicate pumping machinery at Clifton, it had been thought advisable to have a third engine; and it was in course of erection. Steps were being taken to maintain the purity of the supply; and for this purpose, parliamentary powers were being sought to deal with sewage round the various works. Happily, the Bill was passing through both Houses unopposed. During the year, 1760 new services had been laid on; and altogether, the Company were supplying about 62,000 premises. The result of lowering the charges for baths in private houses four years ago had been an increase at the rate of 12 per cent. per annum in each of the four years. Nothing more had been heard from the Corporation relative to the acquisition of the concern. The report was adopted; and dividends at the rate of 7¾ per cent. per annum on the ordinary shares, and at the rate of £5 8s. 6d. on the 7 per cent. maximum consolidated ordinary stock were declared. Later in the proceedings, it was mentioned that this was the forty-third year of the Chairman's service. When he joined, the revenue was not £15,000; now it was £123,000.

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Leeds Corporation Water Supply.—At the meeting of the Leeds Corporation last Wednesday, Alderman Cooke, Chairman of the Water Committee, proposed that application be made to the Local Government Board for sanction to borrow £146,921 for water-works purposes. This amount, Mr. Cooke explained, was the balance of the £250,000 for which borrowing powers were obtained by the Act of 1893. In 1896 the Council approved of the expenditure of £103,000, and he now asked for sanction to borrow the rest. The money was required for ordinary as well as for extraordinary extensions. Ordinary extensions might be summarized as the substitution of large mains for small ones, and the extension of the water-works system to localities where new lots of property had been built. This was represented by a sum of £13,000; but the chief item was £83,500 for a 30-inch main from Swinsty to Eccup, together with the easement. Mr. Cooke added that such expenditure must from time to time recur by reason of the extraordinary growth of the city; and he did not care how often he had to come before the Council, when he could show such excellent results as the Committee had been able to produce. The proposition was agreed to.

The Directors of the Imperial Continental Gas Association recommend a dividend of 5 per cent. for the half year ending the 31st of December, free of tax.

According to a law lately passed, the theft of electricity in Germany is punishable by imprisonment or by the imposition of a fine and possibly the loss of civil rights.

Exhibitions of gas cooking-stoves have just been held at Bristol and Beverley—at the former place by Messrs. John Wright and Co., Limited, and at the latter by Wilsons and Mathesons, Limited—with lectures by Miss Silvester and Miss Atkinson.

The Leeds Fire-Clay Company (Engineering Department) have just secured an order for a fourth installation of shallow regenerators at the Normanton Gas-Works. They have also been entrusted with the erection of a new retort-house, fitted complete with shallow regenerators, at the Easingwold Gas-Works, and with an order for shallow regenerators at the Padiham Gas-Works.

The Lytham District Council have decided, on the recommendation of the Gas Committee, to abolish meter-rents.

Messrs. James Milne and Son, Limited, have recently secured the contract from the Glasgow Corporation for a new station meter, of 150,000 cubic feet per hour capacity, for their Tradeston works; and have obtained an order from the Dundee Corporation for one of the same capacity. In addition to these orders, the firm have in hand for the Gas Commissioners of Wishaw a square station meter of 25,000 cubic feet capacity.

We have received from the publishers (Messrs. E. & F. N. Spon, Limited) "Spons' Architects and Builders' Price Book for 1900," by W. Young. This is the 27th edition of the book, and, as far as bulk is concerned, it is similar to its immediate predecessor. The editions for recent years, however, have contained a chapter on electricity, with complete specifications and estimates of electric lighting installations carried out by the author.

Messrs. Mather and Platt, Limited, of Manchester, have taken over the business of the Reeves Patent Filters Company, Limited, of London, and are issuing a tastefully got-up pamphlet in which a description of their filters is given, together with a number of illustrations taken from photographs of plant installed by the Reeves Company and themselves. The firm are the sole licensees for the Archbutt-Deeley system of softening hard water for town supplies, works, &c., and for the purification of trade effluents.

The operative clause in the Order in Council with respect to the use of acetylene now stands as follows: "Her Majesty is pleased, by and with the advice of Her Privy Council, to order and prescribe that acetylene in admixture with air or oxygen, declared to be an explosive by this Order, shall be prohibited from being manufactured, imported, kept, conveyed, or sold: Provided that nothing in this Order shall apply to acetylene in admixture with air when such admixture takes place only in a burner or contrivance in which the mixture is intended to be burnt; provided also that nothing in this Order shall be held to apply to an admixture of acetylene and air which may unavoidably occur in the first use or recharging of an apparatus properly designed and constructed with a view to the production of pure acetylene."

BANK HOLIDAY.

NOTICE TO ADVERTISERS.—In consequence of the **BANK HOLIDAY** (April 16), orders with respect to **ADVERTISEMENTS** should be received at the Office *not later* than **THE FIRST POST ON SATURDAY NEXT.**

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(GAS DEPARTMENT.)

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The Committee do not bind themselves to accept the lowest or any Tender.
JOSEPH POLLITT,
Clerk to the Council.
Town Hall, New Mills,
March 26, 1900.

CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE.
The Forthcoming Meeting of the Institution of Gas Engineers. . 987
The Price of Coal 987
The Accounts of the London Gas Companies for 1899 988
For the Suppression of Illicit Commissions 988
The Waverley Association Meeting 989
Should Exported Coal be Taxed? 989
The Committee on Municipal Trading 989
The Year's Revenue. 990
Ugly London 990
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market 991
Electric Lighting Memoranda. 991
The Summer Instructions of the Metropolitan Gas Referees . . 992
Suggestions for Patent Law Reform 992
The Scarcity of Coal in the Seventies 993
Accounts of the Metropolitan Gas Companies for the Year 1899 . 995
NOTES:—
The Durability of Paints and Varnishes. 996
The Strength of Frozen Concrete. 996
The Use of Conveyors in Excavating 996
Treating Coal for Coking 996
COMMUNICATED ARTICLE:—
The Future of Water Gas in France. By Just Alix, Chemist to the Lyons Gas Company 997
TECHNICAL RECORD:—
Institution of Gas Engineers—Programme of the Forthcoming General Meeting 998
Waverley Association of Gas Managers—Half-Yearly Meeting at Selkirk 999
The Destruction of Leather Bookbindings 1001
A Model Street-Lamp Column: Incandescent Lighting in South London 1002
Mr. Allen's Researches on the Vapour Pressure of Naphthalene . 1003
Volumetric Determination of Small Quantities of Carbon Monoxide 1004
Automatic Coal Weighing and Recording Machines 1005
REGISTER OF PATENTS:—
Apparatus for Mixing Air and Gas—Füller, E. 1005
Conveyors for Coke, &c.—Jenkins, W. J. 1005
Desulphurization of Sulphuretted Hydrogen—Hemingway, H. W. 1005
Mantles for Incandescent Gas Lighting—Boult, A. J. (Isitt, F.) . 1006
Incandescence Lamps—Denayrouze, L. 1007
Automatically Sealing Gas-Supply Pipes to Burners—Sugg, W. T. 1007
Gas-Engines—Marks, G. C. (J. P. Murphy) 1008
Patent Notices 1008
PARLIAMENTARY INTELLIGENCE:—
House of Lords—Progress of Bills 1008
House of Commons—Progress of Bills 1008
House of Commons Committee on Police and Sanitary Regulations Bills—Bradford Corporation Bill 1008
MISCELLANEOUS:—
Horsforth Water Arbitration 1012
Gas and Water Companies' Stock and Share List. 1013
Gas-Works Improvements and Extensions at Walsall 1015
Proposed Mechanical Stoking at the Southport Gas-Works. . . 1016
The Increase in the Price of Gas at Middlesbrough 1016
Electric Lighting Notes 1016
The Falmouth Corporation and the Water-Works 1017
Notes from Scotland. 1018
Current Sales of Gas Products 1019
Coal Trade Reports 1020
PARAGRAPHS:—
PERSONAL: Mr. James Gemmell; Mr. John Gibb; Mr. John Aird; Mr. Harry C. Page; Dr. Barwise; Mr. Charles Taylor; Mr. Richard Fisher; Mr. John Howgate Buckley 996
The Coal Contracts of the London Gas Companies—Stating Mileage of Mains in the Board of Trade Returns—Thawing Frozen Water in Pipes—Absorption of Light by Glowing Gas. . . . 990
Coal Exports in the Past Two Years. 991
Society of Chemical Industry—Tar Distillation in France . . . 994
The German Benzine Association—Labour-Saving Methods in Gas-Works—The Effect of Low Temperatures on Coal Gas—Steel Production in the United States. 996
Mr. R. Warington on the "Physical Properties of Soil". . . . 1005
River Plate Gas Company, Limited 1011
The "Builder" on the Testing of Gas 1017
Signapore Gas Company—Italian Gas Company 1020
Water Supply at Less than Cost Price for Bradford—Plymstock Water Supply—Hydro-Incandescent Gas-Light Company, Ltd.—Gas Explosion at a Devonport Barracks—The Remodelling of the Teignmouth Gas-Works. 1021

TO CORRESPONDENTS.

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EDITORIAL NOTES.

The Forthcoming Meeting of the Institution of Gas Engineers.

AMPLE evidence is afforded by the programme which has been issued for the forthcoming meeting of the Institution of Gas Engineers, noticed in another part of the "JOURNAL," that the President (Mr. J. W. Helps) and Council are determined that it shall be one of unusual interest. As will be seen, six papers on exceptionally good subjects are to be read and discussed, Professor V. B. Lewes will deliver a lecture on recent developments of water gas on the Continent, and there will be a visit to Woolwich Arsenal, some departments of which that are not usually open to the general public will, by special permission, be inspected. In view of the importance at present attaching to our armaments, this visit should prove particularly interesting and instructive. With regard to the technical matter, it is quite sufficient to refer to the titles of the papers to indicate its value. Probably the two questions which stand out most prominently to-day in connection with the gas industry are those bearing upon the enrichment—or shall we call it "adulteration"?—of gas with the view of increasing its value as an illuminant, and the better utilization of its calorific power. These subjects will be dealt with by Mr. George Livesey and Dr. H. G. Colman. Another matter which is always with us, and to which considerable attention has lately been given, is the presence of naphthalene in gas. Mr. Wilfred Irwin will have something to tell the members about its detection and extraction. Professor Lewes's exceptional abilities as a lecturer will be sure to render specially attractive what he will have to say on the subject he has selected; and the manufacturing and constructive papers by Messrs. C. C. Carpenter, S. Glover, F. W. Stevenson, and A. Baker, will furnish matter which cannot fail to lead to useful discussions. These, however, will not be allowed to absorb all the time at the disposal of the members, as the important question of the proposed amalgamation of the Institution with the Gas Institute will have to be dealt with—and it may be confidently hoped with satisfactory results. The social functions connected with the meeting will be a dinner at the Café Royal and another at the Crystal Palace. Altogether, the gathering promises to be an exceedingly interesting one.

The Price of Coal.

THOSE Gas Companies who have still to purchase their coal supplies for the next twelve months are not finding any disposition on the part of coalowners to modify their terms. The tendency is rather for terms to become more, instead of less, unacceptable as time passes—or, to be literally accurate, we should say, more instead of less unsatisfactory. Gas managers are learning that, at the present time, it is the collieries, and not they, who can speak about "unacceptable" terms; and the coalowners, bent upon making hay while the sun shines, will hear no discussion, nor have much mercy—especially upon those who, in times gone by, have neither known when to be reasonable nor when to stop turning the screw. Human nature is a greater factor in business dealings than some people realize. It must, moreover, not be forgotten that the coal trade has but recently emerged from a period of considerable depression, when not a few pits were closed as too unprofitable to work, while some others were only kept going because the working loss was less than would have been entailed by closing the shafts altogether. This we mention, not as any good or sufficient reason for the collieries asking their present inflated prices—which are, we feel convinced, destined to bring their own retribution—but as explaining the eagerness of some few of the owners to work the present situation for more than it is worth. It is said that the masters, as well as the men, are showing a disposition to keep down the output of coal in order to keep up the price. This is an expedient to which the men have always shown a tendency to resort; but it would require very strong proof to make us believe that the masters are conniving at such a policy at the present time. Unless their prosperity has deprived a very shrewd body of men of their senses, the owners are only sorry that they cannot take fuller advantage of the present extraordinary demand.

We have said that the unreasonable prices now being asked for future supplies will bring their own retribution. Any artificial reduction of output would do so even more

surely, and from the same direction. For the certain consequences of enforcing such prices—obtainable by reason of the absolute necessity of coal for the conduct of many industries, but not really justified by the general level of the prices of other commodities—must be a restriction of trade, a contraction of the demand until the supply overlaps it, and then a rapid fall in the price of coal. There can be no doubt that the immediate result of the all-round increase in the price of gas which is taking or will take place, will be a check to the consumption of gas. Either the quantity sold will be actually reduced, or the increase will be at a less rate than it would have been at the lower price. Similarly, the price of iron, and of all goods made therefrom, or in the process of whose manufacture machinery or coal is used, must eventually bring about a reaction by checking enterprise and trade generally.

At present, however, the game is all in the hands of the producers; and, as we have said, the coalowners are playing it with great vigour and enjoyment. A reference to the figures in the Board of Trade returns for the three months ended March 31 will, in no small measure, explain the strength of their position. The exports of iron and steel during the three months were 966,188 tons, valued at £8,269,800, as compared with 708,653 tons, valued at £5,473,155, during the same period last year. The increase in pig iron exports was about 80 per cent. in weight and 150 per cent. in value. The influence of such a condition of the iron trade on the consumption of coal in this country is obvious. Side by side with the increased demand for coal at home, we see an export to other countries of 10·25 million tons during the first three months of this year, as against 9·7 millions in the March quarter of 1899, and 8·5 millions in 1898. The price realized this year, moreover, is 50 per cent. and more higher than during 1899. The increase in tonnage shipped over that exported in the corresponding months last year was, it may further be noted, 391,144 tons last month, as compared with 136,816 tons in February, and 55,189 tons in January. The increase is not in a diminishing ratio. For a great deal of this inflated demand, the labour troubles in Austria have been responsible; but, although the strike there has practically collapsed, stocks are at a minimum, and the output is certain to be restricted for some time to come. Further, the Baltic is only just opening for the summer trade; and, in view of the state of trade in Russia, there will doubtless be heavy shipments there of both coal and iron goods during the next few months. There is, therefore, but little prospect in the near future of any weakening of the position at present occupied by colliery proprietors. Gas shares this time next year will be better worth buying than ever.

The Accounts of the London Gas Companies for 1899.

The completion of the London Gas Companies' year, by the publication of the accounts of the Commercial Gas Company, enables us to present in this issue our customary statement and analysis of the accounts of the Companies for the year ending Dec. 31, 1899. So far as capital is concerned, the figures are necessarily affected by the process of conversion, and must therefore be interpreted in the light of their history. Capital stock conversion on the part of Gas Companies is a serviceable operation, and so is loan redemption by Municipal Gas Committees; but in both cases the result is to make havoc of comparative statistics. The "sweet simplicity" of the old maximum dividend *régime* was broken by the advent of premium capital; and now utter confusion reigns in its stead. The same remark applies to the revenue accounts, as affected by modern innovations in gas manufacture. This truth, however, while desolating to the comparative statistician, is valuable testimony to the fact of the gas industry being very much alive at all points. It is impossible to lay down in advance the lines along which the gas industry will next develop. Development may be hampered by mistaken or outworn regulations; but it cannot be forced by anything else besides changing circumstances and conditions. Nobody foresaw, twenty years ago, the expediency of those capital stock unifications and consolidations which have actually helped Gas Companies to cheaper capital; just as the modern expansion of gas consumption was not anticipated. Glancing at our page statement, it is quite a comfort to recognize in the returns for gas sold by meter—to the value of £4,328,049—a figure that has a solid, unchanging basis. This entry is greater by £169,700 than that for the previous year; the increase in the case of the Chartered Company alone being £133,100. The gross profit at which the undertakings work on this rental ranges from £39 12s. 6d. per cent. in the case of the Chartered, to £33 12s. 1d. in that of the South Metropolitan Company.

The income of the Companies from public lighting shows a general decrease—partly due, no doubt, to the economy of gas effected by the incandescent burner. The increase from residuals was enormous; amounting to £322,908 for all the Companies. The total increase of the Companies' revenue, from all sources, was just under half-a-million sterling—a plain proof of the vitality of the gas business in London. On the other hand, the positive cost of carrying on the business rose considerably. Although the era of dear gas coal and oil had not set in, the Companies had to pay £293,463 more for their supplies; and everything else went up in its degree. The Companies paid for rents, rates, and taxes £318,522; this being nearly £15,000 more than for the previous year. The carbonizing work of the Companies is exhibited in the accompanying small table:—

Table *showing the Residuals produced per Ton of Coal and Cannel, and the Gas made per Ton of Coal, Cannel, and Oil, by the Metropolitan Gas Companies in the Year* 1899.

Name of Company.	Coke.	Breeze.	Tar.	Am. Liq.	Gas.
	Cwt.	Bushels.	Gallons.	Gallons.	Cub. Ft.
Chartered	12·42	3·07	10·29	31·09	10,662
Commercial	12·24	5·53	12·77	32·66	11,613
South Metropolitan .	12·34	4·67	9·60	33·06	9,854
Mean per Ton . .	12·38	3·74	10·20	31·82	10,478

The differences of manufacturing practice between the Companies are known to be considerable; but it is a surprise to see how seriously these affect the make of gas. Evidently, statutory 16-candle gas can be produced in various ways. With this reflection, we prefer to leave the table to speak for itself to those who can interpret it aright.

For the Suppression of Illicit Commissions.

The Lord Chief Justice's Bill for putting down illicit commissions has been read a second time in the House of Lords The print of the measure is prefaced with an explanatory memorandum, which states that the object is to check these inequitable and illegal secret payments by making them criminal. The use of these terms is very significant—inequitable, illegal, criminal. They form a trilogy which exhibits in a stern progression the descent from the ethical to the penal treatment of an offence. Those who rule their conduct by the law of righteousness, do not want any other deterrent from a practice than the knowledge that it is wrong. Those who are less scrupulous come within the scope of the civil law, which has power over their pockets, if not over their conscience. Where this restraining power is insufficient, and illegality takes the darker hue of corruption, the Sword of Justice only remains to terrorize and punish evil-doers. There is no doubt that corrupt secret payments to agents do demoralize all parties concerned, and discourage honest trade and enterprise. The gravity of the action depends wholly on the existence of this corrupt quality, and the mischief done is not confined to the question of degree. No attempt is made to define "corruption," in this regard; because the thing is so protean as to defy useful definition. The Bill goes quite far enough in the way of particularizing, in specifying that the consideration corruptly tendered, asked for, given, or received must be "valuable." Care is taken, however, that the word "valuable" is not to be construed in the ordinary sense, as a definition of degree. The words "valuable "consideration" in the Bill are to include "any money, gift, "loan, office, place, employment, fee, reward, benefit, or "advantage whatsoever, and any forbearance to demand "any money or money's worth or valuable thing." This is pretty wide. The sense of proportion, however, is sought to be preserved by the insertion of a list of exceptions to what are to be estimated as "valuable considerations" within the meaning of the Act, which comprise gratuities to servants and porters, and "meat or drink or accommo- "dation reasonably and *bonâ fide* given by way of hospitality "only." The business relations of donor and recipient are to determine the character of the gift, not its intrinsic value. If the Bill becomes law, a good many worthy individuals will have to seriously consider various things. The preferential

allotments of shares in some companies are a very long way from the periodical salmon, or the occasional box at a theatre, which incidentally punctuate business connections; but they all come within the range of this Bill. After all, the way of safety will be the rule of common sense. The canker of secret bribery has penetrated so deeply into all commercial life, from remote antiquity, that it will be difficult to eradicate. Contrary to what bookish people who contribute to newspapers may say on the subject, the evil is diminishing, not increasing. It is very like drunkenness. From ranking as the venial weakness of the many, it has descended to be the shameful indulgence of those, be they numerous or few, who are content not to be on the up-grade of humanity. Like drunkenness, venality will always remain in the world. It will continue to affect people of all grades of the community; but it is already disreputable. This is the opportunity for legislation, which is quite competent to save from themselves those who are weak rather than wicked, and to set the policeman on to the remnant that fears nothing else.

The Waverley Association Meeting.

The members of the Waverley Association of Gas Managers have good reason to be pleased with their meeting at Selkirk last Thursday—the only drawback to it being the breakdown of the weather, which necessitated some curtailment of the excursion. Mr. M'Lusky's presidential address was, as six months ago he promised it would be, a following out of the line of his then remarks. He takes up no subject to which he does not bring the touchstone of experience, based upon mature reasoning. He was thus successful in laying the foundation for a discussion of better volume and quality than is usually met with at meetings of the Waverley Association. It is almost a repetition to say that the subjects dealt with were of the ordinary work-a-day sort; but, were it otherwise, the Association would not be fulfilling its mission. There was no travelling beyond the topics which were suitable for managers of works of limited output. The Waverley men are somewhat of a family party—their interests being so much alike. For instance, the reduction of the illuminating power of Scotch gas, which, the week before at Glasgow, was looked upon with such general favour, was differently treated at Selkirk. In the Waverley district, the Newbattle cannels are near at hand; and all the arrangements of gas plant have been made for the supply of gas of high illuminating power. Any change in the quality of the gas would mean costly changes in the plant; and it is highly probable that the consumers in small towns, where customs are held to with tenacity, would oppose the change. The Waverley managers are, therefore, at present against a reduction. They are, however, taking largely to modern methods of consuming gas; and in doing so they are adopting the means of educating, not so much themselves as their customers, in the matters which have led to the subject of reducing the illuminating power being raised in other districts. That managers should be so enterprising as these are in the promotion of the use of gas-cookers and incandescent burners, and should be so advanced as they are on the free-burner question, is unmistakable evidence that the business of gas supply is not stagnating in the district. In the south-east of Scotland, the day of small things is by no means synonymous with the day of decaying things.

Should Exported Coal be Taxed?

It will most certainly strike many habitual readers of the "Journal" that the time is suitable for a thorough reconsideration of the economics of the coal trade of the United Kingdom. Many people of late have asked themselves what would be the result of laying a prohibitive duty on the export of British coal; and in the name of all plain men who would like to understand the rights of this matter, we invite those who have any claim to speak with authority on the subject to offer their reasons in the "Journal" why exported British coal should not be charged with a 50 per cent. *ad valorem* duty. This is an age of reconsideration of many doctrines. It is certainly not an age when the dicta of arm-chair Economists like Ricardo and Mill are accepted without question. There is much attraction in the remarks of the "St. James's Gazette" of last Thursday on this question of taxing coal exports. Our contemporary admits the principle that the prosperity of a commercial nation largely depends on it maintaining an increasing volume of exports, and also that imports can only be paid for by exports. This is all very well, so far as it goes; but in respect to the exportation of English coal, the consideration occurs that this is, for all we can see, a unique gift of Nature to these islands, upon the possession and proper use of which, under Divine Providence, the very existence of the Empire depends. "Coal is not like "any other raw material of trade. The consumption can- "not be made good by further and indefinite production. "The supply is a fixed quantity." The United Kingdom is in the position of being a besieged community. The nations are snapping and snarling round the present limit of our gun-fire. Is it wise and proper to send away so much of our source of energy, that cannot be restored? This is the question. It has often been ventilated before; but here is an opportunity for examining it again, in the light of contemporary events that are counter to all the premisses of the economics of the schools. There is no sort of economic reason for our fighting for the Flag in South Africa; but there is fighting, all the same. France, to whom we are the largest and best of national customers, ought, on the Cobdenish theory, to be our best friend; she is something altogether different. Germany and Russia are bound to us in the bonds of an enormous trade—they wish for our defeat and humiliation, while they buy our coal. Is this right? If so, let it be proved once more in a way that reasonable men can freely accept without being influenced by any political prejudices. If the events and discoveries of the past six months do not affect the dicta of classical Political Economy in this matter, one would at least like to be assured of the fact.

The Committee on Municipal Trading.

Just before the adjournment for the Easter holidays, the House of Commons disposed of the order for a Joint Committee of both Houses of Parliament to inquire into the question of Municipal Trading, by agreeing to the resolution by a substantial majority. There is little to add to our previous remarks on the subject. Sir A. Rollit made a temperate speech against the appointment of the Committee, on the reasonable ground that it is impossible to draw a hard-and-fast line between what Municipal Corporations might or might not undertake. This parliamentary spokesman for the Association of Municipal Corporations made out a plausible case for leaving Local Authorities alone, to do what they thought expedient in the interests of their constituents. He came fresh from the annual meeting of the Association, which had adopted a resolution moved by a representative of Leicester, to the effect that Municipalities ought to be left untrammelled in this respect. The "Journal" has the reputation of looking with no friendly eye on the trading propensities of Local Authorities; but it cannot be truthfully urged against us that we have ever made objection to the "principle" of this form of municipal activity. Our objections to the unregulated extension of the practice are of another kind; and some of them, at any rate, are not very different from what appears to be in the mind of Parliament.

It is felt to be high time to take a survey of the subject apart from the particular applications which come before Select Committees on Private Bills. It is more than probable that the question of instituting some such inquiry would never have arisen but for the ill-advised obstinacy of the Associated Municipalities in asserting a claim to the monopoly of every kind of undertaking in which they might engage with the money of the ratepayers. If municipal trading had never betrayed this tyrannical spirit, and if those who favour it had not made so great a parade of the profits to be realized in this way for the relief of the ratepayers, the House of Commons would not have been so sharply antagonized at the idea. If the Associated Municipalities are wise, they will take warning by the very fact of the appointment of this Committee by a majority of 74 in a House of 208, and drop the monopolistic and profit-making parts of their commercial programme. Then they will have a better chance of persuading Parliament of the disinterestedness of their proposals in this regard. It is a little too barefaced for a party who have so recently opposed cheap electricity supply, in the interest of municipal monopolies, to argue that they should have unlimited powers to appropriate any other public supply undertaking that they might fancy. It sounds innocent enough, for example, for the Sheffield Corporation to wish to provide Turkish baths for the poor. Doubtless, they need them; but what if the

practical effect of receiving permission to provide Turkish baths were to inspire the Corporation with the wish to monopolize the convenience?

It is to be hoped that, when the Joint Committee is appointed, the Gas Companies' Protection Association will be able to offer evidence showing how their acceptance of the status of traders has occasionally affected the relations of Local Authorities with Gas Companies. Such matters, for instance, as the main-laying trouble in St. Pancras are very much to the point. There are likewise known cases throughout the country, where irritating disabilities have been imposed upon Gas Companies in the supposed interest of the municipal electric lighting undertaking. The ideal of Municipalism is all very fine and high-sounding; but practically its operations find expression by the agency of all sorts of small fry in the shape of officials, whose narrow-mindedness is almost beyond belief. Again, Select Committees and the Government Departments want general guidance as to allowing Municipalities to exhaust their credit for trading purposes, when there are other matters for them to attend to; and the recognized danger of increasing the amount of labour directly employed by elective bodies is not to be overlooked in this connection. As we have just remarked, the probability that much will come of the labours of the Joint Committee is not great; but if the Committee is to effect any good at all, it will be by turning the cold light of criticism on the details of the administration and financial conditions of municipal trading. Chatter about the "principle" will be waste of time. The period for repayment of loans, the question of adequate and trustworthy auditing, the fairness of Corporation account keeping, the comparative success of the English and Scotch way of dealing with profits, the question of monopoly—all these are matters which the Joint Committee may deal with instructively.

The Year's Revenue.

The Board of Trade returns of the commerce with other countries constitute a very sure guide as to the condition of trade generally in the home markets; and, as our readers are aware, they have throughout the past twelve months been eloquent of the prosperity of the country. The final figures of the revenue of the United Kingdom for the year ended March 31 provide full confirmation of the inferences drawn from the returns (of the import and export trade) as to the activity of home industries. In April, 1899, the Chancellor of the Exchequer estimated the revenue for the then ensuing year at £111,157,000, or £2,821,000 more than in 1898-9. The actual Exchequer receipts amounted to no less a sum than £119,840,000, or £8,683,000 in excess of the estimate, and £11,504,000 more than the receipts the previous year. After allowing for the fact that the receipts from Customs and Excise were abnormally heavy during last month—owing to the rush to clear dutiable goods in anticipation of increased taxation—the figures quoted afford remarkable evidence of the good times at present being enjoyed by the country generally, so far as money-making is concerned. Were it not for the concurrent enormous expenditure in which the country is involved by the South African War, we might have looked for a considerable remission of taxation. As it is, the poor income-tax payer (and especially he whose income is derived from gas dividends, which never thrive in times of flourishing trade and high prices) will have a big bill to pay in the course of the next twelve months.

Ugly London.

An interesting little article in a recent issue of the "Londoner" refers to the familiar question of what is the cause of the ugliness of London and other English towns. The writer opines that it is "the climate." He refers to a lecture by Mr. Whiteing on this interesting topic, in which the cheering thesis was sustained that London is the ugliest city in the whole world, with the exception of Madrid. In the course of his address, Mr. Whiteing stated that "the frightful lamp-posts of London "had much to answer for." He is doubtless right; and this remark justifies much that has been advanced in these columns in the same connection. By the way, nobody appears to have noticed our recent apology for the painted façades of the Regency period of London architecture; and glazed terra cotta is ruled out of the London County Council list of appropriate building materials for the new mid-London street. Alas! the London authorities deny to the city the only hope for brightness in building! Of course, the climate is insular, complicated with coal smoke; which is certainly not peculiar to London. "Manchester is "dreadful. Birmingham staggers humanity. The stoutest "heart might quail before the apparition of Whitehaven "upon a wet day. To go into Preston towards nightfall "is an experience so painful that it can never be for-"gotten. Who has not cried aloud for death upon "arrival, in a November twilight, at Wolverhampton? "Who has not sighed for the eternal sleep when suddenly "confronted, in a wintry dawn, with busy Blackburn?" Yet, somehow, one has the impression that this is not the whole truth of the matter. Exclusively manufacturing centres do not count in the category which includes Naples, or even Paris—which is a much overrated city as regards beauty. But London! Stand on one of the bridges at nightfall, when the lights are twinkling out. Drive through the Park precincts, at early dawn or dewy eve. Tread those streets which are the most varied in the world for architecture and use; and then pronounce London ugly! Yes, in many aspects and senses London is intensely ugly; and it has a way of exhibiting its very worst side towards the visitors and strangers who nevertheless come to it from the ends of the earth. Yet the man who does not prefer London to "Tetuan upon its flowery hill," is a soulless being upon whom it were futile to waste a second query. Still, London could do with local authorities more solicitous for its little things; and especially the lights, lamp-posts, and lighting might be improved. By the way, the South Metropolitan Gas Company have brought out a new pattern of street lamp-posts, with pentagonal lantern, which, as will be seen by the illustrated description given on p. 1002, is distinctly good.

The Coal Contracts of the London Gas Companies.—It is understood, says the Newcastle Correspondent of "The Times," that about 400,000 tons of the Gaslight and Coke Company's contracts have now been arranged for at c.i.f. prices equal to from 15s. 9d. to 16s. f.o.b.; and that negotiations for as much more are now in close treaty at about the latter figure, which shows an advance of 6s. 6d. to 7s. a ton upon last year's rates.

Stating Mileage of Mains in the Board of Trade Returns.—In view of the practices of Secretaries of Gas Companies differing in regard to stating the mileage of mains in their districts for the Board of Trade Returns—some giving the length of pipes, and others the extent of the streets occupied—Mr. E. Ransome, of Bedford, has applied to the Board for a definition of the heading "Length of Gas-Mains in Miles" in the returns. The Board of Trade have replied as follows: "In view of the terms of the heading, the Board are of opinion that the actual length of the mains of the company, and not the length of streets in which such mains are laid, should be given."

Thawing Frozen Water in Pipes.—The "Ironmonger" calls attention to a practical application of the scientific truth that copper and brass are better conductors of heat than lead. If a length of lead pipe carrying a stopcock is evenly exposed to cold weather, as on the wall of a cellar, it always freezes first at the cock; and if the stoppage be observed in time, a flannel full of boiling water, or a bunsen burner, applied to the cock itself will generally make the water run again. This treatment can be pursued without fear of making a mess, because a pipe is not often burst if the freezing takes place slowly and progressively. The burst is caused by the expansion of the freezing water occurring in a closed length of pipe—*i.e.*, between two shut valves or between two plugs of already formed ice—or else so rapidly that the water still liquid has not time to get out of the way.

Absorption of Light by Glowing Gas.—In the current number of the "Electrician," M. Fournier de Albe devotes one of the interesting abstracts he is furnishing to that publication, under the heading of "Contemporary Electrical Science," to a paper by M. Cantor in the "Ann. der Phys." He says: "Kirchhoff's law makes the ratio of the emission of a gas to its absorption constant, and equal to the emission of an absolutely blank body at the same temperature. This law, as we know, holds for all flames so far examined. The question whether it applies to electrically glowing gases in a vacuum tube has been raised by M. Cantor, and answered in the negative by an important experiment. He sent a stong beam of light through a vacuum tube from end to end and back, and compared its intensity with a beam passing through air under normal pressure. After making suitable allowance for the illumination due to the vacuum tube itself, he found that the beam of light suffered no absorption in the electrically glowing gas. This result is of far-reaching importance. It could only be squared with Kirchhoff's law by supposing the gas to possess an extremely high temperature. This, as we know, it does not possess. Its temperature is more like that of boiling water. Therefore we must conclude that we have here a case of emission practically without absorption, and that the light-yielding mechanism is of a totally different nature from that of ordinary flames."

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1013.)

Business on the Stock Exchange in the truncated week which precedes Easter is usually on a very slender scale; and this year it was no exception to the general rule. Attention was for the most part concentrated on the fortnightly settlement; and when operators had once closed their books, they took their departure until the holiday interregnum should be over. Thus business dwindled down; and things became quieter and quieter until by Thursday, the clock had almost run down. But still, on the whole, prices kept their ground very fairly well, when allowance is made for the natural shrinkage caused by realizations to secure profits. Some disposition to tightness, too, proceeded from the Money Market, where there was a very lively demand all the week. Commencing with the instalment payable on the War Loan, and continuing with the requirements of the Stock Exchange, money was in brisk request at advanced rates. In the Gas Market, transactions were on a most limited scale; and at no time was there any semblance of a disposition to activity. An inclination to do nothing at all just now is quite intelligible. The immediate future of Gas Companies' dividends is necessarily menaced by the abnormal price of coal, and therefore possible buyers of Gas stock may stand aloof for a time, while holders, confident of the value of their undertakings, may with equal caution decline to part with them at present prices. But quiet as business was last week, there was some further shrinkage of values, but not excessive; and in the case of one issue, which has lately been falling, there was a recovery. In Gaslights there was no alteration, the ordinary selling at good medium figures daily. The secured issues were steady too. The few transactions marked in South Metropolitans showed no fluctuation; but the quotation was put down a point. Nothing was done in Commercials; and the *ex-div.* adjustment of the quotation exhibited no falling off. Among the Suburban and Provincial Companies, was the unusual incident of several dealings in Bromley. Here prices were kept up firmly. Brentford and Crystal Palace, however, had to recede. In the Continental group, a little business was done in Imperial at poor prices; but the quotation did not move. Union ordinary recovered some of its losses; but the preference was weaker. Among other changes, Melbourne bonds were put down a couple of points; and Cape Town lost some of its advance. Hardly anything was done in the Water Companies; and their prices are practically unchanged.

The daily operations were: Business on Monday was of the most limited description; but prices were very fair. Crystal Palace ordinary and preference lost 2 each. There was an approach to more activity on Tuesday, but not much. Continental Union rose 5, but ditto preference fell 3, Brentford old 5, and ditto new 3. The general situation was unchanged on Wednesday. South Metropolitan fell 1, and Cape Town ½. Thursday was quiet, but pretty steady, save that Melbourne 5 per cent. bonds fell 2. The Stock Exchange was closed on Friday and Saturday.

ELECTRIC LIGHTING MEMORANDA.

The Wright System of Charging for Electricity—Preferential Trading Avowed—The Statutory Obligation of Fair Dealing—Unreliability of Meter Systems.

An instructive paper on the various methods in vogue of charging for public electricity supply, was recently read by Mr. Lackie before the Glasgow Section of the Institution of Electrical Engineers; and an abstract of it, with a brief report of the discussion, appeared in the "Electrician" for the 6th inst. Editorial notice was also taken of the paper; our contemporary pointing out that municipal committees controlling electricity supply undertakings are "not always clear" upon the bases of the Wright method, which is now so popular. This lack of understanding is said to be shown by cases where disproportionate reductions in price have been made, "especially at the time of the taking over of a supply works by a municipality—and by the frequent supply of electrical energy below cost to large consumers." We always suspected that this sort of thing goes on; and it is gratifying to have the suspicion confirmed on such good authority. It is kind of our contemporary to assign the proceeding to lack of understanding of the Wright device on the part of the municipal electricity supply committees; but we entertain another suspicion—that these bodies are inspired also with a very clear appreciation of the expediency of doing the popular thing. They may not always understand the Wright system; but they know very well they are expected to give patent proof of the advantage of municipalization, and soon learn the need of squaring the big consumers.

It is extremely interesting, moreover, to find the "Electrician" itself confessing that "even the Wright system does not give the absolutely correct theoretical charge that should be made to each consumer," and suggesting a simplification of the method in the shape of employing demand meters for a year or two, to test the nature of the requirements of the various classes of consumers in a town, and afterwards charging each at a single rate. It is regretfully admitted, however, that this would be in contravention of the Board of Trade regulations against preferential rates of charging. The Wright system is characterized as being "probably the nearest approach to preferential charging that the Board of Trade would tolerate"—a very significant admission. In point of fact, this "lets the cat out of the bag." If further proof of this were needed, it would be furnished by the statement which follows, that Mr. Lackie's tables will afford a guide to canvassers "as to which are the most and which the least desirable classes of consumers." If this is not a direct incentive to preferential dealing, we should like to know what would be so classified. This making fish of one consumer and flesh of another, is a transgression against the spirit, as well as the letter, of the Electric Lighting Act, which in this respect agrees with the whole body of British legislation relating to public supply undertakings. What right has a statutory undertaker of electric lighting to have classes of consumers of various degrees of "desirability," from his point of view, and to treat them accordingly, while railway companies, gas and water companies, and all other traders carrying on their business under the protection of an Act of Parliament dare not recognize any such distinction?

We have sometimes called the maximum demand system of charging for electricity a device—and have occasionally termed it a "dodge." In so far as it is preferential charging, it is clearly illegal. Of course, outside an Act of Parliament, a trader can show as much favouritism as he pleases, to himself or to any of his customers. The leading case of the Mogul Steamship Company established this liberty, if it needed any establishing. It is only by a Special Act that uniform dealing can be ensured; but when this is understood to be the common principle of an entire body of statutes, it seems risky, to say the least, to fly in the face of it. There are such things as injunctions; and the Board of Trade may wake up one fine morning and put a stop to all fancy methods for making one man pay more for his electricity than his neighbour and fellow. We have never taken to the maximum demand system, and have always applauded those purveyors of electricity who will have nothing to do with it. Preferential trading is more than non-statutory; it is repugnant to British notions of fair dealing. The United States is the home of it. In that fair land of Freedom, nobody can say what the price of gas is, or what it will cost to send a truckload of oil any distance. Some people pay more, some less. These things are all subject to "deals" of as infinite variety as Cleopatra's charms. Doubtless, as the greatest of Presidents observed of something else, "for those who like that sort of thing, it is just the sort of thing they do like." But it is not the thing that an English merchant would pride himself upon.

We may be accused of vilifying the maximum demand system of charging, because it is calculated to make electric lighting popular, and therefore a more formidable rival to gas where it is in vogue. The gas industry would not, however, suffer harm from the cheapest possible electricity, much less from electricity only made to look cheap by a dodge. The real truth about charging for public electricity supply has never been told by those in the business. The Glasgow Corporation have made a bold attempt to solve the difficulties of selling electricity by meter and indicator, and all the rest of it; and by one of their methods, they offer to cut the whole thing down to what is really a rental charge. If the consumer will engage to pay for a quantity of electricity computed on his maximum demand for the equivalent of five hours per day, for 365 days in the year—that is, for 1825 hours per annum—he gets it at a uniform rate of 2d. per unit. This is business; but the rest is to a considerable extent guesswork. There is no fixed relation between the station output and the readings of the consumers' meters. The two quantities—if quantity is the proper term to use—may agree fairly well, or they may not. There is nothing to lay hold of in the "unaccounted for" of an electricity supply undertaking. We have heard a whisper that a first attempt to apply the maximum demand system on a rigid instrumental basis resulted in a crop of 80 per cent. of disputed accounts; and that the peaceful working of the business afterwards could only be obtained by allowing a good deal of elasticity in adjusting of the quarterly charges, some of which ultimately bore more relation to the personal equation of the customer than to the number of units registered against him, or the nominal price thereof.

Coal Exports in the Past Two Years.—A parliamentary return just issued, giving the quantity of coal exported from the United Kingdom in the past two years, is of special interest in the present condition of the coal market. It shows that in 1899 no less than 41,180,300 tons of coal were sent abroad, as compared with 35,058,430 tons in 1898—an increase of 6,121,870 tons. The various groups of countries comprised in the summary statement in the return all took more coal from us last year, with one exception—viz., the group which includes British North America, the United States, the British West Indies, the Bermudas, the Foreign West Indies, Mexico, Central America, Colombia, and Venezuela; the figures being 405,486 tons in 1898 and 248,403 tons in 1899, or 157,083 tons less. British South Africa, on the other hand, had last year nearly twice the quantity imported in 1898—496,148 tons, against 258,150 tons. From Irish ports (Belfast and Cork), 1839 tons of coal were exported last year, the whole of which went to France. The quantity of coal shipped at each port for use on foreign voyages in 1899 wa 12,226,801 tons, compared with 11,264,204 tons in 1898.

THE SUMMER INSTRUCTIONS OF THE METROPOLITAN GAS REFEREES.

The thorough revision which the Instructions of the Metropolitan Gas Referees underwent two years ago, on the introduction of the Harcourt 10-candle pentane lamp as the standard for testing gas in London, has been followed by further emendations which have been noticed in our columns. They furnish evidence that the Referees are alive to the fact that conditions arise which call for verbal, or even more substantial, changes in the text of their half-yearly publications; and they make them accordingly. An instance of this is afforded by the Instructions for the summer of the present year, which reached us last Thursday. In addition to the usual notification that the maximum amount of sulphur allowed in gas will be 17 grains per 100 cubic feet, there are certain other changes to which attention may be directed. First in order is an entirely new section relating to the service-pipes to the testing-places. It runs as follows:—

> Each testing-place shall be connected with the main or mains specified by the Gas Referees by a service-pipe, one service-pipe to each main, which proceeds directly from the street main or mains, and is without tap or branch, or provision for connection of any kind outside the testing-place.
>
> If obstruction of the service-pipe is found, or if there is reason to think that the quality of the gas is suffering from a deposit of naphthalene, the service-pipe may be washed out in the presence of, and by arrangement with, the Gas Examiner, either by hot water alone, or by any usual solvent, such as benzol, naphtha, or petroleum; but the use of such solvents is to be followed by a washing with hot water. In every case where the service-pipe is washed out, the Gas Company shall send a letter to the Gas Referees, explaining why the washing was considered necessary.
>
> No testing for illuminating power is to be made until after the lapse of an hour since the last washing out. The Gas Companies may, if they think fit, provide a tap and funnel in any testing-place for the purpose of such washing out.

The next change has been called for by the use of incandescent gas-burners for street lighting; and it has been made in the section of the Instructions dealing with the mode of testing the pressure at which gas is supplied. After setting forth that these testings are to be made at such times and places as the controlling authority may appoint, it is stated that, in order to make the test, the Gas Examiner is to unscrew the governor and burner of one of the ordinary public lamps, and attach in their stead a portable pressure-gauge. Then follow these directions:

> In places where incandescent burners are used for street lighting, one street-lamp in each street or group of streets may be provided under the lantern with a branch closed by a screw stopper. The Gas Examiner shall in such cases connect the pressure-gauge by screwing it to an L-shaped pipe fitted with a union, by means of which it may be connected to the service-pipe in place of the screw stopper. The L-shaped pipe is to be of such dimensions as to enable the pressure-gauge to be fixed outside the lantern, but at about the same level as the incandescent burner. It should be provided with a tap.

The rest of the section stands as before.

A few changes have been made in the Appendices. In Appendix A—the description of the pentane lamp—some lines have been added to the fourth paragraph on p. 14, and a new paragraph has been inserted. This part of the Instructions now stands as follows:—

> When the lamp is in use, the stopcock S_2 is to be turned so that the tip of the flame is about half-way between the bottom of the mica window and the cross-bar. A variation of a quarter of an inch either way has no material influence upon the light of the flame. *The saturator A should be placed upon the bracket as far from the central column as the stop at the end will allow. If it is found, after the lamp has been lighted for a quarter of an hour, that the tendency of the flame is to become lower, the saturator may be placed a little nearer the central column.*

The added matter is the portion printed in italics. Dealing with the dimensions of the lamp, the Instructions set forth that the outer diameter of the steatite burner is 24 mm.; the inner diameter, 14 mm.; and the number of holes 30—not less than 1·25 mm. or more than 1·5 mm. in diameter. This description is amplified by the statement that "the holes must be evenly spaced, and in any one burner they must not differ from one another in diameter by more than 0·05 millimetre." This question of the size of burner-holes crops up again in Appendix D—the description of Sugg's "London" argand burner, No. 1. It will be remembered that a full-sized section of the burner is given, with the dimensions in inches; the diameter of each hole being 0·045 inch. Referring to these figures, there is a foot-note to the effect that each testing-place will be provided with a box containing two wire gauges—one 0·044 inch and the other 0·046 inch in diameter; and it is stated that "the Gas Examiner must, once in every month, pass the smaller gauge through every hole, so as to clear out any loose obstruction or detect any hard concretion that might interfere with the proper discharge of the gas." It is added that he should at the same time "satisfy himself that the larger gauge will not pass through the holes." The last addition to be noticed is in Appendix K (the description of the Referees' street-lamp pressure-gauge), on p. 30; and it is necessitated by the insertion of the new matter given above. In the third paragraph, containing the instructions for making a testing of pressure, it is set forth that, in places where incandescent burners are used, the L-shaped pipe already described is to be employed for the attachment of the pressure-gauge.

The recent Instructions have been issued with a title-page and table of contents; and the document may now be purchased through the same agencies as parliamentary papers, at the price of 1s. 6d.—certainly a useful innovation.

SUGGESTIONS FOR PATENT LAW REFORM.

It is some time since the subject of patent law and Patent Office procedure was discussed in these columns; but it is a topic which no technical periodical can neglect for very long, because patents enter so largely into the development of every industry, and occupy so much of the professional mind. The "Engineer" recently published an instructive article on the drafting of patent specifications; and a suggestive paper on the patent system of this country was recently read before the Manchester Section of the Society of Chemical Industry by Mr. Levinstein. This gentleman ought to be able to discourse informingly on the subject, inasmuch as he has had a great deal to do with patents all his business life, and has further earned the gratitude of the country by being instrumental, at his own considerable expense, in setting in motion the Compulsory Licence clause of the Act. Manchester, as represented in this connection by Mr. Levinstein, is deeply interested in chemical patents, which are perhaps the most important of all in their bearing upon national trade, and are certainly also the most troublesome for everybody concerned. Mr. Levinstein was able to claim that Manchester has scored a point in the conversion of the President of the Board of Trade to the opinion that the Patent Act needs amendment. It will be gratifying news to many that Sir E. Fry has consented to preside over a Departmental Committee charged to find means for facilitating searches, and to enable patentees to learn whether or not their proposals have been anticipated.

This will be a good thing if it can be satisfactorily accomplished; and as to this it must not be forgotten that the idea of an official search for anticipations is discredited in advance by the Institute of Patent Agents. Mr. Levinstein dismisses this objection on the part of the Institute as arising from interested motives; but the criticism is not one to have much weight with business men. What has to be considered is, not only the interest of those who put forward certain views, but the value of the views themselves. In this instance, the advantage of an official *gratis* search for anticipations is so obvious on the face of it, that a wise man will be quite prepared to be told that it is entirely illusory. Such is the way of human experience. The Institute of Patent Agents point to American and German experience of official examination as proving that it is occasionally unjust to inventors, causes long delays and involves vexatious proceedings, and is of no value to the patentee after all.

If so much can be truly alleged against the principle of official examination of patent applications for novelty, then Sir E. Fry's Committee will have no difficulty in condemning it, and this particular fancy of would-be Patent Law reformers will be set aside. There is reason, however, in Mr. Levinstein's contention that what is bad in the American and German systems is not the principle, but the mode of carrying it out. Evidence will have to be gathered carefully to test this contention. It will be necessary to ascertain as exactly as possible how the system works where it is in operation; and to determine with equal precision how it ought to work. In the first place, one would suppose, the idea is to help the would-be patentee in the same way as he would help himself if he knew how, and were able to do it properly. This signifies that when application is made for a patent (say) for "a new illuminant appliance to be used in gas lighting," the applicant, knowing the nature of his alleged invention, wants to learn if it has already been patented by somebody else. At present he has to find this out by himself, or through his Patent Agent. The suggestion is that the Patent Office should do it for him—referring him in the result to the older patents that appear to a competent and impartial person to cover or touch upon his proposal. We cannot see the smallest reasonable objection to this programme, which, when acted upon with the ability, fairness, and courtesy that are honourable traditions of the English Patent Office, seems calculated to confer an enormous boon upon the inventor, and to give him a most ample return for his fee. Who that is interested in a particular branch of technics would not pay £3 to know what the records of the Patent Office contain relating to it? This is, indeed, one of the aspects of the question that have to be considered from more than one point of view. Can the Office afford the expense of providing such an informations-bureau? After all, the interest of the would-be patentee, whose ordinary motive is of an essentially selfish nature, is not everything in this connection. His object is to get a monopoly. Why should the State help him to it, as well as grant it to him, at his own risk? Knowledge is a commodity like any other; and others besides Patent Agents might object to the provision of a peculiarly valuable kind of information by a Government Department, for a quite unremunerative fee. The fee, besides, is here charged for something else, and the information is to be "thrown in," actually for nothing. It is a strong order.

Of course, it is urged in support of this request, that the Patent Office is a profit-making institution; and that some at least of the profit might be spared to help the poor inventor in the manner indicated. Even so, it does not necessarily follow that the poor inventor should be helped in this particular way. The trouble and expense might be thrown away upon him. Mr. Levinstein repeats the well-worn complaints that "by our present system the Government receives a large amount of fees for valueless services. It pockets from the poor inventors fees for patents which it must know are utterly valueless, and often for

subject-matters which have been patented over and over again. . . . Our system also encourages the taking out of bluff and bogus patents . . . and does not confer a shadow of a secure title, that a patent suit to establish may spell ruin to all but capitalists." How would official examination for novelty affect these considerations? Not at all, we are afraid; so that the case for such examination cannot rest upon them. As to patent litigation, this is no light matter anywhere; and it has never been proved that English law is either worse or less expensive than that of other countries. No patent law professes to give the patentee a sure title. The great majority of all patents everywhere are valueless; but those that are worth anything, like any other kind of property, will be fought over so long as they are worth attacking or defending. There is no likelihood that any sort or amount of official premonition will prevent the taking out of worthless patents; and is it probable that the traffickers in "bluff or bogus patents," if such there be, would be stopped by the Office? Besides, who is to be the judge of such matters?

It is a little doubtful upon which leg the professed advocates of the encouragement of patentees stand. The American boast is of the number of inventors who patent their ideas; while the German system has the opposite effect—the difficulty of obtaining a German patent being notorious. Which is the better result, even for inventors, it would be hard to say conclusively. There is much to be urged against the artificial encouragement of patenting, as tending to foster the lottery element in national industry. "Invent some taking notion, young man," is the stereotyped advice of the American Patent Attorney, "and then you need never do any more work." On the other hand, the German system is believed to be inspired with the sentiment that patent monopolies are an evil operating in restraint of trade, and as such are only bestowed for unquestionable and distinctly defined merit. This practically means that such a thing as a "master" patent is unheard of in Germany; most of the patents there being for details, such as are called in England "trade" patents. This consideration reminds us that Mr. Levinstein and some other patent law reformers seem to overlook the vast number of these patents. They would not possess any value in themselves, and they are never made the subject of litigation; but professional men often adopt this handy expedient for registering priority for an idea, and there are shopkeepers who make it a rule to advertise all their wares as patented specialties. Consequently, large batches of patents are taken out every year by inventors who do not require any official assistance.

If one gets away from the notion that patent systems are for the benefit of patentees only, and poses the larger question of whether the multiplication of patents is for the good or otherwise of the community generally, there is a formidable case for the opposition to these monopolies. It is very certain that many articles are extremely cheap in Germany, owing to the restricted patent system, which are injuriously dear in patent-ridden countries. Mr. Levinstein complains that we grant in England annually about 9000 monopolies in excess of those granted by Germany; but whether this is a good or a bad thing for inventors he does not say. That it is good for the German and bad for the British public he does not hesitate to aver; but this is a contention that might be used in disparagement of all patent rights whatsoever. A very clear grievance mentioned by Mr. Levinstein is the disconformity of the patent laws of the industrial and commercial nations. Take, for instance, the important example of patents of addition—those for improvements on the original subject-matter. In England, these additional patents are independent monopolies, and are used (whenever it is possible to do so) to eke out the life of the exclusive privileges of the patentee beyond the term of the original patent. In Austria, France, and Germany, additional patents expire with the originating one. The consequence is that the public of the United Kingdom are taxed to support a monopoly for years after it has lapsed across the Channel. It is unnecessary to dilate upon the disadvantage to the English nation of this one-sided arrangement. The matter becomes still more irritating, naturally, when the original patentee is a foreigner, and the English law enables him to go on drawing his royalties, and otherwise burdening our trade, while obliged to do business at home under competitive conditions.

Mr. Levinstein argues also that the facility for disclaiming, which exists under the English law, paralyses fruitful invention and checks industry. It is true that some of the strongest and most oppressive monopolies of recent times have been the result of this process, applied to originally weak patents. This remarkable result is aided by the apparently public-spirited provision of the Act, that no amendment of claims is permissible which widens the scope of the patent. But the practical effect is, that where a patentee has happened to employ a form of words which in the light of subsequent discovery bears a particularly valuable construction, he or his representatives are allowed to cut out every thing besides this one thing. Result—a valid patent where otherwise the patent would not have been worth the specification paper. Nobody can conclusively say that the patentee had not the particular application in his mind from the very first. The Courts will construe his specification and claims on their wording; and so this trick of disclaiming, apparently so innocent, is really a tremendous power which a body of extremely able practitioners know well how to employ to forge a monopoly out of a mere guess-word. The German system, with its requirement of samples and specimens in addition to specification and drawings, nails the patentee down to what he knows at the time. This is undoubtedly one of the points that will need attending to whenever the British system is overhauled.

We have discussed Mr. Levenstein's suggestions, which are extremely pertinent, at such length as to have left no space for dealing with the matter of the "Engineer" article. This, however, is really another branch of the general subject, and may well be treated separately. In these days, when so many men unaccustomed to precise writing are their own specification drafters, hints on the subject are certain to be acceptable.

THE SCARCITY OF COAL IN THE SEVENTIES.

In view of the present abnormal condition of the coal market, it may not be without interest and advantage to consider what causes were responsible for the somewhat similar state of the market which prevailed in the early seventies, to which time we have to hark-back in order to find any approximate parallel to the present situation. The high prices ruling for coal at the commencement of 1873 caused so much dislocation of trade, and gave rise to so much apprehension for the future, that, on the 21st of February in that year, a Select Committee of the House of Commons was appointed "to inquire into the causes of the present dearness and scarcity of coal, and to report thereon to the House." Mr. Ayrton was elected Chairman; and the Committee—of which Mr. (afterwards Sir George) Elliot and the late Mr. Hussey Vivian (afterwards Lord Swansea) were members—after having examined a considerable number of witnesses, including colliery proprietors, merchants, retailers, mine inspectors, and representatives of the workmen, reported to the House on the 18th of July, 1873. The following is a brief summary of the conclusions contained in that report, together with the most important points in the evidence of some of the various witnesses examined.

The Royal Commission appointed in 1866 to investigate the probable quantity of coal contained in the coalfields of the United Kingdom, and the quantity of coal then consumed and exported, having presented in July, 1871, a voluminous report on the subject, Mr. Ayrton's Committee did not deem it at all necessary to inquire into any of the matters contained in that report—contenting themselves with referring briefly to some of the conclusions arrived at by the Commission, in so far as they had any bearing on the then prevailing condition of affairs. In order to ascertain the causes which led to the apparent scarcity of coal at the time of their appointment, the Committee sought, primarily, to ascertain how far the scarcity had arisen from a diminution or stagnation of supply, or from an unusual increase of demand for consumption, either temporary or permanent in its character. So far as the question of the output of coal was concerned, the Committee, from a consideration of the evidence laid before them, arrived at the conclusion that there had been considerable disturbance in the minds of the workmen employed in and about the mines, respecting the number of days or hours per week or per day during which they deemed it to their interest to work, and that the general tendency had been to reduce the hours of labour. It was further stated that the Mines Regulation Act, passed in 1872, had also tended to the same result; the consequence being a falling short of what, with normal working, would have been the possible output.

Referring to this fact, the Committee observed that they had "no reason to doubt that one of the greatest benefits which can be conferred on the mining population is to induce them to work with regularity day by day, and for such a time daily as—while it will not deteriorate their health, social comfort, or moral condition—will not result in idleness or dissipation; but as no standard can be laid down to fulfil these conditions, it must be left to the general feeling of the workmen, improved by education, to arrive, in concert with their employers, at the proper limits for their labour." These observations, made more than a quarter-of-a-century since, are equally appropriate to the present day; the "greatest of benefits" defined by the Committee remains to be conferred upon the mining population. But, as the desired end is only to be attained by inward change, it is not obvious with whom lies the power to confer. It is interesting to note that the output of coal per man employed in 1872—the year when unusually bad working was alleged to have been prevalent—was only 3 tons less than that in 1899, and was actually more than in the years 1897 and 1898. The figures are as follows:

1872.	299	tons per	man employed.
1897.	291	,,	,,
1898.	286	,,	,,
1899.	302	,,	,,

The Committee then passed to the consideration of the consumption of coal; and found in the excess of the demand over the supply the real inwardness of the situation then, as is to be therein found the *causâ causans* of the situation at the present time. They reported that they found a very general concurrence of opinion among the witnesses they examined, that the flourishing condition of the industry of the country and of the population had fully sustained, and had even enhanced, the rate of increase of consumption of coal for the purposes of industry in general, as well as for domestic use. There was also an equal

agreement among the witnesses that the special branch of manufacture which had extended the demand for coal to a degree which could not be met by the producers, and which thereby led to the rise in price, was the manufacture of pig-iron and its conversion into the various forms of rolled iron; and, further, that this increase of demand came mainly from the United States of America and from Germany. The quantity of coal used in iron manufactures was shown to have risen from 28⅛ million tons in 1867 to 38¼ millions in 1872; and the state of the iron trades, and its effect on the coal and coke markets, was very clearly put by Mr. Isaac Lowthian Bell, one of the principal North-country iron-masters. Asked whether he was of opinion that the source of the whole disturbance was in the greatly increased demand for pig, malleable, and manufactured iron, Mr. Bell said:

I do not say the whole cause; it was one of the causes. Of course, a coal-field which had no ironfield would not have been affected by it; but we know a greatly increased demand has been felt everywhere. With us, no doubt, the iron trade gave a great stimulus to the coal trade; and I think the coke in our neighbourhood rose in consequence much higher than the coke in any other district. But the fact is, all industry all through the country has been, and still is, I may say, in a very flourishing condition, and the iron trade with others. The manufacture of alkali in the North of England is in a very flourishing condition; and, again, the increase of railways, and the general substitution of steam for sailing vessels, all added to demands on an output not very greatly increasing, have, I conceive, led to the present state of things.

Then, in your view, it seems that the iron trade primarily, and other trades in a less degree, caused an increase of demand with greater rapidity than the production of coal?

Certainly, in the North of England, it was so. In September, 1871, forge pig-iron was selling with us for 50s., and coke was selling at from 10s. to 12s. a ton. Pig-iron rose gradually towards the end of the year to 64s.; but coke was not affected up to that time. In January, pig-iron rose from 64s. to 70s. 6d., and coke rose to 20s. In March, forge pig-iron was 84s., and coke was 25s. In April, pig-iron rose to 94s., and c ke rose to 32s. 6d. In July, forge pig-iron rose to £5 10s.—more than twice what it was nine months before—and coke rose to 37s. 6d. and 41s. per ton. Now pig-iron rose in spite of the increase in the quantity made . . . and rose unexpectedly to us, just as coal had done to the coalowners.

The Committee, after quoting this evidence, referred to the fact that, then as now, the strong demand for coal for the particular industry of iron manufacture, reacted upon the supply for every other usage of coal, and exercised a marked influence over the price of all qualities. As the most striking example of the effect upon the price of house coal, the evidence of a London coal merchant was quoted, showing that the average prices for best house coal delivered at the wharf—as distinguished from the retail prices, some 5s. to 7s. per ton higher—in London were, for the first five months of 1873, and the five preceding years, as follows:—

1868	18s. 7d.	1871	19s. 3d.
1869	18 8	1872	24 11
1870	18 6	1873 (5 months) .	32 6

while for two days in February, 1873, the price on the London Coal Exchange reached 45s.

Upon the effect of a comparatively small excess of the demand over the supply of coal in raising prices, the Committee made some very true observations, that should be borne in mind at the present moment. "The exact effect of any disturbance of the relations of demand and supply on prices, is beyond the limit of arithmetical calculation. Price depends not merely on the quantity of the commodity, but on the motives which influence both the buyer and the seller in determining how much the other is willing and able to pay, under the belief that the quantity brought to market is or may be insufficient to meet the demand. In the case of coal, much of the demand is of such an urgent nature that the buyer would pay a very large price rather than be deprived of the supply he requires. Nor does the ratio of increase of price necessarily bear any definite proportion to the ratio of diminution of supply. A comparatively small deficiency may produce a very large increase of price if the eagerness of each buyer to secure his own supply, and to guard against deficiency in his own case, be coupled with the ability to pay for it whatever is demanded by the seller. This appears to have been the cause of the comparatively small derangement in the production and consumption of coal enhancing its price in so great a degree."

The conditions named—absolute urgency for supply, and, practically speaking, ability to pay "any price"—exist in the case of gas companies; and the moral, it seems to us, is that those companies should, at all times and by every means in their power, keep themselves thoroughly well posted with the exact conditions subsisting—and obtain the very best advice as to the conditions likely to prevail—in the coal trade, in order to avoid the mistake either of waiting too long to buy when the demand is likely to exceed the supply—as the market hardens with lightning speed when such a condition of affairs is realized, and last comers pay top prices—or of buying too soon and too eagerly on a "hollow" market. If the London Companies had negotiated their contracts for 1900-1 last September or October, would they have had to pay the prices now asked for those supplies? We admit it would have required no small degree of courage to do so; but was not the activity in all branches of the iron trade patent months ago?

As to the proposals which were made then, as they are made now, that Parliament should interfere, either by way of regulation of the home trade, or of imposing restrictions upon the export of coal, the Committee declared that they did not believe that the interference of Parliament with the course of industry—beyond the prevention of injury to the health and morals of children and young persons, and the prevention of accidents from wilful neglect of recognized precautions—could produce any useful or beneficial result to the public.

The Committee further pointed out that there are special objections to an export duty on coal beyond those of the general policy of the country, which would not apply with the same force to many other commodities. "The coal exported to foreign parts is not for the exclusive use of foreign countries. A considerable quantity is used by English shipowners for their homeward and other voyages, while foreign steamships load coal at English ports for their own consumption. It would be just as injurious to the English shipowner, to the merchant whose goods he carries, and to the workman who makes them, to deny them the free use of English coal, as it would be impracticable to levy a differential duty on coal consumed in foreign ships trading with England. Even when the coal is consumed in the interior of foreign countries, it is not infrequently used on their railways to bring to their ports commodities (whether raw or manufactured) to be imported into this country to be exchanged for the exports from England, and all those operations would be prejudiced to the extent to which English coal abroad would either be enhanced in price or diminished in supply." Moreover, "if the result of an export duty on the coal itself deprived foreign countries of the means of manufacturing commodities in which coal is used, it would only have the effect of increasing the export of those commodities, and, consequently, of the consumption in England of the coal required for their production, unless there resulted a great diminution of industry and trade, and a cheapening of coal by depriving the people both of their power to use it in manufacture, and to purchase it for domestic use."

Finally, the Committee concluded their report by declaring that they believe "that the true policy of this country, and the best inducement to the proper conduct of business—as well as the greatest stimulus to a return to a more just balance between supply and demand—is to leave the trade free, and to maintain an inflexible resolution of non-interference on the part of the State. To adopt the opposite course would be to make one class pay for the benefit of another; while any restraint on the profits of private business or industry by the power of the law, must, in justice, carry with it the guarantee of the resources of the State against loss, which . . . . is altogether impolitic." With this conclusion it is impossible to disagree; and all coal buyers must perforce recognize that the coal trade is, at intervals, subject to violent fluctuations, which are usually produced by apparently disproportionate, but none the less perceptible, causes; they must learn to anticipate such fluctuation, so far as it is possible so to do, by the exercise of judgment founded upon accurate information; and, finally, they may console themselves, at times of abnormally high prices produced by such causes, with the reflection that those times are inevitably followed by a return to average prices, the nearness of the reaction being inversely proportionate to the magnitude of the difference between demand and supply which has occasioned the inflation of prices.

Society of Chemical Industry.—The annual general meeting of this Society will be held in London from the 18th to the 20th of July. The business portion of the meeting will be transacted at the Royal Institution, Albemarle Street, under the presidency of Professor C. F. Chandler, M.A., M.D., of New York. The afternoon of the first day will be devoted to visits; and in the evening the annual dinner will be held. Other visits will be arranged for the next day, ending with a reception by the Lord Mayor at the Mansion House. The last day will be spent at Oxford. Delegates from the Society will attend the International Congress of Applied Chemistry which is to open in Paris on the 23rd of July, under the presidency of Professor Moissan—M. Berthelot being the Honorary President.

Tar Distillation in France.—A recent number of the "Génie Civil" contained some particulars on the above subject. The tar distillers in the Paris district are the Paris Gas Company, who carry on this branch of their operations at their station at La Villette; the Paris Asphalte Company, who have two works, one at Pantin and the other at Chalette, near Montargis; and MM. Lassailly et Bichebois, at Issy-les-Moulineaux. These works annually distil about 62,000 metric tons of tar. In addition to a production of 60 to 65 per cent. of pitch, 20 to 25 per cent. of heavy oils, and 2 per cent. of non-rectified light oils, about 5 kilogrammes of pure anthracene and 90 kilogrammes of naphthalene are obtained per 1000 kilogrammes (2205 lbs.) of tar treated. Thus the Paris district produces in round figures from 37,000 to 40,000 metric tons of tar, from 12,000 to 15,000 metric tons of heavy oils, and about 1200 metric tons of light oils. In the North of France there are the Lens Mines, where there is plant for distilling tar from the coke-ovens, as well as other works. The production in the North only amounts to from 9000 to 9750 metric tons of tar, from 3000 to 3750 metric tons of heavy oils, and about 300 metric tons of light oils. A great deal of the tar of the North is distilled in Belgium. Not a pound of tar is imported into France, but large quantities of benzol are, as this product has only to pay a small duty.

ACCOUNTS OF THE METROPOLITAN GAS COMPANIES FOR THE YEAR 1899.

—	Chartered.	Commercial.	South Metropolitan.	All the Companies.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Capital and borrowed money	27,120,015 0 0(a)	1,054,330 15 2	7,868,131 0 0(a)	36,042,476 15 2
Income—viz.:				
Sale of gas by meter	3,040,170 6 1	299,166 1 0	988,713 5 8	4,328,049 12 9
Public lighting, including lighting under contracts	148,428 15 10	20,110 15 8	62,255 8 10‡	230,795 0 4
Rental of meters and stoves	43,762 9 5*	14,202 15 1	63,837 19 7	121,803 4 1
Residual products	919,659 0 1	81,974 16 2	470,739 13 11	1,472,373 10 2
Miscellaneous, including old materials	16,999 16 11	777 12 10	7,771 19 0	25,549 8 9
Total income from all sources	4,169,020 8 4	416,232 0 9	1,593,318 7 0	6,178,570 16 1
Expenditure—viz.:				
Coal and oil, including carriage and dues	1,408,932 11 7	163,582 6 6	629,374 10 2	2,201,889 8 3
Purifying materials, including labour	69,864 7 7	13,835 3 10	31,275 11 2	114,975 2 7
Salaries and wages—manufacture	385,886 6 0	40,056 6 10	128,813 9 3	554,756 2 1
Wear and tear—manufacture	366,215 10 7	33,313 0 5	175,378 11 1	574,907 2 1
Rents, rates, and taxes	243,411 8 5	15,073 15 9	60,037 0 4	318,522 4 6
Salaries—management	22,660 0 1	2,458 13 8	4,800 0 5	29,918 14 2
Collectors' salaries and commission	40,751 0 5	3,978 4 8	17,099 1 1	61,828 6 2
Stationery, printing, and general charges	21,306 5 6	2,527 13 9	11,158 2 4	34,992 1 7
Directors and auditors	5,981 18 0	2,650 0 0	3,805 19 0	12,437 17 0
Salaries and wages, wear and tear—distribution	184,740 2 11	14,445 12 9	95,034 4 4§	294,220 0 0
Repair and renewal of meters and stoves, &c.	105,502 8 8	10,689 8 9	46,325 6 7	162,517 4 0
Law and parliamentary charges	4,829 8 7	482 6 4	1,153 14 4	6,465 9 3
Bad debts and extraordinary expenses	46,044 1 3†	4,009 4 11	35,881 8 9‖	85,934 14 11
Total expenditure on revenue account	2,906,125 9 7	307,101 18 2	1,240,136 18 10	4,453,364 6 7
Gross profit	1,262,894 18 9	109,130 2 7	353,181 8 2	1,725,206 9 6
Do. per cent. on capital and borrowed money	4 13 2	10 7 0	4 9 9	4 15 9
Do. do. gas-rental	39 12 2	34 3 7	33 12 1	37 16 10

(a) Converted. * Stoves only. † Including annuities, £25,125, and £4545 on workmen's compensation account. ‡ Including £23,542 for lighting, repairing, &c. § Including £9179 labour for gas-fittings. ‖ Including £8946 paid to pension, &c., funds, and £23,028 paid under profit-sharing scheme.

TABLE *showing the Capital, Income, Expenditure, and Profit, per Ton of Coal Carbonized (including Oil), in* 1899.

—	Chartered.	Commercial.	South Metropolitan.	All the Companies.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Capital and borrowed money	12 11 7·37	4 8 10·08	7 7 10·07	10 8 5·90
Income—viz.:				
Total gas-rental	1 9 7·00	1 6 10·83	19 8·97	1 6 4·45
Rental of meters and stoves	4·87	1 2·36	1 2·39	8·46
Residual products	8 6·39	6 10·89	8 10·14	8 6·21
Miscellaneous, including old materials	1·89	0·79	1·75	1·77
Total income from all sources	1 18 8·15	1 15 0·87	1 9 11·25	1 15 8·89
Expenditure—viz.:				
Coal and oil, including carriage and dues	13 0·86	13 9·40	11 9·91	12 8·84
Purifying materials, including labour	7·78	1 1·99	7·05	7·98
Salaries and wages—manufacture	3 6·96	3 4·50	2 5·04	3 2·51
Wear and tear—manufacture	3 4·77	2 9·68	3 3·54	3 3·91
Rents, rates, and taxes	2 3·10	1 3·24	1 1·54	1 10·11
Salaries—management	2·52	2·49	1·08	2·08
Collectors' salaries and commission	4·54	4·02	3·86	4·29
Stationery, printing, and general charges	2·37	2·56	2·52	2·43
Directors and auditors	0·67	2·68	0·86	0·86
Salaries and wages, wear and tear—distribution	1 8·57	1 2·61	1 9·43	1 8·42
Repair and renewal of meters and stoves, &c.	11·74	10·81	10·44	11·28
Law and parliamentary charges	0·54	0·49	0·26	0·45
Bad debts and extraordinary expenses	5·13	4·05	8·09	5·97
Total expenditure on revenue account	1 6 11·55	1 5 10·52	1 3 3·62	1 5 9·13
Gross profit	11 8·60	9 2·35	6 7·63	9 11·76

TABLE *showing the Increase or Decrease in each Item during* 1899 *compared with* 1898.

—	Chartered.		Commercial.		South Metropolitan.		All the Companies.	
	Inc.	Dec.	Inc.	Dec.	Inc.	Dec.	Inc.	Dec.
	£	£	£	£	£	£	£	£
Capital and borrowed money	14,014,215	..	10,313	..	119,645	..	14,144,173	..
Income—viz.:								
Sale of gas by meter	133,100	..	15,423	..	21,177	..	169,700	..
Public lighting, including lighting under contracts	..	4,626	..	172	..	2,801	..	7,599
Rental of meters and stoves	7,484	..	1,865	..	1,587	..	10,937	..
Residual products	193,341	..	9,688	..	119,879	..	322,908	..
Miscellaneous, including old materials	1,316	..	..	430	854	..	1,740	..
Total income from all sources	330,615	..	26,374	..	140,696	..	497,686	..
Expenditure—viz.:								
Coal and oil, including carriage and dues	164,104	..	17,275	..	112,084	..	293,463	..
Purifying materials, including labour	..	1,999	3,743	..	4,966	..	6,710	..
Salaries and wages—manufacture	747	..	496	..	7,147	..	8,391	..
Wear and tear—manufacture	60,019	..	..	3,315	11,794	..	68,497	..
Rents, rates, and taxes	12,633	..	837	..	1,451	..	14,921	..
Salaries—management	1,626	..	201	..	292	..	2,119	..
Collectors' salaries and commission	1,516	..	263	..	403	..	2,182	..
Stationery, printing, and general charges	95	..	347	..	1,244	..	1,686	..
Directors and auditors	82	..	..	..	105	..	187	..
Salaries and wages, wear and tear—distribution	..	6,333	..	151	17,828	..	11,343	..
Repair and renewal of meters and stoves, &c.	857	..	1,318	..	7,104	..	9,279	..
Law and parliamentary charges	..	845	206	..	753	..	115	..
Bad debts and extraordinary expenses	4,230	..	2,445	..	2,537	..	9,212	..
Total expenditure on revenue account	236,732	..	23,665	..	167,708	..	428,105	..
Gross profit	93,883	..	2,709	..	..	27,012	69,581	..
Do. per cent. on capital and borrowed money	..	£4 5s. 3d.	£0 3s. 2d.	..	..	£0 8s. 5d.	..	£2 15s. 6d.
Do. do. gas-rental	£1 8s. 1d.	..	..	£0 16s. 5d.	..	3 4 4	£0 3s. 8d.	..

PERSONAL.

Mr. James Gemmell, late of Dreghorn, has been appointed Manager of the Melrose Gas Company, in succession to Mr. W. Smith, resigned.

Mr. John Gibb, of Lanark, has been appointed Manager of the Kirkintilloch Corporation gas undertaking, in succession to Mr. D. Jeffrey, resigned.

Mr. John Aird, M.P. for North Paddington, replying to a deputation last Wednesday, signified his willingness to be nominated as first Mayor of Paddington.

The position of Referee for ascertaining the rainfall in the Derwent Valley for compensation purposes, vacant by the death of Mr. G. J. Symons, has been conferred upon Dr. Barwise, Medical Officer of Health for Derbyshire.

The Directors of the Canterbury Gas and Water Company have appointed Mr. Harry C. Page, of Leigh (Lancs.), Manager of the gas-works, in succession to Mr. T. May, whose resignation was announced in the "Journal" a few weeks ago.

A report recently reached us to the effect that Mr. Charles Taylor, the Engineer of the Derby Gas Company, and Mr. Richard Fisher, the Secretary, will retire at the close of the present quarter. This rumour has in part been confirmed by the announcement which appears in another page of the "Journal" of the desire on the part of the Directors to receive applications or the position to be vacated by Mr. Taylor.

At the last meeting of the Directors of the Formby Gas Company, Mr. John Howgate Buckley was unanimously appointed Engineer and Manager, in succession to his father, whose death was recently recorded in the "Journal." Mr. Buckley has been for fourteen years in the Company's service, and for some time filled the position of Assistant-Manager. At the same meeting, a vote of condolence was passed with the widow and family of the late Manager.

NOTES.

The Durability of Paints and Varnishes.

Professor A. H. Sabin has published the results of an extensive series of experiments on protective paints for ironwork, carried out for the United States Navy Department. The preparation of the test plates was of an elaborate character; a vast variety of pigments and varnishes were used; and the tests, carried out under natural conditions of exposure to air and water, were very severe. All the plates had three coats of paint, well dried between the coats. In most cases deterioration appeared to begin on the surface, which becomes rough. Then little blisters appear, which are caused by the separation of the last coat from those beneath. Finally, the undercoat blisters, in which case it is found almost invariably that rust has formed under the blister. If, however, the paint coating is porous, which seems to be the case with ordinary oil paints, the water reaches the metal and causes rust. This throws off the paint film, and the corrosion rapidly spreads. Red lead in oil differs from both paints and varnishes in being a cement. Ordinary oil paints perished wholly, irrespective of the nature of the pigment or filling employed. Varnishes appeared to stand best, especially the more elastic preparations. Shellac varnish is strongly recommended for metal that is to be immersed in fresh water; but it does not stand ammonia. The baked enamel known as "Sabine Pipe Coating" lasted remarkably well. A patented preparation called "Durable Metal Coating" is stated to have come out best of all.

The Strength of Frozen Concrete.

The question of the action of frost upon portland cement concrete work is a highly important one for constructors. As the "Engineering Record" remarks, it is a commonly accepted opinion among engineers that the construction of concrete masonry, especially above ground during freezing weather, is bad practice, and should be avoided if possible. This would limit concrete work over a great part of North America to the months of April to October inclusive; but necessity has dictated the carrying on of many such works during the winter months. There has still, however, been a great uncertainty as to the effect of freezing upon unset concrete; and Mr. W. A. Rogers, Assistant-Engineer to the Chicago, Milwaukee, and St. Paul Railway, set himself to ascertain the truth of this matter by direct experiment. The details of the tests need not be given; suffice it to say that comparative trials were made with protected and exposed concrete blocks during an exceptionally cold winter. The results went to show that freezing before setting does not seem to injure portland cement concrete, even if, after having frozen hard, the concrete is exposed to alternate freezing and thawing weather. Exposing green portland cement concrete to a freezing temperature seems to affect its rate of hardening, making it slower; but eventually the concrete will be just as good as if it had not been exposed to the cold. The use of salt water seems to counteract the effect of cold in delaying the hardening. A strong example in point was that of an anchor-block for a 100 ton shear-leg crane, which was made during a hard frost. A double-handful of salt was added to every pail of water used in gauging the concrete; and after six months the concrete was found to be perfectly sound and hard.

The Use of Conveyors in Excavating.

An ingenious use of the belt conveyor is reported in the "Engineering Record" in connection with the excavation of the site of the new 120,000-horse power supply station of the New York Gas, Electric Light, Heat, and Power Company. The whole area of the site, which is on the riverside, is being dug out to a maximum depth of 19 feet. It is chiefly made-ground; there being 25,000 cubic yards of earth and 9000 yards of rock to remove. Work was begun by digging a trench 7 feet wide perpendicularly to the river bank, where the barges lay, and extending three-fourths of the way across the site. In this trench was placed a belt conveyor which delivered the spoil thrown upon it to the tips. The main belt runs at a speed of 350 feet per minute, and has an estimated carrying power of 300 cubic yards an hour. It is spanned by three wooden bridges, which carry the spoil to the belt, and drop it through hoppers. All the spoil found on the site is transported in this way, excepting only big blocks of masonry removed from old foundations. The loose stuff is simply scraped up by horse scrapers which go round and round, finally dropping their load into the hoppers. A force of about 75 men, with two ploughs and twelve wheel scrapers, removed about 1200 cubic yards of rubbish in 9½ hours, all of which was easily dealt with by the conveyor at the cost of the boiler fuel and one man. When the excavation is finished, the same conveyor will be used to carry the concrete from the mixers to the footings of the walls and machines. The whole outfit is rigged with timber framework, and the conveyor is driven by a 9 inch by 12 inch engine.

Treating Coal for Coking.

Herr Schild, of Bochum, has continued the study of coking and non-coking coals, with the object of ascertaining the reason for this difference. He now states that coals which form a cake, as well as coke, can be deprived of most of the former quality by long continued washing, or, better still, boiling, in a large quantity of water containing chloride of magnesium. After enough of this treatment, the coals will still coke, but scarcely cake at all. If the wash-water is evaporated, a residuum is obtained which, when added in dust form to the badly-coking coal, almost completely restores this property. The result may be made to improve upon the original performance, if what is washed out of a large quantity of coal is added to a smaller quantity. Nothing is stated respecting the character or composition of this extract of caking oil; but it is said that a substance possessing the same property is lignin, which is a waste residual of the process of preparing sulphite cellulose. Whether a coal can be made to coke well by adding this lye can only be determined by trial. Many considerations of time, quantity of materials, degree of dampness, &c., go to the success of such experiments. Some poor coals will not coke simply because they do not yield gas enough to burn with the oxygen of the air occurring in the mass of the charger; others because they are too rich, and the oxygen burns off the surfaces of the particles into ash, thus preventing agglomeration. Herr Schild is careful to state that nothing but tests on a working scale will show the capacity of a coal (treated for the purpose or not) to make good coke. The subject is of national importance, as much German coal will not coke by itself; and to blend coals for the purpose is not often commercially practicable.

The German Benzine Association (an organization which has been formed for the purpose of fighting certain Continental refiners), it is reported, now commands an annual production of 35,000,000 kilos. of material.

Labour-Saving Methods in Gas-Works.—In the number of the "Engineering Times" for the current month, Mr. C. E. Brackenbury commences a series of illustrated articles on "Modern Methods of Saving Labour in Gas-Works." In the editorial notice of the articles (which is accompanied by a portrait of Murdoch, reproduced from an old steel engraving), it is stated that Mr. Brackenbury will also deal with the manufacture of water gas.

The Effect of Low Temperatures on Coal Gas.—Towards the close of his interesting address on "The Solidification of Hydrogen," at the Royal Institution on the 6th inst., Professor Dewar showed the effect of low temperatures upon coal gas. He demonstrated by experiment the difference observable in the luminosity of gas when burnt under four conditions—as it came from the mains, and after it had passed over solid carbonic acid, liquid air, and liquid hydrogen. In the last case, the luminosity was practically *nil*.

Steel Production in the United States.—The last few years have witnessed a great increase in the production of Bessemer steel in the United States. In 1896, the tonnage of ingots was 3,919,906, and of rails 1,102,892; whereas for last year the figures were 7,586,354 and 2,240,767 respectively. The "Financial News" thinks that these are the sort of figures to bear in mind when British manufacturers get behind in their orders, and let other orders pass because they are full of work. American manufacturers, our contemporary points out, extend their production in like circumstances.

COMMUNICATED ARTICLE.

THE FUTURE OF WATER GAS IN FRANCE.

By Just Alix, Chemist to the Lyons Gas Company.

The facility with which the public are now able to provide themselves with an ample supply of light at a cheap rate, owing to the competition set up between the various systems of illumination, has produced in the gas industry a kind of revolution—a perfectly peaceful one, it is true—out of which, with a certain amount of effort, it will no doubt emerge triumphant, and then become more prosperous and more flourishing than before. The economical explanation of this state of things is a very simple one. It is to be found in a similar set of circumstances to those which have presented themselves at various epochs sufficiently near our own times for our recollection of them to be very clear. There is occurring at the present day, in connection with the gas industry, just what happened to the colouring matter industry fifty years ago, when artificial materials made their appearance; and also to tanning, upon the introduction of more rapid methods of working than those previously in use. Why has the turn of the gas industry to be affected been so long delayed? Because the conditions under which illuminating gas is produced have protected it from the disturbing effects which other industries experience from free competition and the introduction of new and more economical processes.

The future which has been opened before us by existing circumstances is not a particularly bright one. It will be a time of increased work and keener competition; but will there be any insurmountable difficulty? When one is well armed, there is more certainty of the successful issue of a struggle; and do not we gas people possess in the irreproachable past a solid pedestal for the future? Up to within the past few years, the gas industry has been supported by the distillation—more or less perfect, but always sufficient for its requirements—of coal. By this process we obtain from (say) 100 kilos. of carbon about 30 cubic metres, or 1000 cubic feet, of utilizable gas, containing from 4 to 5 per cent. of light-giving hydrocarbons and 70 per cent. by weight of almost pure carbon, as shown by the following figures, obtained with a gas of average quality:—

			Per Cent.
Coke—			
70 per cent., less 8 per cent. of ash = pure carbon			62·00
Gas—			
Illum. hydrocarbons (C_2H_5), containing of carbon		1·608 kilos.	
Methane (CH_4)	,, ,,	6·435 ,,	
Carbon monoxide (CO)	,, ,,	1·284 ,,	
Carbon dioxide (CO_2)	,, ,,	0·153 ,,	
			9·48
By difference (tar and volatile bodies)			28·52
			100·00

We have therefore in the coke 62 per cent. of carbon; in the gas, 9·48 per cent.; and in the tar and volatile bodies, 28·52 per cent. These proportions may perhaps be more easily appreciated when shown diagrammatically, as in fig. 1, in which the dark shading represents the carbon in the gas, the light shading on the left that in the coke, and the right-hand shading that in the tar.

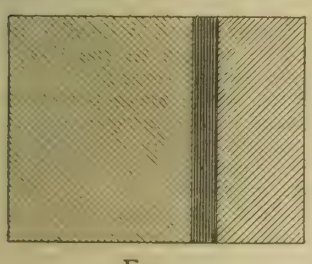


Fig. 1.

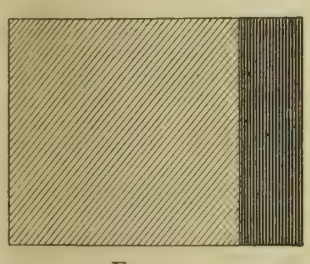


Fig. 2.

From the calorific point of view, the comparison is equally striking between the caloric utilized in the form of gas and that which remains in the coke and tar. A sample of Commentry coal had the following percentage composition: C, 82·72; H, 5·29; O and N, 11·75; and ash, 0·24; and it had also an average calorific power of 7200 heat-units—its heat of combustion being 5100 calories per cubic metre. Now, 1 kilo. of coal yields 300 litres (10·6 cubic feet) of gas possessing a heating value of 1530 calories. Consequently, 5670 calories (7200—1530) remain in the coke and tar. We have therefore 21·25 per cent. of caloric in the gas, and 78·75 per cent. in the coke and tar. Represented diagrammatically, the proportions stand as fig. 2; the dark shading showing the caloric in the form of gas.

The foregoing figures show that we coal-gas makers obtain with our methods of distillation a more than mediocre yield of gasified carbon, especially in an epoch in which the progress of science permits of the easiest utilization of what we must call our "bye-products"—coke, tar, &c.—under the penalty of losing our qualification as gas men.

It is this that has prompted those who have been anxious in regard to the future of the gas industry to seek in a domain already known to them—that of mechanics—means of improving their methods of operation; hence the appearance of regenerative furnaces, inclined retorts, and retort charging and drawing machinery. At the same time, considerable attention has been given to appliances for effecting economy in handling the raw material, with the result that conveyors and elevators have been introduced. All these innovations—interesting, no doubt, in themselves, but often very costly—are signs of the fillip which has been given to the progress of the gas industry, and of the turn of mind which has directed this progress into the purely mechanical channel; because those who have guided it had been trained on these lines, and consequently have followed their tastes and aptitudes.

Notwithstanding the existence of these beautiful mechanical inventions, which have converted certain works into veritable models of precision, the vital question has again presented itself, and has turned the current of thought into a channel perhaps more scientific, but at the same time assuredly more chemical—namely, the more complete utilization of the raw material. Moreover, here is one fact which has affected the future of the gas industry in all countries, and that is the increasing poverty of coals in those constituents which make them valuable for gas-making purposes—viz., the light-giving hydrocarbons. As the seams of coal are worked into, and the mines increase in depth, the quantity of hydrocarbons found in the same class of coal decreases. This phenomenon, which has become very noticeable in connection with the smaller coal measures, threatens to attack the more important ones. Its explanation is to be found in circumstances which are of daily occurrence near us. I refer to the transformation of vegetable matter into peat, and of peat into lignite. Unfortunately, this change takes place also in the deep layers, under the influence of great pressure, in the case of coal, which tends to become of an anthracitic character, and to lose its small percentage of volatile hydrocarbonaceous products, which, as already stated, constitute its special value for gas makers.

But for every ill there is a remedy; and the gas industry has received very strong support from the invention of Dr. Auer von Welsbach, which, by the utilization of the carbon, employs to the greatest possible extent the energy stored up in the coal, and does so, moreover, in its true form—the calorific. In the struggle which the gas companies have to sustain with their numerous rivals—some of which, such as arc and incandescent electric lighting, are already powerful, while others, of more recent date, like petroleum, alcohol, benzol, and acetylene, are making progress as illuminants in circumstances favouring their economical application—Dr. Auer's invention has been a revelation which has resulted in a revolution, inasmuch as all the competitors previously cited have endeavoured to apply its principle to themselves. This has led, in the domain of electricity, to the production of the Nernst lamp; in that of gasified liquids, to the introduction of the Kitson system; and in that of acetylene, to the adaptation of incandescent mantles to lighting by means of this gas.

In face of such a condition of things, what remains for us to do? To enable us to carry on the struggle, there is only one weapon available, and that is water gas. It is by the introduction of the manufacture of this gas that we shall be able to utilize the whole of the caloric in the coal; and it is this fact which explains the universal success of the system at the commencement of the economic crisis in the gas industry. To those who know us, there is nothing surprising in the circumstance that we in France have been the last, or very nearly the last, to recognize this. It is one of the consequences of our temperament. And yet as long ago as the 12th of June, 1878, our distinguished chemist Würtz pointed out that the use of water gas had never been prohibited in France, and that if the process which had been originally devised for its production had been abandoned, or only adopted to a limited extent, this was principally due to technical and economical conditions which had up to that time been unfavourable to its production. Between 1834 and 1865, the towns of Dijon, Strasburg, and Narbonne, and the Royal Printing Office in Paris were successively lighted by water gas. Then the system was dropped, and the whole thing fell into oblivion. In the interval named, coal was to be had in abundance; and modern notions of introducing to an ever-increasing extent the physical and chemical sciences into industry in general had scarcely developed. But to-day we have in our hands a weapon the use of which promises us a brilliant future—viz., the more effective utilization of the caloric in our coal as the result of its more complete gasification.

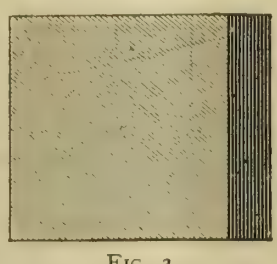


Fig. 3.

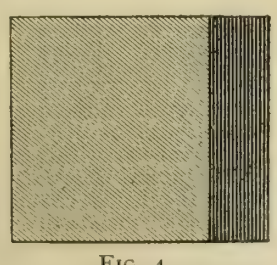


Fig. 4.

In this connection, let us see what figures have to tell us. We know that 100 kilos. of coal yield about 1000 cubic feet of gas, by the customary process of distillation. But by the addition to

our ordinary plant of apparatus for the production of water gas, we should get with our 100 kilos. of coal the above-named quantity of illuminating gas and 70 kilos. of coke, which, when gasified in accordance with the most recent processes, would yield 5000 cubic feet of gas; making a total of 6000 cubic feet of gas per 100 kilos. of coal. The effect is shown diagrammatically in fig. 3, in which the dark shading represents the product of this bulk of coal without water gas, and the light shading the result of its addition.

From the point of view of the quantity of caloric contained in the gas produced in the two cases, the comparison is equally interesting. In fact, in the first case we have—

	Calories.
Coal gas alone	149,350
Coal and water gas (149,350 + 395,400*)	542,750

These results are shown diagrammatically in fig. 4. The combustion temperatures of the two gases are—

Coal gas	2700° C.* = 4892° F.
Water gas	2859° C.* = 5178° F.

The preceding considerations therefore show us that, under favourable conditions, a gas-works in which coal is simply carbonized could produce six times as much gas by more completely utilizing the carbon which is thus so imperfectly dealt with. This enormous difference is well calculated to appeal to the most incredulous; and the eloquence of similar results pleads sufficiently in favour of the new cause.

From the practical point of view, when the question of the selection of a system has to be considered, the choice is not a very easy one; for, though the manufacture of water gas is in theory a simple process, its applications are multitudinous. The following table will give an idea of the results obtainable with a particular process and apparatus:—

Analyses of Water Gas.

Name of Gas.	CO_2.	CO.	H.	CH_4.	N.	O.
Dowson	6·00	23·00	17·00	2·00	52·00	..
Tessie du Motay (New York)	0·21	26·18	27·29	25·43	4·45	0·14
,, ,, ,,	3·10	25·20	28·30	26·60	1·20	..
Granger and Collins	0·14	23·58	35·88	20·55	3·85	0·01
,, ,,	0·30	28·26	37·20	18·88	2·64	0·06
White	..	14·86	47·39	..	27·20	..
Leprince	0·30	6·30	25·25	..	58·41	..
Anthracite	2·05	35·38	52·76	4·11	4·43	0·77
New York	0·10	29·40	38·05	11·85	3·71	0·10
Lowe	..	29·20	22·60	31·90	2·30	0·80
,,	3·80	25·70	31·80	20·80	4·20	..
,,	3·30	18·30	28·10	21·70	3·50	..
,,	0·30	28·98	27·09	25·82	3·88	0·40
Lewes	..	15·15	40·77	29·20	0·54	0·13
Witkowitz	1·00	46·00	48·00	0·50	4·50	..
,,	3·60	40·40	51·00	0·50	4·50	..
Essen	3·30	44·00	48·60	0·40	3·70	..
,,	4·00	41·00	50·00	..	5·00	..
Strache	4·00	40·00	50·00	0·30	5·00	0·70
Dellwik	3·60	40·40	51·00	0·50	4·50	..
,,	3·60	40·40	51·00	0·50	4·50	..
,,	5·10	40·10	48·80	0·40	5·50	0·10
,, $CO_2 + H_2S$	5·20	40·70	47·80	0·70	5·60	..
,,	5·20	40·40	48·30	0·50	5·50	0·10

In the face of such divergent results as those here shown, one is probably embarrassed in making a selection. But, as a matter of fact, there are but few complications in the several systems named. All water-gas processes are really based upon only two principles: (1) The production of "blower" gas rich in carbonic oxide; (2) the production of gas rich in carbonic acid. In the first case, there is formed by the "blow" generator gas, which is afterwards burnt, with the addition of air, in recuperative chambers independent of the generator. In the appliances working on this system, we have, according to Dr. Bunte, the production of gas of the following composition at the temperatures specified:—

Composition of Gas.

Temperature.	H.	CO.	CO_2.	Percentage of Vapour.	
				Decomposed.	Intact.
674° C. (1245° F.)	65·2	4·9	29·8	8·8	91·2
758° C. (1396° F.)	65·2	7·8	27·0	25·3	74·7
1125° C. (2057° F.)	50·9	48·5	0·6	99·4	0·6

In good working, the quantity of carbonic acid cannot exceed 8 per cent. without the temperature falling too much to allow of the conversion of this gas into carbonic oxide being carried out with profit. The latter gas, produced by the "blow," is burnt in the fixing chamber, where the heat of combustion serves to so dissociate the petroleum, or any other enricher employed, that the resulting gas resembles in its composition that obtained by the distillation of coal, with the difference that the methane is replaced by a higher percentage of carbonic oxide, as shown in the following table, which has been prepared by Mr. E. Earnshaw, and published in a recent number of the "Journal of the Franklin Institute."

Constituent.	Coal Gas.	Water Gas.
	Per Cent.	Per Cent.
Benzene	0·50	0·60
Heavy hydrocarbons	4·25	12·80
Carbonic oxide	8·04	30·70
Hydrogen	47·04	32·40
Methane	36·02	13·90
Carburets of a paraffin nature	..	2·40
Carbonic acid	1·60	2·70
Oxygen	0·39	0·70
Nitrogen	2·16	3·8
	100·00	100·00

(*To be continued.*)

* According to Naumann.

TECHNICAL RECORD.

THE MEETING OF THE INSTITUTION OF GAS ENGINEERS.

Programme of the Proceedings.

We have received from the Secretary of the Institution (Mr. Thomas Cole) an advance copy of the programme of the forthcoming general meeting, which, as announced in the "Journal" for Feb. 6, will be opened at the Institution of Civil Engineers on the 1st prox., the President being Mr. J. W. Helps, M.Inst.C.E., of Croydon.

The proceedings on the first day will, as usual, commence with the presentation of the report and accounts, the election of members, the reception of the report of the Scrutineers, and the delivery of the Inaugural Address. A discussion will then take place on the subject of the suggested amalgamation of the Institution with the Gas Institute; and this will be followed by the reading of papers. Of these there are six: "The Adulteration of Coal Gas by Enrichment," by Mr. G. Livesey. "On the Calorific Power of Illuminating Gas," by Dr. H. G. Colman. "Inclined Retorts," by Mr. C. C. Carpenter. "Naphthalene in Coal Gas: Its Detection and Extraction," by Mr. Wilfred Irwin. "Notes on the Carbonization of Cannel and Shales for Gas-Making Purposes," by Mr. S. Glover. "Some Examples of Tank Construction," by Mr. Fletcher W. Stevenson. "An Experiment with a Concrete and Expanded Metal Structure," by Mr. A. Baker. In addition to the papers, there will be a lecture, on the morning of the second day of the meeting, by Professor Vivian B. Lewes, F.I.C., F.C.S., on "Water Gas and its Recent Continental Developments." The annual dinner will take place at the Café Royal, Regent Street, on the evening of the first day; and the third day will be devoted to a visit to the Royal Arsenal, Woolwich, where the following departments will be inspected (some "by special permission"): The main factory, the model-room, the bullet plant and shell foundry, the No. 1 small arm cartridge factory, the No. 1 quick-firing cartridge factory, the north boring-mill (with 40-ton hammer), the south boring-mill, the wheel factory, and the main machine-shop, &c. The party will lunch at the Royal Mortar Hotel, Woolwich, and in the afternoon will be conveyed in brakes to the Crystal Palace, where they will dine together in the evening.

The annual report of the Council, which accompanies the programme, testifies to a continuance of the prosperity of the Institution. Regret is expressed at the loss by death of Mr. Frank Livesey, Mr. G. Ernest Stevenson, and Mr. W. H. H. Broadberry—three of the original members, who took deep interest in the welfare of the Institution. Referring to the past year's proceedings, the Council remark that a prominent feature was undoubtedly the visit to Berlin and Copenhagen in September, which was greatly appreciated by all who attended it. They acknowledge that its success was largely due to the heartiness of the welcome extended to the members by the Berlin Municipality, the Directors of the Imperial Continental Gas Association, and by the German Gas Association, and also to the generous reception accorded to them by the authorities in Copenhagen, and the Directors of the Danish Gas Company, coupled with the kindly care, attention, and forethought of the President—Mr. F. D. Marshall. The works visited were full of interest; and their description will form no inconsiderable addition to the volume of Transactions for the year. On the subject of the suggested amalgamation, referred to above, the Council say: "In consequence of frequently expressed wishes that the advisability of amalgamating the two societies representing the gas industry should be considered, the Council were called together, and, after careful discussion, the opinion was unanimously expressed that such a course would be desirable. The Council of the Gas Institute having also arrived at the same conclusion, a Joint Committee was appointed, which, after holding several meetings, has drawn up a revised set of rules, to be now submitted to the members. Your Council propose, therefore, that the main principles shall be discussed at this meeting, and, in the event of the general feeling being favourable, that the matter should be adjourned to a special meeting to be held about the same time as that of the Gas Institute in June next,

when a resolution to dissolve would be submitted." An invitation having been received from the Société Technique du Gaz en France to take part in an International Congress to be held in Paris in September next, the Council, in accepting it, have nominated two of their number as corresponding members.

WAVERLEY ASSOCIATION OF GAS MANAGERS.

Half-Yearly Meeting at Selkirk.

The Seventy-Eighth Half-Yearly Meeting of the Association was held at the Station Hotel, Selkirk, last Thursday. There was a good attendance. Mr. W. B. M'Lusky, of Selkirk, the President, occupied the chair, and delivered the following

Opening Address.

Welcome, men of Waverley, to the ancient and royal burgh of Selkirk, so long associated in our minds with the name of William Robson, the originator of these meetings. The programme of proceedings promises us a drive to-day by the classic Yarrow, over the battle-ground of Philiphaugh, thence through the richly wooded estate of Bowhill, returning by the Vale of Ettrick. Amid such scenes as these, our thoughts will rise above the common daily round, dispelling business cares for the time being. The hour is twelve; let us turn our attention to labour, which maketh pleasure sweet.

At the conclusion of the remarks which I had the honour of addressing to you at our autumn meeting, I indicated that I would open for discussion to-day the question of supplying and fixing consumers' burners free. I also undertook to lay before you some particulars in regard to the cooker and coin-meter business at Selkirk. While these are topics second only in importance to proper conditions of manufacture and distribution, I feel confident it will not be necessary to treat the subject at length in order to provoke a general discussion. I will endeavour, therefore, to conform to the recognized rule of spring meetings, and give only a short address.

Every gas manager knows the value of a good gas-burner; but the question is whether we apply this knowledge in every-day practice to the benefit of our consumers, in reducing their gas bills or improving their light, or both. We have all learned at some time in our experience the value of a pair of 4-inch pliers and a good burner, as a ready and effective means of concluding an argument and establishing a lasting friendship with a consumer. Consumers will not be bored with statements of laboratory results showing 30-candle power gas, while they probably consume 6½ cubic feet per burner per hour, with a total light of 30 candles and a lighting value of 23 candles per 5 cubic feet. This is a typical case of the consumer with the big gas bill, who affirms that his light is no better than that of his neighbour who, as likely as not, has an equal amount of light for an expenditure of 5 cubic feet per hour. When the gas bill is big, the consumer invariably resorts to a smaller burner, which, if it is of an inferior sort, results in a consumption of 4½ to 5 cubic feet per hour, with a total light equal to 20 to 22 candles—an infinitely worse state of matters; for now "the gas is bad," and it is dear to boot.

From exhaustive tests with various burners with 31-candle gas, I have found a No. 4 enamel regulator burner, passing 5 cubic feet per hour at 17-10ths pressure, giving a light of 22-candle power, while an equal amount of light was obtained from an approved stuffed burner consuming 3·7 cubic feet at 10-10ths pressure. The path of duty is therefore plain. We, as gas managers, know the value of good burners, and we are aware of the absolute waste of money which attends the use of those of an inferior kind, or the indiscriminate use of those which are probably perfectly suitable in one zone of our distributing system but altogether unsuitable in another. Shall we, then, leave the consumer at the mercy of the itinerant dealer, who sells at 6½d. per burner, with the result that the gas is wasted and the painter is to pay for a special spring cleaning? Or shall we see to it that every consumer is provided with some suitable burners at the gas company's expense, regardless of what anyone may say against giving anything for nothing? The practice of supplying burners free to all consumers was adopted at Selkirk in the winter of 1897-98. The work is distributed over the collector-surveyor, the fitter, and his apprentice. We do not, however, encroach upon the trade connection established between large consumers and the local plumbers and gas-fitters. We supply the trade with gross lots of the burners free, marked for each district of supply. In this way, the right burner is fixed in the right place; and perfect harmony exists between the fitting trade, the consumers, and the Gas Company. In fact, we find that the local fitters push our burners. To the credit of the people of Selkirk be it said that they never for a moment viewed our action in this matter with suspicion; on the contrary, they have encouraged the scheme from the start. Consequently, our effort to improve the lighting of their homes and places of business has succeeded beyond my most sanguine expectation. As a matter of fact, the fixing of burners free has popularized the use of gas; and gas lighting has received a fresh impetus.

Any reference to burners which leaves out of account the illuminating power of the gas, can hardly be regarded as complete. For a number of years, but particularly during the past week, there has been a decided expression of opinion in favour of a reduction of the standard of light north of the Tweed; and it is satisfactory to find that cannel-coal Scotland has still a few champions of high-grade gas left, although it may be open to question whether the advocates of the high-grade article or the manufacturers of it are the more numerous. The present agitation for a reduction in the illuminating power is due to two things—viz., the abnormal advance in the price of coal on the one hand, and the great demand for clean, hard coke on the other. From a consumer's point of view, however, it is inopportune; for while we find, on comparing prices of really first-class cannels and splint coals, a difference of 10s. per ton at the pit, and about 9d. per 1000 cubic feet of gas made (having regard to the relative yield of each), in favour of splint, yet when we take into account the yield of illuminating matter per ton in each case, cannel is cheaper, light for light, by about 18 per cent.—the cost per candle per 1000 cubic feet being 0·76d. for cannel, and 0·90d. for splint. In our selection of the raw materials of manufacture, and in the conversion of the same into gas, our guiding principle must ever be the production of an article which will give the consumer the maximum lighting efficiency for his money. It may be necessary at some time to increase the illuminating power and the price—thus reducing the consumption and keeping the gas bill at about the same figure. And probably, at some very far distant date, it may be advantageous to reduce both the standard of light and the price. But in either case, the gas undertaking which supervises the fittings of consumers, and fixes burners free, will be in a position to provide effective gas lighting at moderate cost.

A brief reference to this subject will serve to show the important place now occupied in our returns by gas sold for cooking and heating purposes. A class of consumers who formerly used an average of 50,000 cubic feet of gas each per annum, without a cooker, now consume 71,000 cubic feet each. The part of this increase due to the introduction of the cooker is 21,000 cubic feet, or at the rate of 42 per cent. A class of consumers who, before the introduction of cookers, used 7000 cubic feet per annum, now reach 15,000 cubic feet. The increase from the cooker is 8000 cubic feet per annum, or at the rate of 111 per cent. Another class of consumers who formerly used 6000 cubic feet per annum, now attain the respectable figure of 17,000 cubic feet per annum. Here the increase per cooker is 11,000 cubic feet, or at the rate of 183 per cent.

Coming now to coin-meters, I find that our second year will account for a consumption of 676,000 cubic feet, against 508,000 cubic feet for the first complete year; being 168,000 cubic feet more—an increase equal to 33 per cent. Of 80 coin-meters fixed, 20 (or exactly 25 per cent. of the total) have cookers attached; the balance have boiling rings. An analysis of the accounts shows that the 20 cooker installations consume, on an average, 18,900 cubic feet per annum; whereas those without cookers consume an average of 4966 cubic feet each. Coin-meters with cookers attached are, therefore, worth practically 14,000 cubic feet per annum more than ordinary coin-meter installations. In other words, the 20 cooker installations give a return for the year of 378,000 cubic feet, and the 60 ordinary installations a return of 298,000 cubic feet.

Discussion.

Mr. W. Blair (Helensburgh) said that gas managers attempted to supply gas of a certain illuminating power; but unless they could educate their consumers in the burners which were suitable for the burning of the gas, it was immaterial what quality gas they supplied. In supplying burners free, a gas manager was doing the one thing which was, he thought, most essential for the making of gas popular. He had always advocated, and been allowed, to give burners free—using his own discretion in the matter. His object was to sell gas; and his practice always had been to advise consumers how to extract the greatest amount of duty from the gas, whether it was for cooking, heating, lighting, or motive purposes. There was some talk going on about a reduction of the illuminating power of the gas which they in Scotland had prided themselves upon supplying for, he might say, generations. He was afraid that in many places the reduction had already taken place. If they could, by the introduction of suitable appliances—burners and other things—give the consumer as much light from a low illuminating power gas as he was in the habit of getting from high-grade gas, he did not see why they should not try to push the introduction of such burners and appliances.

Mr. A. Bell, sen., (Dalkeith) thought gas managers should see to the fittings as well as the burners. In many towns anything was supposed to be good enough in the way of fittings. If they were to reduce the illuminating power of the gas, would the fittings be sufficient to supply it? He was afraid a great deal of grumbling and complaint would follow. People would not go in for the refitting of their houses; they would simply complain of bad gas. But if they could get the houses refitted, it would be different. In England, the poorer class of houses had not been fitted for gas consumption hitherto, as they had been in Scotland for many years; and the English people were now fitting upon proper lines. The probability was that in Scotland they would have to refit. Another question was, Were their works capable of supplying the low-quality of gas? If they reduced the illuminating power, all their mains would have to be renewed; because, most assuredly, people would have to burn more gas to obtain the illumination they required. Their plant was not suited for this; and there would be a great upturn in the works,

which would mean a great deal, although it was not a thing which would be done just in a moment. The supply of burners, in his opinion, was a necessary thing. He thought they were quite entitled to show people how to burn gas. There were plenty of good burners in the market; and their cost was small. The subject of meter-unions was spoken of at the Informal Meeting of Managers the previous week. This was a point he was especially strong upon; because he was officially connected with it all through the movement. He saw it commented upon that they had not taken advantage of it. It was the members of the North British Association who had really passed from it. After the Committee of the Association had carried the matter through, the members appointed them further to try to take the English Associations with them. He, for one, was always against that; because he thought it would swamp the matter, and this had proved to be the case. He could never see, either, why the Board of Trade should be consulted in the matter. The measuring part of the instrument was under the control of the Board of Trade; but he thought it was superfluous for them to seek the sanction of the Board of Trade for the couplings. The gas-meter makers said: "Adopt your standards; and the moment you become unanimous upon them, we will adopt them." And they did so; and paid for them. The couplings were theirs now. Gas managers had never taken advantage of them; they had never gone forward as a body with the movement, after having adopted the standards, so that it lay entirely in the hands of gas managers individually. He thought they should again go into the matter, and re-open it. He was confident that if they did so, the English Associations would fall in.

Mr. G. Taylor (Jedburgh) did not see how a reduced illuminating power gas would suit where they had not the best fittings. He did not think it would be any better for consumers, because they would burn more gas. He thought the keeping up of the standard, so long as they could get the coal, was better.

Mr. W. Young (Penicuik) said that since he went to Penicuik —now about two years ago—he had introduced somewhere about 100 prepayment gas-meters. There were altogether about 150 in use; and he found that they were a grand affair. There were consumers whom it formerly took him about six months to collect 3s. 6d. from, and from whom he now got 10s. or 15s.; and they said: "Why did you not introduce these prepayment meters long before?" In his last collection, in March, he had about £55 in coppers—somewhere about 2½ cwt.

Mr. D. Macfie (Edinburgh) said the President, in his very interesting address, emphasized two points—the illuminating power of the gas, and the supply of burners free. There were, of course, differences of opinion upon the subject of high or low illuminating power gas; but the question was coming to the front, and must be faced. As a gas consumer, he preferred high illuminating power; and he thought that in Scotland they had been used to a quality of gas which consumers had appreciated. A question had been raised as to the illuminating power of the gas which was now being supplied throughout Scotland. It had been delicately touched upon by Mr. Blair; and he thought that everyone would like to know authoritatively what was the average quality supplied in Scotland. The time was when the illuminating power was 28 or 30 candles. He did not suppose that anyone would claim that it reached that average to-day; but he thought it would be a charitable assumption to suppose that 25 candles would be a very good average as to what was being supplied. But there was a statement made over two years ago, in print, by a well-known burner maker, to the effect that, owing to the assimilation of the lighting power of Scotch cannel gas to gases in general use throughout the world, there was no longer any necessity of specially numbering burners for use with Scotch gas. This was a challenge thrown down; and no one took it up. He (Mr. Macfie) had never heard any gas manager controvert the statement. The statement amounted to this—that Scotch gas was of from 16 to 20 candle power; and this, he thought, was a large assumption. He would like to endorse the view of the President that gas companies ought to supply burners suited to the gas they manufactured. He should say that in every case where a reduction of illuminating power was carried out, it should be made perfectly well known to the consumers, and all the burners in use should be changed at the gas company's expense. He did not think he ought to touch upon the question of meter-unions (it was getting rather hackneyed); but he might say, without breach of confidence, that the subject had not been lost sight of, and that it might be settled sooner than some supposed.

Mr. A. Bell said he never heard of a burner maker altering the numbering of his burners—he neither saw it in print nor heard of it. It was not the case that gas in Scotland had been reduced to from 16 to 20 candles.

Mr. L. Bell (Innerleithen) thought it would be against the interests of gas companies and consumers that they should reduce the illuminating power of their gas. If they reduced the gas from 25 to 20 candles, it would be a reduction of 20 per cent. in illuminating power; and the price would not be reduced more than 5d. per 1000 cubic feet. But to get the same amount of light from 20-candle gas as from 25-candle gas, the consumer would require to use from 30 to 40 per cent. more gas. In such a case, he thought, the company would be giving the consumer gas for 5d. less, and be pocketing, possibly, 1s. by the reduction. He had found that burners made for English gas would not do for Scotch gas at all; he got only a blue flame with them. In the case of incandescent burners, with high-quality gas, he had to shut up the orifice about half. It was the same with gas-stoves. Some makers sent out gas-cookers which were quite unsuited for Scotch gas. He had introduced slot meters, and he found that he had about 50 per cent. more gas consumed through them than he had without them.

Mr. J. M'Laren (Duns) had always endeavoured to supply consumers with burners free; and the companies he had served had always been very good in giving him every allowance in the matter. As to keeping up the illuminating power, they must know that Duns was a very old place, and the fittings were about as old. If they were to reduce the illuminating power of their gas, they would require to refit about one-half of the town, at their own expense. He thought it would be a mistake for them to do that.

Mr. A. C. Young (Kelso) said in Kelso they would require 1s. 0½d. per 1000 cubic feet added to the price of gas to cover the extra cost of coal. This was a very serious matter; and he did not see how a reduction of 5 candles in the illuminating power of the gas was to answer, to cover even that, because if they reduced the gas from 25 to 20 candles they should reduce the price from 4s. 2d. to about 2s. 6d. But he thought that a reduction of about 2 candles might easily be made, even with existing fittings, if they paid careful attention to complaints. As to the difference between Scotch and English burners, if they were burning 5 cubic feet of gas per hour, with a fair pressure and a given quality of gas, they might have 10 candles illuminating power. With double the gas they would not get 20 candles, but perhaps 40 candles; because, by using a small quantity of gas, there was a tremendous loss of illuminating power, by reason of the atmosphere absorbing the heat of the hydrogen which otherwise would be utilized in keeping up the hydrocarbons to a luminous point. They had, however, to consider the large number of incandescent burners used, and also of cookers, now fixed; and he was afraid that if they had to increase the price of the gas very much, it would frighten those who were using gas-cookers.

Mr. F. Carlow (Lasswade) thought that, if they reduced the illuminating power, they would require to reduce the price of gas also. If they could get the particulars of how much gas was used in gas engines, cookers, and fires, he thought it would help them to come to a decision as to what to do.

Mr. W. M'Giffin (Earlston) supposed that he would be the Manager of about the smallest gas-works present. His pipes had been in use for about 75 years; and he had recommended his Directors, in the circumstances, rather than reduce the illuminating power of the gas, to reduce the dividend a little, and try to give gas at the same price for a year or two. He supplied burners free; and since he began to do so, the consumption of gas had risen about 25 per cent. He had 16 gas-cookers in use; and his summer consumption had increased about 300,000 cubic feet. He was supposed to give 27-candle gas; and he tried to honestly supply it.

Mr. A. Russell (Glasgow) said that in towns where there were a large number of mills to supply, if the illuminating power of the gas were reduced (at least too quickly), the mill-owners might introduce electric light, and thereby the gas consumption would be reduced very much. This was a thing which gas managers should consider, especially in the Borders, where they gave a very high illuminating power. The subject of coke had not been mentioned. He found that it had been advanced all round—in some of the larger works to the extent of from 2s. 6d. to 3s. per ton, which would help to compensate for the advanced price of coal.

The President, in concluding the discussion—alluding to a suggestion that in many cases splint instead of cannel coal might be used in making a change from high to low candle power gas—said splint coal would give 18 to 20 per cent. less light than cannel; and therefore a question which would have to be adjusted with the consumer would be whether he was to pay (say) 3s. 9d. or 3s. 1½d. The durability would be reduced along with the illuminating power, whether the consumer changed his burner or not. The reduction in the light would be in a greater ratio than the reduction in the illuminating power. A manufacturer, in considering how he was to operate for the year, took into account what his gas bill was to be; and if he found, at the end of the year, that his gas bill was up 20 per cent., he would simply adopt the electric light, no matter whether it was to be dearer or not. In Selkirk, there were five mills lighted by electricity; and there was a very free expression among them in favour of gas lighting. In the whole circumstances, he was of opinion that the quality of Scotch gas should be maintained. They had not only the manufacturer, but they had the poor man, in Selkirk. They had 1700 consumers, which was the largest proportion in Great Britain of consumers to the population. There were working men who were consuming 6000 cubic feet of gas per annum; and if they increased these people's bills to 7000 or 8000 cubic feet, he thought they would not be doing a fair thing. The reason why they had so many consumers was that they had always maintained the illuminating power of the gas. He had to be very cautious in the use of slot-meters, because the people in Selkirk were very respectable. The average amount of arrears was only 0·04 per cent. Therefore the slot-meter had come to be considered as only to be introduced where there were bad payers. He had about 90 slot-

meters in use at one time; but now he had only 80. People were sending them back. With regard to gas-stoves and incandescent burners, he found that the calorific power of the gas increased with the illuminating power—not, perhaps, in the same ratio, but near enough to warrant them in maintaining a high standard of illuminating power gas for stoves.

Mr. A. Bell mentioned that there were in Peebles 900 consumers of gas and 600 gas-cookers in use, which was altogether an exceptional case.

Other Business.

Mr. M'Laren moved that Mr. W. M'Giffin, of Earlston, be elected President for next year.

Mr. Young seconded the motion, and it was agreed to.

The President proposed that Mr. A. C. Young, of Kelso, be re-elected Secretary.

Mr. M'Laren seconded the resolution, and it was cordially agreed to.

Mr. M'Laren presented Mr. M'Lusky with the President's Medal of the Association, which Mr. M'Lusky, in a sentence, returned thanks for.

This brought the meeting to a close.

The Excursion.

The members and friends dined together in the hotel—Mr. M'Giffin in the chair. After the dinner there was a drive to Philiphaugh, the residence of Mr. W. S. Steel—beautifully situated on the banks of the Yarrow. The weather broke down in the course of the outward journey, and the drive terminated under uncomfortable conditions. The company were entertained to tea in the mansion house, and were afterwards received by Mr. Steel in his Art Gallery. The music room, the museum, and the conservatory were visited, each of which contained treasures that were much admired. Before leaving the Art Gallery, Mr. Macfie, in the name of the Association, thanked Mr. Steel for his kindness and hospitality. On account of the unpropitious nature of the weather, the remaining portion of the drive, which included visits to the birthplace of Mungo Park, Newark Castle, and Bowhill (the latter one of the seats of the Duke of Buccleuch) was abandoned, and the party returned to Selkirk.

THE DETERIORATION OF LEATHER BOOKBINDINGS.

The Effects of Gas Combustion.

In the course of an interesting paper read by Mr. Douglas Cockerell, at a recent meeting of the Society of Arts, on "Leather for Bookbinding," he referred to the fact that the Council of the Society had decided to appoint a Committee to investigate the subject of the production and deterioration of this class of leather, and went on to deal with the question of the damage it sustains from various causes. He remarked that if the damage noticed in leather bindings were confined to isolated cases, or even to isolated libraries, it might be thought to be the result of some special circumstances or accident; but when it was found that a large proportion of the bindings in most libraries had perished, some common cause for the injury must be sought. Various theories had been advanced from time to time; and some of those generally accepted he briefly mentioned.

The author first considered the theories which assume the damage to have taken place after the books have been placed in the library—viz., that the injury is caused by damp, by excessive heat, or by fumes from the burning of coal gas. He said that damp, as far as he had been able to ascertain, was not nearly so injurious to leather as excessive dryness. In extreme cases, where books were kept in a confined, damp space where air could not freely circulate, the growth of mildew would be encouraged. Although this was undoubtedly injurious, it was not the bindings exposed to damp, but rather those exposed to excessive heat, that first showed serious damage. The soundest vegetable-tanned leather, when submitted in an oven, for even a short time, to a temperature exceeding 100° C., lost its flexibility and toughness. It appeared to be the case that long exposure to the lower, but still excessive, dry heat to which books are subject on the upper shelves of most libraries tended to the same result. On this account it was advisable to pay great attention to top ventilation in libraries; and where the source of heat was a system of pipes or hot air, to adopt means to prevent the air from becoming too dry. This heat theory would, he said, account for the damage, were it not that older bindings which had been exposed to the same conditions were often found comparatively uninjured side by side with those on which the leather was utterly rotten. It would therefore be necessary to look for the reason which had rendered these damaged bindings specially susceptible to the effects of heat.

From time to time, he said, chemists have been consulted, with the result that analysis showed that there was nearly always a quantity of free sulphuric acid present in the leathers which had perished. As sulphuric acid (becoming after a time sulphuric acid by absorption of oxygen from the air) is one of the substances given off when coal gas is burnt, the theory that the damage was caused by gas was arrived at. The following extract from the report of the conference of the Library Association, held at Birmingham in 1887, shows that the gas theory was not a new one at that time:—

> The time-worn theory of the effect of gas upon leather bindings was introduced by two or three speakers. Mr. J. C. Woodward announced that, on submitting some bindings to an analysis, he was surprised to find that they yielded sulphuric acid in the proportion of 12 per cent. (?) to the weight of the leather. Professor Tilden, of the Mason College of Science, said it was naturally the books on the upper and topmost shelves that suffered most. A film of moist exhalation from the fumes of gas settles slowly on the tops of the books, and, evaporating, leaves a deposit of sulphuric acid which gradually destroys both leather and paper. In order to secure the better preservation of books, and to nullify the ill-effects of gas, it is extremely desirable that more careful ventilation should be provided in libraries than is now commonly the case.

It is no wonder that this theory was eagerly accepted by everybody concerned, as it absolved them all from blame. When complaints were made to the bookbinder of the decay of the leather, he escaped all responsibility by blaming the gas; and the manufacturers did the same. It was nobody's fault—a sort of law of Nature, which is hard, but must be put up with. Librarians seemed to say: "We must have books, and we must have gas; and if the two do not go together, it is clearly not our fault." So nothing was done. Unfortunately for this comfortable theory, it was found that the early decay of binding, and the presence of sulphuric acid in the leather, were not peculiar to libraries in which gas was used. At a meeting of our Committee,* Mr. W. J. Leighton showed a half-bound book in dark green hard-grained morocco, bound in 1883, which had been kept on a shelf without much use, the leather of which had rotted utterly. This he stated could not be the effect of gas, as there was only electric light in the library. Mr. Cyril Davenport stated that bindings in the British Museum showed similar decay, and that there they had neither gas nor electric light.

That the fumes of burnt gas are likely to be in some degree injurious to leather is admitted; and it is an additional reason for paying attention to the proper ventilation of libraries. But the evidence quoted seems to show conclusively that the gas theory will not account for all the damage, nor for the presence of sulphuric acid in leather not exposed to gas fumes. In June of last year, I submitted to an eminent firm of leather manufacturers samples of all the various leathers I was using for bookbinding, and their report was: "We have carefully tested and analyzed the sample pieces of leather collected from your place . . . . with the result that all, with the exception of the African leather, contain free sulphuric acid." Dr. Gordon-Parker, the Director of the Leathersellers' Company's Tanning School at Bermondsey, was also kind enough to test samples of various leathers; and I find on the minutes of our Committee's first meeting that "Dr. Parker stated that he had tested samples of Levant morocco submitted to him, and that they had not stood the tests as sound leather should." The samples were in both cases cut from leather I was using in my workshop at the time—leather of the most expensive sort to be got in London. . . . . As it appears from this evidence that sulphuric acid is present in the leather before it is used to cover books, it will be obvious that it is to the process of manufacture that we must look for its introduction.

In the course of the discussion which followed the reading of the paper, Mr. H. B. Wheatley, the Assistant-Secretary of the Society, remarked that the depreciation of bookbinding leathers had been a burning question for many years. The first occasion, he believed, on which any investigation was made was at the Athenæum Club in the forties, when Professor Faraday went into the matter very thoroughly, with the result that all the lamps in the club were provided with special chimneys to carry off the products of combustion; the idea then being that the chief source of mischief was the gas-burners. Further investigation, however, showed that it was probably not so much the gas itself as the heat from the gas—because the books at the United Service Club, where no gas was then used, were in an even worse state than those at the Athenæum. Hitherto it had been generally supposed that the deterioration of bindings was due to heat or bad treatment, which no doubt had much to do with it; but these dangers might be guarded against by ventilation and care. Mr. Walter Reid pointed out that if the books on the upper shelves of a library were found in a worse condition than those on the lower shelves, it did not at all follow that the difference was due to the heat. Wherever gas was used, the upper shelves were affected more than any other part. The watery vapour condensed on the books, which were at a lower temperature, and absorbed sulphurous acid. This by further oxidation became converted into sulphuric acid, which was found in the paper of the books as well as in the binding. Mr. Cockerell, in reply, said his chief authorities for attributing the damage in leather to sulphuric acid were Dr. Parker and Professor Procter. It was of the utmost importance that the investigation, whenever undertaken, should be thorough. It would occupy a long time; but no superficial examination would be of any use. The fact that for many years the damage to leather bookbindings had been attributed almost entirely to the use of gas, showed how dangerous it was to jump to a conclusion on insufficient evidence. He did not for a moment contend that gas was not injurious; and, of course, ventilation should be attended to. But leather went to pieces in libraries where no gas was used.

* A Committee formed at a meeting held at the Central School of Arts and Crafts, Regent Street, to "encourage the production of sound and durable leather for bookbinding."—Ed. J.G.L.

A MODEL STREET-LAMP COLUMN: INCANDESCENT LIGHTING IN SOUTH LONDON.

We have often in these pages lamented the difficulty of obtaining a really well-designed lamp-column—one which combined, without over-elaboration, artistic merit with utility. That difficulty was also felt not so long since by the South Metropolitan Gas Company in connection with their contracts for lighting the leading thoroughfares of South London with No. 4 Kern burners fitted in improved lanterns. It was thought a pity—and very rightly so—to mount the new lanterns on the existing old columns; and therefore steps were taken to get a suitable one. In the first place, a well-known architect was invited to assist the Company. He was told exactly what was wanted; and in due course he submitted a design. It was the most unsuitable thing that it is possible to conceive for the purpose. On a larger scale, it might have answered admirably as a monument in one of our public squares; but as a lamp column, it was altogether out of the question. The services of another architect were requisitioned; and, although he entered thoroughly into the spirit of the thing, his idea of what constituted a fit and becoming lamp column was just as crude as that of his professional brother. His drawing followed very much on the same lines as the first one; and it depicted something which, brought into a corporeal state, would have done duty splendidly as a pedestal for a bust.



Outside aid failing, it was decided to see what could be done at home. Even the Chairman (Mr. George Livesey) turned his attention from matters of greater moment, and concentrated his thoughts for a time on this modest question of the design of a lamp column. Thinking over it from an engineer's point of view, it occurred to him that a lamp-post fashioned somewhat after the style of the Eddystone Lighthouse might meet general requirements and satisfy the most fastidious taste. The result proves that this was a happy thought. He set to work and designed the shaft of a column which is, as far as it is possible to adapt a column, on very much the same lines as the noted lighthouse—that is to say, as regards the curves, which is a distinct feature of the Eddystone. This so-called Eddystone shaft was reproduced on a small scale, a lamp was fitted to it, and then, in order to finish it off, it was placed on a base that harmonized in character with the rest of the design. Thus it comes about that engineering trained heads and hands have produced, without outside assistance, a column which has been generally approved by those responsible, from the Local Authority point of view, for the proper lighting of the roads. In other words, the Authorities have accepted the Company's design, and pronounced it a very good one. This judgment the accompanying photograph will enable most of our readers to endorse. The column is light in appearance, and graceful in form; and, with the improved lantern and incandescent burner, it will remove from those streets in which it is adopted the reproach which we have frequently cast on the hideous gas-lighting arrangements of our London streets. In this reformation of street lighting in South London, the South Metropolitan Company are treating the Authorities with the utmost liberality. They have agreed to give them, free of cost, as many of these columns as they require, and take back the old columns, with the proviso that when, from time to time, they may require to renew or increase the number of the old columns, the Company may be allowed to use the old stock.

Then with regard to the lanterns. They have been devised specially with the view of obviating shadows. A member of the Company's Board relates how, on one occasion when he was driving along the Embankment in a brougham, the horse prepared to jump, and did make a half jump, over a shadow thrown across the road by an ordinary lantern. To prevent occurrences of this kind, the new lantern has been made irregular in shape. The pane facing the road is very wide; it is, in fact, considerably more than one-third of the total circumference. The result is that the shadows thrown by the bars which support that pane very nearly, but not quite, coincide with the kerb-line; and therefore by the time the shadow gets into the part of the road that is used for traffic, it has almost vanished—there is not practically any shadow there.

At the present time, there are, in round figures, 14,000 incandescent street lamps in the Company's district—about 10,000 of them being No. 2 burners, 1800 No. 3, and the balance No. 4; and the number will continue to increase as the work of converting the lamps progresses. The whole of this change has been effected since the spring of last year, when the Company sent out their notification on the subject to the Vestries, which was referred to in our news columns at the time. The lamps are being fitted with Kern burners and Chalmers anti-vibrators. But the Company are really not pinned to any particular system; and if they can find anything better or more economical, they will adopt it. Of course, a great deal depends upon the production of a cheaper mantle in future, and whether it can be used with the Kern burners. However, if a cheaper and equally serviceable mantle were put on to the market, the Company would be quite prepared to discard all the Kern burners, in order to obtain the benefit of the less costly mantle; for the mantle is a continuous, and the most expensive, item in incandescent lighting.

A few words may profitably be added with respect to some special instances of interior incandescent lighting in the South London district. A fair number of public buildings have been fitted up by the Company with incandescent burners. The first, for which an annual charge is made including the cleaning and maintenance of the burners, has been the Camberwell Art Gallery. The large hall contains some good pictures; and the problem of lighting pictures is rather a difficult one. To obtain the best effect, the viewers should have the light screened from their eyes, and the pictures alone directly illuminated. This is the plan on which the Company carried out the work of lighting the hall; and the Curator describes it as being very successful. Since then the Company have fitted up the Camberwell Vestry Hall. This has a sort of double roof—a large glass screen forms a false roof, and above it is an ordinary glazed roof. The hall was formerly lighted by a large sun burner; but the Company, hearing the Vestry were contemplating an installation of electric light, decided to try the effect of improving the gas lighting. In consultation with the Surveyor, they determined upon placing above the glass screen (which is ground and figured) some 16 or 20 No. 4 Kern gas-burners, so that the whole of the light for the large Vestry hall passes through the screen. The result is all that could be desired. There is now a well-diffused, soft, and pleasant light throughout the whole hall; and there is no uncomfortable heating. On the contrary, the burners, from their situation, materially assist in the ventilation of the hall. They draw the vitiated air from below, utilize it, and pass it out through their own ventilating openings;

so that they really perform double service. There is rather a good sequel to this successful effort of the Company in combating the electric light. A short time since, the various Vestries in South London had a meeting in this hall to consider the question of opposing the Company's Bill in Parliament this session. Whatever the result of their conference on that particular subject may have been, in another direction it has had a beneficial effect so far as the Company are concerned. There was a oneness of admiration on the part of the delegates with the illumination of the hall; and it was conceded to be a remarkably good example of lighting. This gratifying piece of news the Company have heard from the Vestry Clerks as far separated as Battersea on the one side and Woolwich and Plumstead on the other. However destitute of all good principles and morality the Company may be in the eyes of the Vestries, they have demonstrated to them to the convincing point that they have one good quality—that they can, given the opportunity, illuminate a large establishment in a manner equal to, if not better than, any other system.

MR. ALLEN'S RESEARCHES ON THE VAPOUR PRESSURE OF NAPHTHALENE.

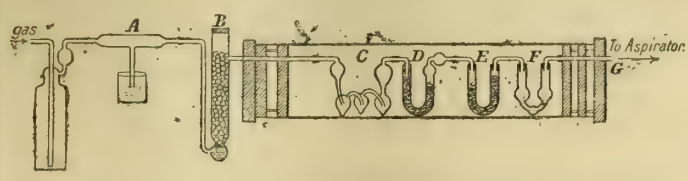
We gave in the "JOURNAL" for Sept. 5 last year a brief note concerning a paper on "The Maximum Pressure of Naphthalene Vapour," which Mr. R. W. Allen, M.A., had presented to the Chemical Society. We have since been able to publish the substance of a more recent paper by Mr. Allen (*ante*, p. 673), read before the Society of Chemical Industry, in which the author endeavoured to apply the results of his laboratory researches to the elucidation of the mysteries of naphthalene deposits in gas-mains. In view of the discussion which his latest paper has evoked in our "Correspondence" columns, readers will be glad to have further details of the parent paper, which is published opportunely in the April number of the "Journal of the Chemical Society." In the following abstract of the paper, we have dealt very briefly with those portions which were given at length in the subsequent paper (*ante*, p. 673). We have, also, for the sake of uniformity, stated quantities in grains in place of grammes, and temperatures on the Fahrenheit in place of the Centigrade scale.

A systematic study of the causes and means of prevention of naphthalene deposits in gas-mains demands an exact knowledge of the amount of naphthalene required to saturate a given volume of any gas at various temperatures, and consequently of the maximum pressure of naphthalene vapour at such temperatures. Naumann has determined the maximum vapour pressure of naphthalene to be: At 59° Fahr. = 2 mm., at 174° Fahr. = 9 mm., and at 212° Fahr. = 20·5 mm. These are the only measurements hitherto recorded; and they obviously only pretend to be approximations. The value given for 59° Fahr. is, on the face of it, improbable, since a substance having so high a vapour pressure would rapidly disappear on exposure, whereas naphthalene vanishes but slowly when freely exposed to the air. Ramsay and Young, in 1884, made some preliminary observations on the vapour pressure of naphthalene, at the time when they made measurements of the vapour pressures of benzene, acetic acid, and camphor; but they abandoned the research in so far as naphthalene was concerned—presumably because the method they employed was inapplicable in the case of that substance.

Owing to the fact that the vapour pressure of naphthalene at ordinary temperatures is very small, the usual system of measurement in the barometric vacuum appeared unsuitable. The evaporation method, which has been used in the case of liquids, seemed worth trial. It rests on the assumption that the vapour pressure of a volatile liquid in a space filled with an indifferent gas is very nearly equal to the vapour pressure in a vacuum. Regnault and Magnus have proved this assumption to be legitimate. A given volume of an indifferent gas at a definite temperature is passed over a weighed quantity of the volatile liquid (or naphthalene) of which the vapour pressure is to be measured; and the loss in weight of the liquid (or naphthalene) is estimated. This loss represents the weight—from which the volume may be calculated—of the vapour required to saturate the given volume of gas at the given temperature and pressure. Therefrom a simple calculation gives the value of the vapour pressure at that temperature. As the operation could be conducted slowly, and as the volume of gas to be employed was unlimited, the process seemed capable of a high degree of accuracy. It was therefore used in the first series of researches on naphthalene.

In the first place, pure naphthalene was prepared by digesting the commercial substance several times with sulphuric acid and caustic potash in turn, and washing with water after each treatment. The phenols and foreign hydrocarbons were thereby for the most part removed; and the purified sample was then thrice distilled with steam. Finally, it was drained, fused, powdered, and dried by exposure for several days in a bell jar over strong sulphuric acid. Its melting-point was then found to be 175·3° Fahr., and only a feeble pink colouration was produced by boiling it with strong sulphuric acid. It was therefore assumed to be pure.

Light U-tubes were then filled with the dried powder, and plugs of cotton wool were inserted, to prevent the powder being carried away mechanically. Dry corks, with glass tubulures, were cemented air-tight into the U-tubes. The water-bath and train of apparatus were substantially as shown. The bath had six air compartments running lengthwise through it, arranged in two tiers of three each; each compartment being 6 inches high and 4 inches wide. The water circulated freely round each compartment, and was well stirred by an agitator driven by water power. The temperature was controlled by a mercury thermostat, attached to a non-atmospheric burner. Holes were provided in the lid of the bath, for the rod of the agitator, the thermostat, and the thermometers which were graduated to tenths of a degree Centigrade. The temperature of the bath could be kept constant within 0·2° Fahr. for 24 hours. The gas passed through a wash-bottle to the safety-tube and pressure-gauge A; then



through the drying cylinder B, and bulbs C, charged with concentrated sulphuric acid. Thence the apparatus used was precisely as described in Mr. Allen's earlier paper—p. 673 of the "JOURNAL"—a calcium chloride drying-tube D; the U-tube charged with naphthalene, E; and a bulb F, charged with sulphuric acid, the outlet of which led to the aspirator G. The pressure and temperature of the atmosphere were observed at the conclusion of each experiment; and the volume of gas in the aspirator was corrected accordingly, and also for saturation by aqueous vapour. Thus the weight of naphthalene carried over in a given time by 1·271 cubic feet of gas, measured dry, and at 59° Fahr. and 760 mm. pressure, was found in all cases. The figures were, therefore, comparable. The ends of the air compartments of the bath were closed by triple layers of wood covered by flannel, with intermediate layers of cork. Air-currents were thus excluded; and the temperature of a compartment was precisely that of the water in the bath. In the first set of experiments, the temperature of the bath was exactly 86° Fahr.; and the gas was drawn through the tubes at various speeds, and the loss of weight of the naphthalene observed. Thence the weight of naphthalene corresponding to 1·271 cubic feet of dry gas at 59° Fahr. and 760 mm. was calculated, and the results recorded. Air, hydrogen, and coal gas were employed in turn in this set of experiments; but the last two gases were expelled from the tubes by air before weighing. The results are recorded in Table I.

TABLE I.

Temperature 86° Fahr. Volume of Gas Employed = 1·271 cub. ft.

Gas Employed.	Length of Experiments. Hours.	Weight of Naphthalene Carried over. Grain.
Air	2½	·4907
,,	3½	·4923
,,	4	·4938
,,	7	·4969
,,	9½	·5000
,,	11	·5047
,,	17	·5092
,,	30	·5123
,,	39	·5170
,,	135	·5293
Hydrogen	1½	·4815
,,	4½	·4830
,,	6½	·4861
,,	14	·5092
,,	24	·5200
,,	110	·5278
Coal gas	3	·4861
,,	6	·4938
,,	15	·4969
,,	20	·5015
,,	55	·5231

These results indicated that practically complete saturation of the gas was obtained in the slowest trials; but even in 24 and 30 hours, 97 per cent. of the saturation amount was obtained. It was decided to limit subsequent experiments at higher temperatures to about 24 hours, and add 3 per cent. to the observed values, in order to obtain the true saturation or "limit" value. Table II. [p. 1004] shows the results of several sets of experiments. In each case, correction was made for temperature, pressure, and the hygrometric state of the gas. The values given refer to 1·271 cubic feet of dry air or gas at 59° Fahr. and 760 mm. The limit value for 113° Fahr. was = (1·962 + 3 per cent.) = 2·021 grains; and for 140° Fahr. was = (6·968 + 3 per cent.) = 7·177 grains. The limit value for 167° Fahr. could not be found with certainty, as the experiments were limited to about three hours, owing to the difficulty of keeping the temperature of the bath constant for a longer period when so high a temperature was employed. If, however, the rate of increase in the naphthalene carried over corresponded with that observed at 140° Fahr., it would appear that the limit value for 167° Fahr. would be = 21·52 grains.

TABLE II.

Temperature 113° Fahr.

Gas Employed.	Length of Experiment. Hours.	Weight of Naphthalene Carried over. Grains.
Air	1½	1·840
,,	2½	1·885
,,	2¾	1·889
,,	5	1·901
,,	9	1·929
,,	21	1·945
Hydrogen	1½	1·843
,,	3	1·873
,,	6	1·907
,,	8½	1·932
,,	24	1·962
Coal gas	2½	1·858
,,	5	1·888
,,	5	1·895
,,	18	1·944
,,	22	1·960
Temperature 140° Fahr.		
Air	2½	5·840
,,	5	6·188
,,	15	6·941
Hydrogen	2	5·892
,,	3½	6·130
,,	4½	6·239
,,	15	6·860
,,	30	6·968
Coal gas	1¾	5·753
,,	3¼	6·198
,,	19	6·958
Temperature 59° Fahr.		
Air	2½	0·2546
,,	4	0·2562
,,	10	0·2593
,,	93	0·2623
Temperature 167° Fahr.		
Air	2½	17·98
,,	3	18·21
,,	3½	18·38

From these limit values, the vapour pressure of the naphthalene was deduced according to Ostwald's formula—

$$p = \frac{62290\ g\ T}{m\ v}\ \text{mm.}$$

where g = the weight in grammes of naphthalene carried off; T = the absolute temperature of the room in degrees Centigrade (= 273 + 15° = 288°); m = the molecular weight of naphthalene (= 128) and v = 36,000 c.c. (= 1·271 cubic foot). The results are shown in Table III.

TABLE III.

Temperature Deg. Fahr.	Limit Weight of Naphthalene Carried Over.	Corresponding Vapour Pressure.
59	0·2623 grains	0·066 mm.
86	0·5324 ,,	0 135 ,,
113	2·021 ,,	0·51 ,,
140	7·177 ,,	1·81 ,,
167	21·52 ,,	5·43 ,,

These values differed so considerably from those hitherto given for the vapour pressure of naphthalene, that an attempt was made to confirm them by the ordinary barometric method. Two glass tubes, ⅝ inch in diameter, and 3 feet long, were, after numerous trials, and with the exercise of special precautions, filled with mercury over a mercury-bath, so that, on inclining the tubes, residual air could with difficulty be distinguished. The height of the mercury in the two tubes was the same. A sealed glass bulb containing pure melted naphthalene was introduced into one of these barometer tubes; and after measurement of the depression due to a small quantity of air which was unavoidably introduced at the same time, the bulb was broken by heat, and the tube was inclined so that the naphthalene solidified at the top, where it did not interfere with the readings. The second barometer tube and thermometers were now lashed to this one; and the whole was exposed in a freezing mixture to a temperature of 0° Fahr. (at which temperature the vapour pressure of naphthalene was assumed to be *nil*), in order to ascertain if an additional small quantity of air had been inclosed in the bulb with the naphthalene. The depression due to the air introduced having thus been ascertained, the tubes were surrounded first with melting ice, then exposed to the air at 60·1° Fahr., and then in turn to the vapours of a number of substances of known boiling-point. The results thus obtained are given in Table IV.

TABLE IV.

Temperature.	How Obtained.	Corresponding Vapour Pressure.
Deg. Fahr.		
32·0	Melting ice	0·01 mm.
60·1	Air	0·08 ,,
102·2	Vapour of ether	0·30 ,,
116·2	,, ,, carbon bisulphide	0·73 ,,
143·2	,, ,, chloroform	2·26 ,,
173·1	,, ,, ethyl alcohol	7·01 ,,
176·7	,, ,, benzene	7·54 ,,
212·0	,, ,, water	18·50 ,,
240·8	,, ,, acetic acid	36·87 ,,
266·0	,, ,, isoamyl alcohol	61·95 ,,

The agreement between the values found and those found by the evaporation method, is very close, as may be seen from the accompanying curve. From such a curve, the maximum vapour pressures corresponding to every 5° C. or 9° Fahr. were deduced. These values are given below in Table V.

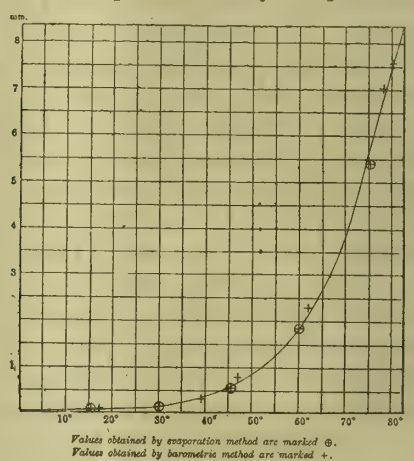
TABLE V.

Maximum Vapour Pressures of Naphthalene.

Temperature. Fahr.	Corresponding Vapour Pressure.	Temperature. Fahr.	Corresponding Vapour Pressure.
32°	0·022 mm.	158°	3·95 mm.
41	0·034 ,,	167	5·43 ,,
50	0·047 ,,	176	7·4 ,,
59	0·062 ,,	185	9·8 ,,
68	0·080 ,,	194	12·6 ,,
77	0·103 ,,	203	15·5 ,,
86	0·135 ,,	212	18·5 ,,
95	0·210 ,,	221	22·4 ,,
104	0·320 ,,	230	27·3 ,,
113	0·510 ,,	239	32·4 ,,
122	0·810 ,,	248	40·2 ,,
131	1·260 ,,	257	49·8 ,,
140	1·830 ,,	266	61·9 ,,
149	2·650 ,,		

This table forms the basis of the figures given in Table II. on p. 673 of the "JOURNAL."

Curve of Vapour Pressures for Naphthalene.



Values obtained by evaporation method are marked ⊕.
Values obtained by barometric method are marked +.

The author, in conclusion, draws attention to (1) the great advantages of the "evaporation method" in measurements of the low vapour pressure of solids at moderate temperatures; (2) the rate of evaporation of the naphthalene into the three gases hydrogen, air, and coal gas being the same, and therefore independent of the nature of the gas; and (3) the low vapour pressure of naphthalene as found in comparison with previously accepted values.

VOLUMETRIC DETERMINATION OF SMALL QUANTITIES OF CARBON MONOXIDE.

The above subject has lately been dealt with, in the "Journal of the American Chemical Society," by Messrs. L. P. Kinnicutt and G. R. Sandford; and a summary of their results appears in the current number of the "Journal of the Society of Chemical Industry." After pointing out that air containing very small quantities of carbon monoxide may have an injurious effect if breathed for some time, the authors review the methods which have been proposed for the detection and estimation of this gas. Those based on the formation of carbon monoxyhæmoglobin are, in their opinion, only of value as qualitative tests; while of the various methods based on the oxidation of the carbon monoxide to carbon dioxide, they regard that in which iodine pentoxide is used as the oxidizing agent as the most satisfactory for the estimation of small quantities. Nicloux estimated the liberated iodine colorimetrically, and Gautier measured the quantity of CO_2 formed; but the authors have been unable to obtain accurate determinations of small amounts of CO by either method. They have, however, obtained good results by titrating the iodine with a N/1000 solution of sodium thiosulphate in the following manner: 25 grammes of iodine pentoxide were placed in a small U-tube which was suspended in an oil bath heated to 150° C. This tube was connected with a Wolff blood-absorption tube containing

0·5 gramme of potassium iodide dissolved in 5 c.c. of water. Its other limb was connected with two small U-tubes—one containing sulphuric acid, and the other fragments of potassium hydroxide; and the air passing through these was freed from all unsaturated hydrocarbons, hydrogen sulphide, sulphur dioxide, and other reducing gases, before coming into contact with the iodine pentoxide, which was prepared by the action of nitric acid on resublimed iodine, and after purification in the usual manner was freed from the last traces of iodine by being heated to 150° C. in a U-tube through which a current of air, freed from all reducing substances, was passed. In the authors' test determinations, the air (from 250 to 1000 c.c.) was mixed with known quantities of carbon monoxide, and passed through the apparatus at the rate of about a litre in two hours. The results, which are given in tabular form, are in close agreement with the theoretical amounts, and show that the method is capable of determining as little as 0·0025 per cent. by volume of carbon monoxide in air. It was also proved experimentally that the determination was not affected by the presence of the other constituents of coal gas; and the authors conclude from their results that if the presence of carbon monoxide in the air be due to a leakage of coal gas, and the amount of CO be known, an approximate estimation of the extent of the leakage may be obtained by their iodometric method.

AUTOMATIC COAL-WEIGHING AND RECORDING MACHINES.

Gas companies obtaining supplies of coal by sea carriage not infrequently have trouble with the collieries over the question of the true weight of a cargo—more coal being reported to have been shipped than the weighing at the works records as delivered. The perfection of coal-weighing machinery (which is often uncertain in its results) is, therefore, to be desired.

That present methods are not always reliable or satisfactory, may be gathered from some remarks made by Mr. Charles Ingrey, M.Inst.C.E., in the course of a discussion upon a paper dealing with the subject, recently read by him to the Cleveland Institution of Engineers. He was, he said, having machines constructed for Sir James Joicey's collieries in Durham, where heretofore there had been no accurate weighing. "Billy Fairplay" had been used; but it was a rough method, and a more accurate mode of getting at the exact quantity raised and sent away was deemed advisable by the management. Again, at the Tyne Dock, where 25,000 to 35,000 tons of coal were dealt with daily, there were really no accurate means of weighing the coal. It arrived in 10-ton waggons; and the number of these formed the basis for calculating the weight delivered. One or two trucks were weighed now and then; and this became the standard until the next test weighing. Mr. Ingrey further remarked that, as in London many of the officials who have to do with gauging the weight of the coal are paid by the ton, such mistakes as are made generally favour the official.

In his paper, Mr. Ingrey enumerated the essential characteristics of a reliable coal-weighing machine, and described the apparatus designed by him to supply the want of such a machine. The machine must be sufficiently sensitive to be accurate in its weighings, yet it must be constructed in such fashion as to enable it to withstand all the heavy strains to which it can be subjected, and be free from delicate or complicated parts, so that it can be exposed to all weathers, and to the effects of coal dust, without loss of efficiency. It should be independent of all manual assistance, and be controlled entirely by the action of the crane or other unloading machinery. It must be rapid in its working, and be provided with a self-recording apparatus which would render disputes impossible. Such an apparatus Mr. Ingrey claims to have produced, and he described its construction, in detail, in the paper referred to. For this detailed description we cannot afford space, and will only say that the machinery appears to combine the two necessities of simplicity and efficiency. Messrs. Cory, who own the principal derricks in the Thames, are said to have spent £100,000 on a pontoon fitted with these automatic appliances; and if, as is contended, they prove satisfactory, similar machinery will doubtless be adopted by both buyers and sellers of coal.

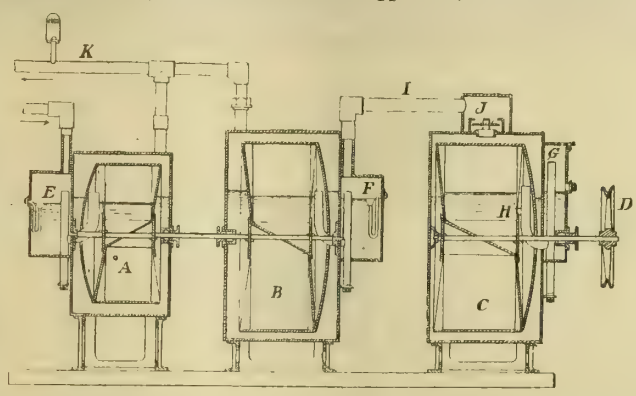
Mr. R. Warington on the "Physical Properties of Soil."—A few weeks ago, we referred to the issue by the Sulphate of Ammonia Committee of a pamphlet by Mr. R. Warington, formerly Sibthorpian Professor of Rural Economy in the University of Oxford, on "Sulphate of Ammonia as a Manure." He has also dealt with this subject in his "Lectures on Some of the Physical Properties of Soil," lately published by the Clarendon Press, and reviewed in the current number of "Nature." He points out that much of the success of manuring depends on the suitable relationship of fertilizers to soil and climate. Substances that are firmly held by the soil may be used without fear of loss, even on light soil and in a district of large rainfall; whereas substances for which soil has but little affinity must be applied with much discrimination. Other things being equal, sulphate of ammonia is more suitable than nitrate of soda for use in the West of England; whereas the order is reversed in the drier climate of the Eastern districts.

REGISTER OF PATENTS.

Apparatus for Mixing Air and Gas.—Füller, E., of Berlin. No. 7443; April 8, 1899.

For mixing air and gas in constant proportion for illuminating, heating, or other purposes, certain appliances are, the patentee points out, usually employed, consisting of a gas-meter and an air-suction apparatus connected to operate in unison, and thereby deliver a mixture of gas and air to the discharge-pipe. Such appliances are, however, he says, unreliable, especially when the pressure of the gas is comparatively low, since the pressure required for driving, not only the gas-meter, but also the air-suction apparatus, is liable to become more or less reduced. The mixture of gas and air thus produced having a low pressure, would not, for example, be suitable for supplying incandescent gas-lamps, since the illuminating power would be thereby greatly reduced.

The present invention relates to improvements in such apparatus; and its objects are: First, to provide a device for supplying compressed air, and for conducting it to the air-suction apparatus, which serves as an



air-meter; and second, to provide a device for regulating the work of the first-named device. In such apparatus, the gas and the air are always mixed in a constant proportion; and the pressure of the mixture obtained can be kept at a convenient height, which is important for illuminating purposes, especially for supplying incandescent gas-lamps.

The illustration shows a vertical longitudinal section of the arrangement of a gas-meter, an air-meter, and an air-suction apparatus driven from without—all of similar construction.

A is the gas-meter, B the air-meter, and C the air-suction apparatus—all similar in construction to the common gas-meter. The drums of the gas-meter and air-meter are rigidly connected by a common shaft passing through stuffing-boxes. The drum of the air-suction apparatus is driven from the outside by means of a rope or band passing over a pulley D. As in a common gas-meter, the casings and the exterior chambers E, F, G are partly filled with water, glycerine, or the like. During its revolution, the drum C draws air through a sieve or grating on the top of the open chamber G, through the bent pipe H, and discharges it in a compressed state into the space above the liquid in the casing of C, and thence into the pipe I. To preserve the pressure of the compressed air in this pipe, a back-pressure valve J is arranged at the top of the casing. The compressed air is conducted by the pipe I to the drum of the air-meter, which will therefore be revolved by the compressed air. The gas is also conducted to the drum of the gas-meter A, which will likewise be rotated. Since the drums are rigidly connected, the compressed air and the gas under pressure serve to drive the two simultaneously; so that at each revolution invariable quantities of air and gas are discharged into the spaces above the liquids inside the casings. The compressed air conducted from the air-meter, and the gas from the gas-meter, enter the common main, K, where they mix together always in the same proportion. The mixture is then conducted further to the place of consumption—for example, to incandescent gas-lamps, or to motors, stoves, or other apparatus, as the case may be.

The portion of the gas and air in the mixture, of course, depends upon the size of the drums A and B, and upon the pressures of the gas and of the compressed air. The pressure in the main discharge-pipe K will equally depend upon the pressure of the gas and that of the compressed air conducted to the air-meter. It will be obvious that, by regulating the pressure of the compressed air, the pressure in the main discharge-pipe may be kept at a certain height. Any failure in the working of the apparatus will therefore be prevented, even when the gas pressure falls.

Conveyor for Coke, &c.—Jenkins, W. J., of Retford. No. 9116; May 1, 1899.

This invention relates to improvements in the De Brouwer apparatus—patent No. 23,770 of 1895—and has for its objects the reduction of wear and tear, and the addition of means for renewal without disturbing the general structure of the conveyor.

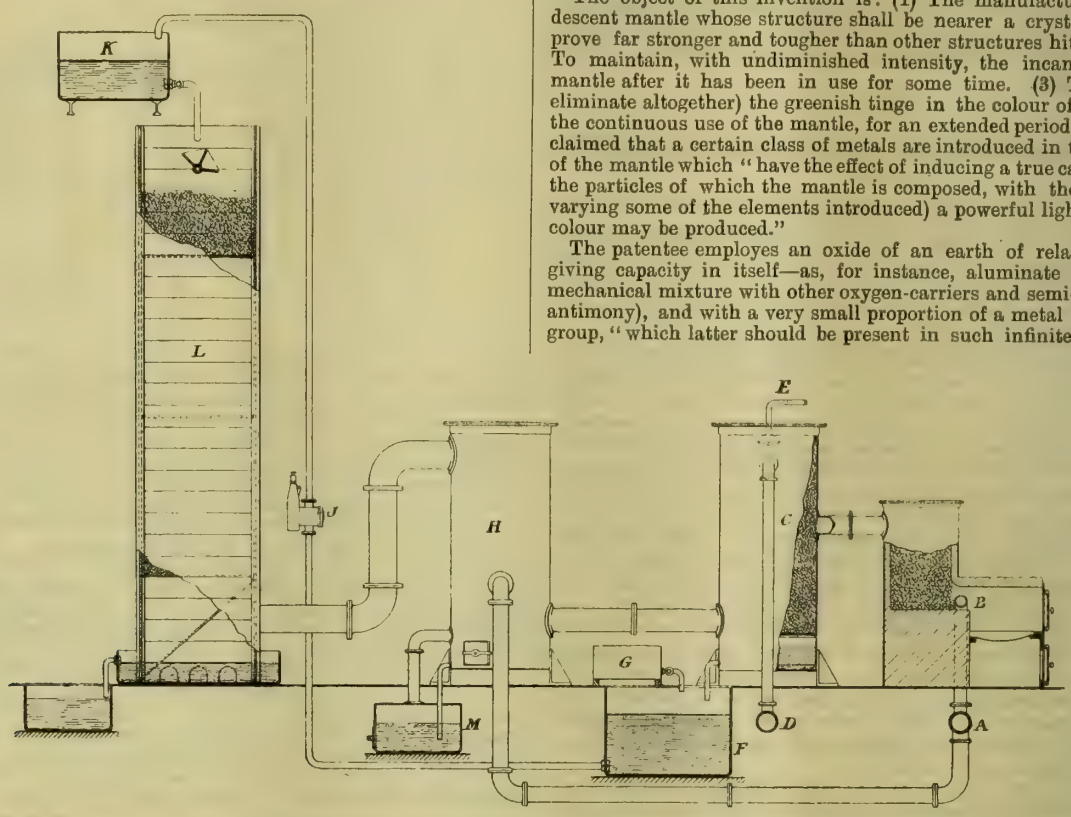
The invention consists in the addition to the floor or bottom of the trough or gutter of the conveyor of a plate of any required thickness, and two angle or flat metal strips or runners for holding the plate in position, and for forming surfaces upon which the wearing portion of the chains run when working. The invention also relates to the chains used in connection with the other parts to form a conveyor as specified in the 1895 patent. With the object of simplifying the chain, the block-links are made in the form shown in the earlier specification; but the side-links are forged or cast with bosses on each side-link, so as to meet in the centre of the corresponding block link; and they are then held together by means of a small rivet passing through the bosses of the two side links to keep them from coming apart when in work.

Desulphurization of Sulphuretted Hydrogen.—Hemingway, H. W., of Walthamstow. No. 9432; May 4, 1899.

This invention relates to the treatment of sulphuretted hydrogen, or gases containing sulphuretted hydrogen, with a view to the elimination

and recovery of the sulphur, and incidentally to the manufacture of sulphite of iron, sulphate of ammonia, and other useful products.

In treating the waste gases evolved in the manufacture of sulphate of ammonia, and in certain other processes, the patentee proposes to proceed as follows: He takes a portion of the sulphuretted hydrogen, and, by burning, converts it into sulphurous acid by any of the well-known methods; or (for the purpose of carrying out one part of the invention without the other part) he burns sulphur or sulphide of iron, or takes the gas from a pyrites kiln. The sulphurous acid gas (however obtained) is led into a tower packed with flint, stone, brick, coke, or other material; a like quantity of ammonia gas, obtained from sulphate of ammonia apparatus or any other available source of supply, being at the same time admitted. The sulphurous acid and ammonia gases, on mixing, form sulphite of ammonia, which, with the aid of a small quantity of water, is washed down the tower. To the solution of sulphite of ammonia, ferrous sulphate is added; sulphite of iron and sulphate of ammonia resulting. If it be desired to obtain all the sulphite of iron as well as the sulphate of ammonia in a fluid condition, the mixture should be slightly acid. Or, instead of washing down the sulphite of ammonia with water, a solution of ferrous sulphate may be employed, and the mixture of sulphite of iron and sulphate of ammonia directly produced.



Into a second tower, or other vessel adapted for effecting the intermingling of the gases, are led the noxious gases containing sulphuretted hydrogen; and down this tower, the solution of sulphite of iron and sulphate of ammonia yielded by the tower first referred to are rained. Or the sulphuretted hydrogen gas may be forced into a vessel charged with the mixture of sulphite and sulphate. In either case part of the sulphuretted hydrogen reacts with the combined sulphurous acid, and forms free sulphur; while a further part of the sulphuretted hydrogen unites with the iron and forms sulphide of iron. Both of these products being solids, the solution of sulphate of ammonia can be filtered off and run into the saturator ordinarily employed in the manufacture of sulphate of ammonia.

Instead of taking the mixture of sulphite of iron and sulphate of ammonia, and exposing it to the influence of sulphuretted hydrogen as described, the solid sulphite of iron is separated by subsidence, filtration, or other known means, from the sulphate of ammonia, and then the former is used in a manner similar to that in which hydrated peroxide of iron is employed in the purification of coal gas. Or the sulphite of iron may be mixed with water, and reduced to such a consistency that it will flow down a tower, and thus be rendered serviceable for the absorption of sulphuretted hydrogen as already described.

In the purification of coal gas, in order to eliminate the sulphuretted hydrogen, the sulphite of iron is used as previously described—either alone or mixed with sawdust or other porous materials—an ordinary purifier being employed. Or the sulphite of iron is exposed in a scrubber to the action of the gas containing sulphuretted hydrogen. In either case, "the sulphuretted hydrogen is absorbed with great rapidity, and only a small amount of sulphite of iron is needed to act upon and absorb a large amount of sulphur."

An arrangement of plant adapted for carrying the process for the desulphurization of sulphuretted hydrogen into effect is shown in the engraving.

The gas containing sulphuretted hydrogen arrives by the pipe A. A portion is conducted to the furnace B, whence it escapes, in the form of sulphurous acid, to the tower or scrubber C; while ammonia or ammoniacal gas, which arrives by the pipe D, is led to the upper portion of the tower. The coke or like porous material, with which the tower is charged, is traversed by a stream of water, which enters by the pipe E; the sulphite of ammonia being thus washed down as it is formed, and flows to the tank F. The surplus sulphurous acid is led to another tower H, the function of which will be referred to later. The tank G contains a solution of sulphate of iron, a regulated supply of which is delivered to the tank. Upon the sulphate of iron mingling with the sulphite of ammonia, reactions take place which result in the production of a mixture of sulphite of iron and sulphate of ammonia; and this mixture passes to the pump J, and thence to the tank K, whence it is delivered to a third tower L. This tower is furnished with coke or like material, through which the liquid mixture passes; the sulphuretted hydrogen, admitted at the lower part of the tower, passing in the opposite direction. There is a device of the "bascule type" for distributing the mixture of sulphite and sulphate over the porous material carried by the perforated trays. In the tower, sulphide of iron and free sulphur are deposited as solids, while a solution of sulphate of ammonia overflows.

Returning now to the tower H, the sulphuretted hydrogen, as it enters, combines with the sulphurous acid, with the result that water and thionic acids are formed and free sulphur deposited; while the water and acid escape to the tank M, which is charged with scrap iron. The thionic acids are here decomposed; sulphide of iron being formed, while sulphuretted hydrogen is liberated. The latter escapes, and returns to the tower H.

Mantles for Incandescent Gas Lighting.—Boult, A. J.; a communication from F. Isitt, of Leichhardt, N.S.W. No. 16,166; Aug. 8, 1899.

The object of this invention is: (1) The manufacture of an incandescent mantle whose structure shall be nearer a crystalline form, and prove far stronger and tougher than other structures hitherto used. (2) To maintain, with undiminished intensity, the incandescence of the mantle after it has been in use for some time. (3) To reduce (or to eliminate altogether) the greenish tinge in the colour of the light, after the continuous use of the mantle, for an extended period. Moreover, it is claimed that a certain class of metals are introduced in the manufacture of the mantle which "have the effect of inducing a true catalytic action in the particles of which the mantle is composed, with the result that (by varying some of the elements introduced) a powerful light of any desired colour may be produced."

The patentee employes an oxide of an earth of relatively low light-giving capacity in itself—as, for instance, aluminate of glucinum, in mechanical mixture with other oxygen-carriers and semi-metals (such as antimony), and with a very small proportion of a metal of the platinum group, "which latter should be present in such infinitesimal quantity, and so distributed through the mass, that its presence will be discoverable only by its oxygenizing action, and which action, in the absence of such platinous metal, would not be produced."

It has, says the patentee, been shown in Williams's patent that a large (almost white) light will be produced if lanthanum and yttrium be added to zirconium in the following proportion: 60 per cent. of zirconia, 20 per cent. lanthanum, and 20 per cent. yttrium. Or the oxide of yttrium may be dispensed with; the composition being then 50 per cent. zirconia and 50 per cent. lanthanum. Carl Dellwik, in his English patent, No. 2110 of 1890, maintains that a powerful red light may be produced from a base of zirconium, to which a small proportion of chromium is added. It is also described by Welsbach, in his patent of 1894, that thorium in a pure state gives comparatively little light; but when there is added to it a small proportion of the oxides of certain rare metals—such as cerium, terbium, neodymium, samarium, praseodymium, yttrium, and lanthanum—it has a high illuminating power. It has further been shown that the oxide of cerium was found to act upon, and to excite, the thorium; resulting in a marked increase in illuminating power. It has, moreover, been asserted that various other combinations or ingredients possessing similar exciting properties, may be used for a like purpose. In such cases, thorium or zirconium oxides have been generally proposed, as being most suitable to form the main body or mechanical base, with a small quantity of the oxide of one or more rare earths mechanically combined therewith. Although such oxides of rare earths may, in some instances, be of service, they are rather theoretically than practically useful as exciting media, when considered from the commercial point of view.

The patentee claims to have discovered, after a thorough practical investigation of the subject, that, in the total absence of cerium oxide, none of the earths mentioned have the power of appreciably increasing the light from a mantle composed mainly of thorium oxide or of the oxides of other earths. Wherever such increased illumination has resulted, it has been due to the presence of a trace at least of cerium oxide, an exceedingly small quantity of which will give wonderfully improved results. Oxide of cerium is the only one of the cerite and yttrite groups of earths which is, for this purpose, of practical commercial value. He has further discovered that the oxides having the above-mentioned properties may be divided roughly into two classes, which he designates as "carriers" and as "developers."

"Carriers" are oxides of high melting point, and are stable—such as aluminium, glucinum, zirconium, calcium, magnesium, and thorium. They are called "carriers" because they form a large proportion of the whole, and thus serve as bases or carriers for the light-developers, which

are in much smaller relative proportions. Indium and gallium are peculiar, inasmuch as they may be used to an appreciable extent both as carriers and as semi-developers. There are a number of other elements which partly possess this property, and others again which only possess it, to some extent, in the presence of related oxides. "Developers" of light and colour are variable oxides according to their degrees of volatility —such as cerium, manganese, indium, gallium, chrome, and such like. On these will depend the light, the colour, and the relative permanence of the incandescent life of the mantle.

The oxides of glucinum, aluminium, zirconium, thorium, magnesium, calcium, and such like elements, and their various mixtures and compounds, are of no considerable value in themselves for the production of mantles for incandescent lighting; but the addition of a small proportion of vari-colour semi-accelerators or "developers," in combination with a very small proportion of a true exciter or "developer," consisting of some metal of the platinum group, will give a powerful incandescent light, which may be varied in colour (according to formulæ) from red to almost white.

The true "developer" which (he says) should be platinum, iridium, or other suitable metal of the platinum group, is introduced in order that a true catalytic action may be set up; and this constitutes one of the main features of the invention. The catalytic action is due to the fact that a platinous metal has great mechanical affinity for oxygen—possessing the faculty of attracting the gas from the atmosphere, and maintaining it in large quantities on its surface. It was shown by Döbreiner, in 1825, that platinum has the power of holding 100 volumes of oxygen. The platinum, though incapable of chemically combining with oxygen, will collect and maintain a large supply of the gas over the surface of the mantle; and the oxygen, combining with the gas from the burner (as supplied constantly to the flame on the inner side of the mantle) will cause more perfect combustion of the hydrocarbon gas. To all appearance, this action is continuous; but as a matter of fact, it is really alternate or intermittent, as may be seen by the result. The greater heat which is due to the presence of additional oxygen, causes the incandescence of the mantle, which serves as a radiating, diffusing, or distributing body for throwing off the light thus developed.

The precise mode of making the mantle is not of great importance; but, in practice, the fabric employed must be impregnated with a solution consisting of soluble salts of aluminium in the proportion of from 20 to 40 per cent., together with soluble salts of glucinum in the proportion of from 20 to 40 per cent., dissolved in water, and with or without oxides of incandescent earths of relatively low light-giving capacity in themselves. The proportion of the combined salts of aluminium and glucinum may thus vary from 40 to 80 per cent. of the whole. Instead of dipping the filamentary fabric into the solution of the combined salts of aluminium and glucinum, mixed with the oxides of incandescent earths, it may be first dipped into a solution consisting only of the salts of aluminium and glucinum, then dried, and afterwards dipped in (or sprayed with) a solution of the oxides of incandescent earths. In any case, the mantles thus far prepared will consist only of "carriers."

It may be advisable to further treat the base or body thus formed, impregnated, and dried, by dipping it into an alkali-fixing solution (preferably aqua-ammonia), or by introducing it into an atmosphere of ammonium hydrate, whereby the salts of the metals will be decomposed, and a coating formed of hydrated oxides and the corresponding salts of ammonia. It should then be partly dried again, and the salts of ammonia washed out in distilled water, to prevent injurious reactions in the frame-work.

The mantle, after having been dried and shaped, is burnt out over a gas-flame in the usual manner; and thus the "scaffolding" (consisting of the stockinette or other filamentary fabric) is destroyed, while the oxides or body of "carriers" constituting the framework is left in the form of a mantle.

The oxides of the minerals are now in the proportion in which the chemical compound consisting of glucinum aluminate is formed. This compound framework or base, although artificially produced, possesses great infusibility and unalterability, and is quite stable. The framework or "carrier" is then dipped into (or sprayed with) a solution of a "developer" composed of one or more of the catalytic incandescing bodies hereafter referred to. When the mantle has been treated with the required "developer," it may be advisable to again subject it to the action of ammonia gas, as before explained, in order that the developer salts may be decomposed; and then, in order to properly unite the "developers" with the "carriers," and to ash the chlorides of platinum or iridium (which in the meantime have been transformed to their hydro-oxides), it is necessary to again burn out the mantle. The result of this will be to leave an ash of the oxides or "developers" with a very minute proportion of platinous metal so distributed over, or throughout, the mass as to produce the desired catalytic action.

It will be remarked that the fundamental principle involved in this invention is that the mantle shall be composed of a stable base called the "carrier," and an exciting medium called the "developer," which must contain a minute quantity of some metal of the platinum group, whereby a true catalytic action is set up. The platinous metal or metals which are utilized to produce the catalytic action should be applied in the form of chlorides; and when the mantle is burnt out, these metals will exist neither as salts nor as oxides, but as chlorides transformed to metallic platinum or iridium, and distributed in minute quantity throughout or over the surface of the oxygen "carriers."

The proportions of the ingredients used, and the selection of ingredients themselves, which constitute the "carriers," the "semi-developers," the colour-producing oxygen "carriers," and the catalytic excitant or "developer," will be varied, according to the illuminating power required, the colour of the light, and the desired stability of the mantle.

The following schedule will give a fair idea of the combinations of minerals which may be used as "developers": (1) For a white light: Solution of soluble salts of aluminium or other stable "carrier," indium, or gallium, with a trace of chloride of iridium. (2) For a yellowish white light: Solution of soluble salts of aluminium or other stable "carrier," gallium, or indium, calcium, and a trace of platinum chloride. (3) For a ruddy or pinkish white light: Aluminium or other stable "carrier," gallium, pent-oxide of vanadium, iridium chloride, and platinum chloride. (4) For a ruddy white light: Aluminium or other stable "carrier," calcium, cobalt, tungsten, and platinum chloride. (5) For a reddish yellow light: Aluminium or other stable "carrier," indium, chromium barium, and platinum chloride.

By varying the proportions, almost any shade of colour from nearly white to a yellowish red may be produced.

The following will serve to illustrate a "carrier" solution:—

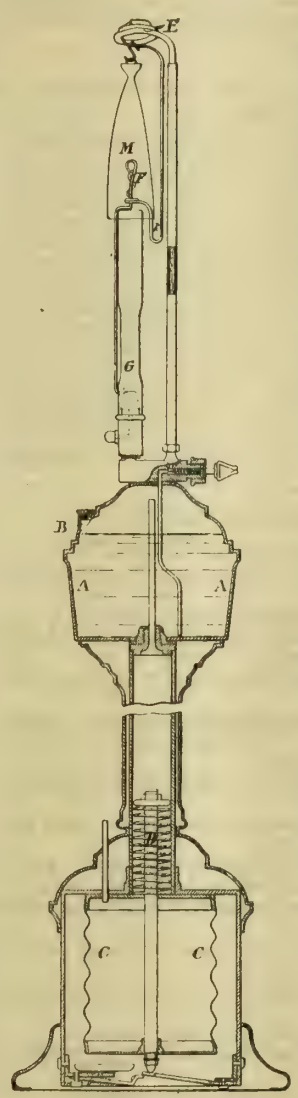
Soluble salts of aluminium, or other stable "carrier" . .	49·98
Soluble salts of glucinum	49·98

To which may be added one or more of the following ingredients, which will act as strengtheners: Calcium of magnesium, from 0·1 to 0·04 part; pyrotartaric acid, 0·1 part; chloride of antimony, 0·5 part; water to be added until the desired strength is obtained.

It will be understood that to 99·96 parts of the "carrier" must be added a trace of a metal of the platinum group, in the proportion of from 0·03 to 0·06 part.

Incandescence Lamp.—Denayrouze, L., of Neuilly, France. No. 9690 May 8, 1899. Date claimed under International Convention, Oct. 18 1898.

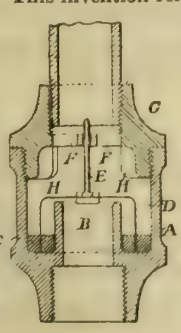
According to this invention, water is forced by air pressure in a small adjustable stream to a vaporizer situated above the mantle; and from this, vapour descends and (passing through a coil situated in the heart of the flame) becomes more or less dissociated with hydrogen and oxygen, which mingle with the gas that supplies the bunsen burner. The pressure of the hydrogen and oxygen in the flame "greatly increases the luminosity of the mantle heated by the burner flame." The patentee says that he has "found that, by passing a small quantity of water vapour through a tube situated near to, or in the centre of, the very hot burner flame of an incandescence lamp, dissociation takes place, so that the resulting gaseous oxygen and hydrogen is being led to the lower end of the bunsen burner, and there combining with supply of the combustible gaseous mixture, a considerable rise of temperature is produced in the burner flame, resulting in a greatly increased luminosity of the mantle."



The construction of lamp shown in the engraving is arranged to work with ordinary illuminating gas and dissociated water vapour. It comprises a reservoir A to contain the water, which is introduced at B. Air under pressure is sent in above the water in the reservoir, by a bellows C, charged with air by means of a suitable air-forcing device. The bottom plate of the bellows has a rod, the top of which is fixed to a washer, which bears upon a spring D so as to compress it when the bellows is distended; and the expansion of the spring compresses the bellows, and forces air into the reservoir A. The lower end of the rod, when the bellows is charged, depresses a blade spring, which works the hammer spring of an alarm gong, so as to give notice when the bellows is completely charged. The air as discharged passes through a small tube to the space above the water, which by the pressure is sent upwards in a thin stream; while a screw-valve regulates the quantity of water before it reaches the vertical tube which extends upward along the incandescent mantle M. This tube may be filled with fine wires—very good conductors of heat. The water, thus already heated a little, reaches the vaporizer E arranged above the incandescent mantle. The vapour formed descends through a small tube parallel to the mantle, till it reaches the coil F situated in the hottest part of the burner flame, and in which dissociation of the water vapour takes place. The gases resulting from the dissociation descend to the base of the burner G through a tube, which there bends inwards and leads the hydrogen and oxygen gases resulting from the dissociation to the base of the bunsen burner, quite close to the pipe through which the ordinary gas is supplied to the burner-nipple.

Automatically Sealing Gas-Supply Pipes to Burners.—Sugg, W. T., of Westminster. No. 10,506; May 18, 1899.

This invention relates more particularly to incandescent gas lighting, where the gas is supplied under considerable pressure; but it is also applicable to ordinary gas lighting—especially where a number of lamps provided with pilots are to be lighted by the turning on of a common main cock, instead of turning on each separate burner.



When gas is turned off at the main (each burner being left "on"), it is well known, says the patentee, that the gas left in the pipes will gradually escape through the burners, and the pipes will become filled with air. In the case of incandescent lighting, this is fatal, for two reasons: First, that the rush of air out of the pipes, when the gas is again turned on, may, and in all probability will, blow out the pilot, so that the burner will have to be relighted; secondly, an explosive mixture is formed, which, on coming into contact with the pilot

(if alight), will explode, and shatter the mantle. Consequently, the object of the present invention is to provide an appliance to be placed just below each burner, which will automatically seal the gas-supply pipe when the gas is turned off at the main, and thus prevent the escape of the gas, and which will automatically unseal the supply-pipe when the gas is turned on again—in other words, keep the service-pipes full of gas when the main cock is turned off.

The casing A is attached to the supply-pipe; while B is an internal cylinder, which forms the inlet to the casing for the gas, and is so arranged that a gutter C is formed externally thereof. D is a bell or cup, intended to fit over the inlet of B, and dip into the gutter, which contains mercury. The bell or cup has a guiding-stem E, which works in a cross-piece F formed on the cover G below the outlet. This cover is provided with radial projections H, which serve as stops to limit the movement upwards of the bell or cup, which may, if desired, be weighted.

When the gas is turned on at the main, the cup of each appliance will be raised, and kept up by the pressure of the gas in the main—a clear way being thus provided to the burner. But directly the gas is turned off at the main, the cup will descend into the mercury; and the supply-pipe will be effectually sealed against the passing out of the gas. Thus the supply-pipe (assuming it is sound) will be kept full of gas; and the disadvantages before-named will be obviated.

Gas-Engines.—Marks, G. C.; a communication from J. P. Murphy, of Philadelphia. No. 20,323; Oct. 10, 1899.

This invention in gas-engines has for its object "the general improvement of engines of this kind"—the leading feature of the invention consisting in a combination of a four-cylinder engine with a two-crank shaft, whereby an explosion takes place for each half-revolution of the shaft. Another feature consists in "a novel valve or valve and igniter mechanism, characterized by great simplicity, and applicable with advantage to two-cylinder engines, although especially adapted for the four-cylinder type." Still another feature of the invention consists in a device for governing the action of the admission-valves. The patentee says he has also in the development of his engine made improvements in the starting mechanism, in the igniting mechanism, in the construction and combination of the shaft, fly-wheel, and shaft-bearing, and in various other parts of the mechanism, as pointed out in a lengthy description and his claims. Reference in the specification is then made to the drawings in which the invention is illustrated—ten sheets of details in all, explained by five sheets of text, which it is impossible to summarize intelligibly.

APPLICATIONS FOR LETTERS PATENT.

6076.—Hillier, W. H., "Oil and gas engines." April 2.
6137.—Kent, W. G., and Gordon, J., "Valve applicable to indicators or meters." April 2.
6164.—New, A. G., "Internal combustion engines." April 3.
6170.—Firth, A., and Jackson, R., "Carburetting apparatus." April 3.
6184.—Hauslich, S. H., "Carburetting air." April 3.
6213.—Golby, F. W., "Incandescence gas-burners." A communication from A. Müller. April 3.
6237.—Schwarzenbach, J., "Electrical gas-igniting apparatus." April 3.
6278.—Whitham, C., and Large, E., "Prepayment meters." April 4.
6304.—Albrecht, A., "Lamps." April 4.
6329.—Winkler, H., "Ignition devices for incandescent gas-lamps." April 4.
6330.—Winkler, H., "Raising and lowering gas-lamps." April 4.
6361.—Bray, G., "Gas-burners." April 5.
6369.—Potter, W. G., "Mantle for incandescent gas-light." April 5.
6391.—Ashley, H., and Martin, H. M., "Liquid meters." April 5.
6425.—Potter, W. G., "Burners for incandescent gas lighting and for heating purposes." April 6.
6465.—Légeret, E., and Lombard, F., "Gas and petroleum motors." April 6.
6467.—Mills, B. J. B., "Oil or gas engines." A communication from A. Eldin. April 6.
6483.—Graham, J., "Controlling the flow of fluids." April 6.
6512.—Jeffery, F. W., "Burners for incandescent gas lighting." April 7.
6532.—Greenall, J., "Gas and like fluid meters." April 7.
6563.—Naef, P., "Recovering products from fuel." April 7.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress was made with Private Bills down to the adjournment on the 9th inst. for the Easter holidays:—

Bill presented, read the first time, and referred to the Examiners: Gas and Water Orders Confirmation Bill (Hoylake and West Kirby Gas and Water, Manningtree and Mistley Gas, South Elmsall, South Kirby, and North Elmsall Gas, and Steyning and District Water Orders).

Bills read a second time and committed: Ossett Corporation Gas Bill, Wetherby District Water Bill.

Bills read the third time and passed: Dorking Water Bill, Exmouth Urban District Water Bill, Fishguard Water and Gas Bill.

HOUSE OF COMMONS.

The following further progress was made with Private Bills down to the adjournment on the 9th inst. for the Easter holidays:—

Lords Bills read the first time and referred to the Examiners: Dorking Water Bill, Exmouth Urban District Water Bill, Fishguard Water and Gas Bill, Kingston-upon-Thames Gas Bill, Mountain Ash Water Bill.

Lords Bill read a second time and committed: Newport (Mon.) Gas Bill.

HOUSE OF COMMONS COMMITTEE ON POLICE AND SANITARY REGULATIONS BILLS.

Wednesday, April 4.

(*Before Lord* E. Fitzmaurice, *Mr.* H. Bemrose, *Mr.* Bill, *Mr.* Heywood, *Mr.* Johnstone, *Mr.* Leuty, *Mr.* M'Kenna, *Mr.* H. J. Wilson, *Mr.* J. W. Wilson, *and Mr.* Wylie.)

BRADFORD CORPORATION BILL.

This Bill, which is to authorize the Corporation of Bradford, among other things, to acquire land for the protection of their water supply, to purchase the undertakings of the Clayton, Allerton, and Thornton Gas Company, and the North Bierley, Eccleshill and Bolton, and Airedale Gas Companies, and to purchase gas from the Drighlington and Gildersome Gas Company, came before the above-named Committee to-day.

The following Counsel were engaged in the case: For the promoters Mr. Balfour Browne, Q.C., Mr. Freeman, Q.C., and Mr. Waugh; for the Drighlington and Gildersome Gas Company, Mr. Worsley Taylor, Q.C., and Mr. Gerald FitzGerald; for the Airedale Gas Company, and the Clayton, Allerton, and Thornton Gas Company, Mr. J. D. Fitzgerald, Q.C., and Mr. Moon; for the North Bierley Gas Company, Mr. Wedderburn, Q.C., and Mr. H. Lloyd; and for the Eccleshill and Bolton Gas Company, Mr. Claude Baggallay, Q.C., and Mr. Lloyd. In the case of other petitioners, Counsel were reserved.

Mr. Balfour Browne, in opening the case, said the only part of the Bill that was really opposed was that relating to the purchase of the gas undertakings; and the Drighlington and Gildersome Company also objected to the powers the Corporation of Bradford were seeking to enable them to purchase from the Company gas in bulk, and to supply it in the borough. Bradford was incorporated fifty years ago, and was made a city in the year 1897. It was the centre of the worsted industry; and the population to-day was nearly 300,000. The borough was largely extended last year; and the rateable value of Bradford to-day was £1,368,109. The city had spent, on improvements and works for the benefit of the people of Bradford, and also for the benefit of the people round about it, on gas-works, water-works, electricity works, tramways, and markets, about £6,000,000. The Corporation owned the whole of the works that were supplying gas within the old borough of Bradford. The borough was extended last year by taking in Airedale or Idle, Eccleshill, Tong or Drighlington, North Bierley, and Thornton. The Corporation had gone for an extension of the borough under section 54 of the Local Government Act of 1858. The matter was referred to the Local Government Board, who deputed one of their officials to make a local inquiry. This inquiry was duly made, and lasted for eight days, with the result that, although the Local Government Board Inspector did not give them for inclusion within the city boundary the district at the north called Shipley and the wedge-shaped district called Clayton, all the rest of the area which was included in the scheme of the Corporation was by Provisional Order added to the borough last year. At that time, the Gas Company in the North Bierley district said: "We want to be left alone;" and he (Mr. Balfour Browne), appearing then for the Corporation, replied: "There is no intention by this Order to affect the Gas Company at all; and we will put in a proviso that nothing in the Order shall affect the position of the Company." But at the same time, he said: "We propose to come for a Bill to purchase your undertaking at the very earliest opportunity, because we think that, as the people of old Bradford are supplied with gas by the Corporation at a cheap rate, it would be an anomaly to leave the people of North Bierley to be supplied by the Company at a dear rate. We think all the people of Bradford ought to be supplied with gas at precisely the same price." He had said then, "We will come for a Bill to purchase your undertaking." It was to redeem that pledge that this Bill was brought forward. He had referred specifically to North Bierley, only by way of illustration; for, of course, his remarks had applied to the districts in which the three other Gas Companies had undertakings. The Corporation of Bradford entered into an agreement at that time with the urban district of North Bierley, that they would come for this Purchase Bill; and the agreement was to the effect that the Corporation undertook, if any Order was made in pursuance of their representations providing for the inclusion of the urban district of North Bierley within the boundary of Bradford, they would procure the insertion of clauses requiring them to improve the district as to tramways, and so forth. In the schedule, it was stated that the Corporation would take such steps as were necessary, by a Purchase Bill or by arrangement, for the supply of of gas in bulk or otherwise, to enable them to furnish gas within the added area; and if they so supplied gas, they should do so at the same price as was for the time being paid by the inhabitants within the existing area. They had a similar agreement with the Idle, the Eccleshill, the Tong, and the Thornton authorities. The Corporation purchased the Bradford Company's works in 1871; and the undertaking had been supplying the centre of the borough. It had cost the Corporation £622,563; and they had made very considerable profits, which had been applied in relief of the rates within the borough. They had four manufacturing stations, and supplied gas over an area of 7321 acres. The area of the borough, however, was now extended, and embraced 22,721 acres; and the desire of the Corporation was to supply with gas the whole of that area, and not merely a part as they did at the present time. The amount of gas supplied was 1687 million cubic feet per annum. The whole of the Companies whose undertakings they were seeking to purchase only supplied 265 million cubic feet in the year. The price in Bradford was 2s. 1d. per 1000 cubic feet, in North Bierley 2s. 10½d., in Eccleshill 2s. 11d., in Idle 3s. 0½d., in Clayton, Allerton, and Thornton 2s. 6d., and in Drighlington 2s. 7d. The illuminating power of the gas in Bradford and the districts was: Bradford 18 candles, Eccleshill 14, Idle or Airedale 16½, Clayton, &c., 16½, Drighlington 16, and North Bierley 17. From this it would be seen that the gas of the North Bierley Company was the best from an illuminating point of view of any supplied by the outside Companies. It would also be seen, however, that the Bradford gas was 1 candle better than that of North Bierley. Well, very naturally, the people in the parts of the borough supplied by the Companies objected to going on paying 2s. 7d. or 3s. for an inferior description of gas, while

they could obtain it from the Corporation at a lower rate and of a better quality. Therefore, when they were coming inside the Bradford boundary, they bargained with the Corporation that the latter should come and ask for this Bill; and here they were accordingly. At the present time, in old Bradford no one except the Corporation had the right to break up the streets; and they regarded this as a matter of the utmost importance. It was a serious nuisance to the town to have three or four different authorities dealing with the streets; and a considerable amount of friction consequently took place between the Gas Companies and the Corporation. This always occurred in cases where Companies had the power to break up streets, and had to replace them to the satisfaction of the Corporation. As he had said, in the old town no one but the Corporation had the right to break up the streets; but in all the added districts to-day, the Gas Companies had this right. When the Corporation purchased the gas undertakings, the whole borough would be put under the same provisions as Bradford. In consequence of the lesson they had had last year, the Corporation proposed, in the case of the four Companies he had mentioned, to purchase the whole of their undertakings. Last year Parliament, though approving of the purchase of the gas undertakings, did not approve of their purchasing a part of them; and therefore they refused the powers which were asked for. Now, the Corporation were seeking to purchase the whole of the undertakings. They did not, however, wish to supply those places outside the borough which were in the area of supply of the local authority, if the authority chose to take the works outside the borough into their own hands. Therefore they proposed, with regard to Clayton, Allerton, and Thornton, to take the whole undertaking, and pay the full price for it. There was a dismembering clause in the Bill, giving those parts of the district not in the borough the right to purchase mains, pipes, fittings, and so forth, in those areas from the Corporation on arbitration terms. If the district did so, then it would be supplying itself with gas; Bradford would be supplying its own part. But the Corporation were willing to go on furnishing the districts with gas, if they did not choose to exercise their powers under the dismembering clause, and purchase their gas from the Corporation. There were a dozen precedents where, in such a Bill as this, Parliament had sanctioned the purchase of the whole of an undertaking. He did not know an instance in which Parliament had sanctioned the purchase merely of a portion of an undertaking. In one notable case of last year—that was to say, the purchase or attempted purchase by the Southampton Corporation of a portion of the South Hants water undertaking—a Committee of the House rejected the Bill, on the ground that it was only proposed to purchase a portion of the undertaking. Dealing with the Clayton, Allerton, and Thornton Gas Company, they were authorized in 1864. The amount of gas sold by the Company in 1899 was 70 million cubic feet, of which about 40 millions were consumed within the portion of the district which was part of the city of Bradford. The area of the Company's district was 3981 acres within the city; and outside it had left 6751 acres. The difference in the price of gas between the Corporation and the Company was 5d. per 1000 cubic feet. In 1897, the Company offered to sell their undertaking to the Corporation, and negotiations took place; but the Corporation considered that the price the Company asked was much too high, and the idea fell through. The Company were at that date willing sellers. The whole question was one of price; and when that was the case, the only way to determine the figure was not to allow either party to settle it, but to call in an Arbitrator. But even if the Company were not willing sellers, what injury, he asked, could be done to the shareholders through purchase by arbitration? An Arbitrator, having heard the evidence, would give the shareholders a capital sum representing their income; and they could invest that in any other security of a like nature, and get the same income. The North Bierley Company was established in 1863. The gas sold by them was 78½ million cubic feet yearly. Of this, 64 millions were consumed within the city; and the difference in price between the Company and the Bradford Corporation was 9¾d. per 1000 cubic feet. The Eccleshill Company was established in 1870; and their works were in Eccleshill, though the whole of their district was within the city. The quantity of gas sold by the Company in 1899 was 25½ million cubic feet; and the difference between their charges and those of the Corporation for gas was 10d. per 1000 cubic feet in favour of the Bradford consumer. The Airedale Gas Company was incorporated in 1870. Practically all their consumers were within the borough; there being only a small area outside, where there were very few consumers. The difference in the price of the Corporation and the Company was 11½d. per 1000 cubic feet. These were all the Companies it was proposed to purchase. In their petitions, they said the purchase should not be allowed; but after hearing the evidence, he would ask the Committee to say it would be for the benefit of the gas consumers, who were the people to be regarded, that the purchase should take place. If he could convince them that the shareholders, as investors, would be no worse off, and that the consumers would be better off, he thought they would pass the Bill. There had been many cases in which gas companies had had their undertakings compulsorily purchased; and he mentioned the recent instances of Ossett, Loughborough, and the earlier cases of Ilkley, Matlock Bath, and Morley. He really thought the argument was stronger for purchase where there was no complaint, than where there was. It was a fact, he believed, that in many cases—some of water companies—where there had been complaints, a Bill to purchase had not passed. In the case of Eastbourne, after a series of dry years, the Water Company commenced pumping water which was very much charged with salt water. The Corporation immediately took advantage of the accident, complained, and promoted a Bill for purchase. The Company urged that it was hardly fair of the Corporation to step in and buy when they were in default by a mere accident; and the Bill was rejected. On the other hand, in the case of Harrogate there was absolutely no complaint; and it was pointed out that, this being so, when the transfer took place the Company would get a higher price. The Bill passed, and now the water-works were in the hands of the Corporation. The question to be considered here was whether any injustice would be done. It would commend itself to everybody that all people in the borough, who had to bear the risk and cost, should have gas at the same price; and this could only be obtained by purchase—fair compensation to the Companies being secured by provisions as to arbitration. With regard to Drighlington, part of which was taken into the borough under the Order of 1899, the gas-works were situated outside the borough, in Gildersome. As Bradford only secured half the area, they thought it would not be fair to take the gas-works. Therefore, while adhering to the principle that everybody should pay the same price for gas, they proposed to buy gas from the Gildersome Company on arbitration terms, though very likely they might have to pay more than would be charged to the people in the borough. The petitions were very similar; and he would only deal with one. The Clayton Company said they had not hitherto paid nearly the full dividends which they might have paid under their Act, and that the profits which they would derive in future would be much greater than in the past. But this would be considered by the Arbitrator.

Mr. *Frederick Stevens*, Town Clerk of Bradford, was examined by Mr. WAUGH. He gave evidence of a formal nature in support of the Bill, and handed in a table of nineteen cases in which gas companies had been compulsorily acquired by local authorities.

In cross-examination by Mr. J. D. FITZGERALD, witness said he put the table before the Committee as showing precedents for the proposal of the Corporation. He did not know that in Chesterfield—one of the precedents—the people for weeks had been receiving practically no water. He was not acquainted with the details of the cases. In their Local Act of 1881, a clause was inserted that the Bradford Corporation should not supply gas within the district of several Gas Companies, including that of the Clayton Company; and under that Act Allerton was annexed to the borough. He did not consider that the Corporation were now seeking to repeal the condition on which Allerton was annexed. The Gas Company opposed the further extension of the borough last year; and to "lighten the ship"—not altogether to get rid of the Company's opposition—the clause was inserted that the Corporation were not to supply gas within the districts of the Company, nor to interfere with their rights. It was the intention of the Corporation then to come to Parliament again with the present application. The sole object of the proviso in the Bill was to pervent competition. The equality-of-charge clause was not extended to the portion of the Clayton Company's area which was outside the borough; but the Corporation would not be able to charge consumers there what prices they liked. Such consumers would be no worse off, because the Acts at present in force would remain operative. He agreed, however, that the Corporation could charge them the maximum of 5s. per 1000 cubic feet; the actual present charge being 2s. 6d. These consumers would not be constituents of Bradford; but while it might be to the interest of Bradford to charge them as much as possible, he did not think Bradford would do so.

Cross-examined by Mr. WEDDERBURN: The North Bierley Company had an area of some 10,000 acres, of which about 4000 were within the borough. Besides the Companies Bradford sought to buy, there were three others inside the borough, which would no doubt be dealt with later on. The Corporation failed in their proposals with regard to them last year. The principle on which the Corporation acted in dealing with some and not with other Companies, had relation to the agreements with the districts which came in on the extension of the city. Under the Provisional Order of last year, North Bierley was to be charged differential rates of 4s. 10d., as against the city rate of 6s. 4d., until gas was as cheap in North Bierley as in the city.

Mr. WEDDERBURN put it to witness that, if the present Bill passed, the charge for gas would be reduced from 2s. 11d. to 2s. 1d. per 1000 cubic feet, entailing a loss to the Corporation on the present consumption of £2798; but that the differential rate would then disappear, and the full rate of 6s. 4d. be charged, upon which the Corporation would make a profit of £4974.

Witness did not agree. He believed the figures had been carefully worked out, and that they showed that for the present the Corporation would make a distinct loss, even with the added rate.

Cross-examined by Mr. GERALD FITZGERALD, for the Drighlington and Gildersome Gas Company, witness said he had no complaint to make against the Company. The question in the case, so far as they were concerned, was whether any injustice would be done—that was to say, should the clause dealing with them be shown to be unjust, it would not be pressed. Mr. Balfour Browne had said that to take a part of the Company's undertaking would be unfair, and that he knew of no precedent for it. But there was in the Act of 1881 a precedent, even in Bradford, for taking two small portions of gas undertakings. The Bill did not propose to purchase the whole or part of the Drighlington undertaking, but to purchase, on arbitration terms, the quantity of gas which the Company at the time of the purchase were supplying in the parts of the limits of supply within the district of Harroworth. If the supply at present was 30 million cubic feet a year, Bradford would take this quantity from the Company. It was proposed that the gas should be measured at the boundary. The 30 million cubic feet would be taken in perpetuity. It might be that this would include the best section of the Company's area of supply. If the district grew and wanted more than the agreed quantity taken from the Company, it was proposed that Bradford gas should be supplied. He was not aware of a compulsory clause in any Act requiring a company to supply gas in bulk to a corporation.

Cross-examined by Mr. LLOYD, for the Eccleshill and Bolton Gas Company, witness said he thought the present was an opportune time for purchase. It was proposed to buy all the undertakings as going concerns; but it was not proposed to sell under Clause 33a, relating to dismemberment, those parts of the undertakings outside the extended area of the borough at old-pipe price. The Bill had been altered within the past two days on this point, so as to make the matter clear. The local authorities now knew that they were to pay at goodwill price. He did not know that Clayton had been informed that they would have to buy at goodwill price. The Bill as originally framed had not contained a goodwill clause.

Mr. G. FITZGERALD put further questions to witness, with a view to showing that the terms of the Bill would empower Bradford to take over the mains and pipes of the Drighlington Company without the word "undertaking" being included in the clause, which would imply that the purchase of a part of the Company's district would be at the price of old iron. The promoters were buying gas, and not property.

Re-examined, witness said that Bradford would pay for the goodwill in paying for the gas; the amount to be given to be fixed by arbitration. The tendency in Drighlington in the future would be for the gas supply to decrease rather than increase; the large millowners being more inclined to manufacture their own gas.

Mr. *W. C. Lupton*, Mayor of Bradford, who was the next witness, gave evidence as to the progress of the city; confirming in this respect the

opening statement of Counsel. The present Bill had received the assent of the Corporation practically with unanimity; and the view of the Corporation, had been confirmed at a public meeting. To his mind the objects of the Bill were good, and if carried into effect would tend largely to the benefit of the town.

Cross-examined by Mr. J. D. FITZGERALD, witness said that the Bill would complete a scheme which the people of Bradford had been for some years past anxious to see carried into effect.

By Mr. G. FITZGERALD: Cheaper gas was, no doubt, one of the inducements held out to the inhabitants of the districts included in the area of Bradford last year to give their consent.

Mr. *W. E. Aykroyd*, ex-Mayor of Bradford, and Deputy-Mayor and Chairman of the Gas Committee, gave evidence as to the extent and capabilities and limits of the gas undertaking of the Corporation. In making the purchase of the undertakings of the Companies, it was the desire of the Corporation that the Arbitrator should give a fair price. The arrangement proposed was a fair and reasonable one.

Cross-examined by Mr. J. D. FITZGERALD: The Thornton and Airedale District Councils might have been in opposition to the Bradford extension proposals of last year; but he could not say of his own knowledge. Counsel might put it that the opposition of these districts was bought off by the promise of the present Bill.

By Mr. G. FITZGERALD: We propose that we should pay your clients a statutory price for a statutory quantity of a commodity, and make no allowance for prospective profits.

Mr. FREEMAN: The prospective profits will be considered in the price.

Mr. G. FITZGERALD: Do you mind putting it in the Bill?

Mr. FREEMAN: It is in.

Mr. G. FITZGERALD: Tell me where. I can only find open arbitration?

Mr. FREEMAN: If my friend can prove that he has prospective profits, he will get them from the Arbitrator; but I cannot put prospective profits in the Bill if they are not proved to exist.

Mr. G. FITZGERALD: Do you concede the principle of prospective profits?

Mr. FREEMAN: If you prove that you have them, and there is nothing on the other side to go against them, undoubtedly the Arbitrator will take them into consideration. I have never known a case where prospective profits have not been brought in.

Mr. G. FITZGERALD maintained that, unless specific words were put in the Bill on this point, prospective profits would not be secured.

The CHAIRMAN: I should be glad if you would give us more general reasons for treating the Drighlington area in a different manner to the other four areas. It is admitted that the proposal of the Bill is almost, if not entirely, without precedent. We are, therefore, bound to go into the matter carefully.

Witness: In the Drighlington case, we do not take the whole of the supply; but we do so, speaking generally, in the other cases. If we took the whole of the Drighlington Company, we should overlap with the outside districts.

Clayton is very similar to Drighlington in this respect?—Yes; but there has been some willingness shown by Clayton to sell. They have negotiated with us for sale; the scheme failing on a question of price. But there has been no negotiation with Drighlington.

Mr. *Charles Wood*, of the Bradford Gas-Works, who was the next witness, said he had been two years in his present position. In 1899, the gas supplied by Bradford for private consumption and for public lighting was 1687 million cubic feet. The Companies supplied 265 million feet. He held that it was inconvenient in the area of the Corporation that another authority should have power to break up the streets. As to the capital expenditure of the Companies compared with the quantity of gas sold, he said that it was very high. The leakage had been very heavy also, except, perhaps, in the case of the Clayton Company.

Mr. WAUGH: Is there any prospect of the private consumers in these outside districts getting gas at the price at which it is sold by Bradford, if this Bill does not pass?

Witness: No. The price of gas in these districts is very high, having regard to the proximity of the coal mines. The Companies have large capital, and large areas to cover. The increase in the gas supply in these districts as a rule is not great; but in 1899 it was large, owing to the improved condition of trade. The extensions of the city boundary, which came into force last year, would also affect the increase.

With the exception of Huddersfield, do you know any instance in which a Gas Company have power to supply gas within the area supplied by the Corporation itself?—No. The Companies will be disappointed if the Bill does not pass. Their only object in coming here is to obtain as high a price as possible.

Thursday, April 5.

Mr. *Wood*, in further examination by Mr. WAUGH, stated, with regard to the proposal to purchase gas in bulk from the Drighlington Company, that the Company would suffer no loss. They would obtain their price for the gas as fixed by arbitration, and would have one large consumer in perpetuity. They would not have any loss in collection or leakage through mains; and they would be able to maintain the whole of their present plant effectively in work. The price charged by the Company for gas was 2s. 7d. per 1000 cubic feet, or 6d. more than was charged by the Bradford Corporation. One-third of the houses in the Drighlington district did not take gas; and he therefore considered that the proposal of the Corporation would result in a large additional business to the Company.

Before witness was cross-examined, permission was given by the Committee for the interpolation of the evidence of Mr. Corbet Woodall, in order that he might be able to fill another engagement elsewhere.

Mr. *Corbet Woodall*, examined by Mr. WAUGH, said that he had visited Bradford and inspected the gas works, and had also made himself acquainted with the districts supplied by the outlying Companies. In 1871, the Corporation purchased the gas-works supplying a portion of the borough; but since that time, the area of the borough had been further extended so as to include various other districts. The four Companies which it was proposed to purchase mainly derived their revenues from within the borough. They were not large concerns; their total consumption being 210 million feet, as against the sale by Bradford of nearly 1700 million feet. It was hardly possible for these small Companies to supply at the same rate as one large undertaking. If the illuminating power sent out by these Companies was raised to the same as that of Bradford, it would entail an increase in price. If the Bill passed, the price for gas would be made equal throughout the city, which would result in a saving to the consumers in the Clayton district of £1475, in North Bierley of £3189, in Eccleshill of £1062, and in Airedale of £1665—a total of about £7500. He thought that in the immediate future the acquisition of these Companies would cast a burden upon the present consumers of gas in Bradford—that was to say, after the Corporation had purchased the undertakings, abolished the existing gas-works, and built new ones to take their place, the charges would be greater. But as against this, there would be the benefit to the whole district of having the gas supply under the Local Authority, who would then have complete control over all the streets. Furthermore, the consumers in the districts would have the advantage of a reduction equal to the loss that the City of Bradford proper would have to bear. This loss would exist only for a short time, because greater economy would result from the undertakings being in one hand. The difference between interest on capital for Bradford and dividends and interest paid by the Companies, would represent about 16d. per 1000 cubic feet, or, on the total amount of gas sold by the Companies, £11,079. The Companies paid dividends totalling £14,867; and the Corporation interest on capital to do the same amount of business would be £3788. He did not see that any financial advantage would accrue to the Bradford Corporation upon the business at present done, as he had no doubt, when the undertakings were purchased, the Arbitrator would award such a sum as would absorb the whole of the profits to be made by the transfer. The amount of capital per million feet of gas sold in Clayton was £733, in Eccleshill £855, in North Bierley £872, in Airedale £911, and in Bradford £390. Among the circumstances which would make the transaction somewhat burdensome to the Corporation, were that they would be saddled by these amounts of capital; the immediate reduction in price; and the fact that three out of the four works would have to be abandoned, and there would be large expenditure in replacing them. There would be no loss to the shareholders in the transaction; while the Corporation would have the advantage of a growing business from the various undertakings, the demand for gas would be stimulated by the lower price, and the consumers would at once enjoy a large reduction in price. Of course, ratepayers consumed gas much more readily when they knew that the profits went into their own pockets as ratepayers; and the cost of manufacture and charges for interest would be greatly reduced. Asked to differentiate between the four Companies and the Drighlington Company, witness said that in the latter case a large area of the Company's district of supply, in which a very considerable portion of the business was done, was outside the City of Bradford. So far as he was aware, there was no Local Authority in a position to take over the outside portion from Bradford; but, for his own part, if the Drighlington Company would be willing to sell the whole, he saw no reason why Bradford should not take it, and continue to supply the district outside until the Local Authority could take it over. In regard to the arbitration clause, he thought the words, "future profits shall be taken into account," would prevent any injustice being done to the Company.

Cross-examined by Mr. J. D. FITZGERALD, witness said that he had never given evidence in favour of the compulsory expropriation of gas companies, and knew of no precedent for the present case.

Mr. FITZGERALD: Then it follows, from those two answers, that you are not in favour of the proposals of this Bill?

Witness: I object to the conclusion at which you arrive. I believe these are not compulsory transfers, in the true sense of the term. The Companies are here in the interests of their shareholders, in order to secure that a full price should be given for the undertakings. There have been negotiations with the Companies; and if the price had been satisfactory, they would not be before the Committee. Continuing, witness said he gave evidence against the proposal of the Bradford Corporation last year to compulsorily acquire the Pudsey Company. That proposal he believed to be injurious to the Pudsey Company. In regard to the Clayton case, there had been no complaint; and the Company were supplying 16½-candle gas when they were only compelled to supply 15 candles.

Cross-examined by Mr. BAGGALLAY, witness said that there were no complaints about the quality of the Eccleshill gas, or of the manner in which the undertaking was carried on. In that case, he had not heard of any negotiations with the Company.

Mr. BAGGALLAY: Do you think it a fair thing that a company who have not yet worked up to the payment of the dividends authorized by statute, and not at the end of their tether with regard to the expenditure of capital, should be compulsorily purchased?

Witness replied that he saw nothing in such circumstances to make a case against the purchase.

Mr. BAGGALLAY: Have you not often contended that a company ought to be allowed an opportunity of working up to their maximum dividends before the question of purchase is entertained, unless there are serious complaints against them?

Witness said he had always contended that it was harder for a company to be required to part with their undertaking against their will; but the case of a company who had not reached their full dividends, or expended their capital, would be dealt with by the Arbitrator. With regard to Drighlington, if the Committee were satisfied that the effect of the Corporation proposal would be indirectly to compel the Company to part with a portion of their undertaking, he would say this would be unfair. The price for gas taken in bulk should not be fixed once for all, but should be subject to revision from time to time.

Replying to questions by Mr. M'KENNA, witness said he did not agree with the statement of Mr. Balfour Browne that there were dozens of cases of statutory companies being taken over against their will. The Loughborough case was the only one he knew of; and to this extent he must qualify his previous statement that he knew of no precedent. When a company had actually entered into negotiations—as in the Morley and some other cases—then he thought the corporation had a right to come to Parliament, and say: "We cannot find terms to satisfy them; and we ask you to give us the right to go before an impartial tribunal to settle them."

Mr. *Chas. Wood* was then recalled for cross-examination. In reply to

Mr. J. D. Fitzgerald, he said he considered the price of Clayton gas was low, bearing in mind the circumstances, and the fact that the leakage was not extravagant.

The Chairman (interrupting) said he would make a suggestion which he thought might curtail the length of the proceedings. There was no allegation on the part of the Bradford Corporation that the gas supplied by the Companies was bad—or, indeed, any allegation of misfeasance of any kind. But they put forward their proposals on large grounds of public policy—that it was desirable as far as possible that the Corporation should obtain control of the gas made within their area, in order to prevent the streets being unnecessarily broken up, and so on. This being the case, he thought it wholly unnecessary to take up the time of the Committee by dealing with the quality of the gas supplied by the Companies. Counsel should, as far as possible, concentrate their cross-examination on points which were in dispute.

Cross-examination continued: He made no charge against the Companies that they had not done the best they could in meeting the wishes of the Corporation with regard to the breaking up of the streets; but with the tramway extension, this question would become more serious in the future, if the gas-pipes remained the property of the Companies. Beyond the fact that there were negotiations in 1897, which were broken off, he had nothing to show that the Clayton Company were willing sellers. Last year, the Corporation asked them if they were prepared to sell gas in bulk, and this year to negotiate a sale of the undertaking; but in each case the Company gave a refusal.

Mr. J. D. Fitzgerald: The fact is that the Corporation of Bradford are anxious to buy at the present time, when they would have to give less money than if the Company were paying maximum dividends.

Witness said he did not think that was the object. The Company had been paying a higher dividend than at present; and there was no proof that the dividends might not decrease instead of increase.

Replying to Mr. Wedderburn, witness said he did not think there would be any profit to the Corporation from the outside districts for many years. There would probably be a loss; but this would be compensated for by the gain to the city generally.

In answer to Mr. G. FitzGerald, witness said that they were not proposing to take from the Drighlington Company their most lucrative district. The part of the area they were taking was away from the works, and there was extra cost for distribution.

Cross-examined by Mr. Moon: He had not heard of any negotiations with the Airedale Company which would indicate that they were willing sellers. He understood that they had been asked if they were prepared to sell their undertaking, and that they said "No."

In reply to Mr. Lankester, witness said that they did not propose to supply consumers outside the borough at the same price as those inside; but they would have the same limit that the Companies now had. In North Bierley, the maximum was 4s., and the charge 2s. 11d. It seemed to him that it would be very unfair to the consumers in the city that they should be called upon to pay part of the cost of the gas for those outside.

Mr. *E. Herbert Stevenson* said he knew Bradford and the neighbourhood very well. He had inspected the whole of the gas-works, with the exception of the Drighlington and Gildersome works, where he did not get permission to do so. The proposal was to purchase four Gas Companies. Of these four, Eccleshill was entirely within the borough, and Airedale was almost all within it; and both the districts served by these Companies were intimately connected with Bradford. In his opinion, it would be greatly to the advantage of the inhabitants if they were served with gas by a central authority. He had inspected the works of the two Companies he had mentioned; and in his view it would be impossible for them, for many years to come, to supply gas at the same rate as Bradford. Indeed, none of the districts around Bradford could do so. Such prosperity as the Companies had enjoyed in the past was due to their vicinity to the borough. The shareholders in the Companies would suffer no loss by arbitration. With two exceptions, in every case the purchase of gas undertakings by local authorities had been to the advantage of the shareholders, because they had received a sum that they could invest in other securities of a similar nature, and get a larger interest; and he was perfectly certain this would be the case in the present instance. The North Bierley Gas-Works were the only ones out of the five that were in a good condition. They were modern and well designed. It was true that some portion of the district served by the Company was outside the city boundaries; but there was not much consumption of gas. In the case of this Company, the only question at issue was the price of purchase. He had considered the case of the Clayton, Allerton, and Thornton Gas Company, and the district they served; and here the only solution of the question was to purchase the undertaking. He was quite willing to advise the selling of outlying portions to Local Authorities, such as the Wilsden District Council. He could see no difficulty that could possibly arise in arriving at a proper purchase-price for the undertakings. As the Companies managed their business at the present time, he did not think it was possible for them to pay their maximum dividend. He did not believe that, with the present price of coal, companies would be able to keep up the dividends which they were now paying. The Drighlington and Gildersome Company supplied Tong—perhaps the most valuable portion of their area—and the population of Tong was entirely an overflow from the borough. The great advantage of the scheme would be that the supply would be distributed to one consumer; and Bradford undertook to take a quantity of gas more than they would actually require. The proposals of the Bill would in no way increase the cost of gas to the consumers in the other districts. The Drighlington Gas-Works were in a bad condition, and were not capable of coping with the increase which might arise a few years hence. As the Corporation had the greater part of the gas supply in their district, he thought it was only reasonable and right that the remainder should be given to them. He knew several instances of statutory gas companies being compulsorily purchased against their will. They were not uncommon. They dated from 1869. The most recent cases were: The Ilkley Bill of 1893. The Chesterfield Gas and Water Bill of 1895, which was a little different. Skipton was, and was not in a way, a compulsory purchase. The Bill was brought into Parliament for the compulsory acquisition of the works. He acted for the Company; and during the progress of the Bill he obtained very favourable terms from the Corporation. Thereupon he advised the Company to settle on the Corporation's terms; and they did so. Stourbridge and Morley were also cases of compulsory purchase of gas undertakings.

Cross-examined by Mr. Baggallay: With regard to the portions to be resold to the outside Local Authorities, there was no reason why they should not pay for them a price based on the amount awarded to the Companies.

Cross-examined by Mr. Fitzgerald, witness said that the Bradford Corporation had received authority from Parliament to supply the old borough, and had supplied nine-tenths of the gas now consumed in the present city area; and therefore they ought to be permitted to supply the remainder.

In reply to Mr. Wedderburn, witness would not say that the purchase-price to be awarded by the Arbitrator would be so great as to give each shareholder on re-investment an interest equal to 3 per cent. The capital of these Companies was not worth 3 per cent. The Companies, as a matter of fact, were asking a price equal to first-class debentures, which they were not entitled to.

Questioned by Mr. M'Kenna, witness said he knew of no instance since 1869 where the undertaking of a statutory gas company had been purchased compulsorily. There had been many water cases.

Friday, April 6.

Mr. *W. A. Valon* said that, in his view, it would be a great advantage to Bradford to acquire the proposed undertakings, and it would not be any disadvantage to the shareholders. He attached considerable importance to the control of the breaking up of streets being in one hand. There was at present some complaint or dissatisfaction among the consumers of the Companies' gas, from the fact that they had to pay more than those who belonged to the city proper before the extension; and this could only be removed in one way—by purchase. For the Bierley district to be allowed to re-purchase the portion of the undertaking outside the city at the value of the pipes, would be manifestly unfair, as the Corporation would have to buy the whole thing as a going concern, and to pay its full commercial value. In the case of that district, there would be hardly any pipes; and so the outside district would practically get their portion of the undertaking for nothing. With regard to the Drighlington Company, it was proposed that the Arbitrator should settle the price per 1000 cubic feet to be paid by the Corporation, and the Arbitrator would take into consideration any future profits that the Company might likely make by the expansion of the district. The fact of the unexpended capital of the Company, amounting to £12,000, would also necessarily be taken into consideration by the Arbitrator. It would be perfectly easy for the Arbitrator to fix a price which would give the Company credit for all their future assets. The price should not be fixed once for all, but should be liable to periodical revision.

By Mr. Baggallay: The sale of the Drighlington Company was about 51 million cubic feet; and the price charged was 2s. 7d. per 1000 cubic feet. In the United Kingdom, there were 440 gas companies.

Mr. Baggallay: Are you aware that, out of the 440 companies, there are only 41 who charge so low a price as the Drighlington Company?

Witness: I daresay that is true; but it does not prove anything.

And do you know that there is no company doing so small a business as 51 million feet who sell at so low a price?—That may be so.

Mr. *Charles Hunt* also gave evidence in support of the Bill. He had had large experience in arbitrations, and had found that where companies were in good condition, and doing good trade, they received full value for their undertakings, with some allowance for compulsory purchase. With regard to the sale in bulk by the Drighlington Company, there would be no difficulty in revising the price from time to time; but it would be unwise to have a too frequent revision. Nor would there be any difficulty in arriving at a price which would take into account future development. Under the circumstances, he thought the proposals of the Bill fair and reasonable.

Cross-examined by Mr. J. D. Fitzgerald, witness said that the Birmingham Gas-Works, of which he was Engineer, were Corporation property, and were acquired by agreement.

This being the close of the promoters' case, the Committee consulted in private. On the re-admission of the public,

The Chairman said: The Committee cannot help thinking that, with regard to the matters dealt with in the gas clauses of the Bill, the parties might come to terms of agreement; and this being their opinion, they have decided to reserve the further consideration of the subject, and not to proceed with the evidence on this part of the Bill until the meeting of Parliament after the Easter holidays, so as to give full time to all the parties to consider the situation, and in the hope that something definite may be put before us.

Mr. Freeman: We have already come to terms with North Bierley.

The Chairman: I am very glad to hear it.

Mr. Freeman: And I think it is not improbable that the same course will be followed with the others.

The Committee then proceeded with other portions of the Bill, and at the close of the sitting adjourned till after Easter.

River Plate Gas Company, Limited.—The report of this Company for the past year shows a profit of £89,326, to which has been added transfer fees, interest, commissions, &c., profit remittances, and the amount brought forward; making a total of £102,294. After payment of fixed charges, making ample allowance for bad and doubtful debts, and providing fully for the upkeep of the works, mains, &c., there remains to be dealt with the sum of £81,917. The Directors recommend that £10,000 should be added to the reserve (raising it to £50,000) and £2000 written off discount on the issue of debenture stock. A final dividend at the rate of 8s. per share, making 7 per cent. for the year (free of income-tax), is proposed; leaving £10,342 to be carried forward. During the year, the sum of £20,636 was spent out of revenue on the upkeep of works and mains, &c. A complete installation for the manufacture of carburetted water gas has been contracted for, and the greater part of the material is now on its way to Buenos Ayres. To provide a site for it, and for other extensions at the Corrales works, freehold property consisting of about 11,000 square metres, adjoining the works, has been purchased, as well as 11,116 square metres of land adjoining the Belgrano works. During the past year, the mains were increased by about 13½ miles, and 1995 new house services were connected.

MISCELLANEOUS NEWS.

HORSFORTH WATER-WORKS ARBITRATION.

Saturday, March 24.

(*Before Mr.* R. E. Middleton, *Umpire.*)

This was an arbitration to decide the amount to be paid by the Horsforth Urban District Council for the undertaking of the Horsforth Water-Works Company, under an Act obtained last year. The proceedings took place at the Surveyors' Institution, London. Mr. R. E. Preston was Arbitrator for the Company; Mr. J. M. Fawcett for the Council. Mr. Pember, Q.C., and Mr. R. A. Shepherd appeared for the Company; Mr. Balfour Browne, Q.C., and Mr. A. W. Bairstow for the Council.

Mr. Pember, in opening the case, said the proceedings were taken under section 6 of the Act of last year, which provided that within six months of the passing of the measure the Council should purchase the water-works under the Lands Clauses Act. The Incorporating Act of the Company (which he believed had been in existence before the incorporation) was passed in 1865. The capital was then £8000 in shares, with borrowing power of £2000. The following year they obtained leave to raise £4000 in shares with £500 in debentures. The dividend on this capital was not limited; and they could distribute 10 per cent. In 1885, the Company again went to Parliament, and obtained powers to raise further capital of £15,000—viz., £12,000 in shares and £3000 in debentures—the interest on these shares being limited to 6½ per cent. The authorized capital of the Company was thus £29,500, but all had not been issued. Under the Act of 1865, the charge for water had been on the basis of the poor-law assessment; but in 1885, this had been altered, and the Company obtained power to lay the charge on the gross estimated rental—the charge being limited to 10 per cent. on rentals of £10 per annum and under, and 7½ per cent. on rentals above £10. In 1899, the Company went to Parliament for the acquisition of certain new streams; but they were met with the opposition of the Burley and Horsforth Urban District Councils. The result was that Parliament granted Burley their Bill, and gave the Horsforth Council power to purchase the undertaking of the Company and to borrow £60,000 for this purpose, the expenses of the Act, and the extension of the works and mains. At one time, the Company had some trouble in avoiding pollution; but at considerable expense they had overcome the difficulty, and the quality of the water was now unexceptionable. As to quantity, in 1897 the resources of the Company were severely taxed; and the Directors then made arrangements with the Yeadon Company by which they were enabled to purchase water in bulk at a cost of 6d. per 1000 gallons, with a minimum payment of £150 per annum. The gathering-ground of the Horsforth supply varied in height from 550 to 725 feet above sea-level; and the area could supply 160,000 gallons a day. There was no trade supply, and no manufactories of importance. There were 6517 consumers last year, and the number was increasing at the rate of 130 or 140 a year. The income last year was £1800; and this had, on the average, increased at the rate of £67 per annum, while the cost of working had for the last three years averaged £400 per annum. The income would, the Company anticipated, be materially increased by the re-valuation of the district, which was imminent. The present valuation was of very old standing; and the gross estimated rental on which the Company charged was nearly £300 below the income-tax valuation. The learned Counsel concluded by urging that the stability of the undertaking, its resources, and its increasing income should be considered in estimating the value.

Mr. Balfour Browne remarked that there was one mistake in the opening of his learned friend. He had stated that the available supply was 160,000 gallons per day; but this was before the compensation water was deducted.

Mr. Pember said he had been mistaken. He found that the total supply was estimated at 160,000 gallons a day; and from this would have to be deducted 42,600 gallons of compensation water. This would leave an available supply of 117,400 gallons daily, or an average of 18 gallons per head.

Evidence was then given on behalf of the Company.

Mr. *John Davis*, Clerk to the Commissioners of Property-Tax for the district of Skyrack, was called to prove that the gross estimated rental of Horsforth was set down in the rate-book at £18,749 14s., whereas the valuation for income-tax was £21,095.

Mr. Balfour Browne said they had nothing to do with the income-tax assessment. All they had to do with was the gross estimated rental at the time of the valuation. This was laid down in the Act of Parliament, and they could not go beyond it.

Mr. Pember replied that they had the right to give evidence that a re-valuation would lead to a large increase in their income.

The Umpire decided that the evidence was admissible.

Witness (continuing) gave instances of the discrepancy in rating, and said on the income-tax basis the revenue of the Company would be increased by £291 per annum.

In cross-examination, witness said he knew the basis of the poor-law rating was the rent that might reasonably be expected from year to year. This might vary from the rent that was paid.

Mr. *H. C. Blackburn*, Chartered Accountant, of Leeds, said he had examined the accounts of the Horsforth Water Company. The capital issued was £26,140, of which £21,200 was in shares and £4940 in loans. There had been expended on capital account £26,682 8s. 1d.—making the capital expenditure £522 8s. 1d. above the amount issued. The cost of the land and compensation was £2262 7s. 5d., reservoirs £10,184 10s. 9d., filter-beds £3881 16s. 3d., mains and pipes £6481 16s., and parliamentary expenses £5315 4s. 4d. The income for the past year had been £1800 18s. It had increased annually, and especially during the last six years. The population of the district was 7600; but of these 1083 were not using the Company's water. The number of houses supplied was 1541. The sum of £156 had been paid to the Yeadon Water Company last year for water supplied in bulk. If the water-rentals were charged on the full value, there would be an increased annual revenue of £291 0s. 6d.

Cross-examined, witness said the cost of the Bill they failed to obtain last year was charged to capital. The rateable value of the works of the Company was £535.

Mr. Balfour Browne: You would not like to be bought on that basis, would you?

Mr. Pember: No. That is why we say the rating is too low.

In re-examination, witness said £1232 had been spent on renewals—an average of above £43 a year.

Mr. *Charles Roberts*, Secretary of the Company, put in the correspondence with the District Council and tables showing the present consumers and the hours of supply. In 1885, they carried out various new works authorized by their Act of that year; and in 1895, under the advice of Dr. Bruce Low, of the Local Government Board, they added two new filter-beds and a pure-water tank. At the same time they made arrangements to prevent any pollution of the supply, and to carry the storm waters into the compensation reservoir.

In cross-examination, witness admitted that when Dr. Low, in 1895, examined the works, he condemned the condition of the gathering-ground. He found then several cases of pollution, and the sources slightly impure. The Company carried out certain works to improve the quality of the water. The gathering-ground was principally grazing land; only two fields were arable. In 1897, if they had not obtained the water from Yeadon, they would have had to put their consumers on short commons. When they went to Parliament last year, they proposed to get a supply from Burley Moor, but were unsuccessful. As to the age of the mains, three or four miles out of the fourteen or fifteen miles were laid in 1865. The gathering-ground comprised an area of 215 acres, the annual rent of which was about £200.

Mr. *A. J. Johnson*, Civil Engineer, of Bradford, said he knew the works of the Company. He had carried out many extensions of the works during the last few years. The Company had an upper reservoir with a capacity of 8 million gallons; a lower reservoir holding 26½ million gallons; and a compensation reservoir of 8 million gallons. Besides these, there were six filters and two pure-water tanks. As to the supply, he estimated the rainfall of the district at 34 inches per annum. Deducting one-fifth, and making an allowance of 15 inches for evaporation and absorption, they could rely on getting a rainfall of 12 inches, which, over the 215 acres of gathering-ground, would produce 160,000 gallons a day. From this had to be deducted 42,600 gallons compensation water; leaving 117,400 gallons daily supply available for Horsforth. This was equal to 18 gallons per head. He had no doubt there was an ample supply of water for the district, and sufficient reservoir accommodation. The lowest part of the district was 200 feet above sea-level, and the highest built upon about 525 feet. They supplied the Ida Hospital, which was in the Leeds area but could not be supplied by that town. This hospital took 405,000 gallons last year. Since the reservoirs were filled in 1897 and 1898, they had taken only the minimum supply from Yeadon. It was against his advice that the agreement with Yeadon was entered into. But at that time Dr. Bruce Low was in the town; and he wished to have an assurance that the Directors could obtain a supply of water. In 1895, a large sum was spent on renewals and services, the whole cost of which had been paid out of revenue. The works, including the reservoirs, filter-beds, and tanks, were in very good condition, and equal to any emergency. In his opinion, there need be no immediate expenditure on the plant, except the ordinary up-keep. There were about 1000 people not supplied with the Company's water. Most of these lived in farmhouses and had their own wells; the rest were small houses near the Town Well. Witness then gave his valuation of the undertaking. He took the gross income for 1899 as £1818, to which he added 10 per cent. for the anticipated increase on the new valuation—making a total revenue of (say) £1980. From this, he deducted the cost of working, rates, and taxes £400, leaving a net revenue of £1580. This he capitalized, at 33⅓ years' purchase, as £52,660. Deducting from this sum £450 liability for three years to Yeadon, and £1050 (being 5 per cent. on a capital expenditure of £21,000) for general depreciation of works, he arrived at £51,160 as the value, to which he added the usual 10 per cent. for compulsory sale, making a total of £56,276. This was his valuation of the property.

Cross-examined: He had advised the Company that, if they looked after the fittings and so reduced the leakage, there would be no need to obtain water from Yeadon; but they did not act on his advice. A good deal of the capital of the Company was held by Horsforth people. In his opinion, they might fairly have anticipated getting their maximum statutory dividend in a few years.

Mr. *Charles Gott*, Civil Engineer, of Bradford, said he had known the gathering-ground of the Company for many years. In his judgment, the rainfall of the district was not less than 34 inches. He had always taken that figure, and considered they could rely on 12 inches of rainfall over the 215 acres. This would give them, after deducting the necessary compensation water, 117,200 gallons a day. These calculations were based on an average of three dry years, so that in wet seasons they could obtain a good deal more. The reservoirs were of unusual capacity; and, in his opinion, the supply was practically secure. As to the mains, the only effective test of their soundness was the efficient supply of water to the consumers; and he had heard of no complaints. The mains buried in the ground would last for a very long time. He had himself taken up old mains which had been in the ground for forty years, and had relaid them as new ones. Since 1885, the Company had made great improvements in their works. New filter-beds had been constructed, and arrangements had been made to prevent fouling of the supply. The Company had carried out all their authorized works; but they had not spent all their authorized capital, and had been liberal in doing work out of revenue. In his view, their position was improving; and he anticipated that the statutory dividend of 10 per cent. might soon have been reached. Horsforth was a residential district of Leeds; and many Bradford people had lately gone there. He knew the arrangement under which the agreement with Yeadon was entered into. That year the Directors had to get more water; and the Yeadon supply was the only water they could obtain. The Yeadon people, having to lay mains, would not give the supply for only one year; so the Company had to make the agreement for five years. But he thought if the Directors looked after the waste, there was as much water in their own hands as the district required; and the agreement, therefore, need not be renewed. This arrangement, he considered, should not be taken into account in estimating the value of the undertaking; indeed, the contiguity of the Yeadon water might be reckoned as increasing the value of the Horsforth works. So far as he

could see, the earning power of the Company was not less than the present revenue. The income of £1800 was amply secured by the prospects of the Company. The local wells must gradually be abandoned, and the people take their supplies from the Company; and there must be an increased revenue consequent upon the adjustment and re-valuation of the township—an increase of income which would involve no extra expenditure. Witness then gave his valuation of the undertaking at £56,282, which concurred with, and was based on the same principle as, that of Mr. Johnson. In doing so, he pointed out that the income had increased on the average £69 4s. annually during the last three years, and that the works were in good order. There was no reason to expect any considerable expenditure on works for some time.

In cross-examination, witness said he had heard no complaints of the quality of the water, or of trouble from it freezing in the mains. The Company had not put aside any sum for depreciation. But this depreciation would be very small; and in his view the increasing value of the undertaking was a sufficient security for the maintenance of the revenue. The supply of 18 gallons per head in a residential district was quite sufficient—in fact it was more than was used.

Saturday, March 31.

Mr. *C. J. Newstead*, Clerk of the Assessment Committee of the Wharfedale Union, said there were eight townships in the Union, and all had been re-valued except Ilkley and Horsforth.

Mr. *Samuel Wood*, one of the Overseers for the township of Horsforth, said there had been a rough re-valuation of the township begun; but it was not yet completed. So far as they had gone, some properties had been increased; but there was a "deal" on which there was no increase at all. All their assessments were subject to appeal; and till then nothing could be definitely known.

This concluded the evidence for the Company.

Mr. Balfour Browne then addressed the Umpires for the District Council. He said they were agreed as to the method of valuation. They were to find out the earning capacity of the undertaking; and that depended upon two or three things. The first consideration was, had the Company got the water required? because if it was bad in quality or insufficient in quantity, the income could not be said to be well secured. He made no attack on the gathering-ground. He would allow that, since Dr. Bruce Low reported, the Company had done something to stop the abominations which had existed. But it was admittedly difficult to keep a watershed like that pure. Then it was obvious, from their agreement with Yeadon, that the Company had not got a sufficient supply; and the payment of £405 in one year showed that the Horsforth Company were at the end of their tether. And besides this, the Company had last year applied to Parliament for power to get a new supply from Burley Moor. As to the rating, he contended that they had nothing to do with the income-tax assessment; all they had to consider was the gross value of the property at the present time. If the Company could have shown that the assessments had been increased, they might have claimed for the prospective value of such increase. But they could not do so; and all they had to go upon was the revenue they obtained—and obtained only by buying water from Yeadon. He urged that the income of the Company could not be said to be well secured. No one would consider it a 3 per cent. investment—indeed, the best water company in the world was not worth that. The depreciation was not nearly enough. The mains were old, and laid so near the surface that they were often frozen. As to the allowance of 10 per cent. for compulsory sale, the learned Counsel said this could only be claimed if the full value could not be measured. But in this case he urged the full value of the undertaking could be measured, so that no allowance should be claimed. There was nothing in the Lands Clauses Act to make it compulsory. There was no decision that held it to be a legal charge; and he appealed to the Umpire not to allow it.

The following evidence was then called.

Mr. *E. J. Silcock*, Civil Engineer, of Leeds, said he had known the district of the Horsforth water supply for many years. The description of the works given by the Company's witnesses was generally correct. He had examined the mains, and had samples of the worst and oldest. There were about four miles of these old mains which would require very shortly to be relaid, to put the system in a satisfactory state. These pipes were very old, and were laid too near the surface. This was not all that was necessary; but if these four miles were relaid, the system would be fairly satisfactory.

The Umpire: What is the size of the mains?

Witness: All are 3-inch and upwards.

Examination continued: There were in the district of supply about 700 acres which were at too high an elevation to be furnished with water by the Company; but the population of this area was only small. As to the gathering-ground, he accepted generally that this was 215 acres in extent. It was not an ideal gathering-ground; and the Company had already entered into agreements to secure some measure of control over the ground. The Company or the District Council might find it to their advantage in the future to purchase the lands, so as to secure full control. Leeds had gone to a great expense lately in purchasing the land in the gathering-ground of their water-works—especially the land near the river. He had examined the rainfall of the district; and he based his calculations on two gauges nearest to the gathering-ground—one at Oliver's Hill, and one at Lawns Wood Cemetery. The result was that he estimated the available rainfall at 11 inches, instead of 12 inches as calculated by Mr. Johnson. They had three consecutive dry years in 1897, 1898, and 1899; and he found the rainfall during these years was 23·92 inches. To this he added, for the difference in elevation between the gathering-ground and the gauges, 8·6 per cent., which would make the gross rainfall 26 inches. In this ground, he considered the loss from evaporation and percolation would not be less than 15 inches, which would leave the net amount available 11 inches. On the 215 acres, a fall of 11 inches would produce a daily flow of 146,630 gallons, or, deducting 42,600 gallons compensation water, a daily supply of 104,030 gallons available for the Company. A further addition had to be made, as the capacity of the reservoirs was greater than usual in relation to the extent of the gathering-ground. It was

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 991.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.	Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.	£			p. c.	GAS COMPANIES.			£ s. d.
500,000	10	Apl. 11	10½	Alliance & Dublin 10 p. c.	20—21*	..	5 0 0	60,000	5	Feb. 23	7	Ottoman, Ltd. . . .	4¾—5¼	..	6 13 4
100,000	10	,,	7½	Do. 7 p. c.	13¾—14¼*	..	5 3 5	500,000	100	Dec. 1	6	People's Gas (2nd Mtg. of Chicago) Bonds.	102—106	..	5 13 2
800,000	100	Jan. 2	5	Australian 5 p. c. Deb.	100—102	..	4 18 0								
200,000	5	Nov. 15	6	Bombay, Ltd. . . .	6½—6¾	..	4 8 11	851,070	10	Oct. 13	7	River Plate Ord. . . .	11¼—11¾	..	5 19 2
40,000	5	,,	6	Do. New, £4 paid .	4¼—4¾	..	5 1 1	250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb. .	100—102	..	3 18 5
880,000	Stk.	Feb. 23	12	Brentford Consolidated	255—265	−5	4 10 7	250,000	10	Apl. 11	8	San Paulo, Ltd. . . .	11½—12⅝*	+½	6 8 0
270,000	,,	,,	9	Do. New . . .	197—202	−3	4 9 1	135,000	Stk.	Sept. 15	10	Sheffield A.	249—251	..	3 19 8
50,000	,,	,,	5	Do. 5 p. c. Pref. .	140—145	..	3 9 0	209,053	,,	,,	10	Do. B.	249—251	..	3 19 8
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb. .	118—123	..	3 5 1	447,427	,,	,,	10	Do. C.	249—251	..	3 19 8
220,000	Stk.	Mar. 14	11½	Brighton & Hove Orig. .	237—242	..	4 15 0	5,600,000	Stk.	Feb. 23	5⅓	South Metrop., 4 p. c. Ord.	134—136	−1	3 18 5
226,320	,,	,,	8½	Do. A. Ord. Stk. .	180—185	..	4 11 11	1,520,000	,,	Jan. 12	8	Do. 3 p. c. Deb. . .	100—102	..	2 18 10
999,500	Stk.	Feb. 23	5	Bristol, 5 p. c. max. .	125—130	..	3 16 11	380,940	Stk.	Nov. 30	5	Southampton Ord. . .	117—122	..	4 2 0
420,000	20	Mar. 29	10	British	41½—42½	..	4 13 0	70,825	,,	Dec. 29	4	Do. 4 p. c. Deb.	120—125	..	3 4 0
60,000	10	Feb. 23	12	Bromley, Ord. 10 p. c. .	24—26	..	4 12 4	120,000	Stk.	Mar. 14	6	Tottenham and (A. 5 p. c. B. 3½ p. c. 4 p. c. Deb.	139—141	..	4 5 1
79,000	10	,,	9	Do. 7 p. c. . . .	19—21	..	4 5 8	250,520	,,	,,	4½		100—102	..	4 8 3
500,000	10	Oct. 13	5	Buenos Ayres (New) Ltd.	9¾—10½	..	5 17 1	55,100	,,	Dec. 14	4	Edmonton	113—117	..	3 8 5
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb. .	99—101	..	3 19 3	182,380	10	Jan. 12	5	Tuscan, Ltd.	8—9	..	5 11 1
150,000	20	Mar. 14	8½	Cagliari, Ltd. . . .	25—27	..	6 2 8	149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.	101—104	..	4 16 2
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	15—16	−½	5 0 0								
60,000	50	Nov. 2	6	Do. 6 p. c. 1st Mort.	56—58	..	5 3 5								
550,000	Stk.	Apl. 11	13½	Commercial Old Stock.	295—300*	..	4 10 0								
236,425	,,	,,	10½	Do. New do. .	230—235*	..	4 9 4								
288,237	,,	Dec. 14	4½	Do. 4½ p. c. Deb. .	142—145	..	3 2 1								
800,000	Stk.	Dec. 14	9	Continental Union, Ltd.	160—170	+5	5 5 11					WATER COMPANIES.			
200,000	,,	,,	7	Do. 7 p. c. Pref. .	175—180	−3	3 17 9	780,399	Stk.	Dec. 29	11	Chelsea, Ord.	307—312	..	3 10 6
51,600	Stk.	Feb. 23	14	Croydon A 10 p. c. . .	335—340	..	4 2 3	150,000	,,	,,	5	Do. 5 p. c. Pref. .	157—162	..	3 1 9
173,400	,,	,,	11	Do. B 7 p. c. . .	265—270	..	4 1 5	160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	145—150	..	3 0 0
555,000	Stk.	Feb. 23	5½	Crystal Palace Ord. 5 p. c.	120—125	−2	4 4 0	175,785	,,	Mar. 29	4½	Do. 4½ p. c. Deb. .	145—150	..	3 0 0
60,000	,,	,,	5	Do. 5 p. c. Pref. .	130—135	−2	3 14 1	1,720,560	Stk.	Apl. 11	7	East London, Ord. . .	196—201*	−½	3 9 8
486,000	10	Jan. 26	11	European, Ltd. . . .	19½—20½	..	5 7 4	654,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb. .	145—150	..	3 0 0
854,060	10	,,	11	Do. £7 10s. paid .	15—16	..	5 3 2	890,000	,,	,,	3	Do. 3 p. c. Deb. .	99—101	..	2 19 5
14,993,975	Stk.	Feb. 9	4½	Gas-light and Coke (4 p. c. Ord. . .	102—104	..	4 14 2	700,000	50	Dec. 14	7½	Grand Junction (10 p. c. max. . 4 p. c. Deb. .	107—109	..	3 8 10
2,600,000	,,	,,	3½	3½ p. c. max. . .	97—99	..	3 10 8	810,000	Stk.	Mar. 29	4		130—135	..	2 19 3
3,799,735	,,	,,	4	4 p. c. Con. Pref.	119—122	..	3 5 7	708,000	Stk.	Feb. 23	14	Kent	307—312	..	4 9 9
3,993,975	,,	Dec. 14	3	3 p. c. Con. Deb.	98—100	..	3 0 0	160,000	,,	,,	7	Do. New, 7 p. c. max. .	200—210	..	3 6 8
70,000	10	Nov. 15	8	Hongkong & China, Ltd.	13½—14½	..	5 10 4	1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max. .	295—300	..	3 10 0
3,800,000	Stk.	Nov. 15	10	Imperial Continental .	211—214	..	4 13 6	406,200	100	,,	8	Do. 7½ p. c. max. .	215—220	..	3 12 9
473,600	Stk.	Feb. 9	3½	Do. 3½ p. c. Deb. Red.	100—103	..	3 8 0	850,000	Stk.	Mar. 29	4	Do. 4 p. c. Deb. .	130—133	..	3 0 2
75,000	5	Dec. 14	6	Malta & Medn., Ltd. .	4½—5½	..	5 9 1	500,000	100	Feb. 23	13½	New River, New Shares	418—423	..	3 3 9
560,000	100	Apl. 2	5	Met. of (5 p. c. Deb.	105—109	−2	4 11 9	1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb. .	132—137	..	2 18 5
250,000	100	,,	4½	Melbourne (4½ p. c. Deb.	105—107	..	4 4 1	902,300	Stk.	Dec. 14	7½	South-wark and (Ord. . . . 7½ p. c. max.. 5 p. c. Pref.	200—205	..	3 13 2
541,320	20	Nov. 15	3	Monte Video, Ltd. . .	11—12	..	5 0 0	126,500	100	,,	7½		190—195	..	3 16 11
567,946	Stk.	Feb. 23	9½	Newc'tle & Gatesh'd Con.	215—220	..	4 4 1	489,200	Stk.	,,	5		160—165	..	3 0 7
299,855	Stk.	Dec. 29	8½	Do. 8½ p. c. Deb. .	104—107	..	3 5 5	1,019,585	,,	Apl. 11	4	Vauxhall (4 p. c. A Deb.	129—134*	..	2 19 9
150,000	5	Nov. 30	8	Oriental, Ltd. . . .	7—7½	..	5 6 8	1,155,066	Stk.	Dec. 14	10	West Middlesex . . .	288—293	..	3 8 3
135,000	5	,,	8	Do. New, £4 10s. pd.	6¼—6½	..	5 6 8	200,000	,,	,,	4½	Do. 4½ p. c. Deb. .	147—152	..	2 19 3
15,000	5	,,	8	Do. do. 1879, £1 pd.	1⅛—1¼	..	4 11 5	200,000	,,	Mar. 14	3	Do. 3 p. c. Deb. .	99—101	..	2 19 5

* Ex div.

*Ex div.

generally accepted that the storage should be equal to 25 days' supply, or (say) 33 million gallons; but the actual storage was 42 million gallons, which was an excess of 9 million gallons. This would add 8220 gallons daily to the supply, making a total of 112,250 gallons per day. In his opinion, the daily supply should be at least 20 gallons per head; so that the Company had only sufficient for 5612 persons out of the total of 6680 at present actually supplied. The inference was that the Company were enjoying an inflated income, for they were receiving water-rentals from a larger population than they could supply. This was proved also by the fact that the Company had only had a short supply in dry seasons; and in 1898 they had no water in their reservoirs. In 1897, the Company made an agreement with the Yeadon Water Company, which proved that they were incapable of supplying their population; and last year they had applied to Parliament for further powers. The present works, he considered, would not supply the population; and it was inevitable that they must be increased. The District Council, when they acquired the undertaking, would have to do this; and the burden would be far in excess of any present benefit derived from it. He should not consider any company well secured who had to go to another company to purchase water to carry out their statutory obligations. In his valuation, he had considered the question of the increased income anticipated by the re-valuation of the district. But, in his view, the difference would be very slight. The assessments at Horsforth were in excess of the other townships in the Union; and a great number of the houses had been built during the last ten or fifteen years, and were fully rated. It was only in the smaller and older property that there would be any increase. He had considered that the valuation should not be on the basis of the last year's income, because the income could be largely increased by the Company reducing their expenditure on maintenance; so he had taken as the basis of his valuation the revenue and expenditure for the last two years. The following was his valuation: Gross revenue: 1898, £1737; 1899, £1801. Working expenses: 1898, £839; 1899, £475. Bank interest: 1899, £47. Adding the payments made for Yeadon water (£405 in 1898, and £161 in 1899) left a net revenue of £1303 in 1898, and £1440 in 1899. The mean of two years' net profits, if the Company had sufficient water, would therefore be £1372. Discounting this in the ratio of 5612 (the number of people the Company's works could supply) to 6680 (the number of people, with the aid of the Yeadon water, actually supplied), left £1151 as the net revenue the works were capable of earning. At 22½ years' purchase, this would equal £25,898. To this must be added £195, profit on the Yeadon water for the period during which the agreement had to run, and 10 per cent. for compulsory sale, which would leave an amount of £28,702. But from this he deducted £1959 for expenditure on works immediately required, which would leave £26,743 as his valuation of the undertaking. He only gave 22½ years' purchase, because he thought this was all so badly secured an income was worth. To carry out their statutory obligations to supply the neighbourhood, the Company would have to incur considerable expenditure.

Cross-examined by Mr. Pember: He had valued two water companies; and in both cases he had taken 22½ years' purchase. One company obtained 22 years, and the other 27 years. When before Parliament last year, he had suggested a scheme for obtaining a further supply of water by pumping, which would only cost £7000 and yield up to 500,000 gallons a day. The water could be pumped for 4d. per 1000 gallons, if 100,000 gallons were pumped daily, or 2d. if 200,000 gallons were taken. The Company's mains which were defective were 2 and 3 inch ones, and could be renewed for about £396 a mile.

Re-examined: The number of years' purchase must depend upon the individual circumstances of each case; but he had never heard of a company who could not supply the necessary water obtaining such a sum as 33 years' purchase. If the Company had carried out their scheme of last year, and at their own estimate, the return on the capital would only be 2½ per cent.; and even if his plan were carried out, the cost would be £7000. In considering the rainfall, he personally thought the deduction of 15 inches for loss too low; but it was agreed on between Mr. Johnson and himself.

Mr. *E. M. Eaton* said he knew the Company's works and their drainage ground. He thought the area was slightly smaller than 215 acres; but he had taken that figure. As to the rainfalls, he had taken the rainfalls of the district by all the gauges which had been in existence for three dry years. It was usual to take from the normal rainfall one-fifth for the average of dry seasons. But as there were two gauges within a few miles of the reservoir, and as there had been three consecutive dry years in 1897, 1898, and 1899, he thought it far more accurate and reliable to take these actual gauges. The years named were not the three dryest years they could have chosen, so the estimate was rather over than under the mark. But taking these three years, he found that the rainfall had been at Oliver's Hill 20·12 inches in 1897, 29·36 inches in 1898, and 24·34 inches in 1899—or a mean of 24·61 inches. At Lawson's Wood, the rainfall in 1897 was 19·54 inches, in 1898 27·32 inches, and in 1899 22·84 inches—or a mean of 23·23 inches. Both gauges were at a lower level than the average of the gathering-ground. In a fairly undulating country like this, with no abrupt valley, it was usual to add 3 per cent. per 100 feet of elevation; so that 2·95 inches would have to be added to the Oliver's Hill gauge and 1·18 inches to the Lawson's Wood gauge. Thus adjusted, the gauges would be 27·56 and 24·41 inches respectively, or a mean of (say) 26 inches. If the three dryest years had been chosen, the figures would probably be reduced. The loss by evaporation and absorption would be not less than 15½ inches; but as 15 inches was the figure practically agreed and accepted, he had taken it, though he was quite satisfied that it was too small. Taking the area at 215 acres, there would be a daily flow of 146,630 gallons; or, deducting the 42,030 gallons compensation water, 104,600 gallons. He agreed that the capacity of the reservoirs was 9 million gallons more than the requirements; and this, spread over three years, would give 8220 gallons daily.

The Umpire asked why witness spread the 9 millions over three years.

Witness said this was the basis on which he always took it. The total population of the district was 7600. Those not supplied numbered 920; so that there were 6680 consumers, and the Company had only water for 5641 persons, or an average consumption of 20 gallons a day. The daily flow and the excess storage of the reservoirs would do that. The average

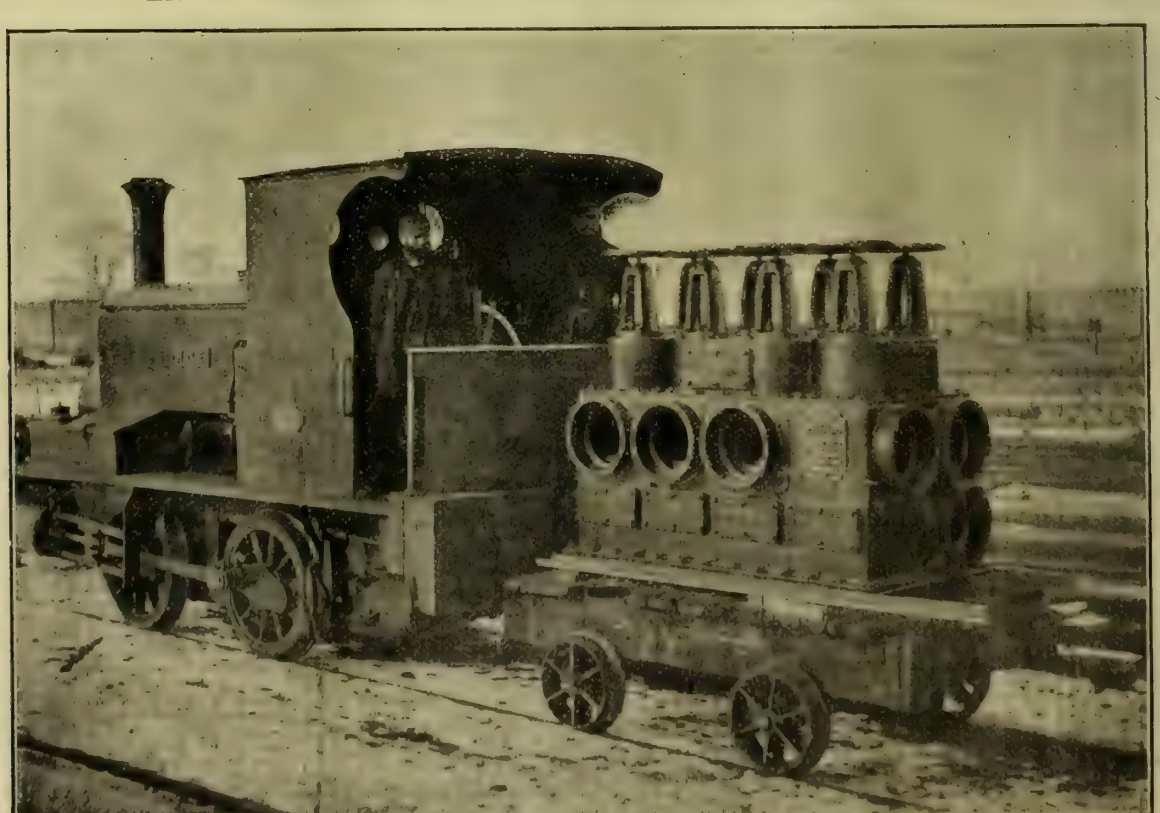
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of 20 gallons per day was an outside amount for a district like this, if the distributing pipes and mains had been in good condition; but many of the mains were old, and the loss from leakage would be considerable. That the Company could not do more, was shown by the arrangement they had made with Yeadon for a supply of water. But Yeadon would very shortly need all their water for themselves. He thought the agreement a very prudent one when it was made, because it was terminable; and before its termination the Yeadon Company would not be likely to need the water, and the payment by Horsforth would be found money to them. Witness then gave his valuation, which was made on the same basis as Mr. Silcock's. He found the mean of two years' net profits, if the Company had had sufficient water, to be £1372; but he discounted this in the ratio of 5641 (the population which could be supplied by the Company's works) to 6680 (the population actually supplied), which gave a net revenue earned by the Company's works of £1159. This, at 22½ years' purchase, would be worth £26,078. He gave only 22½ years, because the distributing mains of the Company were not perfect, and they were not able to supply from their own works the whole district. To this he added the three years' profit on the Yeadon water, £171, and 10 per cent. for compulsory sale—making a total of £28,874. But from this he deducted £2000 for repairs and renewals which were immediately necessary. The filter-beds and pure-water tanks were satisfactory, but the reservoir needed pointing and some small repairs to prevent waste, and the distributing apparatus greatly needed renewals.

Cross-examined by Mr. Pember: At Sheffield, he had been able to reduce the domestic supply to 13 or 13½ gallons per head per day.

Mr. Pember: I see, if we deduct the mortgage debt, you only allow us £21,934. That is making the shares below par. Would you consider that fair?

Witness thought it would be fair, if the Company had got below a par basis. He did not know that at the last sale the £10 shares had realized £18; but the market was very small, and there had been no sales for many years. The Harrogate Company obtained 36 years' purchase; but the conditions were very different from the present case. They had a large margin of revenue; and their works were in good order. This was proved by the fact that the Corporation now made a large profit from the undertaking. As to the Yeadon supply, their Engineer had not yet had a trial of three dry years with the new works.

Mr. Balfour Browne: And in the House, Mr. Gott's evidence was that Yeadon would not have any supply to spare in a few years.

In re-examination, witness said estimates of the rainfall were not always reliable; and they might have less water than they thought. It would, in all probability, cost £4000 to make the Company's distributing apparatus effective.

Mr. Balfour Browne said they had other evidence—the accountant and local witnesses—but he did not think it necessary to call them, as they did not dispute Mr. Blackburn's figures. In summing up, he said there were three points in dispute—What was the revenue? How was it secured? How had one to gauge the security? He contended that the revenue was not earned by the Company, but by the Company and the Yeadon agreement. The income could not be said to be secured; for the Company had often cut off the supply, and since 1898 had only kept up a constant supply by the aid of Yeadon water. As to the gathering-ground, he allowed that something had been done to regulate it; but the farmers might become lax; and they would have another stinging report from Dr. Lowe. The District Council, when they secured the works, had to contemplate an expenditure of at least £7000 to make the supply satisfactory; so that it was evident the undertaking could not be worth the estimate of the Company's witnesses. In conclusion, the learned Counsel repudiated altogether the income-tax valuation. He asked the Umpire, if he should add anything to the present income for any supposed prospective increase from the re-valuation, to give it as a special award, so that they might take the opinion of a Court of Law on the subject.

Mr. Pember briefly replied. He said all they had contended was that there was a presumption that the re-valuation would increase their water-rentals. As to the difference in the valuation, he urged that, even if it cost £2000 to put the mains and pipes in good condition, that would make no substantial difference in their estimate of the value of the Company's undertaking.

The proceedings then terminated; the Umpire reserving his award.

GAS-WORKS IMPROVEMENTS AND EXTENSIONS AT WALSALL.

As the outcome of a report by Mr. Corbet Woodall on the condition of the gas-works and plant at Walsall, the Gas Committee yesterday week recommended the Town Council that ten beds of retorts be re-set, at an estimated cost of £3500, and that two additional purifiers and a washer-scrubber be constructed, at a further estimated cost of £6000. The Committee also proposed to consider the erection of a carburetted water-gas plant and a new retort-house. Mr. Brownhill explained that the £6000 was an expenditure which the Council had previously sanctioned, and for which a loan had been obtained. The £3500 would have to be paid out of current account; but as the Committee had originally estimated they would have to spend £5200, there was some cause for gratification. Mr. Powell complained that members of the Council were not taken into the Gas Committee's confidence, and knew very little of what was being done at the works. Alderman Holden took the same view, and thought the Council were not justified in sanctioning the expenditure of large sums without more information. Mr. Brownhill denied that the Committee had held back any information from the Council, and the recommendations were approved. The Committee's minutes also referred to the resignation of the Gas Engineer and Manager (Mr. W. Gorse), and recommended the appointment of a successor at a salary of £500 a year.

The Gas, Water, and Electricity Committee of the Leigh Town Council have referred to a Sub-Committee estimates, prepared by the Gas Engineer, for extensions at the gas and electricity works; the total amounting to £13,500.

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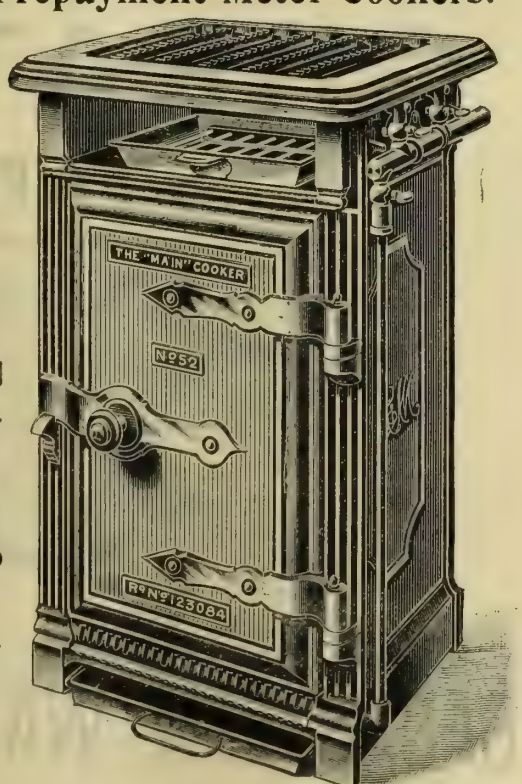


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PROPOSED MECHANICAL STOKING AT THE SOUTHPORT GAS-WORKS.

It is intended to equip the Southport Gas-Works with mechanical stoking machinery; and therefore Dr. Isherwood, in moving the adoption of the minutes of the Gas Committee at the meeting of the Corporation last Tuesday, felt constrained to give the members some information on the question. He said the subject had two aspects—the financial and the humanitarian. If they looked at the financial aspect, it presented them with something like the following: Each man they had employed was able to carbonize 2 tons of coal in an eight-hour shift, for which he obtained 5s.; so that the carbonizing wages cost about 2s. 6d. per ton. With the machinery the carbonizing could be done for 1s. 2d. per ton; and it cost something like 3d. per ton more—3 per cent. on the outlay, and 5 per cent. on the wear and tear; leaving a profit of 1s. 1d. per ton. If they called it roughly 1s. per ton, it meant, on 34,000 tons, a saving of £1700. In his opinion, this would not be the only profit that would result from introducing mechanical stoking. The retorts would be charged more evenly and quicker. He also spoke of the improved conditions under which the men worked with stoking machinery. The difficulty he saw about the matter was the question of the men. At present they had 27 men in each of three shifts, working in eight-hour shifts; so that 81 men were engaged in the carbonizing department. With mechanical stoking, the work could be done by 15 men per shift, which would mean in three shifts a reduction of 36 men. The Committee felt that, if they could come before the Council and show them that by this change they would save something like £1700 or £1800 a year, they might expect the other Committees of the Corporation would assist them in finding every man work. Some of the speakers who followed Dr. Isherwood congratulated the Gas Committee upon taking this step; but Alderman Booth felt it was a serious question for the men. He was of opinion that the Committee should withdraw the report until they were satisfied the men who would be displaced could be engaged on some other work at a decent wage. He moved that the section of the minutes referring to the introduction of stoking machinery should be deleted. This was not seconded; and the minutes were adopted.

THE INCREASE IN PRICE AT MIDDLESBROUGH.

The Middlesbrough Town Council, at their Meeting last Tuesday, discussed the proposals of the Gas Committee with reference to the raising of the price of the gas. Prior to the Council meeting, the Committee had decided to recommend the addition of 3d. per 1000 cubic feet to the price of gas for consumers within the borough, and 9d. increase outside the borough. This is extra to the recent increase of 2d. per 1000 cubic feet, and makes the price 3s. 3d. or 3s. 9d., with 10d. per 1000 feet discount if paid within a month. Mr. Baker objected to fixing the increase at this time of the year, and suggested waiting until the contracts for materials were made. They were given to understand in the estimate before them that £10,432 profit would be made in the year, making, with £1741 balance brought forward, about £12,000. Interest and redemption amounted to £11,750; and it was proposed to create a second or double redemption fund of £4000, called a reserve fund—making £15,750 to meet. This left a balance of £3750. They had been told that a penny increase per 1000 feet produced £2000; so that he thought a 2d. increase would meet their requirements. He questioned, however, the fairness of the estimated produce from the residuals. Last year the residuals had given back 65 per cent. of the cost of coal. Next year 50 per cent. would be a fair estimate, he thought; but he did not think the Accountant had given such credit. Coke had sold at 9s. per ton; and he felt sure that 13s. 4d. for the next year would be realized. Yet if only 3s. increase were noted, this would mean £3000 more. Alderman Bulmer said, although they had still a contract running for coal at 11s. per ton, their next contract could not be for less than 18s. 9d.; and it would be folly not to provide against it. Alderman Wilson, referring to the reserve fund being created, hailed it as a proper step, and hoped nothing would transpire to prevent them paying off capital as quickly as possible, and meeting the due interest and redemption. Alderman Hugh Bell concurred with the proposals for increasing the price. It had been assumed that coal would cost 17s., and the estimated cost of production at this moderate price was 2·8d. per 1000 feet. If they took Alderman Bulmer's figures of 18s. 9d., this would be 3·4d. per 1000 cubic feet. He agreed, however, that Mr. Baker's estimate of 50 per cent. return from residuals was very fair. But the position of the gas-works was a most awkward one. Originally, they borrowed on terms of repayment extending over 35 or 40 years. In 1877, they increased the period to 60 years—powers that were greatly in excess of what was reasonable. No gas plant had such a life. There was not a single stone left of the works of 1858, and even that with which they replaced the old works had since been pulled down and rebuilt. During the last 14 years, they had removed all the surface works then standing, although he did not say they would have to renew every 14 or 20 years. But to spread redemption over 60 years was wrong. By doubling the redemption fund, as Mr. Baker had termed it, they were reducing the term to 30 years. Had they gone further to make it 20 years, it would be well within the mark. The increases were confirmed.

ELECTRIC LIGHTING NOTES.

The Electricity Committee of St. Pancras Vestry last Wednesday reported to that body that the total loans incurred in providing the electric lighting system of the parish amounted to £236,780, of which £17,246 had been repaid. The capital expenditure in 1899 was £47,915; making a total of £288,146. The gross revenue for the year reached £44,880; and the net profit was £6841. Adding to this a balance of £1892 from 1898, there was a total net profit of £8734. Writing off £1600 for depreciation, the Committee proposed that £2000 be appropriated as a contribution to the lighting rate; that £4000 be transferred

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to the reserve account; and that the balance—£1134—be carried forward. Further, having regard to these satisfactory results, the Committee recommended that, after the next June quarter, the price for supplying the public lamps should be reduced from 4d. to 3d. per unit; the price to consumers not using the maximum demand indicator from 6d. to 5d. per unit; the price to consumers using this indicator from 6d. per unit for the first 1½ hours and 3d. per unit afterwards, to 6d. per unit for the first hour and 2d. per unit afterwards. At the same time the Committee recommended that the price to consumers requiring a supply for motive power, heating, &c., should be reduced from 3d. to 2d. per unit. The reductions recommended were to apply only to those supplied at 220 volts, and also to parties who were willing to change from 110 volts to this pressure when required by the Vestry. Dr. Walter Smith, in moving the adoption of the Commitee's report, stated that during the nine years the electric supply of the parish had been in the hands of the Vestry, they had made a net profit on the undertaking of £34,980. The motion was adopted.

On Wednesday, the 4th inst., Colonel J. T. Marsh, R.E., held an inquiry, on behalf of the Local Government Board, into an application by the Farnworth District Council for power to borrow £22,000 for electric lighting and traction purposes. Among those in attendance were the Assistant-Clerk (Mr. W. Tyldsley), the Engineer (Mr. Lacy), and the Architect (Mr. Stone). From the statements made by these gentlemen, who put in various plans, the generating station is intended to be built on some freehold land belonging to the District Council, the site measuring about 1570 square yards. There are to be three dynamos, each with a capacity of 120 kilowatts. Two of these will be for the supply of electricity for lighting and traction purposes; and the third kept in reserve. In addition to the machinery, there will be distributing mains in the compulsory area, for traction, lighting, &c. The population of Farnworth in 1891 was 23,758; and the present population is estimated at 26,000. The total rateable value of property is £76,995; the amount assessable to the district rate being £72,721. The outstanding debt of the Council under the Sanitary Acts amounts to £52,376. The area of the township is about 1502 acres. The Council own the present tram-lines; and the Bolton Corporation are supplying electricity for running the cars over them until some time in 1902. The Inspector having asked if any canvass had been made of the ratepayers, in order to see what consumers of electricity there would be, and as to the revenue therefrom, it was stated that there had been none; but an influential deputation, including millowners and other ratepayers, had waited upon the Council and urged them to provide electricity. A fairly good profit was expected to be made. There was no opposition to the project or to the present application. A term of 25 years was asked for the repayment of the principal and interest of the £22,000 required; it being pointed out that something like three years would elapse before there would be any return for the expenditure. The Inspector intimated that he would visit the site; and the inquiry then concluded.

The Tarapaca Water-Works Company, Limited, have announced a final dividend of 4½ per cent.; making 7½ per cent. for the past year.

THE FALMOUTH CORPORATION AND THE WATER-WORKS.

Another attempt is to be made by the Falmouth Town Council to obtain the consent of the ratepayers to the proposed purchase of the water-works. At a recent meeting of the Council, the Water Supply and Water Purchase Committee recommended that a Bill be introduced in the next session of Parliament to provide, among other things, for the purchase of the water-works, "if so decided." The recommendation was adopted, with the addition of the words "by the ratepayers" after "if so decided." At the same meeting, a letter was read from Mr. J. G. Cox, the Manager of the water-works, in reference to the report in which Dr. Buchanan, a Medical Inspector of the Local Government Board, connected a recent epidemic of typhoid fever with the water supply, and particularly with the intermittence of the service. In the letter, which dealt at length with the facts of the case, Mr. Cox said the Company had conferred a boon on the town for many years, and for more than half-a-century, with the exception of last summer, the health of the place had been good and the death-rate low. The persistent and unwarrantable attempt to connect the cause of that exception with the Company's water, and so depreciate the value of the undertaking, utterly failed; being founded on misrepresentation and what was not true, and resulted only in injury to the neighbourhood and loss to the inhabitants, who disapproved of the attacks. The Company had spent money without stint to improve the quantity and quality of the supply, and it had never been proved to be impure or unwholesome. The Directors had introduced most effective sand filtration. Dr. Buchanan's theories were an entire misconception of the facts of the case. It was decided to inform the Company, in reply, that the Council did not consider that the recommendations of Dr. Buchanan had been satisfactorily dealt with. There was need for frequent and systematic inspection of the sources of supply, for greater pressure on the sanitary authority through whose district the streams pass, and for the remedying of defects in the filtration which had been already pointed out. The Council considered it most important that there should be a continuous supply of water throughout the borough, as an intermittent supply was, in the opinion of Dr. Buchanan, the cause of insuction of polluted air into the water-pipes. Another matter calling for alteration was the lack of pressure on the high-level service.

The "Builder" on the Testing of Gas.—Referring to the increase in the price of gas in London, the "Builder" says: "The great increase in the price of coal will probably necessitate a general rise in gas prices in many parts of the kingdom, and will doubtless result in the admixture of even larger proportions of carburetted water gas with the coal gas than are already employed. Having regard to the fact that carburetted water gas has a lower heating value and a higher specific gravity than coal gas of the same illuminating power, we may again draw attention to the desirability of introducing a heating-power test in the series of tests carried out by the official gas examiners, and to the fact that gas appliances adapted to burn coal gas are not fitted to burn the heavier gas unless it be supplied to the burners under a greater pressure."

LONDON.
WARRINGTON.
STRATFORD.
PLYMOUTH.



DUBLIN.
BOURNEMOUTH.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Though Selkirk is on the western border of the Waverley district, and is not very convenient of access to many of the members, there was a gratifying attendance at the meeting of the Waverley Association of Gas Managers there on Thursday. And if the attendance was good, so were the proceedings. The subjects dealt with were within the reach of all; and the speaking was spontaneous. Information was freely given—a circumstance which drew from Mr. Bell, of Dalkeith, the remark that it used to be very different in the days before the establishment of Gas Managers' Associations. Mr. Bell is full of reminiscences of the early days of gas supply. At the dinner table, he was able to tell that Selkirk was the first of all the towns in the south of Scotland to adopt gas lighting. There was living in the town a shoemaker—by name John Young—who began to make gas for his own use. He manufactured his own gas-pipes, of tin; and he employed a tub for a gasholder tank, and a butter firkin for a gasholder. Mr. Young was afterwards Manager of the Selkirk Gas-Works, and latterly at Dalkeith, and was widely known and respected among gas managers. Another incident of interest came out at the dinner. Ex-Provost Roberts, of Selkirk, who is Chairman of the Selkirk Gas Company, mentioned that, although they had gas-works which were worth about £25,000, they had been so largely built and renewed out of revenue that the capital of the Company was only £4500. Thus the self-denial of the shareholders in the past makes it easy to get along now when competition has arisen. Of how few companies can the same be said. At the meeting, Mr. Bell spoke upon the subject of meter-unions. He takes the same view as I did last week—that it is the gas managers themselves who are responsible for the non-use of the standard meter-unions. The standards have been made and purchased by the Scotch meter makers, ready for use; but no one has given an order for unions made according to them. Is it fear of the Board of Trade which keeps managers back? Surely it need not be. The Board of Trade have never interfered while higgledy-piggledy orders have been given. If they were to interfere when an endeavour to produce uniformity is being made, they would do an ungracious—indeed, an unjust—act. A question in the House of Commons would soon elicit whether there was any likelihood of the Board of Trade putting a stumbling-block in the way of standardizing meter-unions in accordance with the arrangements come to between the gas managers and meter makers in Scotland. I am sure that Sir William Arrol would be quite willing to put any such question. The giving of burners free seems to be almost universal in the Waverley district. Any such action must be entirely *ex gratia*. No company or corporation can resolve to make the receipt of such a supply compulsory. All they can do is to proffer the burners and recommend them; offering, perhaps, at the same time to fix them. If it can be done of consent, there is no harm in giving free burners; but to go further would excite suspicion, and the means would then defeat the end. In the homely towns in the Waverley district, the giving of free burners seems to work well.

Gas managers in the Waverley district are not so enthusiastic as were their colleagues who spoke at Glasgow, in favour of a reduction in the illuminating power of the gas they supply. They are not being pressed much by electric light. There is not a public installation in any of the towns in the district; and none is as yet proposed. They have been accustomed to use the best coal; and they have seen it dearer than it is now. If it came down from high prices before, it may do so again; and in the meantime, the gas undertakings will in a sense "muddle through." This seems to be the position of the managers in the Waverley district; their expectations being probably considerably heightened by the knowledge of the cost it would be to them to alter their works to suit a supply of lower-grade gas. Most likely they are right, so far as they themselves are concerned. It may not cost so much, relatively, in larger towns to reduce the illuminating power; and if a few of them were to go in for the reduction, then the remaining cannel would be available for smaller places, such as the Waverley towns. The gas undertakings in them would thus have a new lease of life.

Mr. Hubert Pooley, of Dunfermline, has presented to his Committee an exhaustive report upon the subject of the extension of the carbonizing plant in the gas-works. He describes the three methods by which increased output may be obtained—by horizontal retorts, by sloping retorts, and by carburetted water gas. The extent to which he suggests that the retort-bench should be added to is four arches, holding eight settings of retorts. With horizontal retorts, the cost he estimates at £2500; and the working expenses per week, at £255, less £84 for residuals—leaving the working expenses at £171, which is equal to an average for the year of 12·23d. per 1000 cubic feet. Sloping retorts of 20 feet in length, he estimates to cost £130 each, inclusive of everything connected with the plant; but as it is necessary to have a height of wall to the eaves of 51 feet, and at Dunfermline the present height is only 39 feet, an extra outlay of £580 would be entailed in raising the walls and roof. The total cost would be £4740; and the working expenses for a week would be £237, less £84 for residuals; leaving the net working expenses at £153. The average working cost would be 12·23d. per 1000 cubic feet. Carburetted water-gas plant capable of producing 200,000 cubic feet of gas per day would cost £2300; but a relief holder, oil storage, and other accessories would be required, which would raise the total cost to £4700. The working cost, to enrich coal gas to 22·59-candle power, would be 20·89d. per 1000 cubic feet. He therefore considers that, with oil at its present value, it is quite out of the question to adopt carburetted water gas as a means of increasing the producing capacity of the works. The estimated saving by the adoption of inclined retorts would be 0·72d. per 1000 cubic feet, which, on a total manufacture of 83 million cubic feet a year, would amount to £249; but interest and sinking fund, at the rate of 6 per cent., would equal £143—leaving a net saving of £106. The conclusion Mr. Pooley comes to is that, considering the present state of the capital account, and that the whole appearance of the works would be changed for the worse by the alterations to the structure of the retort-house, a saving of £106 per annum would not justify the heavy extra cost of sloping retorts, more especially as there had been no allowance made for depreciation; and he does not hesitate to strongly recommend the

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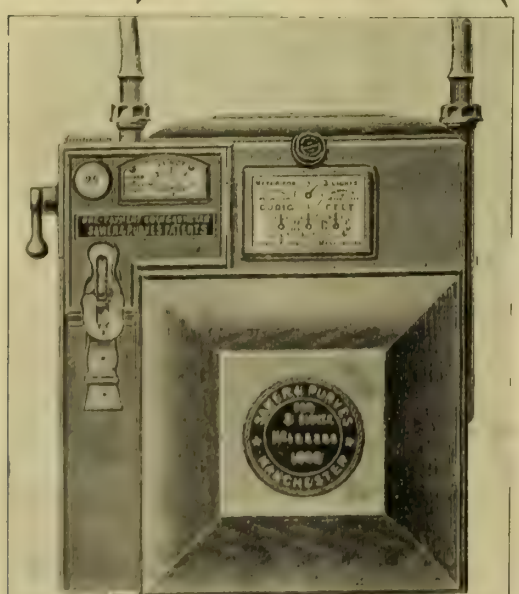
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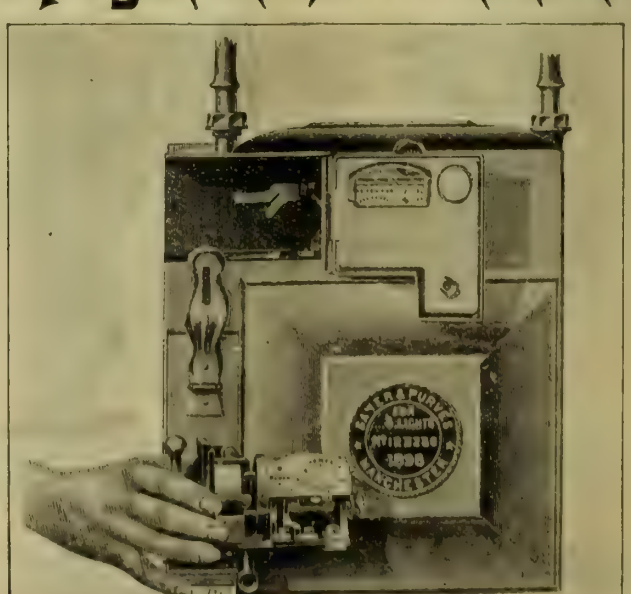
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Commissioners to proceed with the erection of horizontal retorts with as little delay as possible. The report comes up for consideration at the next meeting of the Commissioners. The matter is made so plain to them, that they should have no difficulty in determining what to do.

What is being treated by the newspapers as a "scene" occurred at a meeting of the Perth Gas Commission this week. Bailie Taylor gave notice of a motion in the following terms: "That, owing to some of the gas schemes for which the Commissioners are applying for a Provisional Order to meet the cost not having been considered by the Gas-Works Committee, the Commissioners rescind the resolution passed on the 8th inst, and delay applying for additional borrowing powers, and remit the whole question back to the Gas-Works Committee." Lord Provost Macgregor said that he had considered the question, and, in the public interest, he was bound to hold that the motion was incompetent. They had, after hearing the Convener's statement, unanimously resolved to go on with the application for a Provisional Order; and they could not now go back upon that. Under their resolution, they had incurred liabilities, and were in process of proceeding with the works, on the strength of getting the money. The "scene" then arose—Bailie Taylor and Mr. Anderson both taking part in it, in the hope of getting the Lord Provost to re-consider his ruling. In this, they were unsuccessful; and the incident ended without result. In the circumstances, the Lord Provost could give no other ruling; but it is somewhat curious that the Commissioners should have resolved to go on with a large scheme without (as a body) considering it. The situation bears out what I said a fortnight ago—that Mr. Wilson was not asked to report upon the new works. The Convener of the Works Committee seems to have had notions of his own regarding what should be provided; and a report from the Manager, or a discussion in the Commission, might disturb his plans. It is easy to perceive how difficult it must have been to deal with such people. So marked a departure from the method followed by all other bodies was, almost to a certainty, bound to end in failure somewhere.

A flagrant instance of unlovely parochialism has been manifested by the Town Council of Stirling in their dealing with the Stirling Gaslight Company. In fixing the valuation, they (to use the common phrase) put it on. To them it mattered nothing that the law has laid down that gas undertakings are to be valued according to a fixed principle. The Gas Company, however, were happily able to find relief, in the services of the Public Assessor of Canals and Railways. Even he did not quite please the Company, who thereupon made representations to the Assessor. As a result, the Assessor struck off about £200 from his valuation—leaving it at £2939. Then came the turn of the Town Council to be displeased; and they appointed a deputation to wait upon the Assessor regarding the subject. So far from success attending the efforts of the deputation, the Assessor was able to convince them of the justice of his valuation. This week the deputation reported to the Town Council, recommending that no appeal be lodged against the decision of the Assessor; and the Council agreed to this course. If this should prove to be the last of the "dog in the manger" policy of the Town Council, there should be a feeling of relief all round.

I wrote last autumn about the proposed erection of a new gasholder at Banff, upon ground recovered from the sea. At that time, it was expected that the work could be gone on with promptly—weather permitting; but the ways of municipalities are not of the electric order, and it is only now that the Gas Company have been able to secure the space upon which to erect their gasholder. The Corporation were obliged to go through the form of an auction of the site. It is only a bit of rock, which will require a good deal of labour to chip away before it can be available for any purpose; and there were not likely to be any competitors for it. It could not, however, be given even at a fair rate, without competition being afforded; and the Gas Company have consequently had to wait upon the "dread" forms of law.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April* 12.

Sulphate of Ammonia.—The tone of the market is again weaker; and a further decline in values has to be recorded. There continues to be good inquiry; but buyers' ideas of price are constantly receding, and the bulk of new business has been limited. Supplies are not excessive; but makers have displayed greater anxiety to sell, and have more freely accepted reduced prices. The closing quotations are £11 10s. to £11 12s. 6d. per ton f.o.b. at the ports. There is very little interest in the forward position; and no important business is reported.

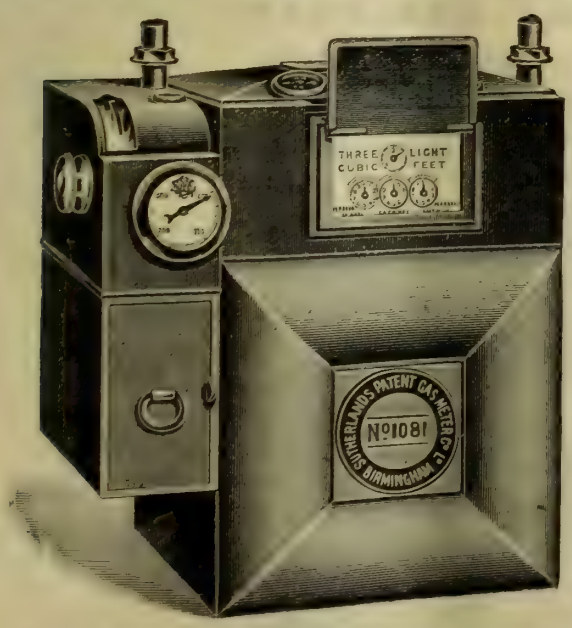
Nitrate of Soda is easier on spot, owing to arrivals; the quotations being 8s. 7½d. to 8s. 9d. per cwt., according to quality. The general position is, however, unchanged.

LONDON, *April* 12.

Tar Products.—The "slump" in benzols goes from bad to worse, A very large business in 90's is reported at 4½d., less 2½ per cent.. naked at makers' works. Remembering that a few years ago benzol was sold at 15s. per gallon, this remarkable fall in price, especially having regard to the diversified uses to which benzol may be applied, is phenomenal. There can be no doubt, however, that at these low prices new uses for benzol will be found, and the continually increasing production absorbed. If it were not that large quantities of specially prepared benzol are now being utilized for gas enrichment, manufacturers would be in a helpless position. There is a little more inquiry for creosote and heavy oils. The production of these is now falling off rapidly; and the consumption of them is simultaneously increasing with the better weather—particularly in the direction of pickling timber. Carbolic acid is decidedly in better tone; and it is not unlikely that, should the present demand continue, prices may be advanced. Solvent naphtha is at last seriously prejudiced by the low prices of benzol. It is to-day quoted at a lower figure than it has been offered at for many years; and even at that price, it is difficult to find buyers. Anthracene is again more interesting, and the business in it is resuming more normal features. The future of this product is more hopeful, especially as it is now seen that the production is rapidly falling off.

Average quotations during the week are: Tar, 17s. 6d. to 27s. 6d.

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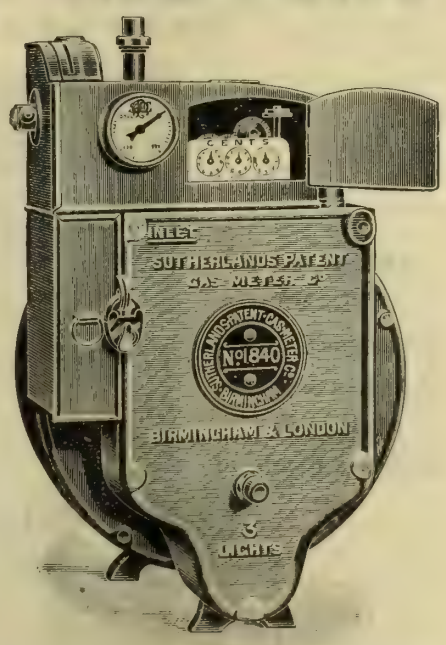
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Sulphate of Ammonia.—This market is again reported weaker; and curiously this is in face of lessened production, absence of stocks in makers' hands, and increased shipments. Considerable variation exists in respect to the ports of shipment; Liverpool latterly being the best market, owing doubtless to its better facilities for shipment. The average of all the ports will show an amount of £11 15s. per ton, less 3½ per cent.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—During the past week, there has been perhaps rather more inquiry for all descriptions of fuel, owing to merchants and consumers getting in supplies prior to the holiday stoppages, which in some cases have extended over three or four days. There is a generally strong tone all through the market, with a continued shortness of supplies. The better qualities of round coal have so far met with a ready sale for house-fire purposes, which has prevented collieries putting down anything into stock. This strengthens the probability of present maximum prices being maintained during the ensuing summer. Inland requirements for steam and forge purposes show no falling off; and the output of common round coals is barely keeping up with deliveries to meet requirements of customers, with the result that prices are not only firm but tend to harden on recent rates. The advance on engine classes of fuel in the Manchester district, reported last week, is being obtained without difficulty, but so far has not been followed outside the immediate neighbourhood—including Bolton, Oldham, Tyldesley, and Leigh—the West Lancashire collieries for the present holding back from any further upward move, as they consider that their prices were previously much above the level of those ruling in the Manchester district. At the pit, general quotations may be given as firm at about 14s. 6d. to 15s. 6d. per ton for best Wigan Arley, 13s. to 14s. for Pemberton four-feet and seconds Arley, 12s. 6d. to 13s. for common round coals, 10s. to 10s. 6d. for medium sorts of slack, up to 11s. and 11s. 3d. for the very best qualities. In the shipping trade, the slackening off recently reported is still noticeable; buyers in many cases holding back from paying present rates. But the Lancashire collieries hold firmly to their minimum basis of 16s. per ton for steam coal, delivered at the ports on the Mersey. Coke makers are getting the advanced rates readily, and are still behindhand with deliveries; but it is hoped that the holiday stoppages of works may possibly place them in a better position in this respect. Ordinary furnace cokes are fetching from 24s. to 25s. per ton, and foundry descriptions, according to quality, from 29s. up to 32s. at the ovens.

Northern Coal Trade.—The demand for coal has been stronger the last few days, in preparation for the holidays; and prices have been firmer. Shipments have been very heavy—especially to the near Continental ports; and, with a full home demand, there is the taking up of the large output. For best Northumbrian steam coals, the quotation is now about 18s. per ton f.o.b.; while steam smalls, which are scarce, are from 11s. to 12s. per ton. In gas coals, it is believed that parts of the large contracts for London have been given out; and though no details are yet officially procurable, it is thought that the price is equal to from 15s. 9d. to 16s. per ton f.o.b. For occasional cargoes, the quotation is 16s. to 17s. per ton. In the coke trade, demand is active; and prices are very firm—exports being heavier. For gas coke, there is a brisk demand; and as there is now a general reduction in the output, the stocks have been reduced, and the prices may be said to be firm on the basis of about 16s. per ton f.o.b.

Scotch Coal Trade.—The demand for all classes continues good; and prices are easily maintained—an advance of about 6d. per ton being obtainable for forward contracting. The Baltic trade has begun, which will increase the demand. The prices quoted are: Main, 14s. to 14s. 3d. per ton f.o.b. Glasgow; ell, 15s. to 16s.; and splint, 15s. to 16s. The shipments for the week amounted to 195,850 tons—a decrease of 10,646 tons upon the preceding week, but an increase of 34,496 tons upon the corresponding week. For the year to date, the total shipments have been 2,586,871 tons—an increase upon the same period of last year of 633,556 tons.

Singapore Gas Company, Limited.—The Directors' report for the year ended Dec. 31, to be presented to the shareholders at the ordinary annual general meeting on the 26th inst., states that the accounts show a similar result to those of the previous year. The profit was £3512, which, added to £357 brought forward from the previous year, makes a total of £3869 After deducting £1524 paid as interim dividend and debenture interest a balance is left of £2345, out of which the Directors recommend the payment of a dividend, for the last six months, of 4 per cent. per annum—making 3½ per cent. for the year, and leaving a balance of £1059 to carry forward.

Italian Gas Company.—At the recent general meeting of this Company, the Directors reported that the additional capital sanctioned at the last meeting made it possible to purchase the Palermo and Girgenti Gas-Works and all the shares of the Milan Gas Industry, likewise those of the Ferrara Company. As was anticipated last year, the considerable extension of the Company's property has greatly increased their former power, and enabled them to resist all adverse influences, the most serious of which is the price of coal. As regards the operation of the individual works, those at Bergamo, Pavia, Tortona, and Palermo all showed a considerable increase in the consumption of gas; and the Company intended to continually make improvements in these works. At Milan and Ferrara things were also satisfactory. The balance-sheet for the past year was submitted. The total receipts amounted to 26,399,002 lire, and the profit allowed of the payment of a dividend of 30 lire per share, 15 lire of which had been paid.

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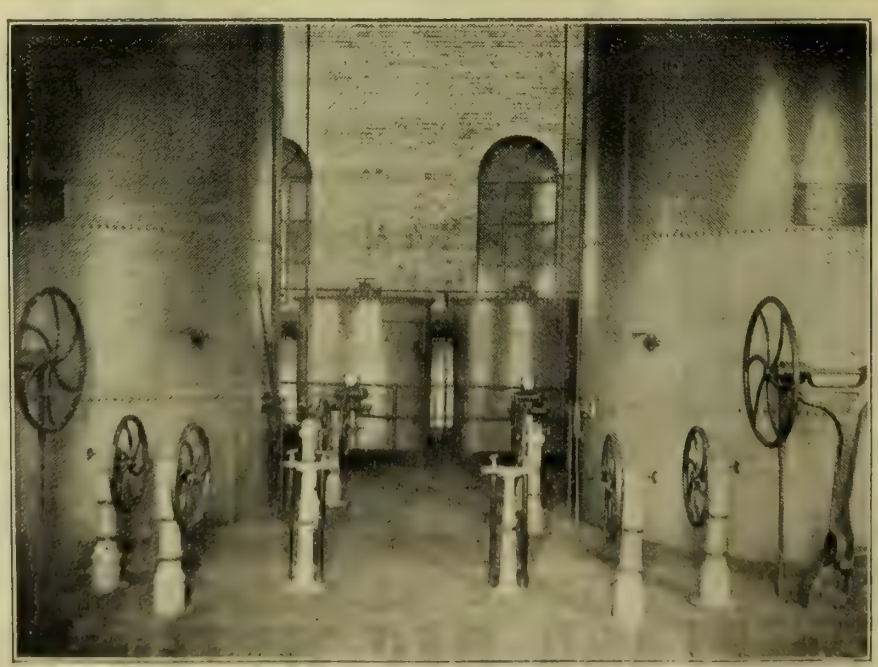
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Water Supply at Less than Cost Price for Bradford.—At the meeting of the Bradford City Council last Tuesday, Mr. E. R. Hartley inquired as to the truth of a published statement that for a period three firms had been receiving water at a daily loss to the Corporation of £375. Alderman Holdsworth, in reply, admitted that there were more than 143 consumers who obtained water at less than cost price. It would, however, be unwise to burden these people so that they could not compete with firms in other towns; but the Water Committee were going thoroughly into the whole question of prices. As to the loss of £375 a day referred to by Mr. Hartley, that was hardly a fact; but he did admit, if everybody paid 9d. per 1000 gallons, there would be a big profit.

Plymstock Water Supply.—Considerable rejoicing took place at Plymstock last Saturday week on the occasion of the inauguration of a supply of water for the village. The subject had been under consideration for several years, when the Rural District Council consulted Mr. H. Francis, the Engineer of the Devonport Water-Works, and on his advice decided to further draw upon the springs which supply Plympton, and to construct a reservoir for the separate service of the village. About 11 miles of mains have been laid. A covered reservoir has been constructed 59 feet long, 40 feet wide, and 12 feet deep, with a water depth of 10 ft. 3 in.; giving a capacity of upwards of 100,000 gallons. The original estimate of the cost was £7500; but the mains were extended beyond the original intention, at a further cost of £800. Applications have been received for more than 300 supplies; and already two-thirds of the interest and sinking fund are provided for. Mr. J. J. M'Andrew, the Chairman of the Plympton Rural District Council, publicly turned on the water, and expressed the opinion that the fact that the district was assured of an abundant supply would have a great influence upon its future prosperity.

Hydro-Incandescent Gas-Light Company, Limited.—At the first general meeting of this Company, held at the Westminster Palace Hotel last Tuesday, under the presidency of Mr. G. T. Augspurg, the accounts presented, covering a period of nineteen months (May 24, 1898, to Dec. 31, 1899), showed a debit balance of £7724, including £862 for Directors' fees, which it had been decided to waive. The Chairman, reviewing the history of the undertaking, stated that the prospectus was issued with the approval and sanction of the Welsbach Company, and the Company was not formed to exploit and work the patents they acquired, but only to exercise control over the proper working of a licence given to the Incandescent Gas-Light Company, Limited. The Company had given up the option granted to them by the International Hydro Company of Hamburg to the Welsbach Company against a cash payment of £5000 and the undertaking, for a minimum period of five years, to manufacture and sell the hydro apparatus—paying over 50 per cent. of the gross profits. It was solely owing to the reliance placed by the Directors on the proper carrying out of this agreement that they deemed it advisable to go to allotment on the small amount subscribed by the shareholders. In the opinion of the Board, the Welsbach Company had not complied with the terms of the agreement; and on this account the Directors were claiming £5000 damages for breach of contract. The Company were now in a position to acquire on very moderate terms what they considered to be the best compressor among all its rivals, not only as regarded compactness, but also as far as cost and efficiency were concerned. The Directors had deemed it advisable to secure options of some valuable inventions, which would, in their opinion, constitute an additional source of revenue. In order, however, to take up and efficiently work these patents, further capital was required; and the Board had been taking steps to reconstruct the Company or to form an entirely new one to purchase all or a portion of the inventions. For the purpose of further considering these proposals, he requested the meeting to appoint a small Committee to confer with the Board and the representatives of the Hamburg Company. A discussion ensued, at the close of which a Committee was appointed to investigate the affairs of the Company, and to confer with the Directors regarding the future.

Gas Explosion at a Devonport Barracks.—An explosion of gas occurred at the South Raglan Barracks, Devonport, last Tuesday evening, causing serious injury to one soldier, and also hurting two others. A private named Purnell went to light a gas-jet at the top of a flight of stairs, when flame burst out at the base of the bracket, and was followed almost immediately by an explosion which threw him down the stairs, blew down a partition dividing the landing from a room occupied by non-commissioned officers, and did considerable damage to the building. There was no suspicion of an escape before the explosion took place; but there seems to have been a considerable accumulation of gas in the room adjoining the landing. Purnell, who sustained a fracture of the skull and other injuries, was taken to the hospital, and the two other soldiers were placed under treatment.

The Remodelling of the Teignmouth Gas-Works.—At a special meeting of the Teignmouth District Council last Tuesday, plans for extending and remodelling the gas-works were considered. Mr. C. Jones explained that a scheme prepared by the late Manager (Mr. J. Portbury) would entail an outlay of £1592; but the plans had since been revised, and in their new form it would mean an expenditure of about £2123. The carrying out of this scheme would produce entirely new gas-works. The plans had been passed and approved by the Local Government Board, and £1500 advanced, £500 of which had been spent in the construction of the new gasholder. The second set of plans submitted were from the present Manager, Mr. Stormonth, who disagreed entirely with those which had been approved. His idea was that the works were conducted on the most costly system known; that the gas was produced on a scale calling for a high price to the consumer (4s. 2d. per 1000 cubic feet), and that the residuals did not produce as much as they should do. By remodelling the works according to his plans, they would carbonize more than double the quantity of coal with less labour and cost, and gas would soon be sold cheaper, and the cost of the works would be about £1300. It was resolved to accept Mr. Stormonth's plans, subject to the approval of the Local Government Board.

The Sculcoates Rural District Council have resolved to apply for the permission of the Local Government Board to the borrowing of £5081 for the purpose of constructing water-works.

The costs incurred by the Yeadon, Guiseley, and Rawdon District Councils in opposing the Gas Company's Bill amount, after taxation, to £1050; Yeadon's proportion—£544—being equal to a rate of nearly 8d. in the pound.

The Campbell Gas-Engine Company, of Halifax, are supplying, to the order of the War Department, portable oil-engines, with dynamo and search-light apparatus, which the engines are intended to work, for use in the campaign in South Africa.

With reference to the article on the supply of gas and electricity in Manchester, which appeared on p. 956 of the last issue of the "JOURNAL," we are asked by Messrs. Alexander Wright and Co., Limited, to state that the order for the standard gasholders to be supplied to the Rochdale Road and Gaythorn works was placed with them, as was also that for the maintenance of the photometers, for the ensuing year.

Our readers are aware that the whole of the buildings on the estate of the Prince of Wales at Sandringham, including Sandringham House and York Cottage (the residence of the Duke of York), have been lighted with the latest pattern lamps of the Welsbach Incandescent Gas Light Company, Limited—principally the new burners of small sizes. Gas had not previously been used in the private apartments of His Royal Highness—the building having been electrically lighted. But the incandescent gas system has been carried out in conjunction with the use in many of the rooms of the "Surprise" pendants of Messrs Best and Lloyd, with the result that very effective lighting combined with facility of changing the position of the light-centre has been secured.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

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First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
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Regenerator or other Furnaces erected to Engineers' own Designs. Best Work Guaranteed. Please write for Estimates.

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Telegraphic Address: "SATURATORS, BOLTON."

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Telegraphic Address: "PORTER, LINCOLN."
[For Illustrated Advertisement, See April 3, p. 898.

WANTED, good Retort Setters immediately.
Apply to JONAS DRAKE & SON, Gas Engineers, Ovenden, HALIFAX.

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WANTED, by the Cheltenham Gas Company, an experienced DRAUGHTSMAN.
Apply, stating Age, and Salary expected, to Mr. R. O. PATERSON, Engineer and Manager.

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Apply, stating past Experience and Salary required, to Box 50, "Courier" Office, TUNBRIDGE WELLS.

WANTED, a Working Foreman for Water and Gas Companies. Water Supply by Gravitation. Make of Gas about 12 millions per annum. One accustomed to Generator Furnaces preferred. Must have a thorough knowledge of Main and Service Laying and Fitting. Salary £2 per week, with House, Coal, Gas, and Water free.
Apply, stating Age, number in family, and with *copies* of recent Testimonials, to GEO. E. WOODFORD, RUABON

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WANTED by the Directors of this Com-pany an experienced and competent ENGINEER AND MANAGER to take entire charge of their Works (make about 550 million cubic feet). He must have a practical knowledge of the Manufacture of Coal and Water Gas and Sulphate of Ammonia upon the best modern systems. The person appointed to devote the whole of his time to the duties, and be able to design and carry out Alterations and Extensions of Plant.
Applications to be by letter, marked "Engineer," stating Age, Salary required, Training and Experience, accompanied by *copies* of three Testimonials of recent date, addressed to the CHAIRMAN, at the Company's Office, Friar Gate, DERBY, on or before May 8, 1900.

SHARES wanted in C. & W. Walker, Limited, either Preference or Ordinary.
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THOMAS WILSON,
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Gas-Works, Coatbridge, April 12, 1900.

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OWING to the adoption of Regenerator Settings, the Shanklin Gas Company, Limited, have now FOR DISPOSAL the following, in first-class condition:—
Three Sections of HYDRAULIC MAINS, two for Beds of six Retorts, and one for Bed of five Retorts; 17 OVAL MOUTHPIECES, 21 in. by 16 in., with all Cross-Bars, Lugs, &c., complete; all the necessary ASCENSION-PIPES, BENDS, and BRIDGE-PIPES, 6-inch SEAL-VALVES, 8-inch CAST-IRON FOUL MAIN and TAR-MAIN, with TEES, &c., to suit.
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FRANK C. TAYLOR,
Engineer and Secretary.
Office of the Company,
Languard Road, Shanklin, I.W

COUNTY BOROUGH OF OLDHAM.
THE Oldham Corporation Gas-Works Committee are prepared to receive TENDERS for the supply of about 146,000 Tons of COAL and CANNEL required by them during the Year ending the 31st of May, 1901.
Specifications and Forms of Tender can be obtained on application to Mr. Arthur Andrew, Gas and Water Offices, Oldham, to whom Tenders are to be sent on or before Tuesday, the 8th of May.
A. NICHOLSON,
Town Clerk.
Oldham,
April 12, 1900.

WALLASEY URBAN DISTRICT COUNCIL.
CONTRACTS FOR STORES.
THE Wallasey Urban District Council are prepared to receive TENDERS to supply, for a period of One Year, from the 30th of June next, the following amongst other ARTICLES, being the principal stores required for the Gas, Water, and Electrical Department:—

Stopcocks and Main Taps.	Common Bricks (Machine and Hand Made.
Fire-Bricks and Retorts.	Ferrules.
Iron and Steel.	Fire Spades and Shovels.
Lead & Wrought-Iron Pipes.	Oils, &c.
Cotton Waste.	Cast-Iron Main Pipes.
Copper Lamps.	Gas, Water, and Electricity Meters.
Lamp Columns (Gas and Electric).	Hydrants and Valves.
Switches and Cut-outs.	Cables and Boxes.
	Ring Burners & Tubing.

Further Particulars, with Forms of Tender, may be obtained, and Samples inspected, on application at the Engineer's Office, at the Works, Great Float, near Birkenhead.
Sealed Tenders, which must be on the printed Forms, endorsed "Gas, &c., Committee, Tender for Principal Stores," and addressed to the undersigned, to be delivered by post not later than Monday, the 23rd inst.
The successful Contractors will be required to enter into Contracts and Bonds, with approved sureties, for the due completion of their Contracts.
The Council do not bind themselves to accept the lowest or any Tender, and reserve to themselves the power to divide any Tender.
By order,
H. W. COOK,
Clerk to the Council.
Public Offices, Egremont, Cheshire,
April 10, 1900.

TYNEMOUTH GAS COMPANY, NORTH SHIELDS.
TO BUILDERS AND CONTRACTORS.
TENDERS FOR RETORT-HOUSE AND CHIMNEYS.
THE Directors of Tynemouth Gas Com-pany invite TENDERS for the Building of a RETORT-HOUSE, 294 ft. long by 74 ft. 9 in. wide inside, and two CHIMNEY SHAFTS, each 100 feet high, to be erected at the Gas-Works, North Shields.
Arrangement and full Detail Drawings, Specification, and Quantities may be seen at the Engineer's Office, on and after Wednesday, the 18th inst., upon payment of £5 5s., which will be returned upon receipt of a *bonâ-fide* Tender.
Tenders, addressed to the undersigned, to be delivered not later than Tuesday, May 1, 1900.
(Signed) W. HARDIE,
Engineer and Manager.
Gas-Works, North Shields,
April 12, 1900.

BOROUGH OF WARRINGTON.
(GAS DEPARTMENT.)
THE Gas Committee of the above Borough are prepared to receive TENDERS for the following—viz.,
(1) Supplying and Erecting Six SETTINGS OF RETORTS.
(2) RETORTS, FIRE-BRICKS, and CLAY.
(3) 1000 to 8000 Tons of CANNEL.
(4) 50,000 Gallons (or part) of BENZOL for Gas Enrichment.
Further Particulars can be obtained on application to Mr. W. S. Haddock, Engineer to the Works.
Sealed Tenders, endorsed "Tender for Retorts," &c., as the case may be, addressed to the Chairman, Gas-Works, Warrington, must be sent in not later than the 27th inst.
FREDK. TAYLOR,
Secretary.
Gas Offices, Warrington,
April 10, 1900.

GLOUCESTER GASLIGHT COMPANY.
GASHOLDER TANK.
THE Directors of the above Company invite TENDERS for the construction of a BRICK GASHOLDER TANK (about 156 feet in diameter and about 41 feet deep) at their Works, Hempsted.
Plans may be seen, and Specifications obtained, on application to the Company's Engineer, Mr. W. S. Morland, Gas-Works, Hempsted, near Gloucester, and on payment of £1 1s, which will be returned on the receipt of a *bond-fide* Tender.
Sealed Tenders, endorsed "Tender for Gasholder Tank," to be sent to the undersigned at the Gas Offices, Eastgate Street, Gloucester, not later than Tuesday, the 1st day of May, 1900.
The Directors do not bind themselves to accept the lowest or any Tender.
WILLIAM E. VINSON,
Secretary.
Gas Offices, Gloucester,
April 5, 1900.

CITY OF LEEDS.
(GAS DEPARTMENT.)
TENDERS required as below—
For CAST-IRON PIPES, BENDS, TEES, SYPHON WELLS, and other IRREGULAR PIPES.
For RETORT MOUTHPIECES, STAND-PIPES, DOOR-FRAMES, SPECIAL BENDS, TEES, FLANGE PIPES, SADDLES, BELTS, PLUGS and CAPS, SYPHON-COVERS, &c.
Samples may be seen on application at the Stores Department, 21, Dewsbury Road, and Forms of Tender and Specification may be had on application to the undersigned.
Endorsed Tenders, addressed to the Chairman of the Gas Committee, Municipal Buildings, Leeds, will be received not later than Tuesday, the 24th inst.
The Committee do not bind themselves to accept the lowest or any Tender.
R. H. TOWNSLEY,
General Manager.
Municipal Offices, Leeds,
April 14, 1900.

UXBRIDGE AND HILLINGDON GAS CONSUMERS' COMPANY.
GAS COAL
THE Directors of the above Company invite TENDERS for the supply of 5500 Tons of GAS COAL, deliveries of which are to commence the first week of May, 1900, and finish the last week in April, 1901.
Tenders to be made out for 5500 Tons of the best description of unscreened Gas Coal from the Durham Coal-Fields, delivered by Barge (free) alongside the Company's Works, Grand Junction Canal, or for the same quantity from the Yorkshire or Derbyshire Pits, delivered by Rail to Uxbridge Station, Great Western Railway. The above quantity of 5050 Tons may also be tendered for, part from the Durham and part from the Yorkshire or Derbyshire Pits, delivery as specified in each case.
Tenders are to state the Names of the Pits from which the above description of Coal will be supplied; the same to be fresh wrought and free from Slate and other Impurities, and to the entire satisfaction of the Company's Engineer.
Deliveries to be according to the requirements of the Company.
Tenders to be received on or before the 24th day of April next, addressed to the Chairman, Gas Company's Office, Uxbridge, Middlesex, and endorsed "Tender for Coal."
A Form of Tender will be sent on application.
W. M. GARDINER,
Secretary
Uxbridge, Middlesex,
April 11, 1900.

CONTENTS.

EDITORIAL NOTES:—

GAS, LIGHTING, &c.— PAGE.

The Scheme of the New Technical Institution 1043
The Problem of the Export Coal Trade. 1044
Incandescent Gas Lighting and Coal Prices at the Eastern Counties Meeting 1044
The Necessity for Economy in Capital Expenditure. 1045
The Progress of Progressivism 1045
The Affairs of the Paris Gas Company 1046
Another Outrage on London Streets. 1046

WATER AND SANITARY AFFAIRS—

Suggested Bill for Controlling the London Water Companies . . 1046
Timely Attempts to Check Extravagant Use of Water 1046

ESSAYS, COMMENTARIES, AND REVIEWS:—

Gas and Water Companies in the Stock Market 1047
Electric Lighting Memoranda. 1047
Dr. J. S. Haldane on Carburetted Water Gas 1048
The Coal Problem 1049
Concerning Fogs. 1050
Directors *versus* Auditors 1051

NOTES:—

Lightning and Electric Lamps—A Correction 1052
The Trade in Magnesite 1052
The Latest Puzzles of Actinism 1052
Refractory Furnace-Linings 1052
Steam Heat Distribution 1052
The Melting of Coke in Liquid Lime 1052
Ferruginous Incrustations in Water-Pipes 1053
Refilling Colliery Workings 1053

TECHNICAL RECORD:—

Eastern Counties Gas Managers' Association—Half-Yearly Meeting at Cambridge—
General Business 1053
Mr. J. H. Sheldrake on Incandescent Street Lighting. . . . 1053
Discussion on the Present Price of Gas Coal and its Effect upon the Gas Industry 1057
Ohio Gaslight Association 1060
Laying Pipes under Water. 1061

REGISTER OF PATENTS:—

Coin-Freed Gas-Meters—Wright, J. F. & G. E., and Sutherland, A. G. 1061
Incandescence Bodies—Duncan, J. H. H., The New Incandescent (Sunlight Patent) Gas Lighting Company, Limited, and Barnett, H. T.. 1062
Continuous Generation of Water Gas—Clauss, F.. 1062
Compressing Gas, Air, &c., for Incandescent Lighting Plant—Snell, C. S. 1062
Regenerative Gas-Burners—Bower, G. 1063
Lamplighter's Torch—Foulger, G. F. L., and Glover, J. G.. . . 1063
Gas-Burners for Incandescent Lamps—Bernstein, S. 1063
Lighting and Extinguishing Series of Street and other Gas-Lamps—Croizat, V. 1064
Production of Compressed Gas—Knapp, W., and Steilberg, R. . 1064
Inverted Incandescent Gas-Burner—Beese, R. 1064
Patent Notices 1064

CORRESPONDENCE:—

The Commercial Company's Make of Gas 1065
Naphthalene in Coal Gas 1065
The Improved Lighting in the South Metropolitan District . . 1065
Illicit Commissions 1065

MISCELLANEOUS:—

Paris Gas Company—The Report and Accounts for the Past Year 1065
Widnes Corporation Gas Supply—The Tar Process to be Abandoned in Favour of Enrichment by Benzol and Carburine . . 1067
Macclesfield Corporation Gas Supply—Proposed Adoption of Water-Gas Plant 1067
Whitwick and Coalville Gas Arbitration 1067
Metropolis Gas Supply—The Chief Gas Examiner's Quarterly Report 1070
Manchester Corporation Gas and Electricity Departments—The Estimates for the Current Year 1070
St. Helens Corporation Gas Supply—The Past Year's Working . 1070
Horbury and the Ossett Gas Undertaking—Satisfaction with the Agreement 1071
The Coal Famine and the Public 1071
Electric Lighting Notes 1073
Notes from Scotland. 1073
Current Sales of Gas Products 1074
Gas and Water Companies' Stock and Share List. 1074
Coal Trade Reports 1075

PARAGRAPHS:—

OBITUARY: Mr. W. Clarke; Mr. Thomas Wadham; Mr. Henry Wyatt; Sir Thomas Earle, Bart.; Bailie Sandilands 1051
PERSONAL: Mr. J. S. Lucking; Sir Wilford Brett, K.C.M.G.; Mr. F. C. im Thurn; Mr Charles Taylor; Mr. Richard Fisher . . 1051
Iron and Steel Institute—The Gas Supply from the Everett Coke-Oven Plant—North of England Gas Managers' Association . . 1047
Professor Lewes's Lectures on "The Incandescent Gas-Mantle". 1048
Working Engines with Producer Gas 1051
The Russian Coal Difficulty 1053
The Bingley District Council and the Bradford Bill—A Trial of Incandescent Gas Lighting in Norwich 1064
Luton Gas Company 1070
Sales of Shares—Additional Water Storage for Heywood and Middleton—The "Builder" on the London Gas Question . . 1071
Consolidated Water-Works Company of Rosario, Limited . . . 1075
The Legality of Water Divining—Rural and Parish Councils and Gas Undertakings—Buenos Ayres (New) Gas Company, Limited—Ilfracombe Water Supply—The Profits of the Bradford Gas-Works—Proposed Extension of the Mansfield Gas-Works and Plant—The Transfer of the Fylde Water-Works to the Water Board—Obtaining Power from Water-Mains 1076
Netherlands Incandescent Gaslight Company, Limited—Dunstable Gas and Water Company—Trouble Over a Lighting Rate—Proposed Extension of the St. Mary Church Gas-Works—A Belgian Gas Undertaking—Swansea Gas Company 1077
Artesian Wells in New South Wales—Holmfirth Water Supply—The Growth of the Southend Gas-Works—Road-Rollers and Damage to Water-Mains—The Use of Water for Gardens in Birmingham—Shrewsbury Water Supply 1078
Accidents at Water-Works—Cowlyd Joint Water Board—Teignmouth Gas Supply—Beverley Water Company 1079

EDITORIAL NOTES.

The Scheme of the New Technical Institution.

THE Joint Committee appointed by the Councils of the Gas Institute and the Institution of Gas Engineers for the purpose of considering the question of the amalgamation of the two Societies, have succeeded in evolving a draft set of rules which they consider might be made the basis of a fusion of the respective organizations into one new, united, and comprehensive technical Institution. Copies of this document are actually in the hands of members; and the scheme will come up for discussion first, in order of time, at the forthcoming meeting of the Institution of Gas Engineers, which will open on Tuesday next. In the circular to members which accompanies the draft rules, Mr. Thomas Cole, the Secretary of the Institution, remarks that "it has been suggested that a suitable "name for the proposed new Association would be 'The "'Institution of Gas Engineers and Managers;'" but he adds that "this point will be open for discussion, together "with other details connected with the scheme, at the "annual general meeting." It will occur to most readers of this communication that something more than "details" will have to be settled on this occasion. In the first place, the question of principle has not been formally dealt with. The programme of the general meeting, to which we gave publicity last week, provides for the raising of a discussion on the general subject immediately after the delivery of the President's Address. This is obviously all that can legally be done at this time, because there has been no regular reference of the matter to a Committee of the Institution. The Council have acted so far entirely on their own responsibility, for which reason their Committee have not formally reported upon their proceedings. The whole thing has been a spontaneous movement, of which the two Councils took cognizance, and which, approving, they merely directed their representatives to put on a practical footing in the shape of a draft of rules. Heartily supporting the general idea as we do, we judge it expedient to offer to all and sundry this explanation of how the matter stands, in order that there may be no cavilling on the point of form. Of course, those members of both Societies who have been instrumental in furthering the mutual attraction of the two bodies, floating on the ocean of public opinion, appreciate the situation; but there are others who have heard little or nothing about it.

Very properly, therefore, having regard to the nature of their commission, the Joint Committee have addressed themselves exclusively to the details of the proposed united organization; and a very creditable Memorandum of Association they have produced. Apart altogether from the drafting of "clauses," which is chiefly a matter of form, the curiosity of interested persons will be concentrated upon the suggestions for dealing with the crucial points upon which the scheme as a whole must be judged. With regard to the name, it may not be amiss to recall the historical discussion of this very question on the occasion of the revision of the constitution of the British Association of Gas Managers at Birmingham, in 1881. It had been proposed to call the new Society "The Gas "Institution," to which objection was reasonably taken. Those who wish to help the Councils in settling this knotty question should carefully read the reported debate, in the light of what other Technical Societies have done since. It is incontestable that all modern offshoots of the original type—the Institution of Civil Engineers—have repeated the first name for the organization, while introducing the specific classification before the generic title. There is no valid objection to the modified title now suggested, unless it be that it hints at a division of members which is nearly obsolete. Far be it from us, however, to dogmatize on such a matter. The question is of great importance—this naming of Technical Societies being emphatically outside the scope of Juliet's time-worn query.

The serious difficulty of the so-called "traders" finds recognition in the forefront of the Memorandum, which, in defining the "objects" of the Institution, refers to a disqualifying clause intended to exclude from membership persons "who shall be actively engaged in or about the "management or business, either as principal, managing "director of a joint-stock company, or as agent, or traveller, "of any trading company, firm, or concern doing business

"with gas undertakings, whether as vendor or as pur-"chaser." Subject to this clause, the Institution is to consist of "persons who are, or have been, engaged in the "conduct of gas undertakings, or who have been regularly "educated as gas engineers." There are some more exact definitions of eligibility; but this is the general idea. It is fair to suppose that the drafters of these clauses carefully and fully considered their meaning and probable bearings, both generally and with reference to A and B cases. There is nothing antecedently objectionable in any of these suggestions.

Lastly, a very distinct trend of public opinion has been followed by the admission of a section authorizing the Council, at discretion, upon receipt of a request from a "sufficient" number of members, associate members, or associates resident in any district, to create a Local Section of the Institution in such district, with power to dissolve such Section at any time afterwards. Each Local Section is to be constituted, and its affairs carried on, in accordance with the rules and regulations laid down from time to time by the Council. All this is very good. It is to be hoped that those into whose hands these recommendations come will consider them all in good temper, and with a single mind to help forward the best interests of the gas industry. In the meantime, it is only right to recognize the good-will, tact, skill, and self-sacrifice of all those who have set their hands and given their time to this preliminary work, inspired, doubtless, by the same spirit to which we gave utterance in these columns on Sept. 5—in the aspiration that, for the gas industry at any rate, the Century might end in Peace and Unity. Let the world clearly see that British Gas Engineers can stand together in one Fellowship, and lend one another a hand when common action is needed. It is the old way, and the only way, of justifying the human instinct for association of the like-minded.

The Problem of the Export Coal Trade.

By a coincidence not uncommon in the every-day work of technical journalism, an "Editorial Note" in last week's issue of the "Journal" mooted once more the question of the advisability of putting an export duty on British coal, and in another part of the same issue there appeared an article recalling an answer given to the question by a Select Committee of the House of Commons in the year 1873. It has possibly occurred to some of our readers who noticed this circumstance, that one article replied in a sense to the other, especially as the Committee addressed themselves particularly to the point of the expediency of taxing exported coal. Other readers, however, may have seen in the revival of the question an example of the familiar observation that the unanswerable conclusions of the political economy of one generation do not satisfy the inquirers of the next generation. The last two paragraphs of the article on "The Scarcity of Coal in the Seventies" are well worth reading. They give the substance, and the phraseology, of an economic conclusion which, for "cocksureness" of matter and pomposity of style, bring back the Cobdenite era in all its glory. There is a hardness and coldness about the diction of the report which reminds the older reader of the historical fact that the Chairman of this very Committee (Mr. Ayrton) afterwards wrecked a Gladstonian Ministry through sheer personal unpopularity. He was a just man, and one learned in all the wisdom of the Egyptians—that is, of the Manchester School of Economists—but desperately arrogant and overbearing. He is gone now; and the style of disposing of economical puzzles which he favoured is likewise dead. The younger generation has witnessed the making of breach after breach in the impregnable rampart of pure commercialism raised by the Cobdenites with logic, cemented by enlightened selfishness; and the old questions which were so summarily laid by these prophets are marching in again, as formidable as ever.

By another coincidence, "Engineering" last week had a leading article in the same sense as our own "Editorial "Note." Our contemporary acknowledged the full force of the objection of scientific economists to any arrest of the national exports, on the ground that it is by these that we pay for imports. Of course, we do not contend for a moment that Mr. Ayrton's political economy was at fault, or that true economical doctrine is for one particular period only. Indeed, we do not offer any judgment on the matter at all; but merely put the question as something which is upon men's minds just now. And it is certain they will not take a reply of 1873 as conclusive. The besetting weakness of economists is their propensity to bind every particular question to the Procrustean bed of their general deductions. Thus, when "Engineering" says that "if our exports of fuel fall off to the extent of "a million sterling per annum our imports must decrease "correspondingly," one is driven to ask, Why? It is pure economic doctrine, no doubt; but is it certain that it is necessary to export coal in order to pay for foreign wheat, and cotton, and wine? Is the coal ear-marked? Could not its value be made up by something else?

The plain man may be pardoned for at least asking whether the qualities and nature of all exports are to be ignored in considering the money value of the total bulk of trade. Of course, if this is so, and British coal is only to be regarded as a commodity, like cotton cloth, then to restrict its exportation or consumption in any way would be wrong. Naturally, the coalowners and others in the coal trade would protest against any restraint being imposed on their commercial operations—let trade be free! This argument would have been esteemed conclusive in 1873. Nowadays, if we mistake not, the general opinion is that the British coal capital belongs to the nation, and not exclusively to the coalowners and miners. Some of this coal possesses peculiar properties, as the country learns during every colliers' strike. Some of it is unequalled for steam raising; other descriptions are best for gas manufacture. The question is, Are we warranted in selling these unique natural products off the premises, so to speak, for the money of those whom we should be quite justified in telling to fend for themselves by other means? It is not as if we can ever restore what is thus sent away. Interference with trade—with any particular trade—is a very serious thing to contemplate; but the exhaustion of the best and most-run-upon British coal is a more serious eventuality still. The export coal trade is not now more than 19 per cent. of the output; and this is some consideration. Perhaps the best result that could follow from a rediscussion of the general problem would be the creation of a stimulus to the more economical use of coal of all kinds, and especially to the avoidance of waste.

Incandescent Gas Lighting and Coal Prices at the Eastern Counties Association Meeting.

The public portion of the work of the presidential year of the Eastern Counties Gas Managers' Association was completed at Cambridge last Wednesday; and Mr. Harry Wimhurst (whose services to the Association the members never tire in acknowledging) leaves the chair with the knowledge that both meetings in his year of office have furnished a large amount of readable matter. As at the first, so at the second, the subjects presented for consideration were of that class which possess something more than superficial interest for every gas manager. At last Wednesday's meeting, the discussions were on street incandescent gas lighting and the coal question. On the first topic, one had concluded that the last necessary word had been said. Gas engineers proved long ago the unequalled efficiency and cheapness of the system for public purposes; and, with the growth of resistless evidence, the views of local authorities and the public have veered round in a gratifying manner. But with the progress of the system, there is, not in all cases but in some (we have noticed it ourselves with regret), a disposition on the part of those having the control of incandescent gas-lamps to shirk attention to points of detail which should be constantly observed in order to maintain and further the success which has been achieved. Mr. J. H. Sheldrake has therefore done good service in giving to the gas industry, in the paper which he read last Wednesday, certain prescriptions (drawn from his long experience as a specialist in public lighting) for obtaining the best and most effective illumination possible in our public places and ways. Constant regard to the advice which he tenders will have the double effect of promoting satisfaction on the part of the public and conducing to the happiness of the gas manager. With most of what Mr. Sheldrake had to say the members were in full agreement; but one or two could not refrain from having a side-shot at the Company with whom he is connected. To Mr. Sheldrake personally, considering his position, this was perhaps hardly fair. Opportunity, however, is said to be a fine thing; and the remarks that were made will no doubt meet the eyes of those for whom they were intended. Mr. Jolliffe's criticism respecting the price of mantles should

be read in conjunction with a reference to the same matter in the article which appeared last week on incandescent gas lighting in South London.

The second subject discussed was that which is engrossing the attention of all gas-works administrators at the present time—the price of gas coal. It was opened by Mr. R. G. Shadbolt, who has on more than one occasion proved his ability to infuse into a subject, without a set composition, the necessary spirit to awaken that interest which is requisite to produce a good debate. His opening disclosed a finished study of the question from the gas manager's point of view; and with most of his deductions from the facts he advanced, few of his colleagues will be disposed to disagree. The fundamental causes which have combined to bring about the present condition of the coal market are shown to be increased exports and the improved home trade. But Mr. Shadbolt, without mincing matters, charges the coalowners with having taken an unfair advantage of their position as masters of the situation to the extent, in the case of gas coal, of from 4s. to 6s. per ton. Three colliery representatives joined in the discussion; but they did not attempt to justify to the full the rise which has taken place of from 5s. to 7s. per ton. Our "Correspondence" columns, however, are open to them, if, on further consideration of Mr. Shadbolt's figures, they care to undertake the task. Taking into his calculations the improved value of residuals, Mr. Shadbolt concludes that increases in the price of gas of from 4d. to 6d. per 1000 cubic feet will be sufficient to enable gas-works proprietors to uphold their position of twelve months ago; and the advances which have already been announced show this is the general feeling. On the whole, Mr. Shadbolt takes an exceptionally cheery view of the situation. He thinks that outside factors will soon come into operation which will tend to bring down coal prices nearer to their former level; and he cherishes the belief that other sources of light, heat, and power will be hit harder than gas, and that the gas industry will benefit thereby. We can only hope that Mr. Shadbolt's accounts and those of other gas undertakings will prove the truth of his prediction; but we certainly have our misgivings.

The general business which received attention included the election of the officers for the ensuing year. Mr. J. G. Hawkins, of Spalding, will be the worthy occupant of the presidential chair; and Mr. Richard Brown, of Cambridge (whom it is a pleasure to welcome into the higher spheres of Association work), succeeds him in the office of Vice-President.

The Necessity for Economy in Capital Expenditure.

Some months ago we took occasion to point out the necessity for gas undertakings restricting as far as possible the work of extending or reconstructing works and plant during a period of high prices, high wages, and dear money. If there were force in the contention then—and its truth was, we think, as indisputable as it was undisputed—how much more forcible is it now! For in the interim, owing to the abnormal state of the coal market and the general activity of trade, prices of all building and construction materials have risen considerably above the already high rates current at the beginning of the winter. The prices of iron, steel, copper, lead, tin, and zinc (the last two in particular) have been steadily on the increase. Owing to the advance in coke, lime, chalk, and cement are all much dearer than they were last year; while wages in the building trades are very high. The Board of Trade report the granting of increases during March to 7174 workpeople employed in these trades, averaging about 3s. per week; London plasterers obtaining a rise of 1d. an hour, making their wages as much as 44s. 10½d. per week, exclusive of overtime. The result of this condition of the markets is that extension of business or plant in any direction is, for Gas Companies, an unduly expensive matter. In so far as the extension of business is concerned—the laying of mains and services, the provision of meters and stoves, and, in the case of prepayment customers, of fittings—the higher expenditure per million cubic feet of business secured is inevitable. So far as the extension of manufacturing plant to take up this business is concerned, it is obvious that it should be kept within the very closest limits of safety. Otherwise, of course, all the consumption thus provided for becomes permanently burdened with a high charge for capital, tending to stereotype a higher price for the gas.

There is, moreover, now a further reason for a niggardly, rather than a lavish, expenditure of capital, and that is the inevitably lower prices of gas stocks which must follow upon the increased charges for gas. Thereby the rate of interest on the realized, as distinguished from the nominal, value of newly-issued stock is correspondingly raised. To illustrate the point, let us assume that, in normal times, an addition to existing plant can be made, equal to providing for an increase in output of a million cubic feet, at the cost of £350; and that such capital could be obtained by means of 3 per cent. debentures at par. The annual charge for interest on capital for the million cubic feet of business would be £10 10s., or 2·64d. per 1000 cubic feet. Now it will not be overstating the case if we say that, at present prices for material and labour, the work that could have been done, and the plant that could have been bought, under normal conditions, for £350, would not cost less than £500. Nor shall we exaggerate the probable effect of the rise in the price of gas during the next twelve months upon the market value of gas stocks, if we assume that this £500 could not be raised next year by 3 per cent. debentures at a price above 96 per cent. On this basis, the annual charge for interest on capital for the million cubic feet of business would be £15 12s. 6d., or 3·75d. per 1000 cubic feet. That is to say, an extension of plant at the present time would (assuming that the capital so spent would have to be replaced by fresh capital obtained from the public within, say, twelve or eighteen months) saddle the output so provided for with an abnormal charge of over 1d. per 1000 cubic feet.

We do not say that such extensions can actually, in every case, be postponed or avoided, for the dearness of coal has notoriously stimulated the consumption of gas. Where they are inevitable, the undertakings must pay the cost; but a very clear case can be shown for exercising the utmost vigilance over all capital expenditure at the present time and in the near future.

The Progress of Progressivism.

Progressivism is getting on. Its more enthusiastic upholders in the newspapers are already playing fast and loose with the profit-making element in municipal trading. Sometimes they clamour for the municipalization of an undertaking because it is profitable; and then they will cry for municipal enterprise to supply something which cannot otherwise be provided, because it does not pay. Last Saturday, the "Daily News" indignantly asked why the old-established service of river steamers on the Thames should be given up, merely because the boats did not pay. The London County Council must step in and supply the need. It only requires to be pleaded that river steamboats are a necessary of life to the working man, and the County Council will doubtless take some measures to provide them. Unfortunately, our daily contemporary advances, as one reason for a Thames steamboat service, the truth that the river channel commands unrivalled prospects; many miles of its banks being perhaps the finest river front in the world. This kind of consideration, however, does not specially appeal to those to whose requests the London County Council lend a gracious hearing. Indeed, if the Council had been allowed their way, Westminster Bridge and the Victoria Embankment would long ago have been spoilt by tramcars supposed to be needed by the working man for getting to and from Lambeth and the City. On the other hand, London will scarcely seem the same without the familiar old steamboats, which gave visitors such ample pennyworths of picturesque river voyaging. But the river had long ceased to be a real passenger route. This use was killed by the parallel railway; and it is idle to lament what is superseded.

Another plea for municipal action untrammelled by the obligation to consider profits, is advanced on behalf of the Workmen's Housing Council. It having been ascertained by experience that the clearing and rebuilding of "insani-" "tary areas" is not a paying business for Local Authorities, the cry is boldly raised for rehousing the evicted people by aid of the rates. In extenuation of this demand, it is argued that, since overcrowding or houselessness drives some people into insanity or crime, it is more economical to help pay the rents of the sane and passably law-abiding. What effect the adoption of this policy by Local Authorities would be likely to have on the independent building trades, is not considered. Still less thought, if possible, is spared for the consideration that the people who are evicted in the cause of improved housing are usually not the same as

those who are afterwards accommodated with comparatively luxurious dwellings at less than their cost. But this does not matter a jot to your true Progressive. So long as he Progresses somehow, he does not care how or whither. As a rule, others pay the fare. The Workmen's Housing Council thoughtfully suggest that if their demands cannot be met by the aid of loans at 2 per cent., repayable in a hundred years, Local Authorities should be empowered to expend profits made on their other undertakings for the promotion of housing schemes. Thus the sins of some Improvement Committees are being visited upon them in the fulness of the time. Why should not everybody have his rent paid by his parish?

The Affairs of the Paris Gas Company.

In another column we give, as usual, an abstract translation and summary of the accounts of the Paris Gas Company for the past year's working. The gas consumption in the Company's district again shows a highly gratifying increase, for which various reasons are given. The growth in the demand for gas during the daytime is very remarkable; and the same may be said of the fast-growing popularity of the incandescent system of gas lighting, which has already turned the tables on the ordinary burners, including those of the regenerative type. Everything in the report goes to show that the Administration are "cultivating their garden," as the French classic has it, with well-rewarded assiduity. Still, it is startling to learn that it was necessary to lay out £185,816 on capital account to meet the demands of the Company's customers. Few would be prepared for such a testimony to the growing popularity of gas in Paris. There has been the usual litigation between the Company and the Municipality, referable to the desire of the latter body to both eat their cake and have it. An interesting part of the report details the nature and extent of the assistance lent by the Company to the Exhibition authorities; and it is only another proof of the kindly way in which this truly great Company treat their employees, that the Directors have voluntarily decided to give all their humbler officers and workpeople a substantial bonus towards meeting the higher expense of living in Paris consequent upon the Exhibition. A very guarded passage at the end of the report mentions the negotiations actually in progress with respect to the settlement that must be arrived at before the expiration of the present concession.

Another Outrage on London Streets.

Commenting last week on the ugliness of London, in connection with which Mr. Whiteing is reported to have said that the "frightful lamp-posts" have much to answer for, we could not know that another protest against the latest outrage of the kind on the amenities of the capital was awaiting publicity in "The Times." Some months ago we noticed the infatuated decision of the moribund St. Martin's Vestry to spoil the region round Charing Cross with central electric arc lamps, which, as we have repeatedly pointed out, is the very worst possible position for street lights in a busy thoroughfare. For several weeks past, the work of fixing the lamp-posts has been in progress; and hideous things they looked in their sickly-coloured coat of foundry paint. Now the heads are being put on; and an "Assoc.R.I.B.A." writes to "The Times" complaining bitterly of the "atrociously debased and vulgar character" of the whole fitment. Who are the persons responsible for inflicting this "grievous artistic humiliation" upon long-suffering London? No Continental people would believe that the power to decide what lamp-posts should be set up in the very centre of the Empire rests with an obscure handful of vestrymen. Perhaps it is the parish beadle. Unhappily, Londoners have the shocking example of Waterloo Bridge to remind them that the London County Council are no more to be trusted in this matter than a parochial official. Talk about the ugliness of London being due to the climate! The climate, with its ever-changing atmospheric effects, is the one redeeming feature of the province by the Thames. It is the hopelessly mean, ignorant, and heedless Public Authorities, both big and little, who make London so much more vulgar-looking than it need be. Such utter lack of distinction in all that goes to the making and equipment of those streets which ought to bear witness to the existence of a sense of dignity on the part of the authorities, could only result from a general lack of a feeling for art on the part of the people. The Royal Academy in Piccadilly, and the ghastly lamp-posts in Whitehall—which testifies the more strongly to the barbarity of British taste? It now remains for somebody to ask a question in Parliament about it to exhibit to the world the astounding fact that the nation pays millions to open up a vista befitting Westminster, only to have the approaches spoilt by the pretty fancy of a small Vestry in street lamp-posts. Truly, we are a practical people, and not like Frenchmen and Germans, who are so foolish as to believe that the matter of street decoration is fit for the solicitude of a Ministry!

WATER AND SANITARY AFFAIRS.

The rejection of the Purchase Bill of the London County Council, followed by the withdrawal of their Welsh Supply Bill, and the adoption of a similar course, in deference to the Speaker's ruling, by the promoters of the Metropolitan Water Companies Bill, indicated pretty clearly that there would not be any general legislation this session upon the London Water Question. The definite terms in which the Royal Commission reported against the County Council as the authority to control the water supply, and in favour of the constitution of a Water Board, threw upon the Government the responsibility of taking the initiative in the direction indicated by the Commission. That they would do so this session, with their hands as full as they are of colonial complications, was generally thought to be out of the question. The immediate necessities of the Metropolis had been provided for by the intercommunication scheme; and consequently London could well afford to wait a little while for the carrying out of the larger project of the purchase and transfer of the water undertakings. The disposal of the Bills above alluded to, however, has not damped entirely the ardour of certain parties who are desirous of reforming the existing arrangements under which the Water Companies are working. Pending legislation on broad lines, it is considered that some attempt should be made to carry out the recommendations of the Royal Commission on the subject of control. These will be too fresh in the recollection of our readers to need recapitulation.

The Commissioners thought their proposals would be equally applicable and desirable whether the water undertakings were purchased or not; but they did not suggest that they should be carried out apart from any general legislation on the water question. Yet a feeling exists that this should be done; and expression is given to it in a leading article in the current number of the "Lancet." Our medical contemporary lays special emphasis upon the recommendations of the Commissioners in regard to conferring more power upon the Water Examiner, who, as well as all the officials appointed to supervise the London Water Supply, should, it is suggested, be paid entirely out of Government funds. He should also have the right, as the Commissioners pointed out, to enter the works at any time, and be in a position to obtain all his information independently of the Engineers and officials of the Water Companies. The "Lancet" thinks that if a Bill were introduced by the President of the Local Government Board to carry out these and other changes in regard to control recommended by the Commissioners, it would be "supported from both sides of the House." We fail to discover the immediate necessity for testing the feeling of the House on these matters. The Water Examiner, as the Commissioners themselves acknowledged, has never had any impediment thrown in his way in the discharge of his duties, nor is he likely to have. At the same time, it would undoubtedly be preferable that, as an important public official, what he now does by courtesy he should be able to do by right; and the Water Companies are not afraid of that right being conferred upon him. But the existing arrangements in this regard do not seem to us to call for special legislation. London would suffer no harm by their being left to be dealt with as part of the whole question.

With the advent of summer weather, the thoughts of the water engineer turn to his reservoirs; experience of the past two seasons rendering him nervously anxious as to their condition. We have just been having a brief spell of unusually warm weather, but are not yet beginning to get alarmed in London, for we have at our doors the faithful Thames, whose volume, though much less last month than it was in February, is still ample. The quantity of water which flowed over Teddington Weir on the 1st ult. was close upon 6000 million gallons—enough to serve London

for 29 days; and though the volume gradually fell under the influence of the drying winds, the flow at the end of the month was equal to seven days' supply, after the Water Companies had drawn their statutory quantities. March was a dry month, the rainfall at Oxford being only 0·5 inch, distributed over about seven days. The average fall being 1·5 inches, there was a deficit of 1 inch of rain for the month, which reduces the excess for the present year to 1·61 inches. While there is no reason just now for expecting a repetition of the troubles arising from the drought of the past two summers, there is quite as much need as ever for the prohibition of the wasteful use of water, and the exercise of care in even its legitimate employment. This fact has been borne in upon the consciences of several Local Authorities in the Provinces, who have already taken steps to prevent their stores of water from being recklessly drawn upon. As will be seen by a paragraph which appears elsewhere, the Water Committee of the Birmingham Corporation have issued a very significant notice to the consumers on the subject of the use of water for gardens; at Bolton, we believe, a house-to-house inspection of consumers' fittings is going on, in consequence of recent large leakage; while the Ashton Joint Water-Works Committee are again taking steps to put a stop to the great waste resulting from "swilling" flags and other indiscriminate uses of water, though they have to confess that they have exhausted every means of warning people against their carelessness in this regard. Thousands of gallons of water are wasted every day in the way alluded to. The Committee have good reason for their action, for even now their reservoirs contain nearly 87½ million gallons less than they did this time last year. In this matter of flag-swilling, it appears that Oldham, Manchester, and Stockport are much in the same condition as Ashton. They have very little water to spare for other than its strictly legitimate uses—viz., domestic and industrial purposes; and they will have to carefully husband their resources. It is therefore advisable to endeavour to enlist the co-operation of the consumers in their efforts to attain this object.

Iron and Steel Institute.—At the forthcoming annual meeting of this Institute, to be held at the Institution of Civil Engineers on the 9th and 10th prox., one of the papers expected to be read and discussed will be "On the Manufacture and Application of Water Gas," by Carl Dellwik, of Stockholm; and another "On Driving Blowing-Engines by Crude Blast-Furnace Gas," by Adolphe Greiner, of Seraing, Belgium.

The Gas Supply from the Everett Coke-Oven Plant.—According to the last report of the Massachusetts Board of Gas and Electric Light Commissioners, the New England Gas and Coke Company began to supply gas from their works in Everett through the Massachusetts Pipe-Line Gas Company to the Jamaica Plain Gaslight Company on the 3rd of December last, and to the Brookline Gaslight Company on the 5th. The manufacturing plant of the Jamaica Plain Company was closed down on the date named, and since then all the gas sold by this Company has been made at the Everett works, and purchased from the Pipe-Line Company. The quantity supplied in this way during December averaged about 365,000 cubic feet per day. Some 1,231,700 cubic feet per day were supplied from the same source, and in a similar manner, to the Brookline Company in that month. This was mixed with the illuminating water gas made at the Brookline works, and distributed in the territory of that Company as a mixed coal and water gas, containing about 54 per cent. of the latter.

North of England Gas Managers' Association.—The 46th half-yearly meeting of the Association will be held at the Gas Offices, Newcastle-upon-Tyne, next Saturday, under the presidency of Mr. W. Doig Gibb, Engineer of the Newcastle and Gateshead Gas Company. According to the circular issued by the Hon. Secretary (Mr. J. H. Penney), the business will open with the presentation of the accounts and the election of officers for the ensuing year and of candidates proposed for membership. Mr. E. H. Millard, of Durham, will then give a *résumé* of his paper on "All Sorts and Conditions of Governors," read at the meeting of the Association held in October last. As the author dealt on that occasion principally with the summer consumption of gas, he will add supplementary remarks, with diagrams, on winter consumption. It may be remembered that at that meeting the President gave notice of his intention to propose a change of rules, to allow of the admission to the Association of pupils and persons holding responsible positions in gas undertakings. The suggestion has, however, been withdrawn until such time as the Committee can present a more matured proposal on the subject. At the close of the business, the members will dine together; and an interesting feature of the subsequent proceedings will be the presentation by the President of the illuminated Jubilee Addresses to Mr. J. H. Cox, of Sunderland, and Mr. Charles Sellers, of York, decided upon in October.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1074.)

The Easter Holiday has not done the Stock Exchange any good. So far from the markets reopening cheerfully, and the public coming in with alacrity to buy, the week has been very dull indeed. Business was extremely meagre, and the general tendency all round was flat. Prices of almost every description, from Consols and the War Loan downward, have undergone a shrinkage. Not even the fine weather could impart a cheerful tone, as it often does. The condition of the Money Market was to some extent responsible, rates ruling pretty stiff, although towards the close there was a tendency to relax the hardness. In the Gas Market, the drift was naturally downwards; the burden laid on all gas companies by the enormous increase in the price of coal becoming generally understood. But still the reductions in the value of quotations throughout the list are moderate and quite reasonable. There were no signs of any alarm on the part of stockholders, or any disposition to part hastily with their holdings. Transactions were only moderate; and we do not believe that much stock actually changed hands. In the Metropolitan area, Gaslight ordinary opened at 102¾, and afterwards touched 103½, but fell away to 101¼ on the closing day; the quotation showing the loss of a point. The secured issues, the return upon which will not be affected by any rise in the price of gas which is likely to happen, were unchanged; but their prices were only moderate. South Metropolitan had a considerable fall for it. But even now it stands very high, although the closing mark was 132½. The debenture also fell a point. Commercials were quiet, and unchanged. There were very few transactions in the Suburban and Provincial group. Brightons appeared steady; but Brentfords and Crystal Palace had to give way. The Continental Companies were in better case, for none of them had to suffer loss in quotation, though prices marked were only moderate. Among the remoter undertakings, Cape Town and River Plate underwent a reduction; but Ottoman furnished the sole instance of a rise in price. Business in Water showed a marked increase in the number of transactions; but they were at lower figures. Realizations were the rule, and the quotations of almost all the Companies showed a reduction.

The daily operations were: Upon the reopening on Tuesday, things were quiet in Gas; and prices were mostly only poor. Buenos Ayres and River Plate fell ¼. There was a slight increase in activity on Wednesday, but not much variation. Cape Town fell ¼. Thursday's transactions were very limited; but many changes took place. Brentford old fell 5, ditto new 2, South Metropolitan 1½, Gaslight ordinary 1, and Crystal Palace 2; but Ottoman rose ¼. In Water, Chelsea and Lambeth receded 2 each, and East London 1. Business on Friday was much the same. South Metropolitan fell 1½, and ditto debenture 1; but Buenos Ayres recovered ¼. Saturday was almost as active as any day in the week. Gas prices did not vary. But in Water, Grand Junction, West Middlesex, and both Lambeths relapsed 1 each.

ELECTRIC LIGHTING MEMORANDA.

No Profits this year for Manchester—Wise Candour—St. Pancras Playing with Insolvency.

It is reported that the Electricity Committee of the Manchester Corporation have met to consider the estimates of revenue and expenditure of the department for the ensuing year. The result of their deliberations has not been officially communicated to the papers; but "it is understood the Committee do not anticipate being in a position to hand over anything out of the profits to the relief of the rates at the end of the year." Last year the amount so handed over was £10,000. "It is supposed that the cost of repairing street explosions which have occurred, and of expenditure in relaying the mains, are in part responsible for the altered state of things." The diction of this explanation is not faultless; and it is especially difficult to understand how a street explosion is "repaired." It is easy to comprehend, however, that such things have to be paid for. The Manchester Corporation Committee are to be commended for their straightforwardness in resolving to clear off their extraordinary working expenses out of revenue as they go along. Their experience is also to be recommended to the careful consideration of such ardent municipalizers as Dr. Little, of Marylebone, and of everybody else who cherishes the delusion that municipal electric lighting is a reliable source of disposable profits. The Manchester Corporation electricity supply undertaking is so big a business that it has attained political significance; and its existence has been advanced as a sufficient reason for the exclusion of all other undertakings of the kind from the region which it more or less effectively occupies. What would be said of the administration of such a concern by a company, if the next year after distributing £10,000 in dividends to the proprietors, the dividend had to be passed because of a street explosion or two and a breakdown of mains?

The least that would be said in the circumstances would be that the Directors ought to have been more provident, and have

refrained from indulging in the luxury of paying any dividend until they were humanly certain that all ordinary trading risks and contingencies had been duly taken into their calculations of net profit. But the Manchester Electricity Committee succumbed to the weakness of all municipal traders. They went on living from hand to mouth, just in the usual way; and now there are no "profits" available for distribution in connection with this very important municipal undertaking. It is to be hoped, both for the sake of the "principle" of which so much is heard in Parliament and elsewhere, and also for the helpless ratepayers, that once having decided to do the right and wise thing by getting out of their Fool's Paradise, the Manchester Electricity Committee will not turn back until they have put their affairs in proper order. One is sick of hearing so much chatter about the "principle" of municipal trading at a profit or otherwise; and meanwhile all the touting electrical engineers of the day are ranging the country "advising" Local Authorities everywhere to go in for electric lighting, assuring their victims that the venture will be a paying one from the start. Manchester ought to be above encouraging this delusion by consenting to the evil practice of declaring profits out of capital.

While on this subject, we must not overlook the splendid example of the St. Pancras Vestry, whose electric lighting business has just been largely advertised in "municipal"-minded journals as having had "a successful year." Let us see in what this vaunted success consists. The principal figures relating to the working of the undertaking for the past year were given in our "Electric Lighting Notes" last week; and we now write with the official statement of the accounts before us. The capital outlay to the close of the year amounted to £288,146, and is still growing. How much of the year's addition of nearly £50,000 was real extension capital, is questionable; but inasmuch as the net amount charged to works repairs and maintenance in the revenue account is only £2610, and on distributing plant only £2000, it may be reasonably concluded that the outlay was not all for enlargements of earning capacity. On this capital of £288,146, the business shows a return of £44,880, of which about £38,000 is outside custom. The Vestry charge the ratepayers £6639 for public lighting, which is very helpful to the show. It cost, on revenue account, £27,230 to keep the concern going, although all charges are cut down to the minimum. Rates and taxes, for example, figure for only £1015; and there are no administration expenses. On the face of the revenue account, however, there is a credit balance of £17,649. Out of this has first to be provided interest £7433, and redemption £3374, or a total capital charge of £10,807—say, 3¾ per cent. on the capital. Cheap enough! These payments leave a net balance of £6841, or a noble trade profit of 2·3 per cent. But there are several little things to be squared out of this handsome sum. Like Manchester, St. Pancras has knowledge of street explosions to be "repaired." One would look in vain for an insurance fund. What about depreciation? That is entirely within the discretion of the Committee; and they virtuously set aside £1600 under this head—for accumulators and meters, and such like, only. Then they vote £4000 to the reserve fund, which stood at £8000; and—reckoning a carry-forward of £1892—the Committee are able to repay £2000 to the lighting rate, and carry forward a balance of £1134 "to the accounts of the current year." And this is what municipal financing calls "satisfactory results"! The Chairman of the Committee (Dr. Walter Smith) is reported to have stated, in moving the adoption of the accounts, that during the nine years the electric supply of the parish had been in the hands of the Vestry, they had made a net profit on the undertaking of £34,980. Of course, this statement gets repeated by all the municipalizers and electrical touts, and helps the fleecing and deluding of other unfortunate ratepayers at the hands of their legal guardians, who, honest men and well intentioned as they are, do not understand the meaning of the word "profit" in connection with this class of business. We will ask Dr. Walter Smith to put it to any competent and impartial auditor—a professional accountant—whether the St. Pancras Vestry have yet succeeded, after nine years, in making both ends meet in the case of their electric lighting undertaking, even with the subsidy for public lighting at perhaps thrice the cost of gas. Without this subsidy, where would the undertaking be? With it, is the undertaking paying its way, with an alleged gross profit balance of 6 per cent. on the ninth year's revenue account, and absolutely nothing hitherto written off the book value of perishable property and machinery standing at upwards of a quarter of a million of money? Let Dr. Walter Smith inquire of a namesake (Professor R. H. Smith) what he thinks of the position.

Professor Lewes's Lectures on "The Incandescent Gas-Mantle."—It has been already notified in the "JOURNAL" that Professor Vivian B. Lewes, F.I.C., F.C.S., is to deliver a course of three Cantor Lectures on the above subject at the Society of Arts; commencing on the 7th prox. In the first, he will deal with the history of incandescent gas lighting; reviewing the discoveries which led to the production of the mantles of the present day, indicating the oxides suitable for making mantles, and the method of preparing them, and pointing out the services rendered by thoria and ceria. The second lecture will be devoted to an explanation of the process of manufacturing mantles, and its influence upon their life. In the concluding lecture, Professor Lewes will describe the burners employed.

DR. J. S. HALDANE ON CARBURETTED WATER GAS.

THE current (April) number of "Public Health," the recognized journal of the Incorporated Society of Medical Officers of Health, contains a full report of an important paper just read before the Society by Dr. J. S. Haldane, F.R.S., a London Gas Referee, on "The Risks attending the Use of Carburetted Water Gas for Domestic Lighting Purposes." The paper is not altogether suitable for reproduction *in extenso* in our columns, containing as it does a good deal of introductory and explanatory matter, and much that appeared in the report of the Home Office Departmental Committee. We propose to skim it here in order to place readers in possession of the eminent author's latest views on the subject, referring to the original source those who desire more.

Dr. Haldane begins by briefly describing the nature and the methods of manufacturing coal and carburetted water gas. As to the latter product, which he assumes to be made by the ordinary producer-*cum*-carburetter and superheater type of plant, he admits that "it has very much the same smell as ordinary coal gas, and consumers would not know the difference." He states the composition of the purified gas as "about 35 per cent. of hydrogen, 30 per cent. of carbonic oxide, 20 per cent. of marsh gas, 10 per cent. of ethylene, &c., and a little nitrogen." He observes that in this country there does not appear to be much difference as regards cost between coal gas and carburetted water gas—the difference which exists depending largely upon local conditions; but he explains that there are other advantages on the side of the latter which render it a desirable accessory to coal-gas works. As regards the toxic qualities of illuminating gas of both kinds, Dr. Haldane cites Dr. J. Lorrain Smith, of Belfast, as having established it beyond doubt that the poisonous effects of both coal gas and carburetted water gas are due to the carbonic oxide alone. The other constituents are perfectly harmless in comparison.

The next step is to show how carbonic oxide acts on the animal economy, and how this action is detected and measured. This introduces the author's own diluted-blood test, which is described and qualified as surpassing all other known tests for carbonic acid in blood in delicacy, accuracy, and simplicity. It is stated that as little as 0·2 per cent., or even less, of carbonic oxide in air, is sometimes fatal to animals; but usually 0·4 per cent. is required to cause death unless the exposure be very prolonged. "There is every reason to believe that the same holds good for men." Less than 0·05 per cent. of carbonic oxide in the air breathed seems to be incapable of forming a dangerous compound with hœmoglobin, on account of the excess of oxygen overpowering it, so that the maximum of saturation does not exceed 35 per cent. With more than about 0·2 per cent. of carbonic oxide in the air, the maximum exceeds 60 per cent. saturation, "and life then begins to be endangered"—apparently in about 1½ to 2 hours. In recovery from carbonic oxide poisoning, the oxide is simply driven out from the hœmoglobin by the oxygen of the air, and escapes in the breath. It is not oxidized in the body. "An hour's breathing of fresh air will suffice in man to remove any dangerous excess of carbonic oxide from the blood; and after three hours the blood is nearly free, although the damage done to the brain, heart, and other tissues during their partial deprivation of oxygen may cause persistent symptoms and often death." Dr. Haldane describes his method of applying the diluted-blood test to determine quantitatively small percentages of carbonic oxide in air, and also to testing coal and carburetted water gas for this constituent. He exhibited the apparatus he employs for this purpose.

Next comes the question of the risks connected with carburetted water gas. First, the risks of the manufacture, which are dismissed as *nil*. This variety of gas making is found to be in practice a "safe and healthy" trade. As regards the risks to the public who use carburetted water gas, the case is declared to be "very different." Dr. Parsons's summary and Mr. A. C. Humphrey's statistics, as given with the Committee's report, are cited, together with Mr. W. T. Allen's table of the mortality returns for Boston (Mass.) since June, 1888. We get also Dr. Haldane's own celebrated exercise in comparative statistics, made for the Committee, displaying what might be expected to happen if London were supplied with gas like that of New York, Boston, and other American towns. "These statistics," says the author, "bring out two points, one being that coal gas is an extraordinarily safe illuminant, so far as risks of poisoning are concerned; the other, that the loss of life from poisoning is fully a hundred times as great with undiluted carburetted water gas as with coal gas. Of the deaths so caused, *only about half are accidental*, the rest being chiefly suicidal, although a few are homicidal."

We pause here to inqure whether the figures relating to other than accidental deaths ought not to have been disregarded in the computation of the risk to life from the use of carburetted water gas as being one-hundredfold that attending the use of coal gas. Dr. Haldane, however, quickly puts the case upon safer ground by remarking that "the risk of poisoning in the American towns supplied with carburetted water gas is certainly very appreciable." The estimation of the degree of risk is another matter. Dr. Haldane proceeds to inquire how the risk occurs. Gas escaping from "one burner" was responsible for 81 per cent. of the accidental, and 55 per cent. of the suicidal deaths reported by the Massachusetts Board since 1889. The ratio

of pure accidents fell to 9 per cent. referred to "gas-stove, or connecting tubing," to 5 per cent. for broken main or service pipe, and to 3 per cent. for "faulty pipe in house." Thus, four-fifths of the accidents and most of the suicides were due to escapes from single burners. This, of course, means bed-room lights; and hereupon the author launches out upon an interesting investigation of what is likely to happen when a gas-jet is accidentally left turned on in a room.

It is easy to ascertain how much gas is discharged by an unlighted gas burner; but the question of how this discharge affects the atmosphere of a closed apartment raises difficult problems of ventilation. From the task of grappling with these difficulties Dr. Haldane did not shrink; and his observations on the results of his experiments are of wide interest. As might have been expected, he found that the rate of inflow of air into rooms varies with the amount of wind outside, the difference of temperature between outside and inside, and other conditions. With a good breeze, the rate of inflow was about doubled. An open fireplace, with no fire burning, about doubled the rate of inflow in a room of 1400 cubic feet; while a fire burning increased the ventilation ten times. With a difference of temperature of 18° Fahr. between inside and outside, the ventilation was increased three times by opening the lower sash of the window 4 inches. With increasing size of room, the rate of natural inflow (other things being equal) increased in proportion to the increased surface of the walls, floor, and roof, and not in proportion to the size of the room. This result Dr. Haldane rightly regards as of special interest, as showing that the value of "cubic space per person" in a large room with only natural ventilation is quite different from that in a small room. For example, in a small bedroom of 500 cubic feet capacity, with all openings closed, the natural ventilation through walls, &c., would amount to 280 cubic feet per hour, whereas in a large room of 30,000 cubic feet it would be only 70 cubic feet per hour for each 500 cubic feet of content. Thus, in large rooms or halls, which, when crowded, often only afford about 200 cubic feet per person, special means of ventilation become almost a necessity. "It is in large, and not in small, rooms that one finds air which contains a large excess of carbonic acid. In the worst class of one-roomed dwellings, with an average of 1400 cubic feet per room and 212 cubic feet per person, Carnelley and I found an average of only 6·6 volumes per 10,000 in excess of outside air, although the samples were all taken in the middle of the night. In churches and other badly-ventilated buildings, one commonly finds from five to ten times this excess."

All this is uncommonly valuable addition to the available data for the rational study of ventilation. Whatever the immediate purpose that instigated Dr. Haldane to make these extensive experiments—he mentions having made nearly 200 air analyses—the thanks of the public are due to him for the useful determinations of what natural ventilation really is and does; for it is by natural ventilation that the vast majority of indwellers must obtain the air they breathe. This by the way.

Taking the most unfavourable conditions for the operation of natural ventilation—doors, windows, and fireplace closed, no wind, and only a few degrees of difference between inside and outside temperatures—a volume of air equal to the content of the room will enter an apartment of 500 cubic feet capacity in 1·8 hours; one of 750 cubic feet capacity in 2·1 hours; one of 1000 cubic feet capacity in 2·3 hours; one of 2000 cubic feet in 2·9 hours; 3000 cubic feet in 3·3 hours; and 4000 cubic feet in 3·6 hours. The first of these rooms represents about the smallest apartment that would usually be regarded as fit for a single bedroom, measuring about 8 ft. by 7 ft. 6 in. by 8 ft. 4 in. high. The largest is a noble apartment 17 ft. by 19 ft., and about 12 feet high. It is instructive to learn that a house with stone walls gave very much the same result as one with much thinner brick walls, so that there is not much choice between houses of different materials of construction. Yet Dr. Haldane admits that there must be exceptional cases, and instances the cabin of a ship as being of necessity almost air-tight except in so far as ventilation is specially provided for. It occurs to one on reading this remark that the treatment of the walls and flooring of rooms may also affect the result; and it would be interesting to learn the effects of distempering, papering, painting, and solid floors, upon the natural ventilation.

Finally, allowing the facts of ventilation to be as Dr. Haldane states them, what is the behaviour of escaped gas from an unlighted burner? It depends on the circumstances and conditions; and this consideration alone is worth recording as a gain. Will escaped gas rise without suffering much admixture with air; will it diffuse in the air? It all depends. When the escape is of large amount, as from unsealing a water-slide pendant, it is the person sleeping in the room above who suffers. When the escape is from an unlit burner it would appear that nothing particular can ordinarily happen, as after a time the gas goes away as fast as it comes. Dr. Haldane "never succeeded in producing an explosive atmosphere in any part of a room by an escape from a burner, although when the burner was taken off, the air near the roof soon became explosive." As regards risk of poisoning, however, which is a different thing from danger of explosion, Dr. Haldane finds that an increase of the percentage of carbonic oxide in the gas aggravates this risk to an enormous—indeed, an "anomalous"—degree. He ventures to put it at "the cube of the relative increase in the percentage of carbonic oxide."

Now, this is a very dreadful conclusion to put forward. A geometrical rate of increase of something, in the proportion of the cube of another factor, is a steadying consideration for any man who has it in his power to alter the second term and has reason to fear the first. This being so, it occurs to one who regards the proposition without prejudice that such a geometrical progression needs very firm support from indisputable facts. Practical persons, especially engineers, habitually look with suspicion on all such neatly-rounded theoretical expressions. It is so easy to say glibly that something increases or diminishes as the cube, or the square, or the *n*th power of something else; but does it? In order to establish such a conclusion beyond dispute, two conditions are essential—first, that the numerical basis of the computation shall be adequate for the mathematical superstructure; secondly, that there shall be no exceptions that do not prove the rule. In this connection, these essentials are lacking. Dr. Haldane cites one case—that of "the notorious one of the Garston district on the outskirts of Liverpool, where the Liverpool Gas Company distributed it [carburetted water gas] without warning of any kind for about a year, with the result that the proportion of fatal and non-fatal poisoning cases in the district was about the same as in Boston." The fatal cases numbered two. Hardly sufficient to establish a series, not to speak of a geometrical progression! Dr. Haldane flatters Surgeon-Lieut.-Col. Cayzer, of that ilk, with having made a "most effective" protest against this practice, which "quickly led to a discontinuance of the supply at Garston." Still, "it moves," as Galileo said of the earth.

Generally speaking, Dr. Haldane thinks that where carburetted water gas is sold mixed with coal gas, there is a "most distinct increase" in the number of gas poisoning cases. Nevertheless, he is fair to admit that the total number of cases is very small; and he confesses that there have been no fatalities from this cause in Tottenham, where a 50 per cent. mixture has been distributed for years. He seems disposed to leave out Tottenham as an irrational quantity; but trustworthy vital statistics are not to be compiled upon this principle. If two fatalities at Garston prove an average, why should not the immunity of Tottenham, of Stepney, of Brentford, of Norwich, or of twenty other places where they use carburetted water gas without knowing it, possess equal statistical value on the other side? To do him justice, Dr. Haldane seems to have come to a perception that there is something more to be said on the whole subject than the Departmental Committee recognized. Possibly he perceives that Tottenham is not singular. He loyally adheres to the report of the Committee, fixing 12 per cent. as the permissible maximum of carbonic oxide; but he also admits that the limit should be an elastic one, and declares that "any cast-iron legislation on the subject seems distinctly undesirable," which is as much as to say that Dr. Haldane has learnt wisdom during the last two years. For if legislation should be locally or centrally "elastic," the antecedent objection to any such legislation at all increases in force, to quote Dr. Haldane himself, as "the cube of the number" of possible exceptions. This being so, it is not worth talking about. Medical officers of health are good servants of the community; but there are other and much more pressing questions of sanitation for them to grapple with than this very problematical risk of carburetted water gas poisoning.

THE COAL PROBLEM.

On page 1071 of to-day's issue, will be found practically the whole of a very interesting article by "A Correspondent," which appeared in "The Times" last Thursday, entitled "The Coal Famine and the Public." The article contains evidence throughout of being from the pen of an expert on the question of coal supply and consumption (if we had to hazard a guess at the authorship, we should be inclined to name Professor Edward Hull); and we therefore feel some satisfaction in saying that, except in regard to fuller detail concerning some points, those of our readers who have followed the subject closely in our columns will not find much that is new to them, either in facts or in conclusions. The article forms, however, such an admirable survey of the present situation from an independent point of view—we must, in the nature of things, look thereon from the standpoint of the buyer whose whole economics depend upon the price of coal—and of the causes from which it has arisen and continues, that we have no hesitation in drawing particular attention to it.

The writer, referring to the present situation, says truly that, although a coal famine, in the absolute and unqualified sense of the term, is unlikely, and, perhaps, impossible, we are relatively coming near to the stage of famine when coal is so scarce that those who require large supplies have much difficulty in procuring them; when the widely-ramified branches of national industry suffer consequent loss and inconvenience; and when the cost of fuel is such as to compel the ordinary citizen to be parsimonious in its use. That such a state of affairs does exist, is only too well known by the heads of the gas industry. Rarely, indeed, if ever, have the gas-works of this country found themselves—as not a few, and those not the least considerable of them, now are—entering upon practically high summer with their coal-stores swept clean; and living from day

to day on the supplies they are able to wheedle from their contractors, or buy at fancy prices in the market. In five months' time, the winter will be at hand. How, in this five months, and at what cost, are the empty coal-stores to be filled? This is the problem (as serious as any that the majority of reigning gas magnates have ever had to face) that is all important, and immediately pressing for solution, at the present moment.

At a meeting of German merchants recently held, one of the speakers, a merchant of high standing, said that the question for the near future was not at what price coal was to be bought, but how it was to be obtained; and so far as can be understood, this is the difficulty in which large would-be buyers find themselves. Colliery owners not merely ask 60 or 80 per cent. more than they were willing to take a year ago, but only offer much smaller quantities; intimating that they are not eager sellers even of those, as it all depends on the extent to which they can increase their output whether or not they are already over-sold!

As to how this both curious and serious state of affairs has arisen, "The Times" correspondent names five principal causes, all of which have been during the past few months repeatedly explained in these columns as being the sources of the scarcity—namely, the increase in the make of iron and steel; the increased requirements of the world's railways, and the larger volume of traffic on those previously existing; the growth of the world's mercantile marine; the almost unequalled prosperity of all manufacturing industries; and the more general diffusion of wealth, leading to a larger consumption of coal for domestic and other purposes. The writer mentions subsequently, but does not give sufficient prominence to, another source of increased coal consumption. This is the enormous growth of the world's navies in the past ten or fifteen years, which have been—in their construction—the source of much of the activity in the iron and steel trades; which will, for their repair and renewal, render much of that activity of a permanent order; and which, moreover, require for their motive power enormous quantities of coal.

Of the five main causes of scarcity enumerated in "The Times" article, the majority will be seen to be more or less of a permanent character. In addition thereto, another, of a purely temporary nature, must not be forgotten, although, somewhat curiously, "The Times" correspondent makes no mention of it. This is the labour troubles on the Continent, more particularly in France, Germany, and Austria. Those troubles are gradually subsiding, and the coal output will now increase; but there are such large arrears of trade standing over in those countries, that coal will be in heavy demand there for some time to come.

The question of prime importance for the coming months is, therefore, how soon the output of the mines will be brought up to the level of the demand. We said last week that we should require very strong proof to induce us to believe that the coal-owners are not doing their utmost to take advantage of the present demand. In this opinion, we are fully confirmed by the statement of the writer of the article before us. He says: "From the various projects . . . . that have come to my knowledge—including not only the opening out of new collieries, but the re-opening of old ones, and the sinkings made to other seams in existing pits—I am of opinion that within the last fifteen months or so provision has been made for adding quite 20 million tons a year to the coal output of the United Kingdom; and, if the same average annual output per employee as that of the period 1894-97 be assumed, the increased resources of production will probably be considerably more." It may be remarked that, as the average output per employee for the years 1894-97 was some 20 tons less than in 1899, this last observation is scarcely accurate. Taking, however, the writer's figure of 20 millions as being the additional output provided for since the beginning of last year, what does this mean for the future? The output in 1899 was higher than in 1898 by 18 million tons. Of this, over 11 millions were due to better working by the men. About 7 millions in all were therefore due to extended operations. Assuming that the remaining 13 millions additional output is placed on the market this year, there should be a total output for 1900 of 233 millions. As we have already hazarded the opinion that the quantity of coal required to be raised this year, in order to supply the home and foreign markets, and to make up and maintain stocks at something like normal figures, will not fall far short of 235 million tons, we do not think that, unless some sudden, and for the present unforeseeable, break occurs in the iron market—hard markets have a knack of breaking up suddenly, through some big operator's nerve giving way—the supply of coal will overtake the demand, and prices collapse, for some months to come. As "The Times" writer says: "No one knows what the coalminers may do, and . . . in these matters the attitude of labour—which is generally the dark horse—counts for much." Happily, the indications at present are not unpromising; but the summer is a favourite time to "play," and wages are unusually good.

It must, however, be borne in mind that a continued maintenance of present prices must tend towards a reduction in the demand; for no one will buy coal or iron at ruling rates unless positively obliged to do so. It is certain that the coal owners are over-straining their advantage by exacting the last shilling per ton that those consumers who must buy will pay; whereas a more moderate treatment of the market would prolong the present period of trade activity. The owners may easily kill the golden goose. With the foreshadowed increase of output, the present relative scarcity would then solve itself into an absolute glut. But, as we have said, we do not think that will be for some months yet.

"The Times" correspondent finally adduces, as a ground for a Government inquiry, the fact to which we have more than once pointed as calling for such investigation, that "some of our most important fields are rapidly nearing a period of permanently dearer cost of working." It is of the utmost importance that it should be known, as the result of expert inquiry, how soon and to what extent the cost of production, apart from the labour charge, will become permanently higher. It is to be hoped that the necessity for such inquiry will be urged on the Government at an early date.

CONCERNING FOGS.

The opinion that gas is decidedly superior to electric light in regard to its power of penetrating fog, which has been expressed by many authorities—notably by Professor Tyndall, and most recently by Mr. W. F. Barratt, of Kingstown*—receives fresh confirmation by the writer of an article in the "Contemporary Review" for April (the Rev. J. M. Bacon), on "Fogs and their Teaching." Mr. Bacon was in Dover during the meetings of the British Association last autumn, and his attention was drawn to the varying power of certain lights to penetrate fog, by a remark of a coastguardsman that the flash of the evening gun from the Castle would pierce the fog which was one night enveloping the town, better than all the other lights round. "While he was still speaking, the clock struck, and, with service-like precision, a dull flare opened out on the heights, fairly eclipsing for the moment any of the gas-lamps, either single or massed (for the town was illuminated), that tried to penetrate the heavy night." Mr. Bacon—putting aside the question of why the gun-flash is supreme in its fog-piercing power—proceeds to state, "as an instructive commentary, that where the fog lay thickest the gas-flames were utterly quenching the usually dazzling arc lamps of the Electric Light Company, which was in keenest competition that week with the older form of illuminant in the town. The same fact," the article continues, "has been inferred, if not irresistibly brought home, on occasions of grave moment. When the electric light was first established at Dungeness, the Trinity yacht *Galatea* went ashore close to the light, those on board being unable to see it. Again, in 1879, the *Bast* was wrecked close to the powerful electric light at Lizard Point." (The Lizard Lights were specially mentioned last July, when the question of light-house illumination was raised in the House of Commons.†) "Again, in 1892, the *Eider* went ashore within a short distance of the electric light of St. Catherine's Point, Isle of Wight; while the terrible calamity of the *Drummond Castle* took place in close proximity to the electric light of Ushant, which (according to the evidence of the survivors) could not even be glimpsed."

The explanation of this undoubted capacity of gaslight to mitigate the darkness of a fog, and the equally certain inability of electric light so to do, is, as Mr. Bacon points out, the fact that a true fog is impervious to rays from the more refrangible end of the spectrum; and he refers to the phenomenon—often noted in the "Journal," but worth substantiating from evidence of an independent witness—that "it will often be found in our London streets that the old-fashioned and much-abused yellow-burning gas-lamps will hang out a warning red beam in a dense gloom through which the actinic rays of the modern electric arc cannot penetrate at all.

Discussing the nature, characteristics, origin, and possible mitigation of fogs, in which gas managers naturally feel a business (conflicting with a personal) interest, Mr. Bacon instances the fact that the darkness produced by an overhead fog is more intense, though infinitely less intolerable, than the gloom of an enshrouding ground fog, as a proof that fogs are usually but shallow bands of mist. That this is so will be found by ascending any commanding height in a fog-bound city, such as the top of St. Paul's Cathedral, when the fog layer will be seen to reach but little above the house-tops. Another feature of the town fog is, as all our readers who live in and around the Metropolis will have remarked, its sharply defined limits—a feature which is also frequently, though not so generally, characteristic of a sea-fog. We have, in the English Channel, sailed out of a dense, dripping bank of mist into the unmitigated glare of an August noonday sun, with the suddenness of a train that is emerging from a tunnel.

"If then," says the Contemporary Reviewer, "the choking cloud lies, like a true isolated cloud, compact, continuous, and well-defined, with the additional characteristic that its depth is very shallow, it might seem reasonable to hope that, by some artificial disturbance, atmospheric equilibrium might be so far affected that the entire cloud could be made to rise, if not to disperse. . . . One method, at least, has been long talked of—namely, the disturbance of the air by the impulse of explosion. Rather more than forty years ago—that is shortly after Crimean War times—when it was a favourite practice to hold reviews on a grand scale on Southsea Common, with much heavy firing, the writer remembers it being confidently asserted among the officers that such cannonades generally brought up wind or change of weather. This indeed is a doctrine

* See "Journal," Vol. LXXIV., p. 321 † *Ibid.*

very generally received, and attempts have been made to connect big battles with subsequent storms; so that were there but the germ of truth in this, it would be no extravagant idea that even a London fog might be borne up and away on the back of an eddy, say, produced by a well-ordered salute on Primrose Hill." Extravagant or not, however, we do not think that gas managers need fear the immediate abolition of fogs, with the attendant enhancement of gas consumption, through the practical application of this idea.

As to the effect of a foggy day upon London's gas bills, Mr. Bacon quotes some not altogether accurate figures. "Statistics furnished by one chief Company [about a dozen years ago] showed that 35 million cubic feet in excess were consumed on a single day of fog. . . . Adding to this the extra supply demanded at the same time of two other Metropolitan Companies, the total excess of gas amounted to 150 million cubic feet; or, put in another way, the cost of the day's fog, in gas, to London could not be put at a less figure than £7000 or £8000." As the total maximum daily consumption of the three principal London Companies a dozen years ago would have only amounted to about 180 millions altogether, and as 150 millions valued at £7000 to £8000 works out at only about 1s. per 1000 cubic feet, Mr. Bacon, or the printer, has evidently gone astray. He probably intended to say, what would be much more nearly accurate, that the excess consumption due to a day's fog was, in London, somewhere about 50 million cubic feet, which would cost, approximately, £7000.

The much more frequent occurrence of fogs in the months preceding Christmas, as compared with the later winter months, has often given rise to speculation; and Mr. Bacon suggests the most reasonable explanation thereof. It lies in the well-known facts that the presence of water at a higher temperature than the air lying over it is a constant cause of fog, and that the sea rises and falls in temperature much more gradually than the land. Every bather knows that the sea is warmer in October than in April, and every schoolboy learns the origin of sea and land breezes. It is, therefore, "easy to see how the tidal waters of Father Thames may frequently be appreciably warmer than the night air, say in early winter. In this case the river might be giving off vapour with a supply too great for the demands of the air at lower temperatures, and a precipitation of fog must be the result. During a midnight balloon voyage in autumn over the north of Kent, the writer and his companions were for a while deceived by what appeared in the moonlight to be the proximity of the sea. On obtaining a wider view, however, it was soon discovered that the phenomenon was due to a sea of dense mist overhanging the Thames, and confined, in the still air, within sharply defined limits." On another occasion, clouds were seen forming over and following the whole course of the Thames, from the sea inland. "The special interest attaching to this account is the fact that the tide had, at the hour in question, just reached its flood, and the entire bulk of warmer water had come up from the sea."

Mr. Bacon calls attention to the dryness of a "pea-soup" fog, and quotes the result of some of Professor Frankland's investigations on this point; the dry nature of the town fog being, in the Professor's opinion, due to the coating of the particles of moisture with soot and smoke—the whole compound forming the familiar yellow, greasy, foul smelling and tasting thing called a "pea-soup" fog. When we wish to look at the sun, we use a piece of smoked glass. In smoking that glass we have carried out a process similar to that by which a "pea-soup" fog obtains its murky colour. "There is no danger," Mr. Bacon humorously observes, "in such a fog, in looking one's hardest at the noonday sun."

As to the possibilities of smoke prevention or abatement, Mr. Bacon is no optimist; and, indeed, he omits entirely from consideration the already marked effect of the substitution of gas for coal as the heat-producer in cooking and room-warming. The abolition of smoke-thickened fogs by this means is indeed a consummation to be desired by all gas managers; for the steady day by day (and daylight) consumption of gas for cooking and heating purposes is infinitely to be preferred to the sudden and abnormal demand for light on the fog-blinded day, involving, as it does when the fog lasts for days together, either an impoverished supply of gas, or the maintenance of an expensive margin of storage or manufacturing plant to cope with a demand that may only arise once or twice in several years. In fact, the days of such prolonged periods of abnormal demands for gas appear, from the cause we have named, to have practically disappeared.

Working Engines with Producer Gas.—The satisfactory results which have attended the establishment of works for the generation of producer gas at Zurich and Lausanne, as well as at Orleans and Poitiers, for furnishing motive power in connection with the working of tramways, have led to the fitting up, at a new station at St. Ouen, of a number of motors to be operated by this gas. The plant consists of Charon motors of 160 and 80 horse power worked with ordinary gas, and of 120 and 60 horse power worked with producer gas. These are to be all operated by the latter gas; and the contractors have agreed to supply power at the rate of 8 c. per kilowatt-hour, including all working expenses, but not interest and sinking-fund charges, for a minimum production of 850 kilowatt-hours per diem.

DIRECTORS VERSUS AUDITORS.

The report of the proceedings at the recent meeting of the shareholders in the Golden Grain Bread Company, is very disheartening to those who, like ourselves, are anxious for Auditors to be encouraged and required to do their duty thoroughly, and to report faithfully upon the accounts they are appointed to investigate. The Auditors of the Company in question—a high-class firm of Accountants—have in their reports, for some time past, called the attention of the shareholders to the fact that, in the Auditors' opinion, the Company's assets were overvalued in the balance-sheets, and the profits correspondingly over-stated. This view the Directors have always contested; and matters came to a climax last week, when the Board proposed to the shareholders at their meeting the payment of a preference dividend of 7 per cent., which the Auditors opposed as being unjustified by what they deemed to be the true financial position of the concern. The majority of shareholders present supported the Auditors; but, by the aid of proxies, the Directors carried their point, and, moreover, obtained the dismissal of the Auditors from the service of the Company.

These proceedings, looked at—as they alone concern us—from a general point of view, can only be described as most ill-advised and unfortunate; for they cannot but tend to discourage any but the strictest and most upright of Auditors from making a searching examination of accounts, and giving an independent, and perhaps unfavourable, report thereon. And, goodness knows, the average Auditor is by no means in want of such discouragement! So far as the particular shareholders in question are concerned, no conduct could well be more fatuous than that of paying dividends declared by a well-known firm of Auditors to be unwarranted, because unearned. It is true that the meeting was outvoted by the proxies of absentees; but the matter had been brought to the notice of shareholders generally on more than one previous occasion, and our criticisms are directed against all those, present or absent, who voted contrary to the advice of their Auditors.

Apart from the question at issue—as to whether Auditors are to be disregarded and dismissed if their report be unpalatable—the proceedings at this particular shareholders' meeting serve to illustrate afresh the possible unsatisfactory features attending the "proxy" system of voting. Doubtless the system is inevitable; but we think that the policy of Directors asking, and shareholders granting, proxies which practically take the control of affairs entirely out of the hands of the shareholders present at a meeting—where matters may perhaps, upon discussion, assume a very different aspect from that which they wore in the proxy circular—should be very sparingly adopted. For Directors to habitually enter a meeting-room with the voting power in their pockets, is, we hold, to defeat the end for which shareholders' meetings were instituted—and, indeed, denotes clearly a lack of faith in the capacity of the management to successfully encounter criticism. Shareholders, who are the most credulous and unbusiness like of creatures, are all too ready to sign any printed form sent them with a stamped envelope for its return.

OBITUARY.

The death is announced of Mr. W. Clarke, Manager of the Shepton Mallet Gas Company.

Mr. Thomas Wadham, Secretary to the Barnstaple Water Company, died yesterday week at the age of about 60 years. He had been in failing health for some months.

Mr. Henry Wyatt, Secretary of the Chiltern Hills Water Company, died suddenly last Tuesday, at Aylesbury. Deceased was for many years Agent to the late Baron Ferdinand Rothschild, and was for some time Chairman of the Urban District Council.

The Directors of the Liverpool United Gas Company have lost a colleague in the person of Sir Thomas Earle, Bart., whose death occurred somewhat unexpectedly at his residence, Allerton Towers, Woolton, on the 13th inst. Deceased attended a meeting of the Board on the previous Wednesday, and subsequently had an attack of bronchitis, to which he succumbed. He was senior partner in the firm of Messrs. T. & W. Earle and Co., and was 80 years of age.

Bailie Sandilands, of Glasgow, died very suddenly at the Royal Cottage, Loch Katrine, on the morning of the 16th inst. It is but a few weeks since he was appointed Convener of the Water Commission of the Corporation, in succession to Mr. Osborne, who held the office for many years. He entered the Town Council in 1896, and was from the beginning of his connection with the body a hard worker. Last November he was made a Magistrate. His death is the third which has taken place among the members of the Council since November—one of the others being Mr. Osborne.

PERSONAL.

Mr. J. S. Lucking, of Rhos, has been appointed Manager of the Clay Cross Gas-Works.

In consequence of failing health, Sir Wilford Brett, K.C.M.G., Chairman of the Buenos Ayres (New) Gas Company,

has been compelled to resign his seat at the Board. Mr. F. C. im Thurn has been elected to fill the vacancy.

With reference to the announcement in the "Journal" last week of the approaching retirement of the Engineer and the Secretary of the Derby Gas Company—Mr. Charles Taylor and Mr. Richard Fisher—at the close of the present quarter, we learn from the "Derby Daily Telegraph" that Mr. Taylor began his professional career with the Nottingham Gas Company, in whose service he spent twenty years—rising to the position of Superintendent of the Basford works. Thirty-five years ago he was invited to Derby to take the position of Engineer and Manager of the gas-works; and during his tenure of the office he has naturally witnessed a remarkable development of the undertaking. When he first assumed command, the quantity of gas manufactured did not exceed 100 million cubic feet per annum; but at the present time the output is upwards of 550 millions. The establishment of the branch works at Litchurch has taken place under Mr. Taylor's supervision; while during the same period the Company's premises in the town have also expanded enormously. Mr. Fisher entered the service of the Company more than fifty years ago as a junior clerk; his father at the time holding the office of Secretary. Working his way up, he was, in later years, appointed as his father's assistant; and upon that gentleman's retirement in March, 1883, his son was called upon to succeed him. We learn that it is the present intention of both Mr. Taylor and Mr. Fisher to continue to reside in or near Derby. As mentioned last week, the Directors of the Company are inviting applications for the position vacated by Mr. Taylor; but no intimation has been given as to the Secretaryship.

NOTES.

Lightning and Electric Lamps—A Correction.

In the "Journal" for Feb. 26 last (p. 467), there appeared a "Note" describing a remarkable photographic record of what was supposed to be an effect of lightning on the public electric lighting installation of the Dover sea-front esplanade. The observation was also made, on the authority of Sir G. Stokes, that these photographic experiments showed that such electric street lighting plant was probably a good thing to keep away from during thunderstorms. Naturally, other technical periodicals published the same warning. It is only right to report, with equal prominence, the fact that Sir G. Stokes has recently withdrawn this observation, on being convinced that the photographic records in question were vitiated by careless movements of the camera. The natural result was to show trails of light from the electric lamps. Such an exposure—using the word in more than one sense—is calculated to furnish legitimate ground of complaint on the part of those who reasonably assume that published experiments have been properly conducted. Careless manipulation of a sensitive photographic plate is very liable to produce startling results; but these are usually only heard of, if at all, in the comicalities of popular magazines. Lightning effects are all too serious to be groundlessly called in question in connection with electric lighting fittings, or any other common street objects.

The Trade in Magnesite.

Further particulars have transpired, in Consular reports and otherwise, of the development of the magnesite industry of the Greek Island of Euboea. This mineral makes a very high-grade fire-brick, for which manufacture last year from 30,000 to 35,000 tons were exported in the crude state, of which 20,000 tons went to the United States, where it is in great demand on account of its purity. The raw rock shows 97 per cent. of carbonate of magnesia, with but a trace of iron, and very little silica. The largest owners of the Greek magnesite deposits are: M. Bodouri, the present Minister of Marine; the Society of General Enterprises; and the Society of Public Works, Athens. Besides these, there are many smaller proprietors. There is a large tract of this mineral land for sale in Euboea; and M. Christomanos, Professor of Chemistry in the University of Athens, is the repository of information concerning the terms of sale, &c., of these properties. Actually, the mineral is put on board at the nearest harbour for 23 frs. per ton; and the duty and freight to England are nearly as much. It is suggested that those who are deeply interested in the trade in this and other refractory materials would do well to buy a mine outright. It is more economical to calcine the rock on the spot, and so get rid of the carbonic acid. It carries well in the calcined state; and not the least recommendation of it is that it can be ground after use, and worked up again any number of times.

The Latest Puzzles of Actinism.

Incessant work is being done, principally by French chemists, upon the so called radio active elements, the existence of which was first made known by M. Becquerel. It has been well said that if it had not been for the previous discovery of the Röntgen rays, that of the Becquerel rays would have ranked as the most remarkable scientific event of the century. These rays appear to emanate from the originating substances without causing the latter any loss. Like the Röntgen rays, they have their own standard of opacity, and readily pass through cardboard and wood. Becquerel found that uranium exhibited this property of radiation in a high degree; and afterwards that thorium, so well known in connection with incandescent lighting, possessed it. More recently, M. and Madame Curie found radio-active constituents in Bohemian pitch-blende; and these were identified as compounds or varieties of bismuth and barium. It is yet doubtful whether these substances are elementary. Owing to the Becquerel rays being susceptible to magnetic deflection, it has been argued that they must be material. Other workers in this field have connected the phenomenon with fluorescence; and lately M. Debierne has announced the separation of a new radio-active element, which he calls "actinium," and describes as being allied to thorium. The action of any of these substances is very slight, compared with that of the Röntgen rays; but, on the other hand, the difference of the amount of energy involved in the respective effects is enormous.

Refractory Furnace-Linings.

Mr. Edward Duryee, the Chemist to the California Portland Cement Company, has published some observations on the behaviour of refractory furnace-linings under various conditions. He remarks that the character of the lining should be determined by the nature of the service required of it. This would seem to be an axiomatic principle; but in practice its violation has caused the failure of many furnaces. A platinum crucible will hold a slag of silicate of lime or soda for any length of time at the highest temperatures; but the addition of lead will cause it to melt quickly. The durability of fire-brick largely depends upon what is brought into contact with it. For cement kilns, Mr. Duryee finds that the best bricks are those which in composition approach most nearly to kaolinite. He makes a kiln-lining of bricks composed of one-third high alumina clay and two-thirds ground old fire-bricks. The bricks are moulded by hand, and are not pressed; and after being lightly burnt, they are dipped in boiling coal tar. When built into their places, these tarred bricks are washed over with a fusible slip of salt glaze, which melts easily and prevents the carbon from being burnt out too readily. It appears to be a strong point with this chemist that fire-brick should not be burnt too hard, but only just enough to prevent subsequent shrinking. He is also in favour of grinding up and working over old fire-brick; for some purposes mixing the material with molasses. This "mix," as he calls it, is boiled and tamped in while hot, when the moisture from the molasses is nearly expelled. A salt glaze is applied to the surface, in order to prevent the carbon from burning out of the molasses.

Steam-Heat Distribution.

One of the most useful of the services that competent technical journalism can render to its supporters, is the following-up of records of technical work and experiments. Much of the information that becomes public property through the agency of print relates to things that are about to be, or have recently been, done; and very often nothing more is heard about them, so that it never transpires whether they are successful or the contrary. For this reason, the "Engineering Magazine" is to be commended for returning to the subject of the important steam-heating plant at Dartmouth College, Hanover, N.H., a description of which, taken from our contemporary, appeared in the "Journal" for July 25 last (p. 230). It is now reported that the distribution of steam has proved successful, with the system already described, draining back to the boilers, which are situated at the lowest level of the establishment. During the past winter, the outside temperature fell on the coldest day to 23° Fahr.; but the drop in the steam pressure was only ½ lb. The pressure in the mains is 20 lbs., but is reduced to from 3 to 6 lbs. at the buildings. The lowest pitch of the pipes is about 0·63 inch for 10 feet. In connection with these long lines of pipe, there are a number of details of construction, chiefly designed to provide for expansion and contraction. This was done in various ways, conforming to the general idea of avoiding strains on the pipes. The greatest movement of the longest line is 6 inches. It is noted that the actual expansion for the long pipes is only from 75 to 80 per cent. of the calculated amount for a solid bar.

The Melting of Coke in Liquid Lime.

In many operations of industrial chemistry, it is important to take account of the degree of subdivision in which materials are submitted to treatment. Sometimes all the difference between success and failure rests in variation of the size of pieces or drops brought into contact with one another. A lesson on this subject is given in some observations of Carlson on the degree of pulverization of the raw materials in the manufacture of carbide of calcium. In the first place, this process consists in heating up a mixture of coke and lime, which is very similar to what has to be done for other objects. Carlson points out that the temperature of formation of calcium carbide is decidedly lower than that of the electric furnace, and that lime also melts well below this temperature. The product of the reaction is, further, a solvent of both lime and carbon. The process of the formation of calcium carbide should be as follows: The lime should melt first, and the coke dissolve in it, with the production of calcium carbide. This reaction is absolutely analogous to that which takes place between iron and dilute sulphuric acid. A solid body dissolves in a liquid with the evolution of gas—in the case of dissolving coke, the gas is carbon monoxide. In the

actual manufacture, pieces of coke the size of a nut are best for the purpose. The gases produced pass off freely throughout the mass, which they warm up, and escape from the furnace at a maximum temperature of 1000 to 1100° C. As the temperature of the electric arc is generally from 3000 to 4000° C., there is a considerable excess of heat. It is claimed that a ton of carbide can be made from 1590 kilos. of coarse raw material.

Ferruginous Incrustations in Water-Pipes.

Dr. Pellegrini recently made a communication to the National Congress of Hygiene of Turin regarding the ochreous deposits which are frequently found in water-pipes to such an extent as to completely obstruct them. The object he proposed was to study whether in these more or less ferruginous deposits of water the *Crenothrix* exerted a special biochemical action, determining precipitation of the iron, and contributing to the obstruction of the pipe. For this, he studied the ochreous formations peculiar to cast-iron pipes, and endeavoured to ascertain whether traces of *Crenothrix* are always found; whether other filamentous micro-organisms can grow there and produce ferruginous incrustations; and, finally, whether, granting the presence of these microphytes in the pipes, the tuberiform formations should be ascribed exclusively to micro-organic origin, or whether these deposits merely prepare a favourable ground for the growth of ferro-bacteria. Numerous experiments and analyses made with water taken from various sources has led the experimenter to conclude: (1) That the ferruginous tuberiform incrustations can form without the existence of the *Crenothrix*. (2) That this is not the only micro-organism which can grow in water-pipes and become impregnated with ochreous deposits. (3) That, whatever the participation of the ferro-bacteria in this phenomenon may be, it is not necessarily due to the abundance of iron salts in the water. (4) That the rugosity of the sediments causes a relative stagnation of the water, and is the indirect cause of obstruction with which the *Crenothrix*, or some other similar micro-organism, co-operates. Dr. Pellegrini recommends coating the interior of the pipes with varnish or coal tar, so as to prevent all chance of obstruction.

Refilling Colliery Workings.

A remarkable story of economical coal working by the aid of the process known as "culm flushing," has been told to the Franklin Institute of Philadelphia by Mr. W. Griffith. It is another illustration of the straits to which the exhaustion of the most easily worked, and consequently cheaper, coal seams is putting colliery proprietors in the United States as elsewhere. It appears that from 15 to 20 per cent. of the product of the anthracite mines, according to the methods of the past, was wasted in the form of powder, and therefore put away in vast piles of so-called "culm," which form mountainous heaps in the vicinity of the pits. Of late years, improvements in the methods of burning small coal have led to many of these heaps being worked over again; while the coal-breakers do not make so much waste as formerly. Consequently, the output of culm is checked; but still a good deal of it is unavoidably produced, only to cumber the ground, which is in places of considerable value. The expedient has therefore been adopted of washing the dust coal, or culm, back into the abandoned workings of the mine, where it acts as a filler. This is effected in the crudest way, by conveying the culm from the coal-breakers, or the pile, to a hopper on the end of a 3-inch pipe leading down to the old workings. A stream of water is turned on to the same pipe; and thus the small coal is washed down. This arrangement recalls projects that have been ventilated for conveying coal in bulk in the same way from the pits to gas-works and other centres of consumption. The water, after carrying down the coal to its destination, drains away to the sumps, whence the mine pumps lift it again. It is stated that the culm in this way gradually fills the old workings with a firm, resisting deposit. Eventually, it is expected that this deposit will take the weight of the old roof, and thus release the coal left to form the old pillars to be mined in its turn.

The Russian Coal Difficulty.—The Foreign Office have just received from H.M. Ambassador at St. Petersburg a despatch transmitting extracts from an article published in the "Industrial World" of that city on the subject of the coal crisis in Russia. After tracing the history of the imposition of duties on foreign—which is to say chiefly English—coal, the writer of the article asserts that the results of this protection of the home trade have been particularly deplorable in the South, where, for ten years at a stretch, a coal crisis has been going on. The prohibition of foreign coal on the railways has raised the price of fuel for the population as well as for the railways themselves. In the Black Sea and Baltic ports, this has been very sensibly felt, and one of the consequences of the cessation of coal imports into the Black Sea has been the rise of freights on grain. It would appear that the coalowners have not justified their promises that, should duties be imposed on foreign coal, Russian coal would come down in price everywhere. Cheap coal and naphtha can be obtained only by, first, the entire abolition of duties on coal, coke, briquettes, and every sort of fuel; and, secondly by permitting the railways to use whatever fuel may at any moment be most advantageous to them. The article concludes with the assertion that without the abolition of the duties on coal—which have been partly suspended—all the expenses of new avenues of communication, &c., will be for the advantage, not of the consumers, but of the mineowners and dealers.

TECHNICAL RECORD.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

The Twenty-third General Meeting of the Association was held last Wednesday, at the Lion Hotel, Cambridge, under the presidency of Mr. HARRY WIMHURST (Sleaford). There was an average attendance of members, among whom were several of the recently elected. A light luncheon preceded the business proceedings, which were throughout of an eminently useful and satisfactory character. On the President taking the chair,

The HON. SECRETARY (Mr. J. H. Troughton, of Newmarket) read the minutes of the meeting held at Sleaford in September last; and they were confirmed.

A WELCOME.

The PRESIDENT introduced the Chairman of the Cambridge Gas Company (Mr. E. Parker), and invited him to address the members.

Mr. PARKER, in appropriate expressions, heartily welcomed the Association to Cambridge; and proceeding to refer to matters affecting the industry, he said he thought there were serious questions ahead, especially in regard to the price of coal and the consequent price of gas to the consumer. A rise in coal of from 5s. to 6s. a ton must of necessity compel almost all gas companies to increase their price for gas. He could not himself see how it was to be avoided in justice to the shareholders, who had a right to expect a certain amount of interest for their money. The interest paid did not seem to him to be, in most cases, at all excessive at the price which gas stock now commanded. For a risk such as gas stock, shareholders were entitled to expect to receive from 4 to 5 per cent. on their money; and he could not see how sufficient was to be earned to pay the dividend unless the price of gas was considerably increased, so long as the price of coal was anything like it threatened to be. The Cambridge Gas Company were not under the sliding-scale; and this he personally thought was a mistake. He considered that in bad times, consumers and shareholders, being to a certain extent partners, ought to suffer together. Another question of great importance to gas managers was that of adopting such labour-saving contrivances as inclined retorts. At Cambridge, they had satisfied themselves—under the advice of their Engineer (Mr. R. Brown), and this was fully confirmed by Mr. Livesey—that, provided the right kind of coal which did not creep could be obtained, inclined retorts were the very best things that could be had. They had now five beds of these retorts; and their policy would be to increase the number as soon as they could. They were somewhat handicapped at the present time owing to the great increase in the price of iron and building; but as soon as they had a good opportunity, they would extend the inclined settings. Regarding the public lighting of streets, he was convinced that the incandescent gas-light was far preferable to the electric light; and, in his opinion, it was most important for gas companies to initiate a policy of effective street lighting.

REPORT AND ACCOUNTS.

The annual report and accounts were, on the suggestion of the PRESIDENT, taken as read. The former was mainly a record of the proceedings of the year. In a reference to the President's Inaugural Address at the last meeting, the Committee observed that it was pleasing to note, in connection with his remarks as to the fusion of the Gas Institute and Institution of Gas Engineers, that it seemed likely to become an accomplished fact at no distant date. The report also stated that the year commenced with a membership of 66. One member had resigned, and two had severed their connection with the Association by the operation of Rule 19. Three new members were elected during the year; leaving the total membership as it was—viz., 66. Six associate members were enrolled at the autumn meeting, under the new rule. The accounts showed that a balance of £38 5s. 3d. was brought forward; and subscriptions paid during the year amounted to £32 0s. 6d.—making a total of £70 5s. 9d. The expenditure had been £35 16s.; and this left a balance in hand of £34 9s. 9d., and a few subscriptions outstanding. The Committee appealed to the members to take a greater interest in the Association by volunteering papers, nominating additional members, and attending the meetings regularly.

NEW MEMBER.

On the motion of the HON. SECRETARY, seconded by Mr. J. G. HAWKINS (Spalding), Mr. A. J. Jackson, of Royston, was elected a member.

INCANDESCENT STREET LIGHTING.

The PRESIDENT, in calling upon Mr. J. H. Sheldrake, of the Welsbach Incandescent Gas-Light Company, to read his paper on the above subject, said he thought, after the members had heard the paper read, they would consider they had acted wisely in forming the class of associate members, and inviting such gentlemen as Mr. Sheldrake to join.

Mr. SHELDRAKE then read his paper, as follows:—

The subject of this paper should, at the present time, be of some interest to gas engineers, and others concerned in the lighting of our public thoroughfares; and my object in placing the matter before you is to give a few practical hints, which may be

of use to those who have not had much experience in this form of lighting. Many failures have been recorded, arising from insufficient knowledge of technical details by those who have had a new form of lighting placed in their hands. In a great number of towns, I am happy to say, these difficulties have been overcome, through the energy and skill shown by those who had the subject under their superintendence.

To show the enormous strides which have been made during the past twelve months in incandescent gas street lighting, I am in a position to state that upwards of 67,800 lamps have been altered from flat-flames to incandescents; and I venture to say that, in the coming year, these figures will be far exceeded.

Lighting authorities in this country, who have been willing in the past to allow 5 cubic feet per burner for street-lamps, now show a disposition to take advantage of incandescent lighting, by using burners of a small size, instead of giving the public the benefit of the extra light which could be obtained. I think this system is one which all gas managers should fight against; and no burners consuming less than 3 cubic feet of gas should be recommended.

As to the distance at which lamps are fixed, there is no settled measurement; each town or district adopts its own distance, to suit the requirements or the pockets of the ratepayers. In some suburban parts of our cities and towns, however, there is no doubt that the lamps are fixed too far apart; whereas, in main roads, where they have the assistance of shop lighting, they are put much closer.

With regard to the lamp-posts themselves, in all new installations it is very important to have lamp-posts of strong pattern, and well fixed into the ground, at a distance from the kerb, so that no vehicles passing would be liable to touch them. In the past, lamp-posts were fixed close to the edge of the kerb; and, from my experience, when these lamps have been fitted with incandescent burners, the breakage of mantles has been very great. But this is a matter which is being rapidly altered, and is not likely to be a trouble in the future. There is one thing, however, to which I earnestly call the attention of gas engineers, and that is the design of the pillars they order. Why do they stick to the old octagon, fluted, and other similar patterns, when, for a few shillings more, nice designs and good castings can be obtained? At the present moment, I think I am right in stating, there are more old-pattern lamp-posts sold than any other. This is a subject which, I think, ought to be seriously considered when new roads and districts are being lighted.

Here, in England, the policy has been to buy a lamp-post, lantern, cradle, lever-tap, and governor all for about 42s. Surely, those days ought to be now past. On the Continent, you will find, they spend from £8 to £12 on every lamp that is fitted. Independently of this, they are always kept clean (I refer to the lamp-pillar as well as the lantern); and anyone who has visited Paris or Berlin, and such cities, must have been struck with the fine appearance of their street lighting.

Lanterns.—The great point in a street-lantern for incandescent lighting is the ventilation. It is no good whatever attempting to fix incandescent burners in ordinary street lanterns, where the top of the lantern is open, or there is a pane of glass out at the bottom, which has, in the past, been used for the torch. The bottom of the lanterns should be closed as much as possible—in fact, if it can be closed altogether, it will be all the better. The top of the lantern should have an inner chimney with a cone at the bottom over the burner. By this means, the hot air from the burner escapes up the inner chimney and out at the top; and any down-draught which might find its way into the lantern from the top, is diverged by the cone, and does not affect the mantle. All existing street-lamps (where it is not desired to have new ones) can easily be altered in this manner, though I think it very important that we should get away from the old 14-inch street-lantern, which has been in existence from the earliest days of gas lighting. They should not be less than 16 inches square, as, in such lanterns, there is a larger capacity, and the mantles are not likely to be affected by the draught, as they would be in a smaller one. Besides, a lamp of this description is more imposing in appearance.

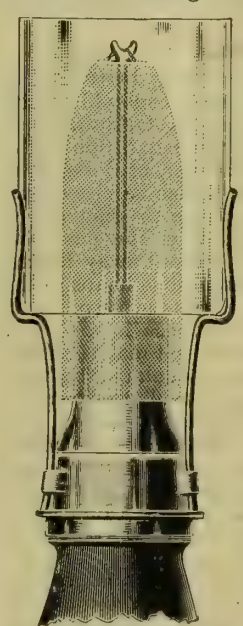
Burners and Anti-Vibrating Arrangements.—I now come to an important part—viz., the burner. From past experience, it has been proved that some form of anti-vibrating arrangement must be used. There are instances where they are not employed; but I think you will find that, in these cases, the lamp-posts have been of a very strong pattern, and not subject to much vibration from the traffic. I consider any form of anti-vibrator which has flexible india-rubber connections is not one which gas engineers should seriously adopt. The mere fact of a flexible connection to a street light does not give me the impression of its being a workmanlike job when fitted. Independently of this, there is the great risk of leakage—which would possibly destroy the lamp—caused either by carelessness or by the india-rubber perishing. This form of anti-vibrator has been extensively used; but I venture to think that an anti-vibrator which has nothing but metal parts is one which must commend itself for wear and tear.

A form of anti-vibrator, of which I have had considerable experience lately, is Chalmer's. This, when originally put on the market, had an asbestos washer in the head of the burner, to prevent the air from the outside of the bunsen tube passing into the head of the burner, and thus spoiling the quality of the flame. Experience has proved, however, that this washer, by its continual action, is liable to wear away and let in an admixture of more air—reducing the calorific power, with the result that the mantles do not give anything like the illuminating power they should. This, I am happy to say, has now been overcome by the introduction of a metal ferrule and washer, which takes the place of the asbestos, with the result that a good flame can always be maintained; and I should strongly recommend gas engineers who have any of the original form of anti-vibrators under their charge, to have them altered. In fixing the burner in the lantern, great care should be taken that it is perfectly vertical, and that the spring works freely, so as to give the full amount of resiliency.

Governors.—The question of suitable governors for incandescent lighting is one which requires care in selecting. They should be constructed to give a pressure on the outlet of not less than 10-10ths. Many that have been tested only give 6-10ths to 7-10ths, which is not sufficient to secure the full efficiency of the burners; and, therefore, disappointing results are given, which are no doubt blamed to the mantle.

Mantles.—I now approach another important part, and that is the mantle. For the present, I do not wish to mention any other than the Welsbach, because I do not know how far I should be looked upon as an infringer, if I ventured to mention any other form of mantle until it had a legal existence. I believe, however, that the Law Courts, within a very short time, will settle this matter. But quite apart from any legal decision, improvements in Welsbach mantles are about to be made by the Welsbach Company as the result of a number of important experiments.

My wish is to call attention to the fact that mantles which are now used for the various sizes of burners should be fitted the regulation distance from the top of the burner. We all know that the magnesia forks which are used vary in length; but, if care is taken to have these the right size, and firmly fitted into the top of the burner (I recommend always that a small piece of fine asbestos thread be just pressed in with the fork), the mantle will last much longer than if it is fitted on a loose, shifting fork, the effect of which is that, when the burner is alight, the mantle is always on the move, and, consequently, wearing away at the bottom. I strongly advise everyone to look to this; and I may say that I think, before long, forks of a different pattern will be adopted, the lower part of which will be in the form of a cone.



It is important that all incandescent burners should be, at every opportunity, cleaned out, so that no thick deposit of dust is allowed to accumulate in the interior. This is always apparent by the flame of the burner rising above the mantle; also by the blackening of the top of the mantle, and consequent loss of illuminating power.

Glass Protector.—Never attempt to use mantles without a glass protector. This has been recommended in the past; but I strongly advise everyone to see that some protection is given, not only to protect the mantle from draughts, but also during the process of cleaning the inside of the lantern. I have recently been experimenting, with the idea of finding out the best glass that can be used; and I am pleased to say that I have found a form of glass which will not only prolong the life of the mantle, but also give a considerable increase in illuminating power.

The burner used was a No. 4; and I find the following were the results:—

	Pressure.		Percentage Increase in Light over Unprotected Mantle
Mantle protected with the ordinary bulb globe	1·0	..	2¼
	1·5	..	4
	2·0	..	4
Mantle protected with new form of glass .	1·0	..	18
	1·5	..	20
	2·0	..	18½

Lighting.—With regard to the means of lighting, personally I prefer the bye-pass with the automatic cock, which, when the burner is alight, turns out the bye-pass. Unfortunately this form of tap is often abused by having the flame too long, or not under control with regard to the pressure. Two screws, however, have been introduced in the bye-pass, so as to check or minimize the excess pressure; but, anyhow, these bye-pass jets should not consume more than 0·3 cubic foot per hour. Working this out, with gas at 3s. per 1000 cubic feet, and allowing for an average of 3000 lighting hours—which, of course, varies according to the different localities—would mean a consumption for the year of 1728 cubic feet, costing 5s. 3d. for each bye-pass.

There have recently, however, been introduced several systems, one of which is the patent arrangement of Messrs. Simmance and Abady, whereby a tap is so constructed that, by giving it one movement, the torch is passed through the flap at the bottom of the lamp, and lights the bye-pass jet. The torch is then withdrawn, and the tap is given another turn, which lights

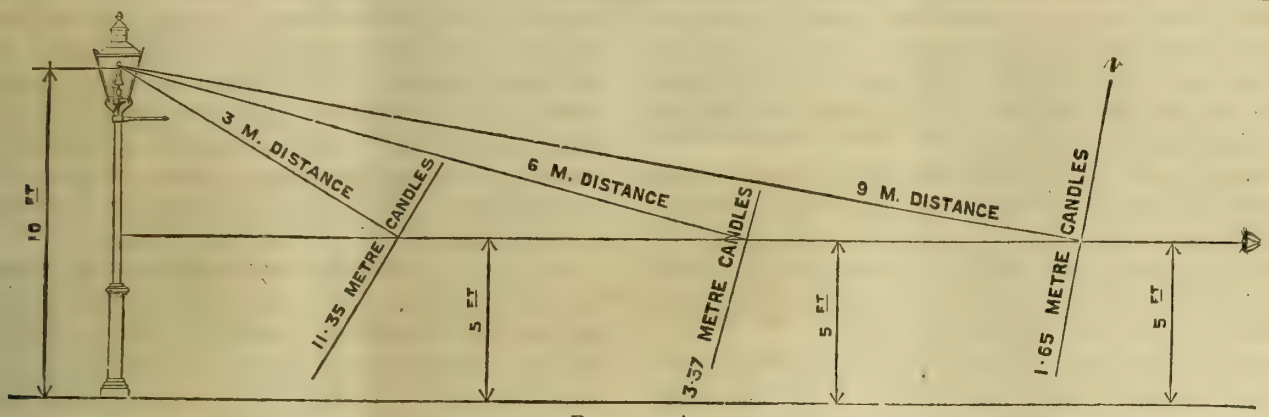


DIAGRAM A.

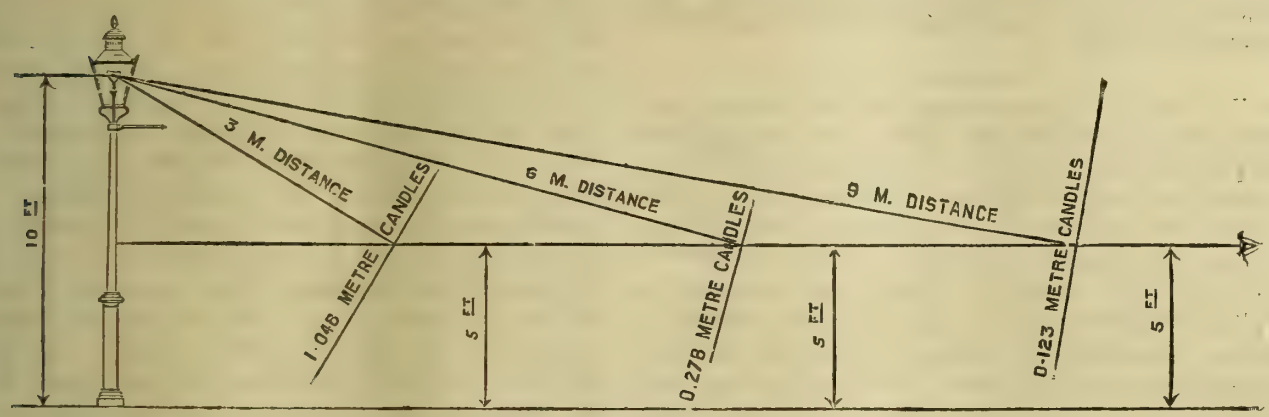


DIAGRAM B.

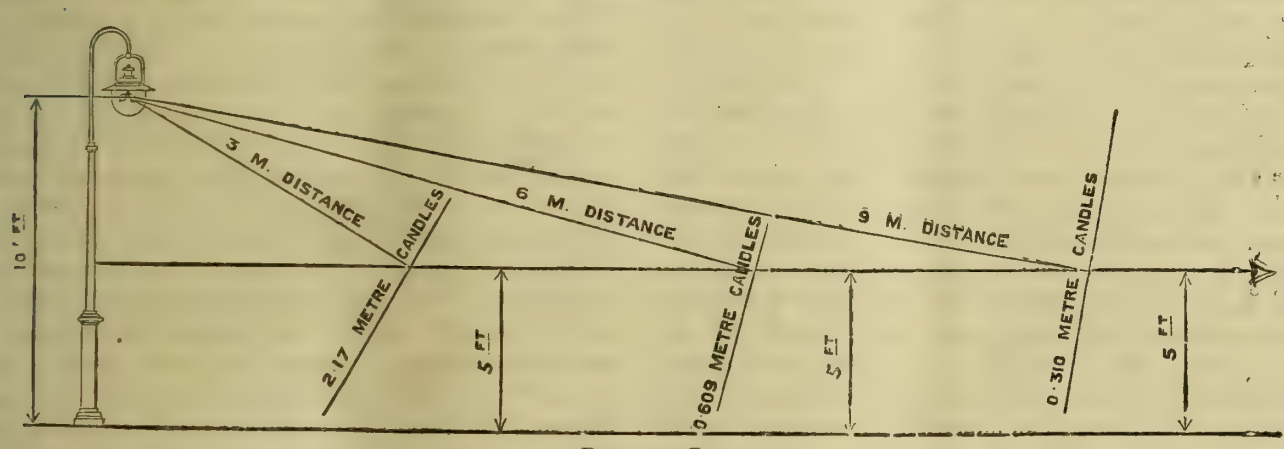


DIAGRAM C.

the burner and extinguishes the bye-pass. This works very well, and, no doubt, will find favour with many.

There is also a torch, working upon a hinge, which can be inserted into the lantern, and thrown at an angle over the top of the burner. This is a form which, I believe, has now been perfected and brought out by Mr. G. F. L. Foulger, of the Gaslight and Coke Company; and, no doubt, many of you have had particulars of it.*

Of course, with the torch form of lighting, it is necessary to have a flap at the bottom of the lamp, hinged from the centre. But there is, I think, considerable risk of danger to glasses and mantles, unless great care is used by the lamplighter when inserting the torch.

Cost of Mantles.—The cost of mantles has been, in some districts, a very important item. Not only were the lamp-posts close to the kerb, but the stand-pipe was not central, and was quite loose in the column; and the consequence was that the least vibration in the road affected the mantle in a very serious manner. In other districts, I hear of only about 1½ mantles being employed per annum per burner. This is a very low average, and shows great care in their use. I think, however, that, with all the latest improvements in the anti-vibrator, and the proper fitting of the mantles to the burners, an average of 4 mantles per annum (with the new form of glass) would not be excessive, considering the high results which are obtained. In every case, it should be insisted upon that an anti-vibrating arrangement should be used.

Lighting Efficiency of Different Burners.—I have recently been assisting at some tests to determine the lighting efficiency or diffused light given by different burners at various distances. The first which was tested was one of the "Westminster" lamps, which had a Kern burner, No. 4 size, fixed at a height of 10 feet from the ground. Several readings were taken at 3, 6, and 9 metres distance from the light at a height of 5 feet from the ground. The photometer used was of German manufacture, and is known as Professor Weber's. At a distance of 3 metres, the light given was 11·35 metre-candles; at 6 metres, 3·37 metre-candles; and at 9 metres, 1·65 metre-candles. These figures [see Diagram A], therefore, state the actual useful light furnished by a burner which was giving about 106-candle power. In a burner of this class, of course, the light given in every direction would be the same.

I afterwards substituted for the Kern burner a 5 feet Bray's burner, which consumed 5·1 cubic feet of gas per hour; and I found the light given from this, at 3 metres distance, to be 1·048 metre-candles, at 6 metres 0·278 metre-candle, and at 9 metres 0·123 metre-candle [see Diagram B].

To follow up these experiments, it occurred to me that it would be very interesting indeed to know how Mr. Smithard, of King's Lynn, fares with his electric light; and I therefore sent down to test under the same conditions as those under which the previous experiments had been carried out. I found that there were two nominal 16-candle power incandescent lamps in each lantern; and, upon testing their photometrical power, they were found to give 24 actual candles. Upon testing these at 3 metres distance, an effective candle power was given of 2·17 metre-candles, at 6 metres distance 0·609 metre-candles, and at 9 metres distance 0·310 metre-candle [see Diagram C].

To prevent any misunderstanding with regard to the figures which I have given, I think it right to mention that the candle power shown at the various distances represents the light of a corresponding number of candles, if placed 1 metre from a screen fixed at the distances mentioned.

With these figures before us, it is now possible to form some reliable opinion as to the actual cost of street lighting by the three systems tested. Presuming gas to be 3s. per 1000 cubic feet, which will do for illustration, the cost of the No. 4 Kern

* An illustrated description of one form of the arrangement referred to appears in our "Register of Patents" to day, p. 1063.—ED. J.G.L.

burner will work out at 12s. 11d. per 1000 hours. In this calculation, I have allowed for the bye-pass. With a 5-feet flat-flame burner, the cost for a similar period would be 15s.; and with electricity at 3d. per unit, the cost would be 30s. At King's Lynn, the cost is 5½d. per unit. I have taken the price for electricity at 3d., which is, I consider, the lowest figure at which it can possibly be supplied at a profit.

To sum up the above results, the difference will be more apparent if I mention that to obtain 106 candles by the use of a Kern burner, it costs 12s. 11d. per 1000 hours; with a flat-flame burner, giving a light of about 10 candles, the cost would be 15s.; or with electricity, giving a light of 24 candles, the cost would be 30s. for the same period. These figures will, I think, prove that gas engineers, by adopting the incandescent gas system of street lighting, are going in the right direction.

In conclusion, the position between gas companies and municipal authorities is not always of the happiest; but, with regard to street lighting, I think that, in view of the competition which may or does occur, gas companies should endeavour, by all means, to meet them in as liberal a spirit as possible. The effect of this is seen in the spirited policy of the South Metropolitan Gas Company.

Discussion.

Mr. W. J. Best (St. Ives) remarked that Mr. Sheldrake had certainly preached from his own point of view; but, in his (the speaker's) experience, there were many places where the incandescent mantle would not answer. In hotels, for instance, where carpets were frequently being taken up and swept, dust got into the mantles and burners, and there they were more or less a failure. He was not for a moment depreciating incandescent gas lighting, because he thought it the light of the future.

Mr. W. D. Child (Romford) remarked that there was no doubt the incandescent gas-light had enabled gas companies to hold their own to a very great extent against the competition of other lights; and this they would have had considerable difficulty in accomplishing in any other way. Therefore, they were glad to receive from Mr. Sheldrake any suggestion that would assist them to utilize this splendid light to the best advantage. He agreed with him that gas companies should not avail themselves of the smaller quantity of gas required to give a high illuminating power, by cutting down the consumption. They had far better avail themselves of the greater intensity and effect in lighting that might be obtained by using (say) 4 cubic feet of gas per hour instead of the ordinary 5 cubic feet, and so show what really good and effective street lighting could be secured by simply changing from flat flame to incandescent burners. Mr. Sheldrake went on to speak of lamp columns. Those managers who had not rapidly advancing towns could not think of changing from the old-fashioned column at the same time that they adopted the incandescent burner; but in districts that were growing, of course they could gradually introduce well-designed styles of lamp columns, and put the old-fashioned ones into places where they would not be so noticeable. He did not think that anyone but a handy man or amateur would fall back upon an india-rubber connection. An engineer would quickly endeavour to devise some kind of connection which would be suitable for an anti-vibrator burner. When he first tried the incandescent light, he used an india-rubber connection; and he soon found that where he saved two mantles, he destroyed two burners and lanterns. As to the length of the forks for supporting the mantles, he believed Mr. Sheldrake said they varied; but when the Welsbach Company supplied new burners, they certainly ought to provide the best appliances for using them. He had himself, in making experiments with the incandescent burner, been tempted to break a piece off another fork and put it into the socket made for it, so as to utilize the mantle to the fullest extent; and he had an idea that he obtained a better illuminating power than was given by a mantle on the length of fork usually sent out by the Company. He thought it was the Company's duty to determine what length of mantle would give the best illuminating power with the quantity of gas they recommended should be consumed, and to supply the right length of fork, rather than leave the gas manager to use indiscriminate lengths.

Mr. J. T. Jolliffe (Ipswich) said his experience led him very much to re-echo every word that Mr. Sheldrake had said, except perhaps that he (Mr. Jolliffe) was not a great believer in the Kern burner. He had not yet been able to get any really satisfactory results that would justify him in discarding the "C" burner for the Kern. But he did think that anyone who was going into this question might with advantage abandon the bulb glass, and use the perforated chimney that had been brought out by Messrs. Falk, Stadelmann, and Co. With this alteration, he found a very considerable gain not only in lighting effect, but also in the duration of the mantles. In his paper, the author stated that somebody was trying to get down to 1½ mantles per lamp per annum. He (Mr. Jolliffe) should say, "Don't." Their object was to light the streets properly, and by cutting down the mantles to so low a figure as that, they would not get the best possible results. All the members present knew as well as he himself did, that the lighting effect of the Welsbach, or any other mantle, seriously diminished after any lengthened period of lighting. Therefore, he said, "Use your mantles liberally." He did not think that less than six per annum should be attempted. He knew that this was a costly matter; and it would be a very important thing for gas companies if the Welsbach Company would reduce the cost of their mantles. It seemed to him an astonishing thing that in Berlin one could buy mantles for 2½d. apiece; while the retail price in England was 1s. each. There did not seem to be anything at all to account for such a mighty discrepancy. He daresay many of the members had (he had himself over and over again) been offered mantles from Berlin at a fraction over 2½d. each. He had tried these mantles, and while he would not say they were quite as good as the Welsbach, they were nearly so. If the Welsbach Company, instead of spending so much money on law, would supply cheaper mantles, it would be an advantage to gas companies and to themselves.

Mr. R. Brown (Cambridge) said the paper was one with which they could nearly all agree. Regarding corporations cutting down the gas consumption to the lowest possible figure, that had been their experience in Cambridge. He tried to introduce the No. 4 burner, so as to obtain the best possible light; but the Corporation insisted on having the No. 3, in order to lessen the consumption of gas. In his opinion, no burner should be allowed in any public street of a size smaller than the No. 4 Kern. Mr. Jolliffe had spoken of the Kern as not being so good as the "C" burner. His (Mr. Brown's) experience was directly opposite. After having had experience with Nos. 3 and 4 Kerns, he would never advise anybody to go in for the "C" burner; the results obtained were very much greater. Mr. Sheldrake had taken them to task a good deal on the subject of lamp columns. Of course, the columns had not made the same progress as the other fittings; and this was not the first time they had been held up to ridicule. He believed it was Mr. Marshall who, at a meeting of the Institution of Gas Engineers, referred to the London gas-lamp posts as monstrosities. Mr. Sheldrake himself said they had been buying all they required for 42s. each; and he then advised them to spend £8 or £12. This would mean extra capital and interest, which would add to the cost per lamp per annum; and he did not think the corporation was yet born who would be prepared to pay extra for any improvement they made in the lamp columns. He agreed that to use ordinary street lanterns for incandescent lighting was simply to court disaster; but whether they could be easily altered for the purpose depended on the character of the lamp. In his case, the lanterns were very old. It would be difficult to alter them; and they would not be a success. If a lantern required a new bottom and top, he thought it better to purchase a new one. He admitted that a No. 4 Kern burner required a 16-inch lantern; but 14-inch lanterns would do equally well for No. 3 burners. As to governors, he was much in doubt as to whether they secured the advantages claimed for them. Concerning the number of mantles used, he did not intend to try to get down to 1½ per lamp per annum, as what they wanted to do was to give the public as good a light as possible. In his case, the average had worked out to 9 per annum; but this was with incandescent lighting only in the main streets. Now that they were lighting the bye-streets, the mantle account would be much less. He thought the glass protector was a great improvement on the ordinary bulb, and he should probably recommend his Board to adopt it. The question of the bye-pass was one that had exercised the minds of both himself and his Board, as to whether they should do away with it altogether. The author had mentioned the torch arrangement of Messrs. Simmance and Abady; but he did not appear very enthusiastic about it. It seemed to him (Mr. Brown) that there would be very great risk in using a torch inside a lantern containing incandescent mantles, as they could not make lamplighters do the same as they would do themselves. He thought that if the bye-passes were improved, so as to give not more than ⅛-inch jet, it would be a great benefit.

Mr. E. W. Smith (Chelmsford), while complimenting Mr. Sheldrake on the excellence of the paper, said there were one or two points he could not quite agree with. Speaking of the distance at which lamp columns were fixed, the author pointed out that in main roads, "where they have the assistance of shop lighting, they are put much closer" than in other parts. Did he understand the author to mean that they were too close, because, if so, he would point out that they must have regard to the times the shops closed. Unless the lamps were kept a reasonable distance apart, he was afraid that, on Sunday evenings and after the shops were shut, they would find there was not sufficient light. He agreed with previous speakers that gas companies could not discard their old-fashioned lamps. The lanterns were a considerable item; and they must continue to use them, or adapt them to the newer form of lighting. As to the new glass protector, in the old days of incandescent lighting they were told they must use chimneys 9 inches long to get the best results. His experience had tended in the other direction; the shorter and wider the chimney (to a point), the better the light obtained. He was inclined to think the alteration proposed by Mr. Sheldrake was a very good one. At Chelmsford, the lighting in the town itself had been for many years done by electricity; and he had been informed recently that the charge per lamp per annum for incandescent electric lighting was £2 6s. 8d.—that was used throughout the year. He mentioned this because he did not see that the author had told them the consumption of the No. 4 Kern burner; and it was well to remember these things in comparing the cost. He considered the Kern better than the old "C" burner.

Mr. R. G. Shadbolt (Grantham), referring to comparisons of the old "C" bulb burner and the Kern for use in street-lamps,

said there was one point they had overlooked, and that was the old-fashioned reflector in use with the bulb burner. For some four winters now, they had lighted the central part of Grantham with incandescent burners. In the first instance, they experimented with the ordinary "C" burner with talc or mica chimneys; but they very soon adopted the bulb burner. He found, comparing their own lamps with those of the Railway Company (which were in close proximity to the "C" bulb lamps, and were fitted with two No. 4 Kern burners), that, although the light was very intense or brilliant at the centre of illumination, still the effect upon the ground did not seem to be as good. In fact, they were satisfied at Grantham that the "C" bulb burner was preferable to the Kern burner. Having related a little experience in which there was an excessive destruction of mantles outside a toy shop owing to the packing of empty crates round the column, he said he agreed with Mr. Jolliffe that efficient lighting could not be accomplished with less than six mantles per lamp per annum. In his own case, they used an average of 5 or 5½.

Mr. J. Carter (Lincoln) could not quite see why the old rub against lamp columns had been indulged in, nor did he see any reason why they should be recommended to associate an expenditure of £8 or £12 for a lamp and column with the establishment of the system of incandescent street lighting. The more economical they could make the original adoption of the system, the more likely were they to succeed. During the last few months, he had been conducting an experiment with the Kern burner; and in some cases he purchased new lanterns for the purpose, and utilized the existing columns, because he recognized that the object he was seeking to attain was not to provide an attractive lamp pillar for those who walked along the street in the daytime, but to provide as effective a light as possible in the streets at night time. He was thinking more of the lighting than he was of gratifying any aesthetic or artistic taste. In two cases he bought new lanterns, and in about twenty cases he utilized the somewhat despised 14-inch lanterns, fitting them with opal tops and closing in the bottom part. The cost of this was about 2s. 6d. or 3s. The lamps were supplied with No. 4 Kern burners, with anti-vibrators; and after 1871 lighting-hours (with 23 or 24 lamps in use) only three new mantles had been required, and in the other 21 cases the original mantles were still in use—in fact, they had been burning for something like 2000 lighting-hours. Having explained the causes to which he ascribed the failure of the three mantles, he said that, after 1800 hours' burning, in one case he put on a new mantle for the purpose of observing whether the ordinary passer-by would be able to distinguish between the light given by those that had been burning 1800 hours and the new one; and a very careful examination would have to be made before anyone would discern any appreciable loss of light. He would like to know whether Mr. Sheldrake could tell them what was the pressure at which the Kern burner could be relied upon to give the utmost efficiency.

Mr. J. H. Troughton (Newmarket) said, with reference to the new glass protector, Mr. Sheldrake in his paper compared the results secured when using this with those obtained by a naked burner. He thought it would have been much more satisfactory if he could have given them the same comparison with the glass that was sold as the latest improved bulb. In his table, Mr. Sheldrake showed that with this glass protector an increased lighting efficiency of something like 14 per cent. was obtained. Some eight months ago they adopted the incandescent system at Newmarket; and all the lamps were fitted up with Nos. 3 and 4 Kern burners. From experiments, he had found them a very great improvement over the "C" burner. In regard to gas consumption, the "C" burner used 4 cubic feet per hour; while the Kern burner consumed a little over that with the bye-pass. There was a good deal of waste with bye-passes if left to the lamplighters; and besides they blackened the mantles. He was rather sorry the author had not said anything about the matchless form of lighting lamps. If some such method could be invented for street lighting, it would be a great improvement. He also missed from the paper any reference to intensified gas-lighting.

The President, having acknowledged the indebtedness of the Association to Mr. Sheldrake for his paper, said that some twelve months ago his Company offered to light Sleaford with incandescent burners, if the authority would assure them of a three or fours years' contract. They did not want any guarantee. The authority could not see their way clear to give any assurance owing to an application by them to the Board of Trade for a Provisional Order to supply electricity. Notwithstanding, he advised his Board to light up the principal streets with the incandescent burner. They adopted his suggestion; and now they had the whole of the main streets lighted with Kern burners fitted in new lanterns. Although they used an anti-vibrator burner, and had protected the mantles in several ways, the average use of mantles was a little over six per annum.

Mr. Sheldrake, in replying, said that, with reference to Mr. Best's remarks, the paper dealt with street and not interior lighting. There was no doubt that the Welsbach or any other form of incandescent burner must be properly and constantly cleansed from all dust and dirt, which, of course, militated against its lighting power. As to Mr. Child's criticisms, the forks to which he (Mr. Sheldrake) referred in the paper were those sold outside the Welsbach Company. There were thousands of these bought from makers who did not take the trouble that the Welsbach Company did to see that they were sent out of the correct length. Mr. Jolliffe had alluded to the use of the bulb chimney with the "C" burner. There was no doubt that this form of chimney did protect the mantle; but he (Mr. Sheldrake) considered there was a great risk in using an enclosed chimney of this form, and a great loss of illuminating power unless they were kept very clean. They "bloomed" very quickly; and the consequence was there was a great loss of illuminating power. Comparisons had been made between the "C" and the Kern burner. The former collected the dust much quicker than the latter; and, in his opinion, one of the great advantages of the Kern burner was that there was no part on which the dust could accumulate, excepting in the cone, which took a long time to choke. A short time ago he saw some tests made with a dirty "C" burner, which only gave about 13 candles; but by cleaning it a light of 42 candles was obtained. This proved that the cleansing of the burner was an important point. As to the cost of mantles in Berlin, of course that was a subject on which he could not say much. In Berlin, there were no patent rights; and there were in England. [Mr. Jolliffe: That's a pity.] That might be so; but it was a consideration from which no doubt gas companies would reap benefit in the future. Mr. Brown had taken him severely to task in one respect, in saying that he (Mr. Sheldrake) had ridiculed the old lamp-posts. This was not so. The position he took up was that those who were putting down new lamp-posts should get the ironfounders to give them a better design than the old octagon and fluted patterns. He did not think for a moment that in England they would spend the same amount of money on the street-lamps that was done on the Continent; and he did not see that they could. They might, however, when opportunity arose, have something a little more tasteful. He agreed that if the ventilation of a 14-inch lantern was altered, it would do for a No. 2 Kern burner, but he should not recommend it for a No. 4. He did not think it was fair to the burner; and the top of the lamp was so open that any down-draught would be sure to affect the mantle in the long run. With regard to the average of 1½ mantles per lamp, that was a figure published in connection with one of the West of England towns. Personally he doubted it. An average of six a year was a very good result; but with the new protector, it might be brought down to about four. He did not think a ⅛-inch flame for the bye-pass would be sufficient, as the least draught in winter would blow it out; and he thought they ought to have a ⅜-inch flame. As to the distance apart of lamp-posts, they should be nearer in towns and cities than in outlying districts; but when they came to hear of lamps being 150 and 200 yards apart, it was certainly a distance that ought to be reduced. In some main thoroughfares, the lamps were only 25 yards apart; and his point was as to whether in such cases they might not be a little farther apart, and the outlying districts get the advantage. For the "C" burners, he thought a 9-inch chimney was longer than there was any necessity for; and a large number had been used only 6 inches long. The new glass was not a chimney; it was only a protector for the mantles on the new burners. The "C" bulb burner was no doubt the best of its class; but such good results could not be obtained with it as with the Kern burner. He congratulated Mr. Carter on the splendid results he had obtained; and, speaking of governors, he thought that the highest results were realized when the gas was at 1 inch pressure. He did not think Mr. Troughton had correctly read his figures as to the percentage increase in light of protected over unprotected mantles. They showed that with a bulb glass an increase of 2¼ per cent. was obtained over the naked mantle, and with the new form of glass 18 per cent. As to matchless gas lighting, they had a new method which was a great success. By turning a tap to the right, a bye-pass was lit; then by putting the lever or tap vertical, the burner was full on; and by turning it to the left, the flame could be extinguished or lowered. This device had been perfected for interior lighting; and before long he had no doubt they would have it adapted for street lighting. He could not say he was altogether in favour of intensified lighting. Splendid results were obtained—30 to 40 candles per cubic foot of gas—but with an expenditure not only of the gas, but of some form of energy, besides which there was the increased wear and tear of the mantles. In some experiments with a series of Kern burners, he had obtained about 104 candles per burner, and 240 candles when working at a pressure of about 8½ inches; but instead of only using 4 cubic feet of gas, he burnt 8½ feet, and energy had to be provided to furnish the increased pressure. Two No. 4 Kern burners would give equal satisfaction, without any trouble or any outside energy. Of course, in certain places a very brilliant light would be useful, no matter what the cost; but for street lighting, he did not look upon intensified lighting as having any chance for some time to come.

GAS COAL: ITS PRESENT PRICE AND EFFECT ON THE GAS INDUSTRY.

Mr. R. G. Shadbolt (Grantham) opened a discussion on the above subject. After a few preliminary remarks, he said they could not talk about gas coal without taking into consideration the coal trade generally, for the gas industry used but a very small proportion of the total quantity raised in the United

Kingdom. If they took the total quantity raised last year as being 200 million tons, and the consumption of gas coal, according to the Board of Trade returns, as about 12 million tons, then they had the proportion that the consumption of coal in the gas industry bore to the whole. There was no mistaking from this that the present price was due not to the demand for gas coal, but to extraneous or outside circumstances, over which the gas industry had no control. The total exports of coal from the United Kingdom last year amounted to 41,180,300 tons, against 35,058,430 tons in 1898. Adding to this the coal shipped at ports in the United Kingdom for ships' use on foreign voyages, amounting to 12,226,801 tons, as against 11,264,204 tons in 1898, they had the increase in the coal (if he might put it so) used out of the country in 1899 over 1898. Of the increase of 6,121,870 tons in exports, 5,589,594 tons were sent to Europe—to France, South of Europe, North Russia, and so on. This accounted for the principal portion. Then adding the increased quantity used by British vessels on foreign voyages (962,597 tons), the total increased quantity used out of the country last year was 7,084,467 tons, or about 3½ per cent. of the total output of the country. Another way of looking at this, and realizing what it meant, was to see the proportion it bore to the coal used by the gas industry. He found that this quantity (the 7,084,467 tons) was a little more than one-half the total used by the authorized gas undertakings of the United Kingdom—in fact, it was about 7-12ths. In other words, as far as the export trade was concerned, about 7-12ths of the quantity used for gas making had been exported over and above the previous year. This must have some effect upon the present state of affairs as to the increased cost to the colliery proprietors. Yet he thought the members would all agree that 5s. or 7s. a ton, as the case might be, was altogether out of proportion to the extra cost the colliery proprietors had been put to. If they tried to look at the matter fairly and squarely, they might safely say that the advances of the last year or two had met the increased cost of production. Going further than that, and taking into account the increases to miners during last year, and the prospective increases, the increased cost of materials of every kind, and incidentals, they would be very liberal if they put the whole of this down at 1s. a ton. So that he thought, without being unfair in any way, they might safely conclude that they were about to be, if not actually being, taxed to the extent of about 4s. a ton for Yorkshire coal, and 6s. a ton for Durham coal. This unusual state of affairs was causing the responsible heads of gas undertakings a great deal of anxious consideration. No doubt it was all due to the flourishing home trade and to the exports as already shown. He thought he might make this as an assertion, that the demand for gas coal was perhaps of all demands for coal the most constant; so that the rise was not due to any fluctuation on the part of gas makers, or any increase or sudden great demand upon the collieries, but it was due to something more than they could control—in other words, they were subject to the fluctuations of others, and were suffering undoubtedly from causes not immediately their own. In considering the effects of this increase in prices upon the gas industry, the first question that presented itself to his mind was, was it likely to be permanent, or was it only of temporary duration? Upon this hinged the whole question. If it was likely to be permanent, then they had only one course before them, and that was to estimate to the full extent the effect it would have upon the cost of producing gas, and put it entirely upon the price of gas to the consumers, because, as had been said by the Chairman of the Cambridge Gas Company, the remuneration of gas shareholders and authorities was none too much as it was. His own idea, however, was that the rise was of a temporary rather than of a permanent nature—that it had almost, if not quite, reached its zenith; and that the long-suffering gas people had reached the limit of (should he call it) the coal tax. Mr. Bennett H. Brough, in an article in the "Nineteenth Century" for April, brought forward a new factor, which would have the tendency of preventing any further great increase in the price of coal generally. He said:

> There have been extraordinary demands principally from Austria, south of France, Belgium, and Russia. In short, throughout Europe there is the same story of the scarcity of coal. "Ill blows the wind that profits nobody." Europe's difficulty appears to be America's opportunity; and if the high prices are maintained, large deliveries may be expected from the United States. Atlantic liners no longer carry coal from Great Britain for the return journey; they take in American coal. In February, the Paris, Lyons, and Mediterranean Railway ordered 75,000 tons of American coal, and 50,000 tons were shipped from Philadelphia to Italy for railway use at a cost of 6s. per ton f.o.b. Indeed, it is possible that American exports of coal may in time become as important as those of wheat and cotton; for whilst in Europe the price of coal has of late years constantly increased, in the United States it has shown a tendency to decline. One of the chief causes of the lower prices obtaining in America is the general use of mining machines, which enables the coalowners to produce their coal with less men; the output per miner being increased 50 to 100 per cent. A lesson in keeping down costs might certainly be learned from the United States.

He (Mr. Shadbolt) thought there was a factor here, which, if coal prices went much further, would at any rate affect the exports to our European markets. The question was, What would it cost to get American coal here? Mr. Standring had very kindly assisted him in this matter; and he had given him as the probable freight for coal from New Orleans to Liverpool 18s. per ton, and from New York rather less; so that if they took the 18s., *plus* 6s. f.o.b., they had the cost as 24s. at British ports. A Russian order was recently placed for 200,000 tons of South Wales coal; and, adding to the 24s. the extra freight for the additional distance for American steam coal to (say) Odessa, one would think that American coal ought to be within reasonable distance of competing in an instance of that kind, where it was being delivered at 31s. The 24s. and 31s. left a good margin between the rates at Liverpool and Odessa. So it seemed to him they were within measurable distance of a new factor. They might depend upon it that, if the European markets were tapped by America, freights might easily fall, and exports from which they, as gas manufacturers, were now suffering, would decrease in consequence. This in itself might in time effect some cure. He (Mr. Shadbolt) therefore took up the position that it looked as though they had reached almost, if not quite, the maximum price. Then there was the question whether this was likely to be permanent or not. He thought they must take the present price as to some extent a forced one. What he meant was that the cost of production did not warrant it—it was the state of the market simply; and as soon as the tension was relieved, from whatever source, the price was bound to fall accordingly. It might be that to some extent the present prices had been decided upon as a set-off against the low prices which ruled a few years ago, and upon which, unfortunately, their gas prices were based. Like water, in course of time this would all find its own level; and eventually they might reach the happy mean. Until then, however, they must keep moving. They had the position to face; and the question was, what were they to do *now?* In seeking for compensating features, they naturally looked almost wholly and solely to residuals. With fuels all round advancing, coke must benefit; and the coke return ought to be improved. To the extent that the residuals were enhanced in value, they would reduce the extra burden. Comparing the prices of residuals with twelve months ago, they might take it, speaking generally, that tar was worth 5s. per ton more, liquor 1s. 6d., and coke 5s. As to whether these advances would outstand the coal advances was a vital question, and subject to many and diverse influences, local and general. They might assume, for the sake of argument, that they would stand good over the next coal contracts. Then if they allowed an output, speaking generally again, of 8 cwt. of coke per ton of coal carbonized, 3 cwt. of 5° Twaddel ammoniacal liquor, and 1 cwt. of tar, they got from coke an increased yield of 2s., from liquor 2·7d., and from tar 3d., making a total of 2s. 5·7d. to set against the increased price of coal. This left a balance of 2s. 6·3d. per ton in the case of Yorkshire coal, and 4s. 6·3d. with Durham coal. If they allowed 9000 cubic feet of gas sold per ton of coal carbonized, they found these balances equalled 3·36d. per 1000 cubic feet of gas from Yorkshire coal and 6·03d. per 1000 feet from Durham coal. Other materials had also advanced; and as Durham coal yielded perhaps more coke than Yorkshire, they might safely add 4d. increase per 1000 feet of gas where Yorkshire coal was used, and 6d. where Durham coal was used. This, of course, was irrespective of sliding-scales and reserve funds, or anything of that kind, and was simply what was necessary to maintain last year's position. Another question followed, and that was, How was this advance in the price of gas going to affect them as an industry? Would it have the tendency of curtailing consumption, or fostering it? Increases in price had not the tendency of fostering consumption as a rule; but it might in this case prove (should he call it) "a blessing in disguise"—at any rate, the cloud might have a silver lining. For, if they took into account the return they might probably expect from residuals, and thereby reduce their burden to some extent, they found, comparing gas with other methods of obtaining light, heat, and power, the increase they had to bear was much less than would have to be borne by the others. Thus the residuals were their salvation; there were no residuals from any of the other sources of light, heat, and power. As he had shown, however, gas manufacturers were unable to meet the entire increase, and they were compelled to put it upon the price of their own commodity, but not in the same proportion as others. In this was their opportunity. Then, again, the ordinary renewals and repairs of gas-works took place very irregularly; and if they could persuade themselves that the present advance in price was only temporary, it behoved them to retrench to some extent so far as renewals and replacements of plant were concerned. If they could shelve schemes of this kind for a year or two, until the price of coal fell to something more reasonable, they would be able to tide over and to benefit thereby. And if they could prove to the public that they had been compelled to advance their prices less than any other means of obtaining light, heat, and fuel, they would again benefit very considerably, more customers would be gained, and they would extend the use of gas for cooking and heating purposes; and this time next year gas stock would probably be more valuable than it was to-day. Speaking of coke, he thought it had been apparent to all of them at different times that gas-works were given very much to over-lapping and under-selling. Coke was the principal residual in the present crisis to which they looked for some return and assistance. In this Association they had a membership representing about 58 different gas-works, 36 of which were under 50 millions in their annual make. It ought not, in a district of this character, to be without the range of possibility to prevent at any rate a great deal of this overlapping and underselling, and so enhance the value of the residual which, at the

present time, was the factor they most relied on. There were large works at which the output of coke was out of all proportion to the local requirements; and consequently the towns immediately adjoining must suffer. He thought that, in a district like the Eastern Counties, the members of the Association might arrange something which, if it would not altogether remove the evil, would at any rate mitigate it.

Mr. J. Carter (Lincoln) thought that probably the root of the whole trouble was the question of the exportation of coal. He sometimes felt that, if he had the power, he would deal with it in a very summary way, seeing how important were our coal resources, and how necessary they were to our industrial existence. It had sometimes occurred to him that the time might now have come in the history of the country when Parliament should take steps to retain the coal for home consumption. Respecting gas coal, a minimum increase of 5s. per ton had been talked about; and he presumed this would be the unfortunate experience of most of them. Mr. Shadbolt pointed out that the blow would be mitigated somewhat by residuals. But when they bore in mind that for the last six months they had had the advantage of higher prices for residuals, it seemed to him there was no possibility of expecting, in the next twelve months, an increased return of 5s. per ton upon saleable coke. Honesty and candour compelled the admission that there was no doubt they had been buying their coal at a price that neither paid the colliery owner for the risk of his capital and for the exercise of his brains, nor the collier for the danger and labour he had to undergo. But the mischief was their friends had placed them in the unfortunate position of having their gas prices based upon the low cost of coal. He was inclined to think that the increased cost of fuel would not have so great an effect in increasing the price of electricity as it would have upon the cost of gas.

Mr. P. W. D. Standring, on the invitation of the President, said the whole question simply resolved itself into one of demand and supply. For the last few years the demand for coal (more especially from foreign nations) had been gradually increasing until it was ahead of the supply. He should like to know whether, in his comparisons, Mr. Shadbolt took into account the Welsh strike.

Mr. Shadbolt said he had taken nothing but what appeared in the returns.

Mr. Standring said the exports were largely diminished in 1898, and this made 1899 look much larger. With Mr. Shadbolt, he should not be at all surprised if they did not see American coal in this country before many years, especially if the price of British coal increased much more. He believed they had an excellent gas coal in America; but how far it was from the coast, he could not say. With regard to the future, he thought the present prices would continue for some time, if they did not still further increase. The wages of the colliers compared with twelve years ago had increased 45 per cent.; and there was every likelihood that they would increase again next year, and then they would work still less. Every colliery was now suffering from a largely decreased output; and he did not think there were any owners of gas coal who would this year want to sell as much as they did last year, simply because they had not got it. As to putting a tax upon exported coal, he thought it would be a good thing for the country; and he did not think the coal owners would object so long as Government made up the profits they lost. (Laughter.)

Mr. C. W. Grimwood (Sudbury) remarked that the rise in the price of coal had placed all gas-works in a disastrous position. But his situation was worse than any of the members present, as, being the lessee of a gas-works, he had no one to fall back upon, and had to bear the whole burden himself. There was no help for it; and all they could hope was that circumstances would alter very soon, with a return to former prices.

Mr. Worthington Church observed that to a large extent the present prices were due to the Continental demand. He did not quite like the word "false" that Mr. Shadbolt used; and he did not think present prices were fictitious, considering the positions in which the colliery owners were located. There was very great trouble with regard to labour. Labour, as Mr. Standring had stated, had increased by 45 per cent.; and the price of timber had gone up by about the same amount during the last two or three years. Then, again, in regard to the shortage of coal, it must be remembered that the output was restricted to a large extent this last winter, because the railway companies were unable to deal with the traffic. One of the Midland managers told him that they had 800 men suffering from influenza and other complaints during the winter; and the fact was they could not possibly deal with the enormous traffic over their lines. To this cause was due the short output of the collieries. The waggons could not get back in anything like time; and at one or two of the collieries in Yorkshire, they had to stop two or three days in a week waiting for supplies of waggons. He was much obliged to Mr. Carter for what he had said when referring to colliery proprietors. He (Mr. Church) was interested as a shareholder in a colliery in Yorkshire, and up to last year they had not had a dividend for four years. He was also a second debenture holder in another colliery, and had not yet been paid a single farthing on his holding. Under the circumstances, the colliery proprietors ought not to be blamed, because many of them had been working at a great loss; and, as far as he was personally concerned, he should be only too pleased to see the prices of coal fall to their normal level.

Mr. C. G. Grimwood (Sudbury) said this question of price bore heavily on small works. Mr. Shadbolt's figure of 8 cwt. of coke per ton of coal carbonized was not what they got in village works. If they obtained an average of 2 or 3 cwt. on a year's working, they were very fortunate. Then with regard to the increased prices for liquor, in a village works, if they did not know where the liquor went to they were very thankful.

Mr. T. Cash (Birmingham) said he was much struck by the remarks made by Mr. Carter when he referred most pointedly to the keen competition that took place some years ago. He remembered some years since going to a very large town in Lancashire to see the Chairman and Engineer of the gas undertaking. He saw them; and the Chairman suggested that he was in a position to give an order for 15,000 tons of coal provided he (Mr. Cash) would take 3d. per ton off. That 3d. was just the profit. But his firm, being burdened with a heavy rolling-stock, he took the order at absolutely cost price, to keep the wheels running. In his own town, it was the custom for a good many years for the Chairman of the Gas Committee to send round to the colliery people to notify them of the tendered prices; and for a good many years, it would be in the recollection of the people who were connected with collieries that at Birmingham they pitted one district against another. They would not buy from North Wales or North Staffordshire one year; and they would miss Derbyshire out altogether the next. Such actions as these had brought about, in great measure, the present state of things. With respect to combination, there was no doubt that, having lost very heavily, the colliery proprietors were forced to consider whether they could not combine with a view to getting better prices. This was the beginning of the whole question; and added to this, they had the largely increased demand, and the very largely increased export. The clauses put in many of the tender forms would also now have to be considerably altered. In the office he represented, they had perhaps half-a-dozen tender forms in which the engineer had the option of increasing the contract quantity by 10 per cent. or reducing it by 10 per cent. The result of this was that, when the demand was weak, the engineer would not take so much by 10 per cent., but when it was strong, he would call upon the colliery proprietors for 10 per cent. extra. Under the new combination, the colliery proprietors had come to the conclusion that it would be a wise thing to do away with any clause of this kind. There was no doubt that the increased demand for coal on the Continent had largely brought about the present state of things.

Mr. E. W. Smith (Chelmsford) said they had heard Mr. Shadbolt and the views of three gentlemen connected with the coal trade; and he was not sure that their views quite accounted for the 5s. or 7s. per ton balance. They were told the extra cost of labour and timber had a good deal to do with the advance in price; but they did not hear quite so much about this until the middle of the past winter. They had been informed that the cost of labour had been going up during the last two years; so that they might conclude it had not gone up with a rush in the middle of the winter of 1899. It seemed to him the increase in price was more to be accounted for by a desire on the part of the colliery proprietors to protect themselves against difficulties in keeping up their winter supplies. He believed that if those managers who were in a position to do so would lay in large stocks of coal during the summer months, and thereby even-up the delivery as much as possible, they would relieve the colliery proprietors, and there would not be so much desire on their part to raise the prices and so protect themselves during the heavy winter months.

Mr. Best agreed with the last speaker that it was a wise policy to have large coal storage, as, with a good stock on hand, they could afford to wait in times of difficulty.

The President thought the best policy would be for gas undertakings to combine in the different districts in order to get the highest possible price for coke. His impression was that this was their stronghold; and if they could combine so as not to overlap, so much the better. When situated within half-hour's run of a large town that had considerable quantities of coke to dispose of, the manager of a small works felt the competition very keenly.

Mr. Shadbolt, in reply, said Mr. Carter had spoken of protection. Certainly one effect of this would be to keep the coal in the country, and no doubt the country at large would benefit directly; but whether it would benefit all round, and eventually, was a moot question. When they spoke of Great Britain to-day, patriotic Englishmen included the Colonies; and he believed there were untold areas of coal-fields in America and in the Colonies to which, when the home resources came to be exhausted, they would no doubt turn, although, of course, the price must of necessity be greater. He did not quite follow Mr. Carter in his remarks about coke; but he (Mr. Shadbolt) adhered to the statement that their coke prices generally were 5s. per ton better than they were twelve months ago. Of course, it would be understood that in his opening he only tried to lay down a basis on general lines. Mr. Standring had referred to the colliers' wages, and said they would want more. Well, he (Mr. Shadbolt) had shown there was at least 4s. per ton to go on with. If coal prices were to be advanced 4s. or 5s. more, the sooner the gas industry got control of the collieries, the better. (Laughter). Mr. Standring had also remarked that, if the colliers were paid better, they would work less; but it was a peculiar comment on the present question, that last year's output

per man was higher than it was the previous year. As to Mr. Church's remarks, he did not use the word "false;" "forced" was the expression he employed. What he meant was that the present position had been forced upon them; and he saw no sufficient justification for it. Mr. Church hoped the time was not far distant when prices would fall to their normal level; so that even their coal friends admitted they were abnormal at the present time. He sympathized very much with managers of small works, as this question must be a serious one indeed for them. Mr. Cash had spoken of combinations being formed with respect to the selling of coal. Then the gas industry would have to combine with the object of buying it. The present were abnormal prices, which were bound to come down sooner or later; and perhaps only artificial circumstances were holding them up.

A hearty vote of thanks was passed to both Mr. Sheldrake and Mr. Shadbolt for their contributions to the proceedings.

ELECTION OF NEW OFFICERS.

On the proposition of the PRESIDENT, seconded by Mr. J. BECK (Stamford), Mr. J. G. Hawkins was unanimously elected President for the ensuing year.

Mr. HAWKINS acknowledged the honour the members had conferred upon him, and assured them that he would use his best endeavours to fulfil the duties of the post to their satisfaction.

On the proposition of Mr. CHILD, seconded by the HON. SECRETARY, Mr. R. Brown was elected to succeed Mr. Hawkins in the vice-presidency.

Mr. BROWN also suitably thanked the members.

Other resolutions were passed re-appointing the Hon. Secretary (Mr. Troughton) and the Auditors (Messrs. Panchen and Ellis), and electing Mr. Frank Clark (Southend) and Mr. R. G. Shadbolt members of the Committee for two years. Mr. E. W. Smith also consented to continue on the Committee for another year in place of Mr. Brown.

VOTES OF THANKS.

Mr. JOLLIFFE moved a vote of thanks to the retiring President for his services during the past year, and referred to the deep indebtedness of the members to Mr. Wimhurst for his work since the inception of the Association.

Mr. CHILD seconded the motion, which was acknowledged in meet terms by the PRESIDENT.

Mr. R. J. SHARMAN (Wisbech) next proposed, and Mr. C. G. GRIMWOOD (Sudbury) seconded, a vote of thanks to the several officers; and this was also cordially passed.

THE AUTUMN MEETING.

On the invitation of the PRESIDENT-ELECT, the members decided to visit Spalding for the autumn meeting.

This concluded the business on the *agenda;* and afterwards the members dined together.

OHIO GASLIGHT ASSOCIATION.

The Sixteenth Annual Meeting of the Association was held at Columbus (Ohio), on the 21st and 22nd ult.—Mr. A. P. LATHROP, the President, in the chair. The preliminary business included the election of 35 members; bringing the total membership up to 240.

The President delivered an Inaugural Address in which he referred to the large increase of business done by most of the gas companies in the State—an increase that was due, not only to good trade generally, but also to better appreciation of the comforts and economies resulting from the use of gas. The net earnings, however, had not materially risen, because of the enormous increase in cost of nearly every article entering into the manufacture of gas. There was no prospect of relief in the immediate future, but, on the contrary, every probability of further advance in the price of coal, oil, &c. Although residuals were somewhat better than a year ago, the increased returns thus obtainable would in no way make up for the advance in the cost of raw material. There was only one direction in which to look, in order to maintain profits; and that was the further growth of business, which must be met at a minimum cost. Great efforts should be made to get gas into buildings situate on the lines of main, but not at present piped for gas. Street lighting by gas was again coming into favour; there was the prepayment meter; and there was also the continually increasing demand for gas-stoves. Many companies in the State had been affected by the competition of natural gas; but it could only be a question of time when the supply would be exhausted. In the coke-oven process as introduced at Boston, there was a prospect of a substitute for natural gas. In dealing with municipal ownership, he referred to the case of a municipality who had acquired an electric light undertaking, and then tried to get the local gas-works shut up as a nuisance and a danger to health. An offer had been made in good faith to the League of American Municipalities, to investigate the accounts of any twenty electric plants to be selected by the President, with a view of comparing the cost with that of electricity supplied by companies. He contended that municipal ownership had not been, and was not, a success; and he challenged anyone to give a single instance of a municipal plant that had cost no more than was anticipated, and yielded all that was promised. It was only after considerable effort that the League was induced to accept this proposition; and then they only did so on condition of being able to raise the necessary funds. So far as he knew, they were making no effort in this direction. He recommended the Association to take the question up, and appoint a Committee to assist in raising a fund for such a purpose. He would himself promise a £20 donation. The roll of the Association was increasing; but still there were many gas companies in the district who did not appreciate the advantages of membership, and he moved the appointment of a Committee on Membership, to make earnest efforts to obtain new members.

Mr. F. E. Persons, of Toledo (Ohio), read a paper entitled "Gas-Appliance Exchanges;" advocating the establishment of exchanges in every gas district, for the sale of all kinds of gas stores and apparatus, to be conducted as an independent venture, but under the patronage and co-operation of the local gas company. The gas-works manager had so many duties that the sales department was at times side-tracked, if not absolutely neglected; and the hardware trade was only of use if sufficiently subsidized to feel that there was more profit in selling gas apparatus than appliances for gasoline, wood, or coals. He argued that a customer who bought a gas-stove at a fair moderate price took more interest in it and in the use of gas than one who was supplied *gratis;* and he enlarged on the importance at the present time of increasing the number of consumers and the output of stoves.

The President having invited discussion, Mr. Olds said he had recently introduced the plan of selling stoves at cost price on the instalment system, and doing the fixing free. He had met with a fair amount of success. He was told that at Springfield (Ill.) a purchaser of £6 10s. worth of gas received a stove *gratis*. General Hickenlooper was quite in favour of the gas-appliance exchange. It was all very well to incur some initial expense in introducing new lines of business; but he did not believe in a permanent policy of stoves *gratis*, and thought the main thing was to sell gas at the lowest possible price. An exchange was, in fact, introduced in Cincinnati many years ago, with the aid of a lady instructress and canvasser, who assisted ladies in the economical and efficient use of gas-stoves. From this small beginning, the thing had spread, till he could safely say that at present 90 per cent. of his customers used gas-stoves. For many years, he was accustomed to fix gas-stoves free, whether purchased through his Company or at a hardware shop. He had, however, discontinued this practice, partly on the representation of the Gas-Fitters' Association of the city—a body whom it was not desirable to offend—and also because, having reduced his price for gas to 2s. per 1000 cubic feet for fuel purposes, he could not possibly offer a bonus in any shape or form in addition to this low price. Mr. Madison had been successful, at Madison (Wis.), in the introduction of gas-stoves. He advertised and pushed the business actively; having a house-to-house canvass, and keeping a record that was revised each year. The city, which comprised 18,000 inhabitants, was divided into four districts; and he kept four men busy for 7½ months of the year. By systematic effort, personal solicitation, and plenty of advertising, it was possible to secure excellent results. Mr. F. W. Stone offered no special inducement beyond a rebate of 20 per cent. in gas on the value of a gas-stove purchased. Thus, if a stove cost £5, he gave £1 worth of free gas. Otherwise he relied on annual canvassing, personal solicitation, and advertising, and endeavoured to avoid antagonizing the hardware dealers or plumbers of the town. He felt the great need at present was a good scheme for educating consumers in the use and advantages of the gas-stove. Mr. E. B. Philipp, as representing a small town, recommended buying cheap stoves and retailing at a nominal price, as a means of increasing consumption. Mr. C. R. Faben, jun., remarked that the ideas of the practical manager were not always in accord with those held at the moneyed end of the Company; and therefore he was not always in a position to put them into practice. Many gas companies looked at the first cost of the stoves, without regard to their money-earning power. It was all very well to put in a few stoves each year at the cost of revenue; but this was not making the most of the opportunity, and he advocated looking at the thing as an investment in itself. Electric light companies did not stand back when a man had not money to wire his house; he did not have to forego the advantages of electricity because of that fact. And they did better than gas companies, which were run on hard-and-fast ideas of treating all alike. He did not advocate free stoves; but if it paid to let meters on hire, it was certainly wise to supply stoves on similar terms, as a means of increasing the average consumption of gas per consumer. Indeed, the capital invested in stoves was more remunerative than that laid out for mains in sparsely occupied districts. Mr. H. L. Doherty believed fully in devoting the best energies to the sale of gas; but he reminded the meeting that the putting out of stoves was only a means to an end, and it was more important to see that the stoves already out were in regular use than to push on the additional ones. Whether they gave away, fixed *gratis*, canvassed, or advertised, they must see that every stove gave satisfaction. Each complaint, well grounded or otherwise, must be satisfied. If five persons said the gas-stove is good, and a sixth added "Yes, but costly," the chances were that his opinion would carry most weight. With gas at 5s., and careful attention, it was possible to get better results than gas at 3s. 4d., and indifference. Much energy

was wasted in unintelligent effort. At Madison, with a population of 18,000, there were 1550 gas-stoves fixed. He firmly believed the cost of the stoves was not the only drawback. People either did not know about them, or were prejudiced against them. Therefore he advocated free cookery demonstrations, and free instruction in the board-schools and at consumers' houses. Let everyone in the city see and know about the working of a gas-stove. Advertising was good; but sometimes there were so many publications in a city that it was a heavy tax to advertise in all. He suggested the formation of a National Advertising Bureau, to arrange advertisements in the leading monthly magazines of the country. This would secure better results than merely advertising in the local newspaper. He did not discountenance the latter, but was sure that by means of a Bureau excellent results would follow a comparatively small outlay; and he would move at a later period of the meeting that a Committee be formed to take up the matter in conjunction with other Associations. Mr. J. D. M'Ilhenny related his experiences in a town of 30,000 inhabitants, where the sale of gas had not heretofore been pushed in any way. He made a complete canvass, taking full record of each house in the district, and offered to sell stoves right out at bare cost, or on the instalment plan, so that customers could try the stove for three months before purchasing. He preferred to sell at cost price, as being more business-like, rather than give away or sell at a nominal charge; and he would rather spend money in advertising or canvassing than in paying part of the cost of the stoves. But every company should be governed by local circumstances; and the policy to follow was the one that paid the best. It was not much use, for instance, to give away stoves in a district where the chief objection to their use was the cost of the gas. Mr. Persons said that by means of combined action among neighbouring gas companies, a considerable saving could be effected in the matter of travelling expenses of cooking demonstrators who went from one town to another. Mr. Doherty explained that his scheme was intended as an addition to local advertising, and in no sense as a substitute for it. He was not in favour of discontinuing local advertising.

(To be continued.)

LAYING PIPES UNDER WATER.

In a recent number of "Engineering News," particulars were given of the work of laying a 36-inch water-main across the Harlem River, lately completed by the Municipality of New York, for the better supply of water to the long strip of territory lying between the Hudson and the above-named river. The line is chiefly remarkable for the excessive weight of the jointed pipe used. At the point crossed, the Harlem is 1200 feet wide; and, to meet future demands from commerce in this improved waterway, it was necessary to dredge a trench across the river to a depth of 30 feet below mean low water. As there is a strong tidal current in the stream, since its recent improvement by the Government, this trench gave considerable trouble; and constant dredging was required to remove the silt brought into it by the action of the current.

The flexible-joint pipe used was 36 inches inside diameter, and was made to lay in 12-feet lengths, with a bell-and-spigot joint at the two ends. The bell was 5 feet in outside diameter at the extreme end, and was there reinforced by shrinking upon it an iron band, 6 inches wide and 2¼ inches thick; the bell was about 30 inches long. The spigot end was provided with two cast bands, 5 inches wide, and rounded to fit the spherical interior of the bell. The dovetailed space between these bands was 6 inches wide by ¾ inch deep; and into this space was poured the lead which completed the flexible joint. Each of the joints required 1100 lbs. of lead. Each pipe length as delivered was 13 ft. 1 in. long, 36 inches interior diameter, and 40 inches exterior diameter in the body of the pipe. The wrought-iron band referred to weighed 663 lbs., and the cast-iron pipe 13,725 lbs.; or 14,388 lbs. for the pipe length complete.

The work of laying the 1200 feet of jointed pipe was begun in June, 1899, and completed on Dec. 6, 1899, by the Contractor for this portion of the work. The method adopted by him for laying the flexible pipe was as follows: A strong float, 97 feet long and 35 feet wide, was provided with a steam derrick for handling the pipe sections; blocking for holding about five pipe lengths at one time on the float; a launching way at one end of the float, &c. After the pipe had left one bank of the river, strong steel cables were securely attached to it; and by means of these cables the float was handled and the pipe was launched, section by section. Four precautionary anchors were used to guard against damage to the float from passing vessels. But as each joint was completed, the steel cables were cautiously slackened, and the weight of the pipe practically pushed the float towards the far shore as one pipe length after another slipped into the water. The cables were then again made fast, and another length was lifted, put in place, and attached, by pouring its joint, to the four lengths still remaining on the float. A repetition of this process, as pipe after pipe was added, finally resulted in the successful completion of the line across the river. The work required extreme care, and great experience and judgment in handling the cables; and the Contractor remained upon the float day and night throughout the operation.

REGISTER OF PATENTS.

Coin-Freed Gas-Meters.—Wright, J. F. & G. E., and Sutherland, A. G., of Birmingham. No. 6090; March 21, 1899.

One arrangement of this coin-freed meter—of the so-called "quiescent type"—is shown in the engraving. Fig. 1 is an elevation and fig. 2 a plan of the mechanism. Fig. 3 is a section on the line C D of fig. 1, with the coin-holder moved forward till the coin makes contact with the pin N (referred to later on).

The frame of the meter supports a rotatable shaft B, on which is fixed radially a coin-holder or pocket E. A plate F, mounted loosely on the shaft B, carries a driving-pawl G pivoted to the back of the plate. This pawl gears with a ratchet-wheel I fixed to a shaft K, which works the screw, nut, or other device supplying the gas in a quiescent or other type of meter. Fixed to the pawl G is a block L, against which the coin rubs as it is moved forward in the coin-holder in the direction of the arrow. When the coin has passed the block, it falls a little further out of the holder; so that if an attempt be made to move it back, it will engage with the face M of the block. The plate F also carries a pin N, which is engaged by the coin in its forward rotation. The plate will then be rotated, and with it the ratchet-wheel I and the shaft K, by means of the driving-pawl G. The coin cannot fall out of the holder till it reaches the end of the shield O, when it drops into a suitable receptacle—the holder being restrained from further motion by a stop. A disc R is fixed to the coin-holder or to the shaft B, so as to rotate with the holder. This disc is provided with notches on its periphery; and an arm T, furnished with a claw, and pivoted on the shaft B, engages with one or other of the notches. On the backward rotation of the holder (which must take place before another coin is inserted), a projection on the arm strikes the pin N on the plate F, and travels the plate backwards—the driving-pawl G slipping over the teeth of the ratchet-wheel I, held by a retaining pawl.

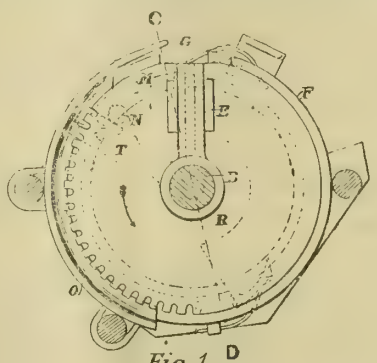


Fig. 1.

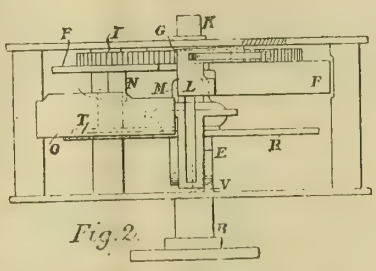


Fig. 2.

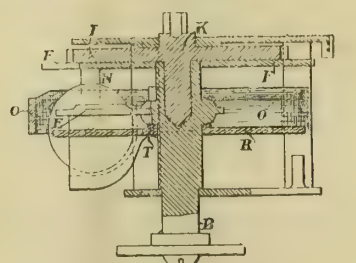


Fig. 3.

The amount of rotation of the shaft K (and therefore the quantity of gas supplied for each coin) can be varied by adjusting the position of the arm T relatively to the disc R, while adjustment can be easily effected, as the arm T is made of sufficiently thin material to spring clear of the disc as required. The notches are numbered in order to show the required delivery of gas.

On an attempt being made to move the coin backwards and forwards when in the holder, so as to produce a greater rotation of the shaft K, the coin catches on the face M of the block L, and presses the pawl G on the teeth of the ratchet-wheel I, which, being held by the retaining pawl, effectually stops the backward motion. The holder is stopped at the right place for the insertion of another coin by a pin V (fig. 2) fixed to the frame. When the holder is in the proper position for the insertion of a coin, the block L may be in front of it; and, to enable it to pass the block, the plate F is made flush with the block L to the right of the block, although it is not flush to the left. This is shown in fig. 2.

In a second modification of the invention, the backward movement of the coin is prevented by its engagement as a pawl in a ratchet-sector. The coin can move forward by slipping over the teeth; and, when it passes the last tooth, it falls out of the holder. In this modification, the amount of rotation of the shaft is varied by altering the position of the ratchet-sector, so that the coin falls out sooner or later. The projection on the radial arm engages in notches in the fixed frame.

In a third modification, the coin is carried in a radial oscillating lever, oscillated from a suitable spindle, and connected to it by a link. The

oscillating coin-arm carries a pocket for the coins; and each coin, when dropped into the pocket, rests upon a toothed ratchet, which permits the lever to be moved forward, but prevents it being moved back by the engagement of the coin. The coin also, when inserted, engages a projecting pin passing into the coin-pocket, and projecting from a horizontal slide. The slide gears into a ratchet-wheel, which is prevented from returning by a spring pawl. The movement of the hand-wheel causes the oscillating arm to carry the penny beyond the end of the projecting fixed rack; and it then falls into the receptacle prepared for it. On the return stroke, however, a stop, adjustably mounted on a projection from the penny pocket, engages the other side of the stop projecting from the straight slide, which is then moved back ready to be operated again when another penny falls in. The amount of the backward motion depends upon the position of the adjustable stop. If the stop is placed well out, then the backward movement shifts the slide but little; while if the stop be close to the penny-pocket, then the slide is moved back an amount almost equal to the stroke of the penny radial arm. By adjusting the stop, the amount of gas to be given for each penny is regulated—that is, the adjustment of the stop determines the arc through which the ratchet-wheel shall be turned by the forward movement of the penny, and therefore the amount of gas given by the meter. The slide-ratchet operating above the ratchet-wheel is pressed downwards by a spring; so that on the forward stroke the ratchet-teeth engage the ratchet-wheel teeth, while on the backward stroke the straight slide slips over the teeth. By this device, it is possible to operate by simple mechanism a straight slide for the purpose of adjusting the gas supplied for a penny.

In a fourth modification, the use of the radial arm is dispensed with, and a push-in knob used instead. The push-rod carries at its end a penny-pocket; and the penny engages with a projection from a straight slide (as described in the last modification), and rests upon a rack formed of a screw-threaded nut. This nut screws on a projecting pin; and its position may be altered by screwing it out and in along the fixed screw-pin. Projections from the end of the screw-rod are supplied, which prevent the push-rod from being moved further than a specified distance. In this case, the adjustment is made by screwing in or out the nut-rack, which thus serves the double purpose of limiting the length of stroke of the push-rod, and preventing the rod being pulled back when the penny is placed in position. By this arrangement, oscillating movements and radial levers are dispensed with entirely.

Incandescence Bodies.—Duncan, J. H. H., of Coleman Street, the New Incandescent (Sunlight Patent) Gas Lighting Company, Limited, of Shoe Lane, E.C., and Barnett, H. T., of Teddington. No. 6919; March 30, 1899.

This invention, having reference to incandescence bodies for use as light-giving media in non-luminous flames, has for objects, *inter alia*, "to improve the colour of the light obtained with such bodies, to produce incandescence bodies having various light-giving properties without departing from the more satisfactory proportionate combinations of refractory substances ordinarily used in producing incandescence bodies, to obtain incandescence bodies varying within certain limits as to the colour or tint of light resulting from their use, and in some cases to give additional strength, durability, and coherence to the incandescence bodies." According to this invention, "variously tinted light-emitting bodies are united or combined mechanically in one composite body, in such a manner that the selectively emitted varying colours or tints of light combine to produce an effect more pleasing to the eye, or better suited to the purpose in view than heretofore." To this end, the patentees propose to "spin, double (*i.e.*, twist), knit, plait, cable, interweave, overweave, or otherwise mechanically connect, or associate separate filaments, threads, cords, rods, or other shaped bodies containing or consisting of different incandescence oxides which yield lights of differing colour or tint, into one composite structure."

Incandescence mantles for use with gas-flames can be made according to this invention in various ways. The following are given as examples of mantles affording "a golden white light."

(1) Two lengths of cotton thread are soaked, each in different solutions—one solution being such as to yield an incandescence body giving a light of greenish tint, for example, the mixture of about 99 per cent. of thoria and 1 per cent. of ceria, and the other solution being such as yields an incandescence body containing 50 per cent. of thoria, 40 per cent. of alumina, and 10 per cent. of chromic oxide. The soaked threads are dried and knitted, or otherwise intertwisted to form a mantle. The two threads may be knitted in such a manner that the mantle is composed of alternate rows of thoria-ceria and thoria-aluminachrome threads, or two or more rows of either kind of thread may be used to one of the other. Another mode of making such mantles is to knit the fabric into a continuous length composed of alternately-arranged short sections of the different kinds of thread, so that mantle lengths may be cut therefrom whose upper and lower portions are of different constitution. Mantles made by a weaving process may have the different kinds of threads equally distributed in the fabric, or one kind of thread may be chiefly at the inner surface of the mantle while the other kind is on the exterior surface of the mantle.

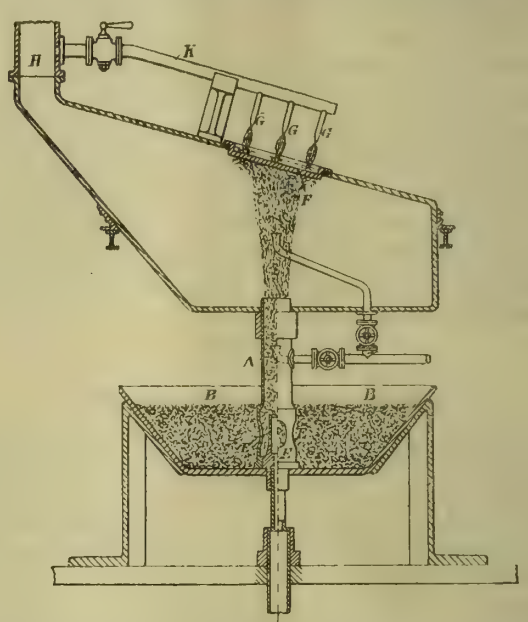
(2) Filaments containing two different mixtures of incandescence oxides are separately produced by the Knofler or some similar process, and the two kinds of filaments being doubled (*i.e.*, twisted) together to form a composite thread, which is made into mantles in the usual way. One kind of filament may contain thoria and ceria in or about the usual proportions, and the other kind alumina, chromic oxide, and zirconia or thoria—a satisfactory prescription for the latter being 35 per cent., chromic oxide 5 per cent., and alumina 60 per cent.; the alumina and thoria being conveniently added to the Knofler collodion in the form of nitrates of aluminium and thorium, and the chromic oxide as chromic acid, and the two kinds of filaments being used in the proportion of twelve thoria-ceria filaments to three of the other kind.

Incandescence mantles made according to the above examples are said to give "a light of golden white colour, which does not become green in tint, even when the mantles are well worn."

Continuous Generation of Water Gas.—Clauss, F., of Meerane, Saxony. No. 8239; April 19, 1899.

According to this invention, a jet of steam is caused—while passing through a vessel or reservoir containing a carbon-carrying powder or hydrocarbon liquid—to take away with it a constant or nearly constant proportion of the powder or liquid, so that a mixture of carbon-containing material and steam is formed, which enters a closed chamber, a part of one wall of which, by suitable means, is kept glowing in order to ignite the powder or liquid, and also to cause the decomposition of the steam for the generation of water gas, which escapes from the chamber. Thus the production of water gas takes place continuously, requiring only a uniform jet of steam, the maintenance of the supply of carbon-carrying powder or hydrocarbon liquid for admixture with the jet of steam, and an igniting-device comprising a closed chamber into which the mixture of steam and carbon-containing material for the ignition of the latter enters, and the decomposition of the steam.

By such process, water gas of great purity may, it is said, be produced; but if the main object is the production of gas as cheaply as possible, the process is modified by allowing the igniting-device to act only for igniting the carbon introduced by the steam-jet into it, and introducing air or oxygen (or an oxygen-carrying substance) into the igniting-device for causing the combustion of carbon, and thereby generating the necessary heat for decomposing the steam. This introduction of air, oxygen, or an oxygen-carrying substance into the water-gas generating chamber may be caused by the jet of steam, which, while its flow carries with it the carbon-carrying powder or hydrocarbon liquid, carries also—in a constant or nearly constant proportion—air, oxygen, or an oxygen-carrying substance, which may be mixed with the carbon-carrying powder or the hydrocarbon liquid; or the air, oxygen, or oxygen-carrying substance may be admitted directly into the generator by pipes or the like.



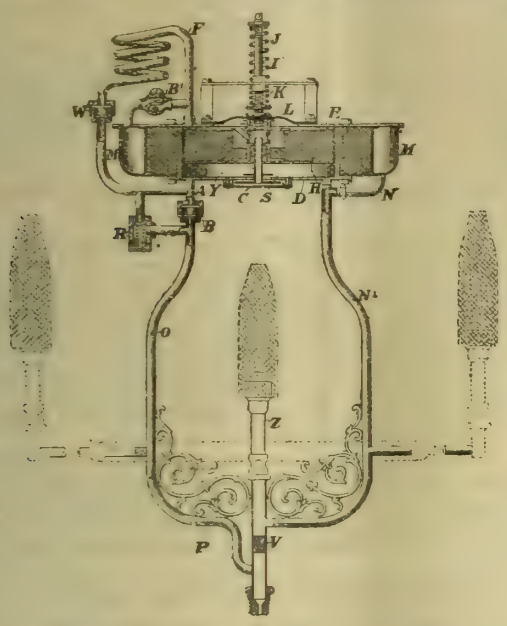
Apparatus for carrying out the process comprises a vessel arranged (as shown) so as to contain a carbon-carrying powder—for example, coal-dust. The supply of the powder to the reservoir B should be such as not to allow its level to fall below the highest point of the holes E (hereafter mentioned). Passing through the vessel is a steam-pipe A normally surrounded for a part of its length by the powder, and having holes E in its sides in the part which is surrounded by the powder. Inside the steam-pipe is a nozzle C, so arranged that the flow of the steam draws the powder through the holes, and carries it along into the closed ignition chamber D in which the steam-pipe terminates. Opposite the mouth of the steam-pipe, the closed chamber has arranged in its wall a plate of refractory material F, kept constantly glowing by means external to the closed chamber. This glowing of part of the chamber-wall is maintained for preference by flames issuing from burners G supplied with gas, preferably attached to a branch K of the water-gas main H, so as to use part of the water gas as generated. Against the glowing part of the chamber-wall the mixture of steam and carbon-carrying powder (which is drawn in through the holes E by the steam passing through the pipe A) is directed; and the powder is ignited by the glowing plate F, which also decomposes the steam in contact with the ignited powder. The result is that water gas is generated continuously, and passes off from the chamber through the main H to a storage holder, or directly to the place of use.

Compressing Gas, Air, &c., for Incandescent Lighting Plant.—Snell, C. S., of Saltash. No. 14,086; July 8, 1899.

In this apparatus for compressing gas or air for incandescent gas-lighting, the attainment of the increased gas or air pressure is effected by the direct expansive action of heat upon the gas or air to be used, without intermediate compressing accessories.

The patentee proposes to make use of a vessel or body A (the cross-hatched portions being of any suitable non-conducting material), fitted with inlet and outlet valves B B^1, whereby gas, air, or the like may enter at the one and be discharged at the other—each valve acting as a check-valve. One side of the vessel (marked D), or an extension (marked C), is heated by any convenient means—such, for instance, as a bunsen burner Z; and the other side E, or an extension F (a coil of tubing), is kept cool by water or other means. Radiation is sufficient in freely exposed situations. Within the vessel A is arranged a displacer H, which may be caused to oscillate, if suspended, or be otherwise put in motion, so as to drive the gas or its equivalent alternately into the hot and cold sections, whereby it is caused to expand and contract accordingly. This vertical oscillation of the displacer is effected as follows: Being suspended on the rod I, its weight is taken by the spring J, and oscillation is retarded in the upward direction by a spring K. The pressure of gas or air within the vessel A, due to expansion through heat, acts on the diaphragm L (or a piston may be fitted instead), thus lifting it and the displacer H, and causing the

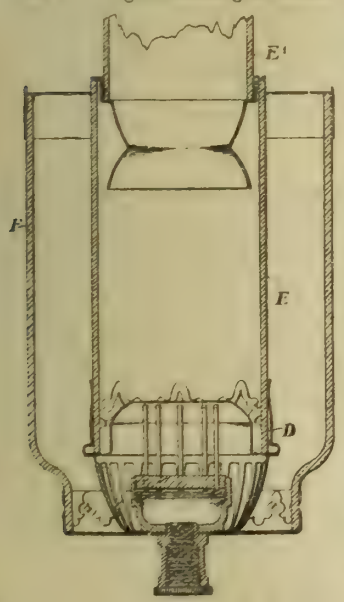
contents of the vessel to be displaced into the lower or hotter section C. By passing the gas or air through the pipe Y, the increasing pressure still further lifts the displacer until the power of the spring K prevents any further advance. Meantime, the gas is also being driven into the reservoir M through the check-valve B^1, and from thence to the burner Z below, or to other lamps on the same circuit (as shown by dotted lines); and when the pressure is greater than that of the incoming gas, the valve



B is kept on its seating—thus shutting off the supply. But so soon as the pressure decreases, through (say) the consumption of gas, the valve B will be opened to the gas supply, and thus a very small fall in the pressure within the vessel A (which must occur in due course) causes a failure to keep the spring K in compression, and the displacer H commences to fall—the valve B^1 at the same time being closed by the pressure in the reservoir M. This movement of the displacer causes the rapid cooling of the gas, by driving it from the vessel A into the cooler portion F of the apparatus through the pipe G and valve W. A partial vacuum results, causing the compression of the spring J until the deficiency is supplied through the valve B, when a rebound follows, and the displacer rises, repeating the cycle already explained; the pressure in the reservoir remaining practically constant. The flow beyond the outlet-valve passes into the service of high-pressure gas (the reservoir M and feed-pipes N and N^1), and is used for the incandescent light Z.

Regenerative Gas-Burners.—Bower, G., of St. Neots. No. 8367; April 21, 1899.

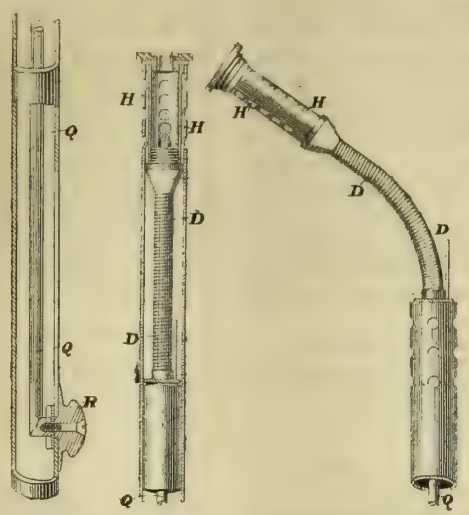
This is a regenerative gas-burner of the double-chimney type, comprising a ring of tubes mounted on a plate which forms the top of the gas-supply chamber. Surrounding the series of tubes is a sleeve D and an annular gallery, and below is a sleeve provided with perforations to permit air to pass to the ring of tubes. The chimney is in two parts E E^1. The lower portion fits into the gallery, and is provided at its upper end with a removable throat-piece, which is formed with a contracted portion; while into the throat-piece the upper part of the chimney fits. An outer cylinder or sleeve of glass F surrounds the chimney E, and is supported by a gallery the bottom of which is closed so that no air can pass up through it to the space between E and F. A ring or band is fitted round the top of the cylinder F (its top edge projecting slightly above the top of the cylinder), and a flat ring or distance-piece placed within the band serves to keep the chimney E in a central position. Openings are formed in the distance-piece to allow air to pass freely down between the chimney E and the cylinder F.



When the burner is in operation, the draught causes air to be drawn down between the inner chimney and the outer cylinder. It is strongly heated in its passage laterally through a perforated sleeve, and circulates among the small tubes of the burner, which, together with the gas passing through them, are heated. The part of the ring or throat-piece which enters the top of the lower portion of the inner chimney is reduced in diameter; the object (according to the patentee) being to cause the flame—which would otherwise be somewhat bulged in the centre—to be drawn in at the top and given the shape of an incandescent mantle.

Lamplighter's Torch.—Foulger, G. F. L., of Upper Clapton, and Glover, J. G., of St. John Street, E.C. No. 23,321; Nov. 22, 1899.

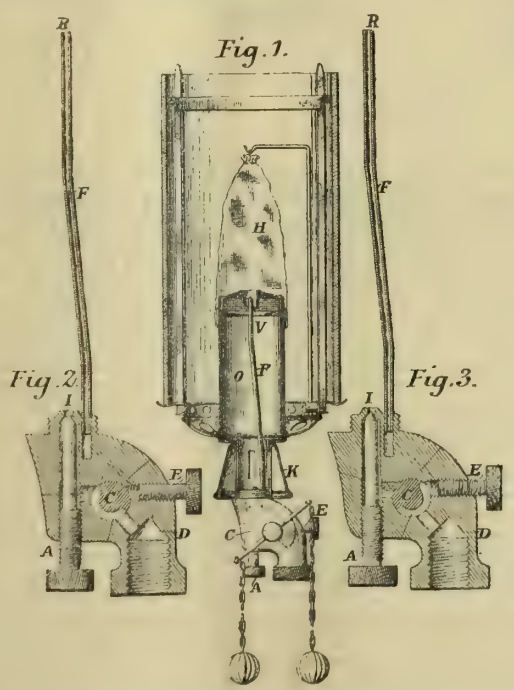
This invention consists in a "flexible wick-tube of an oil or spirit lamp, so arranged within a lamplighter's torch-frame that, by a push or other movement of a rod, the flexible wick-tube can be projected from above the top end of the torch-frame, and be allowed to fall over and above an incandescent burner for lighting the gas—the flexible wick-tube being then drawn back to be within the torch-frame."



When the torch is used for lighting open flames of street-lamps, and the torch-head can be put close to the burner, no motion of the slider R is necessary; but with lamps having incandescent mantles, after the head of the torch has been passed into the lantern, an uprising action on the slider R and rod Q by the lamplighter causes the flame-shield H and the flexible wick-tube D to project beyond the upper end of the torch-stick; the weight of the flame-shield then gradually inclining towards the middle of the lantern and over the incandescent mantle through the flexibility of the wick-tube.

Gas-Burners for Incandescent Lamps.—Bernstein, S., of New York. No. 23,566; Nov. 25, 1899.

The construction of this burner is shown in the engraving—fig. 1 being a complete incandescent gas-lamp with hood suspended over the burner; while figs. 2 and 3 show the part of the complete burner to which the invention particularly relates, in its open and closed positions. Heretofore, in burners for incandescent gas-lights, the patentee remarks, great difficulty has been experienced in securing efficient and convenient adjustment of the supply of the gas to, and an efficient admixture of air and gas in, the air-chamber of the bunsen burner. The supply of the gas used in the bunsen burner has usually, heretofore, been determined by a perforated disc, the perforations of which have been made small or large according to the pressure of the gas estimated at the time of adjusting the burner to the fixture for use. By this method, no regulation of the supply of the gas used can be had at the disc while the burner remains adjusted to the fixture for use.



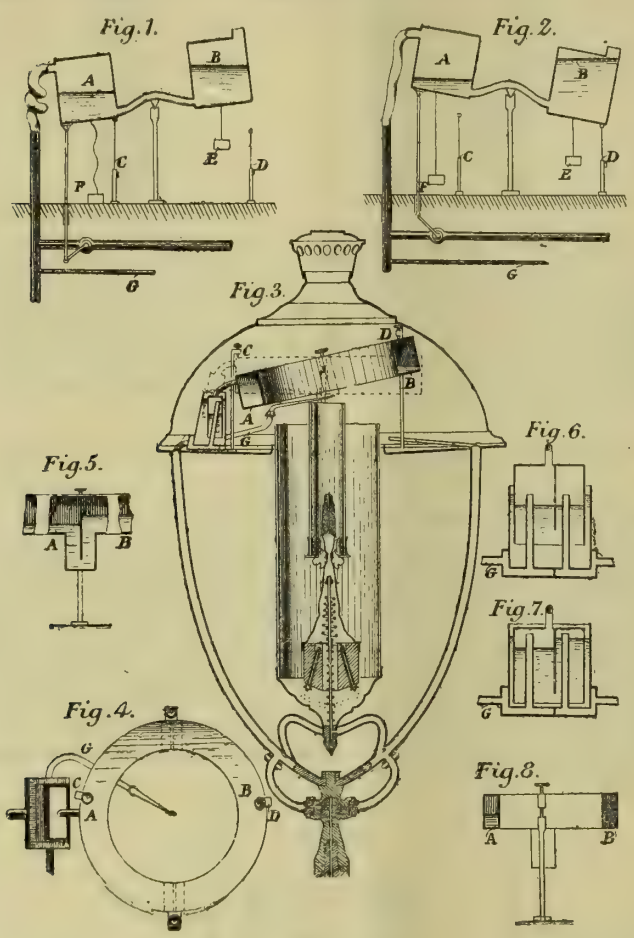
With this invention, the supply of gas, passing through the main gas-inlet D, is regulated at the orifice I, by raising or lowering vertically the regulating-pin A. After passing through the orifice I, the gas mingles in the tube of the bunsen burner O with the air, regulated by an air-shutter such as K; and when lit above, it forms a bunsen flame which renders the hood H incandescent. By revolving the plug C, by means of the rod and chain attachment shown in fig. 1, the course of the gas is changed from the passage leading to the bunsen burner to the bye-passage leading through the pilot-tube F to the pilot-burner R. But before the bunsen flame has been extinguished, the gas is supplied to the pilot-burner, and becomes ignited by the bunsen flame at the orifice V. The supply of gas to the pilot-burner is regulated by the screw E. The flame of the pilot-light does not come in contact with the incandescent hood;

but the subdued light is desirable not only to re-ignite the bunsen flame when the incandescent light of the mantle is again desired, but also for use as a night-light. When the bunsen flame is re-ignited, the pilot-flame is extinguished.

Lighting and Extinguishing Series of Street and other Gas-Lamps.—Croizat, V., of Turin. No. 756; Jan. 12, 1900.

This invention relates to means for effecting the lighting and extinguishing of street or other ranges of gas-lamps from an office or station, by varying the pressure in the mains so that when the pressure is raised beyond a certain limit the lamps are lighted, and when the pressure is lowered to a certain extent they are extinguished. The ordinary pressure is not interfered with, except during the short periods when the lighting and extinguishing are effected. At each lamp, there is a small lighting-flame always burning; and the raising of the pressure opens a passage for gas to the main burner, which is kindled by the lighting-flame, while the lowering of the pressure closes the passage.

Figs. 1 and 2 show diagrammatically how the apparatus acts; the other figures illustrate its practical application to a lamp.

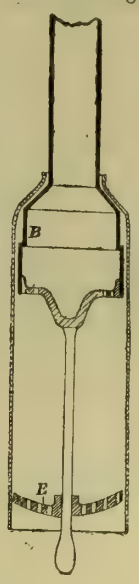


As shown in figs. 1 and 2, two vessels A and B, communicating with each other at the bottom, are poised on a fulcrum; the former vessel communicating by a flexible pipe with the gas-main, the latter vessel open to the atmosphere, or subject to any other approximately constant pressure. When the pressure in the main is increased, liquid passes from A to B, causing the vessels to rock over to the position shown in fig. 2; when the pressure is lowered, the vessels return to their former positions. The vessel A is linked to the lever of the lamp-cock. Thus, by the raising of the gas pressure, the cocks are opened, and the lamps are lighted; and by the lowering of the pressure, the cocks are closed, and the lamps are extinguished. The ordinary variations of the service pressure are not sufficient to move the vessels from the one position to the other—it requires for this purpose a change of pressure sufficient to overcome the effect of the weight of the vessels and their contents acting with the leverage which is determined by the position of the centre of gravity beyond the vertical line of the pivot. Thus, once the vessels have been rocked to the one position or the other, they remain so until there is change of pressure sufficient to overcome the weight acting at the leverage due to their position. The weight and leverage may be adjusted by varying the quantity of liquid in the vessels, the positions of stops C and D, and of the fulcrum, as well as by weights E and F. In the diagram, G indicates the pipe which supplies the small lighting-flame of the cock.

As shown in section in fig. 3 and plan fig. 4, the two vessels A and B are made in one annular piece adjustable on two fulcra by setting screws, and having above it two adjustable screw-stops. The annular piece is divided by partitions on both its sides into the two compartments which communicate with each other at some depth under the partition, as shown in section in fig. 5. The compartment A has from its upper part a pipe and a bell, divided, as shown in section in figs. 6 and 7, into two compartments, having holes through its lower but not through its upper part. The bell is immersed in liquid in a vessel having two tubes, leading respectively from the two compartments. One tube communicates with the gas service-pipe, so that gas from the service-pipe can pass into the compartment A. The other tube communicates with the supply-passage to the lamp.

When the compartments A and B are in the position depicted in fig. 3 (A being down), the bell, as shown in fig. 7, is so deeply immersed in the liquid that no gas can pass from one side to the other, and consequently none passes to supply the lamp, which in that case is extinguished. But when the compartments take the position indicated by dotted lines in fig. 3 (and shown in section in fig. 8), the bell being raised, as indicated in fig. 6, gas passes through holes of the partition shown, to supply the lamp, which is then kindled by the lighting-flame.

Production of Compressed Gas.—Knapp, W., and Steilberg, R., of Hamburg. No. 910; Jan. 15, 1900.



This is an improvement in the apparatus for the production of compressed gas described in patent No. 16,618 of 1899 ("Journal," Nov. 7, p. 1126); the improvement having reference to the arrangement of the lever employed for actuating the pump referred to in the earlier form, and to the introduction of a return-valve in the gas-supply pipe for the reservoir.

Inverted Incandescent Gas-Burner.—Beese, R., of Dresden. No. 2248; Feb. 5, 1900.

This invention in inverted gas-burners for incandescent lamps especially relates to the manner of suspending the incandescent mantle from the head of the burner. The incandescent mantle, which is narrowed on one end in the usual manner, is put with this narrowed end over the bunsen-tube, so as to rest upon the head of the burner; while the lower opening of the mantle is closed by a perforated disc of manganese fastened to the usual supporting-rod, and getting incandescent by the flame.

The manner of suspending the mantle is shown in the sketch. It is put over the bunsen-tube, and resting on the burner-head B with its narrowed end is closed at its lower end by a perforated disc of manganese E, which is fastened to the usual supporting-rod.

APPLICATIONS FOR LETTERS PATENT.

6607.—Langhans, R., "Manufacturing incandescent bodies for illuminating purposes." April 9.

6608.—Boult, A. J., "Gas-burners." A communication from J. Sauvan. April 9.

6625.—Imray, O., "Production of combustible gas from refuse sweepings, waste products, and the like free from carbon monoxide, with or without simultaneous production of cyanogen compounds." A communication from G. Ottermann and Co., and V. Loos. April 9.

6715.—Maris, J. M., "Self-dumping car for coke." April 10.

6729.—Rollason, A., "Gas-motor engines." April 10.

6730.—Thwaite, B. H., "Safety-valve for gasholders." April 10.

6740.—Rault, A., "Generating and storing acetylene gas." April 10.

6857.—Purves, W. T., and The Notkin Syndicate, Ltd., "Carburetting air or gas." April 11.

6865.—Sunderland, R. H. & F., and Marshall, G., "Generation of acetylene gas." April 12.

6882.—Bray, J. W., "Gas-burners." April 12.

6888.—Dodd, A., junr., "Acetylene generators." April 12.

6895.—Graham, M., "Conveying and elevating apparatus." April 12.

6916.—Goodson, J., "Gas-governors." April 12.

6921.—Lake, H. H., "Gas muffle kilns or ovens." A communication from Macario Scuvero and Co. April 12.

6933.—Payne, W. H., "Acetylene gas-generators." April 12.

6971.—Wigham, J. R., "Lighthouse illumination." April 14.

7015.—Borchardt, H., "Means for lighting gas." April 14.

7030.—Brown, D. J., "Gas-generating apparatus." April 14.

The Bingley District Council and the Bradford Bill.—At the annual meeting of the Bingley District Council last Wednesday, the Clerk (Mr. A. Platts), acting under instructions from the Gas Committee, made a report upon negotiations which had passed between him and the Town Clerk of Bradford (Mr. F. Stevens), with regard to the powers now being sought by Bradford to acquire the undertaking of the Clayton, Allerton, and Thornton Gas Company, within whose district of supply the village of Wilsden is included. He was officially informed by the Town Clerk that the Corporation had undertaken to insert in the Bill a clause giving facilities to the authorities in whose districts rights were possessed by the various Companies whose properties the Corporation were seeking to acquire, for the purchase of those rights by the Local Authorities interested. The Clerk added that if this clause were approved by Parliament he did not think it would be necessary for Bingley to go any further with its opposition, as the terms would be quite as good as would be probably gained by opposition. They were like the undertaking given to Cleckheaton and other places. The Council decided to withdraw their opposition if the clause were embodied in the Bill; but power was given for opposition to be made in the House of Lords in case of default.

Trial of Incandescent Gas Lighting in Norwich.—The Norwich Town Council recently had before them a report from the Executive Committee upon lighting certain streets in the city with incandescent gas-burners, accompanied by a recommendation that the Committee should be authorized to put up an installation of about 125 lamps, with fittings and burners, to be fixed by the Street Lighting Company, Liverpool, for three months, for experimental purposes, at a cost for temporary attachments of a sum not exceeding £25, on condition that if the experiment be satisfactory to the City Engineer, the lanterns and fittings shall be purchased by the Corporation at a price not exceeding £2 2s. 10d. each. Mr. Cunnell moved the adoption of the report, and stated that the new system would not cost more than the old one, and would furnish a much better light. Mr. Mallett feared this was the thin end of the wedge, which would bring about an expenditure of between £6000 and £7000 a year. He suggested that the Electric Lighting Company should be approached to see what they would charge for illuminating the streets. He therefore moved that the question be referred back to the Committee for them to consider the advisability of having the electric and gas light experiments carried out in various parts of the city. On a division, the amendment was lost by a majority of 14, and the report adopted.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Commercial Company's Make of Gas.

Sir,—Is there not some mistake in the case of the Commercial Company in the figure of gas produced per ton of coal in your table of comparison between the Chartered, the Commercial, and the South Metropolitan gas? In point of fact, the make per ton in the June half of 1899 was 10,313 cubic feet, and in the December half 10,256 cubic feet—averaging under 10,300 cubic feet. Of course, it will not do to make a calculation spreading the make of gas produced from carburetted water gas over the tons of coal used.

Hy. E. Jones,
Engineer and General Manager.

Stepney, E., April 19, 1900.

[The discrepancy between our correspondent's figures and those in the table referred to appears to have arisen in converting the quantity of oil used into the equivalent of cannel. Although the figure adopted for this purpose was the one which has been generally accepted, it does not appear to accord with actual working results. It was recognized that differences of manufacturing practice considerably affect the make of gas; and this fact was taken to account for the divergent results shown in the table.—Ed. J.G.L.]

Naphthalene in Coal Gas.

Sir,—I thank Mr. Allen for his remarks, *re* my letter, on the above subject. I felt sure that there was some mistake in the figures alluded to, which would be better rectified.

With regard to Dr. Colman's letter, I fully understand—in the light of his fuller explanation—that the partial contact of a slight excess of wash water with naphthalene picrate would not exert its *fullest* solvent action, and that the error would therefore be correspondingly small. The figures I gave as to naphthalene in gas ("1·5 grains per 100 cubic feet to *nil*") were quoted from Messrs. Colman and Smith's paper; but, on re-reading the remarks accompanying the figures, I see that I was wrong in terming this proportion of naphthalene "normal." I must confess that I was unaware that naphthalene was formed from the breaking up of liquid paraffins into permanent gases at such temperatures as are employed in the manufacture of carburetted water gas. With regard to this description of gas as contrasted with normal coal gas, it would, I think, at least be safe to assume that the former would be comparatively free from naphthalene, as by far the greater bulk is produced from coke and steam. I have made inquiries, and am informed that in one particular case no trouble with naphthalene has ever occurred in the working of a large water-gas plant; but whether this is the universal experience, I am unable to say.

H. Leicester Greville.

April 20, 1900.

The Improved Lighting in the South Metropolitan District.

Sir,—In your appreciative notice of the improvements in public lighting we have been making, you give us credit for greater liberality than is our due. We have only agreed to substitute the new "Eddystone" columns for old ones in the main leading thoroughfares selected by ourselves. If the parishes want them elsewhere, of course, they can have them by purchase.

The new "South London" lantern (as we have christened it), and the "Eddystone" column have been protected by the Company; the peculiarity of the latter being the design, and of the former the unequal arrangement of the ribs—thus placing the shadows in a harmless position. The form of the lantern—circular, not pentagonal—moreover has the effect of causing the shadows of the ribs almost to disappear at a short distance from the lamp. We do not wish, however, to keep a good thing to ourselves—being quite willing to give permission to any company or local authority to use either the "Eddystone" column or the "South London" lantern on nominal terms. The Croydon Gas Company applied for such permission, which was granted for all the lamps they may use for the single payment of £1. I mention this because I heard of a tradesman giving as an excuse for his price the item of royalty, which is purely nominal.

I may say that among other forms of lanterns we tried the pentagonal, which, to our surprise, made a far better appearance than the hexagonal form. If a polysided lantern is wanted, I certainly recommend the pentagonal to any other with more than four sides.

One other word, to give credit where it is due. The lighting of the Camberwell Art Gallery is due to Mr. Carpenter, both in conception and execution; and that of the Vestry Hall is also due to him, assisted by Mr. Talbot, our Lighting Inspector.

George Livesey.

South Metropolitan Gas Company,
April 21, 1900.

Illicit Commissions.

Sir,—In your article this week on the above question (and to which I hope you will continue to draw attention, for although the evil be diminishing, not increasing, it is still of sufficient magnitude to be of serious importance), you make the remark that, if the Lord Chief Justice's Bill become law, "a good many worthy individuals will have to seriously consider various things." That is so; and it is true that those individuals do consider themselves, and are considered by the crowd, "worthy."

May I, however, rescue from the oblivion of Hansard a story told by Lord James of Hereford in his speech upon the second reading of Lord Russell's Bill? Some years ago—the story runs—a suit was instituted before the late Master of the Rolls (Sir George Jessel) by a large firm of merchants at Bombay, who complained that their shipping agent in Lancashire had systematically charged them with a very large amount of commission which he had no right to charge. Investigation showed that there were two invoices used, and that the transactions were so conducted as to make a difference of 70 per cent. in favour of the commission agent. In the course of the hearing, Sir George Jessel inquired of the eminent Counsel for the defendant what was the answer to the complaint; and the reply was that the practice was universal in that particular trade throughout Lancashire, and was prevalent elsewhere. Counsel said that he had a large number of respectable people in Court to give evidence in proof of the fact that the practice was universal. The Judge said: "You can send those 'respectable' people home; the sooner they leave the Court the better;" and judgment was found in favour of the merchants.

Substitute "worthy" for "respectable," and the story makes my point. You say that palm-oiling is already disreputable. Outside certain circles, that is true. But how comprehensive some of these circles are, is only too notorious; and the number of "worthy" people contained therein, who shall compute it? The old Latin saying is still too often true: "*Probitas laudatur et alget.*"

F.

April 18, 1900.

MISCELLANEOUS NEWS.

PARIS GAS COMPANY.

The Report and Accounts for the Year 1899.

The following is an abstract translation of the report of the Directors of the Paris Gas Company on the working of the undertaking in the year ending Dec. 31 last, with the principal items in the accounts.

In the year 1899 there was a further augmentation in the consumption of gas in Paris and the 59 neighbouring communes served by the Company; the quantity sent out for consumption being 325,874,001 cubic metres, or about 11,503,352,000 cubic feet, as compared with 320,031,250 cubic metres, or 11,297,103,000 cubic feet, in the preceding twelve months—an increase of 5,842,751 cubic metres, or 206,249,000 cubic feet. This is ascribed, on the one hand, to the normal growth of the consumption, to which the 27,636 new customers obtained in the year contributed; and, on the other, to the effect of the dull weather which prevailed during the latter portion of this period, as well as to the preparations being made for the International Exhibition, which was opened on the 14th inst. The day consumption of gas continues to increase regularly. Last year it reached 109,435,483 cubic metres, or about 3,863,073,000 cubic feet; being 4,580,583 cubic metres, or 161,695,000 cubic feet, more than in 1898, and representing 33·55 per cent. of the total. The receipts amounted last year to 82,630,736 frs. (£3,305,230), or an advance of 1,658,992 frs. (£66,360) on those for 1898. Of the total, 75,125,118 frs. came from the city, and 7,505,618 frs. from the surrounding districts. The number of consumers on Dec. 31 last was 425,276, or, as mentioned above, 27,636 more than at the corresponding date in 1898. The increase in the past twelvemonth was 1563 greater than that for the previous year, and was the result of a further accretion of the number of consumers whose supply of gas is laid on without cost to them. In 1898 there were added 123,292 customers of this class; whereas last year there were 140,776—a difference of 17,484. It is rather remarkable that of the 27,636 new consumers last year, the proportion of those of the ordinary class was greater than in 1898; being 10,152, as compared with 7675. This improvement is due to the exertions of the Company's lighting inspectors, which result in the diminution of the unproductive installations. The number of burners in the public lamps on Dec. 31 was 62,409, of which 50,516 were employed in lighting the city, and 11,893 were in use in the suburbs. These figures show a decrease of 3375 burners in the city, but an increase of 201 in the suburbs—a net reduction of 3174 in the year. The lower figures for the city are due for the most part to the temporary disuse of a large number of lamps in certain public thoroughfares now comprised in the area covered by the Exhibition, and likewise to the substitution of incandescent gas-burners for those of the ordinary kind. At the close of the past two years, the number of burners of various types employed was as follows:—

Kind of Burner.	1898.	1899.	Inc.	Dec.
Ordinary	47,947	38,599	—	9,348
Auer	1,723	8,735	7,012	—
Denayrouze	393	1,877	1,484	—
St. Paul	229	1,164	935	—
Regenerative	3,599	141	—	3,458
Total	53,891	50,516	9,431	12,806

While the effect of this extended use of incandescent burners is to decrease the consumption of gas for municipal lighting, it at the same time improves in a very considerable degree the general illumination of the streets. The incandescent gas system is also being extended to the suburbs; and the Directors are of opinion that it will develop greatly as time goes on—it being more economical than electric lighting, while producing equally good results.

The number of rising mains fixed by the Company in the past twelve months was 1500; bringing up to 48,200 the number in use on the 31st of December. They serve 288,441 consumers, against 263,393 at the close of 1898; the proportion to the total number being 66·24 per cent. then, as compared with 67·82 per cent. now. These improved figures show that the introduction of electricity into the Paris houses has not been so inimical as might have been supposed to the development of gas consumption. In fact, the ordinary consumers taking their supply from these rising pipes burnt 55,489,538 cubic metres, or 1,958,781,000 cubic feet, of gas in 1898, whereas last year they used 57,364,286 cubic metres, or 2,024,959,000 cubic feet—an increase of 1,874,748 cubic metres, or 66,178,000 cubic feet. The efforts of the Directors to extend the use of gas among this class of their customers have, therefore, not been fruitless.

With regard to the works and plant, no change of any importance was made last year; the various stations being equal to the demands made upon them. Extensions of mains were, of course, required; and about 24,778 yards of pipes were put down—17,327 yards in the city, and 7451 yards in the suburbs. This brought up the total to about

1541 miles. There was a net sum of 4,645,404 frs. (£185,816) expended for capital purposes last year, or about £36,758 more than in 1898. The capital account stood as follows at the close of the year:—

	Francs.	Sterling.
Amount expended to Dec. 31, 1898	320,098,496	£12,803,940
„ „ during 1899	4,645,404	185,816
Total	324,743,900	£12,989,756

To meet this there has been raised: By shares, 84,000,000 frs.; by bonds, 254,004,189—together, 338,004,189 frs. (£13,520,167). There is consequently an unexpended balance of 13,260,289 frs. (£530,411). The capital is represented by 336,000 shares and 553,332 bonds. Up to the date of the report, there had been redeemed 230,679 shares and 330,403 bonds; so that 105,321 shares and 222,929 bonds remain to be redeemed before the expiration of the concession in 1905.

The following is the working account for the past year:—

Expenditure.

	Francs.	Sterling.
Value of gas in store on Jan. 1, 1899	59,857	£2,394
Manufacture of gas—		
Coals carbonized	21,538,251	861,530
Coke and tar for heating purposes	4,673,976	186,959
Salaries and wages	5,103,505	204,140
Maintenance of works and plant	2,097,636	83,905
Incidental expenses of carbonization	1,412,318	56,493
Purifying materials and labour	312,596	12,504
Distribution—		
Salaries of engineers and officers	2,671,115	106,844
Repairs, &c., of mains and services	2,084,232	83,369
Miscellaneous expenses, stamps, &c.	479,368	19,175
General management (including interest and sinking fund payments)	27,079,538	1,083,181
Pension and provident funds	1,929,342	77,174
Municipal charges—		
Tax of 2 c. per cub. met. of gas sold.	5,502,489	220,100
Rent of subsoil occupied by mains,&c.	200,000	8,000
Lighting, extinguishing, and maintenance of public lamps (less amount paid by Municipality)	1,379,070	55,163
State charges—		
Official gas testing, stamps, &c.	1,068,590	42,744
Total expenditure	77,591,883	£3,103,675

Revenue.

	Francs.	Sterling.
Value of gas in store on Dec. 31, 1899	33,129	£1,325
Sale of gas	82,630,736	3,305,230
Residual products—		
Coke	14,957,661	598,306
Tar	1,563,020	62,521
Ammoniacal liquor	1,925,693	77,028
Rental of meters and fittings on hire	1,934,855	77,394
Fire-bricks, &c.	47,121	1,885
Interest and discount	1,105,336	44,213
Total revenue	104,197,551	£4,167,902
Deduct expenditure	77,591,883	3,103,675
Balance, profit for 1899	26,605,668	£1,064,227
Add balance of 1898 liquidation	6,690	267
	26,612,358	£1,064,494
Deduct to meet outstanding claims	262,358	10,494
Balance available for distribution	26,350,000	£1,054,000
Deduct for share dividend	11,200,000	448,000
Balance, divisible equally between the Company and the Municipality	15,150,000	£605,000

The total amount coming to the shareholders is therefore:

	Francs.	Sterling.
Dividend as above	11,200,000	£448,000
Half of divisible balance	7,575,000	303,000
Placed to shareholders' credit, as per resolution of March 23, 1875	50,000	2,000
Balance of undivided profits	196,198	7,848
Total	19,021,198	£760,848
Deduct 1 fr. per share for reserve fund.	336,000	13,440
Balance	18,685,198	£747,408
Deduct interim dividend of 12 frs. 50 c. per share paid in October last	1,500,837	60,033
Balance	17,184,361	£687,375

This balance, if it were all available, would allow of the declaration of a dividend of 63 frs. per ordinary, and 50 frs. 50 c. per preference share; but, by virtue of a decree made on June 27, 1898, by the Prefectorial Council of the Seine (from which, however, the Company have appealed to the State Council), a sum of 1,349,521 frs. has to be placed to a suspense account, pending the result of the proceedings. In these circumstances, the disposable balance is 15,834,840 frs. (£633,394), which will allow of the payment of a final dividend of 46 frs. 50 c. per share. Adding the interim dividend of 12 frs. 50 c. per share and the portion of the divisible balance held in reserve (equal to 4 frs. per share), the total dividend for the year is 63 frs., or 50 c. more than that for 1898. This will leave a balance of 210,840 frs. (£8434) to be carried forward. The higher dividend, notwithstanding increased expenses, is explained to be due to the greater quantity of gas consumed, to the profits realized by the sale of coke and ammoniacal liquor, and to the economy exercised generally in all departments of the undertaking.

Reference is made to the great rise which has lately taken place in the price of coal. Under the long contracts which the Directors entered into before the advance, the necessary deliveries of coal were made last year without any appreciable additional expense being incurred. These contracts cover the larger portion of the supplies required during the current year; and consequently the accounts will not be affected to anything like the extent they would have been if purchases had had to be made at present rates. Moreover, the Company are provided with the extra quantity required owing to the exceptional consumption since the latter months of last year.

Coming to the portion of the report dealing with the residuals, the Directors record a revenue of 14,957,661 frs. (£598,306) from the sale of coke; being 393,846 frs. (£15,754) more than in the preceding year. The improved market which allowed of the realization of this substantial increase did not prevent the reduction of the stocks, which at the close of 1899 were much lower than they were at the corresponding period of 1898. Moreover, the contracts entered into at the beginning of 1899 were based upon the very moderate rates then ruling; whereas those concluded for the present year have been made under more advantageous conditions, and consequently they will compensate in a large measure for the additional expenditure arising from the high price of coal. Tar and liquor were also sold with better results last year; the total revenue from these two products—3,488,713 frs. (£139,549)—showing an increase of 462,888 frs. (£18,516) on that for 1898. This improvement arises partly from the better prices obtained for the liquor; but it is also attributable to the increased quantity of prussian blue contained in the spent purifying material, which has enabled the Directors to sell it more profitably.

There is no diminution in the interest taken by the public in the Company's show-rooms; the number of visitors last year being 44,696, or 1394 more than in 1898. Orders were received for 6549 gas appliances, either of the Company's construction or those of other makers on view. Of this number 2715 were cooking or heating stoves, and were quite independent of the 24,597 small stoves which the Company lent gratuitously; bringing up to 315,936 the number in use at the close of the year. These figures show the extent to which gas is used for culinary purposes in Paris. It is much the same with other kinds of gas appliances, employed in industrial operations. The Company encourage, by means of premiums, this special use of gas. The utilization of gas for the production of motive power continues to make progress. At the close of last year, there were at work in Paris and the surrounding communes 2989 gas-engines, furnishing about 12,590-horse power—an increase of 193, representing 1630-horse power, on the number in operation in 1898. The quantity of gas consumed by these engines reached 10,103,000 cubic metres, or rather more than 356½ million cubic feet; being an increase of nearly 19 per cent. on the consumption in 1898. The average power of the engines put up in that year was 6-horse; whereas last year it was 8-horse. The conclusion to be drawn from this fact is that motors of the higher powers will be those more generally employed in the future; and, of course, this will lead to a corresponding increase in the quantity of gas consumed. It is to the production of the larger types of engines that the efforts of makers are now being directed; and the result will be a new opening for the gas industry.

The report furnishes, as usual, full particulars in regard to the provident, pension, and savings funds connected with the Company. Last year the expenses of the provident fund amounted to 555,994 frs. (£22,240); whereas the receipts—which consisted mainly of 1 per cent. deducted from the Directors' fees and the salaries of employees, making 204,166 frs., and a like sum contributed by the Company—were only 419,251 frs. (£16,770). The deficiency has been made up, as usual, by the Company. As from the 1st of July last, the Directors have adopted the provisions of the law of April 9, 1898, in regard to workmen's accidents. There are two pension funds—one for the men engaged upon the works, and the other for the clerks, &c. The balance of the former at the close of the year was 960,345 frs. (£38,414); and of the latter, 9,658,046 frs. (£386,322). The savings fund balance was 290,486 frs. (£11,620).

The Directors could not close their report without some reference to the part which is being taken by the Company in connection with the Exhibition. As our readers are aware, a Gas Pavilion has been erected in the grounds by the Société Technique du Gaz en France; and towards the expenses attending this work the Company have contributed. They are also showing, in various classes, some of the most interesting of the appliances used in the manufacture of gas, as well as specimens of the residual products. But it is in the domain of lighting that the Company will make the best display. The Directors thought it would be advantageous to the gas industry to show the progress made in lighting since the Exhibition of 1889 by the application of the incandescent system. They therefore arranged with the authorities of the Exhibition that they should be allowed to light the parks in the Champ de Mars and the Trocadéro, in conjunction with the French Welsbach Company and the Denayrouze Company. Owing to the increase in the number and power of the burners as compared with those originally arranged for by the Administration of the Exhibition and to the use of compressed gas, the quantity of light at first contemplated will be increased fivefold. This illumination of two of the most frequented parts of the Exhibition will constitute, in a measure, the Company's personal exhibit. In addition to this, they have obtained from the proprietors of certain refreshment establishments promises to employ gas exclusively as the fuel for the stoves and other culinary appliances placed at their disposal by the Company, or to obtain their motive power from gas-engines. While showing themselves keenly alive to the Company's interests at this period of great business and general activity for the city, the Directors are not unmindful of the fact that the large influx of visitors invariably resulting from international displays such as that which will shortly be completed on the banks of the Seine, is followed by a rise in the price of all the necessaries of life; and they could not disregard the result of this increase on the resources of those most liable to be affected by it. They therefore propose to distribute, between the 1st of May and the 31st of October, a sum of £16,000 in two equal parts, to those of their employees whose salaries are £105 or less per annum, and to all the workmen without exception. This is, on a rather larger scale, the course adopted on the occasion of the Exhibition of 1889.

Reference has already been made to the appeal of the Company to the State Council against the decree of the Prefectorial Council of the 27th of June, 1898, in reference to the amortization of their share capital. As the matter is *sub judice*, and a decision thereon is expected shortly, the Directors can only express their belief in the correctness of their reading of their Treaty with the Municipality on the points in dispute—a reading which is supported by those who drew up the document

originally. With regard to the question of the reduction of the price of gas, and a prolongation of the concession, which has been under consideration by the Company and the Municipality more or less since 1892, nothing definite has yet been arrived at. The Directors are sincerely desirous of coming to some satisfactory conclusion on this matter. But the question is one which concerns three parties—the consumers, the Municipality, and the Company; and in any settlement the interests of all must be duly considered.

WIDNES CORPORATION GAS SUPPLY.

Tar Process Abandoned in Favour of Enrichment by Benzol and Carburine.

A significant report has been presented to the Gas Committee of the Widnes Corporation by Mr. Isaac Carr, their Gas and Water Engineer, and adopted by the Town Council. He informed the Committee that the eight single benches of retorts forming the portion of the carbonizing plant known as the "tar beds" would require renewing this season; and, in carrying out the work of re-erection, he recommended that the system of tar enrichment should be discontinued, and that the retorts should be set "in a manner similar to those in the new retort-house." He further recommended that "benzol and carburine spirit should be substituted for the tar as a means of enrichment." In explaining the reasons for these recommendations, Mr. Carr said: "It is necessary to point out that the conditions under which the system of tar enrichment was of value in the first years of its history have gradually altered, until they have now practically disappeared. Twelve years ago—*i.e.*, the period of the introduction of the process—tar was so low in price and so difficult of disposal that a large quantity was used as fuel for heating the retorts in place of coke. Cannel, the then only means of enrichment, was very high in price; oil enrichment, as now recommended, being unknown. Of late years tar has appreciated very considerably in value; cannel has fallen to nearly half its former price; and oil spirit and benzol, as an economical and efficient means of permanent enrichment, have come into general use. The cost of enrichment by means of cannel, at to-day's prices, might be stated at a little over 1d. per candle per 1000 cubic feet. Compared with benzol and carburine, tar enrichment is both more costly and more difficult of application." Mr. Carr added that a further consideration in favour of the substitution of oil enrichment was that it was likely, in a measure, to prevent, or at all events to afford some relief in the event of, another visitation of "the elusive naphthalene difficulty" such as was experienced in the latter part of last year.

WATER-GAS PLANT FOR MACCLESFIELD.

A short time ago, the Gas Engineer of the Macclesfield Corporation (Mr. Ernest L. Newbigging) was asked by the Gas Committee to report to them upon the question of introducing some kind of auxiliary gas-making plant; and at the meeting of the Committee last Wednesday, he complied with their request. He commenced by stating that there is only one kind of such plant in existence—viz., that for making carburetted water gas—which, he said, had been erected at nearly all the largest gas-works in the world, and had proved an unqualified success. He advised the Committee to adopt this process in conjunction with the existing coal-gas plant. Having described the method of making water gas, Mr. Newbigging gave twelve very good reasons to justify his recommendation. By means of a plan, he indicated the best position on the works for the erection of the new plant, and then passed on to deal with the question of cost. He stated that one complete section of the plant, to make 300,000 cubic feet of gas per day, and arranged for duplication at a slight outlay, would cost, in round figures, £2800; a duplicate steam-boiler plant, each boiler being large enough for two sections of generating plant, would cost about £900; an oil-tank, £350; buildings, £2000; relief holder, 36 feet by 16 feet, in steel tank, £725; purifying plant, consisting of four purifiers, 16 feet square and 4 ft. 6 in. deep, with 12-inch centre-valve and connections and traveller, £1300; yard connections and foundations, £400—total, £8475. Supposing the Committee were able to borrow this amount at 3½ per cent., the cost would be £300; but as they would lose the rent of certain cottages cleared away, about £100 would have to be added—making £400 in all. Mr. Newbigging then considered the value to the undertaking of the auxiliary plant he recommended. On this point he said: "You have made during this year about 165 million cubic feet of gas; your increase having been about 12 millions over the preceding year. Suppose, by the time you get this plant erected, you are making 175 millions, and you made 25 per cent. of water gas—that would be about 44 millions. You are able here to make coal gas as cheaply as in most works; and I see no reason why you should not make water gas as cheaply too. Manchester makes water gas at about 4½d. per 1000 cubic feet less than coal gas. We will say that you could make it at 3d. less; then 44 million cubic feet of water gas at 3d. per 1000 cubic feet is £550 saving, or £150 more than the interest on the borrowed money and the house-rents, without taking into consideration the saving in cannel, the cost of more storage, wear and tear in the retort-house, and the saving in not having to buy land to increase our present coal-gas manufacturing plant." He added that there was no nuisance, except the noise caused by the working of the engines, from water-gas plant; and that although some opposition had been offered to the gas on account of its alleged poisonous nature to some extent, the fears on this score had almost vanished. In conclusion, he expressed the opinion that the way he had indicated to the Committee was by far the best and most economical one of increasing their manufacturing plant. In a note appended to his report, Mr. Newbigging stated that since its preparation the price of oil had almost doubled; and that consequently, under the altered circumstances, water gas could not be made much, if any, cheaper than coal gas. He pointed out, however, that the other advantages—such as the consumption of a smaller quantity of coal and cannel, the need for less storage, and so forth—would remain, as well as the absolute necessity for more carbonizing plant. The report was discussed at some length; and it was eventually decided that it should be placed before the Council, and be again considered by the Committee at a future meeting.

WHITWICK AND COALVILLE GAS ARBITRATION.

Thursday, April 19.

(Before Mr. Shiress Will, Q.C., *Umpire.)*

This was an arbitration to decide the amount to be paid by the Coalville Urban District Council for the undertaking of the Whitwick and Coalville Gas Company. The proceedings took place at the Westminster Palace Hotel, London. Mr. Alfred Colson was Arbitrator for the Company, Mr. Corbet Woodall for the Council. Mr. C. A. Cripps, Q.C., M.P., and Mr. Honoratus Lloyd appeared for the Company; Mr. Balfour Browne, Q.C., and Mr. Ram, Q.C., for the Council.

Mr. Cripps, in opening the case, said the purchase was sanctioned by an Act obtained in 1899 by the Council; and under section 5, sub-section 2, it was provided that, in case of disagreement, the price was to be fixed by arbitration in accordance with the provisions of the Lands Clauses Acts. The Council were to pay the actual cost the Company incurred in obtaining their Act in 1898, the expenses of winding up the Company, and compensation to officers and servants in the regular employment of the Company; but the Arbitrators should not have regard, in determining the price, to the fact that the Company were incorporated by Act of Parliament. The Company were not to be compensated as though they were a statutory Company, which affected the number of years' purchase; and, on the other hand, the Company were not to be considered as subject to limitations of dividends, which were imposed when a company obtained statutory powers. Messrs. Lass, Wood, and Co. had taken out the accounts; and both sides had agreed to abide by their figures. The capital consisted of £8000 of 10 per cent. stock and £2000 of 5 per cent. stock. The loan capital authorized was £3750, of which £2500 had been raised. The Council would take this over. The tables showed that the total capital expenditure was £12,815 9s. 7d., and that the payments for parliamentary costs in 1898, when the Company obtained their Act, were £1285 14s. 9d. The profit on gas was £954 in 1896, £1142 in 1897, £725 in 1898, and £1577 in 1899—the year in each case ending at June 30. The substantial question was whether this profit of £1577 in 1899 was maintainable or not. The variations in the profit arose to a great extent because, in a small concern of this kind, capital charges were being constantly paid out of revenue, particularly in matters of repair and maintenance. In this case, the witnesses put the figure for repairs and renewals at 5d. per 1000 cubic feet. The cost per 1000 cubic feet for repairs and maintenance of works and repairs and maintenance of mains and services, were as follows: In 1896, 2·63d. and 6·36d. respectively—a total of 8·99d.; in 1897, 3·13d. and 1·78d. respectively—a total of 4·91d.; in 1898, 6·79d. and 9·75d. respectively—a total of 16·54d.; and in 1899, 4·68d. and 0·92d. respectively—a total of 5·6d. The figures in 1898 were enormous, and he believed were due to the Company laying mains, or doing work of that kind. The actual sum spent in the last year was 5·6d., and the figure taken was 5d.; so that there was an adjustment in regard to the 0·6d. of difference, which worked out to £35 2s. 9d. Then the Manager was a sort of handy man as well; and he did many minor repairs and things of that kind himself. It was, therefore, held that half his wages should be allowed, in the sense that they should not be put down against the profits of the concern. His wages were £91; so that the half would be £45 10s. These two figures made £80 12s. 9d., and, added to the £1577 3s. 11d., gave £1657 16s. 8d. There were certain mains which had been laid by the Company, 10 per cent. of the cost of which had been paid by the Council on condition that, where consumers were obtained on the mains, a third of the amount derived from the consumers should go against the liability of the Council. Last year £14 4s. 7d. was obtained from the Council in this way; and this, with £18 0s. 11d. rent derived from certain cottages, made £32 5s. 6d., which, deducted from the £1657 16s. 8d., left £1625 11s. 2d., which the Company said was the maintainable profit. The multiplier adopted was 26⅔ years; and this gave £43,348 4s. 5d. To this was added the rent of the cottages, capitalized at 22¼ years' purchase, and the sum received from the Council in respect of the mains, capitalized at 10 years' purchase; these two sums being £405 12s. and £145 5s. 10d. respectively. The late Manager, who was now about 70 years of age, was allowed £72 16s. a year. He was about the place, and was employed in various ways. Half of this sum—£36 8s.—was multiplied by 26⅔, because it would come into profit later on, but not until he died. His expectation of life being eight years, this had to be multiplied again by 0·7894. This brought out £608 7s. 3d. He also received a house and gas, which were equivalent to £10 8s. This was capitalized at 22¼ years' purchase, and again multiplied by 0·7894 for the eight years, which gave £182 13s. 4d. These additions to the £43,348 4s. 5d. made the figure of £44,687 2s. 10d. Beyond this, there was the question of prospective value under the head of surplus lands, works, and mains; and this Mr. Stevenson estimated at £3581 10s., which increased the total to £48,268 12s. 10d., or, *plus* the 10 per cent. allowance for the sale being compulsory, £53,095 10s. 1d. From this, however, had to be deducted £2500, the amount of the debt taken over, leaving £50,595 10s. 1d. In addition, there would be sums for the cost of obtaining the Act and of winding up.

Mr. *Samuel Wood*, of Messrs. Lass, Wood, and Drew, handed in tables relating to the affairs of the Company which, acting for both sides, he had prepared. In reply to Mr. Balfour Browne, he said the repair and maintenance of works and plant amounted in 1898 to £355 13s. 3d., and sank to £274 4s. 10d. in 1899; and the repair and maintenance of mains and services in 1898 was £511 1s. 10d., while in 1899 (the account year) the figure sank to £54 1s. 4d. The £511 in 1898 included part of the cost of laying a new 10-inch main in place of a 6-inch one, less value of old pipes taken up and sold. This was the ordinary way of dealing with a matter of this kind. This large renewal was commenced in 1896, but was paid for in 1898. The coal cost practically the same in 1899 as in 1898; but coke went up considerably—the average price per ton in 1897 being 6s. 7d., in 1898 6s. 9d., and in 1899 8s. 5d. In 1898, the profit on gas was 13·85d.; and in 1899 it went up to 26·93d. The dividends in 1898 were 9·16d., and in 1899 13·83d. The standard price was 4s. 2d. The Company had some very large customers. In 1899, the total quantity of gas consumed by ordinary customers was 6,578,300 cubic feet, of which Messrs. Stableford and Co. took 2,408,600 feet, the Midland Railway Company practically a similar amount, Messrs. Wootton Bros. about

500,000 feet, the Constitutional Club 257,000 feet, and the Liberal Club 224,000 feet.

Mr. *E. H. Stevenson*, examined by Mr. CRIPPS, said the general progress of the Company had been exceedingly satisfactory; the growth for the past ten years being over 8 per cent. per annum—a high rate of expansion. There were few places which could maintain such a rate of increase over ten years. Coalville sprang into existence in that ten years, and had grown enormously. Even now there was margin for considerable extension as between the number of houses in the town and the number which took gas. There was no question the Company would now have been selling much more gas if, during the past three years, there had not been an agitation for the purchase of the concern, which had caused the Company to hold their hand as regards capital expenditure on mains. If the Company had extended their mains very largely, the capital employed would not have come into operation, and the Company would have lost greatly when the purchase took place. In the last account year, there were 85 new consumers out of a total of 374. There were consumers only where mains had been put; and not half the district had mains. The district was of a mining character, and contained iron and various other works largely dependent on coal, of which there was plenty. The Company laid a 10-inch main from the gas-works to the centre of the district, part in 1896 and the remainder in 1898; and this accounted for the variation in the profits. This was in place of a 6-inch main. Its length was 2300 yards; and two-fifths of the cost was paid out of capital, and three-fifths out of revenue. This was sufficient for about double the present supply; the maximum output in 24 hours in the account year (which ended at June, 1899) being 85,000 cubic feet. The mains generally of the Company were unusually large. More than a quarter of them were 10 inch, there were 600 yards of 6 inch, 1900 yards of 4 inch, 8800 yards of 3 inch and 300 yards of 2 inch. There was excess capacity in the retort-house of 50 per cent. It had a bench of five arches, with room for another arch. Four of the arches were set with retorts; but only three were used ordinarily in mid-winter. The fourth was requisitioned this winter, because Leicestershire coal, instead of the usual kind, had to be used. The coal-shed had a capacity of 250 tons, which was five weeks' storage under cover for the maximum weekly make. This was quite sufficient. The engine-house and boiler-house were very ample. There was little, if any, margin in the condensers; but the two scrubbers (one being 15 feet high and 3 feet in diameter, and the other 30 feet high and 5 feet in diameter), the Livesey washer, and the four purifiers (which were 9 feet square, and practically new) were considerably in excess. The meter—quite new, and with a capacity of 7000 cubic feet per hour—was 100 per cent. in excess. The two gasholders were of 20,000 and 60,000 cubic feet capacity respectively, which was in excess of requirements. The other necessary equipment—tar and liquor tanks, the manager's house, cottage accommodation, &c.—was all amply sufficient and up to date. Adjoining the works was a plot of spare land, with an area of 2148 square yards, available at any time for the purposes of the works. The unaccounted-for gas in the last two years having been only 7·5 and 8·03 per cent. respectively, showed that the mains and pipes were in very good condition. In his valuation, he started with the figure of £1577 3s. 11d. shown by Mr. Wood as the profit for the year ending June 30 last—this being the proper year having regard to the date of the notice. The right figure to allow for repair and maintenance of works and repair and maintenance of mains and services was 5d. per 1000 cubic feet; the high figures shown in the accounts being due to such things as the laying of the 10-inch main and charging three-fifths to revenue, and other new works. Adjusting the outlay on this basis, the actual expenditure in 1899 having been 5·6d. gave £35 2s. 9d., which, with £45 10s. half the wages of the Manager, he added to the £1577 3s. 11d.—making £1657 16s. 8d. The Manager did nearly the whole of the repairs about the works, and all the repairs to mains and service-pipes. His wages had not been allocated to repairs and maintenance in the accounts; but they ought to have been taken into consideration in arriving at the figure of the year's profit. A part of his wages was included in the 5d. per 1000 cubic feet; and witness therefore made the allowance, as stated, of half his wages. Then certain main pipes were laid under agreement with the Local Authority; the Company paying the cost of the pipes, and the Local Authority allowing for interest at 10 per cent. on those pipes. The public lamps were put on, and any extra consumers were to be a rebate on the interest. One-third of the charge of a large consumer was to be considered the profit of the Company; and this one-third was to be allowed so far as it amounted to the gross amount of interest on the particular main. The difference last year between the interest on the mains and one-third of the price paid for gas consumed through those mains, was £14 4s. 7d. This sum he reckoned should be added to the annual rent of the cottages £18 0s. 11d., making £32 5s. 6d., which, deducted from the £1657 16s. 8d., gave £1625 11s. 2d. as the maintainable profit. He took as multiplier 26⅔ years, because he considered the income of the Company better secured than that of any other non-statutory Company he had met with; there being many houses which did not take gas because there were no mains near them, and others which would take gas if the Company were going to remain. There was, therefore, a very good future for the gas concern. This worked out to £43,348 4s. 5d. The rent of the cottages he capitalized at 22¼ years' purchase (it being customary to value cottage property belonging to a company at a lower number of years' purchase than the undertaking), which produced £405 12s. The interest on mains (£14 4s. 7d.) he capitalized at 10 years—£142 5s. 10d. The late Manager was paid 28s. a week, and had a cottage and gas equal to £10 8s. per annum allowed him. He was permitted to do what work he liked, and practically to be away when he wished. The payment was really in the form of a pension, but some work was obtained from him. When he died, some further assistance would certainly be required, but nothing like the full extent of his wages; and witness therefore claimed that a portion—there being at least half in the form of a pension—would revert to the Company when he died. The Company ought to have the deferred value of this. Taking half his salary (£36 8s.), capitalizing it at 26⅔ years' purchase, and deferring it, gave £608 7s. 3d.; and capitalizing the £10 8s. at 22¼ years' purchase, and deferring it, gave £182 13s. 4d. These sums brought the main figure to £44,687 2s. 10d. To this he added £3581 10s. for surplus land, works, and mains—making £48,268 12s. 10d. The 2148 yards of land he put at 2s. 6d. a yard—a price at which land was selling freely in the locality—which equalled £268 10s. The excesses on works he valued as follows: Retort-house £163, one arch in the retort-bench £30, scrubber and washer £136 10s., purifiers £241 10s., gasholders £900, and main-pipes in the streets (half their value of £3684) £1842. Adding to the £48,268 12s. 10d. the usual allowance of 10 per cent. for the purchase being compulsory, made the total £53,095 10s. 1d., which, less the mortgage, produced his final figure of £50,595 10s. 1d.

Cross-examined by Mr. BALFOUR BROWNE: Most of the new supplies were prepayment consumers. The average cost, according to the tables, of repair and maintenance of works and repair and maintenance of mains and services for the past four years was about 9d. per 1000 cubic feet; but nobody would advocate that this was the right figure. In the account year, the maximum day's make and supply was 85,000 cubic feet; in the half year, following the maximum day's make was 95,000 cubic feet. He had calculated the excess on the smaller figure. The Company had no duplicate engine or boiler; in small works duplicate engines and boilers were not needed. Theoretically, there was a deficiency on the condensers; but they did their work. He agreed that in other cases—Chesterfield, for instance,—he had put the repairs and maintenance at 6d.; but the circumstances were very different, the works there being four times as large as was necessary, which would cause the repairs to be heavier. There was an item in the accounts of "gratuities £11 15s., watch and chain presented to the late Manager." This was a present; it was not like an addition to salary. Then there was a donation of £10 10s. to a colliery disaster fund, and £60 honorarium voted to the Directors and Secretary out of undivided profits, for services in connection with the parliamentary proceedings and the extensions at the works. The latter was capital expenditure really. The Directors received no salary. It was apparent by the increase in the consumption that the price of 4s. 2d. per 1000 cubic feet was not exorbitant. It was not a low price. Witness was then cross-examined at some length regarding the sum paid the late Manager; it being suggested that the Council were being asked, in respect of the pension, to pay £790 to the Company, not to the man. Witness, however, maintained that the Council were only being asked to pay the Company for profit which they would have if they had not this man on as a pensioner. A certain amount of work was obtained from the man; and therefore the Company considered only half the sum paid him as pension. He agreed that there had been considerable increase in the price of coal.

Mr. *H. E. Jones*, examined by Mr. CRIPPS, said he agreed with Mr. Stevenson that the works were all in good condition. In his valuation, he commenced with the figure of £1577 3s. 11d., taken from Mr. Wood's statement, and, like Mr. Stevenson, added the sum represented by 0·6d. for repairs. A fair and proper allowance here for repairs was 5d. per 1000 cubic feet. The works were working easily. There was a good margin of power; they were in the middle of a district where they could easily get pipes, metal, &c.; and they had not been advancing at such a rapid rate as to throw upon them much of the extra renewal which falls upon many gas undertakings, owing to their rapid growth. The Manager was not entirely a manager, but a handy man, and did the repairs; and he attributed, therefore, half his salary to repairs. Adding these two sums of £35 2s. 9d. and £45 10s., made the figure of £1657 16s. 8d., from which he deducted, as was done by Mr. Stevenson, the two items of £14 4s. 7d. for interest on mains and £18 0s. 11d. rent of cottages—leaving £1625 11s. 2d. In this concern, as in many other small ones, there was a potentiality of earning a considerably larger amount than they did from their ammonia. The ammonia was of equal value with the tar. Hitherto the Company had only been getting ½d. per 1000 cubic feet, or £28 a year, for the ammonia, as against £143 for the tar. This £28 could easily be made £86, or even £130 or £140; but there was to be deducted the interest upon the plant which the Company would have to erect. Therefore, he simply added £58 to the £28. This was the smallest net improvement they could possibly make, if they worked this residual up as they should, and, he thought, they would do. This £58 increased the figure of £1625 11s. 2d. to £1683 11s. 2d., as the maintainable profit. To this sum he applied the multiplier of 28½ years' purchase; the difference between this figure and the multiplier used by Mr. Stevenson representing the prospective profit which the Company would probably have earned if they had continued. This gave £47,685. He next added four sums of £401 10s. (rent of cottages £18 0s. 11d., at 22¼ years' purchase), £142 5s. 10d. (interest on mains £14 4s. 7d. at 10 years' purchase), £608 (in respect of half pensioner's allowance, and £183 (cottage and gas £10 8s. per annum, at 22¼ years', rebated for eight years' lapse)—making £49,019 15s. 10d. The surplus works and land he took at £3949 reverting within five years, which, on the 3½ per cent. table, equalled £3581—making £52,600 15s. 10d. His estimate of the surplus land was £362 10s.; the area he took being 2898 yards. Besides the unused plot just by the works, there was a large amount of space on the original works available for extensions. In respect of the works in excess, he allowed the following sums: Retorts £221, scrubbers £160, purifiers £216, gasholders £843, and mains and pipes £1842. At the present rate of increase, this plant would be employed for the most part in five years; and therefore he took the deferred value for it of 2½ years. To the £52,600 15s. 10d. he added the usual 10 per cent., making £57,860 15s. 10d., which, less the mortgage of £2500, gave his final figure of £55,360 15s. 10d.

Cross-examined by Mr. BALFOUR BROWNE: The £58 for the ammonia worked out to £1680 when capitalized. For coal, the Company were paying 1s. 6d. per ton in 1898 over 1897, and 1s. 8d. per ton in 1899 over 1897. In the present year, Tyne coal was advancing about 8s. per ton; and other contracts in the Midlands had advanced 5s. per ton. The Company could raise the price of their gas, though he agreed that a low charge stimulated consumption.

Friday, April 20.

Mr. *Jones*, re-called, made an adjustment of his figures, which altered the total from £55,360 to £54,763.

Mr. CORBET WOODALL: With regard to the ammonia, what you ask is that the Company, not having erected this plant, shall inherit the work of other men who come in and do it?

Witness: No; you have cut the Company off from doing that which anyone would advise them to do next year.

This concluded the case for the Company.

Mr. Balfour Browne, in opening for the Council, said there was a startling difference in the valuations; the figures on one side being about £54,000, and on the other £23,000. The chief question was: What was the maintainable income of the Company? All the circumstances must be looked at, and not merely the income in a particular account year. It was quite evident the Company were taking the benefit of accidental circumstances which had swelled the income of 1899, for the profit of the concern rose from £954 in 1896 to £1577 in 1899. The way to get rid of difficulties of this sort was to take an average, which would be £1099; and this, after proper corrections had been made, was nearer the maintainable income than £1577. The fortuitous circumstance in 1899 was the cost of coal, which was practically the same as in the previous year—viz., 11s. 2d. per ton. This was an accident, and could not continue; and it meant that their income in the account year, if the ordinary price had been paid, would have been reduced by about £400. Then the Company adopted an extraordinary position with regard to maintenance of mains, works, and services. The facts showed that 9d. per 1000 cubic feet was the right amount to charge; this being the average of the last four years. But they were asking the Umpire to accept the figure of the account year, when, owing to the large outlay of 1898, they were able to expend very little. The 10-inch main had nothing to do with the matter, because all the improvement of that main being laid was charged to capital. Counsel declined to go into the minute adjustments made by the Company's witnesses; holding that there was the best proof that the figure for maintenance was 9d. Turning to the valuations put in, he referred to the interest on mains £14 4s. 7d.; pointing out that the payment would cease when the Company had sufficient consumers on these mains to pay them this sum; and those consumers, according to the Company, they could secure to-day. It was wrong, however, to multiply it by 10 years, because there was no 10 years' life in it; the figures should certainly be less. Then capitalizing even the net rent of the cottages at 22¼ years' purchase, was ridiculous. As to the ingenious theory of Mr. Jones with regard to the ammonia, there was no calculation in it. It was nowhere except in Mr. Jones's imagination. He allowed £1680 for something the Company had never done and never would do. This £1680 should be absolutely ignored. Having arrived at the income, the important question arose of the multiplier, which had reference to the security. Counsel differed entirely from Mr. Stevenson, who said that this was one of the best-secured companies he knew. A company who were charging up to the hilt for gas were not secure. The whole meaning of the purchase was the complaints of the excessive price. So excessive was the price, that the Local Authority had had to light portions of the district with oil; and Messrs. Stableford and Co., who consumed 2½ million cubic feet of gas, had threatened that, if the price were not reduced, they would instal the electric light. Probably, he agreed, the Council would have to pay off the old Manager; and in that case they would have to compensate him on the basis of the salary he received. But the Company were asking £900, because they said they might have saved this man's wages. If this sort of criticism was to be allowed, all the working expenses also should have been criticized. The thing was nonsense. If the Company were to be allowed to go into these minute matters, and say they divided this old gentleman into two, and that the Council where to repay the Company half his salary, because he was not worth it, they might do exactly the same with regard to every other servant they had. Then the Act said the Arbitrator should not have regard to the fact that the Company were incorporated by Act of Parliament. To the Company this made a serious difference, which should be represented by at least 5 years' purchase. The Company had an Act in 1898; and they were to be under all the rules and regulations in the General Act with regard to sliding-scale, limitation of dividend, &c. The total amount they could have divided if they had continued to exist was £900; yet they talked about the immense future there was before them. It was absolutely ridiculous to say the Company must be treated as in a position to charge anything they liked. Having regard to all these facts, he held that the Company were not well secured, and that a liberal multiplier would be between 22 and 23 years. There was an entire difference of opinion as to the amount of surplus works. Mr. Stevenson calculated that the maximum daily output and sale was 85,000 cubic feet; but in December, 1899, they were selling 95,000 feet, and this would materially affect Mr. Stevenson's calculations. The claim in regard to mains was unique. For their own purposes, they had laid some mains which were too large. It was much cheaper to do this than to lay a small one and replace it with a larger one as required. No company would do such a thing; but this was the first time he had heard of people measuring up the mains, and saying: "Because this is a little too big, and would hold a little more gas, we should be allowed for it." Mr. Chester held that some of the works were seriously deficient, which showed that these matters were open to criticism. As to the 10 per cent. allowance for compulsory sale, he pointed out that on Mr. Jones's figures it amounted to £5200. This was claimed because the Company had been, in the public interest, compelled by Parliament to part with their property for an equivalent in money. He denied that, because there was compulsion, they were entitled to a penny. This would be making the Coalville ratepayer pay for what Parliament had done. At the same time, if the Company suffered any loss beyond what was included in the real value, this loss should be compensated for. The only thing he could suggest for which any allowance should be made was the cost of re-investment—perhaps 1 per cent.

Mr. *W. R. Chester*, examined by Mr. Ram, said the gas-works at Whitwick were not in a good position for the supply of gas; being on top of a hill, and remote from a railway station, which meant additional cost for the cartage of coal and for the removal of residuals. The buildings and apparatus were in a fair state of repair. Generally, the whole of the plant was being worked at its maximum capacity. On one day in the year 1899, the maximum daily make and output was 95,000 cubic feet. During the past winter, the whole of the retorts were under fire; and there was absolutely no standby. There was a surplus arch in which retorts could be placed; but there were no retorts set. Even if six retorts were placed here, there would be no surplus power whatever. The condensers were deficient, even for the present make; and on the 95,000 cubic feet basis, they would be much more deficient than Mr. Stevenson's figure of 25 per cent. Then in works of this size there ought to be a duplicate boiler and exhauster. There was, too, not more than enough engine power. The Livesey washer of 5000 cubic feet capacity per hour was just equal to the present production. Of the two scrubbers, only one could be regarded as a scrubber in the proper sense; and this was just equal to requirements. The four purifiers were about 13 per cent. in excess; the station meter was just equal to the present demand; the gasholders were deficient in the proportion of 84 to 95, or 12 per cent.; and the tar and liquor storage-tank was about equal to the present output. He handed in a valuation of surplus and deficient works on the basis of a daily output of 95,000 cubic feet, which showed surplus in land of £200, and in purifiers of £60; and deficiencies in condensers of £20, steam-boiler (duplicate) £50, engine and exhauster £150, and gasholders £330—a total of £550. This left a net deficiency to be deducted from the capitalized value of the undertaking of £290. The rent of the cottages in his valuation he treated as part of the income. The mains and meters were about the usual size for a works of this description. The 10-inch main recently laid from the works into Coalville—the centre of the largest consumption—had no surplus whatever. It was such a main as a prudent person would lay in taking up a small one for the supply of a town like Coalville. In the past ten years, private consumption had doubled, and the public lighting trebled. There had been a very large increase in the consumption of the four or five largest consumers, who took 45 per cent. of the whole production. If any of those consumers were to substitute electricity for gas, it would be very serious for the Company. In his valuation, he started with the figure of £1577 3s. 11d., balance of net profit as brought out by the Accountants, from which he deducted interest on debentures and temporary loans £101 5s. 6d.—leaving £1475 18s. 5d. It appeared that during the past three years no Directors' fees as such had been paid; but there had been honorariums and gold watches given, and things of that kind. It was unusual to have no Directors' fees; and no doubt these honorariums had been paid as recompense for the services of the Directors. The usual fees of Directors ranged from ¼d. to 1½d. per 1000 cubic feet; and in this case he took ½d. as a reasonable figure, it being also the average of what had been paid the Directors in one form or another in the last three years. This produced something like £30 a year, and reduced the main figure to £1445 12s. 5d. The large income of £1500 in 1899 was due to the low price the Company paid for coal, and to the increased value of residuals in the same year. They paid nothing extra for the coal, but reaped the full benefit of the increase from 6s. 9d. to 8s. 5d. in the price of coke. The increase in the price of coal and coke since the account year he took as 6s. 6d. per ton in each case; but as a ton of coal only produced about 5 cwt. of coke, the increase on coke was equal to 1s. 4d. per ton of coal carbonized. The net result was that there was an increase of roundly 5s. a ton which would have to be paid for coal; and this, on 1563 tons, equalled £390 15s. Subtracting this from the £1445 12s. 5d., left £1055 3s. 5d. During the year, there was a total expenditure for works, mains, and meters of 5·81d. per 1000 cubic feet. The proper figure should be 6d., which he felt was abundantly justified by the fact that 9d. had been the actual figure for four years. This meant a further deduction of £11 2s. 6d., which left the net maintainable income £1044 0s. 11d. This (the security not being particularly good) he capitalized on the 4½ per cent. table, or 22⅔ years' purchase, which gave £23,201, or, less £290, the amount of the deficiency in works, £22,911, to which had to be added the costs of obtaining the Act of 1898, the winding-up expenses of the Company, and the value of the stocks at date of transfer.

Cross-examined by Mr. Cripps: He allowed Directors' fees, because there was evidence that such had been paid, though not in the form of fees. If the works were continued, he had no doubt a sum would be set aside for Directors' fees; and it was only reasonable that provision should be made for that. A rise in the price of coal should be capitalized, providing there was no possibility of raising the price of gas to correspond. As a non-statutory concern, there would be no objection to the Company raising the charge for gas to meet any rise in the price of coal; but there was a very strong commercial objection. They were already charging a higher price than any other company of like size in the three counties of Nottingham, Derby, and Leicester—practically they were charging the commercial limit. The price was 4s. 2d. per 1000 cubic feet; and up to 1896, it was 4s. 7d. Other residuals, besides coke, had not risen. The difference in the number of years' purchase of a statutory and of a non-statutory company would be about five; but much would depend on the particular company. An exceptionally well-secured statutory company was worth over 30 years' purchase. The maximum day's make of 95,000 cubic feet was after the period for which the accounts ran. In the period covered by the accounts, the maximum was 85,000 cubic feet; and if this were taken, it would slightly alter his deficiency figures—perhaps wipe off the £290. The land was distinctly surplus.

Mr. *Jonathan Longbotham*, a Director of the Ruabon Coal and Coke Company, of the Wharncliffe Silkstone Colliery Company, and of the Tinsley Park Colliery Company, said there had been an advance of 2s. per ton on contracts terminating on June 30, 1900, as against those terminating on June 30, 1898. He found that the Whitwick Gas Company in 1899 paid slightly less than in 1898. This would account for a larger profit than would be otherwise possible. As to the future, with regard to the contracts for the next twelve months, they would be made at an advance of 5s. per ton on last year's prices—an advance of 7s. per ton altogether since 1898. This referred to the Midland district. As to Durham, Mr. Jones had stated that his prices were 8s. per ton more this year than last. The amount obtained by the Company for coke had, of course, risen considerably; but assuming that the advance in the price of coal would be 7s. per ton on the figure paid in 1897, it would not be possible for the Company to be compensated for the increased price of coal by any advance in the value of coke. It required an advance of 3s. 7½d. per ton on the coke to compensate for 1s. advance in coal. In his opinion, it was impossible for the Company to continue working on anything like the basis of cheap coal that they had done.

Mr. *T. H. Heward*, Manager of the Nailstone Colliery, and Chairman of the Coalville Urban District Council, corroborated the previous evidence as to the rise in the price of coal since 1897, which he put at a minimum of 5s. per ton. Messrs. Stableford had stated that they contemplated adopting the electric light. At the present time, a private residence and a factory were lit by electricity.

Mr. *L. L. Baldwin*, Surveyor to the Coalville Urban District Council, stated that in Jackson Street, in the centre of Coalville, oil was used in the public lamps, though the gas-mains were quite close, because they

considered oil was more economical and gave better results than the gas-lamps.

Mr. Balfour Browne, in briefly summing up the case for the District Council, said that, in his opinion, Mr. Chester's deduction of 6d. per 1000 cubic feet for maintenance and repairs was too little; but he thought it was to be accounted for by the fact that gentlemen like Mr. Chester had given evidence on other sides, and they wanted—which was a damnable heresy—to be consistent. In the case of this particular Company, the average of the four account years was 9d. In these things there was no real necessity for consistency, because each case ought to be tried on its own merits. He thought that 22½ or 22⅔ years' purchase was a fair multiplier in this particular instance.

Mr. Cripps said he sympathized with his friend in trying to get what he called "damnable heresies" out of the mind of the only expert witness whom he had called. Mr. Chester threw him overboard altogether in regard to the four years' average, and had rightly done as was done in all these cases—particularly where there was a concern with a rising income. He had taken the figures for the last year. In regard to the coal question, it was utterly inconceivable that anyone, from a business point of view, when making an estimate the value of a concern of this kind, would base its value upon the supposition that some particular article which happened to be abnormally high, would remain at that abnormal height for all time; and therefore Mr. Chester's deduction under this head of £390 15s. was wrong. Again, with regard to maintenance and repairs, Mr. Balfour Browne had been entirely let down by Mr. Chester, who absolutely agreed with Mr. Stevenson on this point. As to Messrs. Stableford not continuing to take gas, Mr. Stableford was a member of the District Council; and if there had been anything in it, he would have come up and given evidence to that effect. Mr. Chester's deduction for Directors' fees was wholly inadmissible. The work had been done by local gentlemen without payment, which was a very common thing in these concerns; and therefore this fictitious sum of £30 ought not to be deducted. In regard to the multiplier, 22⅔ years' purchase was too low. Mr. Chester had admitted that, in the case of one or two statutory companies, he had given 30·77 years' purchase, and had said he would make a difference of 5 years between a statutory and a non-statutory concern. This would make Mr. Chester's figure really 25·77—roughly 26 years—whereas the Company were asking 26⅔ years. In regard to Mr. Chester's deficiency of £290, this was based on a maximum of 95,000 cubic feet; whereas the account year showed a maximum of only 85,000 cubic feet, and there was not the slightest evidence of any deficiency in 1899. In regard to the 10 per cent., he thought Mr. Chester had been coerced by Mr. Balfour Browne into omitting it. But the Act showed that this was a compulsory purchase under the Lands Clauses Act; and this implied the 10 per cent., which had been allowed in other cases. The half wages of the Manager, he admitted, was a far more controversial point. There was a good deal to be said for the way in which Mr. Balfour Browne had dealt with that £45 10s. But it was obvious that in this case the Manager was the handy man who did many of the repairs; and therefore the half of his wages really came under the head of repairs. At the present time, there was an elderly gentleman doing his work in a very easy style; and what they said was that the work could be done for half what they paid him, and that they only ought to make the allowance for the actuarial calculation as to the probable term of his life. This, he considered, was a perfectly right way of doing it. After alluding to the question of the surplus land, works, and mains, the learned Counsel dealt with the outlook of the Company. The future prospects were exceedingly good. There was an enormously growing district, a great deal of which had not been developed as regarded gas consumption. There was no doubt they had a very prosperous area as regarded the future extension of the gas concern. As to the security of the revenue, the real essence of security was the certainty of a growing market in the future; and there was no doubt that, as the price of coal went up, their district, being a coal-producing area, would have increasing prosperity. There was another matter which was not technically before the Umpire at that moment, but which he hoped could be agreed upon and inserted in the award.

The Umpire: That is the matter as to the three items of the cost of the Act, the winding up, and the compensation to officers.

Mr. Cripps: Yes; I see no reason why all three might not be fairly adjusted.

Mr. Ram: It may well be that we can agree; but if we fail, then I would ask, not that this matter should be excepted from your arbitration at all, but that, by consent, if not by the words of the clause, it should be put within your decision, and it may come before you to decide that point.

The Umpire: Very good.

Mr. Cripps: Speaking without instructions, I think Mr. Ram's suggestion is so reasonable that it ought to be accepted—that is to say, if we cannot agree upon these matters, whatever your technical powers may be, we may make another appointment, and give you the powers to deal with the whole question.

Mr. Lloyd said as, according to the Act, the transfer had to take place at the expiration of the first half year after the award, they would like to have the award as early before June 30 as they could get it. It would be unfortunate if they had to go on to Dec. 31.

Mr. Ram said they wished to take the undertaking over before June 30.

The Umpire said, if they would do what they could to bring their labours to an end as regarded the three items, the Arbitrators would not delay them many days.

The proceedings then terminated.

Luton Gas Company.—Striking progress was shown at the 84th ordinary general meeting of the Luton Gas Company, recently held under the presidency of Mr. J. Blundell. The number of consumers, according to the report, had increased by 430; while 300 new stoves had been added, and the use of gas for motive power extended. During the year, several of the mains had been increased in size, and the further large demand for gas, owing to the extension of the town, made it necessary to put up more producing plant, and increase the storage by the erection of another gasholder. Though coal had considerably increased in cost, the Company had not found it necessary to make any extra charge to the consumers, the present low rates of 2s. 5d. to the public and 2s. 3d. to the Corporation for street lighting being maintained.

METROPOLIS GAS SUPPLY.

Dr. A. W. Williamson's Quarterly Report.

The following is an extract from the report of Dr. A. W. Williamson, F.R.S., the Chief Gas Examiner for the Metropolis, on the quality of the gas supplied to London during the quarter ending the 31st ult.

Illuminating Power.—The maximum, minimum, and average illuminating power, in standard sperm candles, at each of the testing-stations, were as follows:—

	Max.	Min.	Aver.
Gaslight and Coke Company—			
Kinghorn Street, Cloth Fair, E.C.	17·2	16·1	16·5
Dorset Buildings, Salisbury Sq., E.C.	17·0	16·0	16·4
Millbank Street, S.W.	17·4	16·3	16·7
Ladbroke Grove, W.	16·9	16·1	16·4
Vincent Terrace, N.	18·1	16·1	17·0
Carlyle Square, S.W.	17·0	15·7	16·3
Camden Street, N.W.	16·7	16·0	16·2
Graham Road, Dalston	18·9	16·4	17·5
Kingsland Road, N.E.	18·1	16·2	16·9
Lambeth Road, S.E.	17·4	16·0	16·3
Hornsey Road, N.	17·4	16·0	16·4
Commercial Gas Company—			
Wellclose Square, E.	17·1	16·0	16·4
Parnell Road, Old Ford	17·0	16·7	16·8
South Metropolitan Gas Company—			
Hill Street, Peckham, S.E.	18·1	15·7	16·8
Bedford Road, Clapham, S.W.	17·3	16·0	16·5
Stoney Lane, Tooley Street, S.E.	17·3	16·1	16·6
Lewisham Road, S.E.	17·0	16·0	16·4
Blackfriars Road, S.E.	17·4	16·0	16·5
Burrage Road, S.E.	17·2	16·1	16·5

It will be seen from these results that the average illuminating power of the gas during the quarter at all the testing-stations was higher than the parliamentary standard. Slight deficiency was reported in the gas testing at the Carlyle Square station of the Gaslight and Coke Company, and the Hill Street station of the South Metropolitan Gas Company.

Purity.—Sulphuretted hydrogen was not reported to have been present in the gas. The average amount of sulphur in other forms than this was considerably less than the quantity permitted—viz., 22 grains—which was only exceeded on two occasions during the quarter. Ammonia was generally present in the gas throughout the quarter, but only in slight quantities. The limit allowed was not exceeded on any occasion.

MANCHESTER CORPORATION GAS AND ELECTRICITY DEPARTMENTS.

The Estimates for the Current Year.

A Special Meeting of the Gas Committee of the Manchester Corporation was held last Wednesday for the discussion and adoption of the estimates of income and expenditure for the current year, which ends in March next. The Committee have, in the past, been able to considerably lighten the city rates by their contributions out of the profits of the department; and last year the sum of about £50,000 was paid over to the City Treasurer in this way. This year, however, the Committee do not anticipate being able to hand over anything approaching the amount that was at their disposal last year towards the relief of the rates; the estimate being, we understand, about £20,000—representing a reduction of £30,000 upon the previous year. No actual details of the estimate will be available for publication until the end of the present week; but several items are mentioned as accountable for the probable reduction in the profits of the Gas Department, the chief of these being the large advance in the price of gas coal, and the increase in the wages bill, in accordance with resolutions recently adopted. We understand that the Committee have allowed in their estimates for a rise in the price of coal, but not to the extent of the advance for which colliery owners in some cases intend to hold out. Of course, any large increase in the cost of coal would mean an advance in the price of gas. The Committee are not yet on the market for gas coal; but tenders are being received for tar.

The Electricity Committee of the Corporation, who also held a meeting the same day to consider their estimates for the current twelve months, and who last year contributed £10,000 in relief of the rates, do not anticipate that they will this year be in a position to hand over anything to the City Treasurer. In fact, it is stated that the Committee contemplate having to draw upon their reserve fund to the extent of £23,000. Among the causes assigned for the probable diminution of profit are the interest that will have to be provided on capital expenditure incurred in extending the system in the outskirts and beyond the boundaries of the city, the cost of repairing damages caused by street explosions, and the expenditure for relaying the mains.

ST. HELENS CORPORATION GAS SUPPLY.

The Past Year's Working.

The report presented at the last meeting of the St. Helens Corporation Gas and Lighting Committee, by the Engineer and Manager (Mr. S. Glover), shows a continuation of the healthy growth which has characterized the undertaking for many years. During the twelve months ending the 31st ult., 574 additional cooking-ovens and grillers were fixed, making a total of 2011; 175 additional boiling-burners, making a total of 593; and 307 heating-stoves, making a total of 1271—bringing up to 3875 the total of cooking and heating arrangements in use at the end of the year. There were 45 additional ordinary meters fixed, making a total of 3652; and 576 automatic meters, making a total of 4016—bringing up the total of consumers' meters to 7668. The cash collected for the year from the automatic meters totalled to £7135 1s. 7d., being equal to 1,736,000 pence, and a weight of 15¼ tons. The amount collected in the year 1899 was £5236 12s. 1d.; making the increase for the present year £1898 9s. 6d. The quantity of gas made in the year was 327,332,100 cubic feet, as compared with 298,062,600 cubic feet in 1899; being an

increase of 29,269,500 cubic feet, or equal to 9·82 per cent. Its illuminating power was 19·12 candles, as shown by 293 tests, against 19·11 candles in 1899. With regard to its quality, the quantity of sulphur in other forms than sulphuretted hydrogen was 7·9 grains, and of ammonia 0·5 grain, per 100 cubic feet, according to the Referees' test; and no carbonic acid or sulphuretted hydrogen was present. Instructions have been given to the Engineer confirming his proposals for the provision of new works to meet future requirements.

HORBURY AND THE OSSETT GAS UNDERTAKING.

Satisfaction with the Agreement.

At the last ordinary meeting of the Horbury District Council, Mr. Thornton, in proposing a vote of thanks to the Chairman (Mr. Sykes), prior to the reconstitution of the Council, referred to the position of Horbury under the provisions of the Ossett Corporation Gas Bill. He remarked that the gas question had been difficult to deal with; but they had thrashed out the matter, and they thought their proceedings had resulted in an agreement being arrived at which was second to none which had ever been secured by any local authority, and which placed the Horbury Council in a prominent and proud position. In regard to the agreement, he might say that, on the very face of it it seemed rather strange that a Local Authority who found no management and no capital, and who ran no risk, were about to participate for the first time in the profits derived by the Corporation of Ossett from the gas-works when they had bought the works from the Gas Company. In London this was regarded as something unique, and altogether an innovation in connection with questions of this sort. Perhaps it might be strange to look at the matter in that light; but still it was the fact that they were about to receive their share of the profits from the gas-works. He was quite sure that when their Ossett friends—many of whom were now finding fault with the Council for the good bargain they had made—knew the whole of the facts, they would not look upon the matter as so strange, because he was persuaded that Horbury had hitherto been the profit-making machine of the Ossett Gas Company, and would no doubt be the profit-making machine of the Gas Department of the Ossett Corporation. Their differences in respect to the mileage of the gas-mains, the consumption of gas, and many other things, had led him to believe that what he had just said about profit-making was strictly true; and he was of opinion that the figures would bear out the statement he had made. The Council had come to an agreement with Ossett on this matter; and it was for the future members of the Council to see that all the details which it had taken the Horbury Council so long to settle were carried out in their entirety. If this were done, he was quite sure that in ten or twenty years' time the ratepayers of Horbury would say the Council did well in securing such an agreement. The Chairman, in acknowledging the vote, said some of the meetings on the gas question were stormy, and others breezy; but he was pleased to say that out of it all they had got an agreement of which he felt proud, and he hoped they all did. He was confident that the more the ratepayers came to understand it, the better they would like it; not because they had gained any real advantage over their neighbours at Ossett, because they had obtained nothing but what was fair, right, and just. He hoped the agreement would last, not twenty years, but to the end of the full term of forty-five years. Most of those present would no doubt then be dead; but their children and children's children would have cause to rejoice over the agreement. They owed a lot to Mr. Barker, their Clerk, for it. To his credit it should be said that he drew the first rough draft of the agreement, which would practically be a model for all future time for the settlement of questions of this kind. The fact was it had already been adopted as a precedent; and therefore their Clerk could take to himself a little flattery for having picked up the fragments of their discussions, and put them into shape.

Sales of Shares.—Last Wednesday, Mr. Frank Amos offered for sale, in pursuance of instructions received from the Directors, £1000 of "A" stock of the Canterbury Gas and Water Company. It was put up in £10 lots, which were quickly disposed of at from £22 10s. to £22 15s. per lot—the average being £22 12s. 6d. On the same day, Mr. C. Stidolph sold £1500 of new £10 shares (7 per cent.) in the Faversham Water Company, at rather more than £17 apiece. On Thursday, Messrs. Tootell and Sons disposed of two lots of £50 of consolidated stock of the Maidstone Gas Company, carrying a dividend of 11 per cent., at £117 each. A lot of £25 of similar stock realized £58.

Additional Water Storage for Heywood and Middleton.—The Heywood and Middleton Water Board have instructed their Engineer (Mr. J. Diggle) to prepare plans and estimates for a proposed new reservoir to be constructed on Ashworth Moor. This is part of what has been known as the Ashworth Moor additional water scheme, originally sanctioned by Parliament in 1877. Since that time, two Acts have been obtained—one in 1889, the other in 1898—for the purpose of extending the period allowed for the execution of the work. Under the Act of 1898, the scheme must be carried out before 1906; and it is feared that Parliament will not grant any further extension. An unusually prolonged spell of fine weather last summer caused the millowners on the Naden Brook to be temporarily deprived of their water rights; and on account of this the Board have had to pay £200 for compensation.

The "Builder" on the London Gas Question.—Referring to the recent parliamentary proceedings on the Bill of the London County Council to legalize the portable photometer, the "Builder" last Friday said: "The general drift of the evidence has been to the effect that the Gas Companies supply 16-candle gas to the testing-stations, but not to every consumer in every part of their districts, and that it is their duty to supply every consumer (save when connected to a dead-end main) with 16-candle gas without regard to cost; while the Gas Companies assert that such a requisition would necessitate the supply from the works of 18¼-candle gas, and that even then there would be constant risk of default. In view of the admitted deterioration of gas under certain conditions of supply, the question for the consumer appears to resolve itself into this: Is it better to pay for 16-candle gas and obtain 14-candle, or to pay for 18½-candle gas and get 16-candle? We consider the former to be the lesser of the two evils."

THE COAL FAMINE AND THE PUBLIC.

"The Times" last Thursday contained a long article on the above subject from a correspondent. In view of the great interest which just now attaches to the general question of the coal supply, we reproduce the communication practically in its entirety.

Having, at one time or another, visited and examined the principal coalfields of the United States, Germany, France, Belgium, Bohemia, and Hungary, as well as those of the United Kingdom, and having given to the economic conditions of the coal industry a large amount of my attention for more than a quarter-of-a-century, I have naturally been struck by the very exceptional character of the recent and existing situation in the coal industry. The most prominent feature of that situation is the world-wide demand for increased supplies, and the consequent efforts that are being made, in all coal-producing countries alike, to bring the supplies abreast of the extraordinary demand. No country on the face of the earth is now in possession of as cheap supplies of fuel as formerly. In the great majority of cases, the last twelve months have witnessed advances of price ranging from 10 to 100 per cent.; but, whether it be China, Japan, Australasia, Continental Europe, North America, or Great Britain, higher values for fuel have everywhere prevailed.

The proximate causes of the recent scarcity and present high cost of fuel all over the world are, in my opinion, the following:—

1.—The increase in the make of iron and steel, which has increased the consumption of fuel within the three years ended with 1899 by probably quite 40 millions of tons.
2.—The increased requirements of the world's railways, which, within the same period, have had to face an enormous increase of business, involving a corresponding increase of coal consumption.
3.—The growth of the world's mercantile marine, responding to the increase of commercial operations, which probably represents an increase of 15 to 20 per cent. on any former period; and a similarly larger demand for coal.
4.—The almost unequalled prosperity of all manufacturing industries, and the demands thereby entailed on coal-producing nations.
5.—The more general diffusion of wealth, and the greater prosperity of whole communities, which have led to a larger consumption of coal for domestic and other purposes.

A very perfunctory examination of this analysis of causes is sufficient to show that they are of world-wide application, although, no doubt, in some countries they will be much more generally active than in others. One of the oldest writers on the principles of political economy has written that all the world, as to trade, is like a single nation. If this remark applies with special emphasis to any particular trade, it must be the trade in coal, for British coal is now supplied, to the extent of over 50 million tons a year, to almost every country in the world; and any rise of cost at the pit or increase in the rates of freight is at once felt by the remotest markets. If it be true that misery likes company, then the coal consumers at home may derive satisfaction from the knowledge that the burden of dearer fuel has equally to be borne, with perhaps less apparent chance of relief, by all other consumers, even in the remotest corners of the earth.

But the threatened coal famine has another unique feature, in following as it does a period of the greatest expansion of mineral, and especially of coal, resources that has ever been known. The extent of this expansion may be estimated from the following comparison:—

Quantities of Coal Raised in the Principal Coal-Producing Countries in 1869 *and in* 1899.

Country.	1869.		1899.*
United Kingdom	102,948,000	..	220,000,000
United States	28,258,000	..	205,000,000
Germany†	25,704,000	..	130,000,000
France†	13,330,000	..	35,000,000
Belgium	12,298,000	..	24,000,000
Austria†	3,600,000	..	15,000,000
Russia	510,000	..	13,000,000
Colonies and India	750,000	..	15,000,000
Japan and other countries	500,000	..	6,000,000
Totals	187,898,000	..	663,000,000

* The figures for 1899 are mostly estimated, but within very narrow margins of error, taking the world's output as a whole.
† The figures recorded for these countries include considerable quantities of lignite and brown coal.

Within the same period, the consumption of petroleum and natural gas for calorific uses has made corresponding progress, equal, approximately, to an addition of at least another 50 or 60 million tons to the annual fuel resources of the world. From this table it appears that during the 30 years ended 1899 the fuel (coal) output of the world increased by 475 millions of tons, or 252 per cent. The curious thing is that, despite the enormous advance, the demand for coal in 1899 was greater, and the apparent danger of a coal famine more real, than at any former period, excepting in the years 1873-74. Let us further see to what this enormous increase in the world's consumption of coal is mainly due.

In the first place, as already stated, there can be little doubt that it is attributable to the increased demands of the world's industrial operations, and more especially of the iron industry. Since 1869, the world's output of pig iron has risen from about 10 million tons to over 40 millions. This alone would mean an increased consumption of coal, as coal, to the extent of between 45 and 50 million tons. But in working up this pig iron into manufactures—rails, plates, structural iron and steel, wire, cutlery, tools, and implements and machinery—probably a further 100 million tons of fuel would be consumed; so that over 30 per cent. of the total increase is directly attributable to the iron trade and collateral industries.

In the next place, as we have seen, transportation in its various forms is responsible for a great part of the increase. The shipping trade of Great Britain alone absorbs nearly 20 million tons of fuel annually. That of the world at large will probably consume three times this quantity; and, after due allowance has been made for the improvements which have enabled steamers to be worked with quite one-half of their former consumption of coal, the vast increase in the relative proportion

of steam tonnage, and in the work done by that tonnage, will in all probability have called for nearly twice the quantity of fuel consumed by the mercantile marine of thirty years ago. In other words, if the world's coal consumption under this head is now 60 million tons a year, this is likely to be 30 million tons more than the quantity consumed in 1869. We know definitely that, in the case of the United Kingdom, the increased consumption in the interval has exceeded 100 per cent.

The coal consumption on railways is a very large and increasing item. On the 25,000 miles of line constructed in Great Britain, the annual coal consumption is now computed at about 10 million tons. There are at present more than 465,000 miles of railways in operation throughout the world; and, if they are assumed to average the ascertained British consumption of fuel, the total consumption of coal in railway operations would be something like 180 million tons a year. From this figure, however, very large deductions have to be made in respect of lines with little traffic and lines that burn other sorts of fuel, such as wood and petroleum; so that, on the whole, the railway consumption of coal fuel will probably be quite 50 million tons under the figure obtained by adopting British practice as a basis. Even so, however, the total coal consumed on the world's railways would come out at 130 million tons, and of this quantity probably one-half has been added during the period under review.

We have now accounted for 245 million tons, or upwards of 50 per cent., of the total increase in the world's consumption of coal during the last thirty years. As with the iron industry, so with general manufactures. As with steam shipping and railways, so with domestic requirements, the gas industry, naval needs, and the many other elements that make up the sum-total of the uses of fuel. During these thirty years, the world's population has increased enormously—probably to the extent of quite 200 millions; and this alone would represent a vast coal consumption, if the general home consumption of coal-using countries be taken at even one-fourth the British standard, which is 3·8 tons per head per annum.

When one examines the main causes of the increase of coal consumption in the past, it is at once apparent that the phenomena producing the results in question are of a more or less permanent character. Hence the increase in the consumption of coal is likely to continue in the future, although whether in a diminishing or in an accelerated ratio no one can with confidence predict. Railways will continue to be built, commerce will continue to extend, iron and steel—the handmaidens of material civilization—will be produced in larger quantities, population will continue to grow all over the world, and the demand for more coal will follow.

We may now proceed, with advantage, to discuss the special circumstances of the coal trade situation, so far as the United Kingdom is concerned. That situation has a number of distinguishing and characteristic features. Perhaps the most prominent of these is the enormous extent of our export trade, which is more than three times as great as that of Germany, the next most important coal-exporting nation, and fifteen times as much as that of the United States, which is the next largest coal-producing nation after our own. Another distinguishing feature of the British coal industry is that our supplies are in many directions threatened with relatively near exhaustion. In Lanarkshire—the most important of the coalfields of Scotland, and the one, of all others, on which the great manufacturing industry of Glasgow mainly depends—in South Staffordshire, in the Forest of Dean, in some parts of Durham and Northumberland, and elsewhere, the available supplies of coal are being so rapidly depleted that more or less serious exhaustion will have to be faced within the next twenty, and in some cases, as in that of the cheap coal of Lanarkshire, within the next ten years.

What is the very lowest figure at which coal can be worked and sold in the United Kingdom? The Home Office records show that within the last twelve years the average estimated value of the total British coal output was only 5s. per ton; while the average official value of the coal output of Scotland was only 3s. 11d. per ton. This latter figure compares not unfavourably with the low selling prices recorded for the United States, and is decidedly under the average prices hitherto recorded for any country in Continental Europe. But it is not by any means certain that the coal extracted from the mines of Great Britain was produced for these prices, even if they were the average selling quotations. It has happened again and again that large quantities of coal have been produced in British coalfields over long periods with no profit at all, and even at a loss. This process, of course, could not go on for an indefinite period—indeed, the exceptionally low figures of 1888 were improved to the extent of about 1s. 3d. per ton in the following year; so that probably, on an average of the two years, the results were not entirely unsatisfactory. But about this time we began to hear a good deal of the theory of the "living wage;" and this movement brought about an advance in the cost of labour which has continued ever since, and is likely to be more or less permanent. Throughout the federated districts of Yorkshire, Lancashire, Derbyshire, &c., the wages paid have since 1889 been from 30 to 45 per cent. higher than those paid in 1888; and until, and unless, we resumed the rates of wages paid in that year, the production of coal at equally low rates would be practically impossible. Indeed, no one appears to anticipate that the general range of coal prices in the United Kingdom will ever again be so low as it has been. Cheap coal is not a function of low wages alone. It depends also on other conditions, such as comparatively virgin mines, shallow depths, thick and easily-worked seams, and other features that are becoming less and less prominent, and in some parts of Great Britain are entirely disappearing.

The average increase of value in the coal trade of Great Britain over the year 1899 is difficult to compute. In some descriptions of coal it has been much more considerable than in others. It has perhaps been greatest of all, strangely enough, in what are ordinarily regarded as the most worthless varieties—viz., smudge or "duff"—which in some previous years have been sold at 1s. per ton, or even less, but which within the last few months have sold in large quantities for 5s. to 6s. 6d. per ton, according to the locality and the purposes to which it was to be applied. A very good test of the difference of value is that supplied by the coal export returns. If we go back to the four years ended 1898, we find that the average declared value of our coal exports in that period was only 8s. 5d. per ton. In the four years ended 1898 the average was about 9s. 3d. per ton. But for the last six months the average declared value was not less than 13s. 6d. per ton, which is an advance of 4s. 3d. on the average of the corresponding exports for the four years ended in 1898. I believe that, so far as our coal export trade is concerned, this is about an adequate and accurate measure of the true difference between then and now. But that difference has not up to the present time prevailed for a longer period than about six months; and if we go back to this time last year, before the very decided rise of prices began, we find that the coal exports are returned by the Board of Trade at an average value of less than 11s. per ton.

But the export coal values, after all, apply to only some 60 million tons at the most, including coke and the coal shipped for steamers in the foreign trade. If the two last-named items are deducted, the export values apply to less than 50 million tons, out of a total computed output of about 220 millions. There would therefore remain 170 million tons to be dealt with, as representing home consumption, or, rather, home consumption *plus* foreign shipping. This remainder is divisible into coking, manufacturing, household, gas, and steam fuel. In regard to all descriptions alike there has been a material rise of values, though not to the same extent. Coking coal has perhaps felt the impulse of heavy demands more than any other description, primarily because of the revival of our iron and kindred industries, but also because there has been unusual pressure on the part of foreign buyers, especially France and Germany. The usual price of coke at the ovens in Durham over a series of years has been about 9s. per ton. For a considerable part of last year, and up to the present time, the value of good coke at the ovens has been 22s. to 25s. per ton. So far as household coal is concerned, the average value in the London market for the four years ended 1897 was 15s. 2d. per ton, while the corresponding average since Midsummer of 1899 has been about 22s. per ton. At the greatest centre of the steam coal trade—at Cardiff—the average official price of that variety of fuel for the two years ended 1897 was 9s. 7½d. per ton f.o.b., whereas for some months past the best qualities of that fuel have been quoted at 20s. to 23s. per ton, and some sales have been recorded as high as 26s. Manufacturing coal, as the owners of iron, steel, shipbuilding, engineering, and other works know to their cost, has gone up fully 4s. to 6s. per ton, according to locality and description; while gas coal, of which the supply is far from unlimited, has followed a similar movement. On the whole, therefore, we are not likely to be far wrong in estimating that for the eight months ended the 1st of March this year there has been an advance of 5s. to 6s. per ton all round in the realized value of coal where supplies were free for sale, as, in view of the previous upward movement, they would generally be; so that coalowners should have had a difference of fully 5s. per ton to dispose of over and above the profits realized previously.

The "man in the street" is likely to find some difficulty in adequately realizing the fact that this difference of 5s. per ton would mean, on the estimated coal output of 1899, a total sum of 55 millions sterling, assuming that it had prevailed over the whole of that year. As, however, it only prevailed over a part, and as the material rise of prices did not take effect till after Midsummer, it is probable that the total increase of values for 1899 would not mean more than 4s. per ton, or 44 millions in all. A sufficient indication of the relative magnitude of this amount is furnished in the fact that even the smaller computation of increase is a larger sum by 5 millions than the total official value of our coal output so recently as 1887. For the last ten years, the recorded average value of our total coal output at the pit's mouth has fluctuated between 5s. 6d. and 7s. per ton. If the average for 1899 be taken at 10s. per ton, which is a highly conservative figure, the total value of the British coal output of 1899 will be about 110 millions sterling, or about 180 per cent. more than the recorded total value of 1887.

These vast figures suggest some notable and interesting problems. One of the more obvious is the equitable distribution of the great increase of profits—or, to put it more exactly, of selling price—realized in 1899, and to be realized in the current year. In the first place, it will not be overlooked that such a "boom" in the coal trade is almost a unique experience, and that no similarly prosperous period has been known since 1873-4, although no doubt in 1880 and again in 1889 coalowners enjoyed a comparatively good time. Speaking generally, the coal trade is subject, more than most other industries, to prolonged periods of apparently irremovable depression, and such a period lasted with hardly any amelioration from 1891 to 1898. During that time, coalowners for the most part were in the depths of despair. Another similar period of pronounced depression extended from 1884 to 1888. During this latter term, the average price of coal at the pit's mouth in Scotland was about 4s. per ton, against 10s. to 11s. per ton at the present time. It is manifest, then, that, if coalowners could not look forward to occasional periods of "spurt" and "boom," most of them would throw up the game, as many of them threatened to do not so long ago. A single year of good prices in the coal trade has more than once had to compensate for many weary and anxious years of bad prices and difficult profits.

Whatever, then, may be the share of the increased price that is falling to the coalowners, it must not be overlooked that it has to recoup them for many years of previous bad trade. But when the increased burdens laid on the coal trade, as the results of recent legislation and the higher cost of working all round, are taken into account, I do not believe that the increase of profits is so great as is commonly supposed. In this view, I am confirmed by the lately-published reports of coal companies.

So far as the miners are concerned, it would appear that they have had a reasonable, if not a sufficient, share of the increased value realized for coal over the last fifteen months. Most of them have had their wages advanced by successive increments until they now stand at 15 to 30 per cent. above the level of a year ago. The average increased wages of the miners has been put by Mr. Pickard, M.P., at about 8d. per ton; but it is well known that, in addition to general or district advances, there have been local or colliery advances, often extended to considerable localities, which would, if combined and averaged, bring up the total general increase of earnings to quite 1s. per ton. This, spread over the total coal output of the United Kingdom in 1899, would mean a gross increase on the year 1898 of about 11 millions sterling in the item of wages alone; or, if the average output per employee is taken at 300 tons a year, it would mean an individual increase for the year of £15.

It was inevitable that the prospect of large profits should tempt coalowners and capitalists to adopt energetic measures to bring about an increase of coal production. From the various projects of this character that have come to my knowledge—including not only the opening out of

new collieries, but the re-opening of old ones and the sinkings made to other seams in existing pits—I am of opinion that within the last fifteen months provision has been made for adding quite 20 million tons a year to the coal output of the United Kingdom; and if the same average annual output per employee as that of the period 1894-7 is assumed, the increased resources of production will probably be considerably more. The throwing of this large additional volume of coal on the market is likely to convert the present relative scarcity into an absolute glut. The question is—When? On this point one cannot profess to be any wiser than the "man in the street." No one knows what the coalminers may do; and they are virtually the masters of the situation. If they work steadily, and take only an average number of holidays, we may look for greater abundance as a proximate event. If they adopt organized restriction, as they did in 1873-4, and have several times done since, they may succeed in keeping up prices for a considerable time to come. In these matters the attitude of labour—which is generally the "dark horse"—counts for much. But, in any event, no relief worth speaking of is to be expected from foreign countries. We have already seen that their position is quite as strained and as parlous as our own.

It was recently suggested in Parliament that another Royal Commission should be appointed to inquire into the extent and duration of our coal supplies. Thirty years have now passed since the Argyll Commission reported on this subject. In the interval, nearly 5000 million tons of our then existing coal supplies have been used up. In many other respects the conditions have changed. Some of our most important fields are rapidly nearing a period of permanently dearer cost of working, which will seriously prejudice the general economic outlook of manufactures and commerce. Our keenest and most successful industrial rivals have greatly cheapened their coal supplies—notably Germany and the United States. There is an uneasy feeling on the whole subject throughout the country. Parliament appointed a Select Committee to inquire into the coal famine of 1873; and the indifference shown by the Government to the coal crisis of the present time is difficult to understand.

ELECTRIC LIGHTING NOTES.

An electric wire conduit running under the footpath of the Old Market Place, Oldham, became charged with gas through a leakage from the neighbouring gas-pipes. During the testing of an arc lamp by workmen of the Corporation Electric Lighting Department last Friday, the gas was ignited (presumably by a spark), and an explosion occurred. The whole of the footpath for a distance of about 50 yards was displaced, and huge pieces of stone and iron were thrown into the air higher than the tops of the surrounding buildings. Happily, nobody was hurt.

Some progress is being made in connection with the endeavours put forth during the past two or three years by the Bermondsey Vestry for the purpose of establishing an electric lighting station and refuse destructor. The assent of Parliament having been obtained to the electric lighting scheme last year, it became necessary to provide land for the erection of the buildings; and a site was recently acquired at the rear of the Town Hall in Spa Road. The area of land allocated to the purpose of the generating station and destructor comprises 2987 square yards, and there is room available for future extensions as occasion may arise. The electric lighting scheme, which has been prepared by Messrs. Kincaid, Waller, and Manville, provides for an expenditure of £17,000 on the destructor-house, engine-house, and chimney-shaft; £11,000 for a six-cell destructor and flues, and three water-tube boilers in conjunction therewith; £8000 for machinery, including 300-kilowatt generators, accumulators, &c.; £7000 for cables and house-service connections; £600 for twenty public arc lamps; and £4300 for contingencies. It is estimated that this plant will be capable of dealing with a lamp connection of 10,500 8-candle lamps. The Vestry recently accepted a tender for the supply of the destructor and boilers, for £10,242. The question of constructing the generating station and obtaining the requisite plant has yet to come before the Vestry. As Bermondsey will in November next absorb, under the London Government Act, 1899, the parishes of Rotherhithe, St. John, Horseleydown, and St. Olave's, under the title of the borough of Bermondsey, and thereby receive an accession of 52,000 persons to the population, it is probable that the new Borough Council will find it necessary to extend considerably the scope of the electric lighting scheme.

The St. Pancras Vestry's electric lighting accounts, showing, as mentioned in the "JOURNAL" last week, a net profit for 1899 of £8734, appear very satisfactory to the superficial reader; but a little investigation rather takes the gloss off them. The total amount now borrowed on the security of the rates is no less than £236,780, and the stated profit works out at about £3 13s. 9d. per cent. per annum. Taking the temporary loans, amounting to £17,876 14s. 6d., into consideration, the percentage is only £3. Of the total indebtedness of £236,780, repayments have been made to date of £17,246 14s. 7d.—£3374 6s. 4d. during the year under review. As advocated by the "JOURNAL" during the early stages of the Vestry's undertaking, a reserve fund has at last been formed, and consists of £8000—£4000 being transferred from the year's profit. Another £1000 has been written off for depreciation of accumulators, and £600 for depreciation of meters, switches, &c.—a wise course decided on at the last meeting of the Vestry, when a contribution of £2000 to the lighting rate was made; leaving an unexpended balance of £1134 9s. 6d. to be carried forward. It cannot be contended that the current is used anything like so extensively as the Vestry's preparations would warrant, for there are only 1184 consumers to purchase the products of mains which alone have cost altogether £125,744 to lay. Repairs, "re-arrangements" and "alterations" to the mains, &c., cost £4071 9s. 10d. last year; the generation of the current (coal, wages at stations, &c.), £16,566 16s. 5d.; and "compensation claims" (ominously headed "special charges"), £93 18s.—the whole expenditure being £27,230 11s. 8d. The total receipts from consumers were £37,692 9s. 9d.; from the public lighting fund, £6639 17s. 8d.; and a few other sundry receipts make the total income for the year £44,880 7s. Interest on the mortgage debt, however, reduced the gross profit by £6454 10s. 8d., and further interest and instalments off loans by another £4353 5s. 2d.; making the net profit for the year £6841 19s. 11d. Adding the sum brought from last year, the net balance is £8734 9s. 6d. The actual net profit of £6841 19s. 11d. for the year is less than 2½ per cent. on the capital expenditure.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

In the Glasgow Town Council, on Thursday, a paragraph in the minutes of the Gas Committee stated that on the 12th inst. the Engineer (Mr. W. Foulis) submitted the general plan and drawings of the first section of the new Provan gas-works, which includes offices, retort-house, coal-store, purifier, boiler and meter houses, two gasholders capable of containing 8½ million cubic feet of gas each, and the necessary excavation work. The Committee, having considered the plans and drawings, approved of the same, and authorized the necessary specifications to be prepared, and thereafter tenders for the execution of the several works to be advertised for. Mr. P. G. Stewart—a member of socialistic tendencies—took exception to this; pointing out that it was an illustration of how the Council would pass matters involving the expenditure of half-a-million of money, while they would take hours discussing the spending of two or three hundred pounds. He thought they should be told how much was to be spent upon the works, and that they should have more time to discuss the subject. He moved to that effect. Mr. R. M. Mitchell, the Convener of the Gas Committee, said he could not accept the suggestion. The plans had been agreed to at a full meeting of the Committee. Bailie Fife said he thought it was due to the Convener of the Gas Committee that it should be stated that the cost of the new gas-works had been entered in the minutes within the past twelve months; and also that for many years the Finance Committee had brought before the Council that at the Dalmarnock works, where they carbonized so much coal, the loss from imperfect machinery was from £9000 to £12,000 a year. There was, therefore, necessity laid upon them to proceed with these works. The plans might, however, be shown round the room. Mr. Paton thought that there could be no objection to the plans being exhibited; but meantime the work must be gone on with, because there was great prospective loss. The Committee did not ask power to accept tenders, but simply to advertise for them; and Mr. Stewart would have plenty of opportunity to criticize the offers in all their details, when they came up. Mr. Stewart then withdrew his motion; and the minutes were adopted. I am afraid that Mr. Stewart's conscience became tender at the wrong time. He must have been well aware of the very large expenditure intended to be made upon the Provan gas-works; and if he thought it desirable that criticism should be offered upon the proposed outlay, he should have spoken when power was being taken to prepare plans. I suppose that in the Glasgow Corporation, as in others, matters of small moment are often discussed at inordinate length; while subjects involving large responsibilities are passed through without much consideration. To this extent, Mr. Stewart may be sympathized with. But, in the present instance, what could have been gained by discussion? Nothing. It would be absurd to imagine, or to suggest, that any of the councillors could have improved upon Mr. Foulis's plans. Any time devoted to discussion, therefore, would have been thrown away. Mr. Mitchell told the Council that the works would be described when the ceremony of cutting the first sod was performed. If that be so, it should be enough. Life in Glasgow is too short for making two speeches where one is sufficient.

At the same meeting, a letter from the Secretary of the Gas-Workers' Union, complaining of the alleged unjust dismissal of several men from the gas-works, was read. On the suggestion of Lord Provost Chisholm, the communication was remitted to the Gas Committee. The letter, it may be presumed, is one of the methods of making the Council Chamber ring with the demands of the Gas Workers' Union for recognition, which, it was said, would take place until recognition has been granted. The sending of this letter to a Committee is, of course, a species of recognition. What right have the Union to complain on behalf of men who may be dismissed? Let the men themselves petition for reinstatement. It will be advisable, in framing their report to the Town Council, and the reply by the Town Clerk to the Union, to make it plain that the Corporation do not admit the right of the Union to call in question their employment or dismissal of workmen.

The Forfar Gas Corporation, at a meeting on Wednesday, had before them a letter from the Law Agent for Messrs. Macpherson and Irvine, of Kirriemuir, the Contractors for the construction of the tank for the new gasholder, in which it was stated that the Contractors did not wish to lead further proof in the reference, and were desirous of having the matter settled. The sum due to the Contractors under the strict interpretation of the contract adopted by the Referee was £746; but it fell short by £200 or £300 of what they had expended in its fulfilment. While the Referee disallowed the claim to that extent, he submitted that the Commissioners would only be dealing fairly by the Contractors in allowing them a reasonable sum for this extra expenditure. Through the shifting of the site, the Contractors had suffered heavily; but the Commissioners had benefited greatly in the more convenient arrangement of access, &c., and in having the larger portion of the north wall entirely renewed. His clients wished to place themselves in the Commissioners hands, and trusted their request might meet with favourable consideration. Provost M'Dougall said the Committee thought it would be well to have all the information before them as to the expense of the arbitration before coming to a decision; and this being assented to, consideration of the subject was postponed.

At Peebles a proposal has been made, as a sort of reply to a request by the men employed at the gas-works for an increase of wages, that they be paid at the rate of 3¾d. per 1000 cubic feet of gas made. In this way, it not being known what the output might be, the men would be paid 27s. a week, and the balance—a sort of bonus—at the end of the year. The Manager (Mr. A. Bell, jun.) said that the wages would be 28s. 3d. per week to constant men, and 29s. per week to winter men. The scheme did not find favour all round; and consideration of it was delayed. The idea is to get the men to take as much gas out of the coal as possible. I am not enamoured of it, because it implies the existence of a belief that workmen do not do the best they can; and, further, I think experience in all ages has demonstrated that a suspected man does not do so well as one in whom confidence is placed.

The Stirling Gas Company have experienced the extraordinary increase in the output of gas during the past three years of almost 20 million cubic feet. Such an augmentation could have only one result—enlargement of the plant. The gas-works are new; and their extension is an easy matter; provision having been made for this when

required. But the storage capacity is different. There are three gasholders, of a total capacity of 320,000 cubic feet. The maximum daily output is over 420,000 cubic feet. The Company have, accordingly, let contracts for the erection of a new holder, at a cost of nearly £10,000. Two lifts are to be erected, giving an addition to the storage capacity of 300,000 cubic feet; and provision is to be made for the addition of a third lift, when necessary, which will give a further capacity of 120,000 cubic feet. The tank is to be above ground. Both the holder and the tank are to be constructed of mild steel. They are to rest upon a bed of concrete 3 feet in thickness. The tank is to be 102 feet in diameter, and 20 ft. 6 in. deep. The outer lift is to be 98 feet, and the inner one 96 feet, in diameter. The lifts are to be 20 feet in depth. The guide-framing will consist of twelve lattice standards, 62 feet in height, braced together by two rows of lattice girders and diagonal tie-rods. The Contractors for the holder and tank are Messrs. Hanna, Donald, and Wilson, of Paisley; and the Engineer is Mr. J. D. Smith, the Engineer and Manager to the Company. The erection of the new gasholder involves the removal of Mr. Smith's dwelling-house.

The Arbroath Gas Corporation have an admirably easy way of conducting their business. At a meeting this week, Mr. Aitken drew attention to the long periods that were sometimes allowed to elapse between the meetings of the Corporation. Between that meeting and the previous one, a period of five months had passed. The Clerk suggested that a meeting of the Committee of Management might be held every month. Ex-Bailie Sandeman said that the work of the Corporation was comparatively small; and he did not see that there was any reason for holding so many meetings as was suggested. After discussion, it was agreed to hold a meeting of the Committee of Management every two months. Mr. Aitken appears to be grieved at having so few opportunities of hearing himself speak. He wanted to know why the illuminating power of the gas had been reduced from 25 to 23 candles; and it was explained to him by ex-Provost Keith that on dull days the pressure was reduced and the illumination might not be so bright, but that everything was done to maintain the ordinary standard of illuminating power. This reply would be hard to beat for *naïveté* I commend it as a model for distressed consumers.

A Sub-Committee of the Dundee Town Council yesterday considered reports by the Gas Manager and the Electrical Engineer upon street lighting. These stated that the annual cost of lighting streets where there are tramway-lines would be £348 by gas and £1138 by electricity; while, in the latter case, there would be an initial outlay of £1730. The Committee resolved to restrict the electric lighting to 22 new lamps.

The Denny Police Commissioners have let a contract to the Barrowfield Iron-Works, Limited, of Glasgow, for the construction of a new gasholder of 60,000 cubic feet capacity, at a cost of £3500. The Convener (Mr. Shanks) said it was a thing which must be proceeded with at once, notwithstanding the advanced prices. He did not see how they could face another winter without more storage accommodation. At present their storage was equal to only about one-third of the maximum day's consumption. Mr. J. M'Gilchrist is the adviser of the Corporation.

The Dumfries Gas Commissioners have found, in contracting for coal, that the price is about 4s. per ton more than under current rates. The price of oil has advanced even more, proportionately. The Commissioners have purchased 1500 tons of Elmbank cannel; and the suggestion has been made that cannel should be used for enrichment, and that oil should be dispensed with. Bailie Currie feared they would be obliged to put something like 6d. per 1000 cubic feet upon the price of the gas.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April* 21.

Sulphate of Ammonia.—Business has been somewhat interfered with by holidays; and prices are very irregular—the closing quotations being £11 7s. 6d. to £11 12s. 6d. per ton, delivered f.o.b. at the ports. A fair amount of buying has been done. But this has only been induced by concessions in prices; and buyers are looking for still lower levels. Supplies have not been excessive, though fairly abundant; but everything is being offered as it becomes available. There is almost no interest in the forward position. Makers seem hopeful for a recovery in values; while buyers take a different view.

Nitrate of Soda is weak on spot, at 8s. 6d. per cwt. for ordinary, and 8s. 7½d. for fine, quality.

LONDON, *April* 21.

Tar Products.—Warmer weather and difficulties with labour have seriously interfered with and delayed shipments of, pitch. The shipping season, however, is rapidly closing; and it is expected that the quantities will be disappointing as compared with the previous year. There is no change for the better in benzol, which is still extremely sick. Carbolic acid is firm; but solvent and other naphthas are weak and unsaleable. The falling off in this respect is most noticeable in burning naphtha. Creosote is a little steadier after a determined effort to depress it. There is no change in the value of the other numerous tar products.

Values obtaining during the week are: Tar, 17s. 6d. to 27s. 6d. Pitch, east coast, 37s. 6d.; west coast, 34s. Benzol, 90's, 5½d.; special qualities for gas, 7½d.; 50's, 8¼d. Toluol, 90's, 1s. Solvent naphtha, 1s. Crude naphtha, 3½d. Heavy naphtha, 9d. Creosote, 2¾d. Heavy oils, 3½d. Carbolic acid, 50's, 2s. 2d.; 60's, 2s. 7d. Naphthalene, 50s. to 70s. Anthracene, "A," 4d.; "B," 3d.

Sulphate of Ammonia.—The position of sulphate is far from satisfactory. A most unaccountable fall in prices is going on in the face of manufacturers having no stocks and very important shipments; and there cannot be a doubt that operations for depressing this market are proceeding. It is hoped that makers will not lend themselves to them by being too eager to sell. The demand is undoubtedly good; and while it is true that buyers are clamouring for cheaper sulphate, they can well afford to pay the price that has recently obtained for some time. Very little business is reported; but dealers' quotations show an average at all ports of £11 10s., less 3½ per cent.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1047.

Issue.	Share	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 11	10½	Alliance & Dublin 10 p. c.	20—21*	..	5 0 0
100,000	10	,,	7½	Do. 7 p. c.	13½—14½*	..	5 3 5
300,000	100	Jan. 2	5	Australian 5 p. c. Deb.	100—102	..	4 18 0
200,000	5	Nov. 15	6	Bombay, Ltd.	6½—6¾	..	4 8 11
40,000	5	,,	6	Do. New, £4 paid	4¼—4¾	..	5 1 1
380,000	Stk.	Feb. 23	12	Brentford Consolidated	250—260	−5	4 12 4
270,000	,,	,,	9	Do. New	195—200	−2	4 10 0
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb.	118—123	..	3 5 1
220,000	Stk.	Mar. 14	11½	Brighton & Hove Orig.	237—242	..	4 15 0
226,820	,,	,,	8½	Do. A. Ord. Stk.	180—185	..	4 11 11
999,500	Stk.	Feb. 23	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Mar. 29	10	British	41½—42½	..	4 18 0
50,000	10	Feb. 23	12	Bromley, Ord. 10 p. c.	24—26	..	4 12 4
79,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd.	9½—10½	..	5 17 1
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	99—101	..	3 19 3
150,000	20	Mar. 14	8½	Cagliari, Ltd.	25—27	..	6 2 3
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	14½—15½	−½	5 3 3
50,000	50	Nov. 2	6	Do. 6 p. c. 1st Mort.	56—58	..	5 3 5
550,000	Stk.	Apl. 11	13½	Commercial Old Stock	295—300*	..	4 10 0
236,925	,,	,,	10½	Do. New do.	230—235*	..	4 9 4
238,237	,,	Dec. 14	4½	Do. 4½ p. c. Deb.	142—145	..	3 2 1
800,000	Stk.	Dec. 14	9	Continental Union, Ltd.	160—170	..	5 5 11
200,000	,,	,,	7	Do. 7 p. c. Pref.	175—180	..	3 17 9
51,000	Stk	Feb. 23	14	Croydon A 10 p. c.	335—340	..	4 2 4
173,400	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
555,000	Stk.	Feb. 23	5½	Crystal Palace Ord. 5 p. c.	118—123	−2	4 5 4
60,000	,,	,,	5	Do. 5 p. c. Pref.	130—135	..	3 14 1
486,000	10	Jan. 26	11	European, Ltd.	19½—20½	..	5 7 4
854,060	10	,,	11	Do. £7 10s. paid	15—16	..	5 3 2
14,993,075	Stk.	Feb. 9	4%	Gas-light and Coke	101—103	−1	4 15 1
2,600,000	,,	,,	8½	4 p. c. Ord.	97—99	..	3 10 8
3,799,785	,,	,,	4	8½ p. c. max.	119—122	..	3 5 7
3,993,975	,,	Dec. 14	3	4 p. c. Con. Pref.	98—100	..	3 0 0
70,000	10	Nov. 15	8	3 p. c. Con. Deb.	98—100	..	3 0 0
3,800,000	Stk.	Nov. 15	10	Hongkong & China, Ltd.	13½—14½	..	5 10 4
478,600	Stk.	Feb. 9	8½	Imperial Continental	211—214	..	4 13 6
75,000	5	Dec. 14	6	Do. 8½ p. c. Deb. Red.	100—103	..	3 8 0
560,000	100	Apl. 2	5	Malta & Medn., Ltd.	4½—5½	..	5 9 1
250,000	100	,,	4½	Met. of 5 p. c. Deb.	105—109	..	4 11 9
641,920	20	Nov. 15	3	Melbourne 4½ p. c. Deb.	105 107	..	4 4 1
667,946	Stk.	Feb. 23	9½	Monte Video, Ltd.	11—12	..	5 0 0
299,855	Stk.	Dec. 29	8½	Newcastle & Gateshd Con.	215—220	..	4 4 1
160,000	5	Nov. 30	8	Do. 8½ p. c. Deb.	104 107	..	3 5 5
135,000	5	,,	8	Oriental, Ltd.	7—7½	..	5 6 8
135,000	5	,,	8	Do. New, £4 10s. pd.	6½—6¾	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.	1½—1¾	..	4 11 5

* Ex div.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
60,000	5	Feb. 23	7	Ottoman, Ltd.	5—5½	+¼	6 7 3
500,000	100	Dec. 1	6	People's Gas of Chicago 2nd Mtg. Bonds	102—106	..	5 13 2
851,070	10	Oct. 13	7	River Plate Ord.	11—11½	−¼	6 1 9
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	100—102	..	3 18 5
250,000	10	Apl. 11	8	San Paulo, Ltd.	11½—12½*	..	6 8 0
135,000	Stk.	Sept. 15	10	Sheffield A.	249—251	..	3 19 8
209,053	,,	,,	10	Do. B.	249—251	..	3 19 8
447,427	,,	,,	10	Do. C.	249—251	..	3 19 8
5,600,000	Stk.	Feb. 23	5½	South Metrop., 4 p. c. Ord.	130—134	−3	3 19 7
1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb.	99—101	−1	2 19 5
880,940	Stk.	Nov. 30	5	Southampton Ord.	117—122	..	4 2 0
70,825	,,	Dec. 29	4	Do. 4 p. c. Deb.	120—125	..	3 4 0
120,000	Stk.	Mar. 14	6	Tottenham A. 5 p. c.	139—141	..	4 5 1
250,520	,,	,,	4½	and B. 3½ p. c.	100—102	..	4 8 3
55,100	,,	Dec. 14	4	Edmonton 4 p. c. Deb.	113—117	..	3 8 5
182,380	10	Jan. 12	5	Tuscan, Ltd.	8—9	..	5 11 1
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.	101—104	..	4 16 2
				WATER COMPANIES.			
780,399	Stk.	Dec. 29	11	Chelsea, Ord.	305—310	−2	3 11 0
150,000	,,	,,	5	Do. 5 p. c. Pref.	157—162	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	145—150	..	3 0 0
175,785	,,	Mar. 29	4½	Do. 4½ p. c. Deb.	145—150	..	3 0 0
1,720,560	Stk.	Apl. 11	7	East London, Ord.	195—200*	−1	3 10 0
654,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb.	145—150	..	3 0 0
890,000	,,	,,	3	Do. 3 p. c. Deb.	99—101	..	2 19 5
700,000	50	Dec. 14	7½	Grand 10 p. c. max.	106—108	−1	3 9 5
310,000	Stk.	Mar. 29	4	Junction 4 p. c. Deb.	130 135	..	2 19 3
708,000	Stk.	Feb. 23	14	Kent	307 312	..	4 9 9
160,000	,,	,,	7	Do. New, 7 p. c. max.	200—210	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.	294—299	−1	3 10 3
406,200	100	,,	8	Do. 7½ p. c. max.	213—217	−3	3 13 9
850,000	Stk.	Mar. 29	4	Do. 4 p. c. Deb.	130 133	..	3 0 2
500,000	100	Feb. 23	13½	New River, New Shares	418—423	..	3 3 9
1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb.	133—137	..	2 18 5
902,300	Stk.	Dec. 14	7½	South- wark Ord.	201—205	..	3 13 2
186,500	100	,,	7½	7½ p. c. max.	190—195	..	3 16 11
480,200	Stk.	,,	5	and 5 p. c. Pref.	160—165	..	3 0 7
1,019,585	,,	Apl. 11	4	Vauxhall 4 p. c. A Deb.	139—134*	..	2 19 9
1,155,066	Stk.	Dec. 14	10	West Middlesex	287—293	−1	3 8 6
200,000	,,	,,	4½	Do. 4½ p. c. Deb.	147—152	..	2 19 3
200,000	,,	Mar. 14	8	Do. 3 p. c. Deb.	99—101	..	2 19 5

* Ex div.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—There is no further development as yet to notice in connection with the gas coal trade in this district, beyond what was reported some weeks back. The large users, however, are making preparations for sending out their usual tenders, which, when they come upon the market, will test the strength of the position taken up by coal-owners with regard to next season's prices. As already intimated, a definite understanding has been come to, both by the Lancashire and the Yorkshire gas-coal collieries, acting in combination, to hold out for an advance of 5s. per ton over last year's prices. Some of the largest users of gas coal seem scarcely, however, to have made up their minds as yet that they will have to pay this advance to the full extent; but the certainty that the contracts can only be placed at prices very much above those of last year is already having its effect in the consideration of an advance in the price of gas to cover the probable increased cost. With regard to the general trade, the position continues strong all round. The holiday stoppages of the pits for three or four days last week have necessarily curtailed the supplies offering in the market; and this for the time being gives further strength to prices, which for all classes of fuel are exceedingly firm at the maximum quotations. The requirements in connection with fuel for iron-making, steam, and general manufacturing purposes are as brisk as ever; and there is a continued shortness of supplies of steam and forge coals and engine fuel. A noticeable feature is that the West Lancashire collieries have not followed the further advance of 5d. to 10d. per ton announced in the Manchester district, as they regard this as simply a levelling up of prices to the rates that were previously ruling in West Lancashire. At the pit, prices remain at 14s. 6d. to 15s. 6d. per ton for best Wigan Arley, 13s. to 14s. for Pemberton four-feet and seconds Arley, 12s. to 13s. for common round coal, and from 10s. for the lower qualities to 11s. and 11s. 6d. for the best sorts of slack. Shipping has fallen off a good deal of late; buyers evidently holding back from paying the basis price decided upon by Lancashire collieries. This, however, remains at 16s. per ton for steam coal, delivered at the ports on the Mersey. But not much business is being put through; and there are rumours of a breaking away in some quarters. Coke continues in pressing demand; and it is difficult to place new orders except at some advance on the current list basis, which remains at about 24s. to 25s. for ordinary furnace qualities, and 29s. up to 32s. for foundry cokes, at the ovens.

Northern Coal Trade.—There is now full work at the Northern collieries; and as the demands have increased during the last few days, the shipments of coal are at the present time very heavy. Best Northumbrian steam coals are firm at about 18s. per ton f.o.b.; and steam smalls are very scarce at 11s. 6d. to 12s. In manufacturing coals, the price is steady; and the demand is again full. Gas coals are in brisk demand, both on old contracts and for occasional cargoes. It is known that part of the contracts for the Metropolitan Gas Companies have been placed in Yorkshire, and are to be shipped from thence to the Thames. But other orders are being slowly settled; and the prices for six or twelve months' contracts vary from 15s. 6d. to about 16s. 6d. per ton f.o.b. For occasional cargoes of gas coals, the price is from that last named to 17s. per ton. There is no alteration in the price of smithy coal. In the coke trade, the demand is full, and prices are very firm—about 35s. per ton being quoted for export. There is this week no alteration in the quoted prices for gas coke.

Scotch Coal Trade.—As was expected, with the opening of the Baltic to navigation, the demand for coal is getting stronger. Prices are advancing, and are expected to go higher yet; there being a great demand for shipping. The rates quoted are: Main 14s. to 14s. 3d. per ton f.o.b. Glasgow, ell 14s. 9d. to 16s., and splint 14s. 9d. to 15s. The shipments for the week amounted to 211,089 tons—an increase of 16,633 tons upon the previous week, and of 52,561 tons upon the corresponding week of last year. For the year to date, the shipments have been 2,097,009 tons—being an increase to the extent of 684,163 tons upon the same period of the previous year.

The Newcastle correspondent of "The Times," writing last Saturday, said: "The South Metropolitan Gas Company are reported to have bought a proportion of their ensuing year's requirements of gas coal at about 16s. f.o.b. Tyne."

The Middlesbrough correspondent of "The Iron and Coal Trades Review" reports that "some very satisfactory contracts have lately been booked for gas coals for forward delivery; and there are cases where consumers want to buy for delivery over the whole of next year. The general quotation for best Durham gas coals is 17s. per ton f.o.b.; and this has been paid for considerable quantities. The Commercial Gas Company, of London, is said to have bought best Durham gas coal for delivery over the summer months at 16s. per ton f.o.b."

Consolidated Water-Works Company of Rosario, Limited.—The gross revenue of the Company for the year ending Dec. 31, after making due provision for bad and doubtful debts, amounted to £37,019, and the working expenses to £16,087; leaving a balance of £20,932, which has been carried to the net revenue account. After providing for debenture stock and other interest and income-tax, writing £250 off preliminary expenses, and placing the sum of £1000 to depreciation fund, there remains an available balance of £11,648 at the credit of net revenue account. On the 1st of November last, an interim dividend of 3 per cent. was paid on the preference shares; and the Directors recommend a further dividend on these shares of 3 per cent. (making the full dividend of 6 per cent. for the year), carrying the balance of £3302 to the credit of the ordinary share dividend account. This amount, added to £1058 already at the credit of the ordinary share dividend account, makes a total of £4360, out of which the Directors recommend the payment of a dividend of 2½ per cent. on the ordinary shares, absorbing £2625, and leaving £1735 to be carried forward. The depression which has prevailed so long in Rosario was less severe last year, and the improvement helped the Company in the collection of their revenue.

R. & A. MAIN, Ltd.

214, ST. JOHN STREET, CLERKENWELL GREEN, LONDON, E.C.

EDMONTON: GOTHIC WORKS. | BRISTOL: 28, BATH STREET. | MANCHESTER: 37, BLACKFRIARS STREET. | GLASGOW: ARGYLE WORKS, KINNING PARK. | FALKIRK: GOTHIC IRON-WORKS.

The "Main" Gas-Cookers.

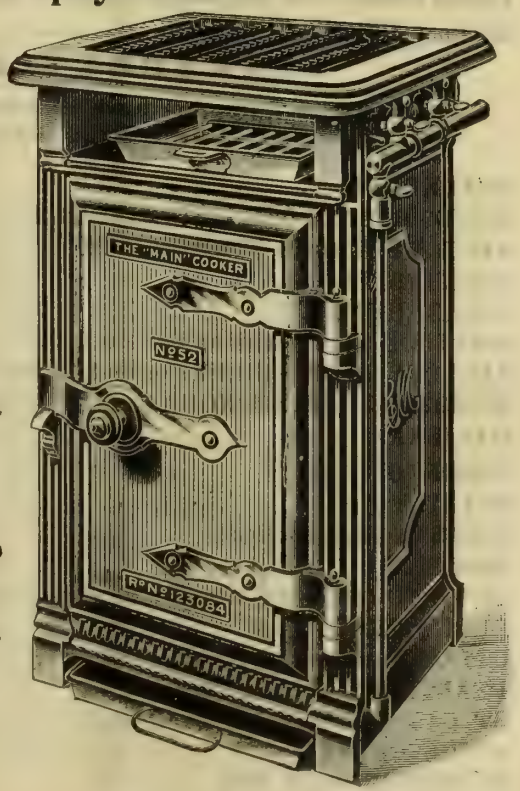


Prices from £4 12s. 6d. to £13 10s.

Practically Indestructible.

Materials and Workmanship of the Highest Class.

Prepayment Meter Cookers.



Prices from 25s. to 80s.

The Legality of Water Divining.—A meeting of ratepayers was held at Ipplepen (South Devon) recently, to consider the question of the special rate levied by the Rural District Council to meet the cost of the abortive scheme for providing a water supply for the village. It was resolved to resist payment of the rate until the opinion of the Local Government Board had been obtained upon the legality of the action of the Council in spending £500 in "divining" and searching for water. A Committee was appointed to take measures for the defence of any ratepayer who may in the meantime be summoned for non-payment of the rate; and a defence fund was opened.

Rural and Parish Councils and Gas Undertakings.—Parish Councils, says the "Local Government Journal," are not empowered either to establish gas-works or to purchase those now existing. This is the answer of the Local Government Board to several proposals which have recently been submitted to them by Parish Councils. It follows therefrom that a Parish Council exercising the powers of the Watching and Light Act of 1833 and the Local Government Act, 1894, can only contract with a company or person for the supply of gas or other illuminant. They can provide the lamps and apparatus at the cost of the poor-rate, but they cannot obtain control over the manufacturing plant; and if no gas or electricity is available, they must content themselves with oil. Rural District Councils are under a similar disability.

Buenos Ayres (New) Gas Company, Limited.—The report which the Directors of this Company will present at the annual general meeting on the 30th inst. shows that the profit for the past year amounted to £48,694. After payment of the fixed charges, and making provision for bad and doubtful debts, there remains to be dealt with the sum of £33,224. From this amount, £12,500 has already been paid to the shareholders as an interim dividend; and the Directors recommend a final dividend of 7s. per share, free of income-tax; making 6 per cent. for the year, and leaving £3224 to be carried forward. Additions have been made to the reserve fund, which now stands at £40,000. Apart from the considerable amounts which have been expended on the maintenance of works, £10,406 has been written off the past year's revenue for depreciation, new plant, &c.

Ilfracombe Water Supply.—The scheme proposed by the Ilfracombe District Council for increasing the water supply of the town was again under the consideration of the Fishery Conservators of the Rivers Taw and Torridge at their last meeting. It was reported that the Committee proposed to take one-third of the water flowing into the Bray at Challacombe; and the opinion was expressed that in a dry summer like the last hardly any water would remain if so considerable a quantity were abstracted. The Rev. J. V. Tanner said he was convinced that the fish would suffer unless compensation water were provided. It was proposed that no opposition be offered to the Bill; an opinion being expressed that a plentiful supply of water for a place like Ilfracombe was of much greater importance than a few trout. Mr. Tanner proposed an amendment to the effect that depriving the river of one-third of its water would be injurious to the preservation of fish, unless compensation water were provided. This was carried by a majority of one.

The Profits of the Bradford Gas-Works.—The Gas Committee of the Bradford Corporation have decided, and their decision has been approved by the Corporation, that there shall be no further appropriation of the profits of the gas undertaking except for purposes connected therewith. The unappropriated profits amounted on March 31, 1899, to £50,247.

Proposed Extension of the Mansfield Gas Works and Plant.—Application is to be made to the Local Government Board by the Mansfield Corporation for power to borrow £6600 for the extension of the gas-works and for additional plant. The amount will be apportioned as follows: Purifiers and house (part cost), £2000; extensions and enlargements of mains, £3600; and new meters, £1000.

The Transfer of the Fylde Water-Works to the Water Board.—There has just been issued by the Fylde Water Board an interesting report on the acquisition by them of the Fylde Water Company's undertaking, which passed into their hands last September. Notice to treat was given on Oct. 25, 1897, the Company claiming £1,422,891; but amicable arrangements were come to whereby the Board had to pay the Company £802,455 12s. 6d., of which £37,000, with interest from August, was to be paid in cash, and £765,455 12s. 6d. allotted in stock at 2¾ per cent. The total liabilities of the Board came to £890,311 6s. 4d., and upon this stamp duty amounting to £4451 15s. was paid. At the end of February last, the consumers numbered 20,045—an increase of 2534 on the year. The capacity of the reservoirs is 252 million gallons; the area of supply 120,000 acres; the normal population, 120,000; the maximum daily consumption, 4 million gallons; and the minimum consumption, 2½ million gallons. The Board is constituted of seven members from Blackpool, three from Fleetwood, three from Lytham, and two from St. Anne's-on-the-Sea.

Obtaining Power from Water-Mains.—The "Dundee Advertiser" for last Wednesday contained the following particulars of a scheme for obtaining power from water-mains: "Now and again we hear of projects for deriving power from the tides; but as yet no practical scheme of this kind has been devised. We learn, however, that a local gentleman has just taken out protection for an invention on other lines which promises great probabilities. This is a motor for utilizing without waste the flow and pressure of water in city mains and pipes. No attempt, so far as we know, has hitherto been made in this direction. The invention referred to consists of a turbine motor, so arranged as to form part of the main. The whole body of water in the main passes through the turbine, so that all the pressure and fall of the water is converted into power, and the water continues on its course in the main without any waste. The motor is so constructed with folding vanes that there is no back-pressure or brake upon its action. Scores of such motors can be placed upon the route of one main, with only a slight decline of power in each succeeding one, while with equal advantage they may be used in the small pipes of towns. The possibilities of this invention as a source of revenue to corporations—who mostly own the gravitation supplies of our towns—is very great; the production of power costing nothing beyond the initial cost of the motor."

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SALTLEY WORKS, BIRMINGHAM	2,000,000	COLCHESTER (Second Contract)	300,000
COLCHESTER	300,000	YORK	750,000
BIRKENHEAD	2,250,000	ROCHESTER	500,000
SWINDON (New Swindon Gas Co.)	120,000	KINGSTON, ONT.,	300,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	CRYSTAL PALACE DISTRICT	2,000,000
WINDSOR ST., BIRMINGHAM (Second Cont.)	2,000,000	DULUTH, MINN.	300,000
HALIFAX	1,000,000	CATERHAM	150,000
TORONTO	250,000	LEICESTER	2,000,000
OTTAWA	250,000	ENSCHEDE (HOLLAND)	150,000
LINDSAY (Remodelled)	125,000	BUENOS AYRES (RIVER PLATE CO.)	700,000
MONTREAL	500,000	BURNLEY	1,500,000
TORONTO (Second Contract; Remodelled)	2,000,000	KINGSTON-ON-THAMES	1,750,000
BELLEVILLE	250,000	ACCRINGTON	500,000
OTTAWA (Second Contract)	250,000	TONBRIDGE	300,000
BRANTFORD (Remodelled)	200,000	STRETFORD	500,000
ST. CATHERINES (Remodelled)	250,000	OLDBURY	300,000
KINGSTON, PA.	125,000	TODMORDEN	500,000
PETERBOROUGH, ONT.	250,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
WILKESBARRE, PA.	750,000		

Netherlands Incandescent Gaslight Company, Limited.—The report of this Company for the past year states that, after making provision for bad and doubtful debts and allowance for depreciation, the net profit is £7157. Including the balance brought from the previous account and a sum written off as a bad debt, but subsequently recovered, the amount at the credit of the profit and loss account is £7280. The Directors recommend a dividend of 7½ per cent., and propose to write £850 off the fluid supply contract account and £138 off the premises account. These sums, together with the Manager's percentage and a bonus to the staff, leave a balance of £1926 to be be carried forward.

Dunstable Gas and Water Company.—At the 28th annual meeting of this Company on the 10th inst., the Chairman (Mr. B. Bennett) stated that the consumption of gas increased last year—being the first rise for some time. For several years the output was stationary or declining; but in 1899 they sold 12 million cubic feet of gas. The revenue account stood at £2716—an increase of £327; and from the balance of £1331, dividends of 7 per cent. on the "A" shares and 3½ per cent. on the "B" shares were recommended. The water undertaking showed an available balance of £1641, from which a dividend of 7½ per cent. was proposed. At present, the town had only one set of pumping plant; and it had been decided to sink a new borehole to a depth of 250 feet, which would supply 10,000 gallons of water per hour. With duplicate sets of pumps, they would have two strings to their bow. The dividends recommended were declared.

Trouble Over a Lighting Rate.—The "Sydney Daily Telegraph" directs attention to the extraordinary position in which the Municipality of Lambton stands with regard to the order of the Supreme Court (brought before the Full Court on Feb. 28). It appears that three Aldermen of the borough were imprisoned on the previous Saturday for contempt in connection with the order, and Counsel made an application for their release. It was urged that they had been appointed specially by the Government to carry out the order of the Court regarding the levying of a lighting rate, as the Municipality had refused to elect Aldermen; but the Chief Justice pointed out that the three Government nominees in their turn refused to do that for which they were appointed. It was contended that they had misapprehended the order of the Court; and it was stated that, in consequence of their having become Government nominees, they were looked upon with great disfavour by the ratepayers of the borough, and were not in sympathy with the law-breaking element. The Chief Justice observed that the case had a serious public aspect, because if the borough could escape their just liabilities, it would be very hard to say that other municipalities might not follow the same course of repudiation. The borough owed something like £12,000 to a bank for money spent in local improvements, of which they had all the benefit; but they now refused to pay a shilling off the debt. It was suggested to the Court that there should be some means of terminating such a scandalous state of affairs; but the Chief Justice remarked that he was afraid that there were no means available under the Municipalities Act. The borough had refused to strike a lighting rate to enable something to be paid off the debt to the bank.

Proposed Extension of the St. Mary Church Gas-Works.—At the last meeting of the St. Mary Church District Council, the Gas Manager (Mr. T. Evans) presented a report in which he recommended, among other things, the enlargement of the retort-house so as to permit of the erection of two additional benches of retorts. He thought the condensers should be replaced by more capacious ones, and a larger exhauster should be put down. These extensions should be commenced at once, so as to be completed during the summer. The Gas Committee thanked Mr. Evans for his report, and recommended that a Gas Engineer should be invited to inspect the works and advise as to the extensions necessary. The Council adopted this recommendation.

A Belgian Gas Undertaking.—At the recent meeting of the Belgian Gas Company, who carry on their operations under the title of the Société Anonyme d'Eclairage du Centre, the profit and loss account showed a balance of 3,547,312 frs. (£141,892), and the profit realized allowed of the payment of a dividend of 20 per cent.—viz., 10 frs. on the preference shares, and a like sum on the ordinary shares. The Company have a large interest in the gas undertakings at Lisbon and Rio. The consumption of gas is constantly increasing at the former place—having risen from 529 million cubic feet in 1891-2 to 776¼ millions in 1898-9; while at Rio everything is most satisfactory. The Company hold shares in other undertakings whose annual sale exceeds 1765 million cubic feet. Thus the gas-works of San Giovanni at Teduccio and Barletta, which also serve Torre del Greco, Barra Portici, Resina, &c., actually figure in the accounts for 3,411,339 frs. (£136,453). The contracts for the supply of these towns will not expire for another forty years. The Company have successfully negotiated a prolongation of concessions for the towns of La Louvière, Menin, &c.

Swansea Gas Company.—The ordinary general meeting of this Company was recently held under the presidency of Mr. T. T. Wood. In moving the adoption of the report, he reviewed the progress of the Company during the past half year, and showed an increase of 13½ per cent. in the quantity of gas supplied as compared with the six months ending December, 1898. This was attributable mainly to the prepayment meter supplies; but another increasing source of income was the cooking-stoves. This latter fact demonstrated the popularity of cooking by gas—a system which had been found exceedingly valuable during the recent "famine" prices of coal suitable for domestic purposes. The Company had during the past half year laid out in new works and the supply of prepayment meter fittings about £15,400; and it was quite probable that they would have to go on spending a very large sum annually in providing these meters. Roughly, he estimated that this would have to be done at the rate of 12,000 consumers per annum. Fortunately for the Company, they had been able to work on old coal contracts. The Directors, however, expected that in the new ones they would have to pay very much higher prices. In conclusion, he predicted that in the near future there would have to be a large outlay for new retorts and stoking machinery, This would result in economy in manufacture, and would lessen trouble with workmen and wages. Resolutions were passed declaring the authorized dividends.

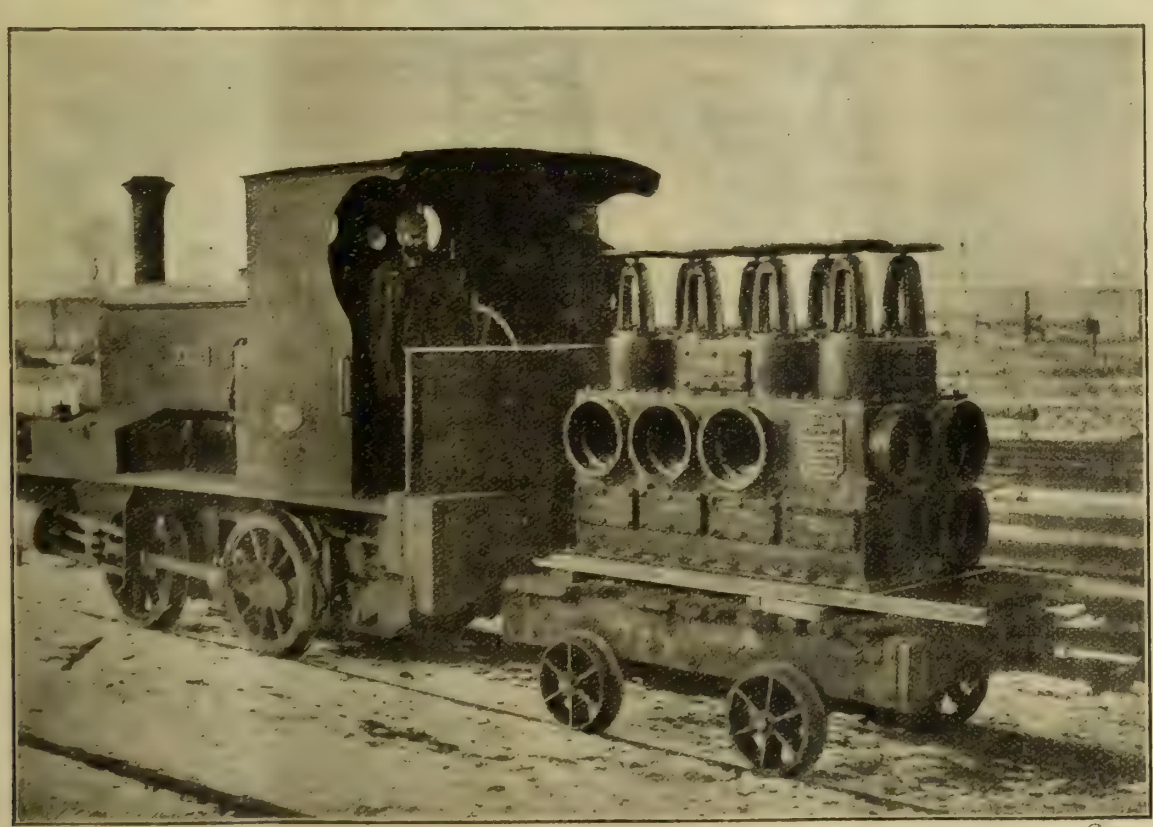
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Artesian Wells in New South Wales.—Sell's "Commercial Intelligence" gives currency to the news from Melbourne that, recognizing the importance of artesian water supply in the dry districts of New South Wales, a deputation of members of Parliament have urged on the Minister of Lands the necessity of introducing a vigorous policy in connection with boring operations. The Minister is said to be favourable to the scheme, and will ask the Premier to place £25,000 on the estimates to enable the necessary operations to be carried out.

Holmfirth Water Supply.—The Holmfirth District Council having applied to the Local Government Board for power to borrow £2250 for works of water supply, Mr. H. Percy Boulnois recently held an inquiry in regard thereto. The Clerk (Mr. Lomax) said the estimated population of the district was 9800, the assessable value £24,135, and the outstanding loans £8729. The chief items of expenditure were contemplated in connection with the reservoirs, the present capacities of which were: Snape, 3¼ million gallons; Austonley, 300,000 gallons; and Goose Green, 8000 gallons (constructed 1866). There was connection between the three supplies. It was proposed to increase the capacity of the Snape reservoir to 4⅓ millions, by raising the embankment 2 feet, and to extend the supply to several townships from which there have been repeated demands for water. The Surveyor and Water Manager of the Council (Mr. G. E. Vint) explained the details of the scheme.

The Growth of the Southend Gas-Works.—In the course of an interview with a representative of the Press, Mr. Frank Clark, the Engineer and Manager of the Southend Gas Company, recorded the change which has taken place in the works and business since he has been in the Company's service—viz., since 1878, when he became assistant to Mr. Septimus Penny, whose predecessors were the late Mr. W. H. H. Broadberry and his son, Mr. W. F. Broadberry, of New Southgate. In 1884, Mr. Penny retired, and Mr. Clark secured the vacant position, with Mr. Alfred Penny as Consulting Engineer. A few years later Mr. Penny died; and Mr. Clark was invested with the full control of the undertaking. Under his supervision, the works have been three times rearranged and extended. When he took command, the working staff consisted of 14 men and boys, with a pay-sheet of £20; now it numbers 110, with a wages-bill of £160. The retorts were heated by direct firing with hand labour, and the bulk of material used was between 7 and 10 tons per day; now the regenerative system is in use, with hydraulic stoking machinery, and the average daily consumption of coal is from 50 to 60 tons. Water-gas plant capable of producing 750,000 cubic feet per diem has been put up by Messrs. S. Cutler and Sons. The storage capacity was formerly only 40,000 cubic feet; but when the holder now building is completed it will be 1,500,000 cubic feet. The area of the works has been increased; and there is now room enough for plant equal to an output of not less than 3 million cubic feet of gas daily. The whole of the distributing system has been overhauled and extended, with a consequent reduction of leakage; and the public lighting has been greatly improved. These changes show that, as this popular seaside resort has grown, the Directors of the Gas Company have made ample provision for meeting its requirements as far as their commodity is concerned.

Road-Rollers and Damage to Water-Mains.—At a recent meeting of the Portishead District Council, a letter was read from Messrs. Curtis, Jenkins, and Co., on behalf of the Portishead Water Company, complaining of serious damage done to their property by the road-roller of the Council causing leakage, and asking that compensation should be made, and that the roller should not again be used at present. The Surveyor (Mr. F. H. Smith) stated where damage had been done to the pipes, but said he was sure it was not through any fault of the Council. The Chairman (Mr. E. G. Lorymer) suggested that they should write to the Company to the effect that the Council were not aware of any damage done; but if there was leakage, it was caused by the insufficient depth at which the pipes had been laid. This course was adopted.

The Use of Water for Gardens in Birmingham.—The Water Committee of the Birmingham Corporation are taking timely precautions to husband their stores of water, in view of a possible shortage in the summer. They have sent out notices to consumers, intimating that, in view of the insufficiency of the present works to meet the demand for water, and the consequent necessity for economy during the summer, they propose to enforce the powers under which any person using water for gardens and lawns without having previously agreed with the Corporation for a supply for such purpose, is liable to a penalty not exceeding £5. The Committee have not hitherto enforced these "powers;" but under present circumstances, they feel it to be their duty to do so, as regards the use of water for garden purposes by means of hose-pipes, automatic sprinklers, and other mechanical contrivances. Such a use will, in future, be dealt with as a contravention of the law, and if it is persisted in after this notice, it will render the offender liable to prosecution. The Committee do not propose to take any proceedings in respect of garden watering by hand.

Shrewsbury Water Supply.—A special meeting of the Shrewsbury Town Council has recently been held to consider the question of the water supply of the town. A letter was read from the Local Government Board urging the Council to lose no time in providing for the town an improved supply of drinking water. The Water Committee laid before the Council a draft letter which they proposed should be sent to the Board in reply. It pointed out that the Council had been considering the question of water supply for twenty years, that they had had many schemes before them, and spent many thousands of pounds in investigating them. The last scheme was to get a supply from high land at Batchcott; but the cost of carrying it out—£155,000—was at present prohibitory. The Committee, therefore, recommended that the present supply of drinking water should be extended by increasing the number of springs from which it is being obtained, and raising the water to a reservoir high enough to serve all parts of the town. The supply from the river would also be improved by the construction of new works, including machinery, subsidence tanks, filter-beds, and a new service reservoir. It was proposed that the letter should be adopted and sent to the Board. A long discussion followed, in which the suggestion to filter the river water for the purposes for which it would be used was strongly condemned; but eventually the proposition was carried.

LONDON. STRATFORD.
WARRINGTON. PLYMOUTH.



DUBLIN. BOURNEMOUTH.

Accidents at Water-Works.—A well which is being sunk at the North Walsham Water-Works collapsed last Friday; and two men who were at work at a depth of 80 feet were buried alive. Efforts were made to rescue them, but with what success has not yet been reported. During some excavations at the Old Park Water-Works, Belfast, the same day, a heavy fall of earth took place. Three men were buried, but were speedily extricated. One, an aged man, is in a critical condition, another has a broken thigh, and the third is suffering from injuries to the lower part of the body.

Cowlyd Joint Water Board.—The finances of this Authority appear to be in a very unsatisfactory state; and the Local Government Board have called upon them to reorganize their position in this respect. The District Auditor in his audit has disallowed two sums—£629 and £709; and he has drawn attention to the fact that, owing to the failure of the Joint Board to provide sufficient funds for their requirements, the overdraft upon the current accounts amounted at the close of last year to £4803; while the overdraft on capital account was no less than £27,704. Application was made to the Central Authority to remit the disallowances; but they regard the statements of the District Auditor as so unsatisfactory that they have replied that it does not appear to them they can properly do so. The Board further observed that the Joint Board had paid for the main from Sarn Mynach to Llysfaen although by an award in August, 1897, only the cost of a portion of this main had to be borne by them. When the matter came before the Joint Board last Friday, no observations were made on the communication.

Teignmouth Gas Supply.—Further reference to the scheme for re-modelling and extending the Teignmouth Gas-Works was made at a meeting of the District Council last Tuesday. Mr. T. Hutchings, a former member of the Council who has just been re-elected after an interval of two years, said that Mr. Stormonth, the Gas Manager, had condemned the plans of his predecessor after having seen only one of them, and in spite of the fact that these plans were approved by the late Mr. F. Livesey, whom the Gas Committee consulted as to the condition of the works. Mr. Hutchings also complained that since Mr. Stormonth had had charge of the works he had on one occasion sent into the town gas charged with sulphuretted hydrogen, and on another occasion an explosive mixture of gas and atmospheric air had been distributed. The Chairman (Colonel Morrison) said these matters had been satisfactorily explained to the Council; and Mr. Jarvis suggested that Mr. Hutchings might find more useful work than that of amateur critic of the gas management. Mr. Banbury said the Manager was endeavouring to economize labour at the gas-works after the mismanagement of past years. Mr. Smith thought the Manager ought not to be condemned before he had had a fair trial, and had been given an opportunity of putting the works into the condition in which he thought they should be. Mr. Stormonth said he found from the books that the make of gas was formerly 104,000 cubic feet per 24 hours with 40 retorts. During the winter, he was in terror lest the furnaces should fall to pieces, and one did so; but despite this, and with six retorts short, he made 108,000 cubic feet of gas in 24 hours. It was, however, impossible for the works to pay in their present state.

Beverley Water Company.—The report presented at the recent annual meeting of this Company showed that the income for the year ending the 31st ult. was £1665, as compared with £1635 before. The expenses were £859, being £61 more than in the previous year. After meeting these, and the cost of laying new services, the profit on the year was £801. After paying debenture interest and other preferential charges, and writing off irrecoverable arrears, there was a surplus of £460. The Directors recommended that a dividend of 4s. 6d. per share be paid; and that the balance be carried to the extensions account, 1898. The report was adopted.

The Directors of the Oriental Gas Company, Limited, have resolved to pay an interim dividend at the rate of 3½ per cent., free of income-tax, on account of the year ending June 30 next.

According to a Reuter's telegram which has lately appeared in certain papers, the Pittsburg Coal Company have received inquiries from German firms as to the price of Pittsburg gas coal.

At the recent anniversary of the formation of the Gas Workers' Union it was stated that there were 6000 members more than at this time last year, and that there had been an increase of 2000 in the past quarter.

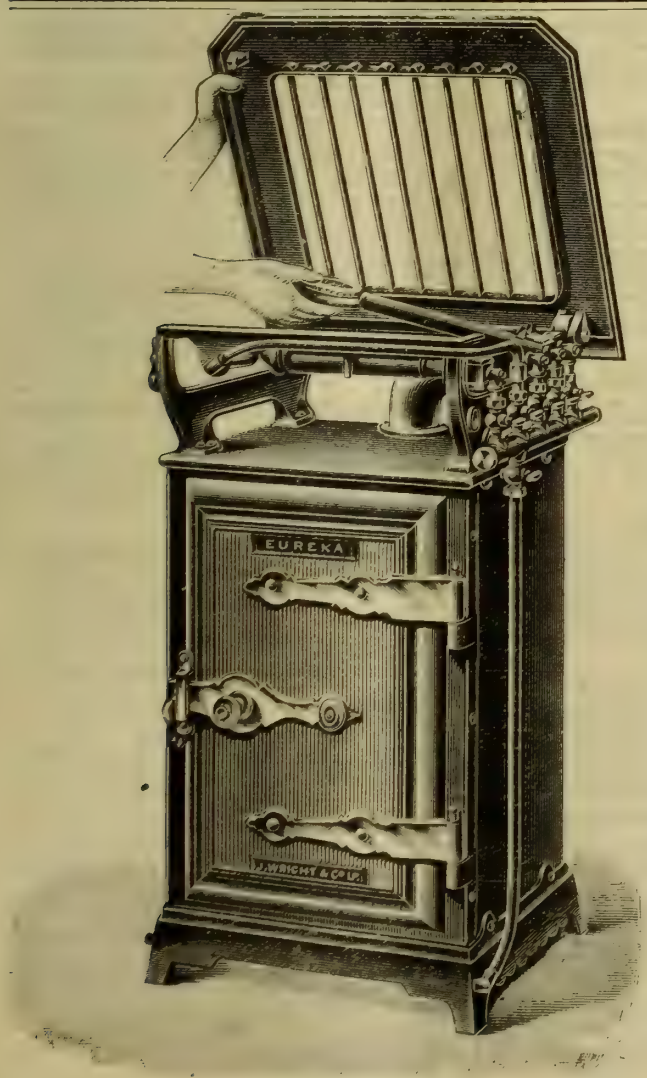
The tender of the Leeds Fire-Clay Company (Engineering Department) has been accepted for completing, under the supervision of Mr. S. Glover, the fitting up of the extended retort house at the St. Helens Gas-Works.

There was naturally great rejoicing at Port Elizabeth when the news of the surrender of Bloemfontein reached that town on the 14th ult. The Manager of the gas-works (Mr. W. Arnot) was not a whit behind his fellow-townsmen in his public expression of gratification at this successful *coup*. He made a big bonfire at his works, and gaily decorated the large gasholder in celebration of the event.

After careful investigation into the various systems of stoking machinery, the Gas Commissioners of the Greencck Corporation have decided to adopt West's, and have placed a contract with West's Gas Improvement Company, Limited, to put up at their Inchgreen works the latest type of compressed air stoking machinery, including charging and drawing machines, air-compressing plant, &c.

The "Cannon" Hollow-Ware Company, Limited, of Deepfields, Bilston, are making considerable additions to their premises. On the 19th inst., the first section of the extensive new works intended to be completed in connection with the Company's gas-stove department was opened in the presence of the Directors of the Company. The new erections comprise a spacious foundry and necessary dressing-shops and stores.

The Gas Committee of the Birmingham City Council have announced that from the 16th inst. there will be an advance equal to 2s. 6d. a ton all round in the price of coke and breeze. In addition, they are revising the conditions on which the delivery of coke can be undertaken by the department. It is explained that these changes are due to the recent difficulties experienced in obtaining the haulage required for the prompt delivery of coke, the considerably increased cost of the available haulage, and the continued great demand for this kind of fuel.



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JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c., CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special attention to Repairs.
Before placing Orders, please write for Estimate.
Telegraphic Address: "SATURATORS, BOLTON."

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."
[For Illustrated Advertisement, See April 3, p. 898.

CANNEL, COAL, ETC.

JOHN ROMANS & SON, EDINBURGH,

Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application
No. 80, ST. ANDREW SQUARE, EDINBURGH, } SCOTLAND.
NEWTON GRANGE, NEWBATTLE, DALKEITH, }

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM; and 45 & 47, Westminster Bridge Road, LONDON, S.E.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Addresses:
"Braddock, Oldham." "Metrique, London."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

TO GAS AND WATER OFFICIALS.

HIGH-CLASS Cycles at reasonable and low Prices. Guaranteed for Twelve Months. Sent on approval. For Cash or Gradual Payment System. Send for Catalogue, Post Free.
MELROSE CYCLE COMPANY, COVENTRY.

SULPHURIC ACID for Sale.

BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

WANTED, by steady Man (aged 33), a Situation as FOREMAN in Gas-Works. Total Abstainer. Thoroughly experienced in Regenerative, Generative, and other Settings, and the general routine of Gas-Works. Highest Reference from present Employer.
Address, No. 3477, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation by a smart, active Man (aged 37), Abstainer and Non-smoker, and just from the Colonies. Capable of taking charge of Small Gas Plant, acting as general help to Manager, or occupying position as Storekeeper in Large Gas or Engineering Works. Used to Fitting, Meter Fixing, Service Laying, Drilling, Tapping, and Screwing, Index Reading, Collecting, &c. Thirteen Years' Character.
Address No. 3480, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, good Retort Setters immediately.
Apply to JONAS DRAKE & SON, Gas Engineers, Ovenden, HALIFAX.

WANTED, a Working Foreman at the Gas-Works, Newport, Salop. House and Garden, Gas, and Coals Free. Married Man preferred.
Apply, stating Wages required and References, to Mr. HEANE, Secretary.

WANTED, two good Retort Setters, used to Generator and Regenerator Settings. Must understand Plans well. High Wages paid to good and steady Workers.
Apply, by letter, to No. 3482, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for a Gas Company in the South of England, a WORKING FOREMAN. Must be a good Carbonizer, and used to the general routine of Gas-Works.
Apply, by letter, to No. 3476, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a steady, reliable, married Man, about 30 years of age, as STOKER, accustomed to Shovel Charging and attending to Engine and Exhauster. Wages 30s. per week and overtime. Constant employment to a suitable Man.
Apply, with Testimonials, to the MANAGER, Gas-Works, Bognor, SUSSEX.

WANTED, a thoroughly competent Man as WORKING FOREMAN for Gas-Works making 45 millions. Must be a good Mainlayer, able to take charge of Machinery, and do all Repairs.
Applications, with *copies* of Testimonials, stating Age, Experience, and Wages required, to No. 3479, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C. A Residence is provided on the Works, with Rates, Gas, and Water free.

CLEETHORPES GAS COMPANY.

ACCOUNTANT required by above Company to take charge of General Office. Salary £130 per year, rising £10 annually to £150 per year. Only those thoroughly experienced in the detail work of a Gas Company's Office, and having a knowledge of Secretarial Duties need apply.
Applications, with *copies* of Testimonials, to be sent to the undersigned.

E. J. BROCKWAY,
Engineer and Secretary.

WANTED, an Assistant for a Gas-Works making about 43 millions per annum. Will be required to assist in the keeping of Accounts, advise Consumers as to Fittings, and generally assist the Manager in all Departments. One with a knowledge of Drawing preferred.
Applications to be sent with Testimonials, not later than Saturday, the 28th inst., to No. 3478, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C., stating Age and when the Candidate is prepared to take up his duties if appointed. Salary £70 per annum.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality. SPECIAL FIRE CEMENT, OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

SADLER & CO., Ltd., Middlesbrough, Tar Distillers and Tar Colour Manufacturers. BENZOL specially prepared for Gas Enrichment free from Sulphur. Pure Hydrated OXIDE OF IRON for Purifying Gas either for Sale or Lent on Hire. Always Buyers of GAS TAR and AMMONIACAL LIQUOR.

WANTED, at once, a steady active Man as METER INSPECTOR and COLLECTOR, who must be competent to read Meters correctly, write a good hand, and be correct at Figures. Salary to commence 25s. per week.
Application, accompanied by recent Testimonials, to be made to the MANAGER, Gas-Works, Bexhill, SUSSEX.

DERBY GASLIGHT AND COKE COMPANY.

WANTED by the Directors of this Company an experienced and competent ENGINEER AND MANAGER to take entire charge of their Works (make about 550 million cubic feet). He must have a practical knowledge of the Manufacture of Coal and Water Gas and Sulphate of Ammonia upon the best modern systems. The person appointed to devote the whole of his time to the duties, and be able to design and carry out Alterations and Extensions of Plant.
Applications to be by letter, marked "Engineer," stating Age, Salary required, Training and Experience, accompanied by *copies* of three Testimonials of recent date, addressed to the CHAIRMAN, at the Company's Office, Friar Gate, DERBY, on or before May 8, 1900.

THE Urban District Council of New Mills invite APPLICATIONS for the position of GAS MANAGER and SURVEYOR. The person appointed must be competent to undertake, and have a thorough knowledge of, the duties appertaining to both Offices, and devote all his time to the duties of the two Offices.
Applications, in Candidates' own handwriting, stating present and previous Employment, Age, Salary required, and whether in a position to commence duties at once, accompanied by not more than three recent Testimonials, to be sent to me the undersigned not later than Five o'clock, on Thursday, the 26th inst.

JOSEPH POLLITT,
Clerk to the Council.

Town Hall, New Mills,
April 12, 1900.

WANTED, Two Second-Hand Purifiers, 12 feet square or equal area.
Send Particulars and Price, and say where Purifiers can be seen, to No. 3481, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

NEW PREPAYMENT GAS LEDGER.

A SIMPLE but Perfect Record of the Slot Meter for One Year on One Page.
For a Sample Sheet, please enclose Twelve Stamps to Mr. S. DAWES, Homedale, CLEVEDON.

FOR SALE—Two Lancashire Boilers, each 6 ft. diameter by 20 ft. long, with Mountings. Been in use only a short time. Made by the Yorkshire Engine Company, Limited, Sheffield.
Apply to NEWTON, CHAMBERS, & Co., LIMITED, Thorncliffe Iron-Works, near SHEFFIELD, where the Boilers may be seen.

EXHAUSTERS, 1500 to 60,000 feet per hour, with or without Engines.
LIVESEY WASHERS, CUTLER CONDENSER, SCRUBBERS, 5 feet and 6 feet diameter, METERS, GOVERNORS, PURIFIERS (Sets of 6 feet and 10 feet square), BOILER and other TANKS, VALVES, &c.,
J. FIRTH BLAKELEY & Co., Thornhill, DEWSBURY.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

SHANKLIN GAS COMPANY, LIMITED.

GAS PLANT FOR SALE.

OWING to the adoption of Regenerator Settings, the Shanklin Gas Company, Limited, have now FOR DISPOSAL the following, in first-class condition:—
Three Sections of HYDRAULIC MAINS, two for Beds of six Retorts, and one for Bed of five Retorts; 17 OVAL MOUTHPIECES, 21 in. by 16 in., with all Cross Bars, Lugs, &c., complete; all the necessary ASCENSION-PIPES, BENDS, and BRIDGE-PIPES, 6-inch SEAL VALVES, 8-inch CAST-IRON FOUL MAIN and TAR-MAIN, with TEES, &c., to suit.
Also seven new 21 inch by 16 in. by 9 ft. 6 in. OVAL RETORTS.
The whole may now be seen disconnected upon application to the undersigned, who will furnish any further Particulars.

FRANK C. TAYLOR,
Engineer and Secretary.

Office of the Company,
Languard Road, Shanklin, I.W

SPENT OXIDE on Sale, and Fresh Oxide required, at the Dukinfield Gas-Works.
Apply to the MANAGER.

CONDENSER (Morris & Cutler's), 21 ft. 6 in. by 6 ft. 6 in. by 3 ft. 6 in., 1 million per day. Equal to new. Exceptional Bargain, if sold promptly.
Address No. 3463, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—A Washer by Cockey. Size 10 ft. by 4 ft. 9 in. by 3 ft. 9 in., in four Compartments, with Manholes, Water-Supply Pipes, and 6-inch Gas-Connections. All in good condition. Suitable for a Gas-Works making 12 millions a Year and under.
For Particulars, apply to the MANAGER, Gas-Works, Whittington, near CHESTERFIELD.

ASHFORD URBAN DISTRICT COUNCIL.

TENDERS FOR GAS COAL.

THE Gas Committee are prepared to receive TENDERS for the supply of 5500 Tons of good GAS COAL.
Forms of Tender and Information may be obtained, on application (in writing only), from J. Morton, Manager, Gas-Works.
Tenders, endorsed "Coal," to be delivered on or before Five p.m., on Friday, April 27, 1900, at my Office, 11, Bank Street, Ashford, Kent.

JOHN CREERY,
April 20, 1900. Clerk.

COUNTY BOROUGH OF OLDHAM.

THE Oldham Corporation Gas-Works Committee are prepared to receive TENDERS for the supply of about 146,000 Tons of COAL and CANNEL required by them during the Year ending the 31st of May, 1901.
Specifications and Forms of Tender can be obtained on application to Mr. Arthur Andrew, Gas and Water Offices, Oldham, to whom Tenders are to be sent on or before Tuesday, the 8th of May.

A. NICHOLSON,
Town Clerk.

Oldham,
April 12, 1900.

GLOUCESTER GASLIGHT COMPANY.

GASHOLDER TANK.

THE Directors of the above Company invite TENDERS for the construction of a BRICK GASHOLDER TANK (about 156 feet in diameter and about 41 feet deep) at their Works, Hempsted.
Plans may be seen, and Specifications obtained, on application to the Company's Engineer, Mr. W. S. Morland, Gas-Works, Hempsted, near Gloucester, and on payment of £1 1s, which will be returned on the receipt of a *bonâ-fide* Tender.
Sealed Tenders, endorsed "Tender for Gasholder Tank," to be sent to the undersigned at the Gas Offices, Eastgate Street, Gloucester, not later than Tuesday, the 1st day of May, 1900.
The Directors do not bind themselves to accept the lowest or any Tender.

WILLIAM E. VINSON,
Secretary.

Gas Offices, Gloucester,
April 5, 1900.

BOROUGH OF SMETHWICK GAS-WORKS.

TENDERS FOR NEW PURIFIERS.

THE Gas Committee invite Tenders—
1. For Building a BRICK PIT, 88 ft. 6 in. by 62 ft. 2 in. and the PIERS to carry four Purifiers.
2. For a Set of four PURIFIERS, 36 ft. by 24 ft., and Covers, with Valves, Connecting Mains, and Lifting Gear.

Copies of Specifications and Drawings may be obtained on application to Mr. B. W. Smith, at the Gas-Works, at a charge of £1 1s., which will be returned upon receipt of a *bonâ-fide* Tender.
Contractors will be required to pay the Standard Rate of Wages recognized in the District.
Tenders, endorsed "Contract No. 1" or "Contract No. 2," and addressed to the Chairman of the Gas Committee, to be delivered to the undersigned on or before the 3rd of May next.
The Committee do not bind themselves to accept the lowest or any Tender.

By order,
(Signed) W. J. STURGES,
Secretary.

Gas Offices, Town Hall,
Smethwick, April 9, 1900.

HOYLAKE AND WEST KIRBY GAS AND WATER COMPANY, LIMITED.

TENDERS FOR GAS COAL AND CANNEL.

THE Directors of the above-named Company are prepared to receive TENDERS for the supply of GAS COAL and CANNEL as follows:—

3500 Tons, more or less } SCREENED GAS COAL.
3050 Tons without } UNSCREENED GAS COAL.
900 Tons restriction } CANNEL.

Price to include delivery on rails on Gas-Works Siding, Hoylake. Deliveries to extend as required from the 1st of July next to the 30th of June, 1901.
The Directors reserve to themselves the right to accept Tenders for the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any Tender.
Sealed Tenders, marked "Tender for Coal," must be delivered to the undersigned not later than Ten a.m. on Wednesday, the 2nd of May next.
No Canvassing.
Printed forms of Tender will be forwarded by post upon application in writing.

By order,
A. G. READDY,
Secretary.

8, Filey Terrace, Hoylake,
April 18, 1900.

DRIFFIELD URBAN DISTRICT COUNCIL.

THE Gas Committee of the above Council are prepared to receive TENDERS for the RENEWAL of THREE SETTINGS of RETORTS and the CONSTRUCTION of GENERATOR FURNACES for the same.
Particulars may be obtained of Mr. Henry Tobey, Engineer, Malton.
Tenders must be delivered to the undersigned on or before the 1st day of May next.

GEO. B. TONGE,
Clerk to the Council.

Driffield, April 17, 1900.

RAMSBOTTOM GAS COMPANY.

TENDERS FOR COAL.

THE Directors of this Company invite TENDERS for the supply of 6000 Tons of GAS COAL, to be delivered at their Siding, Stubbins, near Ramsbottom, as may be required during the Year ending June 30, 1901.
Further Particulars and Form of Tender on application to the undersigned.
Tenders to be sent to John Rothwell, Esq., Chairman, Gas-Works, Ramsbottom, and endorsed "Tender for Coal," not later than Saturday, May 5.

FRANK BARRETT,
Manager and Secretary.

BOROUGH OF NELSON.

THE Gas Committee invite Tenders for the supply of CONDENSERS for their Gas-Works.
Form of Tender, with Particulars, can be had on application to Mr. A. Allan, Gas Engineer, Gas-Works, Nelson.
Sealed Tenders, endorsed "Condensers," to be sent to me the undersigned, not later than the 4th of May, 1900.
The lowest or any Tender will not necessarily be accepted.

R. M. PRESCOTT,
Town Clerk.

Town Hall, Nelson,
April 18, 1900.

TENDERS FOR GAS COAL.

THE Corporation of Droitwich invite TENDERS for the supply of from 1200 to 1700 Tons of best screened GAS COAL, to be delivered free at Droitwich (G.W.) Station, at such times and in such quantities as may be required prior to the 31st of May, 1901.
Particulars and Form of Tender may be obtained on application to the Manager of the Gas-Works.
Sealed Tenders, on the form provided for the purpose (with Analysis of the Coal to be supplied), endorsed "Tender for Gas Coal," to be sent to the undersigned, on or before the 11th of May.
The Corporation do not bind themselves to accept the lowest or any Tender.

S. JOHN TOMBS,
Town Clerk.

Droitwich, April 12, 1900.

TO COAL MERCHANTS.

THE Milton-next-Sittingbourne Urban District Council invite TENDERS for a supply of GAS COALS, for the year ending March 31, 1901. The quantity required will be about 1400 Tons; and the deliveries must be in such quantities and at such times as the Gas Manager shall direct.
All necessary Information, with Specification and Form of Tender, can be obtained on application to Mr. A. Davison, Gas Office, Milton-next-Sittingbourne.
Sealed Tenders (which must be on the form supplied) should be addressed to the Chairman, Milton-next-Sittingbourne Urban District Council, and endorsed "Tender for Coal," and must be sent or delivered to me before Four o'clock p.m. on Tuesday, May 1, 1900.
The right of rejection of any Tender is reserved.

WM. PARHAM,
Clerk to the Council.

Town Hall, Milton-next-Sittingbourne,
Kent, April 19, 1900.

DEVONPORT GAS AND COKE COMPANY.

TENDERS FOR GAS COALS.

THE Directors of the Devonport Gas and Coke Company invite TENDERS for the supply of 20,000 Tons or 10,000 Tons (at their option), of unscreened (through and through) NEWCASTLE, DURHAM, or SILKSTONE GAS COALS, to be shipped in such quantities, and at such times, as may be required, between the 1st of June, 1900, and the 31st of May, 1901.
The Cargoes to be discharged at the Tamar Wharf, Devonport.
Tenders may be quoted either c.i.f. or f.o.b. or f.o.r. at Devonport (but c.i.f. preferred), endorsed "Tender for Coals," and addressed to the Chairman, Devonport Gas and Coke Company, Devonport.
Tenders to be sent in on or before Monday, the 30th of April next.
Devonport, April 18, 1900.

TENDERS FOR GAS COAL.

THE Directors of the Watford Gas and Coke Company invite TENDERS for the supply, during the Twelve Months from the 1st day of July, 1900, to the 30th day of June, 1901, of 11,500 Tons (more or less), of GAS COAL (screened or unscreened), to be delivered at the Bushey Station of the London and North-Western Railway.
Forms of Tender and Information may be obtained on application (in writing only) of me the undersigned.
Tenders to be delivered on or before the 7th day of May, 1900, addressed to the Chairman of the Watford Gas and Coke Company, Watford, and endorsed "Tenders for Gas Coal."
Tenders must be on the form supplied, any alteration of which will invalidate the Tender.
The Directors do not bind themselves to accept any Tender.

J. DUNCAN ROYAL,
Secretary.

Watford Gas and Coke Company's Offices,
Watford, April 13, 1900.

GAS TAR.

THE Aberystwyth Gas Company invite TENDERS for the purchase of the surplus TAR produced at their Works for a period of Twelve Months, commencing the 1st of May, 1900.
Tenders to be sent in not later than the 28th of April, 1900.

R. T. JONES,
Secretary.

WINCHESTER WATER AND GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors ask for Tenders for delivery of 6000–8000 Tons over Twelve Months from the 1st of July next.
Full Particulars and Price to be sent on or before Friday, the 27th inst., to the undersigned.
Lowest Tender not necessarily accepted.

FREDK. G. DEXTER,
Engineer and Manager.

Offices: Staple Gardens,
Winchester.

HAWORTH URBAN DISTRICT COUNCIL.

THE above Council are prepared to receive TENDERS for the supply of 3000 Tons of GAS COAL (screened or unscreened), delivered at the Station of the Midland Railway Company, Haworth, during the ensuing Twelve Months.
Tenders to be sent to me the undersigned not later than Thursday, the 26th inst.

WM. ROBERTSHAW,
Clerk.

Burlington Chambers, North Street,
Keighley.

BARNOLDSWICK URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

THE Council are prepared to receive TENDERS for the supply of 2200 Tons of best screened GAS COAL, to be delivered at Barnoldswick Station (Midland Railway) by the 31st of May, 1901.
Further Particulars may be obtained from the undersigned.
Tenders to be sent in not later than May 2, 1900, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Coal."

D. E. GARLICK,
Manager.

SHIPLEY GASLIGHT COMPANY.

TENDERS are invited for the supply of the whole or part of 18,000 Tons of best screened GAS COAL or NUTS, to be delivered free at Shipley Station (Mid. or G.N.) or into the Company's Coal-Stores per Leeds and Liverpool Canal during the Twelve Months ending June 30, 1901.
Tenders to be sent to the undersigned not later than Saturday, May 5, 1900, endorsed "Tender for Coal."
The Directors do not bind themselves to accept the lowest or any Tender.

T. G. WILCOCK,
Secretary and Manager.

Gas-Works, Shipley.

BOROUGH OF CLITHEROE.

(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Gas Committee invite Tenders for the supply of 4000 Tons of screened GAS COAL, to be delivered during the Year ending May 31, 1901.
Further Particulars and Form of Tender may be obtained from the undersigned.
Sealed Tenders, endorsed "Tender for Gas Coal," addressed to the Chairman of the Gas Committee, to be delivered at my Office on or before Tuesday, the 1st of May, 1900.

ROBT. BARRETT.

Gas-Works, Clitheroe,
April 11, 1900.

PETERBOROUGH GAS COMPANY.

GAS COAL.

THE Directors of the above Company invite TENDERS for 4000 Tons of best screened GAS COAL or COBBLES, to be delivered in equal weekly quantities to Aug. 31, 1900.
Tenders, endorsed "Coal," and addressed to the Chairman of the Company, to be delivered not later than Twelve o'clock at noon, on Tuesday, the 8th day of May, 1900.
The Directors do not bind themselves to accept the lowest or any Tender, and reserve to themselves the power to accept a portion of a Tender.

JOHN BARTON,
Secretary and Manager.

Gas-Works, Peterborough,
April 20, 1900.

ALTRINCHAM GAS COMPANY.

COAL AND CANNEL CONTRACTS.

TENDERS are invited for best screened GAS COAL and CANNEL for One Year from the 1st of July next.
Estimated Quantities required: Coal 11,000 Tons; Cannel, 4000 Tons.
Deliveries to be free at Altrincham Railway Station, and as required.
Sealed Tenders, endorsed "Tender for Coal" or "Cannel," stating the description of each, the pits from which they are to be raised, the amount proposed to be supplied, and cash terms for monthly payments, to be sent, addressed to the undersigned so as to be received not later than Twelve o'clock noon, on Tuesday, the 8th day of May next.
The Directors do not bind themselves to accept the lowest or any Tender; but the person or persons whose Tender may be accepted will be required to execute an agreement for the sure performance thereof.
No Special Form of Tender is required or supplied.

F. R. B. LINDSELL,
Secretary.

Gas Offices: Moss Lane,
Altrincham, April 20, 1900.

[For continuation of Contract Advertisements, see p. 1084.

The Latest in Incandescent Street Lighting.

SIMMANCE & ABADY'S PATENT SYSTEMS.

ABOLISHING CONSTANTLY

BURNING FLASH-LIGHTS.

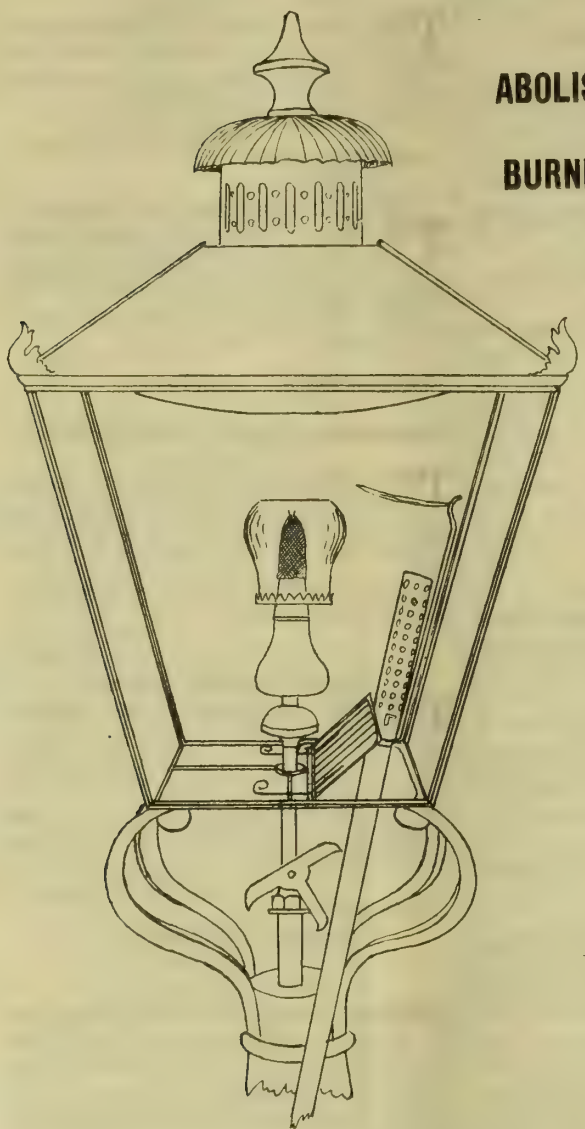


Fig. 1.
Turn Main Cock half on and light Jet.

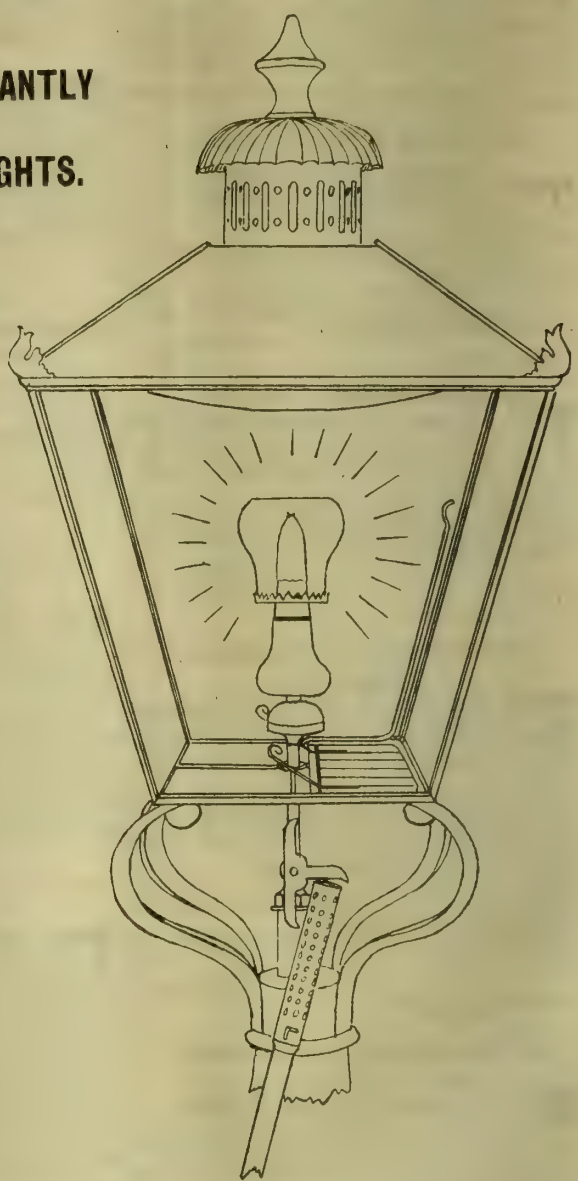


Fig. 2.
Withdraw Torch and Turn Cock fully on.

THIS IS THE PATENT COCK WITH

MOMENTARILY LIGHTED BYE-PASS

REFERRED TO BY Mr. SHELDRAKE, in his Paper Read before the Eastern Counties Gas Managers' Association at Cambridge last week (see p. 1054).

It has been specified by the **PLYMOUTH CORPORATION** for use in about 2000 Lanterns.

SPECIAL NOTE.

No special, expensive Lantern is required, the Lighting Flap being arranged with a Stop to absolutely prevent the Torch coming in contact with Burner, Mantle, or Globe.

ALEXANDER WRIGHT & CO., LIMITED,

SOLE OWNERS OF PATENT.

CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE.
The Westinghouse Combination Power Plant 1105
The North of England Meeting 1106
The Excuse of "Unavoidable Cause" 1106
The Performance of Street-Lamps 1106
Toujours Coal! 1106
A Hint to the London County Council 1107
Sensible Trade Unionists in Council 1107
WATER AND SANITARY AFFAIRS—
Conference on the Rating of Reservoirs—Suggested Amendment of the Law 1108
INSTITUTION OF GAS ENGINEERS:—
Inaugural Address of Mr. J. W. Helps, M.Inst.C.E. 1109
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market 1114
Electric Lighting Memoranda. 1114
Patent Law Reform—Hints on Specification Drafting 1115
Coal and Coal Mining 1116
NOTES:—
A Blue-Flame Oil-Stove 1118
A New System of Electric Traction 1118
The Cost of Private Electric Lighting 1118
Nordenskiöld on the Rare Earths 1118
Damp Houses. 1118
Coke-Ovens in France and Germany. 1118
TECHNICAL RECORD:—
North of England Gas Managers' Association—Half-Yearly Meeting at Newcastle-on-Tyne—
General Business 1119
Supplementary Paper by Mr. Millard on "All Sorts and Conditions of Governors" 1119
Jubilee Presentations to Mr. J. H. Cox and Mr. Charles Sellers 1122
Ohio Gaslight Association 1123
The Supply of Water Gas in Dublin. 1124
The Discovery of Coal Gas. 1126
The Expense of the Pilot; A New Torch for Incandescent Lamps 1127
REGISTER OF PATENTS:—
Manufacture of Gas for Lighting and Heating—Hodder, A. E., and Lester, J. B. G. 1127
Street-Lamps—Livesey, G. 1128
Igniters for Gas—Friedeberger, L., and the "Vulkan" Gesellschaft für Selbstzündende Glühkörper mit Beschränkter Haftung . . 1128
Lighting-Torches for Incandescent Lamps—Foulger, G. F. L., and Glover, J. G. 1128
Lighting Street and Other Lamps—Foulger, G. F. L., and Glover, J. G. 1128
Checking Apparatus for Coin-Freed Gas-Meters—Pipersberg, H. . 1129
Gas Pressure-Regulators—Hein, R., and Hahn, T. 1129
Incandescent Gas-Burners—Heinroth, P., and Tresenreuter, G. . 1129
Stopping Leaky Pipe-Joints—Dresser, S. R. 1130
Stopping Leaky Joints in Gas and Other Pipes—Dresser, S. R. . 1130
Pipe Couplings—Dresser, S. R. 1130
Patent Notices 1130
CORRESPONDENCE:—
The Proposed New Technical Gas Institution. 1130
Mr. E. H. Stevenson's Evidence on the Bradford Bill 1130
PARLIAMENTARY INTELLIGENCE:—
House of Commons—Progress of Bills; The Gas Undertakings Returns 1131
House of Lords Committee—Dorking Water Bill 1131
House of Commons Committee—Airdrie, Coatbridge, and District Water Trust Bill 1132
Subways under London Streets 1133
London Water Companies and the River Lea 1134
LEGAL INTELLIGENCE:—
Electric Light Companies Sued for Penalties for Deficient Supply 1135
The Welsbach and Sunlight Litigation 1135
MISCELLANEOUS:—
West Riding Coalowners and Gas Coal Contracts 1136
Meeting of the River Plate Gas Company, Limited 1136
Meeting of the Singapore Gas Company, Limited 1136
Manchester Corporation Gas Supply—Local Government Board Inquiry; Tenders under Consideration 1137
The Annexation of Gas Undertakings by Bradford 1137
Opening of Gas-Works at Selsea 1137
Brussels Municipal Gas Supply—The Gas Committee's Report on the Past Year's Working. 1138
Gas and Water Companies' Stock and Share List 1138
Electric Lighting Notes 1139
The Rating of Reservoirs—Conference of Local Authorities . . 1140
Notes from Scotland 1141
Current Sales of Gas Products 1143
Coal Trade Reports. 1143
PARAGRAPHS:—
PERSONAL: Mr. James Mansergh; Mr. John Stewart; Mr. E. Jones; Mr. W. E. Barney; Mr. Albert Ford; Mr. Arthur H. Cane, F.R.G.S. 1117
OBITUARY: Peter Simpson 1117
North British Association of Gas Managers—Sulphate of Ammonia Manufacture in France—A Century of Chemistry at the Royal Institution—The Bacterial Treatment of Crude Sewage—Gas Undertakings and the London Building Act 1108
The "James Forrest" Lecture 1116
Recovery of Ammonia from Ammoniacal Liquor without Distillation 1118
The Cost of Introducing the Metric System 1126
Water-Closets *v.* Earth-Closets at Hull—Issue of Further Capital by the South Staffordshire Water Company. 1130
New Joint-Stock Companies 1134
Railway Companies and the Increased Price of Coal—Rochdale Corporation Water Supply—Gas Profits at Blackpool—Street Lighting in Chicago 1135
Liverpool Gas-Fittings Company, Limited—Bombay Gas Company, Limited—Sheffield Gas Workers and the Union . . . 1144
The Accident at the North Walsham Water-Works—Heysham and the Morecambe Gas Bill—The Helston Gas Company and the Corporation—Gas-Works in the Market—The Deduction of Income-Tax from Dividends—Sales of Stocks and Shares . . 1145
Additional Capital for the South Staffordshire Water Company—Accident to a Large Water-Main—Tipton Gas Profits and the Rates—Cardiff Water-Works Finances—The Projected Transfer of the Spalding Water-Works—Water Charges at Bradford—Manchester Corporation Water Supply 1146

EDITORIAL NOTES.

The Westinghouse Combination Power Plant.

A GOOD deal of curiosity has been aroused by the strong bid now being made by the Westinghouse interest for a commanding position in the British engineering industry. It is altogether unnecessary to describe that interest here; and it is with some difficulty that one can even approach the subject with any adequate sense of comprehension. A successful man of business or a leader in manufacturing enterprise in the United States has a way of blossoming into an Institution. For some reason, or for many, the prophets of the American dispensation seem to transcend the ordinary limitations of humanity elsewhere, and become vast organizations known by their names. Astor, Vanderbilt, Rockefeller, Edison, Westinghouse—it is really hard to believe that these are the names of men. They share the nimbus of impersonality which always surrounds the original Mahomet or Napoleon. The difference that the American notable usually keeps a shop, only makes him a more mysterious figure still. Mr. George Westinghouse has kept shop in many things in his time; and his latest speciality is gas-engines. When the industrial history of the closing years of the century is written, it will not be his fault if the words "Advent into British trade of George "Westinghouse" do not form the heading of an important chapter. For the moment, our interest in this Westinghouse manifestation has its source in some reflections of what it means in regard to the British gas industry. The British Westinghouse Electric and Manufacturing Company, Limited, have come here to make gas-engines, at works near Manchester which it is understood will be the biggest factory of the kind on earth. The natural question that is suggested by this statement is, Why?

The answer offered is that Mr. George Westinghouse, who should know what he is about, believes implicitly that the gas-engine is likely to be the most generally used prime-mover of the future. He perceives that the whole subject of the generation and utilization of power is now engaging more interest than ever before. He sees what is being undertaken at Niagara in the way of generating electricity for all industrial and lighting purposes by water power; and he believes that the electrical operation of tramways and railways will make headway in the near future, on account of its possessing many advantages over steam. He has for long been familiar with the electrical industry and the pipe-line distribution of natural gas in great quantities; and he has an active interest in the development of large gas-engines. He turns from idle aspirations for more Niagaras to the practical conclusion that the gas-engine, actuated by gas generated at central points, and distributed in pipes as required, will prove the most economical source of power, to be locally converted into, and used as, electricity. This, then, is the new combination which the Westinghouse interest has backed with all its technical and material resources. Whether it is to be justified by the results or not, it is, at any rate, an adventure that is not being undertaken half-heartedly.

It is not for us to say anything about the merits of the Westinghouse gas-engine. That is a matter that must be left to the arbitrament of time. We only wonder whether the Westinghouse scheme will arrest, and turn back, the movement which it is understood, from the examples of Belfast and Leyton, has already set in for the supersession of gas-power electric lighting stations by steam-power stations. That is one thought. Another is the reflection that if gas for Westinghouse engines is to be made and distributed from central stations, those stations will be none other than gas-works, as we know them. Natural gas is of stronger heating power than any artificial gas; but coal and carburetted water gas come next to it, and are the only transportable forms of gaseous fuel. It was the late Mr. Denny Lane who showed the superiority of coal gas to the electric current as a means of power transmission. Now the Westinghouse Company have adopted his prescription, and say, in a pamphlet explaining their method, that "to "convey energy to a distance three essentials—cost, safety, "and reliability—must be considered. These are all con- "served when, instead of conveying the actual power, we "convey the potential ability to create energy. By way "of analogy, the conducting of energy in the form of gas "is to the conveying of power by electric current or other- "wise as the carrying of a million-dollar bank-draft is to "the hauling of a ton and a half of gold." With this very

picturesque image, we will leave the Westinghouse programme for the nonce. Only one remark remains to be offered for the present. The Westinghouse people, speaking of the price of town's gas, aver that this is cheap enough for the economic performance of comparatively small units. "But," they add, "the last word has not yet been spoken. "Experiments which have been long and carefully con- "ducted justify the belief that within a short time gas will "be commercially produced and sold at a cost so far below "the lowest price that now prevails in any part of the "world, that, the three conditions being attained, we shall "enter on a new industrial situation." One would like to know what, if any, justification there is for this decidedly strong and striking statement.

The North of England Meeting.

This year's spring meeting of the North of England Gas Managers' Association at Newcastle last Saturday will be memorable on account of the event—happy in more senses than one, but with a shade of sadness in it—which took place after the formal proceedings had ended. As the President said, where could any other District Association be found which could produce two such men as Mr. Cox, of Sunderland, and Mr. Sellers, of York? Both these gentlemen have had a long and a distinguished career at the head of gas undertakings; and they are both still in office. It was fitting that, on the completion of their fifty years of service, the Association should offer them their hearty congratulations, and that these should take a tangible form. On the other hand—although the expression may be a hackneyed one, no more appropriate can be coined—the Association, in doing honour to their veteran colleagues, were in reality honouring themselves. The Association are rightly proud of two such members; and if regret should enter into their reflections, in any form, it can only be that the opportunities for converse with them must, in the nature of things, be now brief and few. The meeting itself, however, is not likely to be looked back upon as one of the bright and lively spots in the history of the body; for Mr. Millard, of Durham, had it all to himself, and he had exhibited more than half of his stock of points for discussion at the previous half-yearly meeting. His paper, read then, and the supplementary remarks contributed now, have certainly been the product of much patient research, and belong to a branch of human knowledge which is more adapted for quiet perusal and verification than for impromptu discussion. Certain managers have preferences for particular arrangements of plant, in the stating of which some show of debate might appear; but the essence of the whole subject was the complexity of all endeavours to govern gas supply, arising, among other causes, from the multi-varying circumstances which are to be found in different places. Therefore, though research were to be carried on to the end of the world, there need be no hope for a state of uniformity being reached. By all means let inquiries such as Mr. Millard instituted, and carried on with conspicuous success, be continued, because the more knowledge which can be secured upon such a vexing subject the better. A perfect instrument was spoken of; but it is to be feared that the only perfectly governed gas supply would be one in which there would be a separate main from the gas-works to every consumer's premises, and a governor upon each main, with a man to look after it. Of course, this reduces all attempts at governing to the position of compromise; and there it must remain. It is the greatest benefit to the greatest number which the gas manager must aim at giving. To discover how to be able to do this is a worthy object of study. Therefore it is to be hoped that Mr. Millard will continue the work he has so well begun; and that others may be induced to emulate him.

The Excuse of "Unavoidable Cause."

It is worthy of notice by those responsible for the conduct of gas undertakings which are under obligations to maintain the supply once given to any consumer, according to the terms of the Act, that several Electric Lighting Companies of London have recently been haled before the Magistrates for failure to fulfil their statutory engagements. In one set of complaints, the Company pleaded guilty to having been too greedy of custom. They took more customers than they could properly serve; and for the inevitable consequential default they were fined, and admonished not to do it again. On the other hand, for failures by the same Company which were shown to the Magistrate to have proceeded from different causes, and to have been unavoidable, there was no punishment. This merciful judgment was given so naturally, that it requires a little particular criticism to see, in the excuses which exculpated the Company, the same plea of *force majeure* that prevailed in another Court to excuse another offending Company. It is remarkable that only in Electric Lighting Orders has this significant term *force majeure* been admitted to English law phraseology. It is an amplification of the old English legal expression "act of God," descriptive of some unavoidable catastrophe preventing the fulfilment of a contract. Gas and water supply are peculiarly exposed to accidental interruptions; but long experience, ample resources, trained foresight, and ceaseless vigilance usually avail to keep the public from suffering inconvenience or loss thereby. Still, Gas Companies have never professed to be able to work miracles; and they cannot perform either physical or economical impossibilities. For instance, to make gas at the same price as before with coals at double the cost, is an impossibility, unless something very exceptional comes in to help. Yet it is quite likely that some people who have had to pay 35s. a ton this spring for the same coal that they bought last year at 25s. per ton, will protest against the Gas Company putting another 6d. per 1000 cubic feet on the price of gas to help them to pay their coal bills. Similarly, although Gas Companies are bound to do everything in their power to keep up the supply, a real, strong, combined sudden strike of all hands employed in the works would surely excuse the management from continuing the business. There have been occasions when the political partisans of strikers who have caused Gas Companies some temporary inconvenience, have striven to set in action against the same Companies the ordinary legal remedies for such shortcomings as their own friends' performances brought about. But the infantile guile of this behaviour is not less illicit than contemptible. A London Electric Lighting Company have been excused for making default in their supply because they could not get supplies of the description of coal they wanted, and because some new boilers on order were not delivered to time. This is a fairly liberal interpretation of *force majeure;* and it will not be lost sight of.

The Performance of Street-Lamps.

The instructive diagrams with which Mr. J. H. Sheldrake illustrated his Eastern Counties paper on lighting, deserve attention altogether apart from whatever particular application was given to them by the author. It is not often that anybody takes the trouble to make a study of street lighting effects on the spot; and Mr. Sheldrake merits warm thanks for his exposition of the actual facts of public street lighting by the three different kinds of light tested. Experiments of this nature are very troublesome to carry out, and require expensive apparatus, besides needing to be carefully worked out afterwards if their indications are to be of any real use. How necessary work of this kind is, however, is shown incidentally by the circumstance that the two incandescent electric lamps, supposed to be of 16-candle power each, were only yielding a lighting effect of some 24-candle power together. One hears a great deal in these days about the portable photometer, regarded as a means of keeping Gas Companies up to the mark. What the electricians would say about it if the same measure of inspection were meted out to them, has not yet transpired. It is to be noted that Mr. Sheldrake's determinations of lighting effect are very consistent; all the light-sources showing the same proportionate effect of distance. Future writers on artificial lighting will not overlook this contribution to the technical record of the subject. As will be gathered from the necessarily much-condensed abstract which appears in another column, General Hickenlooper has read a paper on "Street Lighting" before the Ohio Gas Association. It is a mine of information relating to many branches of the subject.

Toujours Coal!

In the course of his remarks on the present coal difficulty at the recent meeting of the Eastern Counties Association, Mr. R. G. Shadbolt spoke of the possibility of imports of coal into Europe from America—a question which, it may be remembered, was discussed in the "Journal" some two months ago (*ante*, p. 670). In this connection, we would refer our readers to an article which recently appeared in the "Iron and Coal Trades Review," under the title of "The American Coal Bogey," and which can be read with

interest by all who are anxious to see an end to the present inflated condition of the coal market. The writer takes the view that it is only possible for American coal to compete with English in the European markets at times of abnormal scarcity and dearness of coal in this country, and that the suggestion that coal exports from America may become, in the course of a few years, as important as those of corn and cotton, will, when English prices resume their normal level, appear as little short of ridiculous. In the meanwhile, however, American coal is now being delivered both in Italy and Austria; and every ton so imported stops an order for a ton of English coal, and therefore helps forward, be it never so slightly, the time when the inevitable fall of prices to their normal level will take place. That time, it may be noted, will, in the opinion of the writer in the "Iron and Coal Trades Review," probably be reached within the next two years, and possibly within twelve months. A consummation devoutly to be wished! We should not, however, like to commit ourselves to a prophecy of a return to "normal" prices within twelve months; for, with the wages factor to take into account, and the possibility of trouble with the men when the reaction sets in, and it is sought to materially reduce wages, it is probable that the return to the level of what we have been accustomed to consider reasonable prices will be some while in its accomplishment, and it has not yet commenced. We are prepared to see it begin within the period suggested, and expect to see gas coal bought this time next year at a very considerable reduction compared with prices now ruling; but it would not be wise to count with certainty upon only paying advanced rates for the ensuing year.

So far as that period is concerned, the situation has practically been settled; for we hear on every hand of forward contracts being executed at rates above rather than below the price which, writing a month ago, we named as being that at which the next twelve months' requirements would probably have to be bought, unless the coalowners could be induced to adopt a more reasonable attitude. We then gave reasons for holding that there was little prospect of the collieries abating their demands, and spoke of 15s. 6d. per ton, "f.o.b." in the port of shipment, as likely to be the best terms to be had for Durham gas coal. We now hear, from a quarter in the market that is usually well informed, that the largest Metropolitan Company have purchased three-fourths of their requirements up to June of next year at prices equal to about another shilling a ton above that we estimated, which means, in round figures, a sovereign a ton "c.i.f." Such purchases (equal to about 1½ million tons) naturally serve, to a large extent, to fix the market for the period they cover.

What such a price for coal will eventually mean for gas consumers north of the Thames remains to be seen (for the Horseferry Road authorities will probably not make any pronouncement on the subject until after the close of the parliamentary session), though it can be fairly well surmised. The Chartered Company, it will be remembered, carried forward, after paying their last dividend, £193,333 —equal to about 2¼d. per 1000 cubic feet per annum on their output. Bearing in mind the high return for residuals this half year, and that the Company's present coal contracts do not expire until the end of June, they will probably have a carry-forward at that time equal to 3d. per 1000 cubic feet for the ensuing year. As, however, in addition to higher cost of fuel, Gas Companies have all of them to face heavy increases in the cost of materials required for repairs and renewals, and also for purification, it is not easy to see how, on the most favourable assumption, the consumer north of the river is to escape another 6d. on the present price of 2s. 11d.

A Hint to the London County Council.

During the past fortnight, London newspapers of all shades of political opinion have joined in the cry that the London County Council ought to step in and run the Thames steamboats, in order to save from extinction a time-honoured service, and preserve a valuable attraction to sight-seers. It is very curious to mark the diverse and ingenious ways in which this appeal to Municipalism to make good the failure of private enterprise is justified by the different journals. Of course, the organs of Progressive opinion have no hesitation in proving that this particular branch of municipal trading is all of a piece with the recognized "program" of the County Council. The newspapers which usually revile the Council and most of its works, as easily show that, if that body wants to make itself really useful to Londoners, this is its chance. The various journalistic voices, however, are hopelessly discordant when it comes to suggesting how the waterway of the Thames should be utilized for passenger traffic between bridges. It cannot be gainsaid that the old penny steamboats have not paid their way for many years, for a variety of reasons. First, and chiefly, the traffic is insufficient in quantity; and it is doubtful whether more could be attracted to the river route even by providing a fleet of new boats, with protection against the weather, and running frequently. A large amount of capital would be needed even to make an experiment, though otherwise nobody can say what might be the possibilities of the route. In the meantime, how clearly the situation thus disclosed proves the difficulty of settling the problem of municipal trading on general principles! It has been stated that the London County Council would not be justified in taxing the ratepayers to the tune of £5000 a year—the estimated loss on a river steamboat service—for this particular object. But that the object is in itself a desirable one is generally agreed. It seems also pretty clear that, if the County Council does not undertake to provide the service, nobody else will. Now, there is a way by which the Council well might do it, not only without throwing any additional burden upon the ratepayers, but even at a saving on its general budget. If the Council would only accept the verdict of Parliament and of the Royal Commissions on its "water policy," stop the waste of money on this hopeless account, and at the same time cease worrying the Gas Companies and all the other usual subjects of its superfluous attentions, the cash thus saved would more than suffice to place upon the river the finest passenger-boat service of any capital city of the world.

Sensible Trade Unionists in Council.

Really, if the Scottish Trade Unionists could be taken as fully representing the Trade Union movement, we should have to reconsider the attitude of reserve, not to call it suspicion and distrust, which the "Journal" has been driven to maintain with regard to the official Trade Unionism of England. The fourth annual Scottish Trades Union Congress was held last week in Edinburgh, and the Corporation of Edinburgh did not see fit to extend a municipal welcome to the gathering. This Corporation coolness was actually defended by the President of the Edinburgh Trade Council, who remarked that these formal municipal ceremonies result in the talking of a "certain amount of "platitude," which is a thing that "could not honour any "man;" and that therefore they might well be dispensed with. Shade of the Reformers' Tree! A Trade Union delegate objecting to what Thomas Carlyle used to call "windbaggery!" Any man who should speak in this sense in the South would be in danger of the London County Council. Of course, the President's address was tinged with "Labour Party" politics; but he said at least one memorable thing. Touching on the familiar question of such meetings—that of the direct representation of Labour in Parliament—the President remarked that he should "like "to see the working man in a different frame of mind before "payment of members and election expenses out of the "public purse came into operation." To introduce such a measure at present "would not advance labour repre-"sentation at all; it would only benefit the scallywag, the "'stickit' professional man, and gentlemen of like stamp, "who, with oily tongues and elastic consciences, would "reduce cajoling of the working man to a fine art." This is more common sense than has been heard at any Trade Union Congress whose proceedings we have followed. The last English one was rebuked by a lady member for its helpless, hopeless twaddling over generalities. The Scotsmen seem to be of a different mould; and if they go on like this, they will earn the respect of those who differ from them in some matters of opinion.

*** In our issue of the 24th of April, we published an article, headed "The Coal Famine and the Public," taken (as we stated) from "The Times" of the previous Thursday. We regret that the publication of the article was made without our first obtaining the permission of the Proprietors of "The Times" to its reproduction in our columns.

WATER AND SANITARY AFFAIRS.

In view of the projects already sanctioned and those which have been formulated for the construction of additional reservoirs in the valleys of the Thames and Lea, the subject of the rating of these important adjuncts of a water-supply system is one of very considerable interest, alike to the owners of the works of which they form an indispensable part and to the authorities of the parishes in which they are located. They necessarily occupy large tracts of land which might, but for their presence, be utilized for pasture, or possibly building, purposes. The Local Authorities in the Thames Valley view with no little concern the prospect of an almost unbroken chain of water reservoirs extending from Wraysbury to Hampton, inasmuch as, apart from the danger to health which they consider would be caused by the humidity of the atmosphere produced by this series of artificial lakes, the land in their vicinity would, as they assert, be deteriorated in value, and moreover—and this is a far more important matter from their point of view—these extensive structures would only be rated, as the law now stands, at one-fourth of their value. It is stated that the Hampton District Council lose in this way £1862, and neighbouring Local Authorities smaller sums amounting to £3650. It was only natural, therefore, that the above-named Council should endeavour to ascertain whether the existing method of rating reservoirs is the proper one; and they set about the work in a summary fashion by raising the rates in respect of the reservoirs of the Southwark and Vauxhall Water Company. The Company resented this attempted interference with the established practice, and declined to pay the higher charges. The matter came before the local Justices, who, it may be remembered, supported the view taken by the Council. But the Company appealed to the Higher Court, and were successful. Nothing daunted, the Council carried the case to the House of Lords, only to fail in upsetting the decisions of the two tribunals immediately below. The Council accordingly had, doubtless reluctantly, to conform to the law.

The dictum of the octosyllabic poet as to the condition of the man who complies against his will is, however, as true now as it was in the time of the Commonwealth. The Council are "of their own opinion still;" and it is shared by their neighbours at Sunbury, as well as by other Local Authorities in the Thames Valley and elsewhere. It was notified in the "Journal," shortly after the pronouncement of the decision of the House of Lords, that steps would be taken to obtain an amendment of the law, and that a conference would be convened for the purpose of considering the best method of proceeding. This, as will be seen by the report which appears in another column, was held last Wednesday, at the Cannon Street Hotel, and was numerously attended. The initiative in the matter was taken by the Sunbury District Council, whose Clerk (Mr. C. E. Goddard) undertook all the preliminaries in connection with the meeting. The tone of the speeches was, on the whole, moderate; the few very hard words used having reference to the existing law rather than to those who are only acting in accordance with it. The Local Authorities consider that large receptacles for the storage of water which have been formed by the skill of the engineer for the use and to the profit of a commercial undertaking should be rated on a higher scale than natural ponds or lakes, on which no such skill has been brought to bear; in other words, that the latter are, in the language of the statute, "land covered with water," whereas the former are, so to speak, storehouses of water, and part of the machinery by which the supply is furnished to the consumers. They are, it is stated, supported in this view by no less a legal luminary than Mr. Littler, Q.C., the Chairman of the Middlesex County Council, as well as by Sir F. Dixon-Hartland, M.P., the Chairman of the Thames Conservancy Board. On the other hand, the Companies have the support of the law as well as several decisions enforcing it.

In the last of these judgments in their favour—the one which has given rise to the present movement—the Lord Chancellor emphasized the point that when Counsel was asked: "If a reservoir is not land covered with water, what is it?" he was unable to give any other reply than that it was "a reservoir." His Lordship confessed his inability to understand the ground on which he and his learned brethren were asked to "disturb, or throw any "doubt upon," the construction of the words which had prevailed for a very considerable period. He thought the case was perfectly clear; and the Council's appeal was dismissed, with costs. As already mentioned, the parties aggrieved by the law as it stands took the first steps in the direction of obtaining its amendment at the conference last Wednesday, when it was unanimously resolved to form an Association of Local Authorities to take up the matter, and apply to the Home Secretary and the President of the Local Government Board to bring in a Public Bill to carry out the object sought. Should this be done, the Water Companies, whose revenues would be considerably affected by the proposed change in the basis of rating, will have to incur further expense in defending their interests from attack, although they are admittedly not responsible for the law which will give rise to it.

North British Association of Gas Managers.—The Secretary of the Association (Mr. R. S. Carlow, of Arbroath) has issued the usual circular preliminary to the annual meeting, which will take place in Edinburgh next July, under the presidency of Mr. W. Ewing, of Hamilton. He reminds the members that the Committee are now making the necessary preparations for the gathering, and invites their co-operation in rendering it at least equal in interest and profit to any of the meetings which have preceded it.

Sulphate of Ammonia Manufacture in France.—Supplementing the particulars on tar distillation in France recently reproduced in the "Journal" from the "Génie Civil," this publication has lately given the following: "In the North and North-West districts there are two kinds of sulphate producers—first, the gas-works, particularly the two at Lille, which sometimes manufacture alkali and at other times sulphate; then the works at Roubaix, Tourcoing, and Rouen. The entire production of these works cannot be ascertained; but the combined gas-works of France, except those of Lyons and Paris, which are classed separately, produce 4000 metric tons of sulphate. In addition to these sources are the regenerative coke-ovens."

A Century of Chemistry at the Royal Institution.—Professor Dewar, Fullerian Professor of Chemistry, on Thursday last delivered at the Royal Institution the first of a series of four lectures on the above subject. He said Davy and Faraday dominated the Institution for fifty years, and commenced the investigations which they were carrying on at the present day. The work done by these professors laid the foundations of the present modes of work. Davy was probably one of the most remarkable geniuses of the age, on account of the methods of experimental work which he taught. Alluding to Davy's work at the Royal Institution, Professor Dewar mentioned his experiments in connection with water gas, analyzing air, and measuring gases; and he gave examples of the methods adopted by him, and the results obtained.

The Bacterial Treatment of Crude Sewage.—As a supplement to the second report on the bacterial treatment of crude sewage at Barking and Crossness, to which reference was made in the "Journal" for the 24th of October last (p. 998), Dr. Clowes and Dr. Houston have presented to the Main Drainage Committee of the London County Council some notes on the deposit which accumulates on the coke fragments of beds. The deposit contains some fine particles of coke and sand grains, and also cotton and woollen fibres and diatoms; but it consists largely of chaff, straw, and woody fibres. As this deposit increases, the capacity of the beds decreases. A series of gaugings of a 13-feet coke bed showed that the decrease of capacity was proceeding at the rate of 1 per cent. of the original capacity per week. Dr. Houston says the practical bearing of his experiments seems largely to depend upon whether the effluent is discharged into a stream used for drinking purposes, or otherwise.

Gas Undertakings and the London Building Act.—Gas undertakings in the Metropolis have recently been held (in the case of the Wandsworth and Putney Company) to be subject, in regard to the construction of gas-works or other buildings, to the provisions of the London Building Act of 1894. It is not perhaps generally known that a tribunal exists to which applicants for consents under that Act, who may deem themselves aggrieved by the decisions of the London County Council or the District Surveyors, or by the conditions attached to such consents, may appeal; and, moreover, that the tribunal has power to hear appeals either by the parties interested in person, or by counsel, solicitor, or agent, as the appellant may desire. The course of appearing in person, or by agent other than a lawyer, is naturally the least expensive, and a manual has been prepared by Mr. C. H. Love (Clerk of the Tribunal) for the guidance and assistance of appellants so desiring to be heard. All the regulations as to the procedure to be followed, and fees to be paid, in respect of such appeals, and the constitution and powers of the tribunal (which is composed of three members, appointed severally by a Secretary of State, the Council of the Royal Institute of British Architects, and the Council of the Surveyors' Institution), are explained at length; a schedule of the appeals heard and decided up to the present time is appended; and a suggested form of notice of appeal is given. The book is published by Messrs. P. S. King and Son, of Westminster.

INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS,

MAY 1ST AND 2ND, 1900.

Mr. J. W. HELPS, M.Inst.C.E., of Croydon, President.

INAUGURAL ADDRESS.

Gentlemen,—In placing me in the presidential chair, you have done me an honour which I need hardly say I appreciate more highly than I can find words to express; and although the position is one which brings with it many responsibilities and some anxiety, I trust that, with your assistance and forbearance, I may succeed in carrying out the duties of the office in such a manner as to merit your approval.

It will, I think, be naturally expected that some portion of my remarks will be devoted to the consideration of the suggested amalgamation of this Institution with the Gas Institute. Inasmuch, however, as the matter will be laid before you at a later period of our proceedings, I do not propose to deal with it in any detailed manner.

No one interested, however little, in the gas industry can possibly consider the present position of affairs, and the condition which has prevailed during the past ten or twelve years, without coming to the conclusion that the existence of two Institutions, each claiming to represent the gas engineering profession, is unwarranted, and not only likely to cause a certain amount of unnecessary personal feeling between members of our profession, but liable to interfere with that progress and prosperity which I feel sure it is the wish of all concerned to see associated with our industry. The circumstances connected with the unhappy events which eventually led to the secession of so many members of the Gas Institute, and to the formation of a new Society, must be too well known to need any present comment.

For some time past, members of both Institutions have taken frequent opportunities of discussing the subject, and of testing the feelings which might exist among the members of the two Societies with regard to reunion; and when the matter came to be more formally approached, it was gratifying to find that apparently no difficulty existed which was in any way likely to prove an insuperable obstacle. As you have already been made aware from the report of the Council, a small Joint Committee was formed, who, after holding several meetings, and carefully and dispassionately discussing the whole question, eventually formulated a set of rules which, while differing in one or two particulars from those of the present Societies, should, I think, provide a basis for a thoroughly sound and representative body.

It will be at once apparent that the difficulties which will have to be surmounted by the Gas Institute are greater than in our case. A glance at the new rules governing the qualifications for membership will make it obvious that many of those belonging to the Institute will be no longer eligible. I, of course, allude to those who, though interested in the gas industry, are not practically engaged in the management or direction of gas undertakings, but who owe their inclusion to the fact that they are concerned in the supply of various apparatus, material, &c., used in or about a gas-works. Now, while acknowledging the many advantages which might accrue to an Association from the inclusion of the names of many of these gentlemen, and while recognizing the many benefits which our industry has derived—and will, I trust, continue to derive—from their efforts, I cannot help feeling that the experience of past years indicates that it is necessary for the success of an Institution which is to represent our profession, that it should be constituted of those actively engaged as Gas Engineers or Managers, and of those only; and I am strongly of opinion that this belief is shared by the principals of most of the firms who are directly or indirectly represented in the Gas Institute.

The success of the industry means much to the welfare of such firms; and surely it would be a suicidal policy on the part of their principals to persist in any action which the members of our profession might view as distasteful. I have far too great a belief in their common sense, as well as in their ideas of justice, to think that for one moment they will permit any action on their part to interfere with the efforts of those who are at the present time striving to bring about the much-to-be-desired re-union. Should the scheme be favourably received and eventually accepted, our industry would be represented by a body which, numbering about 800 members, and having an annual revenue derived from subscriptions alone of nearly £1500, should, I cannot help thinking, be strong enough and wealthy enough to be capable of carrying out more useful and more important work than has so far been achieved by any such Association.

I do not think it can be denied that, in the earlier days of gas manufacture, managers of works were men who held their positions by the possession of strong natural intelligence and undoubted energy, but who, through no fault of their own, were hardly possessed of that early training which fitted them for acting in any other capacity than that of manager. The consequence naturally was that when extensions were required, and the services of a consulting engineer not called in, the preparation of drawings and submitting of plans and specifications were left to the contractors, while matters requiring chemical knowledge of anything more than an elementary character were probably altogether neglected. The result has been, therefore, that much of our engineering progress, and much that we have learnt of the chemical side of our profession, is due to the efforts of those somewhat outside our immediate circle.

Now I do not, of course, mean in any way to belittle the efforts of those who bore the burden and heat of the early, and probably troublesome, days of gas manufacture. There are many whose names could surely not be included in such a category as I have above sketched, and many who, though not either strictly speaking engineers or scientists, have left their mark on the field of progress of our industry in no indistinct fashion. In spite, however, of the spread of education, and more especially of technical education, which has enabled the youth of the present day to acquire information with the minimum of exertion and but little expense, I am forced to the conclusion that it is anything but creditable to the gas industry of Great Britain that it has taken so little share in the promotion of scientific education generally, or in providing facilities for chemical and physical research, or experimental engineering.

I do not intend to recapitulate the suggestions which were contained in my Presidential Address to the members of the Southern District Association of Gas Engineers and Managers in 1897, nor the stirring words in which our ex-President referred to the same question in his address before this Institution last year—I refer, of course, to the "Establishment of Experimental Works and Chemical Laboratories." The subject, however, is to me of such paramount importance that I am loth to lose the opportunity of again bringing it before you to-day. So far, the various suggestions made have failed to provoke any discussion in the columns of the Technical Press—and this in spite of certain editorial allusions, which certainly paved the way for the full consideration of the questions involved. Let me content myself for the present by asking you, and indeed all members of our profession, whether, in the event of the amalgamation to which I have alluded being brought about, a fitting opportunity does not present itself for the formation of a strong Committee to carefully consider the advisability of establishing in some way or other a Chemical and Physical Laboratory, with properly qualified principal and assistants.

Our industry owes a debt of gratitude to those companies and corporations who have recognized the value of the services of skilled and trained chemists on their staff; and the services that these chemists have rendered to the industry cannot be too highly appreciated. Again, many engineers are themselves chemists of repute; and the work that they have done in this direction I, for one, wish to heartily recognize. But, appreciating as I do the fact that upon chemical investigations and physical research the prosperity of our industry depends in no small degree, I am bound to say that the efforts of those to whom I have alluded are not sufficient to bring about such satisfactory results as would be obtained if supplemented by the work

which could be so well and thoroughly carried out in a properly organized and carefully managed laboratory.

There is, I fear, but little doubt that the outlook for gas companies is at the present moment darker than it has been for many years. The extraordinary rise in the price of coal—which I believe I am right in saying is quite unjustified, and due to causes which, in my judgment, have never been satisfactorily explained—appears to me to render it absolutely necessary that gas companies generally throughout the country should make a considerable addition to the selling price of gas. Now, although such a rise can hardly need any justification in the eyes of the public, still it goes without saying that such an action is likely to have a prejudicial effect on the consumption of gas, especially as the rise in price must give to electric lighting authorities a certain advantage of which doubtless they will not be slow to avail themselves.

Oil, too, has—no doubt partly as a natural consequence—nearly doubled in price, and this will add very considerably to the cost of the manufacture of carburetted water gas. It will not, however, as far as I am at present in a position to judge, increase the expense to an extent equal to that which will be the case with coal gas—assuming that coal contracts are made at the prices which are at present being demanded. It is therefore in this serious crisis the duty of all engineers and managers to consider very carefully every claim which promises to reduce the cost of delivering gas to the consumer, and also the best methods of keeping up the consumption under the altered conditions.

With regard to the first point, over two years' experience of the manufacture of water gas strengthens my belief that gas companies possess in this process a means whereby the cost of producing gas can be kept lower than would otherwise be possible. This may not, of course, prove to be the case generally—so much naturally depending on local circumstances; but that it has been the experience of the Company with which I am more particularly interested, I will endeavour to show.

The manufacture of water gas was commenced at Croydon in January, 1898; the necessary enrichment prior to that date being obtained partly by means of cannel, and partly by carburine in the Maxim-Clark carburetter. The average illuminating power of the gas in 1897 was 15·01 candles; and the cost of gas into the holder was 14·10d. per 1000 cubic feet, as shown by the following figures.

1897.

Dr.	£	*Cr.*	£
Coal and cannel, &c.	43,486	Coke	15,826
Purification	1,457	Breeze	1,362
Salaries	1,812	Tar	3,748
Wages	9,161	Sulphate	2,897
Repairs and maintenance	7,433		
	£63,349		£23,833
	23,833		

£39,516 = 14·10d. per 1000 cubic feet made.

I should mention that in the above year the charge for wear and tear was unusually low; being only 2·86d. per 1000 cubic feet made, against 3·60d., the average of the seven previous years. Had the figure, therefore, for 1897 been the same, it could easily be seen that a considerable addition would have to be made to cost of production.

The cost of making gas of an illuminating power equal to 16·15 candles in 1899, when about 30 per cent. of carburetted water gas was used, was 13·07d. per 1000 cubic feet, made up according to the following figures.

Dr.	£	*Cr.*	£
Coal and oil	43,674	Coke	20,535
Purification	2,549	Breeze	1,478
Salaries	1,939	Tar	2,655
Wages	8,254	Sulphate	3,283
Repairs and maintenance	11,531		
	£67,938		£27,951
	27,951		

£39,987 = 13·07d. per 1000 cubic feet made.

I have taken the above figures for 1899, and having calculated the amount of coal and cannel necessary to produce the gas made of the required illuminating power—5 per cent. of Boghead cannel (which, I believe, is a low estimate) being assumed as necessary—I have substituted this material for oil, and have thus obtained the following estimated statement, which shows that the cost of gas would have been 14·71d. per 1000 cubic feet, or 1·64d. per 1000 cubic feet in excess of what it was as shown by the published balance-sheet.

Dr.	£	*Cr.*	£
Coal and cannel	56,540	Coke	28,007
Purification	1,529	Breeze	2,070
Salaries	1,939	Tar	3,300
Wages	11,012	Sulphate	4,594
Repairs and maintenance	11,531		
	£82,551		£37,971
	37,971		

£44,580 = 14·71d. per 1000 cubic feet made.

I should state that in the above figures the allowance for coke is calculated on the full average price realized; although I think I should have been justified in taking it at a lower rate, as I believe that had the excess quantity been produced, the price received per ton for the whole would have been somewhat lower. I have adopted the same principle with regard to breeze, tar, and sulphate of ammonia; while on the other side, purification and wages have been charged on the average of the four previous years—a slight addition, however, being made to the wages to compensate for the rise granted to workmen in the year 1898.

It may now be of interest if I give the actual cost of manufacturing carburetted water gas in 1899. I may say that great care has been exercised in keeping the accounts, both for labour and material, entirely separate from those dealing with coal gas manufacture, &c.; and this has been rendered practicable by the fact that our two plants are absolutely distinct up to the point where the gases unite at the mixing cylinder prior to entering the holders.

Carburetted water gas produced = 211,189,000 cubic feet.
Average illuminating power, 19·90 candles.

Cost of production:—

	£	d.	
Coke at 17s. per ton	2,970	3·261	per 1000 cubic feet.
Breeze at 7s.	269	·306	,, ,,
Oil at 2¾d. per gallon	6,685	7·597	,, ,,
Manufacture	1,278	1·453	,, ,,
Purification	862	·980	,, ,,
Wear and tear	620	·710	,, ,,
Water	176	·200	,, ,,
Salaries	571	·650	,, ,,
		15·157	
Credit Tar sold, £87 = 0·098d.			
,, Breeze ,, £199 = 0·227d.			
		·325	

Net cost per 1000 cubic feet = 14·832

The above figures show, therefore, that to manufacture 1000 cubic feet of carburetted water gas of an average illuminating power of 19·90 candles cost 14·83d., or only 0·73d. more than the cost of manufacturing 15·01-candle power coal gas in 1897. The increase in illuminating power was thus equal to 4·90 candles. But as only 30 per cent. of the carburetted water gas was required to produce a mixed gas of an illuminating power of 16·15 candles, or an increase of 1·14 candles, it follows that the cost per candle for enrichment would be 0·73d. ÷ 3 ÷ 1·14 = 0·21d. per 1000 cubic feet.

It will be noticed that I have taken the enrichment as equal to 1·14 candles, although in reality it was 1·75 candles, as the average illuminating power of the coal gas produced was only 14·40 candles. As, however, I have taken the cost of manufacturing 15·01-candle power coal gas in my calculations, and as I have no figures to show the actual cost of manufacturing gas from north-country coal without any enrichment whatever, I have estimated the extra enrichment to have been 1·14 candles.

I have already stated my belief that the decrease in the production of coke must have a beneficial effect on its price. This is, however, a contention not easy to prove by figures; and I have therefore charged the coke used in manufacture at the average price realized throughout the year. There are many advantages arising from the use of carburetted water gas which it is needless for me to mention, as they have been brought before you so frequently. I should, however, like to draw attention to the facilities carburetted water-gas plant affords to an engineer for working his coal-gas plant to the best possible advantage, more especially with regard to letting down and starting of retorts, and keeping them under slow fire. This is, of course, an advantage to which it is not easy to assign a definite pecuniary value. I may, however, state that in 1897 we let down and started retorts on 37 occasions; while in 1898 and 1899 the figures were 21 and 18 respectively. This must, I think, represent some appreciable

saving in coke and labour, as well as in wear and tear on the retorts themselves.

Having now placed before you some of the advantages of the use of water gas, I think, to be perfectly fair in the matter, I ought to mention one or two points, in which carburetted water gas fails to compare favourably with coal gas. I have during the past year made a great number of experiments on the comparative calorific values of coal gas, pure water gas, and the mixture of the two, and also upon the illuminating values of each consumed in burners other than the standard argand; and I am bound to confess that my results are not quite as favourable to carburetted water gas as my thorough belief in its general merits would lead me to desire.

I do not intend to give my results in detail, especially as this will probably be done, at any rate in the case of calorific value, in a paper which is to be brought before us during our proceedings. I will therefore content myself by giving a few general results at which I have arrived.

In testing for calorific power, I have used the Dowson calorimeter, and I give the results (after allowing for condensed water) in British thermal units. It is somewhat difficult to make comparisons in a manner which shall be perfectly just to carburetted water gas. Using as we do ordinary Durham coal, and producing from it (say) 10,700 cubic feet of gas per ton, it is hardly practicable to obtain a gas of a higher average illuminating power than 14½ candles. On the other hand, in order to obtain the requisite enrichment, we usually manufacture carburetted water gas of about 20 candles. Apparently, therefore, the only way to make a comparison between the calorific powers of the two is to calculate the number of British thermal units represented by 1 candle of illuminating power in each case; and my experiments lead me to believe that this method is not quite fair to the carburetted water gas. I find that as the illuminating power of the coal gas is lowered, the higher will be the results obtained in British thermal units per candle; while the units per candle in the case of carburetted water gas will be lowered as the illuminating power is raised. For instance, when comparing coal gas of an illuminating power of 14·06 candles with carburetted water gas of 23 candles, the comparison is as 40·6 British thermal units per candle is to 26·6 British thermal units—a difference of 35 per cent.; while when 15·76-candle power coal gas was compared with 18·70-candle carburetted water gas, the former gave 36·8 units per candle, and the latter 31·5 units—a difference only of a little over 14 per cent. Had I been in a position, after appreciating this point, to compare the gases under conditions more equal as to illuminating power, I feel sure the difference between their calorific values would have been still further reduced.

With regard to the illuminating power available from coal and carburetted water gas, or from the two mixed, when consumed in burners other than the standard argand, I have made a number of experiments of which a short *résumé* may be of interest. The burners used were as under—

Sugg's governor burners 4 ft., 5 ft., and 6 ft.
Goodson's 5 ft. governor burner.
Hawkins and Barton's governor burners 5 ft. and 4 ft.
Bray's 6 ft. special.

The comparison I have adopted is somewhat similar to that used in the previous set of tests—*i.e.*, I have compared the value of the above burners with 1 candle as obtained in the argand burner. For instance, supposing the argand gave an illuminating power of 15 candles, and the Sugg's governor burner 10 candles, the value of the latter would be represented by the figure 0·66 of a candle. I found that with coal gas the value varied from 0·81 of a candle to 0·60; the former value being given with a 6 ft. burner, and the latter with one governed to pass 4 ft. only. The average of my results was 0·74 of a candle. With mixed gas (the amount of carburetted water gas being about 30 per cent.), the results varied from 0·73 to 0·68; the average being 0·71. With carburetted water gas, the values varied from 0·72 to 0·59; the average being 0·66 of a candle.

The conclusions to which these results point, therefore, are—

1.—That a mixture of 30 per cent. carburetted water gas and 70 per cent. coal gas gives a result, when burned in the above-mentioned ordinary burners, averaging about 4 per cent. less than that obtained from coal gas alone.

2.—That carburetted water gas (of an illuminating power varying between 17 and 20 candles) gives a value averaging over 10 per cent. less than those obtained from coal gas consumed in similar ordinary burners.

As I have already said, my results are not as favourable as I should have liked to have seen them; still I am confident that, after taking them into careful account, the balance of advantage undoubtedly remains on the side of carburetted water gas. It should be, I believe, possible to produce a burner of the ordinary type, whereby the illuminating power obtained from the mixed gas—which, of course, is the important point—may be considerably improved; and with regard to calorific values, I am inclined to the belief that the higher flame temperature of the carburetted water gas makes up to some extent for a portion of its deficiency in this respect.

I approach with some diffidence the question of the effect which carburetted water gas has on naphthalene deposits. I believe it has been stated by some that the use of this gas has almost entirely done away with the trouble from this cause. I am bound to admit, however, that my experience does not bear out this statement. I do not mean to say that carburetted water gas has no effect whatever on the amount of naphthalene deposited; but I fear I cannot say that our total number of complaints caused by stopped service-pipes has been less during the past two years than it was formerly.

It must, I think, be admitted, however, that complaints received during the winter months are more difficult to deal with than those which engage attention during the summer season; and since we commenced to use carburetted water gas, it is very certain that, while the trouble in summer has shown an increase, our winter difficulties have declined to a most appreciable extent. To deal thoroughly with this question would require more time than I have at my disposal—even if I were to devote to it the whole of my address. I feel, however, that the matter is of so much importance that I should fail in my duty if I were not to give to it something more than a passing allusion.

The naphthalene difficulty has, I believe, been an ever-present one with us in Croydon; and looking at the manner in which stopped pipes are usually dealt with, it is somewhat of a mystery to me why the whole of the mains and services are not absolutely blocked with accumulated deposits. The only possible explanation is that under certain conditions gas has the power of picking up and carrying to the burners for consumption certain quantities of naphthalene previously deposited. The chemical aspect of the question has been, and still is, engaging the attention of more than one experienced chemist, and lately we have been somewhat startled by the theory that it is possible for naphthalene to be produced in the distributing system from gas which entered the mains and services practically free from it; the principal evidence adduced in favour of this theory being apparently the inability of its author to throw down from the gas as it enters the mains anything like a sufficient quantity of naphthalene to account for the deposits afterwards encountered. I think we shall require evidence of a very much stronger character before this theory can be credited. The author also expressed an opinion that variations in temperature have but little effect on the deposition of naphthalene. Well, I do not mean to attempt a theoretical dissertation on this subject; but I must say that the experience I have gained of late years strengthens me in my belief that, given a gas so produced as to contain naphthalene, the deposition of the latter in the mains is almost entirely a question of change of temperature—that is, of course, assuming that no previous steps have been taken to remove it.

In proof of my contention, may I ask your consideration for a few moments of the conditions existing at Croydon. Our experience leaves little doubt in my mind that the gas as we produce it does contain sufficient naphthalene to generally saturate it at the particular temperature at which it enters the holders. The total quantity to do this may be but small; and I believe that gas which contains but a few grains per 100 cubic feet is capable of depositing naphthalene in the mains when subjected to a considerable reduction in temperature.

This question of saturation is, of course, dependent on certain chemical laws; and it is, I believe, being carefully considered in more than one quarter at the present time. Now, although I am not absolutely certain on the point, I

firmly believe the carburetted water gas made at Croydon is practically free from naphthalene. I have, however, no stronger evidence in favour of this belief than the fact that the tar produced in the manufacture, when carefully tested by a chemical expert, was found to contain no measurable trace of this hydrocarbon. Assuming, therefore, that carburetted water gas is being used to the extent of 30 per cent., the mixture entering the holders is composed of this proportion of a gas free from naphthalene, and 70 per cent. of coal gas containing just as much naphthalene as it can hold at the particular temperature which exists. The result is (especially as the carburetted water gas is generally of a higher temperature than the coal gas) that the mixture becomes under-saturated. It then enters the holders; and should this take place in summer, it is exposed to the heat of the sun, under which conditions its degree of saturation is further reduced. My contention, therefore, is that, in leaving the holders, the gas exists in a condition in which it may be assumed to be capable of picking up old naphthalene deposits, until it may become saturated; and as it cools in travelling through the underground system, the naphthalene is again deposited—the result being, as I have before stated, that our troubles from this cause are considerably greater in summer than in the winter months.

I think further evidence in support of this statement is found in the fact that since our adoption of carburetted water gas the inlets and outlets of our holders, which previously were constantly becoming stopped, have given no such trouble; and on examining them quite recently, I found them practically free from deposits. In winter, the conditions are reversed. Both the coal and oil gases are colder on entering the holders; and as these during the winter months are probably the coldest portions of our plant, it is quite possible that in their interiors some portion of the naphthalene may be deposited. On entering the mains, it is highly probable that the temperature to which the gas is subjected is higher than that which existed in the holders themselves. It is therefore more likely that old deposits of naphthalene should be picked up, than that new ones should be thrown down; and I think this idea is supported by the fact that at such times the illuminating power of the gas at Croydon suffers no reduction in travelling from the works to our testing-station nearly two miles distant. Indeed, it is true, although I make the statement with a certain amount of diffidence, that during the year ending Dec. 31 last, the average illuminating power of the gas as tested at the works was 16·10 candles, while at our town testing-station it was 16·15 candles.

In dealing with the question of naphthalene, it seems to me there are two or three courses open: Either to manufacture the gas (as appears quite possible) so that it shall not contain sufficient naphthalene to cause solid deposits under the varying conditions to which it may be subjected; to so produce it that any naphthalene it may contain shall be deposited simultaneously with the deposition in a liquid form of some other solvent hydrocarbon of similar vapour tension, and so avoid the solid formation; or, in the event of the gas containing enough naphthalene to cause trouble, to remove this on the works by passing it through some suitable solvent, or to deal with it in the mains by some such process as that known as the Hastings carburation process, which I contend is simply a form of washing under another name, but which has this advantage that not only is it less expensive than the process of washing on the works in the matter of solvent used, but it removes less of the illuminating qualities of the gas, as it is only necessary to use sufficient oil to remove that proportion of the naphthalene which would otherwise be deposited under the varying conditions in the mains. I had hoped to be in a position to give you my personal experience of this process; but circumstances unfortunately prevented my being able to get the apparatus into use as early as I expected.

As I previously said, it is not my desire to enter deeply into the strictly theoretical side of this vexed question, but rather, by stating facts which have come under my notice, to render some assistance to those more able than I, who are engaged in the investigation of the subject from a purely chemical standpoint; and it is with this object in view that I venture to give you some particulars relative to the deposition of naphthalene in my own district as compared with that of one of my neighbours—I allude to the town of Redhill—where naphthalene has apparently never shown itself in any shape or form, while, as I have before said, in Croydon it forms the source of one of our principal difficulties. In both these towns, practically the same descriptions of coal are used. Regenerative settings and fairly high heats are common to both works, although in Croydon the make per ton is somewhat higher than at Redhill, while at the former place manual stoking machinery is partly used.

The principal difference in the treatment of the gas commences after it leaves the retorts. At Croydon, steps are taken to remove the tar from the hydraulic, and to keep the gas separate from the tar as much as possible, annular condensers being also used. At Redhill, however, a tar-seal is used in the hydraulic; while the gas and the tar travel together through a long length of foul-gas main, which forms the only condenser. On carefully considering the matter, I came to the conclusion that the principal reason for the absence of naphthalene in the Redhill gas was to be found in the fact that this hydrocarbon was abstracted from the gas by the tar as they travelled together in the foul-gas main; and I assumed that if this were the case, it would be only natural to expect that the Redhill tar would contain a larger percentage of naphthalene than would be found in that produced at Croydon. I therefore had samples from both works carefully tested, and, somewhat to my surprise, the results showed that while the tar from the former works contained 5·7 per cent. of naphthalene, that from the latter contained 8·5 per cent.

These tests were only made during the last few days, and I have had no time to carry the investigation further. But the slight consideration I have been able to give to the matter since, seems to point to the probability that the freedom from deposits in the former district is rather due to the fact that the mode of manufacture results in a gas being produced containing so little naphthalene that no difficulty is experienced with it afterwards, than to the absorption of naphthalene being effected by the treatment to which the gas is afterwards exposed.

In connection with the purification of carburetted water gas, some difference of opinion, I believe, exists as to the relative advantages of the use of oxide of iron and lime; and although views on this subject must be considerably modified through the great rise in the price of oil, I still venture to give some particulars of experiments I have made on the question.

The average of a very considerable number of tests shows that the amount of carbonic acid present in carburetted water gas as it enters the purifiers is about 3·8 per cent.; while sulphuretted hydrogen exists to the extent of from 200 to 250 grains per 100 cubic feet, with about 5 to 7 grains of sulphur compounds. To ascertain the loss of illuminating power due to the presence of carbonic acid, I have made numerous experiments by testing the gas for carbonic acid before and after its passage through the oxide purifier, and again at the outlet of the lime purifier; the illuminating powers of the gas being also carefully recorded. The average results are shown in the following table:—

Illuminating Power.			Carbonic Acid.		
After Oxide.	After Oxide and Lime.	Difference.	Before Oxide.	After Oxide.	Difference.
14·58	18·24	3·66	4·08 p. ct.	3·85 p. ct.	0·23 p. ct.

Difference = 0·98 of a candle for 1 per cent. of carbonic acid.

The above figures show that the loss due to 1 per cent. of carbonic acid is higher than is usually estimated. But they are the results of a long series of experiments; and I give them for what they are worth. It will also be noticed that the oxide of iron apparently absorbs an average of about 0·23 per cent. of carbonic acid—a somewhat strange result, and one which I will not attempt to explain beyond saying that it may be possible that the presence of sulphuretted hydrogen in the gas at the inlet to the oxide purifier may have had some influence on the tests.

Now, taking the value of a gallon of oil at 7 candles per 1000 cubic feet, to make up for 3¼ candles loss due to the presence of carbonic acid, an extra half-gallon of oil must be used, the value of which, at 3d. per gallon, is 1·50d. From this amount must be deducted the value of the extra

volume due to the presence of carbonic acid (say) 0·56d.; and if an addition of 0·10d. be made to cover the cost of oxide purification, a figure of 1·04d. is obtained, to compare with the 0·98d. which I have stated to be the cost of purification by lime in Croydon. It would therefore appear that, even with oil at 3d. per gallon, the advantage rests with the process which effects the abstraction of carbonic acid. I am of opinion that lime in (say) four boxes of ample size, and oxide in a final catch-box, forms a most economical combination; the objection to it being that at times the oxide fails to act on the small traces of sulphuretted hydrogen with which it has to deal, and unfortunately the use of Weldon Mud (of the action of which in connection with the removal of the last traces of sulphuretted hydrogen in coal gas I cannot speak too highly) is impossible under the conditions, as at times it would be liable to receive carbonic acid.

Earlier in my address, I stated that, in addition to his endeavour to cheapen the cost of production, the engineer should do his utmost to popularize the use of gas. Now there is little doubt that what is known as the prepayment system has given to gas engineers a ready means of fulfilling this latter requirement. I hope, therefore, I may be excused if, before concluding, I give a few facts and figures relative to its working in the Croydon district.

The supply of gas on the prepayment principle was adopted in 1889. Under this system, houses are provided with the necessary fittings, including a meter whereby the inspector, by means of a special key, is able to secure to the consumer a certain quantity of gas for which he pays in advance—a weekly rent of 2d. or 3d. being charged according to the fittings supplied. In 1894, my Company took over the outlying districts of Carshalton, &c. Here it was decided to make a trial of the penny-in-the-slot system; and we have therefore had an opportunity of comparing the merits of both principles.

I am afraid that gas companies are rather inclined to base their estimates of the success of prepayment systems upon the usually rapid increase in the number of those adopting them, and to neglect the consideration of the main question—viz., whether the venture is a really paying one at the prices charged, *especially when compared with the terms offered to ordinary consumers.*

At the end of last year, the Croydon Company had 14,604 meters in use, 4539 of which were on the prepayment, and 379 on the automatic principle. The average consumptions per consumer were as under.

Ordinary	61,000 cubic feet.
Prepayment	18,600 ,, ,,
Automatic	15,800 ,, ,,
Average	47,000 ,, ,,

In 1889, the average consumption per consumer was 61,000 cubic feet; so that, notwithstanding the fact that the number of stoves on hire had increased from 1080 to 6200 at the end of 1899, the consumption per consumer had been decreased to 47,000 cubic feet, which, of course, points to the probability of the cost of distribution having considerably increased.

The following table shows the capital expended under the various systems, also the amounts received for gas and rental of meter, fittings, &c., and the percentage on the total represented by such rental. I should say that service-pipes are not included in these figures,

	Amount received for Gas.	For Rental.	Total Expenditure.	Percentage of Rental on Outlay.
Ordinary	£67,935 2 0	£3,593 10 0	£37,410 4 0	9·60
Prepayment	8,985 14 0	2,394 14 0	19,412 11 3	12·33
Automatic	759 11 0	166 17 0	2,036 7 1	8·20

The average amounts expended on the several classes of consumers are as under.

Ordinary	£2 18 5
Prepayment	4 9 9
Automatic	7 8 5 (including cooking-stove)

The charge for gas in Croydon is at the rate of 2s. 8d. per 1000 cubic feet, and in the Carshalton district 3s. 5d., with an additional 9d. per 1000 cubic feet for rent of fittings, &c., where automatic meters are used.

Now the actual cost of dealing with the three systems has been accurately kept; and the following table will, I think, supply definite information as to the conditions under which the various consumers are paying for the gas supplied.

	Ordinary. s. d.	Prepayment. s. d.	Automatic. s. d.
Gross amount received per 1000 cubic feet, inclusive of rents, &c.	2 9·60	3 2·54	4 2·00
Cost of collection, inspection, bad debts, 10 per cent. depreciation, &c.	2·28	8·79	1 2·15
	2 7·32	2 5·75	2 11·85
Price of gas	2 8·00	2 8·00	3 5·00
	0·68	2·25	5·15

It will thus be seen that, while the automatic and prepayment consumers are being supplied with gas at 5·15d. and 2·25d. per 1000 cubic feet respectively under the selling price, the ordinary consumer is paying within 0·68d. of the full amount. In these calculations the principal charges are for depreciation, &c.; and this is apparently unduly large in the case of the automatic system. The reason for this is that the cost of the stove must be included in the outlay, while no extra rent can be charged; for it would be manifestly unfair to levy a rent for a piece of apparatus which leads to an increased consumption of gas, upon each 1000 cubic feet of which an extra charge is made to meet the added expenditure.

It is true that in Carshalton the consumers do not live so closely together as is the case in Croydon; and this may somewhat increase the expenses attending the working of the former system. It is nevertheless a little surprising to find that the cost of collection, inspection, and office expenses in the case of the automatic system is 3·03d. per 1000 cubic feet, as against 2·89d. with the prepayment meters. In the case of the former, the collector and assistant can only make 300 visits weekly; while with the latter one inspector attends to 700 consumers each week. It would appear, therefore, from the above figures that the prepayment system is really cheaper to work than is the automatic; and that it has many advantages over the last named, our experiences in Croydon undoubtedly prove. There are two objections which will probably be raised against the Croydon system; the first being that there is a danger of a consumer being left without gas at an inopportune moment, and secondly that a consumer may not always be prepared to pay the amount demanded for the gas he requires.

I must confess that the first objection does constitute a difficulty. Still, I can safely say that such occurrences are far rarer than might be supposed; while with regard to the second, I can only say that I rarely, if ever, hear of an instance in which the objection is raised.

On the other hand, prepayment meters work so accurately that it is never found necessary to make any adjustment between the amount of gas consumed and paid for, and that registered by the ordinary index. This can scarcely be said with the penny-in-the-slot meters. The discrepancies which arise are somewhat delicate to deal with; and the fact that they do occur renders it almost impossible to keep a satisfactory check on the collectors.

Further, I should like to point out that there is a manifest injustice to large consumers burning gas under the automatic system; and in proof of this I give below examples of two typical cases taken at random from my Company's books. "A" is a customer supplied with a 5-light meter and a cooking-stove, which cost, with fixing, £5 13s. 7d.; while "B" has a 3-light meter and a cooking-stove which cost £2 1s. 9d., fixed.

"A"—Total expenditure for meter, house-fittings, cooking-stove, and fixing			£9 2 9
Amount received for gas supplied, rent, &c.—viz., 59,300 cubic feet at 4s. 2d. per 1000 cubic feet		£12 7 1·00	
Less for gas only do. at 3s. 5d. per 1000 cubic feet		10 2 7·00	
Difference available for rent, depreciation, &c.		£2 4 6·00	
Deduct—			
Cost of collection, inspection, and clerks	14s. 11·67d.		
10 per cent. depreciation	18 3·30		
		£1 13 2·97	
Balance, being extra profit		£0 11 3·03	
"B"—Total expenditure for meter, house-fittings, cooking-stoves, and fixing			£5 17 4
Amount received for gas supplied, &c., 8400 cubic feet at 4s. 2d. per 1000 cubic feet		£1 15 0·00	
Less for gas only do. at 3s. 5d. per 1000 cubic feet		1 8 8·00	
		£0 6 4·00	
Deduct—			
Cost of collection, &c.	2s. 1·45d.		
10 per cent. depreciation	11 4·00		
		£0 13 5·45	
Difference, being loss		£0 7 1·45	

In the foregoing calculations, the charge for collection, &c., is based on the average cost per 1000 cubic feet; but if the amount per consumer were substituted—viz., 3s. 6d. (which would perhaps be quite fair, inasmuch as it costs just as much under this head, whether the amount of gas consumed be large or small), the disparity between the two cases would be much more marked.

Gentlemen, I have, I fear, trespassed far too long on your time and patience. If so, let me ask your forgiveness, and also your acceptance of my sincere thanks for the kind attention you have given to my remarks.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1138.)

Last week brought no improvement into the state of business in the Stock Exchange. There was an utter absence of all animation. There was as little inclination to solidly invest as to speculate; and the order of the day seemed to be to do nothing. People appeared to want some event to stir them, and nothing came; and the tightness of the Money Market tended to repress exuberance. The settlement engaged attention, but even that was light. And before the week was over, the attendance had begun to diminish; for to-day is a holiday on the Exchange, and with it in view some thought that, if they could not do any work, they might as well go away and play. Prices, of course, are lower all round, though there was no drop of any considerable magnitude. The Money Market, which had been looking a little easier at the close of the preceding week, began to harden at once, and rates all through the week held up stiff. There does not seem to be very much prospect of any relaxation just at the present time. Business in the Gas Market was quite as quiet as in any other department; and there was not much by way of incident to record in it. Perhaps the chief feature was that changes in quotation were both few and slight. Although the temporary reduction in the coming dividends imposed on Gas Companies by the exorbitant prices demanded for coal is now getting more generally understood, shareholders are not betraying any weakness, and sacrificing their holdings. Among the Metropolitan Companies, Gaslight ordinary opened at 102¼, and gradually eased down to 101; but the quotation was left standing. Little was done in the secured issues; but the preference had to recede slightly. South Metropolitan changed hands once at 132; but the final mark was 128½. The stock, however, was standing at such a high figure that it was susceptible of some reduction in reason. Commercials were not touched. There were only two or three transactions in the Suburban and Provincial group; and they gave no indication. Quotations did not move. The Continental Companies were no busier than the others; and they, too, had a moderate fall, which affected Imperial, European, and Cagliari. The remoter undertakings were also among the losers; Monte Video and Cape Town being lower. Only moderate business was done in Water at about middle prices. There was no tendency either way; and quotations were left undisturbed.

The operations were extremely limited all through the week; and it will suffice to note the daily changes of quotation. On Monday, South Metropolitan fell ½. On Tuesday, Imperial Continental and Cagliari receded 1, and European part paid ½. On Wednesday, South Metropolitan moved back 1, and Cape Town and Monte Video ½. On Thursday, South Metropolitan fell ½. On Friday, Gaslight preference relapsed 1½. On Saturday, South Metropolitan ½.

ELECTRIC LIGHTING MEMORANDA.

Another "James Forrest" Lecture—Sir F. Bramwell's Opinion of the Electric Lighting Acts—Cases of "Force Majeure."

The "James Forrest" Memorial Lecture at the Institution of Civil Engineers was entrusted this year to Sir W. H. Preece, whose subject was "The Relations between Electricity and Engineering"—a very good subject, too. It is the more to be regretted that the lecture remains to be delivered; for the discourse that got itself spoken on this occasion was no exposition of the subject. Sir W. Preece, of course, is a very clever man, and a fortunate; or he would not be where he is to-day. But as a lecturer, or a maker of a presidential address, he never seems to be quite sure whether he is holding forth to an infant school, or speaking to men who know his and their business so well as to desire to know it better. There are many points of contact between electrical science and engineering which both electricians and engineers, and the busy, anxious world behind them, want to have defined and criticized. Meanwhile, even the "Electrician" is fain to offer an excuse for Sir W. Preece's display of "childishly simple" experiments. It is that his "audience was composed mainly of civil engineers—men who, perhaps, had spent all their long lives in building docks and canals, and who hitherto had missed every opportunity of seeing a magnetized poker pick up iron nails." This is how the authorized abstract report makes the eminent lecturer speak of electric lighting: "An electric glow lamp does not vitiate the air. It does not throw into circulation in the air any product of combustion. The question of ventilation is very much reduced in importance and rendered more simple in effect." Prodigious, indeed!

It is not to be wondered at that after more than an hour of this stream of ponderous platitude, Sir Frederick Bramwell, who must have been boiling over with the desire to pitch into somebody or something, by way of relieving his over-charged nerves, took the opportunity offered by seconding the formal vote of thanks to the lecturer for making a lively onslaught on the Electric Lighting Acts of his native land. The "Electrician" describes Sir F. Bramwell's as a "smart little speech" which made amends for much of the antecedent boredom. Sir Frederick could not be dull if he tried. Whatever else he may be, he is one of the most humorous of mankind. In the circumstances, it would be unfair to take his impeachment of the Electric Lighting Acts too seriously. At the same time, it would be an absurdity to side with Sir W. Preece, who flatly contradicted his professional brother on the point, declaring that Sir Frederick was utterly wrong, and that no better Act than the Electric Lighting Act of 1882 was ever passed. We quote always from the "Electrician." It passes comprehension that an engineer can justify an experiment in legislation which had a purely negative effect until it was amended six years later. From some standpoints, the operation of the first Act as a brake upon electrical speculation may be approved; but it cannot by any stretch of charity be credited with having encouraged electrical enterprise in any way. It has doubtless protected some interests; but electricians have never ceased to chafe under its restrictions.

Some interesting police-court proceedings took place last week in London, in connection with the charges against several of the Metropolitan Electricity Supply Companies for making default in carrying out their statutory obligations to their customers. The Metropolitan Company had to answer six summonses in regard to Marylebone. The cases had stood adjourned for three months, after the Company pleaded guilty and submitted to the judgment of the Court, to see how matters would go. During the interval, there have been fourteen failures of the service; but these were all explained to the satisfaction of the Magistrate, who remarked that the explanation offered exculpated the Company. On the original summonses, however, to which the Company pleaded guilty, he condemned them to pay 5s. for every time (total £1 5s.) with ten guineas costs. At Greenwich, seven summonses were heard against the London Electric Supply Corporation for failure to supply a Deptford public-house. The facts were admitted; but the Company pleaded unavoidable accident, or *force majeure*, by way of extenuation or excuse. The difficulty had been the partial failure of the coal supply. The case stands over for decision on the 4th inst. At the Southwark Court, the same defendants had to meet a similar charge, and offered the same defence, which prevailed. The Magistrate, Mr. Paul Taylor, decided that the Company's default was covered by the term *force majeure*. Failure to procure the necessary fuel is not negligence, neither is inability to foresee the circumstance that new boilers on order will not be delivered in due time. The summonses were dismissed.

The salient feature of the proceedings is the introduction for the first time in such circumstances of the plea of *force majeure*. As was noticed in one of the cases, this term is new to English statute law, and requires interpretation. One Counsel said it means the same thing as *actus Dei*; but it was very reasonably observed that it covers more than this. Mr. Paul Taylor, as we have seen, reads it rather broadly; and he is doubtless right in so doing. For if those who introduced the term did not mean it to cover more than the older form of words "act of God," they would have contented themselves with the more familiar expression. To say sooth, it would be a good thing if the bad old Latin term were to be dropped altogether. It is distinctly impious, inasmuch as it throws upon the Deity the entire responsibility for every untoward and mischievous catastrophe, and assumes that the same Power has nothing to do with things when they go right. *Force majeure*, however, is foreign language; and we ought therefore to leave it to the international jurists. It has become the practice of late in the drafting of Gas Acts to insert a clause protecting the undertakers against frivolous prosecutions, and also exempting them from penalties for defaults which are referable to any cause which is held by the Court having cognisance of the case to be beyond their control. This provision is adequate to the real requirements of the undertakers of a statutory supply undertaking, which are merely that they shall not be held liable to perform impossibilities. The fewer new puzzles that are set before the Courts the better. It is against the whole spirit of English law to define general words. We do not like *actus Dei*, nor *force majeure*. "Unavoidable cause" is English; and is sound, good sense as well.

The Council of the Chemical Society have decided to commemorate the services rendered by the late Sir Edward Frankland by requesting his "pupil, collaborator, and friend," Professor Armstrong, to give in the ensuing autumn a memorial lecture on his life-work.

PATENT LAW REFORMS—HINTS ON SPECIFICATION DRAFTING.

Several expressions of appreciation of our article of the 17th ult., entitled "Suggestions for Patent Law Reform," having reached us (some accompanied with observations on the debateable points of the matter), it will be convenient to dispose of the subject for the time being by publicly acknowledging these contributions to the discussion. Our attention has been directed to a leading article that appeared in "Engineering" on Jan. 12 last, in which very similar opinions to our own were expressed as to the questionableness of turning the Patent Office into an Informations-Bureau. This article went very thoroughly into other considerations bearing upon the general proposition that Government ought to help the would-be patentee more than the Patent Office is allowed to do at present; and it is a pity that Mr. Levinstein before he spoke on the subject at Manchester did not take to heart some of the thoughtful passages of the article. With regard to the helping of poor inventors to get patents, it is pointed out that the Patent Act of 1883 went a long way in this direction, by providing for the transmission of applications by post, by the sale of stamped forms at post offices, and by offering other facilities to the applicant who is his own patent agent. Our contemporary supports the "Journal" testimony to the faithfulness with which the staff of the Patent Office, high and low, have laboured to give the fullest effect to the provisions of the law. Nevertheless, it is remarked that there is no proof that all this has proved an unmitigated blessing to those in whose behalf it is supposed to have been intended.

This expression of our contemporary's is rather high-pitched. Nobody expects unmitigated blessings to flow in upon him from any source—least of all from a Government department. Inventors perhaps are more exacting in this way than other people; but even they ought to be content with a reasonable balance of advantages over drawbacks. It is asserted, however, that this condition is not realized under the present system. Too great laxity in the drafting of the provisional specification is said to be allowed—out of mistaken kindness to the applicant. It is unquestionably true that the facility and cheapness of the procedure for obtaining provisional protection lead to much waste of time, trouble, and money at the instigation of ignorant and unskilful applicants who really have no invention at all. It is difficult, to the point of impossibility, for any Examiner or Controller to do strict justice to many of these applicants; and so, in the end, injustice is done to them, to the system, and to the public.

This reflection recalls the advice lately given by the "Engineer" on the subject of the drafting of patent specifications. It is a great mistake—although many people commit it every day who should know better—to believe that anything will do for a provisional specification. This blunder arises partly out of the erroneous belief that there will be ample opportunity for putting matters to rights in the complete specification. But its main source, we venture to think, lies in the deplorable lack of thoroughness, of "grounding," in the superficially-schooled people of these times. Take the "Engineering," and the "Engineer" catalogues of some common applicants' errors: Failure of the provisional specification to describe the nature of the invention; failure of the title to sufficiently indicate the subject-matter; hopeless incapacity on the part of the author of the document to express his ideas in writing; wrong spelling; incorrect placing of marks and stops; various spelling of technical words and scientific names; leaving out of important words from a sentence; attempts at scientific or legal phraseology vitiated by ignorance both of the language and of the subject-matter. Most of these failings are due to different degrees of ignorance, and the rest to that kind of carelessness which is only ignorance in another guise. Many people start a-patenting on their own account without having the smallest notion of what constitutes a clear, intelligible, complete definition. Consequently they are completely at a loss even for a title for what they fondly imagine to be their "invention." They need a friend to surprise them with the sudden query, "What are you doing there?" Then they might reply, without thinking twice, "I am making a new gas-burner," or whatever it might be. This gives the title of the invention. But for ten men who could "give it a name" straight off, nine would be sorely puzzled to solemnly assign a "title" to their invention at the head of a Patent Office form.

Similarly with the drafting of the provisional specification. The idea of this is really that of writing a letter to a friend telling him in ordinary language what one has been working at of late. So easy to prescribe, so hard to get done! Of course, the first essential is to know one's self what one has been doing, with what means, and to what purpose. In the old-fashioned style of schooling, which admittedly ran overmuch to grammatical studies, when it was not overdone a boy at least learnt the nature of a sentence, or "saying." If he attained to the perception that the sentence is the unit of intelligible language his necessary grammatical instruction was complete. If he remained in the state of ignorance that tacitly holds the single word to constitute the unit of speech or writing, he would always be exposed to the risk of failing to speak or to write intelligibly. This imperfect state is now the general one for those who have passed through modern elementary schools. They can hardly spell common words, and their carelessness on the point is such that they will not take the trouble to see that they spell technical or scientific terms accurately and consistently. Wrong punctuation comes from ignorance of the construction of the sentence. Obscure, laboured, unintelligible diction is due to the same ignorance, coupled with want of thought about the proper meaning of the words used. On general principles it might be imagined, with some plausibility, that people engaged in technical work, or endowed with a taste for science and of an inventive turn of mind, would know the proper use of their own special "lingo." But this is far from being the case.

The "Engineer" cites an example in point. "The lightest coal-tar hydrocarbon is peculiarly liable to ill-treatment. We read in different patents of 'benzene,' 'benzine,' 'benzole,' 'benzoline,' and 'benzin.' Sometimes two or three forms occur in one specification. According to the best chemical practice, 'benzin' is extinct; 'benzine' means a light spirit obtained from crude petroleum, and is quite different from 'benzene,' which is C_6H_6. 'Benzol' and 'benzole' are trade names for 'benzene;' but they usually convey the idea of a less highly rectified spirit unless they are preceded by the adjective 'pure.'" This is a very good lesson indeed. Again: "Confusion often arises in the incorrect employment of technical words in other branches of science. We have noted 'segment' instead of 'sector,' 'spiral' instead of 'volute,' or *vice versâ*. Even 'cocks' and 'valves' borrow one another's names." If specification writers knew that, in the trial of patent cases, there is often great use made of dictionaries, they would take care to have respectable authority for the meanings they attach to important words. The advice should not be thrown away upon writers of technical papers in general.

It is possible to agree with the "Engineer," that "punctuation is a purely esoteric art, capable of mastery only by compositors and readers—and they seldom agree on the rules," while still holding that its intelligible practice should have no terrors for persons who know the construction of sentences. We do emphatically agree, moreover, with the observation that punctuation, if it is done at all, ought to be done according to the conventions of the printers, and not after the vagaries of an amateur scribe. Another pitfall of the specification-writer is the plenitude of conventional "tags" which he is sure to find in use by others, and to copy for himself. These consist of such phrases as "with or without some other ingredients," or "the like," or "otherwise substantially as described." It is safe to say that few of the writers who employ these phrases know how the Courts understand them. To these innocents, it may not be amiss to remark that the Courts conform to a principle of interpreting words in certain connections which is called the rule of "*ejusdem generis*." This means that general words following words of particular description of the application, are limited to the things described and their analogues and equivalents. Thus, if a man is describing what to do in manufacturing a brick, and he uses the term "&c." in this connection, this will not be construed as covering everything else, but only things partaking of the character of a brick. This is worth knowing.

Returning to the subject of patent-law reform, we are reminded that the question of official searches for novelty has been mooted for many years. We are also asked to correct Mr. Levinstein's reported statement that the Institute of Patent Agents discredit the general idea of an official search for anticipations. What the Institute—in agreement with most persons of experience—do condemn is the German and United States systems of Patent Office procedure. In connection with this subject, we believe that Mr. W. Lloyd Wise is going to make a suggestion at the coming Paris Congress on International Patent Right. This eminent authority, who has been a devoted worker in the field for a quarter of a century, objects equally to the issue of Letters Patent at applicant's own risk, and to preliminary official examination with power of refusal of protection. What he recommends is preliminary official examination for novelty, but not for utility—the applicant's attention to be expressly drawn to any prior publications which seem to at all bear on his claims. Then, if the applicant still elects to proceed, he should not be debarred from doing so, subject to mention of the prior matter. Such is Mr. Lloyd Wise's compromise, which seems perfectly simple and fair. It is debateable, however, whether an applicant for provisional protection has any claim whatever to be told his business at the national cost. In no other department of commercial enterprise is the adventurer so helped at the public charge. If a man brings out a play, or a novel, which is open to the imputation of plagiarism, he has to "stand the racket," however innocent he may be; and it is difficult to see why an author should be worse served than a would-be patentee. It is not even proposed to assist the ingenious designer of trade-marks to avoid the unpleasant consequences resulting from copying another man's sign.

After all, it may be argued that the Patent Office fees are only a stamp duty, not *ad valorem*. There is much in the familiar plea for the encouragement of inventors by refusing to take their money for a useless application that might be used against the costly stamping of agreements not worth the paper on which they are written. Protection, as it is called, is already quite cheap enough in this country. The price does not cover the lowest estimate of the cost of making a search for colourable anticipation, even in the form of a patent. Mr. Lloyd Wise, as

we understand him, would extend the official search to all published matter, including old magazines and periodicals out of print. It is too large an order, especially at the price. The patentee does not deserve to be treated like the only child of the State. Generally speaking, he needs instruction far more than encouragement. Ninety per cent. of the patents granted by all countries are worthless to everybody; and it is a curious aberration that prompts men to desire the increase of the mass of lost labour, wasted time, squandered money, and disappointed hopes which is represented in this deplorable ratio of failures to successes.

COAL AND COAL MINING.

The publication of a revised edition of the late Sir Warington Smyth's book on the above subject* is opportune, coming as it does at a time when the abnormally high price and the scarcity of coal is attracting so much attention in the industrial world. This, which is the eighth, edition has been revised and extended by Mr. T. Forster Brown, who occupies the post formerly held by Sir Warington Smyth—that of Chief Inspector of the Mines of the Crown and of the Duchy of Cornwall—and who is a well-known writer upon the coal question. In his preface, Mr. Forster Brown (who was assisted by his son) says that his object has been to maintain the author's original design, and to retain the general character of the book; but his anxiety not to unduly touch the original matter has, however (coupled with the fact that the book had been from time to time revised by Sir W. Smyth), brought about the unhappy result that the reader has to be constantly asking himself whether the statements before him refer to conditions existing ten, twenty, thirty, or even more, years ago, or whether to the circumstances of the present day. Mr. Brown would, in our opinion, have made the book of much greater value had he, in order to include only the latest available statistics, entirely re-written such chapters as that on "The Use of Coal," and "The Duration of the British Coalfields."

It is, in fact, quite misleading to have—as we find in the last-named chapter—the question of the resources of our coalfields dealt with in the main from the standpoint of one writing before the appointment of the Royal Commission on Coal in 1866 (to which no reference is made), and in the same chapter, and without any indication of difference in dates, the output of coal given as 200 million tons a year (as it was in 1897 or 1898), while the exports of coal are in yet another place referred to as "over 27 millions of tons," which was the quantity exported in 1889. As the author in his first preface declared that his book was "intended mainly to convey sound information to the unpractised," we do not think that Mr. Foster Brown can claim to have "maintained Sir Warington Smyth's original design," in publishing a chapter so calculated to mislead the uninformed. Subject, however, to this reservation, the book is to be commended to anyone desirous of learning something of the inner working of that vast industry which forms the backbone of the trade of the country, and without which the gas industry could not exist. For readers of the "Journal," the most directly interesting section is that dealing with the probable duration of the British coalfields; and we must confine the remainder of this review to a consideration of the views of the authors on that most interesting and important question.

Of the importance of the question, the authors show themselves well aware: "Contented security may in its ignorance of the facts assume, and persons interested in maintaining their own special trade may represent, that the coal-seams are 'practically inexhaustible,' and may stigmatize as 'alarmists' those who would invite attention to the bearings of a question so vital to our immediate posterity. But a fair examination of the statistics . . . and of the local conditions of our coal-bearing districts, will show that at least the time for prudent forethought has arrived." Owing to the difficulty to which we have already referred, it is not possible to say—though from inference it is possible to surmise—when the foregoing was written. If in the sixties it was demonstrably premature to speak of the question as being then vital to "immediate posterity;" and even if (as we infer it was) written recently, we think it is taking too gloomy a view of the outlook to suggest an actual—as distinct from a relative—scarcity of coal as probable during the next generation. Considering that out of the 90,000 million tons estimated by the 1866 Commission to be available in the known coalfields in 1869—to say nothing of the further 56,000 million tons then estimated to exist in the concealed coal-beds at less depths than 4000 feet—we shall, by the end of this year (that is to say in 31 years) have only brought to bank just over 5000 million tons, it is impossible to feel alarmed as to the immediate future. That "prudent forethought" should be exercised, in the interests of our posterity, we should, however, be the last to deny; and a time like the present serves to remind all coal-users that care and economy in its consumption is a public duty, as well as true commercial wisdom.

The disadvantage of the dual authorship is, in this connection, shown by the fact that, while on the first page of the chapter on the "Duration of the British Coalfields," the question is spoken of as "vital to our immediate prosperity," four pages on we find the opinion stated that "the increase to our production of from 2 to 3 millions of tons annually, serious as it undoubtedly is, will keep us within comparatively moderate figures for a long time to come, and at all events defer—as regards the country at large—the evil day *for two or three centuries*." The former quotation is evidently the work of the reviser; the latter that of the author. The result is certainly not homogeneity.

As to the really important point—namely, not when the whole of our coal resources will be exhausted, but when the cheaply-worked coals, which have brought about our commercial supremacy, will become worked out—Mr. Forster Brown expresses the belief that a period of from 50 to 70 years hence will probably see their exhaustion, and "we shall become dependent upon more expensive fuel, and be rapidly outstripped by countries (such as America, China and Japan) possessing large and cheaply-worked coal resources." That, as has been repeatedly urged in the "Journal," is a question which might well engage the attention of a Committee of Experts, appointed by the Government.

Mr. Forster Brown refers also to the possibility of our being handicapped in the struggle with Continental coal-producing nations for the possession of the foreign coal market, by the irregularity and combativeness of the miners. From recent events, in Austria, Germany, and France, it would not be unfair to infer that these other countries, who are our chief coal-selling rivals, are as likely to suffer from such troubles as we ourselves.

In spite of his somewhat pessimistic views regarding the future generally, Mr. Forster Brown is more optimistic than most authorities—including the Argyll Commissioners—as to the possibilities of deep coal-mining. Referring to the general consensus of opinion that below a depth of 4000 feet from the surface the increase of temperature would prevent the possibility of working, he remarks that "a considerable experience of deep mines induces me to believe that the difficulty of temperature may, by due appliances, be overcome to a much greater depth." As tending to confirm this view—or at any rate to prove the reasonableness of the contention of Professor Hull and the Coal Commissioners, that it was possible to work down to a depth of 4000 feet—it is of interest to note that at the Pendleton Colliery, near Manchester (the deepest mine in Great Britain), mining operations are being carried on at close upon 3500 feet below the ground; while the Calumet and Hecla copper mine in America has attained the enormous depth of 4900 feet, and a colliery at Mons (Belgium) is 3937 feet deep.

As to the question of imposing a tax upon our exports of coal, it is remarked that "such an impost would undoubtedly be open to serious objections," which contribution to the discussion does not carry us much further; but that "whatever may be the proper solution of this problem"—that is to say of the whole question of the increasing demands upon our stock of coal—"there can be but one opinion amongst thinking men, that the time has arrived when a thorough investigation of the problem should be undertaken with a view to minimize the disastrous effects to the commercial prosperity of the country that will surely arise from a neglect to consider, and take steps to provide against, a contingency which is already within measurable distance." The book ends with suggestions for the more economical production and utilization of the coal we do possess; special attention being called to the great advantage that we should derive by the cheapening of production through the adoption of coal-cutting machinery. That, however, is a proposal against which the miners in this country have, in their short-sightedness, set their faces; and it is not, therefore, likely to be adopted in the near future.

We will end this notice by expressing the hope that Mr. Forster Brown will before long completely modernize what even now is, but would then in a higher degree be, an interesting and useful little treatise.

The "James Forrest" Lecture.—This lecture was delivered at the Institution of Civil Engineers on Monday evening last week, by Sir William H. Preece, K.C.B., F.R.S., Past-President of the Institution; his subject being "The Relations between Electricity and Engineering." He said the four great principles underlying the practical applications of electricity are: (1) The establishment of a magnetic field. (2) The establishment of an electric field. (3) The disturbance or undulation of the ether. (4) The work done by the generation and maintenance of electric currents in material systems. He illustrated these principles by some simple experiments. Having considered the practical generation of electricity, the lecturer referred to its use in war, civil engineering, and sanitation, and discussed the subjects of the transmission of power, transformers, electric units, &c. His concluding remarks were as follows: "We can scarcely hope for new sources of energy to be discovered; but there are some existing ones we have not touched yet. When the evil day arrives for our coal supplies to give out, we may perhaps be able, by the aid of electricity, to utilize the heat of the sun and the tides of the ocean. There is, however, a vast illimitable store of energy not only in the rotation of the earth upon its axis, but in the internal heat of this globe itself. As we descend, the temperature gets higher and higher. It ought not to be difficult to reach such temperatures that, by thermo-electric appliances, we might convert the lost energy of the earth's interior into some useful electric form." The lecture was repeated on the following day.

* "A Rudimentary Treatise on Coal and Coal Mining." By the late Sir Warington W. Smyth, M.A., F.R.S. Eighth Edition, revised and extended by T. Forster Brown. London: Crosby Lockwood and Son, 1900.

PERSONAL.

Mr. James Mansergh has been elected President of the Institution of Civil Engineers, in succession to Sir Douglas Fox.

Mr. John Stewart, Manager of the Strathaven Gas Company, has been appointed Manager of the Lanark Gas Company, in succession to Mr. John Gibb, who, as already mentioned in the "Journal," has been transferred to Kirkintilloch.

Mr. E. Jones has resigned the position of Gas Manager and Surveyor to the New Mills District Council; and, in response to an advertisement, twenty applications for the post have been received. Three of the candidates have been selected to appear before the Council this week.

Mr. W. E. Barney, Secretary of the Horsham Gas Company, has been appointed, out of twenty applicants, Inspector under the Sale of Gas Acts, by the Middlesex County Council. He will have the supervision of the new meter testing and stamping office which has been erected adjoining Messrs. Thomas Glover and Co.'s new works at Edmonton.

It will be seen by the report of the proceedings at the annual meeting of the Singapore Gas Company which appears elsewhere, that the Engineer and Manager, Mr. Albert Ford, is now in England. Before leaving Singapore on the 23rd of March, he was the recipient of an illuminated address from the employees of the Company, who also presented him with a gold necklet, set with pearls and diamonds, for Mrs. Ford. Mr. Ford suitably thanked the donors for their gifts, and expressed the hope that all would go well while he was absent.

Mr. Arthur H. Cane, F.R.G.S., the Secretary of the Reading Gas Company, presided over a large and distinguished gathering at the ninth annual dinner of the Institute of Secretaries (of which body he is this year the President), held in the Empire Room of the Trocadero Restaurant last Friday. In responding to the toast of the evening, Mr. Cane dwelt upon the success of the Institute which had been very marked and continuous. The number of members had increased from 200 at the beginning to 1145 at the present time. But, still, he pointed out, seeing that there were upwards of 12,000 companies in the country, with as many secretaries, they might reasonably look forward to yet greater success in the future. The Institute had thoroughly justified its existence to business men and the general public. It had already accumulated invested funds to the amount of £2000; and he was glad to be able to state that many directors of companies were now showing their approval of the Society.

OBITUARY.

Peter Simpson.

There are times in the work of a journalist when he takes up his pen to record the end of the life and labours of a fellow man with particularly keen sorrow; and it is so on this occasion. Peter Simpson, who was beloved and honoured among gas men throughout the length and breadth of the country, passed from this life into the next alone and in the stillness of the night on Monday or early morning of Tuesday last week. Sad to say, the closing days of his life were filled with sorrow and anxiety. Pneumonia had stricken down the only son, and only child, Robert, who had arrived at middle age. Attacked by the complaint in an acute form, delirium set in; and the affectionate father and other friends had much to do to restrain the sufferer from leaving the house. Death claimed the son about one o'clock on Monday. Friends who were present with the aged parent during the day state that they remarked, although he had been somewhat indisposed during the previous week, how well he looked, and when the great trial came he bore it with the fortitude which was characteristic of the man in the time of trouble. But who can tell the anguish suffered beneath that stoical exterior? Mr. Simpson retired to rest as usual; but before daybreak, the spirit of the father had followed that of the son. Such an end to such a life as his is indeed pathetic. The medical attendant certified that death was due to syncope as the result of shock.

Mr. Simpson was esteemed in the gas profession more for his sterling personal qualities, than for any notable work he accomplished outside the Rugby Gas Company, of which he was the trusted and faithful servant for little short of forty years. In figure, in style, in his benevolent countenance, which mirrored the goodness of his kindly heart, he was a typical "fine old English gentleman." That figure, the hearty shake of the hand, and the pleasant greeting are memories which many will hold dear; and, for some time to come, at the meetings of the Midland Association and at the next gathering of the Gas Institute, the members will be painfully conscious of a void in their midst. Mr. Simpson's connection with the Midland Association dates from its origin in 1877, and rarely has he ever been absent from the meetings since then. He was present at the first meeting in October of that year; and was then elected Hon. Treasurer. He held this office for two years, during which time Mr. Charles Hunt was President. The selection of Mr. Simpson as Mr. Hunt's successor is a testimony to the great respect in which he was held among his neighbouring colleagues; and, by pressure, he was also induced to head the affairs of the Association for two years. In September, 1884, he was re-appointed Hon. Treasurer (Mr. J. Tindall having occupied the position during the intervening years); and he continued, without interruption, to hold the office until his death. On two occasions—once during his presidency and in 1892—he received, and generously entertained, the Association at Rugby. On his retirement from active work in the year named, the members, in wishing him enjoyment of his well-earned leisure, presented him with a handsome salver and silver antique cup, "as a token of their respect and esteem." Mr. Simpson was also an original member of the British Association of Gas Managers; and we believe that his cousin, who was then at Dunfermline, was one of the first three who met to discuss the question of founding such an Association. Through all times, Mr. Simpson has remained steadfast to the old organization; and for some years he has been a Trustee of the Institute, and a member of the Benevolent Fund Committee. He was not a prominent man in the public proceedings of the Technical Associations to which he belonged; but he was a quiet and useful worker and a trusty counsellor.

Mr. Simpson's record as the Engineer and Manager of the Rugby Gas Company is an interesting one. It commenced in 1854 and ended in 1892—the long period of 38 years spent in one service! It was on May 29 of 1854 that the Directors appointed him Manager out of 26 applicants for the position. Things were not then so flourishing as they afterwards became under his management. His remuneration was in those early days "£90 per annum, with house, fire, and light;" and it was stipulated that he should "devote the whole of his time to the service of the Company, and find security for £200." A few years before his engagement, the price of gas was 7s. 6d. per 1000 cubic feet. Four years after, it was 4s. 7d.; and the quantity of gas sold only about 9½ million cubic feet. Before he concluded his management, the price had been brought down to certainly 2s. 10d., if not under; and the consumption had increased something like six or seven fold. In the first years of his service, various extensions of the old works were made. In 1869-70, however, it was decided to remove the works to the present site in the Newbold Road; and the new works were constructed entirely from plans prepared by Mr. Simpson. The charging of the first retort took place in September, 1870; and at a meeting of the Directors on May 6, 1872, the following interesting resolution was passed: "That the new works, being generally completed, a present be made to Mr. Simpson of £105, and a gold watch and chain, with a suitable inscription, for his valuable services in designing and carrying out the new works in a highly satisfactory manner, and that his salary be increased £50 per annum from the 25th March last." In 1875, the Company was converted into a Joint-Stock Company with limited liability; and seven years later an Act incorporating the Company was obtained. From then, under Mr. Simpson's judicious management, the business continued to prosper and the works to expand. Advancing in years, in 1892 Mr. Simpson retired; and he was succeeded by the present Engineer and Manager, Mr. Charles Meiklejohn, who has successfully continued the work to which his friend and predecessor had devoted the best part of his manhood. On Mr. Simpson's retirement, the Directors presented him with a cheque for £100; and some two years ago, they wisely elected him to share in the administration of the concern which his labours had done so much to build up.

In the town itself, Mr. Simpson had become to be regarded with veneration. Good deeds, his sympathetic nature, his uprightness and integrity, and his endeavour to act justly to all men had endeared him to the people among whom he lived. He was one of the founders of the Congregational Church at which he worshipped, and had been Treasurer for many years. For the past few years, he had been a member of the District Council. Outside the chapel, the institution in which perhaps he took the greatest delight was the hospital. For a number of years, he was a member of the Management Committee; and he endowed a bed there in memory of his wife, who died as the result of an accident, in 1881.

Solemn and touching was the funeral of father and son on Thursday afternoon. The inhabitants of Rugby, rich and poor, thronged to the cemetery, and lined the pathways up which the *cortége* passed. Only immediate relatives assembled at the house of the deceased; but at the gates of the cemetery were representatives of the various bodies with which Mr. Simpson had been associated. The Gas Company were represented by the Chairman (Mr. John Parnell), the Vice-Chairman (Mr. A. J. Lawrence), and all the other members of the Board, excepting one, who was confined to his house through illness. The Secretary of the Company (Mr. T. M. Wratislaw) was also there; and the Engineer (Mr. C. Meiklejohn) headed, with the President (Mr. J. Ferguson Bell), the members of the Midland Association who were able at short notice to be absent from home—viz., Messrs. W. North, B. W. Smith, T. Berridge, W. R. Cooper, and V. Hughes. Mr. Tew, jun., was present on behalf of his father, who was unable through indisposition to attend. Among other of Mr. Simpson's friends who are associated with the industry were Messrs. A. C. Scrivener, T. E. Priestman, G. J. Eveson, and T. Vale. Floral tributes of regard and friendship were sent by, among others, the Directors and officers of the Gas Company, the President and members of the Midland Association, Mr. and Mrs. C. Meiklejohn, Mr. North, and Mr. Scrivener. After the completion of the burial service, the large crowd reverently filed past the grave; and they saw on the lid of the top coffin the simple inscription "Peter Simpson, Died 24th April, 1900, in his 75th year."

NOTES.

A "Blue-Flame" Oil-Stove.

It is announced in the trade journals that the gas cooking-stove is this season to encounter sharp competition from petroleum "blue-flame" stoves. The familiar oil cooking-stove, with a wick, has long been a common object of the countryside where gas was not available; but the apparatus always had its drawbacks, and at best demanded a degree of care in use which was not always available. It is now stated that petroleum-stoves without wicks are making good headway and giving great satisfaction to users. The so-called "blue-flame" oil-stove is among the latest of these. The American patent describes it as "a stove comprising a burner and oil reservoir in connection with said burner, and having a maintained oil level and means for raising or lowering one of said parts in relation to the other, the other part being fixed." One pattern of this stove has a reservoir containing a gallon of oil. The flow of oil is controlled on the principle of the bird fountain. The burners are of great power, and capable of performing a good deal of work. Naturally, there is no soot nor smoke from the highly aerated flame. The stove is recommended as being "wickless," and "valveless." It may not as yet do all that a gas-stove can do; but the manufacturers of the latter, and of the gas they consume, should be warned by the appearance of the new order of oil-stoves, which are a reminder that there is no monopoly in these things.

A New System of Electric Traction.

It is stated that those localities which have hitherto resisted the assaults of the trolley-wire tramway electricians are about to be rewarded by having at command a new system of electric traction which is to avoid all the drawbacks of the cheap and nasty overhead arrangement. This is called the Johnson-Lundell system, and great things are spoken of it. To begin with, it is on the surface-contact principle, thus doing away with all the troubles of both overhead and conduit methods of distributing the current. The success of the new system is reputed to be assured by the excellence of the detail arrangements of all kinds. It is not so much that the inventors have any extraordinary achievement to advance, as that they have patented improvements in dynamos, motors, controlling switches, methods of motor control, and a surface contact system of power transmission which, taken all together, constitutes an unrivalled combination. It is claimed, for instance, that the new generators can be built with 20 per cent. less material, and at 15 per cent. less cost, than corresponding machines of the ordinary design. The starting power, or "torque," of the motors is both increased and its application greatly simplified. Indeed, the inventors have succeeded in making the cycle complete, so that, when the car is running down hill, the motor becomes a brake and sends back current into the line. Thus a descending car will help another car up, just as if they were mechanically connected.

The Cost of Private Electric Lighting.

In the issue of the "Engineer" for April 20, an attempt is made to display the comparative advantages of electric lighting by a private installation and by current taken from a public supply. In all cases the lamps are supposed to be in regular use for 1800 hours per annum, or about 5 hours per day, and everything is equalized as much as possible. The private installation is given the choice between steam, gas, oil, and water turbine power. The last, of course, is the cheapest; but it is rather out of it except for unusually favourable situations. Fifty lamps of 16-candle power are supposed to represent the consumption. Coal is taken at 20s. per ton; gas at 3s. 3d. per 1000 cubic feet; and oil at 6d. per gallon. The first cost of the different plants would not differ very much, although the gas-power plant would always be cheapest, with or without accumulators. Altogether, the cost of maintaining 50 lamps for the period stated works out at £117 with steam power, £95 with gas power, and £97 with oil power. Adding accumulators, the expense is raised to £141, £114, or £115 per annum for the different sources of power. This seems a curious result of the introduction of the only electrical parallel to the gasholder. If electrical storage were practical, surely it ought to reduce working expenses instead of adding to them. Taking the necessary current from a public supply, the cost, at 2d. per unit, would be £46, at 3d. per unit £68 10s., at 4d. per unit £91, and at 5d. per unit £113 10s. Thus only at something less than the last price is a public supply come cheaper than the home-made article.

Nordenskiold on the Rare Earths.

Baron A. E. Nordenskiöld has discussed before the Geological Society some of the remarkable circumstances connected with the occurrence of the so-called rare earths. The first mineral mentioned in this connection was scheelite, and the next cerite, which contains no less than four rare metals. The bright incandescent light produced when the latter is fused with charcoal-powder was first observed by Cronstedt, in 1751. Nearly 130 years were to elapse before the observation was to be turned to useful account. The paper next referred to the discovery of glucina, lithia, selenium, and yttria. Minerals containing yttria and oxides related to it were at one time thought to be almost limited to certain pegmatite veins running in a broad zone on both sides of the 60th parallel of latitude. Latterly, fluocerite, orthite, and gadolinite have been found in Dalecarlia; and among these minerals, Benedicks discovered a silicate of yttrium containing 1·5 per cent. of nitrogen and helium. Thorium, discovered by Berzelius in 1829, was originally obtained from the rich mineral locality of Langesund; but it has since been recorded from many other localities. It is now obtained from the monazite sand of rivers in the Brazils and South Carolina. Thorite contains about 0·5 per cent. of inactive gas, probably a mixture of nitrogen and helium. The latter element was first obtained from the mineral cleveite, which also contains thorium, discovered by Nordenskiöld in 1877. Among the strange minerals is fergusonite, one of the richest sources of the remarkable gas, or mixture of gases, which on our planet seems to be almost exclusively confined to minerals containing rare earths.

Damp Houses.

In connection with the modern tendency of the extensive use of coke-breeze and gravel concrete in house building, Dr. G. M. Lowe, lecturing on "Damp Houses" before the general meeting of the Sanitary Inspectors' Association, made a strong appeal for the preservation of the porosity of walls in the interest of health. He said that damp houses must necessarily be unhealthy; and this condition is chiefly due to wet soils, wet walls, and walls impervious to air. All houses ought to have an impervious damp course in the walls, with the area enclosed by the walls covered with impervious concrete, or with tar paving. Dr. Lowe pointed to the fact that the painted walls of crowded rooms are frequently damp with moisture condensed from the atmosphere, which is saturated with carbonic acid and aqueous vapour, exhaled from the lungs and skins of the occupants. From this hot and dark atmosphere people pass into the pure, cold air outside, and wonder at the feeling of lassitude, headache, and chill experienced. The obvious remedy for damp houses is to cut off the cause: (1) By maintaining the porosity of walls and of roofing materials, so as to ensure free ventilation; and to construct windows that will open wide near the ceiling. (2) By cutting off all ground air and moisture by an impermeable layer of concrete or asphalt extended throughout the basement to the outside of the external walls. This point of the porosity of walls has not been much in evidence in the recent discussions on improved house building in which the members of Architectural Association have engaged. It would be well if the facts could be established by direct experiment.

Coke-Ovens in France and Germany.

According to the "Génie Civil," there are 410 regenerative ovens in the North of France—viz., 180 at Lens, 80 at Nœux, 60 at Drocourt, and 70 at Anzin—those at the two last-named places being on the Semet-Solvay system. There are some 60 ovens being built at Aniche, 120 near Douai, and 160 at Lens. In Germany, at the end of 1895, there were 7866 regenerative coke-ovens in operation—1864 being on the Ruhr; and among this number there were 1390 on the Otto system, which is by far the most common. They are about 30 feet long, 6 feet high, and 1 ft. 9 in. in average width. Their capacity is 6·650 metric tons of coal, which they convert into 4 tons of coke in 30 hours. In 1895, 210 ovens were built; in 1896, 302 ovens; in 1897, 240 ovens; and in 1898, more than 300 ovens. The latter are near the blast-furnaces in the Ruhr district. These ovens yield an average of 3·5 per cent. of tar, and 1·25 per cent. of sulphate of ammonia, and 0·35 per cent. of benzol on the weight of coke. Ruhr coal contains 1·5 per cent. of nitrogen; and the yield of sulphate is about 11 kilos. per metric ton. There is thus great room for progress. In 1880, Germany only produced 1200 metric tons of benzol, or one-eighth of the consumption; the remainder being imported from England. At present, about 2000 tons are used for the enrichment of illuminating gas; the proportion being from 4 to 5 grammes of benzol per cubic metre of gas, or from 1700 to 2100 grains per 1000 cubic feet. In Germany, only 5 per cent. of the gas is thus enriched. As in the ovens, the gases are first run through certain heavy oils which take out the benzol, this can be recovered by distilling the oils; and 92 per cent. is thus saved, while only 8 per cent. is left in the tar. At the beginning of 1896, 90 per cent. benzol was worth 65 frs. per 100 kilogrammes in France; in July, it was worth 100 frs.; and in November, 125 francs. During the last eighteen months prices have stood at 27 frs. to 32 frs. per 100 kilos.

The Recovery of Ammonia from Ammoniacal Liquor Without Distillation.—The Société pour le Traitement Rational des Vidanges employ, according to the the "Revue des Produits Chimiques," a method of recovering the ammonia from ammoniacal liquor without distillation, the principle of which is the addition to the liquor of a non-volatile acid, and the thorough admixture of the two by continuous agitation. The principle may be applied commercially in the following ways: (1) The liquids may be made to trickle on vertical surfaces or in cascades; (2) they may be passed separately in a fine state of division into a chamber, by the aid of a vaporizer; (3) or they may be agitated with blades, rotary brushes, or similar appliances, so as to bring them into contact with the air of a closed chamber. These various methods may be combined, and the absorption of ammonia increased by agitating the air by some mechanical means. The non-volatile acid preferably employed is sulphuric acid, concentrated or diluted. Sulphurous solutions, such as sulphate of potash, soda, or alumina, can also be used.

TECHNICAL RECORD.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

Half-Yearly Meeting in Newcastle.

The Forty-Sixth Half-Yearly Meeting of the Association was held in the Gas Office, Newcastle-on-Tyne, last Saturday—Mr. W. Doig Gibb, Engineer to the Newcastle and Gateshead Gas Company, the President, in the chair. There was a very good attendance.

The Annual Accounts.

The President, in submitting the annual accounts, said that the balance was £10 11s. 4d. more than it was in the previous year.

Mr. H. Lees (Hexham) suggested that the rules of the Association should be printed and issued to members and associates, along with a card of membership, yearly.

Mr. T. Bower (West Hartlepool) said the Committee were about to reconsider the rules. Probably it might be sufficient at present to leave the matter with them; and a copy of the new rules could then be issued to every member.

This was agreed to.

New Members.

The following were admitted to the Association:—

Members.—Mr. Ernest W. Wright, Market Weighton; Mr. H. Lawton, Idle; Mr. T. Smith, Darlington; Mr. J. Sykes, Huddersfield; Mr. F. J. Bancroft, Hull; Mr. Thomas H. Duxbury, Bradford; Mr. T. Byrom, Yarm; Mr. J. W. Sturdy, Easingwold; Mr. R. Wood, Barnard Castle; Mr. W. Scott, West Hartlepool; Mr. O. Sisson, Barnard Castle.

Associates.—Mr. J. Duff, Morecambe; Mr. E. W. T. Richmond, Warrington; Mr. H. A. Fawell, Middlesbrough: Mr. J. H. Kemp, Harrogate; Mr. J. Petrie, Jarrow; Mr. F. Coulthart Sugden, Upper Armley.

The Association now consists of 83 Members and 53 Associates—a total of 136.

Departed Members.

The President: It is almost inevitable that one penalty the Association must pay for increased membership is the sadness which all connected with it must feel when Death with his heavy hand comes into our midst. During my year of office, three gentlemen have passed away to the silent land—one associate member and two members. Mr. Thomas Havelock, of Newcastle, was one of the kindest-hearted men I ever met. To the poor, his unostentatious charities were many; to all, his cheerful smile and encouraging words made life more pleasant. His end came with startling suddenness. It was an eloquent tribute to his worth that rich and poor, old and young, united to show respect for his memory when all that was mortal was consigned to the silent tomb. We have also to mourn the loss of Mr. Trewhitt, of West Hartlepool. Ill-health prevented his attendance at many of our recent meetings, and I was thus debarred from becoming intimate with him. But he was one of the small band who originated the Association, and in his day did much good service for it both as member and President. The father of the Association has also passed away in the person of Mr. W. Hardie. His services to the Association as one of its founders, as a Past-President, and as its Secretary for a long number of years, are so well known and have been so appreciated as to require no eulogium from me. We must all regret that he was not allowed to enjoy longer the presentation which the Association recently gave to him. He had, if ever man had, the interests of the Association at heart. Nothing remains but for one and all to try and continue it in the same flourishing condition to which he raised it. This I hope will be his enduring monument. I have been brought into such close contact with him in business and in private life, that I am unable to speak what I feel; but as Secretary of the Association I am sure every member has experienced his kindness and his courtesy, and will realize that no words of mine can heighten or intensify the respect and love we all had for him. And now he is gone, and nothing remains but his memory. Mr. Penney and myself, in the name of the Association, sent a wreath to Mr. Hardie's family. This action, I am sure, the Association will approve of. We must not, I think, after this lapse of time, now open afresh the floodgates of sorrow and pain to the families of our departed friends; but we cannot but regret the events, and record the heavy losses which the Association has sustained.

Mr. E. H. Millard on "All Sorts and Conditions of Governors."

The President said the members would remember that at their last half-yearly meeting they had a most interesting paper by Mr. Millard, of Durham, and that, unfortunately, there was no time left for its proper discussion. It was therefore thought advisable, rather than start a discussion and have to finish it in a premature way, to delay the full consideration of the paper till this meeting. He thought it was Mr. Terrace who suggested that by this time Mr. Millard might be able to extend his paper by giving his experiences of winter as well as of summer consumption; and Mr. Millard had kindly prepared some supplementary remarks and diagrams for winter consumption. He had great pleasure in calling upon Mr. Millard to read those supplementary remarks.

Mr. Millard's remarks were as follows:—

In the paper I had the honour of reading at our last meeting, I touched upon several different sorts and types of governors; noting, in passing, two or three points which had struck me in my own practice. I briefly drew your attention to the steady improvement effected in the design of station governors, particularly as regards the adoption of water-loading; and, considering its steadiness in loading and unloading, I am surprised to find the alteration of pressure still carried out in so many works by means of cast-iron weights lifted on and off by hand (sometimes a very heavy one).

From water-loading governors it is only a step to a self-loading governor. In these governors the loading depends upon the relative positions of a water vessel on the bell of the governor and an adjoining water supply; water flowing from the latter to the former and *vice versâ*, according to the lowering and rising of the governor bell in response to the consumption demands. Any manager of small works who has simply a single-lift holder, or who by any other means is able to maintain a constant inlet pressure to his governor, could himself, at the expense of a few shillings only, make such governor self-loading; and to any such I should be pleased to give any hints required.

It was the failure of my self-loading governor to act as I thought it should do which led me to get out a consumption diagram, when the explanation was clear—viz., that I did not know accurately the variations in the rates of consumption from time to time. I thought it would be interesting to see how far others succeeded; and I give you the results in the diagrams on the wall. I was asked to supply further similar diagrams in regard to winter consumptions, which I now do.

After referring in detail to these supplementary diagrams, the author said: At the last meeting, I submitted the proposition that the pressure diagram should follow the consumption diagram with minimum and maximum pressures determined with due regard to the satisfactory supply of the district. I would now take the opportunity of amplifying this by stating that, while it is possible to fix permanently a minimum pressure, it is impossible to so fix the maximum pressure, as the maximum hourly rate of consumption is a fluctuating quantity from year to year, and even from period to period of the same year—in fact, from day to day. In nearly all the diagrams I am inclined to think there is a fundamental error, in so far as the maximum pressure is applied prior to the reaching of the maximum consumption—in fact, the pressure is regulated as though the peak of the consumption curve were cut off or obliterated entirely. I apprehend that the reason the pressure is increased at all is that the supply mains, either arterial or distributory, are not large enough for the consumption at the period of maximum demand; while the same remarks apply with equal force to the supply-pipes of many of the consumers, who thus require a greater pressure at the meter outlet during maximum consumption than they do with the minimum consumption. Hence the greater need for the pressure diagram to conform to that of the consumption, particularly at the time of maximum demand.

Examining the self-loading diagrams, there is little doubt that, had the capacity of the water vessel on the governor bell not been restricted, the outlet pressure given would have followed the peak of the consumption curve. In my own particular case, take the morning consumption, when the pressure does not attain its maximum, and you get the peak on the pressure diagram similar to the consumption peak. Although Mr. Whatmough, in his paper on a similar subject read at the meeting of the Manchester District Institution in September last, does not give consumption diagrams, yet in the two cases when the pressure does not reach its maximum (diagrams 5 and 6 illustrating his paper) you see the peak form in those pressure diagrams. One thing brought out on these diagrams in an especially clear manner is the fact of the long time taken to reach the maximum from the time of commencing to light up; so that even in a Lancashire mill town this process requires over an hour, and in the majority of cases is spread over two hours, while the decreasing consumption extends over double the time in each case.

I have also prepared two diagrams relating to the supply of electricity, which, while being outside the scope of this paper, are not without interest. In these the same points, not to say peaks, are to be noticed; and we may comfort ourselves with the fact that the ratio between maximum and minimum consumption is not nearly so high in our own case as in theirs.

I was reminded, after the last meeting, that I had omitted to make any reference to lamp-governors. This was done purposely, as I considered the paper quite long enough for the time at our disposal. Having obtained a fresh lease of your time, I may just say that I was led astray by the ambition to be in the fashion, to adopt the small viewly metallic governors for the public lamps. I can only say that I am now returning to the old tried and true, though not so comely, love, the leather diaphragm governor, next to which I would place the soapstone float type of governor.

Discussion.

The President said he had no doubt they had all read Mr. Millard's previous paper before coming to the meeting. The paper, and the supplementary remarks, simply bristled with controversial points. He did not believe for a moment that Mr. Millard expected them to agree with him in everything. In

fact, he was sure, from what he knew of Mr. Millard, that he would rather like some to disagree with him. He had just noted that Mr. Millard, in his previous paper, alluded to the use of gas-engines for exhausters, and the different forms of bye-pass arrangements in connection with gas-engines. Then he touched upon loading by water, referred to compensating chambers, and discussed various forms of valves. He went very fully into the relationship which should exist between the consumption of gas and the pressure of the gas at the works; and he wound up by mentioning lamp-governors. In all these things, there was ample scope for discussion. They had fortunately more time that day than they usually had; and he therefore expected a discussion worthy of the name.

Mr. H. Lees (Hexham) said he was quite sure Mr. Millard was anxious that there should be a good discussion; and he hoped, in the interest of the subject, and for the honour of the Association, that he would not be disappointed. In his original paper, Mr. Millard made some remarks as to the style of his writing. He did not think that any gentleman need apologize for style, if he was prepared to carry that style to its logical conclusion. He (Mr Lees) knew it was somewhat difficult to do so in the case of a metaphorical and allegorical style. Mr. Millard introduced to them an individual who afterwards turned out to be a governor which was guilty of certain indiscretions, so much so that he was unable to walk upon a straight line, any more than diagram No. 7; and this he attributed to water. It was, perhaps, too much to ask them to adopt the same conclusion. However, Mr. Millard did not leave them there long; for he had now brought before them a series of diagrams which, he was sure, would be full of interest to them after the meeting, because, although many of the points he had raised did not exactly deal with the question of governing, they were yet of considerable interest and value to them. When they studied these diagrams again—as he hoped they had done since their last meeting—he fully trusted they would find something more in them than they had yet done. The question of pressure was one which had been considered at several meetings within the past few years. It was surprising how some people changed their views. He noticed that one member took exception, in some form or other, on the occasion when Mr. Chester had, in connection with a paper, shown some diagrams obtained by a self-loading water arrangement, and asked why this should not be worked by hand. Of course, Mr. Chester made the only reply he could—that it might have been done by hand had the hand been there at the proper time, and known the proper time to do it. The same member, at a meeting of the Manchester District Institution, asked why they should have governors at all. He believed that they, in that Association, had long since decided that it was advisable to have governors; and he thought that these diagrams would convince them upon the point. There were many questions with reference to the regulating of the pressure for districts and difference in levels, and the dividing of the districts into sections; and, in addition, there were the difficulties in connection with the smallness of their own mains and of consumers' fittings, all of which made the subject a very complex one. Anything which might be advanced with a view to the removal of some of these difficulties would be a considerable help to them. Mr. Millard had done a great deal in this direction. In his own case, he supposed that he would require to apply some of the principles laid down, and he would then see whether he could accord with them. The comparing of the consumption with the pressure diagram would be very useful to him. He thought they would find that the consumption varied to an extent they did not expect. The self-loading governor had not always met the expectations of those who had adopted it. He could not account for this. But that it was a step in the right direction he thought they would admit. A short time ago, Mr. Chester brought before the Gas Institute a scheme that got rid of the difficulties which the self-loading governor did not. Mr. Millard referred to it; but perhaps it did not come within the scope of the paper. He thought they were much indebted to Mr. Millard for his communication.

Mr. D. Terrace (Middlesbrough) said that Mr. Millard had given them, very fully, the whole of the possible facts in connection with governing and pressures—or rather, he should say, the pressures and consumptions for nearly every occasion they could imagine. The President had referred to certain diagrams with which he had some connection. The high-pressure mains, so far as he could ascertain, had always been laid with a small pipe on the top to bring back a record of the output, and to let them know at the works what to do when there was a draught on the main. He thought this was a much better plan than depending on a governor-bell as an indication of the consumption, because, in the one case, they were in the heart of the consumption, and, in the other, the governor-bell was at the one end, and could not tell what was wanted at the centre. He therefore believed the small pipe the more reliable principle to go upon.

Mr. C. Dru Drury (Sunderland) thought they were all very much indebted to Mr. Millard for what he had brought out so clearly. Many of them, perhaps, had not realized the nicety with which they could adjust the pressure to the consumption; and the diagrams would be a most interesting study to them all, and would probably make them take up the subject much more keenly than they had done. While they should look and strive to work towards an ideal, it was not always possible to do so. In many cases gas managers had to make much smaller mains serve the purpose than they would if they had to begin *de novo*. This would, therefore, probably explain the rather odd diagrams they would find if they were to work out matters as shown. Of course, this need not prevent them in any way from attempting to get an ideal system. He could not see that there was much advantage in water loading, as compared with loading by weights. In any event, the work must be done by hand. He was not speaking of self-loading governors. With water loading they got a more regular pressure, but still the attendant who was there must weight it; and he might easily leave it too long, and effect a change in the pressure which would not be desirable. He thought it was a case of automatic changing; and he did not see why they should not stick to weights in the matter of loading.

Mr. W. J. Warner (South Shields) said he was quite familiar with all the diagrams he saw before him, except that in which the indication was the maximum consumption; and he thought that the whole thing was met by a reference to the pressure having to be maintained though the consumption might be reduced through the later hours of lighting. Till they obtained a perfect system of meters, service-pipes, and fittings, he thought that the maximum pressure would have to be maintained till the later hours of the night, though the consumption should fall very considerably. There was one point which had not been referred to, with reference to the return-pipe, which gave, at the works, the pressure in a central position. This furnished an indication of what the pressure should be at the point from which it was brought back; but that was no new idea. He thought it must be between thirty and forty years ago that it was adopted by a Frenchman, and, if he remembered aright, was worked in Paris. But in that case the return-pipe did not stop at showing the pressure; it acted on the governor itself, adjusting it to the pressure at the point of consumption. Mr. Millard touched upon the merits of metallic or diaphragm lamp-governors. He had had both in use for a great many years. They tested some thousands of them during the year; and only the other day, when he asked which was the best governor, he was told that they thought the disc was the best. He himself, however, was somewhat inclined to the diaphragm. In the disc, they got the dirt inside; and in the diaphragm they had the hardening of the material, which affected the consumption. The subject before them was a very interesting one. It was one he had studied for a great many years. They knew that the double cone was at work nearly thirty years ago. There was the other method, of counterbalancing, which, he believed, had originated in his own works. It was not so necessary now, in large works, where the districts were supplied through several governors; but in small works it was one of the best things, he thought, which could be adopted.

Mr. J. Hepworth (Edinburgh) said he rose with some reluctance to speak on the question before them, but he had none whatever in tendering his thanks to Mr. Millard for his very valuable paper, and especially for his most interesting diagrams. Mr. Millard had been very modest in his paper. He (Mr. Hepworth) really considered the author had given them the evolution of a governor, though he said, he thought, in his former paper, that he felt it somewhat difficult. Mr. Warner referred to the governor which accomplished more than the return-pipe spoken of in the cases of Durham and Middlesbrough. This governor was at work, as he happened to see it some two years ago, in Germany; and it was answering the purposes for which it was intended, as, he had no doubt, the arrangement at Durham did which had been referred to by the author. In the case of the French invention, it did not simply impart information at the governor station as to what the pressure was in the middle of the town or at some other point, but it immediately put on or took off the pressure as required. It was a good many years since he first employed a governor; but, oddly enough, the first one he used, more than thirty years ago, was a water-loading governor. He liked a water-loading governor. He had heard, as an objection to it, that it took such a time to put on pressure. There was no difficulty in putting that right. If the pipe was not large enough, they should make it sufficiently large, so that, if needed, the pressure might be applied in a shorter time. But, as Mr. Millard had pointed out, in one case the pressure was found to be put on more rapidly by water than by hand loading. Governors were now well made by most manufacturers; and they performed so well the functions they were intended to do, that there did not seem to be very much more left to accomplish. Mr. Millard's paper and the remarks which had been made all seemed to point in the direction of some ideal state of things, which at present, perhaps, had not been reached. It occurred to him, with reference to the small pipe referred to by Mr. Millard and Mr. Terrace, that he might ask what the effect would have been if, in the small pipe, an electric wire had been placed, not only for conveying the information, but, as in the case of the foreign governor referred to, for automatically putting on the pressure, whether the man were there or not, or taking it off. He thought they were looking forward to the time when, perfect as things now were, they should have an ideally perfect governor, which would not only be automatic, giving what information was required, but doing what was needed as well as telling someone else to do it. All the diagrams seemed to him to point to the necessity for a closer knowledge of the actual condition of things, which they possibly could get better than by a man sitting in the governor-room. The man did not know what was the real state of affairs in the

town. He did not know what sudden demand might arise, or when the demand might cease. Therefore, if they could get the perfect instrument which was here diagnosed, they would have, he thought, very little more to discuss in relation to governors. It had been mentioned that the great difficulties in the matter lay not only with the governor but with the engineer in the constantly altering condition of things as regarded the distributing mains, and the great differences which came to exist with respect to the requirements of a district. If their mains were perfect to-day as regarded size and capacity, they knew what would happen next week, if the town were a prosperous and growing one. The mains would be insufficient, at all events next year; and nobody proposed to put a new main in every year, or even ten years. The conditions were always altering. A consumer started with five lights, and in a very short time he was using five-and-twenty. These were difficulties which possibly no engineer was quite able to cope with; but there was no reason why, at all events, they should not look in the direction in which Mr. Millard had been leading them that day, with the view of getting the most perfect governor they could to meet conditions which were somewhat complex, and which, unfortunately, were always varying.

Mr. F. P. Tarratt (Darlington) said he should like to call attention to one of the diagrams. The governor here did not give way in correspondence with the curve showing the maximum consumption, although, as he understood, it was a self-loading governor. It appeared to drop for a couple of hours, and then afterwards to regain the high peak.

The President concurred in the remark that the paper gave room for very great reflection, when at their leisure. He was quite certain that nearly all of them were more or less guilty of possessing some of the defects in their arrangement of pressures which Mr. Millard had pointed out. It was, of course, the case—as Mr. Drury, he thought, had said—that they must do the best they could in their varying circumstances. They were not all blest with efficient mains; nor were they blest with a gas consumption which always went on equally at the same time each night, and continued according to diagram. He found, in Newcastle, for instance, that their consumption at night varied enormously, and even on two following nights, owing to some darkness or otherwise. He thought the only criticism which he could give upon Mr. Millard's paper was in the sentence where he said that the pressure diagram should follow the consumption diagram. He held, most emphatically, that no system of governing could be proper, or be theoretically perfect, unless the pressure diagram anticipated the consumption diagram. It was not sufficient, he (the President) thought, that the consumption on the mains should so reduce the pressure as to give indication of it in the governor-house. They must anticipate the greater demand that was to come on the mains. Of course, it was not right that they should anticipate it by hours. It was quite right, as Mr. Millard had pointed out, that they should note it as often as possible; but still they should anticipate the demand if they were to be safe.

Mr. Millard, in closing the discussion, said he thought they had let him off very lightly indeed. He thought that there were openings in the paper where he might have been tripped up; in fact, if he were to start now, he thought he might trip himself up. The first point Mr. Lees criticized him upon was not in his paper at all; it was a remark he made upon another gentleman's paper at another meeting altogether. With reference to Mr. Chester's paper at the Gas Institute meeting, Mr. Chester made a great point that, by means of an electrical indicator, he had arrived at the conclusion that, in order to get at the period of maximum consumption at the end of a district, he required 4-10ths or 5-10ths more pressure than he had been accustomed to put on. A diagram, straight off, in the first instance, would have told him that, if he had had another 5-10ths at the governor, he would likely have got 4-10ths or 5-10ths more at the end of the district. In the diagram Mr. Chester submitted, before the electrical appliances were fitted, there was a red line to indicate the line the governing man was to take, and which showed how the man had attended to his instructions. This was similar to what he showed in one of his diagrams, and similar to what Mr. Terrace had introduced. He showed it so as to indicate how, by means of a district governor, he got off the day pressure. If he had started his diagram at the time the pressure at the far end began to droop, and had loaded until the time when the far end of the district was at its minimum, had gone on in a gradual line, and then had, at that period, followed the governor action, he should have had a strictly level line in the district. Take Mr. Terrace's diagram, which he prepared when he wrote his paper of (he thought) 1893, it really led Mr. Terrace to come to this method of coping with his pressure. Mr. Terrace started about a quarter to four, and loaded until about half-past four. The town followed the same line, and the district also increased—showing most conclusively that the pressure was put on too early if the idea was to maintain a regular pressure on the district. It was maintained too long, because, in the district, at ten o'clock, the pressure began to go up again; and it would have been an advantage to have taken the pressure off at ten o'clock, instead of letting it go on till half-past eleven. There was a dead-level from four to eleven. If they inverted the diagram of the district, to get it as the works' pressure, they would almost get a level-line in the district. Mr. Chester's electrical apparatus showed most conclusively that, when he loaded his governors to what were his own preconceived notions of what the consumption was to be, he was an hour out of it. The pressure was on the diagram an hour before it was required; and it followed thus all the way through. The only objection he could see to the high-pressure pipe in the main was that it required a man's continual attention in the governor-house. In works the size of Mr. Terrace's, a man's wages were as nothing to the securing of an even distribution of pressure; but it was different in works of his (the speaker's) size. The great danger in loading by weights was that the pressure was put on at once, as the diagrams showed; but water-loading was more regular, and was therefore superior, because the intermediate steps were really drops of water. What he maintained was that the movement of the governor-bell gave them the nearest criterion they could have as to the gas consumption. Mr. Warner mentioned about the return-pipe, forty years ago, acting on the governor-bell. But it was a question whether this was altogether an advantage, because the pressure at what might be termed the outlet of the high-pressure main would require to vary about 1-10th or 2-10ths; so that, to a certain extent, the governor would respond, but it would simply maintain one level, and increased pressure would not be got in the district, to cover the period of maximum consumption. In such an arrangement, not only must the governor itself maintain the pressure, but it must give increased pressure to cover the defects, not only of the mains into the heart of the district, but also of consumers' fittings. Mr. Hepworth spoke of many members probably not knowing what took place from time to time in the several parts of their supply, outside their works. He could go farther than this, and say that they did not know from the works the five-minutely consumptions, as he knew, because, in order to get his pressure diagram, they took observations of the holders every ten minutes. He had tried to point out, in one of his diagrams, how very closely the governor-bell varied with the consumption. He did not say that it was a perfect system, but he could say it was better than anything they had, for works of his particular size. He would not, however, go the length of asserting that it was the only governor for large works. He was sorry to say that nobody had given him a hint as to the difficulty he had shown in another of the diagrams. The governor there worked very well until incandescent lights were fitted up, after which (when he took off the pressure at midnight) the bye-pass lights of the burners went out, because of the jerking action; and he had to discard the governor. With respect to the distributing mains, it was certainly absolutely necessary, from time to time, to take simultaneous diagrams (such as Mr. Terrace took) at the works, and in different parts of the district. He had been accustomed to follow Mr. Warner's plan, of having testing-pipes on the mains, and sending his own men to test them. He was afraid he had sometimes been misled by them, because of their not having been fortunate enough to have hit upon the exact five, or ten, or fifteen minutes during which the maximum consumption was going on, and which would, of course, greatly vitiate the results. The reason for the governor not giving way, as Mr. Tarratt observed, was that it had attained its maximum pressure when the maximum consumption was 25,000 cubic feet per hour; and the engineer had said that this was as far as he wanted to go with the consumption. If the governor had not been restricted as to capacity, there was not the slightest doubt about it, that the governor-bell would have responded to the increased consumption. This was the point upon which, he said, all the diagrams except one were behind the mark. The President had said that consumption varied enormously. Of course, it did; and it was the inability to know that the consumption was varying which led to all their present troubles. If the President's consumption jumped up enormously, his governor would drop. If it did so, that would be a very good criterion as to the consumption. The President took exception to his saying that the pressure followed the consumption. He really should apologize for expressing himself so badly. What he meant was that the lines should be similar in shape, and that they should be actually simultaneous, as they would be with a governor which was acting efficiently. There was one trouble which they found when they tried to have excess pressure put on beforehand; and he thought this was really the crux of so many complaints. Take Mr. Terrace's diagrams; the people evidently lighted up about half-past four, when they had about 20-10ths—an excess of pressure. When the pressure was on, they would very likely check their taps; but when the consumption in the district took away the pressure, the question was whether they adjusted the taps again. They must all do the best they could in the varying circumstances in which they were placed. It was a question whether any of them were more unfortunately placed than he was as regarded the district he had to serve. There were in his district some hundreds of feet of rise and fall; and it was a most difficult matter indeed to keep the pressure anything like so regular as he would like it.

Mr. W. Ford (Stockton) moved a very hearty vote of thanks to Mr. Millard, for his most interesting and really instructive papers.

Mr. T. Bower (West Hartlepool) seconded the resolution, and it was adopted.

Mr. Millard acknowledged the vote.

Election of Office-Bearers.

The President announced that the result of the ballot for the election of office-bearers was as follows:—

President.—Mr. E. H. Millard, of Durham.
Vice-President.—Mr. M. Dunn, of Goole.
Auditor.—Mr. H. Lees, of Hexham.
Hon. Secretary and Treasurer.—Mr. J. H. Penney, of South Shields.
New Members of Committee.—Messrs. W. Cowley, of Spennymoor, and T. Hardie, of Gateshead.

Mr. Millard returned thanks for the honour conferred upon him in electing him to the office of President, and stated that they in Durham would be very pleased to see the Association there at their next meeting.

Vote of Thanks.

Mr. J. H. Cox (Sunderland) proposed a vote of thanks to Mr. Gibb for the able manner in which he had presided over the meetings.

Mr. Dru Drury seconded the motion.

The President returned thanks, and the business proceedings closed.

The members and friends afterwards dined together in the County Hotel—Mr. Gibb in the chair. In the course of the proceedings, the Chairman intimated that Mr. Ford, of Stockton, was about to take a voyage to America, for the benefit of his health; and he was sure they all wished him God-speed and a happy return.

Presentation of Addresses to Mr. J. H. Cox and Mr. Chas. Sellers.

A pleasing incident in the midst of the toast-list after the dinner was the presentation of Jubilee Addresses to Mr. J. H. Cox, of Sunderland, and Mr. Charles Sellers, of York. The addresses were engrossed upon beautifully illuminated cards, framed in gilt. They each displayed the coats of arms of Newcastle and of the respective towns in which the gentlemen reside, as also a couple of views in Newcastle and a couple in their respective towns. On account of some of the members being obliged to leave for home by early trains, the unusual practice was adopted of displaying the address in the dining-room before the company sat down. They were much admired for their execution and the general scheme of colouring. The terms of each were:—

The North of England Gas Managers' Association very heartily congratulate John Henry Cox, Esq., on the completion, last year, of his Jubilee of Service as Manager and Secretary of the Sunderland Gas Company, and on the faithfulness and efficiency with which such service has been rendered, as manifested by the spontaneous recognition of his merits by Directors and shareholders alike.

The Association regard with pleasure their sense of the good work done by Mr. Cox, as one of the promoters and Past-Presidents of the Association, and as one who has materially assisted in raising it to the satisfactory position it now holds; they cordially convey, at the same time, their best wishes for his health, happiness, and prosperity.

Signed, on behalf of the Association, at Newcastle-upon-Tyne, this 28th day of April, 1900.

President—W. Doig Gibb; Vice-President—E. H. Millard; Ex-President—C. Dru Drury; Members of Committee—T. Bower, W. Ford, M. Dunn, A. B. Walker; Hon. Secretary and Treasurer—J. H. Penney.

The North of England Gas Managers' Association very heartily congratulate Charles Sellers, Esq., Secretary and Manager of the York United Gaslight Company, on the recent completion of his Jubilee of Service with that undertaking, and on the faithfulness and efficiency with which such service has been rendered.

The Association regard with pleasure their sense of the good work done by Mr. Sellers, as one of the promoters and Past-Presidents of the Association, and as one who has materially assisted in raising it to the satisfactory position it now holds; they cordially convey, at the same time, their best wishes for his health, happiness, and prosperity.

Signed, on behalf of the Association, at Newcastle-upon-Tyne, this 28th day of April, 1900.

President—W. Doig Gibb; Vice-President—E. H. Millard; Ex-President—C. Dru Drury; Members of Committee—T. Bower, W. Ford, M. Dunn, A. B. Walker; Hon. Secretary and Treasurer—J. H. Penney.

In making the presentation, the President said: We now come to the most important part of to-day's proceedings. Of the small band of gentlemen who were the founders of the Association, we fortunately have yet several left. They have borne the brunt of the battle and the heat of the day; and though perhaps not now so vigorous as once they were, we rejoice that they are generally still hale and hearty, and can and do give the Association the benefit of their ripe understanding and great experience. Two of these gentlemen have now served for over fifty years with the respective Companies with which they are both still connected—Mr. J. H. Cox at Sunderland, and Mr. Charles Sellers at York. I do not know whether to describe myself as still young or as middle-aged; but, in comparison with those we honour to-day, I may still consider myself young. It might therefore be deemed presumptuous on my part to personally act as I am doing, though I yield to none in my personal desire to do our friends honour. But I act to-day in a higher capacity. The Association have done me the honour to appoint me their President; and it is as their President, and as the mouthpiece of the Association—and, I may add, our Association as a unanimous whole—that I assure our friends that we unite in heartily congratulating them. Their cases cannot be separated. They are both of them founders, energetic helpers, and Past-Presidents of the Association. They have served their respective Companies with conspicuous ability and devotion. They are always ready to help and to advise their more inexperienced or less fortunate friends. They both have a fund of humour, and are always cheerful. I ask confidently, where can any other Association produce two such men with such records? The Association thus not only honours them, but our friends honour the Association with their presence. We congratulate them most heartily on the attainment of their Jubilees, and wish them health, strength, and happiness for many years to come. That the congratulations may be recorded in a tangible form, I now ask their acceptance of the illuminated addresses which the Association have had prepared for them; and I hope when these are hung up in their respective homes, they may often serve as reminders that they were the men whom the Association delighted to honour.

Mr. Cox said he was greatly indebted to the President for the very handsome manner in which he had brought this matter before the company. He felt considerable difficulty in expressing his thanks for the honour the Association had done him. He was exceedingly obliged to the members for their kindness. His connection with the Association had been a very pleasant one. When it was established, there were faces there whom they now sadly missed. Among them were Mr. Trewhitt, Mr. Hardie, Mr. Wallis, and Mr. Cowen. These had all "gone over to the majority;" but there were young men following them who, he was sure, would make a mark for themselves. The gas industry had made great strides since he was first connected with it. He remembered in Newcastle, not fifty years ago, a square gasholder, confined within heavy walls for fear of explosion. He had seen, at Seaham, a gasholder made of wood and cork, just like a ship. At that time gas was 7s. 6d. per 1000 cubic feet; it was now considerably less. Coal was then half-a-crown a ton; and other things were in like proportion. Whatever might be the ultimate result of the present high price of coal, there was no doubt that there were good times in store for the gas industry.

Mr. Sellers said there might be individuals present who could readily find suitable language with which to clothe their acknowledgments of such generosity as they had shown to Mr. Cox and himself, but he must confess he experienced the greatest difficulty in doing so. The feeling that was uppermost in his mind was one which prompted him to simply, but seriously, thank them for the great honour they had done to him. For if he were to speak for an hour, all he might say would resolve itself into that expression. He thanked the President for the very kindly references he had made to him; and he thanked the members for the hearty way in which they had endorsed the President's remarks. But they would permit him to say that in their great generosity they had reversed the world's ruling of cases especially like his own; for, instead of putting his many shortcomings as a member of the Association in the forefront, and applying Shakespeare's definition of the world's ruling—that

> "The evil that men do lives after them,
> The good is oft interred with their bones"—

he was aware that, burying the evil which he had done, and the shortcomings of which he had been guilty, they had put in the foreground all the good he had ever done, and had given that good emphasis and prominence and a long life. He was quite aware that there was a marked difference between the position filled by himself and that occupied by Mr. Cox, upon whom they had conferred a similar compliment to that which they had put upon him. From the time the Association came into existence down to the present, Mr. Cox had always most loyally and faithfully done his very best to promote the interests of the Association; while he (Mr. Sellers) had been the chief of sinners. He had neglected his duty, and therefore he could not feel that he was deserving of the compliment they had paid to him. He had not only committed sins of omission, but he had committed sins of commission which were rather worse. But when he referred to the difference in their positions, he meant it also in a domestic sense. Mr. Cox had chosen the better part, and had become the head of a family; and he (Mr. Sellers) felt sure that every member of that family would rejoice with Mr. Cox that day for the honour the Association had conferred upon him, and would hand that compliment down as an heirloom. He (Mr. Sellers) had no family to rejoice with him, and no family to whom to hand down the heirloom. As he looked round the tables, he could see, in his mind's eye, several vacant chairs where dear old friends used to sit—friends with whom he had worked shoulder to shoulder, with pleasure and profit to himself, and with benefit to the Association. And when he looked again round the table, he could see several old colleagues, who, like himself, were fast travelling on to "the sere and yellow leaf," as might be seen by the crop of silver threads among the gold. Before he sat down, he wished to express the feeling which was uppermost in his mind, and that was that he felt thankful that he had had health to reach the fifty years' jubilee at which he had arrived; and he felt sure that Mr. Cox would join and share with him in that expression. And, although they would never have another jubilee—for it was not given to any man to attain but one such jubilee—they could do the next best thing, and wish, heartily and sincerely, that at least some gentlemen who were in that room would reach that happy period, and receive a similar compliment to those which the Association had paid to them.

OHIO GASLIGHT ASSOCIATION.

(*Continued from p.* 1061.)

General Andrew Hickenlooper, of Cincinnati, read a very interesting paper on "Street Lighting," commencing with a full historical introduction, tracing the progress from prehistoric times to the introduction of gas, and touching upon the earliest installations, both in England and America. In regard to the volume or quantity of light necessary, he said it was absurd to advocate the use of lights of great intensity, where economical considerations precluded their being used with such lavish prodigality as to produce a uniform effect, as the system that gives the greatest uniformity of illumination over the whole surface to be lighted, is the most serviceable. The duty of a municipality was not fulfilled by brilliantly illuminating a few prominent thoroughfares at the expenses of the back streets and lanes. Illuminating power was not the same thing as illuminating effect; no photometer yet invented would accurately gauge the efficiency of any street lighting system. It was one thing to produce an intensely concentrated light, but quite another to utilize the same in a manner proportionate to its intensity. The very brilliancy of the source might prove a detriment rather than an advantage; so it was a mistake to regard the candle power as a fair representation of practical value. Petroleum, gas, and electricity were the three systems of lighting competing for public favour. Oils were not acceptable where gas or electricity were available; and the incandescent electric light was totally unsuited because of its inherent defects, limited power, and excessive cost. As the Company with which he was connected was to-day supplying two-thirds of the private electric lighting, both arc and incandescent, in the city of Cincinnati, he could claim to be in an independent position, and prepared to fairly consider the relative merits of arc electric and incandescent gas lamps. No one could deny that a 200-candle power light was more brilliant than a 20-candle light; but it did not follow that the former was more suitable as a unit of light, especially if the perceptive power of the eyes was exposed to alternate intensity of light and darkness. The effective rays of the arc light were confined to an area represented by 30° above and below the horizontal line, and there were inherent practical defects due to the variation in the adjustment of the carbons, producing flickering, change of colour, &c., that could not be compensated for by monetary consideration. The term "2000-candle power," though meaningless, deceptive, and grossly exaggerated, was, like any other frequently, persistently, and impressively told lie, accepted by the public, without regard to the fact that under the best conditions the lamps had never been proved to exceed a fourth of this rating; and this subterfuge was still being practised as a means of securing street-lighting contracts at a price greatly in excess of the previous charge for gas. But the ghastly glare, the deep shadows, and the frequent interruption have dispelled the eloquence of the speculative promoter, and the arc lighting craze was now at an end. Electricians themselves now acknowledged that attempts to measure the candle power of arc lamps had proved to be failures, and that the 2000-candle power claim, French measurement, and other exaggerations were a mistake. The opinions of eminent authorities were quoted, showing that 500 candles is a liberal estimate for a 450-watt arc lamp. Some tests made for the author on an arc lamp in actual use, showed a variation within 17 minutes ranging from 40 to 226 candles; and the average of the tests, which comprised eleven readings, was 96-candle power. The lamp was at the same time supplying an average of 288 watts, instead of the 460 watts required by the contract and paid for by the city. The Electric Company were supplying 3325 arc lamps for 3820 hours per annum, at the rate of £17 per lamp. If the value of 460 watts per hour was £17 per annum, then the city was only receiving something less than £11, and was losing about £20,000 per annum. These 3325 arc lamps, costing £56,500 per annum, had replaced 12,000 gas and gasoline lamps which cost just over £42,000 per annum—representing an increased cost to the city of over £14,000 per annum. Several tests made by Professor French averaged 164 candles for a 460-watt arc lamp, which corroborated the author's result of less than 100 candles for 288 watts. The increased cost, and uncertainty of the light, had led to public protests being addressed to the Board of City Affairs, requesting that, if the Welsbach gas-burner could not be introduced, a return might be made to the old system. Attention was then directed to the Welsbach gas-burner and the progress it had made as regards street lighting. At Munich, over 7000 Welsbachs now replace the ghastly glare of the arc lamps, and the principal thoroughfares of Paris are now lighted by Welsbach burners. Berlin, acknowledged to be the best lighted city in the world, had discarded arc lamps, and now used 35,000 incandescent gas-burners. Liverpool, finding that electricity was six times as costly as gas, had disregarded its own electrical works in favour of a contract with the Gas Company. Bolton and other cities in England, also the principal cities of the United States, had followed this example. At Cincinnati, three of the main suburban avenues, representing a length of over 4½ miles, were lighted by Welsbachs, averaging 40 yards apart, double burners at intersections, and single ones between—in all 260 burners in 204 lanterns—and the result was highly satisfactory to the public. Petitions were sent in objecting to the extension of the arc lamp system and requesting the Welsbach instead, both on the score of economy and of efficiency.

Several speakers in the ensuing discussion, including Mr. Dickey, of Dayton, Mr. Cline, of Springfield, and Mr. Wilkiemeyer, of Evansville, testified to the success of the Welsbach system of street lighting in their respective districts, after extended trial. Mr. John Franklin, Distribution Superintendent to the Cincinnati Gas Company, exhibited a number of appliances for the better utilization of the Welsbach lamp in street lighting, including a lantern devised by himself. The principal features were a pilot igniting arrangement for use with the ordinary torch, including a sliding shutter and a three-way cock. The lamplighter opens the shutter, turns the cock half way on, which admits gas to the pilot, ignites the same, closes shutter, and then turns the cock full on, thus igniting the burner and extinguishing the pilot. There is an anti-vibrating spring arrangement, and also a needle valve for adjusting the supply of gas to the burner. He also introduced a contraction in the bunsen or air tube, which greatly improved the mixing of the gas and air before combustion, and enabled a duty of nearly 30 candles per cubic foot of gas per hour to be obtained. He used an ordinary globe to protect the mantle, but placed on the top of it an enamelled steel deflector and a mica chimney, which protected the mantle from insects and also improved the draught of air to the burner. The lantern top was of special construction, arranged to turn back on hinges. A specimen of this lantern was exhibited, also lanterns intended for outside shop lighting, &c., together with examples suitable for large interiors, such as churches or workshops. He also exhibited a special arrangement for the connections of meters, that was used in Cincinnati with very satisfactory results.

A paper on "The Present Status of Fuel Gas" was read by Mr. J. R. Lynn, of Portsmouth, O. The supplies of natural gas were being rapidly exhausted, complete failure having already occurred in some districts, and in course of time others would follow suit. Under such circumstances, the possibility of providing an artificial substitute was extremely interesting. There was no evidence of the likelihood of selling gas at a price that would permit competition with coal and solid fuels for all purposes, but they could promise a gas that would meet all domestic requirements during certain seasons of the year, and render satisfactory service for intermittent use at any time; and in considering a fuel gas for all purposes, regard must be had to the vast requirement to be met, and to the character of the competition in the form of other heating materials with which it must contend. The only gas that could surpass natural gas in efficiency was pure oil gas; and even when oil was lowest in price, and circumstances were most favourable, this gas had never proved a commercial success in competition with coal or water gas, though there were several comparatively small Pintsch plants in successful operation. As regarded water gas, although it had to a great extent replaced coal gas, recent developments did not argue well for this particular method of production; and unless some unforeseen condition should arise, a marked decline in the relative percentage of water gas might be expected. So it was out of consideration in contemplating future fuel gas enterprises. With regard to soft-coal water gas, for which much had been promised, it had proved a failure; and there was no record of an instance where the apparatus stood the result of a fair, impartial, well-conducted test. The questionable history of many schemes and bubbles of the past, accounted more than anything else for the present apathy of investors towards the promotion of fuel gas enterprises. Under present conditions, there was but one possible method of manufacturing an economical gas that would increase the present field of the market for gaseous fuel, and that was by the distillation of coal in large quantities, and the complete utilization of all bye-products. Coal gas was equal in efficiency to carburetted water gas, and could be produced more cheaply in almost any part of the country. When residuals sold readily at fair prices, the coal gas man could make an excellent showing; and even with a dull market he still possessed some advantage. So if any gas was to supply a vast fuel demand, coal gas would do it, although not capable of being sold at the same price as, or quite filling the place now occupied by, natural gas. One ton of bituminous coal under a boiler in constant operation, was in practice equivalent to 25,000 cubic feet of coal gas. As the coal cost 8s. 4d. per ton, the gas must be sold at 4d. to be equal to it in value—a figure not likely to cover the cost of distribution alone. The price for fuel gas would have to be adjusted according to the local values of coal and solid fuels. Advocates of coal gas for this purpose were neither dreamers nor promoters of shadowy schemes, but voiced honest opinions, and treated the subject rationally. The manufacture of coal gas on a large scale would admit a material decrease in the cost of production, and the large consumption per mile of main and per meter would reduce the cost of distribution; while much that is wasted in the average gas-works could be turned to profitable account. What effect a greatly increased production of residuals and bye-products would have upon their market values was a matter of speculation, but the logical conclusion was that it would result in closer competition, to the detriment of existing gas-works. Attempts were now being made towards setting great undertakings of this nature on a commercial footing; and the results would be watched with much interest. The substitution of coke-ovens for retorts had been under discussion; but this

would only be practicable in works of the first magnitude. There were 84 gas undertakings in Ohio, and they produced during the past year 3400 million cubic feet of coal gas, and 630 million cubic feet of water gas. But not more than four of them exceeded a production of 200 million cubic feet of coal gas per annum, and these alone could benefit by modern improvements to any extent. Some 800 million cubic feet of artificial gas was sold for fuel and power purposes, and the proportion so applied was increasing—many companies in the State being able, during a portion of the year, to show a day output far exceeding that of the night.

Mr. M'Donald, in opening the discussion, said that nobody would ever make gas out of coal that would be equal, heat for heat, to coal, or capable of profitable application to any purpose for which coal would be equally serviceable. But the conveniences afforded by gaseous fuel were so great that consumers did not object to pay six or eight times the cost, heat for heat, of coal. Gaseous fuel would not be used for boilers or furnaces, or even for a hall stove in use 24 hours a day; but it would be used for the cooking stoves, for heating water for baths and domestic purposes, and for gas-fires where the room was only occasionally required. The meeting of these demands alone would mean multiplying the present output of gas by 5. Mr. Doherty said that the heating power of 25,000 cubic feet of gas was equivalent only to that of 1000 lbs. of coal, of which 80 per cent. could be practically utilized. But if the gas was used in a gas-engine, and compared with the coal required to raise steam for a steam-engine of similar power, it would be found that 7000 cubic feet of gas were as good as a ton of coal. If anyone used the figures given in the paper they should first be verified, as he found that the equivalent of one ton of coal under a boiler was nearer 50,000 cubic feet of gas. Mr. Stone said he had read somewhere that 180 gallons of oil, 25,000 cubic feet of natural gas, or 35,000 cubic feet of coal gas, were equivalent in heating value to a ton of coal. The advance in price of oil had led him to make particular inquiries, and he agreed with the author that at the present price of coal, coke, and tar, within (say) a radius of 100 miles, there was no soft-coal water-gas process at present that could compete with the straight coal-gas process. General Hickenlooper said that a test had been made at Cincinnati by three independent experts; and the results entirely confirmed those arrived at by the author. Mr. M'Donald remarked that one ton of coal to 25,000 cubic feet of natural gas, or 35,000 cubic feet of coal gas, was a very generally accepted figure. Mr. Doherty said that there must be something wrong in the values usually accorded to coal and gas, or some mistakes in the tests quoted. One ton of good coal was considered to be capable of yielding 28 million B.T.U. Taking coal gas at 750 units per cubic foot—and he thought 650 units would be more accurate—25,000 cubic feet of gas only represented 18¾ million units. An efficiency of 70 per cent. could be obtained with the coal; and he doubted if over 80 per cent. could be utilized from gas. Certainly they would not get the whole of the 100 per cent. Mr. Whysall said there was no difficulty in displacing a ton of coal with about 15,000 cubic feet of natural gas.

Mr. Lynn, in replying, said that his results for coal were obtained by careful practical trial with a view of getting as much as possible for it; but he did not actually test the coal gas. He gave that the benefit of the theoretical heating value, which was rather understated by Mr. Doherty, as he found that 1 cubic foot of good coal gas would develop 750 units. Natural gas was usually credited with 1000 units; but the Ontario natural gas would not give more than about 890 units, and the gas supplied to Detroit from Ohio was only equivalent to 840 units.

"Prepayment Meters" was the subject of a paper by Mr. J. D. M'Ilhenny, of Philadelphia (Pa.). The general experience had proved this system to be a means of popularizing gas, and opening up a line of business hitherto unobtainable among small householders. Much had been heard about the usefulness of these meters in large cities; but they were as well adapted, and might be of more positive value, to a small gas undertaking than to a company that supplied millions of cubic feet per day. The first cost of the prepayment meter was regarded as an obstacle, though no one hesitated about procuring ordinary gas-meters. The extra cost of a 3-light meter was about £1 4s.; and if an annual charge of 4s. was set aside for interest, depreciation, and maintenance, which was certainly a very ample estimate, he contended it was more than covered by the saving in bad debts, cash discounts and allowances, and time spent in collection, which might be devoted to canvassing or other useful work that produced some positive result. Considerable expense was frequently incurred in pushing the use of gas-stoves; and prepayment meters, while not more costly, were of equal value as bringing in fresh business. Attention was directed to a table showing the monthly sales and cash receipts during the year 1899 in a small company having 700 meters in all. Commencing with 53 prepayment meters in January (which had increased to 86 by the end of December), the sales of gas were nearly 2¼ million cubic feet, and the cash receipts £700. He had made inquiry at another small works, having something under 1000 meters in all, and was informed that 203 prepayment meters were in use, with eminently satisfactory results to all parties concerned; and the receipts averaged £3 10s. per meter per annum. They were enabled to tap a new source of business, and also to deal effectively with troublesome customers. There had been no complaints; and the relations of the company with the prepayment users were excellent. Even in a town of 4000 inhabitants, out of a total of 700 meters, 215 were prepayment; the output being 10 million cubic feet of gas, and the price 6s. 3d. per 1000 cubic feet for light and 5s. 2d. for fuel. The company were so well pleased with the results that they had decided to extend the system. Prepayment meters were now as satisfactory in working as ordinary ones, from the mechanical point of view; and the risk of robbery from the cash-boxes had proved to be very trifling and easily dealt with. They were also well adapted for use with natural gas—the 20-light size being most suitable; and one company, having set 1000 of them, was now averaging £4 7s. 6d. yearly revenue per meter. He concluded by quoting the experiences at Tottenham (England), as lately presented by Mr. Eldridge before the Southern District Association of Gas Managers.

The Secretary introduced the discussion by reading a letter from Mr. Curtis, of Woodbury (N.J.), who, after three years' experience, had nothing but good to say of the system. He intended to enlarge the output of prepayment meters as opportunity offered. Mr. Gribbel remarked that the best proof of the success of the prepayment meter was the fact that the makers had as much as they could do in turning the meters out fast enough to fill orders. Mr. Ritter said he had 550 meters on the new system in use at Columbus for 18 months; and while he did not wish to draw any conclusions as compared with the ordinary system, he had not formed so favourable an opinion of them as was expressed in the paper. The saving in bad debts, cost of collection, &c., was quite outset, in his case, by imperfect mechanism and theft. In placing the meters, also, it was necessary to distinguish clearly between *bonâ fide* new customers and those who simply changed from the ordinary system to the new. In his experience, people who would not take gas except by the prepayment system were such poor customers as scarcely to be worth having; and his average receipts per meter had not at any time exceeded £2 10s. per annum. He did not wish to infer it was not a success, as he thought that in other circumstances and localities it would give better results. He merely mentioned a few difficulties, some of which could be remedied in the future. Mr. M'Ilhenny, in replying, said it was no use to expect too much from the prepayment system. Where natural gas was abundant, and the artificial gas was required for lighting only, it might not be a success, as the lighting business alone, with the class of people who would be likely to adopt the system, was very small. It was with people who also used the gas for fuel that the prepayment meter was making such headway. Where the gas was used for lighting only, the returns would not be better than with the ordinary meter.

THE SUPPLY OF WATER GAS IN DUBLIN.

At the Meeting of the Royal Society of Dublin last Wednesday, an interesting paper on "Recent Analyses of the Dublin Gas Supply" was read by Professor J. Emerson Reynolds, M.D., F.R.S. In the course of it, he said:

Large quantities of the city gas are used for various purposes in Trinity College, and it is the practice to analyze it occasionally in the chemical laboratory in order to ascertain whether its quality is maintained. In the course of the series of analyses made during the last five months, I detected a marked change in composition, which began in February and continues to the present time. This change indicated that plain coal gas was no longer supplied, but that a mixture which includes a considerable proportion of water gas has since been delivered. On the 12th of March, I drew attention to this change, in the course of a lecture delivered in the College on that date. Extracts from that lecture appeared in the daily papers, and led to considerable discussion, in the course of which opinions were attributed to me as to the probable effects of the change, which I did not express. I therefore desire in this paper to place on record the analyses made, and to shortly state the related facts which should influence opinion as to possible danger attending the public use of mixtures of coal and water gas.

Twelve analyses of the Dublin gas, performed between the 25th of November, 1899, and the 16th of January, 1900, showed that it contained, on an average, 6·2 per cent. of carbonic oxide; and a series of analyses performed since showed a great increase in the proportion. On Feb. 22 the percentage was 7·2; on Feb. 27, 8·6; on March 1, 8·7; on March 3, 8·5; on March 6, 10·8; on March 7, 12·6; on March 8, 11·2; on March 9, 17·9; and on March 10, 10·6. Apart from minor variations, to which I shall not further refer, the significant difference in the series is the increase in the percentage of carbon monoxide found in the specimens examined. The first series of analyses prove that the ordinary coal-gas supply to Dublin during nearly three months contained, on an average, 6·2 per cent. of carbon monoxide; the second series, that there had been a gradual rise in the proportion of carbon monoxide until it had doubled on the 7th of March, while two days later it had nearly trebled—17·9. It then fell away, and subsequently rose again to 16 per cent. in March. So great a change could, practically, only be due to the addition of water gas. When the trend of the results became clear, I communicated with the Gas Company in the first instance, and they admitted that a proportion of carburetted water gas had been mixed with the coal gas.

Members of the Society are well aware that what is technically known as water gas is produced by passing steam over red-hot coke, when the following change occurs: $H_2O + C = CO + H_2$. That is to say, the carbon in the form of coke, when sufficiently heated, removes the oxygen from the water vapour, and produces therewith carbon monoxide gas, while hydrogen is set free. The mixture of combustible gases so obtained gives a very slightly luminous flame and has little odour. When petroleum or other oils are vaporized at a sufficiently high temperature in this gas, their products render the flame much more luminous, and communicate a strong odour. The product is carburetted water-gas, and it contains about 30 per cent. of carbon monoxide; the rest consisting of hydrogen and small proportions of its carbides. This gas is much cheaper than coal gas; it is more readily and quickly manufactured; and its production enables a gas company to use up to advantage a considerable proportion of their coke. Moreover, it can be easily made of almost any desired illuminating power, and is not more explosive with air than plain coal gas. It is therefore much to the interest of the Dublin Company to mix a considerable proportion of this water gas in their supply. Such mixtures have been used in the United States since 1878, and to a much smaller extent in this country since 1891. Some American cities, such as Boston, New York, and Chicago, burn almost unmixed water gas. But in the United Kingdom comparatively few towns as yet use a mixture; and in those which do, 50 per cent. of water gas is seldom exceeded. In London, very little has been used; and several companies have not distributed any.

There does not seem to be any statutory difficulty in the way of the gas companies substituting water gas for coal gas; and there would not be any general objection to their doing so, provided there was no greater risk to health and life than with ordinary coal gas. But that such danger does exist is beyond question, as carbonic oxide gas is a powerful and direct poison. A gaseous mixture which contains much of it, as Dublin gas now does, is necessarily more poisonous than the ordinary coal gas, which seldom included more than 6 per cent. Therefore, in the lecture already referred to, I said only so much by way of warning, and added: "I do not want you to suppose that there is ground for undue alarm, or that the addition of water gas to coal gas is not legitimate. I think, however, that the fact of so material a change in the nature of the supply should have been notified to all consumers, in order that they might be on their guard against escape of the new gas from any causes." I do not think it would be possible to draw attention to a serious matter of the kind in milder terms than these; and no others were used by me. Nevertheless, at a recent general meeting of the Alliance Gas Company, the Managing-Director is reported to have said that the question was brought forward to create a "scare." It is therefore desirable to deal with the question of the danger to health and life which attends the use of the mixed gas more fully than I considered desirable in the first instance.

An important report of a strong Departmental Committee, appointed by the Home Office, was issued last year on the manufacture and use of water gas and other gases containing large proportion of carbonic oxide. This Committee examined a number of gas managers, as well as medical and other experts; and, after taking evidence, which was obtained from America as well as the United Kingdom, requested a distinguished member —Dr. J. S. Haldane, F.R.S.—to draw up a digest of the evidence affecting the poisonous action of carbonic oxide mixtures, and to make independent experiments in order to clear up some doubtful points. This important digest forms the chief of the several appendices to the report of the Committee; and the results arrived at represent the grounds upon which much of the report has been based. Anyone desiring to correctly estimate the value of the conclusions expressed in the general report should therefore refer to Dr. Haldane's excellent statement; but it is sufficient for my purpose to cite the conclusions which affect the question with which I am concerned. The report states that "the poisonous action of coal gas and water gas is due solely to the carbonic oxide which they contain," and that "the higher the proportion of carbonic oxide, the greater is the poisonous property of the gas;" that further, "given equal conditions as to size of room [in which an escape occurs], flow of gas, length of exposure, &c., the danger to life from an escape of carburetted water gas, or of coal gas mixed with any considerable proportion of water gas, is far greater than that from an escape of ordinary coal gas. The danger, in fact, increases at a much greater ratio than the proportion of carbonic oxide." This deliberate statement by the Committee of well-ascertained facts disposes once for all of the assertions made by interested and unskilled persons that the water-gas mixture is not more poisonous than ordinary coal gas. Carbon monoxide is well known to act as a poison by forming a strong compound with the hæmoglobin of the blood, and so preventing the absorption of oxygen from the air which is necessary for the maintenance of life. So strongly is the carbonic oxide held by the blood, that it is desirable to resort to inhalation of pure oxygen in cases of partial poisoning by it. According to Dr. Haldane's report, air containing anything more than 0·2 per cent., or 2 parts per 1000, ought to be regarded as entailing risk to life. Half a part per 1000 is still capable of causing, even in healthy persons, giddiness and headache. Dr. Haldane adds: "The after-symptoms of carbonic oxide poisoning are often of a very serious nature;" and he then details the character of the symptoms.

It has recently been asserted by gas managers and others that the water-gas mixture has not caused more accidental or other deaths than plain coal gas. This is not the opinion of the Committee. Taking the case of Boston, they point out that in 1886, when there were 29,554 consumers using plain coal gas, no accidents were recorded. In 1890, there were 46,848 consumers of a gas supply of which only 8 per cent. was water gas, "and there were six deaths from gas poisoning." In 1895, the number of consumers reached 68,214, and 90 per cent. of the supply was water gas, and 24 deaths occurred. In 1897, the consumers numbered 79,893, the gas contained 93 per cent. of water gas, and there were 45 deaths. After discussing the cases of other towns, the Committee go on to say: "After making every other due allowance, we feel that the state of affairs disclosed in Boston, New York, San Francisco, and other towns, is decidedly serious." Dr. Haldane points out that the number of accidents by the use of the mixed gas increases approximately as the cube of the gain in percentage of carbon monoxide. Thus, if the percentage of carbon monoxide be increased from 6 to 18, the probable cases of poisoning would be 27 times greater. "This rule," he says, "would seem to be borne out in the case of Toronto; and, so far as it is possible to judge from the very partial information available in the case of towns in the United Kingdom distributing any water gas, experience in this country also points in the same direction."

The author concluded by referring to some of the recommendations of the Committee; among others to those referring to the present use of imperfect gas-fittings, and the advisability of conferring upon a Central Department power to "make regulations, enforceable by adequate penalties, limiting the proportion of carbonic oxide in the public gas supply at night to 12 per cent., or such greater amount as the Department may consider desirable."

Professor Cole, who presided, in inviting discussion on the paper, remarked that Professor Reynolds had, by bringing the subject under the notice of the Society, placed it in a scientific arena, and had freed himself of the charge of personal bias.

Professor Tichborne (Official Gas Examiner for Dublin) said, with regard to the statement about the scare, he was quite sure that Professor Reynolds did not wish to create one. But some little alarm had evidently been caused by the extraordinary statement made in the House of Commons that the high death-rate of Dublin was due to the manufacture of water gas. The highest death-rate of the city was during the first and second weeks of January, when it was 51·3 and 51·9 respectively. The average for January was 47·1; for February, 41; for March, 37·5; and for April, 33·1. So that there had been a steady and gradual diminution from the first week of January; and he hoped it would continue. Though the highest death-rate was during the first and second weeks of January, he was officially informed that the first carburetted water gas was sent into Dublin on the 6th of February. These statistics showed that there could be no connection between the high death-rate and the supply of water gas. If there were any, the more water gas they had the better, because the death-rate had steadily declined since its introduction. He did not see any necessity for supplying carburetted water gas at night. The gas possessed certain advantages over ordinary coal gas. It had a higher illuminating power, it could be produced more quickly, and the products of its combustion were much purer. He would take the liberty of reading an extract from the report of the Departmental Committee to which Professor Reynolds had referred:—

> In the daytime, however, the amount of carbonic oxide is not of serious consequences. An escape of carburetted water gas is as easily detected as one of coal gas, and, except in very special circumstances, can be avoided or remedied long before the atmosphere is in the least degree poisonous. Even at night very slight escapes of an ordinary character, caused, for instance, by imperfections in the joints of fittings, do not appear to us to be rendered more formidable by the introduction of carburetted water gas. It is practically impossible for a really poisonous atmosphere to be produced by such escapes; and though it is evident that constant exposure to small leakages of gas may be to some degree prejudicial to health, we do not think that the existence of anything like chronic poisoning by carbonic oxide has been established.

He might say that cities like London, Manchester, and Belfast were being supplied with the gas, and, in fact, Dublin was behind the times in the employment of it. He had made careful inquiry at the Dublin Hospitals, and had learned that there had not been any accident from this gas during the past three months. He had been told that there had been several from electric currents; but nothing very serious. He could not trace any deaths from this cause, though two or three cases had been taken to hospital. And he was further informed that a very large proportion of the burns sustained, especially by children, arose from the use of oil-lamps.

Dr. C. F. Moore said he had been called to two cases of accident from water gas. In one of them, a man seemed to have only put his nose into the receptacle for the gas, and he was dead and perfectly cold when discovered shortly afterwards. In connection with the factories of Dublin, he had very great reason to apprehend the danger arising from the more deleterious composition of the gas burnt. There were a great many places in which gas-engines were employed, and where a large amount of inevitable escape of gas took place therefrom. Water gas had a greater specific gravity than coal gas, and therefore it took a longer time to clear away after an escape. For this reason, the

danger of an explosion when a light was brought into contact with it was increased. A large number of people were engaged in these works where gas-engines were used; and therefore he thought it was very important that such a paper as that of Professor Reynolds should be made public in Dublin.

Mr. JOHN R. WIGHAM remarked that Professor Reynolds seemed to have been particularly guarded and careful in his statements, and said he thought the effect of the paper would be to do away with the slightest feeling that there need be any scare in connection with the matter. Professor Reynolds had told them that carbon monoxide gas was poisonous. Nobody doubted this for a moment. The extracts which he read from the report of the Departmental Committee tended, not to alarm, but to soothe the public mind, and to reassure the people as to the use of water gas. The Committee recommended that there should never be a greater proportion of carbon monoxide than 12 per cent. He thought it would be found that the average of the figures which Professor Reynolds had quoted dealing with the percentages of carbonic oxide in Dublin gas was not more than 12 per cent. If people supposed that the present gas supply of Dublin was particularly dangerous, he thought they were labouring under a very great mistake. Nobody should know more about the poisonous nature of the mixture than the people in the works where the gas was made. Some of those present who were connected with the Gas Company knew perfectly well that there was not the least danger, and that not the slightest accident had occurred through the gas from first to last. If there was the possibility of people being so suddenly killed by the gas, were not those employed at the works most exposed? It was true they were supposed to be skilled persons; yet in the manufacture of the gas there was the possibility of getting a puff of it in the face. Such things had happened, and no inconvenience had resulted, as far as he knew. He did not mean to say that the truth should be suppressed in any way. One great thing about water gas was that if it was poisonous it was also exceedingly pungent. If a man or a woman went to sleep in a room in which the fireplace and windows were closed, unless he or she were under some disability, from having taken drink or some such cause, the gas was so pungent that it would awake the person before it could do harm. [Professor Reynolds dissented.] Well, he (Mr. Wigham) was quite familiar with its peculiar smell. It was by no means similar to that of ordinary gas. It had a much more disagreeable odour; and the fact of its having this odour was an evidence of its safety. As to Professor Reynolds's criticism of the Gas Company for not having given the public notice of the change, he (Mr. Wigham) did not think they were called upon to do so. The Company was a creature of the law. They made their gas and supplied it to the public under certain legal restrictions; and he did not see that they were called upon to say to the public, who did not understand these things: "Look out, because we have made a new kind of gas." He thought this would be a foolish thing. The Company knew they were making a change which would only be perceptible to an expert; and he thought it would be an exceedingly dangerous thing to have created a public panic upon such a subject. Professor Reynolds's opinion was looked up to in all quarters; and they should expect him to quiet down any needless alarm, and not in any way to accentuate it.

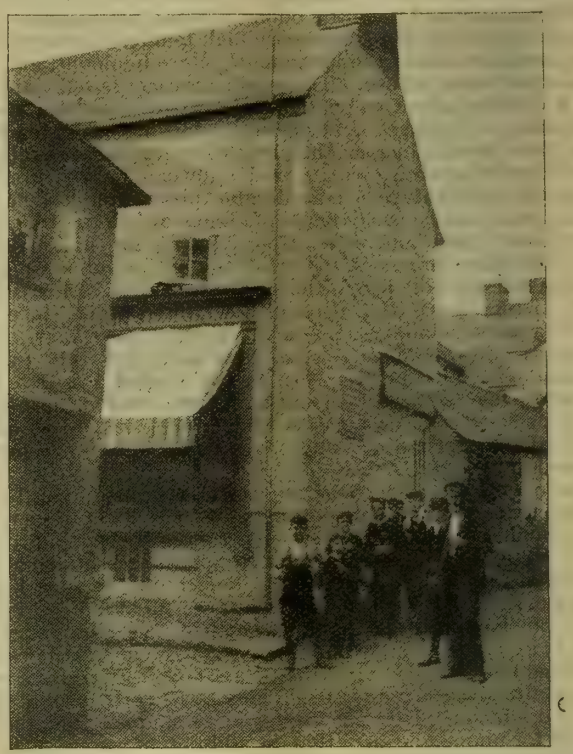
After some further discussion,

Professor REYNOLDS replied to the remarks of the various speakers. Referring to the point urged that no accidents had occurred, he said he presumed the public read the newspapers, and that, therefore, they had received warning of the change in the composition of the gas, though the warning had not come from the Gas Company.

The Cost of Introducing the Metric System.—This subject was dealt with in the April number of "Cassier's Magazine." It is pointed out that more than twenty years ago, in a report on the subject, made to the Franklin Institute by Dr. Coleman Sellers and the late Mr. W. P. Tatham, it was stated that, according to calculation, in a well-regulated machine-shop, thoroughly prepared for doing miscellaneous work, employing 250 workmen, the cost of a new outfit, adapted to new measures, would not be less than £30,000, or £120 per man. If new weights and measures were to be adopted, so the report continued, all the scale-beams in the country would have to be regraduated and re-adjusted; the thousands of tons of brass weights, the myriads of gallon, quart, and pint measures, and of bushel, half bushel, and peck measures, and every measuring rule and rod throughout the land, would have to be thrown aside, and others, which the common mind cannot estimate, substituted. The great mass of English technical literature would become almost useless, and would have to be translated from a language which we, and the nation we have most to do with, understand perfectly, into a new tongue, which is strange to most of our people. As a question of cost, let those who advocate this change consider it carefully. Altogether, the ultimate benefits of the change proposed would be of less value than the damages during the transition. Those who choose to do so can use the metric system, and no one can object to it; but, for the Government to require its people to use that, and no other, would be an abitrary measure which they would be neither willing nor able to bear.

THE DISCOVERY OF COAL GAS.

We have received from the Rev. E. Ambrose Couch, of Bridgwater, a print of a photograph which he has taken of the house at Redruth in which Murdoch, the inventor of gas lighting, lived from 1782 to 1798; and we reproduce it, accompanied by



a few notes on the subject of Murdoch which Mr. Couch has been good enough to prepare. Of course, many of these particulars are known to the majority of our readers; but it will no doubt be interesting to have the details from the pen of a non-technical writer. Mr. Couch says:—

Though gas lighting is to-day the popular mode of illumination, there are, perhaps, but few people who are aware where, when, and by whom coal gas was first discovered and first burnt. So rapid has been the development in the procuring of artificial light, that there are people alive to-day who can remember that, at one time, the quickest way of obtaining a light was by spending many precious minutes in trying to strike a spark of fire from a flint—allowing it to drop into a box containing tinder composed of charred linen or cotton rags. This small spark had then to be gently heated and fanned, until it became of sufficient strength to ignite a brimstone match when applied to it. It was in this tedious way that our fathers obtained light in the "good old days." Great was the need, in those times, of that most excellent virtue, patience—and especially if it should happen that the tinder in the box got wet during the night; for in that case there was nothing for our fathers to do but to wait till the return of natural light. In 1827, however, there was invented a match which ignited by friction, though it did not come into general use for many years. In these times, the "rush-light," which gave the faintest glimmer amid surrounding darkness, was the only mode of illumination known in many a home. The rush-light was succeeded by candles and the snuffers—giving trouble and an offensive smell of which many to-day are ignorant. Then there came the various stages of oil-lamps—at first burning animal-fats and oils expressed from the bodies of fish, and afterwards mineral oils such as paraffin and benzoline.

It was not till the close of the eighteenth century that the world became acquainted with that kind of lighting which is now so popular—coal gas. The person to whom this great and really beneficial discovery is due—a discovery which completely revolutionized the then existing modes of illumination—was William Murdoch. A native of Old Cumnock, in Ayrshire, he was sent by the firm of Boulton and Watt, Engineers, of Birmingham, to superintend the erection and fitting of their steam-engines in the noted Cornish mines. It was while he was in the county of Cornwall that he made a number of experiments on gases for the purposes of illumination; and the house depicted in the accompanying photograph, situated in Redruth, is the identical house where William Murdoch discovered coal gas, and applied it to practical use in the lighting of it, in the year 1792. The small iron plate affixed to the end of the house (as shown in the photo) bears the following inscription.

WILLIAM MURDOCH
LIVED IN THIS HOUSE
1782—1798.
MADE HIS FIRST LOCOMOTIVE
HERE AND TESTED IT IN 1784.
INVENTED GAS LIGHTING AND
USED IT IN THIS HOUSE 1792.

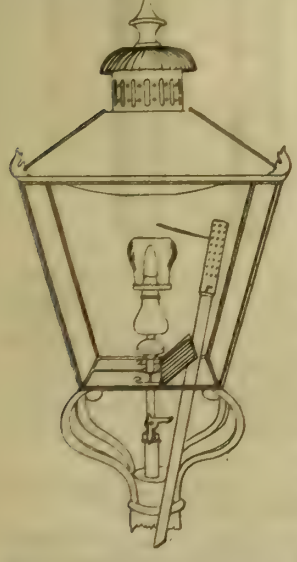
William Murdoch continued his investigation, and brought

this new light into public notice in the year 1802. It was in that year that the peace of Amiens was declared; and in commemoration of the event, the whole front of Boulton and Watt's Soho Foundry, in Birmingham, was lit up with gas. A contemporary writer thus describes it: "The whole front of the extensive range of buildings was ornamented with a great variety of devices that admirably displayed many of the varied forms of which gas-light is susceptible. The luminous spectacle was as novel as it was astonishing; and Birmingham poured forth its numerous population to gaze at it." Murdoch did not patent his invention, and gas was brought to the notice of London in the year 1803. In 1805 Pall Mall was lit up with it; and in 1810 a Company was formed, under Act of Parliament, for the manufacture and supply of the new illuminant in a district of London. The lighting of the whole of London quickly followed; and "the time had arrived when men were to see the capital all the year round from dusk to dawn, blazing with a splendour beside which the illumination for La Hague and Blenheim would have looked pale." This was but the prelude to its universal adoption—first in England, then in other countries of the world—as seen at the present day.

THE EXPENSE OF THE PILOT: A NEW TORCH FOR INCANDESCENT LAMPS.

There has been quite an awakening of interest lately, through the appeals of various new devices, in the question of the method of igniting street incandescent gas-lamps. It is recognized that, in order to promote the extension of the incandescent system, and the better to enable it to compete with the electric light, the cost must be brought as low as possible consistent with good illumination. One direction in which it has been thought retrenchment might be effected has been in the "dropping of the pilot." It cannot be denied that the constantly burning bye-pass involves an expenditure of gas which, even in a moderate installation of street-lamps, forms an appreciable annual charge. Readers of the paper by Mr. J. H. Sheldrake which we published last week, had this brought home to them in a striking little calculation which he made. With gas at 3s. per 1000 cubic feet, he showed that the consumption of gas by a street-lamp bye-pass would represent a cost of 5s. 3d. per annum; and multiplying this by the number of lamps in use, or proposed to be adopted, it will be seen that there is an expenditure which is worth saving. In fact, the annual expense of maintaining the bye-pass, taking Mr. Sheldrake's figures, is actually about equal to the cost of the number of mantles which engineers experienced in this system of lighting say are required per annum to ensure efficient street lighting. Therefore, on this point alone, the question of doing away with the flash-light is worth serious attention. But beyond this, the pilot is charged by lighting engineers with reprehensible conduct, which augments the cost of maintenance and labour. It frequently blackens the mantles, and causes them, particularly in cold weather, to fracture by heating them unevenly. In inclement weather, too, it has the bad habit of going out; and in cold seasons complaints are made of the supply-tube becoming stopped up, and so causing the extinction of the jet. This cessation of duty on the part of the pilot, delays the lamplighter who has either to indulge in the undignified action of climbing the lamp-post, or must fetch a ladder to re-start the delinquent.

The constant cost and these annoying failures have suggested various other expedients for performing the same service. There have been the self-igniting arrangements, which, for street-lighting purposes do not appear so far to have "taken on" to any extent. Then some months ago, we noticed a patented device introduced by Messrs. Alex. Wright and Co., by which the ordinary torch could be employed. It consisted of a special form of cock, and a bye-pass in one corner of the lantern, which, on being ignited by the torch, threw over the top of the mantle a long thin flame. This was ingenious; but there has been an improvement upon it which rather takes our fancy, though some engineers may prefer the original form. With the new invention, no special form of cock or bye-pass of any kind is required; all that is necessary for the safe and sure lighting of incandescent lamps being contained in the torch itself, which is simple in construction, easy to handle, and suitable alike for flat-flame or incandescent burners. On inserting the torch in the lantern, the lamplighter can, by merely a slight pressure on an india-rubber bulb in the handle, project a flame some inches in length over the top of the mantle, while keeping the torch as far from the latter as the dimensions of the lantern will allow. There is nothing more difficult about it than there is in the ordinary torch to which the lamplighter is accustomed. The means by which the jet of flame is secured are these: In a groove in the handle of an ordinary torch, a small tube is inserted, at the lower end of which is the india-rubber bulb already mentioned. The tube terminates at the head of the torch in a small reservoir containing benzoline (perhaps ½ oz.), and upon this reservoir fits the ordinary colza oil container and torch head. Through this, however, passes a small tube, terminating at the side of the flame, and bent over it at about right angles. The colza oil burner being alight, and pressure being applied to the rubber bulb, a small amount of benzoline vapour is sent up the tube, lighting at the colza flame, and shooting out at right angles (as shown in the illustration). In addition to its main purpose, the flame, being luminous, will be found useful to the lamplighter in performing his duties on dark nights. The torch, being fitted with a hook, can also be used for turning on the cocks of lanterns already fitted with permanent bye-passes.

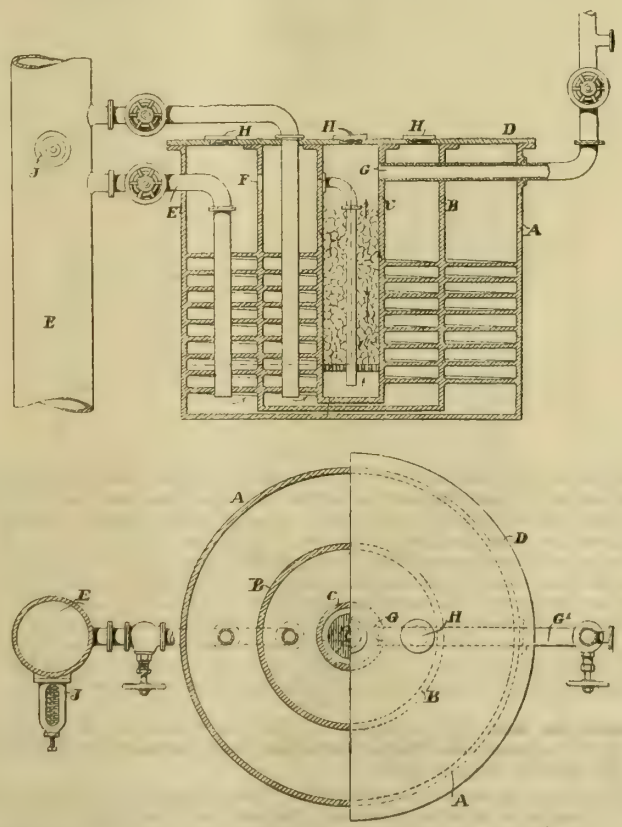


Of course, the great point to be considered is whether there is any liability of injury to the mantles by using an arrangement of this kind. Seeing that the torch is inserted through a lighting frame, which shuts down quite sound, and which has a stop upon it to keep the torch some inches from the burner or glass, and that a flame can be projected several inches, there does not seem any possibility of damage to the mantle being occasioned by its use. There is a notion abroad that the action of this torch is similar to that of a blow-pipe. This is a mistake; the description we have given showing clearly that it does not rely upon the force of air to divert the flame horizontally. More might be written regarding the patentees' claims as to savings in capital and economies in other directions which even this simple torch may effect in connection with incandescent street-lamps; but they will be patent to gas engineers. Messrs. Alex. Wright and Co. inform us that it is not their intention to make a charge for the torch; but to supply and maintain it free—making a moderate annual charge per lamp lighted, varying with the extent of the installation. This charge, it is said, will only be a trifle compared with the savings that will be effected by the use of the torch.

REGISTER OF PATENTS.

Manufacture of Gas for Lighting and Heating.—Hodder, A. E., and Lester, J. B. G., of Queen Victoria Street, E.C. No. 10,439; May 17, 1899.

This invention comprises the provision of a power-station from which air is forced along mains through the district to be illuminated; and from the mains branch-pipes would be led to the various installations in the system. The generator provided at each installation comprises two or more concentric annular carburetting chambers, each connected to the air-supply main by a conduit provided with means to independently regulate the amount of air passing to each chamber. Hydrocarbons of



different specific gravities are employed—separate from each other; each being allotted its own chamber. In this way, "the proportion of carburetted air obtainable from each chamber can be adjusted so that the gas resulting from the mixture of these carburetted streams may have any quality or richness desired."

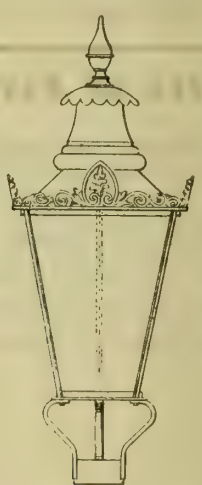
When working the apparatus, the outer chambers are partially filled—one with a light hydrocarbon such as petroleum ether or benzene, and the other with a heavy hydrocarbon such as petroleum, having a flash

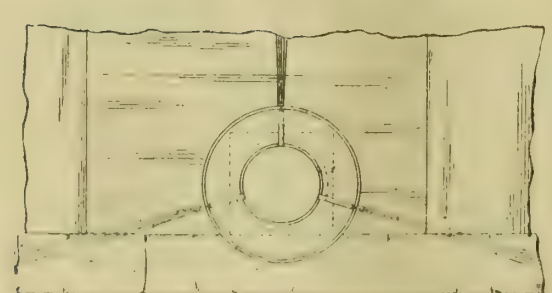
point at or about 120° Fahr. The central chamber is filled with naphthalene (albo-carbon), resting on the false bottom. By means of the valves, air is admitted to the chambers, and passes up through the hydrocarbon in each—being forced to take a helical passage through them by means of the spiral blades or vanes. The air thus carburetted passes from each chamber into the space below the perforated partition in the central chamber. Here the carburetted air from the two chambers becomes mixed, which mixing is further effected by its passage through the perforated bottom. In the central chamber the carburetted air is further enriched by the naphthalene; and the gas thus formed is carried off through the orifice G for consumption.

The generator shown comprises an outer cylindrical vessel A, having arranged within it a second vessel B; and within the vessel B is a third vessel C. The lower part of each outer chamber thus formed is provided with spiral blades or vanes; and the lower part of the central chamber is provided with a perforated partition or false bottom. All three chambers are closed above by a plate D. A main-pipe E communicates with a central pumping-station, from which it receives a continuous supply of air under pressure; and communicating with it are branch-pipes entering the outer chambers at their upper ends, and extending down to within a short distance of the floor of each. The upper ends of the chambers are in constant communication with one another by passages F; and both chambers communicate with the central chamber by an orifice preferably in the upper end of the chamber and a dip-pipe within the chamber, which extends down, through the perforated partition, to within a short distance of the floor of the chamber. At the upper end of the chamber is a second orifice G. Each of the chambers has a screw-plug H; and the pipe E is provided with a loaded relief-valve J.

Street Gas-Lamps.—Livesey, G., of Old Kent Road, S.E. No. 11,431; June 1, 1899.

The object of this invention is "to construct a framed lantern for incandescent gas street-lamps, in such a way that the shadows which must necessarily be produced, shall so fall as to constitute the least possible source of danger." To this end, the lantern is made circular, and the frame is formed with three bars or uprights, arranged so that no shadow will be thrown across the road, nor parallel with the curb—see the accompanying elevation of the lantern and a plan view, with the top removed, and showing also the pavement.





One of the bars of the lantern is at the back, and the other two bars at equal distances from the back bar, but in such a position that the shadows will cross the curb at an acute angle, as near to the lamp as possible. To illustrate more practically the position of the side-bars, says the patentee, let it be supposed that the distance between the back and the two side-bars, measured on the circumference of the circle, equals, in each case (say), 4, then the distance between the two side-bars, measured round the front of the lantern, will equal (say) 5¼. By this means, it is claimed that a good, clear (that is, without shadows), and extended front to the lamp facing the roadway is obtained; while the shadows, which must necessarily be produced, will be in the best position to obviate danger.

Igniters for Gas. Friedeberger, L., and the "Vulkan" Gesellschaft fur Selbstzundende Glubkorper mit Beschränkter Haftung, of Berlin. No. 16,056; Aug. 5, 1899.

This invention relates to a process for "the preparation of igniters for gas, by heating a mixture of salts of platinum with refractory oxides or salts producing such characterized by the employment of chlorides of the platinum group in combination with cyanogen salts of the platinum group in the presence of a refractory acid or a compound yielding the same on heating."

Both the cyanides and the chlorides may be used either in the form of uncompounded or compounded or composite salts. Examples of the latter are, for instance:—

A.—Cyanide of barium and platinum ($BaPtCy_4 + 4H_2O$); cyanide of magnesium and platinum ($2MgPtCy_4 + 7H_2O$); cyanide of ammonium and platinum ($(NH_4)_2PtCy_4 + 2H_2O$); cyanide of zinc, platinum, and ammonium ($ZnPtCy_4 + 2NH_3 + H_2O$); cyanide of thorium and platinum ($ThPt_2Cy_8 + 16H_2O$); and the like; or corresponding cyanides of the other metals of the platinum group.

B.—Chloride of thorium and platinum ($PtCl_4 + ThCl_4 + 12H_2O$); chloride of magnesium and platinum; chloride of ammonium and platinum ($PtCl_4 + 2NH_4Cl$); and the like; or corresponding chlorides of the other metals of the platinum group.

As refractory oxides, all oxides of the alkaline earthy metals and the earthy metals may be used in the form of such salts as are decomposable by heat—as, for instance, nitrate of thorium, nitrate of magnesium, nitrate of zinc, and the like.

As chlorine-expelling agents, may be used—silicic acid, hydrofluoric acid, fluosilicic acid, boric acid, phosphoric acid, and the like, either as such or in the form of decomposable compounds, such as alkaline silicates, chloride of silicon, organic silicon compounds, soluble borates, soluble phosphates, and the like.

The patentees prefer to use, as most advantageous: Platinic chloride—that is to say, hydrogen platinum chloride ($H_2PtCl_6 + 6H_2O$), together with the double cyanide of barium and platinum ($BaPtCy_4 + 4H_2O$) as the metal-yielding component, and nitrate of thorium as the refractory oxide-yielding component, in combination with silicic acid as the chlorine-expelling component. The employment of silicic acid, they say, has, in addition to its very energetic expelling action on the chlorine, the important technical advantage that it enables, by means of the impregnation method usual in the manufacture of incandescent mantles, shaped igniters to be manufactured, in which a large surface is combined with great resisting power to shocks, and permanence of shape.

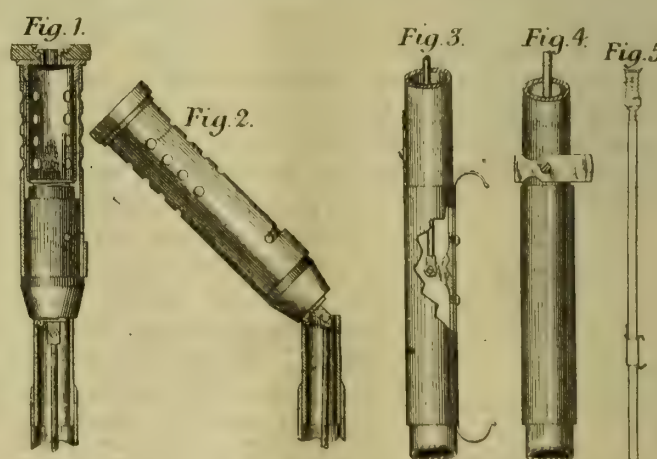
In carrying out the invention "in its most perfect form known," they suggest proceeding as follows: A fabric of cotton, wool, silk, asbestos, or the like, is first impregnated with a solution of water-glass (soluble silicate of potassium or sodium); and, after cautious drying, it is treated with a mineral acid, preferably hydrochloric acid, whereby the alkaline silicate is decomposed, and its silicic acid caused to remain behind in the gelatinous state. The silicified fabric is then impregnated with a watery solution containing 25 parts of hydrogen platinum chloride, platinic chloride ($H_2PtCl_6 + 6H_2O$), 6 parts of double cyanide of barium and platinum ($BaPtCy_4 + 4H_2O$), 19 parts of nitrate of thorium, and 50 parts water. After drying, the impregnated silicified fabric is cut into pieces of desired size and form, which are exposed to the action of heat so as to reduce the thorium nitrate to thoria, and the platinum salts to platinum. Thus "a withstanding refractory structure is obtained, intermingled with extremely fine particles of platinum."

The igniter thus produced will "not only ignite the gas with certainty in any state of the weather, but maintains its igniting capacity for a very long time."

Lighting-Torches for Incandescent Lamps.—Foulger, G. F. L., of Clapton, and Glover, J. G., of Clerkenwell. No. 22,625; Nov. 13, 1899.

This invention (in the words of the patentees) is "chiefly intended for lighting street and like gas-lamps or lanterns, in which incandescent mantles or the like are used, and enables the pilot or side light to be dispensed with, and the ordinary oil or spirit torch to be employed as at present."

For this purpose, the torch proper is made with a hinge, so that the upper or flame portion can be canted over the uprising gas, by the action of a rod with which the handle of the torch is provided, after the torch has been inserted into the body of the lamp. The canting is to such an extent that the gas-flame is lighted either through the small quantity passing through the mesh of the mantle fabric, or by the torch being canted over the top outlet of the mantle for lighting the gas from above—this being determined more or less by the height of the chimney, if one be used.



The arrangement referred to will be clearly understood from the illustration. Fig. 1 is a section of the upper part of the torch for ordinary lighting purposes. Fig. 2 is an exterior elevation with the head canted for incandescent lighting purposes. Fig. 3 is a part sectional elevation of the handle portion of the torch-stick, with the sliding ferrule and retainer appliance. Fig. 4 is an elevation of the handle part of the torch-stick with a sliding ferrule and the retainer appliance reversed, or thrown out of action. Fig. 5 is an elevation (on a reduced scale) of the torch and stick complete.

Lighting Street and Other Lamps.—Foulger, G. F. L., of Clapton, and Glover, J. G., of Clerkenwell. No. 23,082; Nov. 20, 1899.

This invention consists of an oil or spirit container and a wick-tube for a fixed flame, and a spirit container from which (by a current of compressed air) the spirit "becomes atomized and forced through, or within

range of and from, the fixed flame; the air being passed through a tube connected with a hand bulb or other compressor to a distance from the fixed flame."

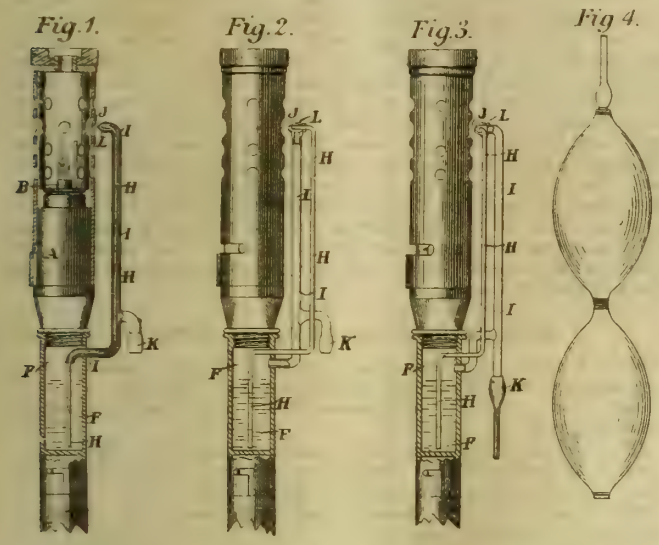


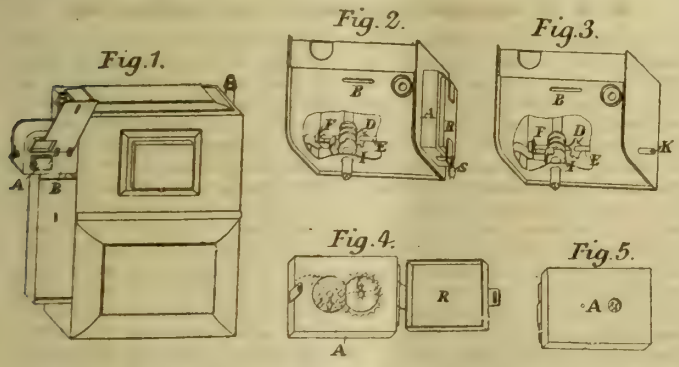
Fig. 1 is a sectional elevation of a torch-head, with the air-supply pipe encircling the spirit or oil supply-pipe. Fig. 2 is a part sectional elevation of a torch-head with the air-supply and spirit or oil supply-pipes connected at the top only. Fig. 3 is a part sectional elevation of a torch-head similar to fig. 2, but with the oil or spirit and the air supply-pipes differently arranged. Fig. 4 is an elevation of the air compressor or pump (of the usual construction).

The oil or spirit container A is secured to a spirit-container F; and pipes H I are arranged in connection with the spirit-container leading to a hole J in proximity to the fixed flame of the burner B. A branch K from the pipe I is in connection with a bulb or compressor (fig. 4), at a distance from the fixed flame; so that by compressing it, air is forced into the pipe I, and acting upon the spirit in the container forces it up the pipe H to the nozzle L, where it is met by another current of air from the pipe I, becomes atomized, and is forced through the hole in the torch-head and out of the corresponding hole on the other side. In doing so, it becomes ignited by the fixed flame, and issues from outside the torch-head—the size and volume of flame being determined by the amount of action on the compressor.

Checking Apparatus for Coin-Freed Gas-Meters.—Pipersberg, H., of Luttringhausen, Germany. No. 25,756; Dec. 30, 1899.

This invention consists in connecting a coin-freed gas-meter with a closed removable tell-tale, which registers the introduction of coins, is removed by the inspector, when the money is taken out, and opened in the office for the purpose of checking the amount paid in.

Fig. 1 shows the tell-tale A, in connection with the box B for the introduction of the money, attached to the gas-meter. Figs. 2 and 3 represent the coupling of the tell-tale with the rest of the working mechanism. Figs. 4 and 5 illustrate the removed tell-tale.



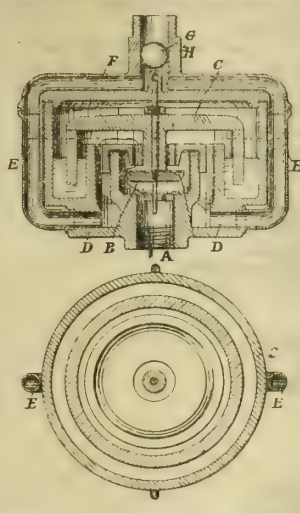
On a spindle, which, after insertion of a coin, must be rotated once by means of a crank handle in order to release the right quantity of gas, a worm is arranged, which acts on a tooth-wheel D, mounted on the indicator spindle E, which is arranged at right angles to the other spindle. The spindle E, which connects the tell-tale A and the indicating working mechanism of the meter, is displaceable longitudinally, and at F is under the influence of a spring which, as long as the tell-tale is not connected with the meter, presses the shaft out of the working position (fig. 3) in such a manner that the contact between the worm-screw and the tooth-wheel is broken. The spring simultaneously presses against a pawl, which engages with a notched disc I mounted on the first-named spindle; so that the rotation of the spindle is also prevented so long as the tell-tale is not connected with the meter.

The shaft E, which is carried through the side of the box B for the introduction of money, is furnished at its free end with a cleft K for the reception of an indicator-pin; so that, when the tell-tale is mounted, the pin is firmly connected with the shaft, and transmits the number of rotations to the indicating mechanism of the tell-tale. This consists of a dial-plate, cam-wheel, ratchet-wheel, and pawl. The tell-tale is closed by means of the cover R and the connected lead-piece S; and after the tell-tale has been placed on the box into which the coins are dropped, the whole apparatus is closed by means of a folding cover with the assistance of a lead-piece.

The operation of the tell-tale is as follows: The indicator-pin having been inserted in the cleft K of the shaft E, the cover is closed, and at the same time displaces the spindle against the action of the spring, bringing it into the working position, so that the tooth-wheel D engages with the worm. By the pressing back of the spring, the pawl is forced down simultaneously from the ratchet wheel I; so that, after a coin has been introduced, the spindle can be rotated without hindrance. The number of rotations of the spindle is now transmitted by the worm and tooth wheel D to the shaft E, and thereby to the counting mechanism of the tell-tale, in such a manner that the number of rotations of the spindle is registered on the dial-plate, and a checking of the number of times money has been put in is duly effected.

Gas Pressure-Regulators.—Hein, R., of Friedenau, Germany, and Hahn, T., of Kötzschenbroda, Saxony. No. 770; Jan. 12, 1900.

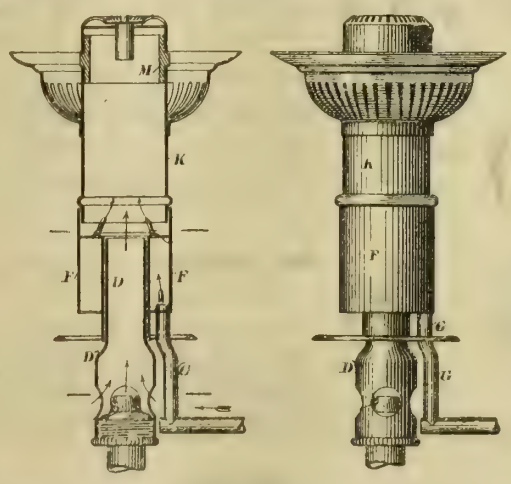
This invention relates to a gas pressure-regulator with floating bell, characterized by the fact that the upward pressure on the bell, in every position, stands always in a certain definite relationship with the pressure on a valve in connection with the bell, and under the direct action of the inlet pressure of gas; the object aimed at being to dispense with the use of special devices in connection with the valve, for the relief of pressure, when required.



As shown in the engraving, the gas enters through the opening A, and arrives under the valve B, which is in rigid connection with the bell C, dipping into the mercury. The greater the pressure of gas, so much the higher will the bell rise out of the mercury. The upward pressure upon the bell (made of light material) will now decrease; and the valve will close the admission opening for the gas more or less as the bell rises, while at the same time the pressure underneath the valve comes into more effective operation, and reaches its highest point so soon as the valve has fully closed the admission-opening. In this case, however, the upward pressure upon the bell is so small that the weight of the bell itself causes it to have a tendency to fall, and the valve again to open. By a correct choice of the wall-thickness of the bell, say the patentees, and of the material to be employed, as well as of the diameter of the valve, "the construction may be so nicely arranged that, without the use of special pressure-relieving parts, the gas will only enter the tube D under a certain determinate pressure." After passing through the latter, the gas next traverses the tubes E, and through the cover F, which is provided with passages for it; the cover being furnished with an exit-pipe H, in which a regulating-screw G works, and by the aid of which the delivery of gas is controlled.

Incandescent Gas-Burners.—Heinroth, P. and Tresenreuter, G., of Berlin. No. 3735; Feb. 26, 1900.

The patentees point out that burners as heretofore constructed for incandescent lighting (usually of the bunsen type in modified form)—produce the heat required for heating the incandescent body, by mixing together gas and air in such a manner as to cause the gas to issue from a number of small orifices into a pipe to which air has access. This mixture of gas and air burns with a blue heating flame; and, when the mixture, before being consumed, is again as intimately mixed as possible with air at low pressure, a much higher degree of heat is produced, and the incandescent body gives a more brilliant light.



The burner here consists of a nipple screwed upon the gas-supply pipe, and formed with several small orifices. Upon the nipple is fixed the mixing-tube D, having openings near its lower end, serving as air-inlets from the exterior. The gas mixes with the air, and the mixture flows upward in the direction of the arrows, and then enters a second mixing-tube K of much larger dimensions. The mixing-tube is supported upon the upper extension of a cylindrical chamber F, carried upon the first mixing-tube. The chamber is closed near the top by a plate, in which is formed a ring of small orifices. A tube G enters from below into the chamber F; and the extension of this tube leads to an air-compressing apparatus of any convenient form—for example, a pump, air-blast, or other suitable arrangement for supplying air under comparatively low pressure. The pressure, in fact, need not be more than that of the gas—say, a few millimetres of water column.

The air from the apparatus thus passes into the air-chamber F, and

then in the direction of the arrows. The orifices through which it passes are preferably drilled so as to cause the air-jets to issue in an inclined direction (as shown by the arrows), and thus impinge immediately upon the air and gas mixture ascending through the mixing-tube D. It thus becomes intimately mixed therewith; the new mixture finally flowing upwards into the mixing-tube K, and thence to the burner.

Upon the upper end of the tube K is mounted the burner-socket M—mostly made of steatite—with slits through which the mixture passes and comes in contact with the mantle carried in the ordinary manner. The mantle is "thus heated to an exceedingly high degree, even with a very moderate air pressure from the pipe G; and a light of great brilliancy is produced."

Stopping Leaky Pipe-Joints.—Dresser, S. R., of Bradford, Penn., U.S.A. No. 1998; Jan. 31, 1900.

Fig. 1 represents a sectional view of two pipe sections connected by a thimble and having the particular repair device applied to them. Fig. 2 shows the repair device applied to a leaded joint.

The object of the inventor is to provide a repair device which can be applied to the joints of pipes for conveying gas, oil, or other fluid, to stop leaks therein, without removing the pipe or disturbing the joints in any way; and it consists of a pair of clamping-rings provided each with an annular recess to receive a packing-ring, and clamping-bolts which draw the rings together, and force the packing up against the ends of the joint.

Fig. 1.

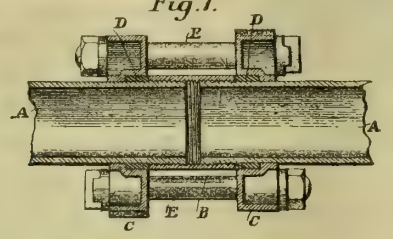
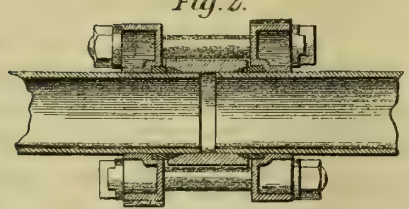


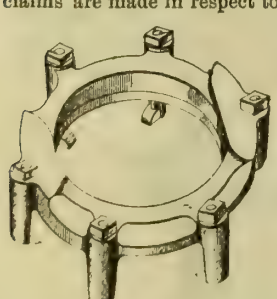
Fig. 2.

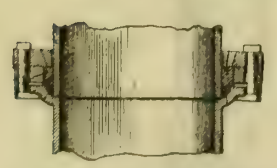


The meeting ends of the two sections of pipe A are secured together by a screw-threaded union B. C represents the clamping-rings, each of which is provided with an annular recess slightly larger in diameter than the union B, to receive a packing-ring D; and E represents the clamping-bolts for drawing the clamping-rings together—clamping the packing rings against the ends of the union B, and compressing them between the ends of the union and the bottom and sides of the recesses.

Stopping Leaky Joints in Gas and other Pipes.—Dresser, S. R., of Bradford, Penn., U.S.A. No. 1996; Jan. 31, 1900.

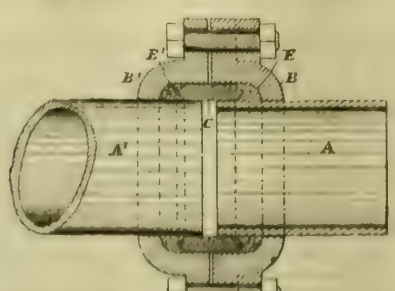
This "repair clamp ring" is shown in the engraving; and the following claims are made in respect to it: A repair device, comprising among its members a sectional clamp ring, having an annular recess adapted to receive a packing-ring, and provided with circular bolt-holes through both sections; the ring being also furnished with projections extending from one side. The projections are provided with polygonal recesses on their inner sides, with clamping bolts having round bodies and polygonal heads. The heads have projections to engage the exterior of the bell and adapted to engage the recesses of the projections, whereby the bolts are held in engagement with the bell, and prevented from turning.





Pipe Couplings.—Dresser, S. R., of Bradford, Penn., U.S.A. No. 1997; Jan. 31, 1900.

The object of this invention is to provide a tight coupling for plain-end pipe, and to provide for expansion and contraction without using the force or pressure of the gas or liquid conveyed in the pipe. The main feature of difference in this invention from others in use, is said to be that, instead of using



two loose rings, the patentee uses only one, dispenses with the rubber gasket, and omits utilizing the force or pressure of the material conveyed in pipes to assist in compressing the elastic packing, by using mechanical means only to compress it.

In joining pipes with this coupling, section B of the coupling is slipped over the pipe A; and the elastic packing E is then slipped on the pipe. The loose ring C is then slipped on the pipe so that the end of the pipe comes nearly to the centre of the loose ring. Then the other section of the pipe coupling B^1 is slipped on the end of the pipe A^1; and the elastic packing E^1 is slipped on the pipe. The end of the pipe is then put into the loose ring C, so that it will nearly (but not quite) abut the end of the pipe A, and in line with each other. Then the sections B and B^1 of the coupling are drawn together; the bolts are put in the holes in the outer rim of the coupling; and the nuts are put on the bolts and screwed up. This forces the loose ring C against the elastic packings E and E^1, fixing them tightly to the pipes and sections of coupling B and B^1; and at the same time the elastic packing-rings E and E^1 are packed tightly to the ends of the loose ring C—making "a perfectly tight packing at all exposed points of escape."

APPLICATIONS FOR LETTERS PATENT.

7057.—Brewer, G., "Conveyors for coal and other materials." A communication from The C. W. Hunt Company. April 17.

7080.—Boult, A. J., "Condensers." A communication from P. Audouin. April 17.

7185.—Fehse, O., "Support for incandescent mantles." April 18.

7201.—Thompson, W. P., "Bunsen burners, and means for igniting same." A communication from F. W. Braun. April 18.

7208.—Lindemann, O., "Internal combustion motors." A communication from E. Körting. April 18.

7209.—Lindemann, O., "Purifying gases." A communication from E. Körting. April 18.

7210.—Welsbach, C. Auer von, "Osmium illuminating filaments." April 18.

7211.—Welsbach, C. Auer von, "Osmium vacuum lamps." April 18.

7228.—White, J. W., and Forster, J. S., "Conveyors." April 19.

7233.—Hookham, G., "Water-meters." April 19.

7252.—Bleach, H., and d'Alquen, H., "Illumination lights." April 19.

7253.—Seraine, J., "Gas-motors." April 19.

7357.—Schattner, E., and Harmer, F. W., "Incandescence lamps or burners." A communication from M. Cohen. April 20.

7384.—Collis, A. B., "Gas and oil engines." April 21.

7423.—Pettibone, H., "Manufacture of gas." April 21.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Proposed New Technical Gas Institution.

Sir,—In perusing your article in this week's issue, I notice that it is proposed to exclude from membership persons who are managing-directors of joint-stock companies.

It appears to me that this wants qualifying, so as to render eligible managing-directors of non-statutory gas-works working under the Joint-Stock Companies' Acts, if such managing-directors are properly qualified gas engineers.

Birmingham, April 26, 1900. H. Ashton Hill.

Mr. E. H. Stevenson's Evidence on the Bradford Bill.

In reporting the evidence given by Mr. E. Herbert Stevenson on the Bradford Bill, in the "Journal" for the 17th ult., it was stated (p. 1011) that, in answer to a question by Mr. M'Kenna, he said "he knew of no instance since 1869 where the undertaking of a statutory gas company had been purchased compulsorily. There had been many water cases." Mr. Stevenson says this summary report does not represent correctly what he stated. The actual question and answer were as follows: "[Q.] Do you know any precedent later than 1869 for compulsory purchase against the will of a statutory company?—[A.] There is no case at all, Sir, in which it has been fought through both Houses. I think there is only one case of a water undertaking where it has been fought through both Houses; but there are several where it has been fought in one House, and then either an agreement come to or no opposition in the second House. You see, the company, having lost in one House, usually considers that it is not worth while spending a lot of money in the second House, and risking further loss." Mr. Stevenson points out that, while he stated that there had been no compulsory purchase fought through both Houses, his evidence showed that there had been several cases which he considered compulsory fought through the first House.

Water-Closets v. Earth-Closets at Hull.—At a meeting of the Water and Gas Committee of the Hull Corporation on Monday last week, a report was presented by the Engineer (Mr. F. J. Bancroft), with reference to the proposed substitution of water-closets throughout the city for the present system of earth-closets. If the recommendations of the Sanitary Committee with respect to the substitution of water-closets for 36,109 earth-closets is adopted, he estimated the additional quantity of water required per day for flushing purposes at a million gallons at least, on the low basis of ten flushes per day for each closet.

Issue of Further Capital by the South Staffordshire Water Company.—An extraordinary meeting of the South Staffordshire Water Company was held last Thursday, for the purpose of creating and authorizing the issue of new stock. The Chairman (Mr. Frank James) explained that their Act of 1893 empowered them to raise £150,000 of additional capital, and part of this amount had been issued. The meeting was to authorize the issue of the balance; and he accordingly moved that the remaining £50,000 of capital be now issued. In explanation of the necessity for the increase, he stated that they were spending money in order to make provision for the extraordinary demand for water in the district. The motion was adopted.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

The following further progress was made with Private Bills last week:—

Bills read a second time and committed: Cleethorpes Gas Bill [Lords], Falkirk and District Water Bill [Lords], Great Berkhampstead Water Bill [Lords], Motherwell Water Bill [Lords], Portland Urban District Gas Bill.

Bills read the third time and passed: Glastonbury Corporation Gas Bill, Maidenhead Gas Bill.

Petitions were presented against the following Bills: Exmouth Urban District Water Bill, Falkirk and District Water Bill, Motherwell Water Bill.

On Thursday, the usual returns relating to gas undertakings—for the year ending Dec. 31, 1899, in the case of Companies, and for the year ending March 25, 1900, in that of Local Authorities—were presented, and ordered to be printed.

HOUSE OF LORDS COMMITTEE.

(*Before Lord* CLIFFORD OF CHUDLEIGH, *Chairman; the Earl of* PORTSMOUTH, *the Earl of* ROMNEY, *Lord* HATHERTON, *and Lord* SEATON.)

DORKING WATER BILL.

This Bill, which is to authorize the Dorking Water Company to raise further capital, acquire more land, and construct additional works, came recently before the above-named Committee.

Mr. PAGE, Q.C., and Mr. F. HAMILTON appeared for the Company; Mr. WEDDERBURN, Q.C., and Mr. WILLIAMS represented the Dorking Urban and the Dorking Rural District Councils, who presented a joint petition against the Bill.

Mr. PAGE said the Bill was promoted by the Dorking Water Company mainly to enable them to raise additional capital to the extent of £20,000. The Company was incorporated by Act of Parliament in 1869; and the capital raised up to the present time was £29,574. This was all expended by the year 1898. For improvements which had taken place since, it had been necessary to rely upon the income, out of which there had been expended for capital purposes as much as £2236. The result had been disastrous to the shareholders; for whereas, up to 1898, ordinary shareholders had been receiving dividends varying from 7 to 8½ per cent., since then, in consequence of the income being spent on capital, they had had only 5 per cent. One of the objects of the Bill was to enable the Company to raise a certain amount of capital for the purpose of paying back this £2236. The Company were authorized to supply water to what was known as the old parish of Dorking, which, since the passing of the Local Government Act, 1894, had been subdivided into the parishes of Dorking Urban and Dorking Rural—the latter comprising the two hamlets of Holmwood and Westcott. The population of Dorking Urban at the last census was 7132; and the rateable value was £43,000. Dorking Rural had a population of 3829, and a rateable value of £22,000. The population of Dorking Urban and Rural in 1881 was 9577, and in 1889 it had increased to 10,961. Since 1891, there had been a considerable augmentation of the number of houses, and also of the population in the urban district, and to a certain extent in the two hamlets; and Westcott was being somewhat largely extended. Under the powers of the Act of 1869, the Company had originally one source of supply, which was from what was known as the Tower Hill well and pumping-station, and was freehold. This was soon found to be insufficient; and other supplies had from time to time been obtained, particulars of which Counsel gave. One of the objects of the Bill was to secure parliamentary authority for holding these other sources of supply. It was also proposed that filter-beds should be constructed; and the total amount required was £20,000. Of this sum, £16,000 was to be raised by the issue of shares, and £4000 under borrowing powers. Counsel then referred to the statements made by a section of the Urban District Council with regard to the Company being unable to properly perform their duties, and to the negotiations set on foot for the Local Authority acquiring the undertaking. The Company agreed, subject to the approval of the Local Government Board, to sell their property to the Council. The latter, however, were met by the Local Government Board with the objection that the Company's area of supply extended beyond the urban limits; and, by virtue of a section of the Public Health Act, a District Council could not buy an undertaking which extended beyond the district of the proposed purchaser. In the spring of last year, the Council endeavoured to get rid of this difficulty by applying to the County Council to incorporate the parish of Dorking Rural in the urban district; but the County Council, after considering the matter, decided that they had heard of no adequate reason for extending the boundaries of the urban district. Therefore, it had been impossible for the Urban Council to buy the undertaking. It might be asked why, if the Company were willing to sell in 1898, they were not willing to sell now. There were various reasons. The Company had made themselves liable for between £2000 and £3000, which they had no authority from Parliament to expend on capital account. They had, moreover, considerably improved the sources of supply of late; and this being so, they thought their future must be better than their past state, and that they would not only be able to fully do their duty to the inhabitants of the district, but would be able to improve their financial position, and restore to the ordinary shareholders what had been spent out of the income on capital account. They had therefore declined to renew the negotiations for the sale of the undertaking, and came to Parliament and asked that they should not be compelled to sell their property either to the Urban District Council alone, or to the Urban and Rural District Councils combined. Lately a Joint Committee of the two Councils had been formed, and on the 19th of January a letter was written to the Company, upon the Committee's instructions, asking whether they would be prepared to insert a clause in their Bill to enable the Councils to acquire the undertaking on terms similar to those incorporated in the agreement entered into between the Company and the Urban Council in 1898. The reply was to the effect that the Directors were not prepared to insert such a clause. The Committee reported to their respective Councils; and it was unanimously resolved by the Urban Council to present a petition against the Bill. The Rural Council, which consisted of 14 members, also resolved to petition against the Bill; but only five members voted—three in favour of the petition, and two against it. It was remarkable that of the four representatives of Holmwood and Westcott on the Council, only one voted in favour of the petition and two against it; while the fourth did not vote. At the annual parish meeting of the Rural District Council, a resolution was carried that the petition ought not to be proceeded with, and that the parishioners were quite satisfied with the way in which the Company were performing their duties. With regard to the Urban District Council, he was informed that no ratepayers' meeting had been held, and that there was no desire on the part of the public for the change suggested to be made.

The following evidence was then given:—

Mr. *G. R. Strachan* stated that he and his partner had advised the Company for fifteen or twenty years. In the summer of 1898, the effect of the continual drought was very great. Last year, which was extremely dry, there was no curtailment. The capital the Company were applying for was necessary; and he did not think it would last more than ten years, as they supplied a large and scattered area. No serious complaints had ever been made against the Company.

In cross-examination by Mr. WEDDERBURN, witness said he was in favour of water undertakings being owned by local authorities. He did not, however, think that one should be given power to purchase within an indefinite time, but that they should make up their minds if they were going to purchase within three or six months. In another ten years the Company would have to apply to Parliament again for money, but not for quite fresh works.

Mr. *R. Barclay*, the Chairman of the Company, gave evidence in support of Counsel's opening statement as to all the capital of the Company having been spent, and a portion of the income used for capital purposes. He also said that recently the Directors had carefully considered whether or not they ought to sell, and they had come to a negative decision. The present circumstances were wholly different from those of 1898. Since that time they had obtained substantial supplies of water from their new works, upon which they had spent a considerable sum of money. The deputations from the Urban and Rural Councils suggested that the Company should consent to a clause being inserted in the Bill enabling them to purchase the undertaking at any time within ten years; and this they objected to—being of opinion that it would put the shareholders in an unfair position.

Mr. WILLIAMS (in cross-examination): Do I understand that the Company are willing to sell when it suits their convenience?

Witness: Yes.

If the Committee insert a clause authorizing us to promote a Bill in Parliament next session, will the Company then agree to such an arrangement?—As Chairman, I cannot give a direct answer to that without consulting my fellow-Directors.

Mr. *J. Daws*, Manager to the Company, said that at present they had 9000 consumers, and were giving a continuous supply of water. In 1898, owing to the non-completion of the Deepdene works, the service was not a continuous one all through the summer. Since the completion of those works, however, with two exceptions, they had been enabled to furnish a constant service, notwithstanding a repetition of the drought last summer, and the town being one of the hardest places in the country to supply constantly.

Mr. *A. J. Canter*, representing the Westcott Ward on the Rural District Council, said his constituents were against the undertaking being purchased by the Local Authority.

Evidence was then called for the petitioners.

Mr. *G. Scales*, Clerk to the two District Councils, spoke as to the number of complaints received by the Urban Council in 1898, in regard to the insufficiency of the supply of water by the Company during June, July, and August. He said a Joint Committee of the Urban and Rural District Councils formulated a scheme for the purchase of the undertaking, and a definite agreement was arrived at between the Councils and the Company in September, 1898, subject to the approval of the Local Government Board. The agreement, however, fell through, owing to circumstances which had been explained. As far as the Urban Council were concerned, there had been no change of opinion as to the undertaking being purchased; and the Council were willing to pay a reasonable price for it. He understood that the Company objected to a clause being inserted to allow the Council to purchase at any time within ten years. To meet this objection, however, if a clause were inserted giving the Council power to purchase, they would immediately take steps to bring in a Bill next session to carry out the project.

In cross-examination, witness said he did not know that, before presenting a petition against the Bill, they ought to have taken a resolution of an advertised meeting of ratepayers. As this had not been done, he supposed he would be personally liable for the costs incurred.

Mr. *G. S. Mathews*, Surveyor to the Urban District Council, Dr. *S. Rideal*, the Water Examiner at Dorking, and Mr. *H. E. Ponting*, a member of the Rural District Council, supported the petition.

Mr. WEDDERBURN said that for many years it had been an admitted principle in Parliament that water supplies should be in the hands of local authorities, if they so desired. It had been enough, in many cases, for the local authority to say: "Do not give the company additional capital, because we will undertake to apply for powers to purchase next year." It was difficult for the Dorking Company to say that the Local Authority should not have a clause to purchase, because in 1898 they agreed to sell, and, but for the technical view taken by the Local Government Board, the undertaking would have passed into the hands of the Council. The water supply had not been satisfactory to the inhabitants of Dorking; and the view of Dr. Rideal was that it would have to be entirely revised in the course of a few years. For two reasons, therefore, the present was the time for the Local Authorities to come to Parliament. The Company were applying for additional capital; and this was the moment to ask the Committee to give them the purchase clause. Also, the people of Dorking saw that whoever supplied water would have to begin all over again; and if there was to be a new supply, and a great alteration, they wished it to be done by the Local Authority, and not by the Company The only suggestion against it that had been made in that case was that a section of the Borough Funds Act had not been complied with; but this applied solely to the costs of the petition. He asked the Committee

to insert the following clause in the Bill; and if they would not do so, not to pass the measure. Counsel then read the clause, as follows:—

If the Dorking Urban District Council and the Dorking Rural District Council or either of them shall introduce a Bill into Parliament, which they or either of them are hereby empowered to do, and shall *bonâ fide* promote the same in the next available session of Parliament, to empower them or either of them to purchase the undertaking of the Company, or to provide for the constitution of a Water Trust, and to empower the Trustees so to be constituted to purchase the undertaking of the Company, the Company shall not oppose such Bill, except in so far as may be necessary in order to secure the insertion therein of clauses to protect their interests with respect to such purchase; and for that purpose the Company shall be at liberty to petition either or both Houses of Parliament, and to appear on such petition by Counsel, Agents, and witnesses, if they think fit. And if the said District Councils or either of them obtain an Act authorizing such purchase, and if they or either of them or the said Trustees so authorized (hereinafter called "the purchasers") shall give a written notice of their intention to purchase within six months of the passing of such Act, the Company shall, at the expiration of such six months, sell and transfer, and the purchasers may purchase and acquire, the undertaking, property, rights, powers, and privileges of the Company, subject to all the existing mortgages, obligations, and liabilities of the undertaking. Any such sale and purchase shall be on such terms and conditions as may be agreed upon between the Company and the purchasers, or, failing agreement, shall be determined by arbitration in accordance with the provisions of the Lands Clauses Act with reference to the purchase and taking of lands otherwise than by agreement. And in the construction of the said provisions, the expression "the promoters of the undertaking" shall mean the purchasers, and the expression "lands" shall mean the undertaking of the Company: Provided that, in addition to the sum to be paid by the purchasers to the Company under the foregoing provisions of this section, the purchasers shall pay to the Company—(*a*) the reasonable costs of obtaining this Act, and (*b*) the reasonable costs of winding up the Company. And the purchasers shall also pay to any officer (other than a director) and servant (other than a weekly servant) in the regular employment of the Company, who has been in such employment for a period of ten years or upwards, and who shall not be willing to continue or who shall not be continued in the service of the purchasers, an amount equal to two years' salary.

Counsel added that the effect of that clause would be that if next session the two Councils, or either of them, obtained an Act authorizing them to purchase, they would have to give the Company written notice of their intention to do so within six months of the passing of the Act.

Mr. Page, in reply, said he should have asked the Committee not to insert the clause in the Bill, even were it the joint offspring of the two Local Authorities, which it was not, but only of the Urban District Council. There was no reason for the Committee to insert the clause, for it would be open to the Councils to come next year to get leave to buy out the Company. He asked the Committee to compel them to wait until they had put themselves in the right position to come—until they were satisfied that they were voicing the desires of their constituent ratepayers in presenting the Bill to Parliament, and not when there was a doubt in regard to the wishes of one district.

The room was then cleared. On the re-admission of the parties,

The Chairman announced that the Committee had decided to pass the preamble of the Bill.

On the consideration of clauses, the promoters and opponents of the Bill agreed to the insertion of a clause to the effect that the District Councils shall, within twelve months after obtaining the Act of Parliament, which is to be unopposed, give notice of their intention to purchase, and that the vendors shall sell. If the parties cannot mutually agree to terms, they are to be settled by arbitration under the provisions of the Lands Clauses Act. In addition to the sum to be paid by the purchasers, they are to pay the Company their reasonable costs of winding up, and compensation to officers; and the Company are not, before obtaining the consent of the Councils, to expend before Dec. 30, 1901, more than £5000. The Company are also to pay half the cost of the joint Councils' petition against the Bill.

HOUSE OF COMMONS COMMITTEE.

(*Before Sir* T. Gibson Carmichael, *Chairman, Sir* Cameron Gull, *Mr.* Carlile, *and Mr.* Horniman.)

AIRDRIE, COATBRIDGE, AND DISTRICT WATER TRUST BILL.

This Bill, which is to constitute a Water Trust for the burghs of Coatbridge and Airdrie and the adjacent district, and to vest in it the undertaking of the Airdrie and Coatbridge Water Company, recently came before the above-named Committee.

Mr. J. D. Fitzgerald, Q.C., Mr. Gully, and Mr. W. Russell appeared for the promoters; Mr. Balfour Browne, Q.C., Mr. Worsley Taylor, Q.C., and Mr. Erskine Pollock, Q.C., for the Airdrie and Coatbridge Water Company; Mr. Littler, Q.C., Mr. Pember, Q.C., Mr. Worsley Taylor, Q.C., Mr. Claude Baggallay, Q.C., and Mr. W. Neilson, for the Caledonian Railway Company; and Mr. Pope, Q.C., Mr. Balfour Browne, Q.C., and Mr. Forbes Lankester, for the North British Railway Company.

Mr. Fitzgerald, in opening the case, said the Bill was promoted by the two Corporations of Airdrie and Coatbridge and the County Council of Lanarkshire for the purpose of constituting and incorporating a Water Trust, and transferring to it the undertaking of the Airdrie and Coatbridge Water Company. This action of the promoters was the outcome of a decision given last year by a Committee of the House of Commons on a Bill which was then promoted by the Company, which was that the Bill should only proceed on condition that if a Trust was formed to acquire the undertaking of the Company, it should be transferred. Within the limits of supply in the burghs and the county, there was a population of between 70,000 and 80,000. The Company was incorporated as long ago as 1846; and for 30 years the shareholders had always been paid their maximum dividends. When these had been received by a company, any income more than sufficient to pay them should be applied in reducing the price of water. What happened with the Airdrie and Coatbridge Company was what often occurred with companies similarly situated. As the shareholders had been receiving for years their maximum dividends, and having, owing to the provisions of their Act of 1846, very extensive powers of charging for water, which they were not obliged to exercise to the full extent to earn their maximum dividends, they ceased to have any substantial interest in the economical or efficient carrying on of the water undertaking. If any money was spent wastefully or extravagantly, they could always meet it out of the surplus revenue. He did not wish to go in detail into the matters discussed last year. It was sufficient to say that the Company had been unfortunate. They had applied on several occasions to Parliament, and their Bills had been rejected; and, of course, considerable expense had been incurred, which fell entirely upon the consumers. In 1892, owing to the increase of population in the area of supply, they obtained an Act for the construction of new works; and in carrying these out they became involved in very serious litigation and heavy costs. They appear to have had every misfortune that it was possible for a Company to have in carrying out the works. When they came to construct one reservoir, they found they could not get a good holding-place for their embankment; and the site of another reservoir had to be changed. The position they got themselves into was that their estimates were exceeded by as much as 50 per cent., their capital was overspent, and they were obliged to apply to Parliament for further powers and more capital. It was not unnatural that this state of things should have created very great discontent in Airdrie and Coatbridge, as well as in the county surrounding; and what increased the discontent was that the result of all this miscalculation, mismanagement, or misfortune—whatever name they chose to give it—was that the shareholders met the difficulty by raising the water-rate from 1s. to 1s. 4d. in the pound, taking for themselves their maximum dividends as before. Another source of dissatisfaction was that in the Acts of the Company no rates were fixed for the supply of water for manufacturing operations. A great many people required water for such purposes, and the terms on which they were to receive it were left by the Acts to be settled by agreement. All the petitioners against the Bill offered opposition confined practically to clauses. They objected to the terms for carrying out the proposed transfer; and it would be the business of the promoters to show that they were just and fair, and honourably carried out the decision of the Committee of last year. He gave the assurance that the promoters would take over and assume the liability for the uncompleted works of the Company; but while he did this, he could not help saying that the Company had increased the difficulty of the proposed transference by entering upon arrangements for the erection of offices, and letting the contract for the new reservoir.

Evidence was then given in support of the promoters' case.

Mr. *J. M'Murdo*, Joint Town Clerk of the burgh of Airdrie, examined by Mr. Fitzgerald, gave the Committee some particulars as to the water requirements of the district, and the manner in which the Water Company had catered for them, and expressed the opinion that the time had come when the undertaking should be in the hands of a Trust. He laid special emphasis upon the requirements of manufacturers.

In cross-examination by Mr. Worsley Taylor, witness said the whole desire of the promoters was to be just and fair to the Company, and to carry out honourably the decision of the Committee of last year. He made no charge against the Company of wasteful expenditure; and as to the letting of the contract for the reservoir, all he said was that the Company were wrong in taking action at the time they did, with this transference in view. He should have no objection to inserting in the Bill a provision to the effect that the purchase of the undertaking should be completed within six months of the publication of the award of the arbitrators.

The Chairman (interposing) said the Committee were of opinion that there was little difference between the parties, and that an arrangement could easily be arrived at.

Mr. Fitzgerald said the promoters were prepared to undertake to pay all debts, sums of money, and claims on capital account, provided a statement of them was submitted by the Company within one month before the commencement of the arbitration, and that the liability was limited to the amounts down in the statement.

Mr. Worsley Taylor pointed out that subsequent to the presentation of such a statement the Company might incur a liability which the Trustees ought to discharge—a liability, for instance, connected with the maintenance of the undertaking.

An intimation was here given by the Committee that this should be provided for in the Bill.

Mr. Worsley Taylor said, after this expression of opinion, there would be no difficulty in arranging a suitable clause.

After some discussion between Counsel, it was arranged that the final adjustment of the matter should be postponed.

Mr. Fitzgerald then dealt with the opposition of the two Railway Companies. He explained that at present the rate of charge for water for manufacturing purposes was fixed by agreement, and that last year the Corporations undertook that, if they acquired the water supply, they would fix the rate in the statute. Therefore, in this Bill the promoters set out a sliding-scale which moved in sympathy with the charge for domestic purposes. The Railway Companies alone objected to the scale, and wished the fixing of the rate to be left in the first instance to agreement, and failing this, to the decision of the Sheriff.

Mr. *M'Murdo* was recalled, and gave evidence in support of the arrangement in the Bill. He pointed out that the rate proposed was less than that now paid by the railways to the Water Company, and that it was one which the whole trading community, with the exception of the Companies, approved of and accepted. Last year the promoters satisfied Parliament that the transference of the undertaking to a Trust would be in the interest of the community. Now it was suggested that this transference would increase the water-rates, and thus inflict hardship upon the Railway Companies. On this point, he might say that last year a statement was put before the Committee showing that in ten cases in Scotland where there had been a transfer from a Company to a Trust there had been no increase in the rates in any of them, and in eight there had been a decrease.

Mr. *George H. Hill*, M.Inst.C.E., was examined with reference to the clause in the Bill fixing the maximum rates. It set forth that the Water Trustees should furnish water for other than domestic purposes at rates not exceeding the following: 7d. per 1000 gallons up to 100,000 gallons per half year; 6d per 1000 gallons of excess beyond 100,000 gallons up to 200,000 gallons per half year; and 5d. per 1000 gallons of excess beyond 200,000 gallons per half year. The clause further provided that

whenever the domestic water-rate was reduced below, or increased above, 1s. 2d., a proportionate reduction or increase, as the case might be, should be made in the rates for other than domestic supply; so that the rate per 1000 gallons up to 100,000 gallons should be as nearly as possible 7-14ths of the domestic rate, the rate per 1000 gallons of the excess beyond 100,000 gallons up to 200,000 gallons as nearly as possible 6-14ths, and the rate per 1000 gallons of the excess beyond 200,000 gallons as nearly as possible 5-14ths. Witness said he considered this clause fair and reasonable and extremely convenient, because it provided a sliding-scale the action of which would soon become familiar. People would know exactly what they had to pay. He was not surprised to learn that all the traders of the district had accepted the arrangement. He had seen the clause proposed by the Railway Companies, but he preferred the one in the Bill, because it had the great merit of being calculated to avoid litigation.

In cross-examination, witness said he preferred that the Water Trust should determine the price, rather than that it should be left to the decision of the Sheriff. The North British Railway Company used about 80 million gallons of water per annum, for which they now paid the Water Company at the rate of 6d. per 1000 gallons, whereas under the Bill they would pay 5d.

The CHAIRMAN intimated that the Committee did not think the clause had been justified by evidence.

Mr. FITZGERALD said there was the evidence that all the traders in the district accepted the clause.

The CHAIRMAN: If you cannot produce any further evidence, the clause must go.

Mr. LITTLER then asked the Committee to insert a clause, the draft of which he submitted.

Mr. FITZGERALD said the promoters could not accept it; but if the case were adjourned, he would present a clause of his own, and the Committee would be able to judge between the two clauses.

This course was adopted.

At the meeting of the Committee on a subsequent day,

Mr. FITZGERALD said he was able to inform the Committee that the adjournment had borne fruit, and that, after going through the amendments proposed by the Water Company, the promoters were in a position to present to the Committee agreed amendments so far as the Company were concerned. He thought he might say that they ensured that the Company would get full and fair value for their undertaking. The only other matter left was the new clause providing a maximum scale of charges for the supply of water for trade purposes. The Railway Companies, who used a large amount of water, objected to the original clause, and in their petitions suggested that the provisions of the Burgh Police (Scotland) Act of 1892 should be substituted. The promoters had now adopted the suggestion, and they put before the Committee a new clause in the following terms:—

No person shall be entitled, without special agreement with the Trustees, to use the water supplied through the pipes of the Trustees, except for domestic and ordinary purposes; but when there is a supply of water more than is required for such domestic and ordinary purposes within the limits of supply, the Trustees shall, if so required, contract with any person or persons within such limits to supply any public baths and washhouses, works, manufactories, or other premises within the limits of supply, with water at such rate and upon such terms and conditions as may be agreed on; and in the event of disagreement, either as to the ability of the Trustees to give the supply or as to the rate, terms, or conditions on or in respect of which the supply is to be given, the same shall be fixed by the Sheriff of the county of Lanark (excluding Sheriffs-Substitute), upon summary application by either of the parties; and the decision of the Sheriff shall be final: Provided that when water is thus supplied from such surplus it shall not be lawful for the Trustees to charge the parties obtaining the same both with the domestic water-rate in respect of the premises for which such supply is given, and also for the supply of water obtained by them; but the Trustees may either charge the domestic water-rate chargeable in respect of such premises, or charge for the supply of water furnished to the same, as they shall think fit, and any rate or payment for water supplied under this section may be recovered by the Trustees in the same manner as the domestic water-rate.

Mr. POPE objected to the exclusion of Sheriffs-Substitute, on the ground that as, according to the law of Scotland, the term "Sheriff" included Sheriffs-Substitute, the promoters were seeking to alter the general law by a Private Act without sufficient reason.

After some argument, the words within parentheses in the clause were struck out.

Mr. POPE invited the Committee to insert in the next clause (43) words to secure that the Trust should not be allowed to supply water outside the limits, unless the requirements both for domestic and trade purposes had been met within them.

Mr. FITZGERALD submitted that the proposed words were quite unnecessary, and contrary to practice.

Mr. POPE said that similar words had recently been inserted in the East Stirlingshire Water Bill. The reason why the Railway Companies pressed the matter was that if they were to make an application to the Trust for more water, the latter might reply that they could not furnish it because they had certain outside areas to supply.

The CHAIRMAN said the Committee decided to accept the words.

The other clauses having been adjusted, the Bill was ordered to be reported.

SUBWAYS UNDER LONDON STREETS.

A Select Committee of the House of Commons, presided over by Sir William Houldsworth, had under consideration, just before the adjournment for Easter, the Bill promoted by the Corporation of London to obtain, among other things, certain powers with respect to "making further and better accommodation for the laying of pipes, wires, and other apparatus in, over, or under streets, and as to the control of streets and structures across them, and the fixing of apparatus for public lighting in streets." The provisions relating to these matters are contained in Parts VI. and VII. of the Bill; and when they were reached, Mr. Littler, Q.C., who appeared for the promoters, stated that there were a large number of opponents to this part of the Bill, but it was one of considerable interest. It embodied to a great extent a new departure; but the City was in this as in so many other respects absolutely unique. It was no exaggeration to say that in no important thoroughfare was there a single square yard or foot of ground which did not enclose some sort of appliance for the public service—gas-mains, water-mains, pneumatic tubes, wires for electric lighting, electric energy, &c. In addition to all this, the Postmaster-General had served the Corporation with notices for the opening up of an enormous number of streets for the purpose of laying telephone wires. The Corporation were constantly having complaints of the delays which took place in City traffic, in consequence of the perpetual interference with the ground; and the power asked for in the Bill, to construct subways for the reception of pipes and wires, would, it was hoped, prevent the breaking up of the thoroughfares. The Corporation would not act in an arbitrary manner, and the Board of Trade would control their decisions.

Evidence was then given in support of these portions of the Bill by Mr. W. Bicknell, a Clerk in the service of the Corporation, Mr. D. J. Ross, M.Inst.C.E., their Engineer, and Sir J. Wolfe Barry, their Consulting Engineer. The last-named witness explained that the desire of the Corporation was to take general powers for dealing with cases as they arose, instead of having in each instance to go to Parliament for special powers. The gas, water, and other companies could only be asked to put their mains into the subways or service works when the latter were fit and proper for the reception of pipes and wires. The construction of these works would be a gradual process, and it was designed to meet an evil of crying public importance. In cross-examination by Mr. Pope, Q.C., on behalf of the New River Company, Sir John admitted that the Bill would oust the jurisdiction of Parliament in regard to the subways, and substitute that of a Government Department. Sir Benjamin Baker also gave evidence. He stated that when the Metropolitan Railway was made (some 40 years ago) the gas and water pipes were diverted, although plans were not deposited to show how the work was to be done. This was bad enough then; but in carrying out the Central London Railway works opposite the Royal Exchange, he found the difficulty had increased tenfold. In making the District Railway from Blackfriars to the Mansion House, they took the opportunity of constructing a subway on each side for gas and water pipes—the Metropolitan Board of Works paying for it. The object now was to take opportunities, as they arose, of similarly collecting other pipes and wires elsewhere in the City.

Mr. Shiress Will, Q.C., for the Charing Cross and Strand Electric Lighting Company, called (in evidence against the Bill) Mr. Wilmot Seale, Secretary of the Company, who stated that they feared the powers which the Bill would confer on the Corporation, because it would enable the officers to dictate and control the system of supply, and the working of the undertaking; indeed, the powers were such as no public authority hitherto had been allowed to exercise in connection with electric lighting undertakings.

The Committee were then addressed by Mr. Shiress Will, who dwelt on the importance of insisting on the subways which the Corporation sought power to construct being of such dimensions as would afford room for men to get at electrical wires for purposes of repair. His objection to the Bill, however, would not be so great if his learned friends would undertake that any subways which the Corporation might make should be of the same character as those constructed under the London County Council Subways Act, 1893. At the same time, he contended that the Committee were now being urged to create a precedent of a very dangerous character, as they were asked to sanction a general power to construct subways under another name, subject only to the approval of the Board of Trade. Mr. Pope said the Bill seemed to him to be capable of doing a great deal of mischief. The Corporation, however, had done their best to meet him; and he was not disposed to resist it except on the ground of principle. It was manifest that anything which avoided the constant breaking up of the streets would be a great advantage; but if the Bill were passed, it would oust the jurisdiction of Parliament, and substitute for it that of a Government Department. This was a new principle in legislation. No doubt the Board of Trade had at present *quasi*-legislative powers; but they could only be exercised subject to an appeal to Parliament. Under this Bill there would be no such appeal to Parliament. Mr. Pember, Q.C., for the East London Water Company, made the same point, and objected to the vagueness of the definition clause, which, he said, invented a new term—"public service works." Mr. Balfour Browne, Q.C., for the City of London Electric Lighting Company, said his clients had spent £490,000 in the City, had laid 500 miles of conduits (mostly under the pavements), and supplied 436,000 lamps of 8-candle power each, and 548 arc lamps for street-lighting purposes. They complained seriously of the Bill, which would render them liable to remove all their wires from the streets, and place them in a conduit after they had been laid under the sanction of an Act of Parliament. The Corporation treated the Electric Lighting Companies worse than they treated the Gas and Water Companies. In the case of the latter, they intended to provide for a continuance of their supply during alterations; but they would be able to cut off the supply of his Company, and absolutely ruin them, because they were under a statutory obligation to keep up their supply. Mr. Littler remarked that if any amendments of the kind suggested were considered necessary by the Committee, the Corporation would be very glad to make them on the clauses. Mr. Balfour Browne said he was dealing with the preamble. He wished the Bill to be rejected as being most unfair throughout.

Mr. Littler then replied. He said that the two Electric Lighting Companies were the only serious opponents of the Bill. The Gaslight and Coke Company had withdrawn all opposition, and his friend Mr. Pope only took exception to the proposals of the Corporation on the ground that they were contrary to parliamentary precedent. He (Mr. Littler) contended that this was really not the case; and he quoted several Acts of Parliament in which clauses had been inserted giving equally wide powers to different public bodies. He declared that the Bill was a fair and honest attempt to put an end to a state of things which caused much inconvenience in the City. He added, in answer to the Chairman, that he saw no reason why the Electric Lighting Companies should not be put on the same footing as the Gas and Water Companies with regard to continuous supply.

After deliberating in private, the Chairman announced that the Committee had decided that the preamble was proved; but at the same time they thought the Bill was one which would have to be very carefully dealt with on the clauses. The Committee were of opinion that provision

should be made for the continuance of the supply of electricity during alterations. This point ought to be conceded to the Electric Lighting Companies as well as to the Gas and Water Companies.

LONDON WATER COMPANIES AND THE RIVER LEA.

As already mentioned in the "JOURNAL," the consideration of the four Bills dealing with the Metropolitan Gas Supply, which had been referred to a Select Committee of the House of Commons presided over by Mr. Oldroyd, was delayed in consequence of the long inquiry necessitated by the importance of the measure for the reconstitution of the Lea Conservancy Board, which preceded them on the list. As far as our readers are concerned, the Bill is only of interest from the fact that the Lea is drawn upon by the New River and East London Water Companies, who make an annual payment to the Conservators for the privilege.

Owing to the number of parties affected by the Bill, there was a strong array of Counsel present when Mr. Worsley Taylor, Q.C., opened the case for the promoters. He explained at the outset that the Bill was introduced by the Lea Conservancy Board in fulfilment of a pledge given to Parliament last session. He gave a sketch of the history of the river from the time of King Alfred, and went on to say that the present Conservators had jurisdiction over 27¾ miles of navigation. The reason why they were now proposing to reform themselves was that since 1890 one person and another had from time to time introduced Bills into Parliament, not so much for the purpose of altering the constitution of the Board, and not quarrelling with the way in which the Board had done their duty with the limited means at their disposal, but rather with the object of getting some representation where it did not at present exist for themselves, or some more representation in cases where they had it already. The points for the Committee to consider were these: What should be the number of representatives on the Board in future, what interests should be represented, and in what proportion should those interests be represented? He should propose that the number should be kept at thirteen, or thereabouts. The London County Council had proposed fourteen, though, modestly enough, they had contemplated monopolizing seven of the number. He should suggest, in the terms of the Bill, that the seats on the Board should be allocated as follows: Appointed Members.—One to the Herts County Council, one to the Essex County Council, one to the Middlesex County Council, two to the London County Council, one to the Corporation of London, one to the Corporation of West Ham, one to the New River Company, and one to the East London Company. Elected Members.—One to be elected by the Local Authorities and riparian owners in the upper district, one by those in the middle district, one by those in the lower district, and one by the bargeowners. The Bill would give enlarged conservancy powers, mostly dealing with pollution. It was proposed to increase the aggregate yearly sum payable to the Board by the New River and the East London Water Companies to £8000, of which £3750 would be paid by the former and £4250 by the latter. The New River Company drew 22 million gallons, and the East London Company 36 million gallons daily out of the Lea; and it was necessary that a higher price should be charged the Companies for this water than they were now paying, in order to enable the Board to deal properly with the purity of the river.

The first witness called was Mr. George Corble, the Clerk to the Board. He said he considered it important, whatever the constitution of the Board might be in the future, that the trading interests should be adequately represented. He described the composition of the Board, which included some of the largest toll-payers on the river. The Conservators did not pay their way every year, and they were not able in an ordinary year to put £1500 to the sinking fund, for which the Act of 1874 provided. Last year the total income was £23,283, and the expenditure £23,717; showing a deficit of £434, or, with the sinking fund, £2000. There had been a deficit on twenty years' working. He thought it was fair to charge the Water Companies an increased rent. It was only right that the Board should reap some of the benefit of the enhanced value of the water, in order to enable them to keep up and improve the navigation, and benefit the districts through which the river passed.

In the course of his cross-examination by Mr. Pember, Q.C., for the East London Water Company (who queried what the Company would get for the £4500 which they were asked to pay), witness said they would have the benefit of the improved navigation and of the extra supervision over the river. In answer to Mr. Pope, Q.C., who represented the New River Company, witness said the Conservancy had undertaken new duties for the purification of the river, and this was the reason why Parliament had provided that the New River Company should contribute to the cost—that they should contribute in regard to these particular works, which would be of benefit to them. Mr. Pope said this was contrary to the present proposition. The witness replied that the question now was a new one. One point the Committee would have to consider was whether it was right that the contribution of the New River Company should be increased without additional benefit to the Company by the works to be carried out by the Board. Asked what was the object of the proposed change in the constitution of the Board, witness replied that the matter had been pressed upon them by the London County Council and the other Local Authorities. Moreover, the Board had large works to carry out, and they expected to get more money for their water. They wished to have an increased staff of sanitary inspectors. If the Board had not brought in the Bill, the County Council and the other Local Authorities would have done so.

Major Lamorock Flower, the Sanitary Engineer to the Board, whose duty was to prevent the pollution of the river, declared that the sum allowed for the purpose of the protection of the water by the Lea Conservancy Act of 1868 was totally inadequate. He did not consider prosecutions for river pollution advisable unless in special circumstances. In the thirty years which had passed since the establishment of the Board, they had proceeded only eight times, and the prosecutions had not been in all cases attended with success. The amount of pollution had been considerably abated. Analyses of the river water should be provided for, and tanks and apparatus obtained for testing divers modes of sewage treatment. To limit unduly the amount of money to be expended in protecting an area from which a water supply was drawn, was false economy in its worst sense. It was most important that the whole watershed of a river should be under the control of one conservancy board, for the tributaries frequently showed most dangerous pollutions, and required to be constantly looked after. The Middlesex County Council could assist, and so could the other County Councils comprised in the basin of the Lea; but the Conservancy Board should be the chief authority for the protection of the water. The New River Company should contribute in the same proportion as Hertford to the improvement of the river.

Mr. C. Nelson Tween, the Engineer to the Board, was the next witness. He stated that the navigation of the river had been much improved under powers conferred by the Act of 1850. After the passing of that Act, new works of considerable magnitude had been carried out till about 1870, since which date no new locks had been constructed. The works were in need of considerable repair. He thought the expenditure required to place the navigation in a proper condition was £99,500, which should be spread over ten years.

The Chairman of the Board (Mr. R. Benyon Croft) followed. He said he had specially considered the question of its constitution, owing to the repeated attempts of the London County Council and the West Ham Corporation to get increased representation on it. Last year, in view of the Bill then being promoted by the London County Council, by which they sought to have seven representatives on the Conservancy, a compromise was come to; the Board pledging themselves to introduce a Bill this year. In fulfilment of the pledge, they had sketched out the present scheme, which would fairly represent all the interests concerned. He considered it would not be advisable to give the Local Authorities a preponderating influence. The Board as at present constituted had worked well, and no change was required; but if any were made, it should be in the direction sketched out in the Bill.

Mr. H. L. Cripps, Parliamentary Agent to the London County Council, then gave evidence on their behalf. He contended that the Lea Conservancy Board was completely under the control of the Water Companies, and declared that they would not be able to meet the interest on their debenture stock if it were not for the payments received from the Companies. He considered that the Board should depend on statutory contributions rather than on voluntary payments; and if this were arranged, he should think there would be no one more likely to assist than the ratepayers of London. Mr. G. L. Gomme, the Statistical Officer to the Council, stated that the present Conservancy Board had not, in their opinion, met the requirements imposed by the Legislature. In dealing with this question, they had to consider the duties of the Board as to pollution, navigation, water supply, the maintenance of bridges, and so forth; and the proposals of the Bill would reduce the representation of the Local Authorities to a sham. So far as the Thames Conservancy was concerned, the Act of 1894 had done away with the representation of the riparian owners. Mr. Erskine Pollock, Q.C., addressed the Committee; contending mainly that the representation on the next Board should be arranged on the basis of population, and that, therefore, the London County Council should have a dominant voice.

Mr. Pember protested against the proposal to raise the East London Water Company's payment to the Conservators to £4500 a year—an increase of 130 per cent.—and to reduce their representation on the Board by 50 per cent. While the Board were making this claim on the Company, they did not, he said, ask the Local Authorities for anything, nor did they increase the rates of the toll-payers. Any new works undertaken by the Board would not benefit the Water Companies.

Mr. W. B. Bryan, M.Inst.C.E., the Engineer to the East London Company, said that, in order to take water from the Lea in summer, storage was absolutely necessary, and this had to be provided by the Company; whereas water could be taken at all times from the Thames without storage. This fact, he considered, had a bearing on the amount which ought to be paid to the Lea Conservancy Board for the water taken by his Company. He did not consider that the two Water Companies ought to be called upon to pay the large sum asked for in respect of the water drawn from the Lea.

The Committee were next addressed by Mr. Pope, who said the claim of the New River Company to representation on the Board was based on the rights of ownership. It would be unjust to call upon the Company, who would receive no benefit from the works under the Bill, to pay a large contribution towards the extra revenue for the Conservancy. The Company claimed an absolute right to the waters of the Lea over and above the quantity necessary for navigation. This right was acquired under Act of Parliament, subject to an annual payment of £3500 by the two Water Companies, and £42,000 as a capital sum by the New River Company.

The Committee having consulted, the Chairman announced that they had decided to approve of the preamble of the Bill generally, subject to any slight modification that might arise on the consideration of clauses. With regard to the provisions of the Bill, the Committee had determined that the constitution of the Board should be as follows: Bedford, Hertfordshire, Essex, Middlesex, and West Ham, one representative each; London County Council, two representatives; the Corporation of London and local interests, including Local Authorities within the watershed of the Lea, and situated in Hertfordshire, one representative each; the Local Authorities of Essex and Middlesex, Hackney, Poplar, and Limehouse, one each; the New River and East London Water Companies, one each; and, finally, the bargeowners, one representative. The Committee had further decided that the amount of the annual payments which the promoters asked for should be conceded—viz., £8000 for the general purposes of the Conservancy and £2000 for sanitation purposes, or £10,000 in all.

The clauses of the Bill were subsequently adjusted; and the Bill was reported.

New Joint-Stock Companies.—The Birmingham Incandescent Lighting Company, Limited, has been formed with a capital of £1000, in £1 shares, to manufacture, work, sell, let on hire, and deal in burners, meters, wires, and other gas and electrical accessories and appliances. The Barbados Manjak Mines, Limited, has been registered with a capital of £10,000, in £1 shares, to adopt an agreement with the Merivale Manjak Mines, Limited, H. J. Wenham, and Honchell du Boisson, and to carry on, in Barbados, or elsewhere, the business of miners and merchants of ores, metals, oils, tarry earth, &c.

LEGAL INTELLIGENCE.

ELECTRIC LIGHT COMPANIES SUED FOR PENALTIES FOR DEFICIENT SUPPLY.

At the Greenwich Police Court, last Tuesday, before Mr. Kennedy, the London Electric Supply Corporation, Limited, appeared in answer to seven adjourned summonses taken out at the instance of Mr. Thomas Allen Shoddick, the occupier of the Dover Castle public-house, Broadway, Deptford, for making default in their supply of electrical energy.

Mr. Lawless appeared for the prosecution; Mr. C. M. Bailhache represented the Company.

Mr. Lawless, in opening the case, remarked that it was an important one, and one of peculiar hardship upon the complainant, who had spent £200 in having the electric light fitted to his premises. The fact was that the defendant Company, while they had the monopoly to furnish electricity in Deptford, were also competitors with other companies for the supply of the West of London. What was contended was that during the winter the Company neglected to provide Deptford with electricity while they were supplying the West-end. The result was that this large public-house was left in the dark from something like 4 o'clock to 8.30. Notwithstanding that the supply was lacking, the Company sent a big bill to the complainant. He did not know why Parliament gave such a monopoly to a private Company; and the only remedy consumers had was to ask his Worship to inflict a fine of 40s. on each summons.

Mr. Bailhache admitted the failure to supply on certain dates, and quoted the Electric Lighting Orders Confirmation Act, to show that the Company were not responsible for failure due to inevitable accident or *force majeure*. The latter was, he said, foreign to English statutes; and if the Magistrate should be against him, he must ask for a case.

Mr. Kennedy said he presumed that *force majeure* was practically the same as *actus Dei*.

Mr. Bailhache thought it covered more than this.

Mr. *R. S. Bain*, the Company's Managing-Director, gave evidence of the difficulties they laboured under by reason of the failure of contractors to supply boilers to time, as well as to explosions of tubes, which necessitated the withdrawal from use of five or six boilers. The coal supply had been the cause of the difficulty, as the Company had had to accept North-country coal, which was unsuitable for their purpose. In order to provide better for their customers, they cut off wholesale consumers—the Metropolitan Supply Company and the Chelsea Company—and declined after November to take any further orders. When it was impossible to supply everyone, the Company cut off the circuit which would cause the least public inconvenience, and in this circuit Mr. Shoddick was included.

In cross-examination, witness said they had to cut off some circuit, and they deliberately cut off Deptford. In the West-end they had competitors—one Company in every parish. There was another Company having powers in this district; but it was not working. The same state of affairs existed at Southwark, where similar summonses were also pending. Mr. Shoddick's bill for the quarter was £64, in spite of the defective supply.

Mr. Bailhache argued that *force majeure* meant not only act of God, but circumstances beyond the control of the Company. The Company made provision for the increase of their business, and he maintained that they could have done no more than they did. Had the Company cut off the West-end when this course was necessary, panic might have been caused in some of the theatres and public buildings.

Mr. Lawless argued that *force majeure* did not apply in this case. The Company took customers with their eyes open, knowing that the contract for boilers had been broken.

Mr. Kennedy said he would give his decision on the 4th inst.

At the Southwark Police Court, a similar case to the one above reported came before Mr. Paul Taylor. In this instance the London Electric Supply Corporation were summoned by the London County Council for having failed to maintain, on certain dates in January and February, a proper supply of electric light to 148, Borough High Street, the Weights and Measures Offices, Union Road, and St. George's Public Library, Borough Road.

At the outset, Mr. Bailhache applied for an adjournment. A similar case had, he said, that day been heard at Greenwich, and the Magistrate had reserved his decision. If this were against the defendants, the Magistrate would be asked to grant a case for the High Court. The points raised at Greenwich were practically the same as at Southwark. He relied upon a proviso to section 50 of the Provisional Order granted to the Corporation in 1889, which stipulated that no penalty should be imposed when the Court held that the default in the supply was due to unavoidable accident or *force majeure*, or was so slight as not materially to affect the value of the supply.

Mr. Taylor: Is the term *force majeure* often used?

Mr. Bailhache: This is the first Act in which I have seen it. If the Magistrate at Greenwich decides against me, I have asked him to state a case on this term; and if you are against me, I shall ask you to do the same. It is important to know what *force majeure* in the English statute means. I think the practical meaning is default without negligence.

Evidence similar to that above reported having been given,

Mr. Taylor said that the wording of the proviso pointed clearly to the fact that if there was any negligence at all on the part of the Company, it would be his duty to convict. But had there been negligence? Not the slightest evidence had been given to show it. Yet even, indeed, if there was slight neglect, it seemed, under the circumstances, to be covered by the term *force majeure*. If, on the other hand, it was contended that want of foresight was negligence, how could it be said that the defendants could have foreseen the failure of the contractors to provide their boilers? Or how could it be said that they could have foreseen that the South African war would have caused a shortage in the supply of Welsh steam coal by the colliery owners? On the whole evidence, he had come to the conclusion that he must dismiss the summonses.

A similar case was heard at the Marylebone Police Court. The Metropolitan Electric Supply Company appeared before Mr. Plowden to answer six adjourned summonses, issued at the instance of the Marylebone Vestry and the Marylebone Board of Guardians, for, in the month of December, making default in the supply of electrical energy. His Worship having reviewed the evidence, said the electric light seemed to have flitted over the parish with the fitfulness and brilliancy of summer lightning—one never knew when it was coming. He thought the explanation of the Company as to the failures during the present year exculpated them from blame; and he should not therefore take them into account. On the original summonses, the Company would have to pay 5s. for each date (total, £1 5s.), with 10 guineas costs. His Worship added that the public would be encouraged and consoled by the statement that these failures would not occur again, or at least that they would be few and far between.

The Welsbach and Sunlight Litigation.

Last Saturday, Mr. Justice Byrne gave judgment on a summons which had been argued before him at considerable length, as to the sufficiency of the answers to interrogatories put in by the Secretary of the plaintiff Company. It will probably be recollected that the defendants wished to interrogate certain of the Directors and Mr. Mackean, the plaintiffs' Chemist; but this was refused, and leave given to interrogate the Secretary only (*ante*, pp. 153, 210). The object of the interrogatories was to elicit information as to the receipt by the Incandescent Gaslight Company (the plaintiffs' predecessors) of fluid for impregnating mantles from Dr. Welsbach in 1891 and 1892; and the Secretary, in his answer, said the matters inquired into occurred prior to the incorporation of the plaintiff Company, and that he had no personal knowledge of them whatever. He had made inquiries of the Directors, servants, and officers of the Company as to what knowledge they had acquired on the subject in the course of their employment, and was informed by them that they possessed none; and he was advised that he was not obliged to make inquiries of persons who happened to be at present Directors or officers as to any knowledge they might possess accidentally, and not from their position as officers or agents. His Lordship held that this answer was illusory and insufficient; and he ordered a further answer to be given, but suspended the operation of the order pending an appeal.

Railway Companies and the Increased Price of Coal.—In consequence of the high price of coal, and in order to recoup themselves for the loss sustained thereby, the principal Railway Companies have issued a notice to all firms interested in the coal trade of their determination to charge at once an additional 3d. per ton for the use of all the companies' waggons. They have also decided to make a charge at their coal wharves of 1d. for weighing every vehicle—hitherto performed gratuitously.

Rochdale Corporation Water Supply.—The water undertaking of the Rochdale Corporation had a deficiency of £1357 at the close of the financial year 1897-8; and as the sales of water last year produced £1180 more than in the preceding twelve months, there would have been little or no loss had it not been for changes in the Money Market. A number of loans had run out, and they had to be renewed on terms which mean the payment of considerably above £1000 more interest. The increase in the amount received in water-rentals is made up of £561 for domestic and £619 for trade supplies. The Corporation now draw upwards of £7000 a year for water used for the latter purpose. In spite of the effect on the Water Department of the dearness of money, the present financial position of the old works is quite as good as was anticipated when the Water Bill was being discussed in 1898. The revenue has increased at a greater rate than was expected. However, the Water Committee will require the proceeds of a fourpenny rate in order to be able to square their accounts.

Gas Profits at Blackpool.—At the meeting of the Gas Committee of the Blackpool Corporation on Monday last week, the Gas Engineer (Mr. John Chew) presented a preliminary report on the working of the gas undertaking in the year ending March 25. The quantity of gas sold was 425 million cubic feet; being an increase of 41 millions on the previous year's figures. This is rather more than the annual make in each of the two neighbouring towns of Fleetwood and Lytham. The gross profits for the year amount to £20,300; and, after making allowance for interest, sinking fund charges, depreciation, &c., there remains a surplus of upwards of £12,000, which, as usual, will be placed at the disposal of the Corporation for reducing the rates. The surplus is £1000 more than the previous year's net profit, and is equivalent to a contribution of about 10d. in the pound on the present rateable value of the borough. The effect of the increased price of coal was not felt till the close of the year, when some of the contracts ran out, and further supplies had to be obtained. The results achieved, as shown by the figures given above, furnish another tribute to Mr. Chew's judicious and experienced management.

Street Lighting in Chicago.—The largest municipal street-lighting system in the United States is maintained in Chicago; and its cost is shown by the report of the City Electrician, Mr. Edward B. Ellicott, for the past year. There are 1310 miles of streets lighted—713 miles by gas, 327 by gasoline, and 270 by electricity. The average cost per mile of thoroughfare for the year was $654·48; that for the gas-lighted streets amounting to $784·6, that for the gasoline-lighted streets to $442·48, and that for the electric-lighted streets to $567·45. From an insignificant plant installed in 1887, and capable of furnishing 125 lights, the system has been increased to its present capacity, and is now furnishing a total of 3502 2000-candle lights. The cost of material and labour for the year was $143,709·82, to which was added the expense of replacing and repairing circuits and conduits, bringing up the total cost to $157,486·53. The average number of lamps being 2893, the total cost per lamp was $54·43, or, including office salaries, amounting to $1·50 per lamp, $55·93. The average number of lamp-hours per lamp was 4041; the average cost per lamp per hour, including office salaries, was therefore 1·384c. The average cost of duct in underground construction, where 3-inch vitrified clay tubing with cement joints is used, was 74c. per foot for double conduit work, or 37c. per foot per duct, including manholes and laterals.

MISCELLANEOUS NEWS.

WEST RIDING COALOWNERS AND GAS COAL CONTRACTS.

Protest Against Proposed New Conditions.

The following appeared in the "Leeds Mercury" last Saturday: "We understand that the West Riding coalowners propose to alter the conditions under which they have hitherto supplied gas coal by contract. One of the most important alterations is that the coal contracted for shall be delivered at the rate of 40 per cent. during the summer months—April to October—and 60 per cent. during the winter months. Hitherto Leeds has obtained 73 per cent. of its supply during the winter months; and the change would mean that 13 per cent. would have to be saved from the summer delivery and stacked for winter use. This may seem a slight thing, but it is not so. It would entail the provision of increased storage-ground, the cost of stacking, and the cost of conveyance from the stack. This would not be all. It is well known that the quality of gas coal rapidly and seriously deteriorates by exposure. A moderate computation of the increased cost such a condition would entail is said to be 1s. 6d. per ton on the 13 per cent. This alone would be a material advance for Leeds, whose gas making requires from 300,000 to 400,000 tons per annum. The coal-owners, in seeking to impose this condition, evidently desire to have more coal in winter for the ordinary market, in which they would obtain a considerably higher price than they do for contracts. They probably also wish to limit stacking in summer. It is further proposed by them that 'the total or partial failure of any receipt or delivery is not to vitiate the contract as to any other receipt or delivery.' Then, 'each month's deliveries [are] to be paid for in full in cash in each succeeding month;' and 'if the purchaser make default in any payment, the vendors may, at their option, cancel or withhold all future deliveries.' At the close of the municipal year, more than a month elapses between the last meeting of the old Gas Committee and the first of the new; and compliance with the latter condition would therefore require some other arrangement than that which has hitherto been found necessary. A stipulation to which objection is taken is that 'no purchaser shall have a right to demand any fulfilment of this contract out of heaped stock.' The Corporations of Leeds, Bradford, Huddersfield, Halifax, and Keighley recently received an intimation regarding the conditions it was proposed to insert in gas coal contracts by the West Riding coalowners. Grave objection being taken to some of the stipulations, the Corporations appointed representatives to see the coalowners on the matter. The interview took place in Leeds a few days ago. Mr. Currer Briggs conducted the discussion on behalf of the coalowners, and Alderman Lowden, of Leeds, was the spokesman for the Corporations. On the part of the latter, the most serious objection was taken to the change affecting the percentage of coal to be supplied during the winter and summer, and a vigorous protest was made against it on the ground stated above. Mr. Lowden, we understand, plainly told the representatives of the coalowners that the Corporations were strongly opposed to such a condition, and that insistence would simply mean that they would seek to reduce their coal consumption by availing themselves of water gas, with which the coal gas could be enriched. The result of the interview was an arrangement to further discuss the conditions; and on that occasion the Chairman and Vice-Chairman of the Gas Committee, with the Gas Engineer, of each of the five towns named, will represent the Corporations."

RIVER PLATE GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held yesterday week, at River Plate House, Finsbury Circus, E.C.—Mr. A. E. Bowen in the chair.

The Secretary (Mr. Ernest Heald) having read the notice convening the meeting, the report and accounts were taken as read.

The Chairman, in moving their adoption, said the shareholders would probably expect him to say something about the negotiations which the Directors entered into for the purchase of the Rosario Gas-Works, and which the shareholders authorized them to conclude at an extraordinary general meeting on Oct. 30 last. After careful investigation and mature consideration, the Board decided that, as the state of the London Money Market was then so unsettled, and the war news was so discouraging for the moment, they would not be justified in going on with the business in the terms of the proposal they had in hand. They accordingly made the owner, Senor Santa Maria, a counter offer as regards terms of payment, which, however, he declined to accept; and so the business had been allowed to drop. Owing to the plague having broken out in Rosario, things had been very bad there lately; so that the Board did not think they need have any regret in not having accomplished the transaction. Regarding the report and accounts, some of the shareholders might consider the figures a little disappointing, inasmuch as so much profit had not been made as in 1898; but in 1897, they had a gross profit of £80,662, as against £91,408 in 1899. The Directors regarded last year as an exceptionally good one; and so, out of the profits earned, they passed £20,000 to the reserve fund, and £10,000 to the contingency fund. The Government project to fix the official par rate for paper at 44 c. gold, had had the effect of causing the gold premium to advance from 107, at which the Company's paper balances were converted into gold at the end of 1898, to 130; and this adversely affected the accounts, but the contingency fund had not been touched. What, however, had had the most serious effect on the profits had been the falling off in the selling price of coke and other residuals. The total sales of residuals had yielded less by (say) £14,000 odd. The fall in prices was caused entirely by the competition of imported coke. But this had diminished a good deal since the beginning of the year; and better prices were now being obtained. Notwithstanding the great competition in Buenos Ayres, 7·17 per cent. more gas was sold than in 1898. The quantity of coal carbonized was 1900 tons more; and the cost was 4s. 3d. per ton less. The yield per ton of coal was higher than in 1898, though they then considered it extraordinarily good. They had, however, to supply 23 candle power gas; so that it was expensive to produce. During the year they paid in national and municipal taxes, no less than $264,365 paper—an increase over 1898 of $30,550, or nearly £2700. About 13½ miles of mains were added to their system during the year; and the net gain of customers was no less than 1995—making a total of 24,667, though they had to put in as many as 6251 new services to obtain this net increase—so very active was the competition between the Companies. The Electric Light Companies did not do the Company much harm, as they only took from them 16 customers during the year. At the end of last year, they lighted 6780 public lamps, as against 5808 at the close of 1898. After a passing reference to the cordial relations existing between the Company and the Municipal authorities, and a tribute to the ability and energy of the Company's local representatives and officials, he alluded to the extensive revision of the distribution system that had been made in connection with the paving and repaving of the city. In 1899, 32,724 metres of mains were removed and revised, as against 25,142 metres in 1898. The sizes of 6786 metres of mains had been changed; and, in one way or another, 681 metres had been modified. Besides this, 3271 metres had been taken up in streets where they had duplicate mains of the old Argentine and Belgrano Companies. These extensive works had all been charged against revenue; but it was money well laid out. No less than £21,029 was spent out of revenue last year in the upkeep of the works; and they had the authority of their Chief Engineer for saying that everything was in first-class condition. New automatic charging apparatus at the Corrales works had given every satisfaction; and the new workshop for meters had been a great success. During the year 1874 meters were made in it, and 4653 repaired. To pay for various works and purchases of land, a further amount of £30,000 of debenture stock was sold; and consequently the charge for interest had increased from £9702 to £10,441. The capital and expenditure was £34,758, against £26,985 in 1898. It included the cost of additional land at Corrales, part of the cost of a carburetted water-gas installation, the expense of connecting the Corrales works with the main system of sewers so as to get rid of the ammoniacal liquor, and the purchase of a piece of land adjoining the Belgrano works. Among other figures to which he referred was the item of stocks of coal, &c., which stood at £62,998. They had, he explained, rather heavy stocks of coal at the end of the year—sent out, he was glad to say, at cheap freights. Regarding the distribution of the profits, they were able to give the shareholders the same dividend as last year, pass £10,000 to the reserve fund, and carry forward practically the same amount. Looking at all the circumstances—some very exceptional—he thought the proprietors would be well satisfied with this result. Of course, it would be in the minds of the shareholders that the very high prices ruling for coals must very much affect their prospects; but he was pleased to say that so far they had not had to buy any dear coal. They had succeeded in purchasing a very considerable portion of their requirements, of one class of coal, for this year, and also for well into next, at the price paid last year; and of the other class, they fortunately had sufficient contracted for early last year to last them until about September next. So that, if they had to submit to purchase an additional quantity at the high prices, it would not be a very serious matter as regards this year's accounts; and by next year they hoped that matters and prices would have settled down. On the whole, he thought he might assure the shareholders that their prospects were in every way encouraging. From January to date, the consumption of gas had been very satisfactory—better than anything they had ever had before.

Mr. C. P. Ogilvie seconded the motion, which, after a few congratulatory remarks from Mr. C. Surgey, was unanimously carried.

A final dividend at the rate of 8s. per share was declared; making 7 per cent. for the year.

The retiring Directors (Messrs. A. E. Bowen and C. P. Ogilvie) and the Auditors were next re-elected.

A vote of thanks was passed to the London staff, to the Chairman and members of the Local Committee, and to the General Manager (Mr. Gabarret) and the Chief Engineer (Mr. Rowbotham); and similar recognition was made of the services of the Chairman and Directors.

SINGAPORE GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held last Thursday, at the Cannon Street Hotel, E.C.—Mr. Samuel Spencer in the chair.

The Secretary (Mr. R. M. Christie) read the notice convening the meeting; and the report and accounts—which were referred to in the "Journal" for the 17th ult.—were taken as read.

The Chairman said he would ask the shareholders to pass the accounts as presented; and at the close of the meeting, he would like to have their views in private as to the reply that should be made to the letter they had received from the Municipality. Turning to the accounts, they would have noticed that they worked out, as regarded the net profit, about the same as in the previous year; and they would remember he stated that this period was the most favourable they had experienced for some years. The shareholders would have observed that the present balance-sheet was different to any that had previously been put before them; as, following what the Board proposed doing last year, the figures had been worked out at nearly their sterling value—the dollar having been reckoned at 2s. 6d., as against 4s. 6d. previously. This would enable the accounts to be better understood by anyone examining them, and it would do away with the enormous amount that had hitherto appeared as loss on exchange. The net profit was £3512, which enabled the Board to recommend a slightly increased dividend—namely, 3½ per cent. for the year, as against 3 per cent. paid for the previous twelve months. The shareholders would remember that, at the extraordinary meeting held in November last, it was agreed to cable to the Municipality that the Company were willing to accept such a sum as Mr. Corbet Woodall (the Engineer consulted by the Commissioners) might recommend; but on Jan. 25 they wrote declining such an arrangement. Since then—namely, on Feb. 15—the Municipality had written saying that they had a promise from the Governor, in council, of a loan for the purpose of establishing municipal gas works; and they asked the Company to state definitely, on or before April 30, the lowest price they would accept. The shareholders would also remember that at the last meeting the Board unhesitatingly said they considered the works worth, as a going concern, £55,000. They had since seen no reason to alter

their views as to this figure, as, taking the profit for the last two years as averaging about £3500, and multiplying the figure by 16¾ years' purchase —the number of years stated by the Municipal Engineer to be "a fair rate"—the amount would work out at over £58,000. The Commissioners, however, would not see the matter in this light; and they had sent the Company word in their last letter that they would not pay anything like the sum named for the undertaking. It was therefore considered advisable by the Board to ask an eminent gas engineer to give an opinion on the value of the property, so that this could be submitted to the shareholders. They thereupon consulted Mr. A. F. Phillips, who was a great authority on the value of foreign gas-works, and was also known to the Commissioners. Mr. Phillips had submitted a report, in which he stated that he considered a fair price would be £45,000, exclusive of the land. The exact words used by Mr. Phillips were: "I estimate the value of the works and plant to-day, as set out in the report, at £45,000, and am of opinion that the Company will be justified in accepting such an amount, and the Municipality should be willing to pay it." At the private meeting later on, the Board would ask the shareholders to decide what figure should be cabled out as the sum they were willing to accept for the works. He might point out that, at the price named by Mr. Phillips, the rate of profit realized on the past two years' working would give the Municipality a return of 7 per cent., in addition to which they would save the London expenses, which would be equal to certainly another 2 per cent. The result to the Commissioners would be a saving on their rates of at least £1200 to £1500 a year. As the Municipality were really in earnest in the matter of having their own gas-works, the Board were strongly of opinion that it would be wise to try to come to terms with them, and make them an offer such as they could readily accept. The Directors were hopeful that the sum to be decided on by the shareholders as the selling price would be such as the Municipality could fairly agree to give. He would be pleased to answer any questions; but he thought it would be better to pass the accounts as they stood, and defer any discussion till the private meeting. They were fortunate in having Mr. Albert Ford, their Engineer and Manager, present to assist them in coming to a decision in regard to the price they should ask for the works. He concluded by proposing that the report and balance-sheet be received, adopted, and entered on the minutes.

Mr. W. T. Batten seconded the motion.

Mr. S. H. Dean said he would like to know the meaning of the item in the balance-sheet, "Contingent fund, £1000."

The Chairman replied that this was made up of money which, if they had liked, might have been distributed, but which instead was put to reserve and invested in the business. If the Company were to continue in existence, the amount could now be taken from the business and put aside. He added that the Company were never in such a good position as at the present time. They had £2800 in the bank.

The resolution was carried unanimously.

On the motion of the Chairman, seconded by Mr. B. Green, a dividend was declared on the ordinary shares of 4 per cent. per annum, free of income-tax, making, with the interim dividend, 3½ per cent. for the year.

The retiring Director (Mr. R. Garraway Rice) and the Auditors (Messrs. Magnus Ohren and Thomas Guyatt) having been re-elected,

Mr. Robbins proposed, and Mr. H. W. Smith seconded, a vote of thanks to the Directors.

On the motion of Mr. Dyer, seconded by Mr. Samuel While, a similar vote was passed to the Engineer and Manager.

Mr. Ford, in returning thanks, said he thought too much credit had been given to him personally for the great improvement that had taken place in the Company's position. The Directors had done a lot towards this end. He was glad that, in spite of the increased cost of coal, labour difficulties, and the loss on exchange, they had managed to make a little improvement; and he congratulated the shareholders on the fact that the dividend had been increased.

The proceedings then terminated.

MANCHESTER CORPORATION GAS SUPPLY.

Local Government Board Inquiry.

An inquiry was held at the Manchester Town Hall last Tuesday, by Mr. E. A. Sandford Fawcett, relative to an application made by the Corporation to the Local Government Board for sanction to borrow £250,000 for the purposes of their gas undertaking.

The Deputy Town Clerk (Mr. T. Hudson) explained that the Act of Parliament under which the application was made was that of 1899, by which the Corporation were empowered to borrow an additional sum of £500,000 with the sanction of the Local Government Board; and they now asked for power to borrow the first half of this amount. The principal works included in the application were at the Bradford Road station—the largest of the three stations in the city. It was proposed to erect new plant for testing coal and cannel, which would be permanent. The cost was estimated to be £5500. The other items he explained to be the following: Completion of the arching and culverting of the River Medlock (which flows through the works) over a length of 184 lineal yards, at an estimated cost of £11,500; at the Poland Street pipe-yard, buildings comprising a storekeeper's house, mess-rooms for men engaged in the yard and the streets, and stables, the estimated cost being £12,930; the Whitworth Street storage yard to be enclosed with a boundary wall, and sheds to be erected for the storage of mains and pipes, estimated to cost £1930; and land £3570. The next item in the loan was one of £80,000 for the extension of the gas-mains in the city; and of this the sum of £20,665 was for trunk mains and the rest for service mains. The next item was for meters, the use of which was increasing, due to the fact that the Corporation did not make any charge for hiring. The sum estimated to be required in three years was £100,000. The last item was for stores—£34,570. With regard to the item for land, he took it for granted that a term of 50 years would be allowed for repayment of the loan; and as to the substantial works enumerated, he asked that the Local Government Board would grant a period of 40 years. On previous occasions, only 30 years had been allowed; but this was thought to be too short a term. The buildings were substantial and likely to last 50 years, and it was considered reasonable that a term of 40 years should be granted. In regard to the smaller pipes, he asked for a term of 25 years. It would be more convenient to the Corporation if an equated term were granted. As regarded the meters and stoves, he did not ask the Inspector to equate these with the other items. Formerly they had had the short term of five years for this class of loan; but they thought this very inadequate. They had a guarantee from the makers of meters which extended over five years. The "life" of a meter was nearer 20 years than five; and they asked for 15 years. As regarded the stoves, they asked for seven years, and not five as previously. They admitted that the "life" was not so long as that of the meters.

The Right Hon. *Thomas Briggs* (the Lord Mayor) having given formal evidence in support of the application,

Mr. *Charles Nickson*, Superintendent of the Gas Department, said that during the past five years 18,200 new houses had been erected in the area supplied by the Committee. In 1881 the city population was 341,000, in 1891 it was 505,000, and in 1900 it was estimated at 550,000. The total population of the area of supply was now estimated at 709,000, and there were 126,191 consumers. The increase in the use of gas had been very great in recent years. In 1890 the consumption was 2973 million cubic feet, in 1898 it was 4158 millions, and in 1900 it was estimated to be 4520 millions. The increase in the past five years had been at the rate of 5 per cent. per annum. Altogether, the department had borrowed £2,576,000; and the present debt was £1,026,450. The property of the department was estimated to be worth £2,123,784. The total income for the past year was £643,000, against £523,000 in 1896. There had been an expenditure of about £98,000 a year for the past five years on extensions; and he considered that the developments of the next five years would be quite as great.

Mr. *J. Swarbrick*, Architect, and Mr. *W. C. Waddington*, Superintendent of the Street Mains and Lighting Department, furnished details of the works proposed, and information showing their necessity.

Mr. *T. De Courcy Meade*, the City Surveyor, was also called, and gave evidence as to some of the works required.

Mr. *J. Gibson Newbigging*, the Engineer of the Gas Department, said that, notwithstanding the great demand for the electric light, the consumption of gas maintained a steady average increase of about 5 per cent. per annum; and this rate was likely to be kept up. It was largely due to the constantly growing demand for prepayment meters, and for gas for purposes other than lighting. He supported the various proposals laid before the Inspector.

The inquiry concluded; and the Inspector afterwards visited the various sites mentioned.

Tenders under Consideration.

At a meeting of the Gas Committee of the Manchester Corporation held last Friday, a number of tenders for new plant, tar, &c., were considered; but no definite decision was arrived at as to their acceptance or otherwise. It was, however, decided to advertise for the requisite supplies of gas coal and cannel to meet the ensuing year's requirements. Although the Committee anticipate that they will have to pay a considerable increase in the price of coal, especially in view of the firm attitude the coalowners are adopting, they have not decided on any recommendation to the Council as to an increase in the price of gas to consumers. This question will, however, probably be settled at the monthly meeting of the Council to be held to-morrow (Wednesday). In the meantime, it is interesting to note that the Gas Department are securing some compensation for the increased cost of production in the better prices they are getting for coke; and at Friday's meeting the Committee decided to further raise the price from 16s. 8d. (the present figure) to 18s. 6d. per ton—the advance to come into effect to-day.

THE ANNEXATION OF GAS UNDERTAKINGS BY BRADFORD.

The negotiations which have been going on between the Bradford Corporation and the North Bierley Gas Company for the purchase of the Company's undertaking by the City Authority have, it is reported, been practically completed. A good deal was done towards that end when, a short time ago, the parties were in London; and it was reported at a meeting of the Finance and General Purposes Committee last Friday that satisfactory arrangements had been arrived at. When the North Bierley district was included in the city boundaries, it was agreed that the rates in that district should remain at 4s. 10d. in the pound until such time as the gas was supplied at the price charged by the Corporation. This arrangement has, no doubt, led to special efforts being made to come to terms with the North Bierley Company. The terms agreed to are based upon a thirty-one years' purchase; the Corporation acquiring the whole of the Company's area of supply excepting the districts of Scholes and Oakenshaw. These districts will, no doubt, eventually be handed over to the Cleckheaton District Council, with whom negotiations are going on for the transference of that area. At present, however, there is a difference of opinion with regard to the purchase price. The price of gas at North Bierley is now 2s. 11d. per 1000 cubic feet, while the price charged by Bradford is 2s. 3d. per 1000 cubic feet, with certain discounts, varying according to the amount of gas consumed. Terms had not at the end of last week been agreed upon between the Corporation and the other Companies supplying gas in the newly-added districts.

OPENING OF GAS-WORKS AT SELSEY.

In February last year a Company was floated, with a capital of £10,000, to provide a supply of gas for the watering-place of Selsey, in Sussex; and in August the erection of works was commenced. The undertaking was pushed forward with such dispatch that on Saturday, the 21st ult., the Directors, officials, and a few friends, met together, and witnessed the ceremony of turning on the gas. The works occupy a site on land acquired by Mr. Newton Clayton, 2 acres having been secured by the Company, of which one-half is at present made use of; the other being available for extensions. The plant is capable of supplying 5 million cubic feet of gas a year; and this output may be doubled with very little structural alteration. Mr. A. F. Painter was the Engineer employed;

and Messrs. Williams and Carnall were the Contractors. Messrs. Newton, Chambers, and Co., Limited, supplied the apparatus; and Messrs. W. Parkinson and Co., the governor. Four miles of pipes have been laid in the district; and as the business grows, they will be extended by six miles. The price of gas at the outset is to be 5s. per 1000 cubic feet; but it is intended to freely introduce the prepayment system. The gas was turned on by Mr. E. R. Painter, Chairman of the Company, after which the party adjourned to the new Selsey Hotel, where luncheon was partaken of. Mr. E. R. Painter presided; and Alderman Ballard, of Chichester, was in the vice-chair. At the conclusion of the repast, several appropriate speeches were made; hearty good wishes being expressed for the success of the undertaking. Mr. Newton Clayton gave the toast of "The Selsey Gas Company," which was responded to by the Chairman, who dealt with the prospects of the concern. During the evening, several designs, illuminated by gas, were on view in Selsey.

BRUSSELS MUNICIPAL GAS SUPPLY.

The Gas Committee's Report on the Past Year's Working.

According to the report of the Gas Committee of the Brussels Municipality for the past year, which has lately been presented, the total quantity of gas sold was 31,474,415 cubic metres, or about 1,111,047,000 cubic feet, compared with 29,252,661 cubic metres, or about 1,032,619,000 cubic feet in 1898; being an increase of 2,221,754 cubic metres, or 78,428,000 cubic feet. This is a considerably larger increase than that recorded in last year's report (for the year 1898) as compared with 1897. The total production of gas in the past twelve months reached 38,724,160 cubic metres (1,366,962,848 cubic feet); being 2,181,280 cubic metres (76,999,184 cubic feet) more than in 1898. The entire bulk of gas was disposed of as follows:—

	Cubic Metres.
Ordinary consumers	24,721,512
Municipal establishments, at 10c.	1,030,782
Gas-engines, at 10c.	2,104,763
Industrial purposes, at 10c.	1,323,710
Heating purposes, at 10c.	1,063,958
Illuminating devices, balloons, &c.	98,487
Artizans' dwellings and miscellaneous	1,131,203
Total sold	31,474,415
Public lighting and illuminations	4,999,760
Used on the works, &c.	1,182,989
Unaccounted for	1,066,996
Total production	38,724,160

It is interesting to notice that the use of incandescent burners and the extended adoption of electric lighting have not had the effect of checking the growth of the gas consumption. This is strikingly shown by a diagram accompanying the report, from which it is seen that the output of gas in the winter months has increased during the past twenty years by 125 per cent., while that for the summer months has actually gone up by more than 200 per cent. The total number of inhabitants is now 208,987; the consumption per head being about 5300 cubic feet, and the average price 2s. 9d. per 1000 cubic feet.

The total receipts amounted to 6,336,795 frs. (£253,472), and the expenses to 4,228,645 frs. (£169,146)—leaving a balance of 2,108,150 frs. (£84,326), compared with 1,762,354 frs. (£70,494) in 1898. Allowing 41,304 frs. for the reduced value of the stores, the profit resulting from the undertaking is 2,066,846 frs. (£82,674).

The section of the report dealing with the manufacturing operations shows that 122,273 tons of coal were carbonized and 1344 tons of oil employed for enrichment. For 1898, the figures were 118,682 and 900 tons respectively. The quantity of coke sold at the works was 852,458 hectolitres (about 2,344,260 bushels), and the whole of the stock was disposed of. All the tar products were sold regularly, at fairly remunerative prices. Sulphate of ammonia fetched a higher figure, and there was none in stock at the end of the year. As usual, the breeze was utilized in the manufacture of compressed fuel, which is employed in heating the retorts and generators. In view of the augmentation in the consumption of gas, the new works in course of construction, as mentioned in a paragraph which appeared in the "JOURNAL" a few weeks since, have been pushed on as fast as possible. These works are expected to be in operation some time during the current financial year.

The total amount of capital employed in the undertaking at the close of 1899 was 24,989,291 frs. (£999,572), compared with 23,489,453 frs. (£939,578) at the corresponding period of 1898. Mains to the extent of 187,425 metres (206,167 yards) occupied the subsoil of the city on Dec. 31, 1899, compared with 186,882 metres (205,570 yards) at the end of 1898. The leakage amounted to 2·75 per cent. of the total quantity of gas sent out, against 3·24 per cent. in 1898. The number of meters in use was 26,809—an increase of 2360. There were 425 prepayment meters fitted up; making a total of 2146 meters of this kind in use in the city. In 1898 the number put in was only 290; so that the report bears evidence that this convenient method of obtaining a supply of gas is appreciated. It will be seen from these figures that there was renewed activity in the interior fitting work, which had slightly fallen off; the number of orders received being 1503 against 947 in 1898. At the close of the year, there were in use 7706 of these interior installations, as well as 3534 rising pipes—an addition of 497 of the latter in the year. The gas-stoves on hire numbered 17,973, against 14,729 in 1898 and 13,038 in the preceding year; and 367 gas-engines, representing 3088-horse power, were at work—the larger number of them being in printing and bookbinding establishments. The consumption of gas for motive power rose last year to 2,104,763 cubic metres, or about 74,298,000 cubic feet. Outside lanterns are let to private consumers; and 22 single-jet and 130 high-power lamps were in use on Dec. 31, 1899. This was a slight falling off as compared with 1898. For the public lighting there were employed 6349 lamps, of which 697 were fitted with high-power burners. The total number of hours of lighting was 3815. Between midnight and one o'clock in the morning, 670 high-power and 1137 ordinary burners were turned off during the year.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1114.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 11	10½	Alliance & Dublin 10 p. c.	20—21	..	5 0 0
100,000	10	,,	7½	Do. 7 p. c.	13½—14½	..	5 3 5
800,000	100	Jan. 2	5	Australian 5 p. c. Deb.	100—102	..	4 18 0
200,000	5	Nov. 15	6	Bombay, Ltd.	6½—6¾	..	4 8 11
40,000	5	,,	6	Do. New, £4 paid	4¾—4¾	..	5 1 1
880,000	Stk.	Feb. 23	12	Brentford Consolidated	250—260	..	4 12 4
270,000	,,	,,	9	Do. New	195—200	..	4 10 0
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb.	118—123	..	3 5 1
220,000	Stk.	Mar. 14	11½	Brighton & Hove Orig.	237—242	..	4 15 0
226,320	,,	,,	8½	Do. A. Ord. Stk.	180—185	..	4 11 11
999,500	Stk.	Feb. 23	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Mar. 29	10	British	41½—42½	..	4 13 0
50,000	10	Feb. 23	12	Bromley, Ord. 10 p. c.	24—26	..	4 12 4
73,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd.	9¾—10½	..	5 17 1
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	99—101	..	3 19 3
150,000	20	Mar. 14	8½	Cagliari, Ltd.	24—26	−1	6 6 11
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	14—15	−½	5 6 8
50,000	50	Nov. 2	6	Do. 6 p. c. 1st Mort.	56—58	..	5 3 5
550,000	Stk.	Apl. 11	13½	Commercial Old Stock	295—300	..	4 10 0
286,425	,,	,,	10½	Do. New do.	230—235	..	4 9 4
288,237	,,	Dec. 14	4½	Do. 4½ p. c. Deb.	142—145	..	3 2 1
800,000	Stk.	Dec. 14	9	Continental Union, Ltd.	160—170	..	5 5 11
200,000	,,	,,	7	Do. 7 p. c. Pref.	175—180	..	3 17 9
51,600	Stk.	Feb. 23	14	Croydon A 10 p. c.	335—340	..	4 2 4
173,400	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
555,000	Stk.	Feb. 23	5½	Crystal Palace Ord. 5 p. c.	118—123	..	4 5 4
60,000	,,	,,	5	Do. 5 p. c. Pref.	130—135	..	3 14 1
486,000	10	Jan. 26	11	European, Ltd.	19¾—20¾	..	5 7 4
854,060	10	,,	11	Do. £7 10s. paid	14½—15½	−½	5 6 5
14,993,075	Stk.	Feb. 9	4½	Gas-light and Coke	4 p. c. Ord.	101—103	..	4 15 1
2,600,000	,,	,,	3½		3½ p. c. max.	97—99	..	3 10 8
3,799,735	,,	,,	4		4 p. c. Con. Pref.	118—120	−1½	3 6 8
3,993,975	,,	Dec. 14	3		3 p. c. Con. Deb.	98—100	..	3 0 0
70,000	10	Nov. 15	8	Hongkong & China, Ltd.		13½—14½	..	5 10 4
3,900,000	Stk.	Nov. 15	10	Imperial Continental		210—213	−1	4 13 11
473,900	Stk.	Feb. 9	3½	Do. 3½ p. c. Deb. Red.		100—103	..	3 8 0
75,000	5	Dec. 14	6	Malta & Medn., Ltd.		4½—6½	..	5 9 1
560,000	100	Apl. 2	5	Met. of	5 p. c. Deb.	105—109	..	4 11 9
250,000	100	,,	4½	Melbourne	4½ p. c. Deb.	105—107	..	4 4 1
541,920	20	Nov. 15	8	Monte Video, Ltd.		10½—11½	−½	5 4 4
667,946	Stk.	Feb. 23	9½	Newc'tle & Gateah'd Con.		215—220	..	4 4 1
299,895	Stk.	Dec. 29	3½	Do. 3½ p. c. Deb.		104—107	..	3 5 5
150,000	5	Nov. 30	8	Oriental, Ltd.		7—7½	..	5 6 8
135,000	5	,,	8	Do. New, £4 10s. pd.		6½—6¾	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.		1½—1¾	..	4 11 5

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
60,000	5	Feb. 23	7	Ottoman, Ltd.	5—5½	..	6 7 3
500,000	100	Dec. 1	6	People's Gas of Chicago 2nd Mtg. Bonds	102—106	..	5 13 2
851,070	10	Apl. 27	7	River Plate Ord.	10¾—11¼*	..	6 4 5
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	100—102	..	3 18 5
250,000	10	Apl. 11	8	San Paulo, Ltd.	11½—12½	..	6 8 0
135,000	Stk.	Sept. 15	10	Sheffield A.	249—251	..	3 19 8
209,053	,,	,,	10	Do. B.	249—251	..	3 19 8
447,427	,,	,,	10	Do. C.	249—251	..	3 19 8
5,600,000	Stk.	Feb. 23	5½	South Metrop., 4 p. c. Ord.	128—131	−2½	4 1 5
1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb.	99—101	..	2 19 5
380,940	Stk.	Nov. 30	5	Southampton Ord.	117—122	..	4 2 0
70,825	,,	Dec. 29	4	Do. 4 p. c. Deb.	120—125	..	3 4 0
120,000	Stk.	Mar. 14	6	Tottenham and Edmonton A. 5 p. c. B. 3½ p. c. 4 p. c. Deb.	139—141	..	4 5 1
250,520	,,	,,	4½		100—102	..	4 8 3
55,100	,,	Dec. 14	4		113—117	..	3 8 5
182,380	10	Jan. 12	5	Tuscan, Ltd.	8—9	..	5 11 1
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.	101—104	..	4 16 2
				WATER COMPANIES.			
780,999	Stk.	Dec. 29	11	Chelsea, Ord.	305—310	..	3 11 0
150,000	,,	,,	5	Do. 5 p. c. Pref.	157—162	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	145—150	..	3 0 0
175,785	,,	Mar. 29	4½	Do. 4½ p. c. Deb.	145—150	..	3 0 0
1,720,560	Stk.	Apl. 11	7	East London, Ord.	195—200	..	3 10 0
654,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb.	145—150	..	3 0 0
390,000	,,	,,	3	Do. 3 p. c. Deb.	99—101	..	2 19 5
700,000	50	Dec. 14	7½	Grand Junction 10 p. c. max. 4 p. c. Deb.	106—108	..	3 9 5
810,000	Stk.	Mar. 29	4		130 135	..	2 19 3
708,000	Stk.	Feb. 23	14	Kent	307—312	..	4 9 9
160,000	,,	,,	7	Do. New, 7 p. c. max.	200—210	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.	294—299	..	3 10 3
406,200	100	,,	8	Do. 7½ p. c. max.	212—217	..	3 13 9
850,000	Stk.	Mar. 29	4	Do. 4 p. c. Deb.	130—133	..	3 0 2
500,000	100	Feb. 23	13½	New River, New Shares	418—423	..	3 3 9
1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb.	132—137	..	2 18 5
902,300	Stk.	Dec. 14	7½	South-wark and Vauxhall Ord. 7½ p. c. max. 5 p. c. Pref. 4 p. c. A Deb.	203—205	..	3 13 2
120,500	100	,,	7½		190—195	..	3 16 11
489,200	Stk.	,,	5		160—165	..	3 0 7
1,019,585	,,	Apl. 11	4		129—134	..	2 19 9
1,155,066	Stk.	Dec. 14	10	West Middlesex	287—293	..	3 8 6
200,000	,,	,,	4½	Do. 4½ p. c. Deb.	147—152	..	2 19 3
200,000	,,	Mar. 14	8	Do. 3 p. c. Deb.	99—101	..	2 19 5

*Ex div.

ELECTRIC LIGHTING NOTES.

The Board of Trade have intimated to the Vestries of St. George's-in-the-East and Mile End Old Town and the District Board of Works of Limehouse that they propose to grant the applications of these Local Authorities for Provisional Orders. They were opposed by the County of London Company, who already possess electric lighting powers for these districts.

A Local Government Board inquiry was held at Rhyl last Thursday, in regard to an application by the Corporation for sanction to borrow £12,250 for electric lighting purposes and £6750 for a refuse destructor. In support of the application, the Town Clerk stated that Rhyl was so rapidly developing that it was absolutely necessary a refuse destructor should be provided; and in order to be up-to-date, the Council had decided to erect electric light works. It was calculated that a substantial profit would be made out of the electric light; but, in addition, the Council would supply the Rhyl and Prestatyn Light Railway with electricity to the advantage of the town.

A fire, which caused considerable alarm, broke out last Saturday afternoon, at the residence of Lord Battersea, Surrey House, Marble Arch. A workman, who had put an installation of electric light into the large oak-room, proceeded to test his work, with the result that the wires, being in contact, set the oak ceiling on fire, and the wood burned rather fiercely. The alarm was at once given, and the domestic fire-extinguishing service was brought into working order. Meanwhile, part of the oak panelling was torn down to prevent the spread of the flames, and some valuable pictures were removed. When the hose was turned on to the flames they were promptly subdued, so that when the Fire Brigade came upon the scene their services were not required. The damage done by the flames was not great, but a very considerable amount was caused by the water.

At a special meeting held last Friday, the Weymouth Town Council had under consideration an elaborate report by Professor A. B. W. Kennedy on a proposed scheme of electric lighting for the borough, together with a supplementary report by his partner, Mr. Jenkins. Professor Kennedy's estimate for the plant is £38,300; to which must be added the cost of land, engineering charges, &c. He therefore assumed that the amount to be borrowed for carrying on the scheme will be £42,000. He reckons that in two years from the start the income from the undertaking will be £5625; and the expenditure, including capital charges, £5000—leaving a balance of £625, besides a saving of about £750 in the cost of gas, making together £1375. He considers, however, that the undertaking will actually pay its way, including capital charges, within the first complete year of working. The report was adopted, and it was decided to instruct Professor Kennedy to prepare a scheme in accordance therewith, together with the necessary plans and details for submission to the Local Government Board, in order to obtain their consent to the raising of the amount required. A proposition was brought forward to call a public meeting to obtain the ratepayers' consent to the scheme; but it was rejected, on a division, by 13 votes to 5.

The Town Council of West Bromwich having applied to the Local Government Board for sanction to borrow £30,000 for purposes of electricity, an inquiry into the matter was held last Friday, at the Town Hall, by Mr. G. W. Willcocks, M.Inst.C.E. Mr. A. Caddick (Town Clerk) represented the Corporation; and among those present were Mr. A. D. Greatrex, the Borough Surveyor, and Mr. R. Quinn, the Electrical Engineer. The Town Clerk explained that the application was chiefly to obtain money for acquiring land, erecting buildings and the requisite machinery, and laying mains in the compulsory area for the purposes of power distribution and electric lighting. This area comprised the main thoroughfare of the town, and a site for the works had been purchased at a cost of £1250. He had received a letter from the Board of Trade containing their requirements, to which the Corporation had assented; but the formal sanction of the Board had not yet been obtained. Mr. Quinn gave details of the scheme, and pointed out that the Corporation proposed to generate a much smaller quantity of electricity than the present demand. They estimated that the total annual revenue would be about £3756, and the expenditure £3348, which would leave a small surplus. There was no opposition to the application.

A deputation from the County Councils Association and other local bodies waited upon Mr. Ritchie at the Board of Trade last Thursday, in reference to the Electric Lighting Act, 1882, Amendment Bill, which seeks to affirm the principle that public authorities ought not to incur any additional trouble and expense in rebuilding or repairing any of their bridges merely because a company have been permitted to utilize the bridge for carrying their electric mains or pipes. The provisions of the Bill are analogous to those contained in the Tramways Act (33 & 34 Vict., cap. 78, sec. 32) with respect to roads. The deputation having laid their views before Mr. Ritchie, he, in reply, said the principle for which the deputation asked appeared to be a reasonable one, although some objection might be taken to its being retrospective. It was rather a strong order to say, when Acts of Parliament and Provisional Orders had been obtained by electric lighting concerns under protection of the existing law, that they should now be made liable under the Bill to expenses to which they were not previously liable. The Bill, which was very defective, had a most unfavourable position in the House; and he suggested that it would be better if it were withdrawn and reintroduced in an amended form. The position of electric lighting was not what it was in 1882; and he thought that the deputation would have a strong case if they went to Parliament and asked for a reconsideration of the position in which local authorities were placed in connection with all such expenses as those in question.

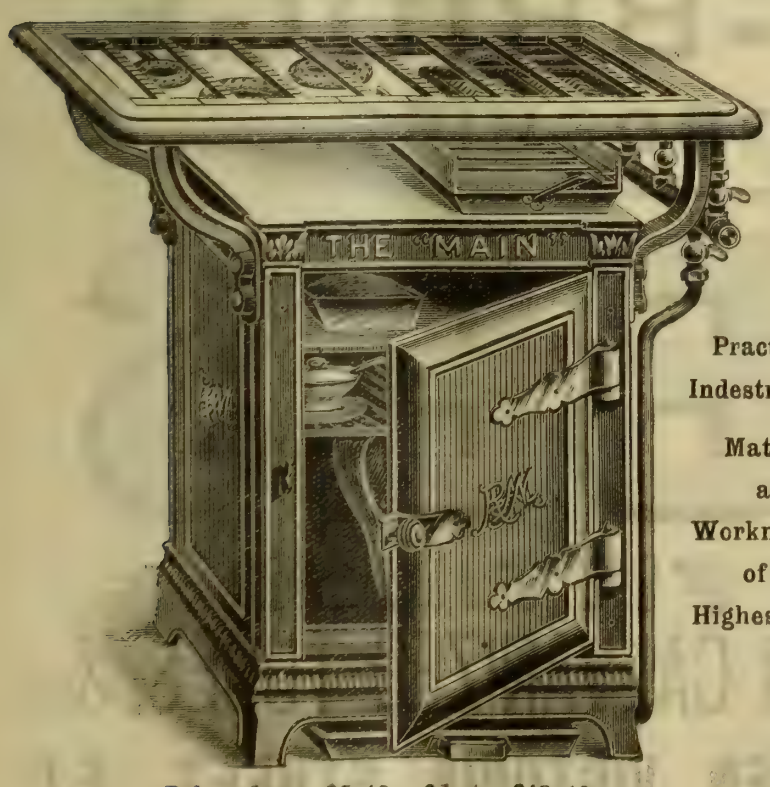
Notwithstanding the opposition of the Marylebone Vestry, and the fact that a new governing body—the Marylebone Borough Council—will come into existence in November, the President of the Board of Trade has granted to the Marylebone Electric Supply Company a Provisional Order conferring upon them the right to supply current in the parish in competition with the Metropolitan Electric Supply Company. Dr. J. Fletcher Little, who, it may be remembered, introduced the deputation which waited upon Mr. Ritchie on the 17th of January last (*ante*, p. 214), in communicating this fact to the Press, says that, as far as the ratepayers are concerned, the only hope is that Parliament will not confirm

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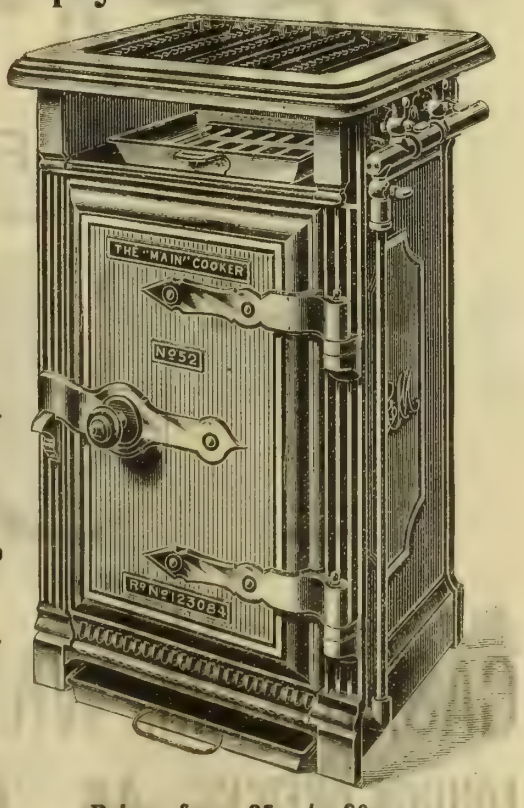


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his action. He proceeds: "Mr. Ritchie's view is that the competition of another Company will diminish the evils from which we at present suffer. This is not so. There is no certainty that it will even reduce the present exorbitant prices. Understandings and working arrangements as to what they deem fair charges are well-nigh certain between two monopolist Companies—they are so clearly to their interest. As to damages for breach of duty in failure to supply, the existence of another Company will not alter the law in favour of the consumer. He will remain, as at present, without any compensation. Further, the ordinary ratepayer will soon become aware that another body has obtained the right to tear up the streets and obstruct the traffic. The influential deputation of ratepayers asked Mr. Ritchie to do two things—first, to give the consumer a legal right to damages for breach of duty on the part of the Company; and, secondly, to exercise his powers to reduce prices. Mr. Ritchie informed the deputation that he believed that, had the evidence then brought forward been laid before the Committee of the House of Commons, the Provisional Order of the Vestry would have been confirmed. Now, the Vestry, in opposing the granting of the Provisional Order to the Marylebone Company, informed Mr. Ritchie of their intention to apply again for a Provisional Order supported by the evidence which he considered so conclusive. No one can doubt that Mr. Ritchie's action is intended to get rid of the responsibility placed on him by Parliament to see that the consumers are fairly dealt with. The statement that the consumers have no remedy in damages he met by a blank denial; but I believe he has since been convinced, by the opinion of eminent Counsel forwarded to him, that he was wrongly advised on this point, and that the members of the deputation were, unfortunately, right. As regards the desire that the Vestry or its successor, the new Council, should have a Provisional Order, it is lamentable to see Mr. Ritchie adopting a course which, should it prove successful, will confer on the shareholders of a Company a gift of considerable money value, which ought to be in the hands of the ratepayers of Marylebone."

THE RATING OF RESERVOIRS.

Conference of Representatives of Local Authorities.

At the Cannon Street Hotel, last Wednesday, a conference of representatives of Local Authorities in the counties of Middlesex and Surrey was held for the purpose of discussing the best means of obtaining an alteration of the law relating to the assessment of reservoirs to the general district rate in urban districts and to the special expenses rate in rural districts. The initiative in the matter was taken by the Sunbury Urban District Council, whose Clerk (Mr. C. E. Goddard) had convened the conference by circular; and the following places were represented: Barnes, Brentford, Edmonton, Enfield, Esher and the Dittons, Hampton, Molesey (East and West), Staines, Sunbury, Twickenham, Walthamstow, and Walton-on-Thames. Delegates from the Middlesex and Surrey County Councils were also present. Mr. W. Harris, J.P., Chairman of the Sunbury District Council, presided.

The Chairman, in opening the proceedings, stated that the initiative in the matter before the delegates had been taken by Sunbury; but Hampton had borne the burden of carrying the question to the House of Lords, and judgment had gone against them. The present meeting was a continuation of the one originally held; and he believed they all felt the absolute injustice of the law as it now stood in regard to the rating question. But it was useless to sit still while an Act of Parliament stood over them which stated that the reservoirs for which they claimed the full rating were only "land covered with water." He should be glad to hear any suggestions; and he felt that it was essential that they, as representatives of the various districts, should annoy and worry somebody, if anything was to come of it. The main point was how to get the money with which to carry on the agitation. Perhaps the Local Government Board could provide funds; but if the Councils acted on their own responsibility, there were such things as surcharges, though he had no very great dread of them himself.

Mr. Goddard read a letter received from Sir F. Dixon-Hartland, Chairman of the Thames Conservancy Board, in which he said he considered the existing law a scandal. He thought, however, that, unless a number of public bodies took up the matter, and endeavoured to get some amendment, a private member was utterly helpless. He was glad the Sunbury District Council had taken steps to unite these bodies; and anything he could do to put an end to the present crying injustice, either in the House of Commons or elsewhere, he would be glad to do. Mr. Goddard also submitted a statement he had prepared, which showed the losses to Local Authorities in consequence of the rating of reservoirs at one-fourth their value. The figures were as follows: Hampton, £1862 (rateable value of the reservoirs £12,422); Barnes, £1604 (£9509); Esher and the Dittons, £782 (£5758); Sunbury, £794 (£5296); East and West Molesey, £469 (£5086). In answer to a question, he said the rateable values quoted did not include buildings and machinery.

Mr. Croysdale (Middlesex County Council) said he had been in conversation with Mr. Littler, the Chairman of the Council, and found he was in agreement with him that the law as to the rating of reservoirs should be altered. He agreed that as it now stood it was nothing less than legalized robbery. There were, no doubt, difficulties in their way. The scheme would have to be very comprehensive, and all the districts covered by water-works in the country should be asked to join them, as it was unfair for the fight to be confined to the districts of the Thames Valley. Of course, they would not include some of the towns in the North, where the water-works formed part of the corporation property. In his opinion, there was no reason why reservoirs should not be rated equally with machinery of every kind. There was the question of cost. A Private Bill, if opposed, as, of course, it would be, might land them in costs amounting to £20,000. This outlay, however, could be easily met if the whole country took up the dispute.

Mr. Allbliss (Hampton) opposed the spending of the large sum named, and said he thought a strong representation to the Local Government Board would be the best course to pursue. They demanded an alteration of the law as a right.

Alderman Burt (Surrey County Council) thought it undesirable to go

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too far afield in their operations, as it would tend to complications, and the Committee would prove unworkable. He was not alarmed at the £20,000 mentioned; but he did not consider the question one which should be dealt with by a Private Bill. He thought if £200 were subscribed, it would go a long way to meet the initial expenses; and they might induce Sir F. Dixon-Hartland to bring in a short Bill and introduce a deputation.

Mr. Greening (Esher and the Dittons) supported the suggestion of a deputation to the Local Government Board, who, he thought, were the proper people to promote the Bill.

Mr. Sanders (Hampton) said the question was not one relating to the rating of reservoirs only, as the Water Companies also claimed exemption from the full rate in respect of their filter-beds. He thought the meeting would agree with him that it was only right to ask for a fair rating of property held for commercial purposes; and he believed a deputation to the Home Secretary might have some effect.

Mr. J. H. Scott (Sunbury) said he found that, under section 211 of the Public Health Act, 1875, it was not competent to repeal any of its provisions by private action; and he might remark that the law under which they were suffering would never have passed if municipal feeling had been as active then as it is at present. He could only add to what had been said that the Water Companies made an average profit of 43 per cent.; and to have their trade warehouses assessed at a quarter their value was a public scandal. He proposed the following motion: "That, having regard to the decision of the House of Lords in the case of *The Hampton Urban District Council v. The Southwark and Vauxhall Water-Works Company*,* that a wholly artificial reservoir constructed and used by a Water Company for the storage of water is merely 'land covered by water' within section 211 of the Public Health Act, 1875, and is accordingly rateable to the general district rate in urban districts and the special expenses rate in rural districts at only one-fourth of the full rateable value, this meeting is of opinion that such a state of law is unjust and ought to be amended."

Alderman Burt suggested the following addition: "And that an Association be formed of representatives affected, or likely to be affected, by the present method of assessment of reservoirs and water-works. That the Association apply to the Secretary of State for the Home Department and the President of the Local Government Board to bring in a Bill to amend the law on the subject, and, if necessary, to authorize local authorities to expend a reasonable sum in support of the object in view. That a Committee be appointed to give effect to this resolution, with power to add to their number."

The motion, as amended, was carried unanimously; and it was decided to forward a copy to each Council, who should be requested to send one delegate each, with two each from the County Councils of Middlesex and Surrey.

The thanks of the meeting were accorded to Mr. Harris for presiding and to Mr. Goddard for his services as Clerk to the conference; and the proceedings closed.

* See "Journal," Vol. LXXIV., p. 1380; and *ante*, p. 89.

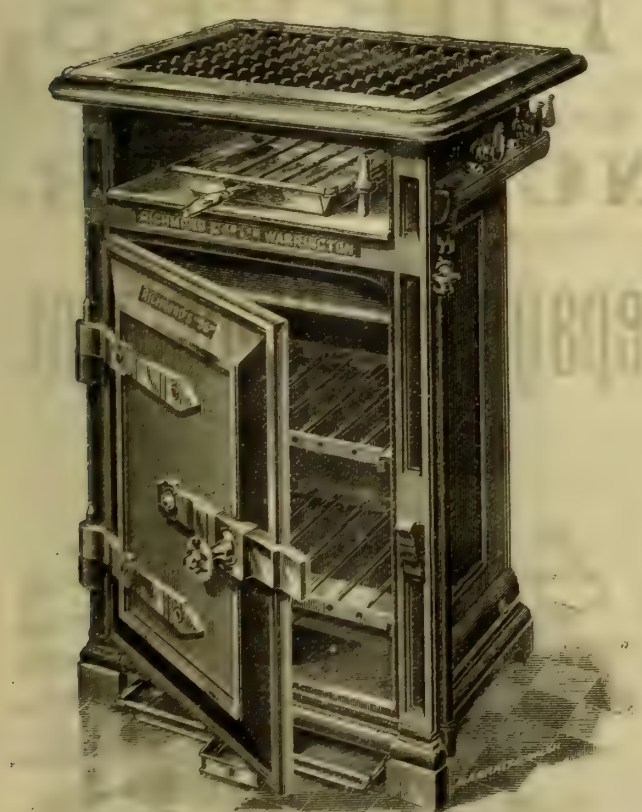
NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

At a meeting of the Dundee Town Council on Thursday, the subject of the coal contracts for the gas-works was under consideration. Ex-Provost Ballingall, Convener of the Gas Committee, said the Sub-Committee had been considering the question of the contracts, and notwithstanding the increased price of coal at present compared with that ruling last year, they had unanimously decided to recommend that 55,000 tons be purchased. At the present time, they had 12,000 tons in stock; and the purchase they proposed would bring up the stock to 67,000 tons. They had this year used 64,000 tons, which would leave 3000 tons in stock at the close of the year. The average price last year was 15s. 7d. per ton; and it was now 19s. 2d.—showing an increase of 3s. 7d. per ton. This represented a total of £9800, or something like 4d. per 1000 cubic feet of gas. They could buy a few thousand tons from time to time, as was required. They did this last year, when they only purchased 48,000 tons at the beginning of the year. Since then they had bought 12,000 tons, as opportunity offered. They lost about 1s. 6d. per ton upon last year's prices. They were finishing this year with 12,000 tons of coal in stock; and the question for them was whether they should arrange to complete next year with a large stock of dear coal. He thought it would be wise to finish with a small stock. Mr. William Longair said there was a very decided opinion that coal would be cheaper in August and September; and most of the large users were acting on this principle. He did not think they would be taking any great risk if they bought six months' supply instead of twelve. Lord Provost Hunter said he understood, from the information laid before the Committee, that exactly the reverse was expected. Mr. J. M. Nairn pointed out that some of the offerers for the contracts were persons with whom they had had trouble. He did not think that anyone who had given trouble in one department should be allowed to offer in another. He thought they should have some information as to the various qualities of the coal. Ex-Provost Ballingall said it would be very indiscreet to place the price and the analysis upon a sheet. If they did so, he had no doubt that a good many of the contractors would decline to offer. It was explained that all the contractors had completed their contracts, and that there had been no trouble with any of them. The proposal of the Committee was agreed to.

The Perth Gas Commission on Monday met to consider the matter of the appointment of a Gas Manager. Lord Provost Macgregor presided. From the terms and conditions, it appeared that the applicant must be a competent engineer, able to prepare specifications, drawings, and estimates of costs for any extension to the gas-making plant and works, and to superintend the carrying out of any extensions at the gas-works; and that he must reside in such a part of the burgh of Perth or district as the Gas Committee would approve or require, and devote the whole of his time to the discharge of the duties appertaining to the appointment, and not absent himself from the burgh without the consent of the Chairman of the Gas Committee. The salary offered is £300 per annum



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(meantime without house or other emoluments); and the appointment might be terminated at three months' notice on either side. The Corporation retain in their service as Consulting Gas Engineer Mr. Thomas Whimster, who for 44 years was Manager of the gas-works; but he will take no active part in the management, and will only advise on matters when requested by the Committee to do so, and where they might consider his long experience of special value. From a minute, it appeared that the terms and conditions had become the finding of the Gas Commission in Committee. Mr. Watson moved the adoption of the resolution come to in Committee. In doing so, he said they had got an idea of what were the qualifications, emoluments, &c., of gas engineers from eighteen different corporations; and they had decided to advertise for a gentleman both as Engineer and Manager. It was most desirable that the Manager should have his house on the works. Ex-Bailie Wright seconded. Mr. Wotherspoon moved, as an amendment, that the words "meantime without house or other emoluments" in the terms and conditions should be deleted, and held that £300 was quite a sufficient salary, and did not require any other inducements. Mr. Grieve seconded. After a long discussion, a division was taken, when 12 voted for the amendment and 10 for the motion.

The Commissioners also disposed of an item of business of equal importance—the arrangements for carrying on the works during next winter. Mr. Watson moved that an additional lift be added to the wire-rope guided gasholder at the Shore. He pointed out that Mr. Foulis and Mr. Gillespie had both been consulted, and were of opinion that it was absolutely necessary for another lift to be added to one of the holders, owing to the enormous increase of consumption during the past year. Ex-Bailie Wright seconded. He said that, in Committee, they had been told that there was a debt of £190,000 resting on the gas-works, and that because of this they should pause ere they proceeded to spend the additional sum indicated. He should like to point out that nearly £100,000 was taken up with annuities, over which the Commissioners had no power to help themselves. He also remarked that when the Town Council of Perth took over the gas-works the charge for these annuities upon each 1000 cubic feet sold was 1s. 3d. At the present time, the charge did not amount to 4d. per 1000 cubic feet, showing that by the expenditure of money they practically saved money. Last winter they had a great hue and cry about bad gas and little of it. Next winter evidently, from the remarks of Mr. Watson, unless they were prepared to do something in the direction proposed, the cry would be even louder. It had been suggested to spend £320 on additional retorts; but last winter a very much superior quality of coal had to be used at the gas-works, and there again they could have saved a great expenditure had there been more retort power. Councillor Anderson moved, as an amendment, that they delay proceeding with the erection of this lift. He was more than astonished at the spendthrift policy of some members of the Council—more especially in reference to the gas-works. They had already £191,399 of debt upon the works; and they were making application for another £50,000. They were also saddled with the debt of the annual feu-duty on the ground. He thought it was time that this extravagant policy was stopped. After criticizing the recommendation of Mr. Foulis and Mr. Gillespie, Mr. Anderson said he did not see how they could be stupid enough in Perth to adopt a proposal such as this. Mr. Wotherspoon, in seconding, said it was a notorious fact that they had spent far too much on the gas-works. On a division, 11 voted for the amendment, and 10 for the motion. The Commissioners are already advertising for a Gas Manager. They are doing their best to prevent good men from applying, by thus quarrelling among themselves. Whoever may be appointed will require to school the Commissioners for a few years, if he wishes to lead a quiet life.

"The Notkin Syndicate, Limited"—What is it? It is a Company which was registered in Edinburgh, in February last, to acquire (as the Articles of Association say) letters patent for an invention for a method of, and apparatus for, automatically and continuously carburetting air for illuminating, heating, and other purposes. Put in another way, it is a Company to work the invention of M. Bouchaud-Praceig, which was exhibited in Edinburgh a month or two ago. The invention was fancied by some people, who, I understand, began to make inquiries about it. The story is they discovered that a Russian gentleman held protection for a somewhat similar invention, of prior date; and that, before anything could be done, it was necessary to come to terms with him. A deputation went to Russia to see him. My information is that somebody else was on the road, upon the same business; but that the Edinburgh men came in first. When they unfolded their proposal to acquire his interest, the Russian was not a little surprised. His invention had not been taken up—and, in fact, his protection had only three months to run. It looked as if it were to expire, and no result to come to him, when, lo! men from the far West came to him, and asked him to sell it. If it was worth their while to come so far, there must be something in it. Accordingly, a stiff price was put on; and the Edinburgh people paid it. Then they returned home, and formed the Company. The capital is £10,000 in £1 shares. Business is being pushed; and the promoters are confident of success. It is not claimed that the system is applicable to town lighting, but that it is a most suitable light for country houses. A practical test is being made, the results of which will be announced. This is all I can say about the matter at present; but I shall probably have something to add next week.

At a meeting of the Royal Scottish Society of Arts in Edinburgh, on Monday night, a paper by the venerable Mr. T. Whimster, late Gas Engineer at Perth, on "A Method of Deriving Continuous Power from the Rise and Fall of the Tide, for Mechanical Purposes," was read by one of his sons. Mr. Whimster himself was present to answer questions. His proposal is an ingenious device whereby, by means of dams, the inflowing and outflowing tide may be made to drive machinery. The paper is remitted to a Committee to consider the merits of it. We are not concerned with the merits; but we are glad that Mr. Whimster is still vigorous of mind, as he was of yore, and is able to occupy his well-earned leisure in matters which tend to the good of the community.

Sheriff Brand, of Ayr, has issued an interlocutor in a petition at the instance of the Police Commissioners of Troon, acting as Gas Commissioners under the Acts of 1876 and 1893, for permission to erect a gas-holder and other works, to eventually cost about £15,000, and to dispense

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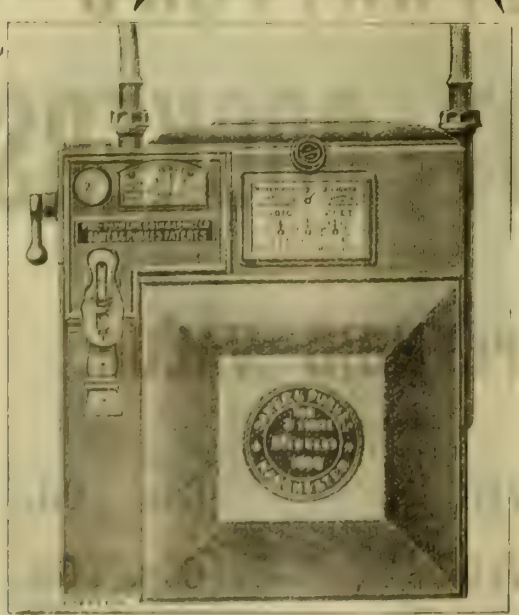
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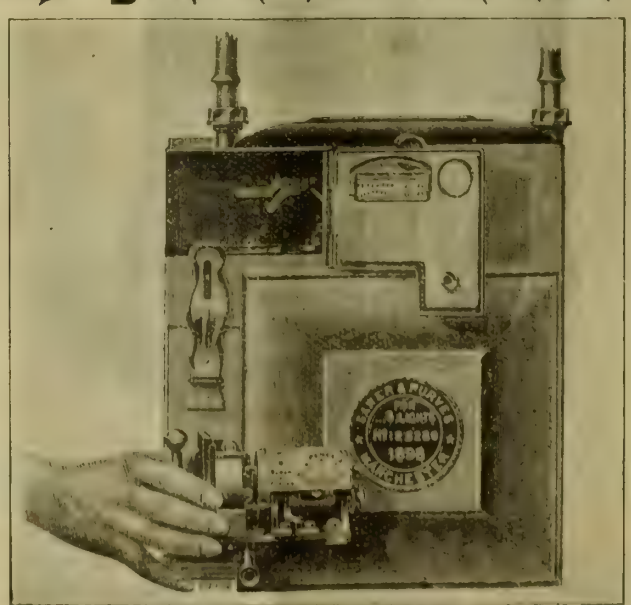
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with the consents of owners and occupiers of dwelling-houses living within 300 yards of the proposed erections. Mr. W. M'Neill was an objector; and evidence led showed that the gasholder would, when erected, be within 20 feet of his cottage. The Sheriff, in his interlocutor, dispenses with the consent of Mr. M'Neill, holds him liable in expenses to the petitioners, and gives the necessary permission to proceed with the erection.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April* 28.

Sulphate of Ammonia.—The market remains quiet; and prices at the different points are still somewhat irregular. Values have, however, been fairly well maintained; the closing quotations being £11 6s. 3d. to £11 10s. per ton f.o.b. at the ports. There has been considerable inquiry for delivery over the summer months; but buyers' ideas are for the most part too low to admit of business. Makers are holding for a premium on spot prices, while buyers are endeavouring to get in at a discount.

Nitrate of Soda is weak on spot; the quotations being 8s. 4½d. per cwt. for ordinary, and 8s. 6d. for refined, quality.

LONDON, *April* 28.

Tar Products.—There is again more inquiry for carbolic acid, which, however, is scarce in makers' hands; most of them having taken advantage to sell forward when prices ruled much higher than they are to-day. To be in parity with crystals, crude carbolic should be several pence higher than to-day's quotations. Solvent naphtha is dull; and the demand for toluol has seriously fallen off. There is no business doing in heavy naphthas; and both creosote and tar oils are in a neglected state. Anthracene is dull; naphthalene is moving off freely in its various grades. There is a strong market for pitch; and contracts for next season at slightly above to-day's price are reported.

Quotations during the week have been: Tar, 17s. 6d. to 27s. 6d. Pitch, east coast, 37s. 6d.; west coast, 34s. Benzol, 90's, 5½d.; special qualities for gas, 7½d.; 50's, 9½d. Toluol, 90's, 1s. Solvent naphtha, 1s. Crude naphtha, 3½d. Heavy naphtha, 10d. Creosote, 2½d. Heavy oils, 3¼d. Carbolic acid, 50's, 2s. 2d.; 60's, 2s. 7d. Naphthalene, 50s. to 70s. Anthracene, "A," 4d.; "B," 3d.

Sulphate of Ammonia.—Excepting that very little sulphate is offering, and that this is being taken up, there is no change of moment in this market. Dealers report business dull; but makers have none to sell—the nominal quotation being £11 7s. 6d. per ton, less 3½ per cent., at all ports.

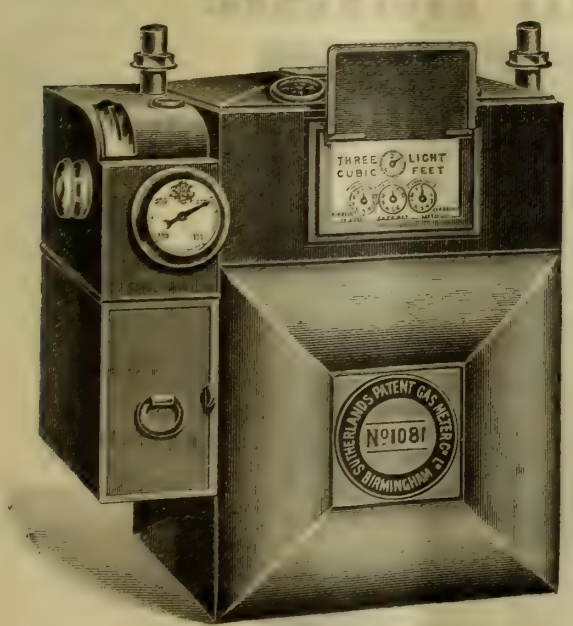
The total income of the Basingstoke Corporation Water Department for the year ending March 31 last was £3199; and the gross profit £1926. After providing for interest and repayment of loans, the net profit was £989. It has been decided to reduce the water-rate from 1s. 2d. to 1s. in the pound.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—With a continued scarcity of supplies in all descriptions of fuel, the tendency of prices necessarily is in a strong hardening direction; and during the past week there has been a further upward move. One very noticeable feature of the position is that, notwithstanding the advanced season of the year, all the leading collieries are still short of the better qualities of round coal; and not only is nothing going into stock, but coalowners have to purchase in outside districts to keep up deliveries of house-fire coal to their customers. This is a condition of trade that precludes all probability of prices easing down during the summer months. In fact, it is rumoured that some further advance is not impossible, owing to the fact that very large quantities of the better classes of round coal are being drawn away for manufacturing requirements; and the prospects for next winter are anything but satisfactory from the consumer's point of view. Collieries are absolutely denuded of stocks; and there would seem to be very little chance of these being replenished to any material extent. In the meantime, prices are exceedingly strong at the maximum quotations; and it would be difficult to buy any description of house coal under 14s. 6d. to 15s. 6d. per ton at the pit. The Lancashire collieries have now taken up a definite position with regard to the forthcoming locomotive fuel contracts, which will also govern pit prices upon all other contracts for steam and forge qualities of coal. It was stated some time back, in these reports, that an advance of 6s. per ton over the contract prices of last year for locomotive fuel was being talked of. This has now been definitely agreed to by the Lancashire Coal Sales Association; and the minimum basis for these contracts over the ensuing twelve months is to be 14s. per ton at the pit. Some small quantity has been bought at 1s. per ton below this figure; but any further contracts can only be settled at the rates fixed by the Association. This will also bring general contract prices for steam and forge coals up to about 14s. and 14s. 6d. per ton, in some instances. With regard to gas coal, the position is unchanged from what has been previously reported. One or two contracts have been put through during the past week; and on these collieries have had no difficulty in getting the full advance of 5s. per ton over last season's prices. So that this may be taken as the practically established basis for other contracts that have to come forward during the season. This will raise the basis price for gas coal to something like 13s. 6d. and 14s. to 14s. 6d. and 15s. per ton at the pit according to quality. On engine classes of fuel, there has also been a further upward move in prices; the Lancashire Coal Sales Association having decided that after the 1st of May the minimum price for slack is to be 10s. 6d. per ton at the pit, with better qualities quoted above this figure in proportion. For shipment, there is still only a limited amount of business; and here and there sellers have been taking prices under the Association basis of 16s. per ton for steam coal, delivered at the Mersey ports. This figure, however, remains the official list rate. For coke, the demand is quite as pressing as ever; and prices are very firm at the minimum of 24s. to 25s. for furnace, up to 30s. and 32s. for good foundry qualities,

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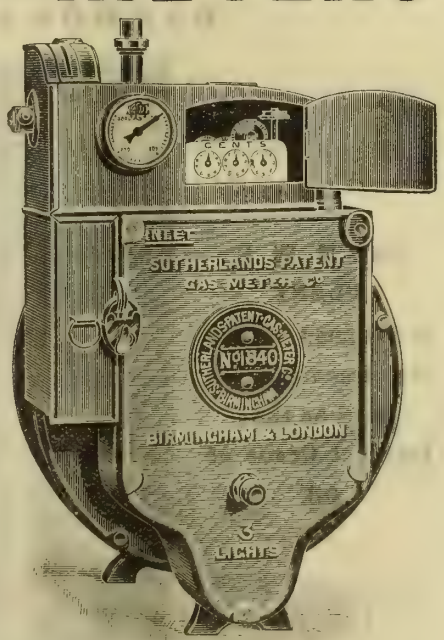
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at the ovens. Gas cokes have been further advanced by 1s. 10d. per ton, and are now quoted 18s. 6d. at the Manchester works.

Northern Coal Trade.—The coal trade is decidedly more active; and there are in some instances advances in prices. The Baltic trade usually influences the coal trade of the North-east very greatly; and this demand is now making itself felt. Best Northumbrian steam coals are 18s. 9d. to 19s. 6d. per ton f.o.b., and steam smalls are about 12s. and 12s. 6d.; the latter continuing scarce. There is little or no alteration in the price of manufacturing coals. In the gas coal trade, there is a good demand; and heavy shipments continue to be made, which are likely to be increased by the opening out of the Baltic trade. There have been some contracts entered into for the Metropolitan Gas Companies; but the prices and conditions are very irregular, and it is believed that a large portion of one contract has been given to a rival coalfield. For such contracts as have been allotted here, it is thought that the average price will be equal to about 16s. per ton f.o.b. In coke there is a good demand; and prices are very firm, both for home use and for export. In gas coke, there is a lessened production to deal with, and hence prices, if unchanged, are very firm at the last quotation we gave; about 16s. per ton f.o.b. being the medium figure. The Newcastle Gas Company have practically purchased the whole of the coal they need for the year beginning in July next, the price being about that above stated.

Scotch Coal Trade.—There is no change in the condition of trade. Outputs are moving off freely, and prices continue to be firm. The quotations are: Main 14s. to 14s. 3d. per ton f.o.b. Glasgow, ell 15s. 3d. to 16s. 6d., and splint 15s. to 15s. 3d. The shipments for the week amounted to 207,468 tons—a decrease of 3506 tons upon the preceding week, but an increase of 48,132 tons upon the corresponding week of last year. For the year to date, the total shipments have been 3,003,613 tons—an increase of 742,899 tons upon the same period of last year.

The Newcastle correspondent of "The Times," writing on Saturday, said: "It is reported that the South Metropolitan Gas Company, unable to buy Durham coals at less than 16s. to 16s. 6d. a ton, have ordered a considerable portion of their ensuing half-year's supply from Yorkshire, at about 15s."

The Newcastle correspondent of the "Colliery Guardian," writing last Thursday, said: "The contract for supplying the Crystal Palace District Gas Company with about 100,000 tons of gas coal, which has usually come to Tyneside, has been given to Midland firms. After much negotiation, the South Metropolitan Gas Company have secured acceptable tenders for a portion of their requirements from local collieries at prices which are said to range from 16s. to 16s. 6d. per ton f.o.b. Tyne. These contracts are for six months' delivery instead of twelve."

The County Council of Dublin have decided to take the necessary measures for prosecuting an appeal against the judgment of the Master of the Rolls in the action of the Alliance and Dublin Consumers' Gas Company in regard to the use of steam-rollers (*ante*, pp. 752, 815).

Liverpool Gas-Fittings Company, Limited.—The Directors, in submitting the statement of accounts for the year ended March 31 last, report that the net profit for the year is £516, which, with the £148 left after paying last year's dividend, makes £664 to the credit of profit and loss. The Directors recommend that a dividend be declared for the year at the rate of 5 per cent. (free of income-tax). This will leave £164 to be carried forward.

Bombay Gas Company, Limited.—In the report which the Directors of this Company will present at the ordinary general meeting on the 10th inst., they state that, compared with the year 1898, the revenue from the public lamps in 1899 exhibits an increase of £710 19s. 10d., and from private consumers of £3046 18s.; making, with residual products, a total increase of £4015 14s. 5d. The larger expenditure for coal carbonized is chiefly due to higher cost of material and freights. Loss by exchange, amounting to £15,088 19s. 2d., has been written off the revenue. Mr. F. W. Chamberlain has had the management of the Company's affairs in Bombay for the last eighteen months; and the Directors express their gratification at being able to report the satisfactory progress made during this period. After writing off £1158 18s. 6d. for the renewal of a gasholder, the balance of the general revenue, including the amount brought forward (£422 13s. 2d.), is £15,175 2s. 10d. Deducting the interim dividend paid in December last (£7200), and £375 added to the reserve fund, there remains £7600 2s. 10d. for distribution. The Directors recommend a dividend of 3 per cent. (making 6 per cent. for the year), carrying forward £400 2s. 10d.

Sheffield Gas Workers and the Union.—A local branch of the Gas Workers and General Labourers' Union has been formed at Sheffield, and is reported to be making vigorous progress—600 members having been enrolled previous to meetings held last Friday. The meetings had for their purpose the urging of the need of more efficient organization upon the gas-works employees. At one of the meetings, the Chairman of the new branch (Mr. James Hammond) presided; and he stated that since it was started seven weeks before, a large number of gas workers had enrolled themselves, although there were still a few who remained outside. Some time ago the workers at the three gas-stations approached the Directors with a request for an additional 6d. a shift on the wages of all employed in the carbonizing department. The Directors, however, met them in a very half-hearted way; granting an increase of 3d. to certain grades only, and regretting that they could not alter the wages of the rest of the men. The employees, however, thought that they were entitled to a general increase, and to secure their ends they must be united. Since the above concession, the general labourers had been advanced another 1s. a week for certain work, and had later been successful in obtaining a further increase. The enginemen, whose work was very responsible, had been unable to secure better wages, although, in his opinion, the Company could well afford to grant their request. The existence of the Union would give them a better chance of improving their position than they had before possessed. This looks as though, whatever other branches of labour may be doing, the Sheffield gas workers are not taking so kindly to the Union as the officials could wish.

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The Accident at the North Walsham Water-Works.—The two men who were entombed in a well at the North Walsham Water-Works (as reported last week) were rescued after twenty-four hours' incarceration. It appears that they were working in connection with the water-works, 90 feet below the surface, when the sides of the well collapsed 20 feet from the top, the soil blocking the exit from a 7-foot cylinder in which the men were engaged. After tunnelling had been tried for several hours, the men were spoken to, and supplied with milk and eggs. When rescued they were taken to an hotel, where, with careful nursing, it was expected they would soon recover.

Heysham and the Morecambe Gas Bill.—The Heysham District Council are evidently believers in full, free, and thorough discussion. For nearly five hours last Thursday night, they sat, debating whether or not they should carry their opposition to the Morecambe Gas Bill to the House of Lords. No resolution could be arrived at; and the meeting was then adjourned until the following morning, when the Council again met and resumed the discussion. After seven hours' deliberation, they decided to carry their opposition to the Upper House. The chief objection is to the Morecambe Authorities applying the profits of the gas undertaking to the relief of Morecambe rates, and altogether excluding Heysham from any benefit. Has their attention been called to the Glastonbury case?

The Helston Gas Company and the Corporation.—Considerable discussion took place at a meeting of the Helston Town Council on Thursday with reference to the right of the Gas Company to open the streets for the purpose of laying or repairing their pipes. At a recent meeting, the Council decided that the Company should be required to give three days' notice before interfering with streets, unless it was a case of emergency. Mr. A. R. Thomas moved that this resolution be rescinded, and said that when the undertaking was started in 1833 a lease was granted by the Corporation for 100 years, giving the Company ample powers unconditionally to break up the streets. These powers were never questioned until 1893. Since then correspondence had taken place between the Council and the Company; and the former had recently taken Counsel's opinion on the subject, which was that the Corporation had no power to grant a lease. Counsel's opinion, however, was not always to be depended upon. The Gas and Water Companies had conferred great benefit on the town, and any difference could be settled without attacking the Companies' title. Mr. W. Harris seconded the motion rescinding the previous resolution. Mr. H. Toy suggested that a Committee should be appointed to confer with the Gas Company. The Mayor (Mr. A. Pengelly) said the resolution was passed because of a little friction with the Water Company with reference to opening the streets. The Council thought it best to serve both Companies alike. The streets had been opened at most inopportune times by the Gas Company. Mr. A. E. Radcliffe contended that the Company had no statutory power, as the undertaking was not incorporated by Act of Parliament. As to the lease granted by the Corporation seventy years since, it was not worth the parchment on which it was written. Eventually, a Committee of five was appointed to confer with the Gas Company, to see what terms they are willing to agree to, and to report to another meeting of the Council.

Gas-Works in the Market.—It will be seen by two announcements which appear elsewhere that Mr. Alfred Richards will offer for sale next Tuesday, at the Mart, Tokenhouse Yard, E.C., the Sawston Gas-Works, situated about equi-distant from the Whittlesford and Shelford stations on the main Cambridge line of the Great Eastern Railway. They are held for a term of about 70 years unexpired, at a nominal rent of £1 per annum. On the 23rd inst. he will bring under the hammer the Crawley Gas-Works (freehold).

The Deduction of Income-Tax from Dividends.—"A Secretary" has written as follows to the "Financial News," on the subject of the rate of income-tax to be deducted from dividends: "I have received from Somerset House a reply to my letter to the Chancellor of the Exchequer, and it is clear therefrom that I am correct in my intention to deduct 10d. in the pound from dividends payable out of profits earned in the half year ending June 30, 1900. It appears, however, that this arises from the fact that my Company is a British one, and that in the cases of foreign and colonial companies the tax is deductible at the rate which is current when the dividends are payable. Foreign and colonial companies are at the moment, therefore, at a disadvantage as compared with British companies; but when the tax is reduced, the foreign and colonial companies will receive immediate relief, whereas the British companies' relief will be deferred."

Sales of Stocks and Shares.—At the Mart, Tokenhouse Yard, last Tuesday, Mr. Alfred Richards sold some ordinary stock of the Lea Bridge District Gas Company, ranking for a standard dividend of 5 per cent., subject to the sliding-scale (last dividend on similar stock 6 per cent. per annum), at £120 per £100 of stock; yielding the purchaser 5 per cent. interest. At the Mitre Hotel, Chatham, on the same day, Mr. Franklin Homan offered for sale a few fully-paid £5 shares in the Chatham, &c., Water-Works Company, which were disposed of at £14 12s. 6d. each. On the same occasion, a £50 "A" share in the Rochester Gas Company fetched £126 10s.; and two similar shares, £127 each. Six fully-paid £12 10s. "B" shares in the same Company realized £22 10s. apiece; fully-paid £3 6s. 8d. "C" shares, £6 5s. and £6 7s. 6d. each; and fully-paid £8 10s. "D" shares, £22 and £22 2s. 6d. each. The following day, at Gravesend, Messrs. Glover and Homewood disposed of several original shares in the Gravesend and Milton Gas Company, by order of Trustees, at £45 each; some new issue shares in the same Company fetching £34 apiece. At the Castle Hotel, Windsor, the same day, Messrs. Buckland and Sons sold a number of shares in the Windsor Royal Gas Company. Original (£25) shares realized £41 10s. and £41 15s. each; preference shares of £8 each, fully paid, made £11; and new shares of £20 each, fully paid, fetched £30 apiece, while some on which £8 has been called up sold for £11 each. On Thursday, Messrs. Alexander, Daniel, and Co. offered for sale by auction £15,000 of the Bristol Water Company's 7 per cent. maximum consolidated ordinary stock, in lots of £100, at the reserved price of £158 each. The highest price realized was £162; and the lowest, £160—the average being £161 0s. 0·8d. The total amount of the sale reached £24,150. Messrs. Crashe sold at Colchester last Friday some "A" and "B" shares, of £20 each, in the Colchester Gas Company, which realized prices ranging from £35 to £49 15s. per share.

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Additional Capital for the South Staffordshire Water Company.—At an extraordinary general meeting of this Company held last Thursday, the Directors were authorized to raise, by ordinary, preference, or debenture stock, the £50,000 remaining uncalled up of the £150,000 sanctioned by the Company's Act of 1893; large expenditure having lately been incurred in making provision for the extraordinary demand for water in the district.

Accident to a Large Water Main.—Last Wednesday night an extraordinary burst occurred on the Liverpool water-main at Colebrook, near Northwich. A cast-iron pipe, weighing three tons, burst to the extent of 10 feet by 2 feet. The tremendous rush of water opened a hole 15 feet deep and 14 yards long, and washed a portion of a bye-road away. Northwich water-gauge house was flooded; but no serious damage was done. Had the usual quantity of water been passing, 45 million gallons would have been lost.

Cardiff Water-Works Finances.—At a recent meeting of the Cardiff Water Committee, it was stated that the actual expenditure for the half year ending March, 1900, in connection with the Water Department was £8921, which showed a surplus of £165 on the estimated expense. This was exclusive of the loan charges during the same period, which amounted to £28,178 for principal and interest. It was reported that the Penylau reservoir and water-tower had been rated at £740; while the Corporation Engineer (Mr. C. H. Priestley) put the value at £419.

The Projected Transfer of the Spalding Water-Works.—A special meeting of the Spalding Water Company was held last Thursday, to consider the provisional contract made by the Directors for the sale of the undertaking to the Spalding District Council. There was no opposition; and the proposed transfer was approved. According to the terms arranged, the shareholders will obtain a considerable premium for their shares. The Council are promoting a Bill for the purchase of the works; and the measure is unopposed. The agreed price is £24,000.

Tipton Gas Profits and the Rates.—The Finance Committee of the Tipton District Council recently decided to recommend the levying of a general district rate of 2s. 9d. in the pound. They had, however, only reckoned upon receiving £250 from the profits of the gas undertaking as in previous years; but at a meeting of the Gas Committee yesterday week, it was found they would be able to hand over £800 from the profits. This enabled the Finance Committee last Tuesday to recommend that the rate be 2s. 7d. in the pound, the same as last year.

Water Charges at Bradford.—The Water Sub-Committee of the Bradford Corporation have been considering the question of dealing with the charges for water to large consumers; and as a result an important recommendation is to be made to the City Council. At the present time, the price of water to consumers up to 400,000 gallons is 9d. per 1000 gallons; and after the consumption of 400,000 gallons, the price has been 6½d. per 1000 gallons. The Committee have decided to raise the price of water used over 400,000 gallons to 8d. per 1000 gallons. The net cost price of water is 8¼d. per 1000 gallons.

Manchester Corporation Water Supply.—The annual report of the Manchester Corporation Water Committee states that the consumption of water still continues to increase. The annual increase in consumption from 1895 (when the supply from Thirlmere was brought into use) to 1899, a period of four years, has been on the average at the rate of about a million gallons per day. The average daily consumption for the past year has been 32½ million gallons, as compared with a consumption of 21 million gallons ten years ago, and above 2 million gallons in excess of that in 1898. About 25 million gallons of this has been supplied from Longdendale, and the remainder from Thirlmere. A considerable proportion of this increase in consumption is to be attributed to the general adoption of the water-closet system in the city and district. Having regard to this increased demand for water, the Committee are of opinion that the time is fast arriving when they will have to take action in regard to laying an additional pipe in connection with the supply from Thirlmere.

Messrs. Biggs, Wall, and Co. have received orders for the erection of their "Rapid" manual retort-charging machines from the Ilfracombe and Monte Video Gas Companies.

The Halifax Corporation have placed with Messrs. R. Dempster and Sons, Limited, of Elland, a repeat order for coal-hoppers, hydraulic and foul mains, &c., in connection with inclined retorts.

Messrs. A. C. Wells and Co. have just shipped out to St. Helena, for the Government, thirty Wells lights, which are to be used for the purpose of lighting the enclosures in which the Boer prisoners are quartered.

Messrs. Graham, Morton, and Co., Limited, are showing in the Gas Section of the Paris Exhibition, at the stand of M. Derval et Cie., furnace builders, of Paris, a large working model of a complete installation of inclined retorts.

The Leeds Corporation Gas Committee have decided to accept the tender of Messrs. Graham, Morton, and Co., Limited, for the provision of automatic coke conveying and storing plant at the Meadow Lane Gas-Works. The contract price is £5340.

Messrs. James Milne and Son, Limited, have secured the following contracts for square station meters: One of 80,000 cubic feet per hour capacity for the Coatbridge Gas Company, one of 50,000 ditto for Yeadon and Guiseley, and one of 25,000 ditto for Beverley.

At the Mart, Tokenhouse Yard, to-morrow, Mr. Alfred Richards will offer for sale, by order of the Directors, 2500 fully-paid £10 ordinary shares in the West Ham Gas Company. They will rank for a standard dividend of 7 per cent. per annum, subject to the sliding-scale; the last dividend on similar shares in the Company having been at this rate.

Last Tuesday, the Directors of the Chard Gas Company, with the Manager and Secretary (Mr. F. Turner), inspected the extensive works of Messrs. Willey and Co., of Exeter. Several of the principal citizens, including the Town Clerk (Mr. G. R. Shorts), were invited to meet them; and at the close of the visit the party were entertained at dinner by Mr. H. A. Willey, at the New London Hotel.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

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[For Illustrated Advertisement, See p. 1157.

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THE Directors of the above Company are prepared to receive APPLICATIONS from experienced and competent persons to take charge of the Gas Department of the above Railway, under the supervision of the Locomotive Superintendent.
Salary £350 per annum.
Applications, by letter, with Testimonials enclosed, endorsed "Application for Gas Engineer," to be addressed to the Secretary of the Locomotive Committee, Midland Railway, Derby, to be received by him not later than nine a.m. on Thursday, May 17, 1900.
ALEXIS L. CHARLES,
Secretary.
Derby, April 27, 1900.

SHARES wanted in C. & W. Walker, Limited, either Preference or Ordinary.
State Number for disposal, and Price required, to No. 3468, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a second-hand Washer, capable of dealing with at least 150,000 cubic feet per day.
State Price, with or without Valves, to the MANAGER, Gas-Works, FORMBY.

GAS Tar for Sale.
Apply to the SECRETARY of the Gas Company, TENTERDEN.

EXHAUSTER for Sale, 5000 feet, George Waller and Co., in good condition. Replaced by larger one.
C. W. GRIMWOOD, Sudbury, SUFFOLK.

CONDENSER (Morris & Cutler's), 21 ft. 6 in. by 6 ft. 6 in. by 3 ft. 6 in., 1 million per day. Equal to new. Exceptional Bargain, if sold promptly.
Address No. 3463, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—Two Lancashire Boilers, each 6 ft. diameter by 20 ft. long, with Mountings. Been in use only a short time. Made by the Yorkshire Engine Company, Limited, Sheffield.
Apply to NEWTON, CHAMBERS, & CO., LIMITED, Thorncliffe Iron-Works, near SHEFFIELD, where the Boilers may be seen.

FOR SALE—Four 6 feet square Purifiers, together with 6-inch Centre-Valve and Connections. To be taken out on account of being replaced by larger ones.
The Boxes and Valves are in good condition, and can be seen working at present on application to W. C. HOLMES AND CO., HUDDERSFIELD.

EXHAUSTERS, 1500 to 60,000 feet per hour, with or without Engines.
LIVESEY WASHERS, CUTLER CONDENSER, SCRUBBERS, 5 feet and 6 feet diameter, METERS, GOVERNORS, PURIFIERS (Sets of 6 feet and 10 feet square), BOILER and other TANKS, VALVES, &c.,
J. FIRTH BLAKELEY & Co., Thornhill, DEWSBURY.

FOR SALE—A Washer by Cockey. Size 10 ft. by 4 ft. 9 in. by 3 ft. 9 in., in four Compartments, with Manholes, Water-Supply Pipes, and 6-inch Gas-Connections. All in good condition. Suitable for a Gas-Works making 12 millions a Year and under.
For Particulars, apply to the MANAGER, Gas-Works, Whittington, near CHESTERFIELD.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

LONGWOOD GAS COMPANY.

TAR AND AMMONIACAL LIQUOR.

THE Directors of the above Company are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR (5° Twaddel), produced during the Twelve Months commencing July 1 next.
Tenders, endorsed "Tar and Liquor," to be sent in on or before Wednesday, May 9, addressed to the undersigned, from whom any further Particulars may be obtained.
JOHN HENRY BREARLEY,
Engineer and Secretary.

SEVENOAKS GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the Sevenoaks Gas Company invite TENDERS for the supply of 7000 to 8000 Tons of GAS COAL (Durham or Yorkshire preferred), during Twelve Months ending May 31, 1901, delivered at the Company's Siding, Bat and Ball Station, S.E. & C.R., Sevenoaks, Kent.
Tenders to be sent in by not later than Tuesday, May 8, 1900, addressed to the Chairman, William Hughes, Esq., 88, High Street, Sevenoaks.
Further Particulars, if required, may be obtained of the undersigned.
HENRY HOW,
Secretary.
Gas Office, Sevenoaks,
April 27, 1900.

MILLOM URBAN DISTRICT COUNCIL.

TO GAS-WORKS ENGINEERS AND CONTRACTORS.

THE Council invite Tenders for the Materials and Labour in providing WROUGHT-IRON FRAMING for supporting Tar-Tanks, also ROOF over the same, CORRUGATED IRON SHEETING for sides, WOOD BEAMS for Railway Metals and the RAILS for same at the Millom Gas-Works; also the supply and fixing of about 60 yards of 10-inch and 8-inch PIPES and CONNECTIONS.
Plans and Specifications may be seen at my Office.
Sealed Tenders, endorsed "Tar-Tanks Shed," must be sent to me by the 15th of May next.
The Council will not be bound to accept the lowest or any Tender.
W. T. LAWRENCE,
Clerk to the Council.
Millom, Cumberland,
April 24, 1900.

MILLOM URBAN DISTRICT COUNCIL.

TO GAS-WORKS ENGINEERS AND CONTRACTORS.

THE Council invite Tenders for the Materials and Labour in providing an ADDITIONAL LIFT by telescoping existing Single-Lift Gasholder, 60 feet diameter by 16 ft. 2 in. deep, with Cup, at the Millom Gas-Works.
Plans and Specifications can be seen at my Office.
Sealed Tenders, endorsed "Gasholder," must be sent to me by the 15th of May next.
The Council will not be bound to accept the lowest or any Tender.
W. T. LAWRENCE,
Clerk to the Council.
Millom, Cumberland,
April 24, 1900.

CORPORATION OF WALSALL.

TENDERS FOR GAS COAL.

THE Corporation of Walsall invite TENDERS for the supply of 50,000 Tons of STAVELEY, YORKSHIRE, or any other good GAS COAL, and 5000 Tons of screened GAS NUTS, to be delivered during One Year from the 1st of July next, at the Corporation Siding at the Pleck Gas-Works, Walsall, as may be required.
Forms of Tender and Specification may be obtained on application to the undersigned.
The Corporation do not bind themselves to accept any Tender; and they reserve the right to divide the Contract between several firms.
Tenders, sealed and marked outside "Tender for Gas Coal," and stating the price for large Coal and also for Nuts, are to be sent to the undersigned on or before Saturday, the 26th of May inst.
JOHN R. COOPER,
Town Clerk.
Borough Offices, Walsall,
April 28, 1900.

TO LIME MASTERS.

THE Corporation of Walsall invite TENDERS for the supply of about 850 Tons of LIME, which will be required at their Gas-Works during One Year from the 1st of July next; the deliveries to be in such monthly quantities as the Manager of the Gas-Works may from time to time direct.
The Lime is to be Hand-picked, and clear from Refuse and Ashes, and to be delivered at the Corporation Siding at the Pleck Gas-Works as required.
Payments monthly.
Tenders, sealed and marked outside "Tender for Lime," are to be sent to the undersigned on or before Saturday, the 26th of May inst.
JOHN R. COOPER,
Town Clerk.
Borough Offices, Walsall,
April 28, 1900.

WALLASEY URBAN DISTRICT COUNCIL.

TO COAL MERCHANTS AND OTHERS.

THE Wallasey Urban District Council are prepared to receive TENDERS for the supply of about 23,000 Tons of GAS COAL and CANNEL for their Gas-Works, delivered in Waggons at Duke Street Siding, Birkenhead, separately, for One, Two, or Three Years, from the 30th of June next.
Specifications and any further Information may be obtained on application to the Engineer, at the said Works, Great Float, near Birkenhead.
Sealed Tenders, addressed to the undersigned, and endorsed "Gas, &c., Committee—Tender for Coal and Cannel," to be sent per post not later than Wednesday, the 16th day of May, 1900.
The Contractor will be required to enter into a bond, with approved sureties, for the due completion of the Contract.
The Council do not bind themselves to accept the lowest or any Tender.
By order,
H. W. COOK,
Clerk to the Council.
Public Offices, Egremont, Cheshire,
April 28, 1900.

HERTFORD GASLIGHT COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of about 2000 Tons of unscreened SILKSTONE GAS COAL, delivered at the G.N.R. Gas-Works Siding, Hertford; and about 1500 Tons of SEABORNE COAL, delivered alongside Gas-Works Wharf.

Delivery to be as required over the Year ending the 30th of April, 1901.

The Directors reserve the right of dividing the Contract.

Tenders, endorsed "Coal," to be sent in before the 8th of May next.

ROB. WATSON,
Manager and Secretary.

Gas-Works, Hertford,
April 25, 1900.

SHREWSBURY GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the Shrewsbury Gaslight Company, invite TENDERS for the supply of about 15,500 Tons of screened GAS COALS, to be delivered free at the Great Western or London and North-Western Goods Yard, Shrewsbury, during the Year commencing July 1, 1900, and ending June 30, 1901.

The Directors reserve to themselves the right to divide the quantity into two or more Contracts, and do not bind themselves to accept the lowest or any Tender.

Tenders must be made on Forms (containing further Particulars), which may be obtained on application at the Company's Works, or by post, and must be sent to the undersigned, on or before the 24th day of May, 1900.

By order,
WM. BELTON, Assoc.M.Inst.C.E.,
Secretary and Manager.

Gas-Works, Shrewsbury,
April 28, 1900.

THE Llandudno Urban District Council invite TENDERS for the supply of 7000 Tons of best screened GAS COAL, capable of producing a minimum of 10,000 cubic feet of 18-Candle Gas per Ton, to be delivered, Carriage Paid, between the 1st of July next and the 30th of June, 1901, at the Llandudno Station of the London and North-Western Railway, in such quantities and at such periods as may be ordered from time to time.

Forms of Tender may be obtained on application to the undersigned; and only such Tenders as are upon the prescribed Form will be considered.

In every case where the Particulars asked for are not given, the Tender will be thrown out and not considered.

Tenders must be sent to the undersigned not later than the 11th day of May next.

The Tender of any Person or Firm who personally or through an Agent canvasses any of the Officers or Members of the Council will be rejected.

The Council do not bind themselves to accept the lowest or any Tender.

(Signed) ALFRED CONOLLY,
Clerk to the Council.

April 26, 1900.

ACCRINGTON DISTRICT GAS AND WATER BOARD.

THE Members of the Board invite TENDERS for about 600 Tons of OIL suitable for the Manufacture of Carburetted Water Gas.

The Oil to have a Flashing-Point of not less than 73° (Abel's Test).

A full description of the Oil, with a Sample, must be sent with the Tender.

The Oil must be delivered free into the Storage-Tanks of the Board at the Gas-Works, Accrington, in such quantities and at such times as the Board or the General Manager may require.

Tenders must be at a Price per Imperial Gallon.

Sealed Tenders and Samples must be addressed to the Chairman, the Accrington District Gas and Water Board, St. James' Street, Accrington.

Tenders must be in my hands on or before Wednesday, the 9th of May next.

The Members of the Board do not bind themselves to accept the lowest or any Tender.

By order of the Board,
CHAS. HARRISON,
General Manager.

General Offices, Accrington,
April 19, 1900.

COUNTY BOROUGH OF WIGAN.

TENDERS FOR STORES.

THE Gas Committee invite Tenders as follows:—

CONTRACT No. 1—CAST MAINS and CONNECTIONS.
" " 2—WROUGHT-IRON TUBES and FITTINGS.
" " 3—BRASS TUBES and FITTINGS.
" " 4—LEAD PIPE.
" " 5—BLOCK TIN.
" " 6—CHARGING & FIRING SHOVELS.
" " 7—BROOMS.
" " 8—WOOD TROUGHING & COVERING
" " 9—GALVANIZED STOVE-PIPE and CONNECTIONS.
" " 10—BAR-IRON.
" " 11—STREET-LAMPS.
" " 12—GALVANIZED IRON BUCKETS.

The Contracts will be for One Year, commencing on the 1st of April, 1900, and ending on the 31st of March, 1901.

Forms of Tender to be obtained from the undersigned.

The Committee do not bind themselves to accept the lowest or any Tender.

Tenders, sealed, and endorsed with the name of the article tendered for (a sample of which must be forwarded, addressed to the Gas Engineer), to be addressed and delivered to J. J. Charnock, Esq., Town Clerk, Town Hall, on or before Monday, the 14th of May next.

J. TIMMINS,
Engineer.

Borough Gas-Works, Wigan,
April 26, 1900.

TENDERS FOR COAL.

THE Directors of the Oxford Gaslight and Coke Company invite TENDERS for the supply of about 33,000 Tons of screened GAS COAL and NUTS, to be delivered in Trucks at the Gas Company's Siding (G.W. Railway), before June 30, 1901.

Tenders, stating description of Coal, to be sent by post, endorsed and addressed to the undersigned, not later than May 14, 1900.

JAMES ELDRIDGE,
Engineer and Manager.

BOROUGH OF DONCASTER.

TENDERS FOR COAL.

THE Gas Committee of the Borough of Doncaster are prepared to receive TENDERS for the supply of 24,000 Tons of best screened GAS COAL, during a period commencing July 1, 1900, and terminating June 30, 1901.

Particulars and Tender Forms may be obtained on application to the Chairman, or to the undersigned.

Tenders should be sent, under seal, to the Chairman, endorsed "Tender for Coal," not later than Ten a.m. on Thursday, May 10 next.

By order of the Gas Committee, who do not bind themselves to accept the lowest or any Tender.

R. BRIDGE,
Engineer.

Gas-Works, Doncaster,
April 25, 1900.

ILFORD GAS COMPANY.

TENDERS FOR COALS.

THE Directors of this Company are prepared to receive TENDERS for the supply of 7500 Tons of GAS COAL, at their Works during the ensuing Year, commencing the 1st of July, 1900.

Delivery to be made in Barges alongside the Company's Wharf at the Works, or f.o.r. Ilford Station, G.E.R., in specified monthly quantities.

The firm whose Tender is accepted will be required to enter into an agreement, under monthly penalties of £20 each, for the due performance of the contract.

The Company do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, giving Analysis and full Description of Coal, to be delivered to the Secretary not later than May 14, from whom Forms of Tender and any further Particulars may be obtained.

Gas-Works, Ilford,
April 28, 1900.

TO COLLIERY PROPRIETORS.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for GAS COAL, NUTS, and CANNEL, for delivery during Twelve Months to the 30th of June, 1901.

The quantities required will be approximately—

100,000 Tons of Gas Coal (Tenders to state whether Screened or Unscreened).
100,000 Tons of Nuts.
60,000 Tons of Cannel.

Tenders (Forms for which can be obtained on application) must be delivered to the undersigned, by post, not later than the first post on Friday, May 11.

The Directors reserve the right to take the whole or any portion of the quantity offered, and do not bind themselves to accept the lowest or any Tender.

HANBURY THOMAS,
General Manager and Secretary.

Commercial Street, Sheffield,
April 27, 1900.

COWES URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

THE Gas Committee of the above are prepared to receive TENDERS for the supply of the whole or part of 4000 Tons of best screened GAS COAL, to be delivered f.o.b. in quantities as may be required during the Year ending May 31, 1901. Four days allowed for loading at port of shipment.

Tenderers may at their option give an alternative price including delivery in Sailing Ships, not exceeding 13 ft. 6 in. extreme draft, at the Gas Department's Wharf at Cowes, or in Sailing Ships or Steam Ships at the Railway Company's Wharf at Cowes.

The Committee reserve the right to accept Tenders for the whole or any portion of the quantity offered, and do not bind themselves to accept the lowest or any Tender.

Any further Particulars may be obtained of the undersigned.

Sealed Tenders, endorsed "Tender for Coal," to be delivered at the Offices of the Department not later than the 14th day of May next.

By order,
WILLIAM HALLIDAY,
Secretary.

Gas Offices, 40, High Street,
Cowes, April 25, 1900.

BRIDGNORTH CORPORATION GAS-WORKS.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Gas Committee are prepared to receive sealed TENDERS for the supply of GAS COAL, including carriage to the Bridgnorth Railway Station, for One Year from or soon after the end of June next.

Evidence as to quality of Coal must accompany each Tender.

Quantity required: About 2500 Tons per annum in proportionate deliveries as directed—say 70 per cent. during Winter Months, and 30 per cent. during Summer Months.

Sealed and marked Tenders must be sent to the undersigned not later than Monday, the 14th of May.

The Committee reserve to themselves the right to divide the quantity into two or more Contracts, and do not bind themselves to accept the lowest or any Tender.

Official Forms of Tender are not furnished.

By order,
J. H. COOKSEY, Town Clerk,
Secretary.

Bridgnorth, April 28, 1900.

RAMSBOTTOM GAS COMPANY.

TENDERS FOR COAL.

THE Directors of this Company invite TENDERS for the supply of 6000 Tons of GAS COAL, to be delivered at their Siding, Stubbins, near Ramsbottom, as may be required during the Year ending June 30, 1901.

Further Particulars and Form of Tender on application to the undersigned.

Tenders to be sent to John Rothwell, Esq., Chairman, Gas-Works, Ramsbottom, and endorsed "Tender for Coal," not later than Saturday, May 5.

FRANK BARRETT,
Manager and Secretary.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Leek Urban District Council invite TENDERS for the supply of Best Screened GAS COAL, Washed NUTS, and CANNEL for One Year from the 1st of July, 1900, to be delivered at the Leek Station on the North Staffordshire Railway at such times and in such quantities as may be required.

Further Particulars and Forms of Tender may be obtained from the undersigned.

Sealed and endorsed Tenders, addressed to the Chairman of the Gas Committee, to be delivered at the Town Hall, Leek, not later than Saturday, the 12th of May, 1900.

By order,
C. HENSHAW,
Clerk of the Council.

Town Hall, Leek,
April 28, 1900.

BOROUGH OF BARROW-IN-FURNESS.

TENDERS FOR COAL AND CANNEL.

THE Corporation are prepared to receive TENDERS for the supply of screened GAS COAL AND CANNEL during the Year ending the 30th of June, 1901.

Form of Tender and further Particulars may be obtained from the Manager of the Gas-Works.

Tenders, addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Coal," to be delivered at the Town Clerk's Office not later than Twelve o'clock noon on Wednesday, the 23rd day of May, 1900.

The lowest or any Tender not necessarily accepted.

By order,
C. F. PRESTON,
Town Clerk.

Town Hall, Barrow-in-Furness,
April 26, 1900.

SKIPTON URBAN DISTRICT COUNCIL.

TO COLLIERY PROPRIETORS, COAL MERCHANTS, AND OTHERS.

THE Council invite Tenders for the supply of about 8500 Tons of Best Screened GAS COAL, to be delivered free at the Railway Station at Skipton, or at the Council's Siding adjoining the Gas-Works on the Leeds and Liverpool Canal, between July 1, 1900, and July 1, 1901, in monthly quantities.

No Form of Tender issued.

Further Particulars as to periods and quantities of Deliveries, &c., may be obtained from the Manager, Mr. J. H. Woodward, Gas-Works, Skipton; and Tenders, endorsed "Tender for Gas Coal," are to be sent to him on or before Saturday, May 12, 1900.

The lowest or any Tender not necessarily accepted.

RICHARD WILSON,
Clerk to the Council.

April 27, 1900.

BOROUGH OF BRIGHOUSE.

TENDERS FOR GAS COAL, CANNEL, AND LIME.

THE Gas Committee are prepared to receive TENDERS for the supply and delivery of GAS COAL and CANNEL and BUXTON LIME required at the Mill Lane and Birds Royd Gas-Works during the Year ending the 30th of June, 1901.

Specification and Form of Tender can be obtained on application at the Gas Engineer's Office, Mill Lane, Brighouse.

Sealed Tenders, stating Price per ton delivered at the Gas-Works, or alongside Gas-Works by the Calder and Hebble Canal, or at Brighouse Railway Station, must be sent in on or before Friday, May 4, 1900, addressed to the Town Clerk, Public Offices, Brighouse, and endorsed on the outside "Tender for Coal" or "Lime," as the case may be.

The lowest or any Tender not necessarily accepted.

By order,
JAMES PARKINSON,
Town Clerk.

Town Clerk's Office, Brighouse,
April 24, 1900.

CARDIFF GASLIGHT AND COKE COMPANY.

TENDERS FOR COALS.

THE Directors of the above Company are prepared to receive TENDERS for a supply of 80,000 Tons of best well screened large GAS COALS, to be delivered between the 1st of July, 1900, and the 30th of June, 1901, in monthly quantities in accordance with the Specification.

Parties tendering may do so for the whole quantity, or for quantities from 5000 Tons upwards.

Forms of Tender and Specification of monthly deliveries may be obtained on application to the Engineer and Manager, Mr. H. Morley, M.Inst.C.E.

Sealed Tenders to be sent to the undersigned not later than Ten a.m. on Thursday, the 7th day of May next, addressed to the Chairman of the Company, and endorsed "Tender for Coal."

The Directors do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right to apportion the whole quantity as they may think fit.

By order,
GEORGE CLARKE,
Secretary.

Gas Offices, Cardiff,
April 21, 1900.

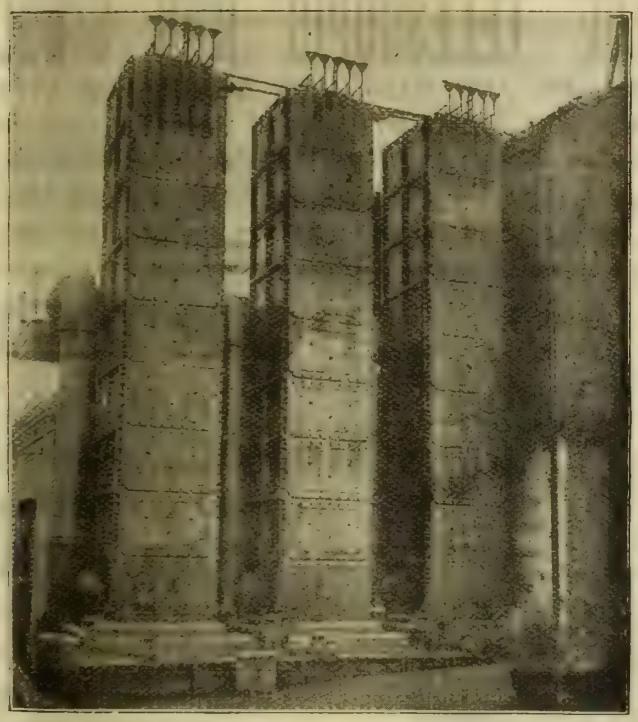
AND CHANDLER, Ltd.

PATENT "STANDARD" CONDENSER.

ECONOMY OF WATER.

SMALL GROUND AREA.

EFFICIENT CONTROL.



SLOW SPEED.

LARGE AREA FOR PASSAGE OF GAS AND WATER.

EASY ACCESS TO EVERY PART.

Photo. of Patent "Standard" Condensers erected at Coventry.

PATENT "STANDARD" CONDENSERS IN USE AND IN COURSE OF CONSTRUCTION.

3 Patent "STANDARD" CONDENSERS, Coventry.
2 Patent "STANDARD" CONDENSERS, Antwerp.
2 Patent "STANDARD" CONDENSERS, Scarborough.
2 Patent "STANDARD" CONDENSERS, Randers.
3 Patent "STANDARD" CONDENSERS, Copenhagen.
1 Patent "STANDARD" CONDENSER, Herne Bay.
1 Patent "STANDARD" CONDENSER, Cette.
1 Patent "STANDARD" CONDENSER, Barking.
1 Patent "STANDARD" CONDENSER, Pinner.
1 Patent "STANDARD" CONDENSER, Pelton Colliery.
1 Patent "STANDARD" CONDENSER, Tuborg.
1 Patent "STANDARD" CONDENSER, Elsinore.
1 Patent "STANDARD" CONDENSER, Sutton.
1 Patent "STANDARD" CONDENSER, Veile.

ADDRESS: *3 & 4, Palace Chambers, Bridge St.,*
WESTMINSTER, S.W.

DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

GASHOLDER & BOILER WORKS,

WEST BROMWICH, NEAR BIRMINGHAM

(ESTABLISHED 1765).

MANUFACTURER OF TELESCOPIC AND SINGLE GASHOLDERS,

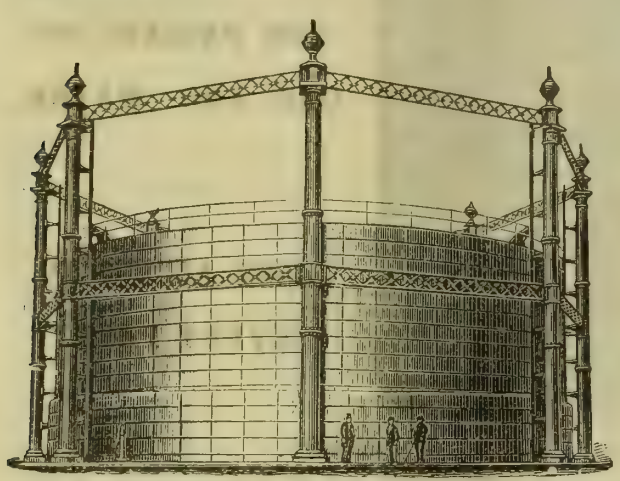
WROUGHT AND CAST IRON TANKS FOR DITTO,

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, and all kinds of GAS APPARATUS,

Wrought-Iron Roofs, Bridges, Girders, &c.,

Steam, Hot Water, and Range Boilers, Tanks, Cisterns, Boats, and all kinds of Wrought-Iron Work.

DRAWINGS, SPECIFICATIONS, AND ESTIMATES SUPPLIED ON APPLICATION.



PORTER & CO.,

GAS ENGINEERS,

MANUFACTURERS, IRONFOUNDERS, & CONTRACTORS,

GOWTS BRIDGE WORKS,

LINCOLN.

Telegraphic Address: "PORTER LINCOLN." National Telephone, No. 13.

ESTIMATES FOR GAS-WORKS OF ANY SIZE.

References to 600 Works already erected.

N.B.—All Communications to be addressed to the FIRM ONLY.

THE

DENAYROUZE LIGHT SYNDICATE, LTD.

28, VICTORIA STREET, WESTMINSTER, S.W.

The Pioneers of Incandescent Burners without Chimneys.

THE "SMALL TORCH" Burner (Bandsept Patent) for Street Lighting, consuming **3½** feet of Gas per Hour, having an efficiency of **25-Candle Power per Cubic Foot of Gas** consumed at ordinary pressure, is not only the **BEST** but **CHEAPEST** intensive **CHIMNEYLESS** Burner on the Market.

PRICE COMPLETE WITH MANTLE

4s. 9d.

All other Burners supplied by the Syndicate proportionately reduced, full Particulars of which will shortly be issued to the Trade, and followed by new and complete Catalogue.

HUMPHREYS—GLASGOW

CARBURETTED WATER-GAS PLANT

These instances are all from the LONDON designs of Messrs. HUMPHREYS & GLASGOW.

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
Copenhagen	700,000	Coventry	600,000	Lawrence, Mass.	400,000
Copenhagen (Second)	2,500,000	Coventry (Second)	600,000	Commercial Gas Co.	850,000
Belfast	1,700,000	Bordentown, N.J.	125,000	Commercial (Second)	850,000
Belfast (Second)	4,500,000	Winchester	225,000	Commercial (Third)	1,250,000
Brussels	750,000	Shanghai	225,000	Rotterdam	850,000
Brussels (Second)	750,000	Stockport	600,000	Dorking	150,000
Liverpool	3,500,000	Norwich	1,000,000	McKeesport, Pa.	500,000
Liverpool (Second)	4,500,000	Holyoke, Mass.	600,000	G.L.&C.Co., Bromley	3,750,000
Tottenham	750,000	St. Joseph, Mo.	750,000	G.L.&C.Co., Nine Elms.	2,750,000
Tottenham (Second)	750,000	Lea Bridge	350,000	Durham	200,000
Santiago de Cuba	400,000	Lea Bridge (Second)	350,000	New York	4,000,000
Swansea	750,000	Stockton-on-Tees	500,000	Scarborough	800,000
Manchester	3,500,000	Edinburgh	2,000,000	Perth, W.A.	125,000
Brighton	1,750,000	Guildford	350,000	Bremen	550,000
Preston	1,400,000	Brentford	1,200,000	Maidenhead	225,000
New York	1,200,000	Syracuse, N.Y.	850,000	Epsom	225,000
Southport	750,000	Bridlington	150,000	North Middlesex	150,000
Bath	1,000,000	Middlesbrough	1,250,000	Wandsworth	1,800,000
Newburg, N.Y.	350,000	Croydon	1,250,000	Aarhus	800,000
Newburg (Second)	250,000	L. & N.W. Ry., Crewe	700,000	Falmouth	150,000
Hoylake	125,000	Taunton	225,000	Southampton	800,000

SINCE JANUARY 1ST, 1899.

Hartlepool	750,000	Antwerp	1,500,000	Hull	1,500,000
Utrecht	1,000,000	Brussels	1,000,000	Longton	600,000
Deventer	150,000	Brighton (Second)	1,850,000	Staines	600,000
Portsmouth	1,000,000	Stockport (Second)	600,000	Commercial (Fourth)	2,000,000
Bournemouth	1,000,000	Croydon (Second)	625,000	Dublin (Second)	2,000,000
Aylesbury	150,000	Maidenhead (Second)	225,000	Faversham	200,000
Hamburg	1,750,000	G.L.&C.Co., Beckton	2,250,000	Birmingham (Swan V'ge)	1,500,000
Redhill	275,000	G.L.&C.Co., Fulham	1,750,000	St. Gallen (Switz.)	225,000
Dublin	2,000,000	Tottenham (Third)	350,000	Colney Hatch	400,000
Posen	450,000	Sydney (Harbour)	500,000	Southampton (Second)	500,000
Dunedin (N.Z.)	150,000	Sydney (Mortlake)	500,000	Tunbridge Wells	1,000,000
Lincoln	500,000	Manchester (Second)	3,500,000	Liège	1,000,000

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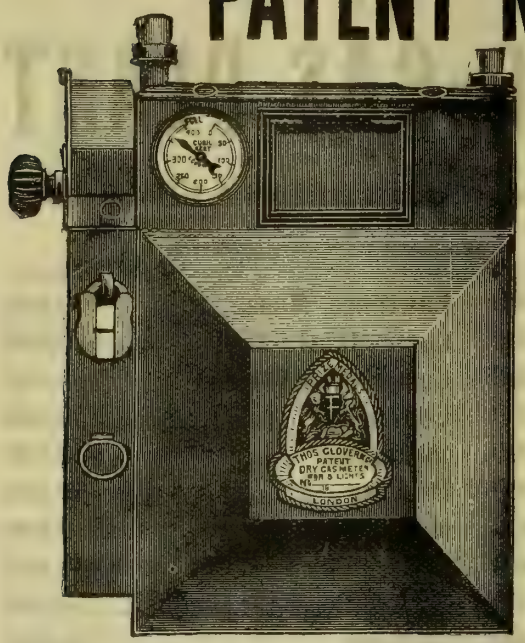
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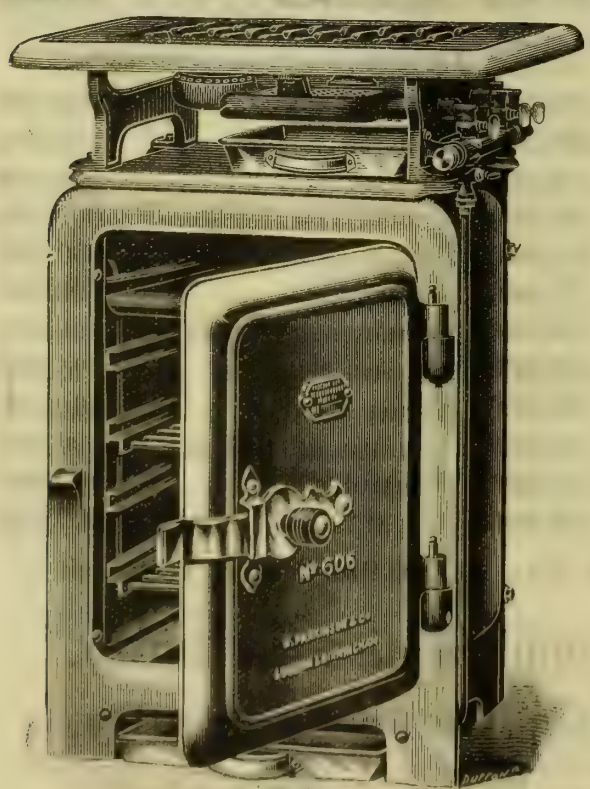
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CONTENTS.

EDITORIAL NOTES:—

	PAGE.
GAS, LIGHTING, &c.—	
Meeting of the Institution of Gas Engineers	1181
In Committee on the London Gas Companies Bill	1182
The Question of the Price of Coal	1183
Settlement of the Bradford Bill	1183
The Affairs of the Imperial Continental Gas Association	1184
INSTITUTION OF GAS ENGINEERS:—	
GENERAL MEETING IN LONDON—	
Review of Proceedings	1184
The Proceedings Summarized	1186
General Report—	
Annual Report and Accounts	1190
Additions to the Roll; The New President; Thanks to the Past-President; President's Address; The Proposed Amalgamation	1191
Reading of Papers; Appointment of Scrutineers; The Autumn Meeting and the Paris Conference	1193
Votes of Thanks	1194
Water Gas and its Recent Continental Developments. Lecture by Vivian B. Lewes, F.I.C., F.C.S.	1194
Papers and Discussions—	
The Enrichment of Coal Gas. By George Livesey	1200
The Calorific Power of Illuminating Gas. By Harold G. Colman	1204
ESSAYS, COMMENTARIES, AND REVIEWS:—	
Gas and Water Companies in the Stock Market	1210
Electric Lighting Memoranda	1210
Arbitration in Trade Disputes	1211
TECHNICAL RECORD:—	
Ohio Gaslight Association	1213
Examinations in Gas Manufacture	1214
Vitrified-Clay Pipes for Gas and Water Mains	1215
REGISTER OF PATENTS:—	
Separating and Extracting Gases from a Gaseous Mixture, Purifying, Exhausting, and Compressing Gas, and Increasing its Illuminating Power—Mazza, E. N.	1216
Regenerative Coke-Ovens on the Everett System—Schniewind, F. W. C.	1217
CORRESPONDENCE:—	
Gas Institute Visit to Paris	1217
Patent Law Reforms	1217
Directors *v.* Auditors	1217
Local Authorities and the Price of Gas	1218
PARLIAMENTARY INTELLIGENCE:—	
Gleanings from the Committee Rooms	1218
House of Lords—Progress of Bills	1219
House of Commons—Progress of Bills	1219
House of Commons Committees—The Gaslight and Coke, Commercial Gas, and South Metropolitan Gas Companies Bill	1219
House of Commons Committee on Police and Sanitary Regulations Bills—Bradford Corporation Bill	1234
LEGAL INTELLIGENCE:—	
South-Western Police Court—London County Council *v.* Wandsworth and Putney Gas Company	1235
The London Electric Supply Corporation Fined	1235
The Charge for Water for Street-Cleansing Purposes	1235
MISCELLANEOUS:—	
Meeting of the Imperial Continental Gas Association	1235
Meeting of the Buenos Ayres (New) Gas Company, Limited	1236
Meeting of the Southampton Gas Company	1237
The Proposed Royal Commission on Coal—Unworked Stores of the Mineral	1237
The Examinations in Gas Manufacture—The Papers at the City and Guilds of London Institute; The Polytechnic Examinations	1238
Manchester Corporation Gas, Electricity, and Water Supply—The Estimates for the Ensuing Year	1238
Stalybridge Corporation Gas Supply—Mr. Carr's Salary Increased	1239
Lincoln Corporation Gas and Water Supplies—The Annual Reports	1239
Stockton Gas-Works Accounts	1240
West Bromwich Corporation Gas Supply—Probable Increased Charges	1240
Rotherham Corporation Gas Supply	1240
Gas and Water Companies' Stock and Share List	1240
The Work of the Public Health Department of the Corporation of London in the Past Year	1241
Electric Lighting Notes	1242
Notes from Scotland	1243
Current Sales of Gas Products	1244
Coal Trade Reports	1244
PARAGRAPHS:—	
PERSONAL: Mr. Hugh M'Nair; Mr. G. B. Smedley; Mr. T. R. Murray; Sir F. Abel; Sir F. Bramwell; Dr. Ludwig Mond; Mr. A. Siemens; Sir William Crookes; Mr. F. Ward Holland; Mr. R. O. Wynne-Roberts; Mr. Walter Grafton, F.I.C., F.C.S.; Mr. Herbert Bullivant; Mr. Thomas Wilson; Mr. A. E. Broadberry; Mr. James Brooks; Mr. B. W. Smith	1212
OBITUARY: Mr. A. T. Squarey; Mr. J. T. Tall; Sir Francis Marindin, K.C.M.G.	1213
American Coal for Russia—The Consumption of Gas in Paris during the Exhibitions	1184
Gas-Engines for Electric Traction—The Price of Coal—The Gas Section of the Paris Exhibition	1211
Dispute at the Newport (Mon.) Gas-Works—Gas Profits at Wigan	1219
Gas Profits at Rochdale	1237
Sales of Stock and Shares—A Cumberland Water Scheme—Sale of the Old Hull Gas-Works—Georgetown (British Guiana) Gas Company—Fatality at the Beckton Gas-Works	1245
Lambeth Water-Works Company—Brixham Water Supply—Okehampton Water Supply—Suggested Purchase of the Aldershot Gas and Water Works by the District Council—Slough Gas Company—The Dorking Local Authorities and the Water Company's Bill—Progress of the Birmingham Water Scheme	1246

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

EDITORIAL NOTES.

The Meeting of the Institution of Gas Engineers.

THE meeting of the Institution of Gas Engineers last week, under the presidency of Mr. J. W. Helps, of Croydon, was of average interest, so far as the programme of business went; but the attendance suffered from the untoward clashing of the meeting with the continuation of the sittings of the Committees on the two biggest gas schemes of the year. The major interest for the gas engineering profession lay in the rooms where the future of the Gas Companies of London and of the suburbs of Bradford was being decided; and, as a consequence, the Institution came off second in their regard. This was a great pity; for the President and the Council of the Institution deserved a better fate. Both for his Inaugural Address and his conduct of the business of the meeting—including the delicate task of bringing before the members the scheme for their own translation into another "company"—Mr. Helps well earned the thanks of his colleagues; and it must have been a disappointment to him in particular to miss so many of those upon whom his predecessors in office had been able to rely for imparting vivacity and weight to the technical discussions of the Institution meetings. However, all those who could attend did so, if only for brief periods; and everybody loyally supported the chair to the best of his ability and opportunities. We deal at considerable length with the President's address elsewhere; suffice it therefore to remark here that it was of a quality to enhance Mr. Helps's already high reputation. His gifts as a ready and pleasant speaker also shone conspicuously. Certainly, Mr. Helps is a force to be reckoned upon in the ranks of the younger—in the sense of still rising—members of the British gas engineering profession.

The papers read at the meeting were, on the whole, of fair, if not remarkably good, quality. Outside the Institution, however, professional attention will be attracted to the proceedings of this year chiefly on account of their bearing upon the all-important question of the possibility of restoring national unity of organization. Here it must be admitted that the meeting took the new scheme very quietly. Out of respect for the President and the Sub-Committee of the Council, who had met the deputation from the kindred Society on the matter, the proposed draft of the new rules was accepted in principle. There was no enthusiasm on the subject, as indeed was not to be expected. No company of men could be enthusiastic over the acceptance of a course of action which practically destroys their independent corporate existence. We have hitherto systematically refrained from offering any opinion as to the merits of the re-arrangement provisionally agreed upon by the representatives of the two Societies who now divide between them the personality of the gas engineering profession and the calling of gas management of the three kingdoms. Now that one of these bodies has formally given its adhesion to the scheme, at the price of surrendering its individuality, the opportunity seems a fitting one for commending this good example to the other party to the possible union, which, being more numerous, may be supposed to contain a greater variety of opinions and sentiments.

It has been truly said that the members of the Gas Institute are called upon to consent to more and greater alterations of their existing order, for the single sake of unity, than are their professional brethren of the Institution. At the same time, the members of the Gas Institute should not forget that, in consenting to abandon their own organization, the members of the Institution are indeed making the greatest of all possible sacrifices. Not to labour the point, which is better left to feeling than exactly defined, the members of the Gas Institute should take the decision of the men who once left them, or who never were with them, as a great and sincere compliment to their President and Council, who have already worked so well in the cause of unity. The most debateable questions remaining for the Institute to take into consideration are the name of the new organization, the constitution or membership, and the amount of the subscription. The question of finance is very simple. We have hesitated to say anything about it, feeling that this is a matter entirely for the members. If it pleases the membership of a club to fix the entrance fee and annual subscription high or low, that is their affair. Nevertheless, a technical organization professing to represent a whole industry differs radically from a club, and in nothing more than the ideas regulating the admission of members and the finances.

Honestly, our preference would be for the lowest possible scale of charges to members of all classes that would clear necessary expenses, which should also be cut down to the lowest working amount. Not that the remuneration of the secretariat should be stinted—quite the contrary, indeed, in the interest of efficiency. But membership should be made as little burdensome as possible on those who have most need of its advantages.

It should be clearly understood, moreover, that membership carries no adventitious advantages whatever—no certificate of competency, no claim upon municipal or other public forms of hospitality, or anything beyond itself. The harm that has been done by the "Entertainment Committee" nuisance is pretty well understood by this time; and it must never be repeated. A self-respecting man should be as ashamed to pass round the hat for his society as he would be to beg on his own account. Men will feast and make merry when they meet old friends; and long may the race of gas men have the heart to enjoy life—but not at other people's expense. All the legitimate advantages of association are surely attainable at a strictly moderate expense. So far as the existing membership of the Gas Institute is concerned, it would be an unwarrantable demand that a single eligible individual should be called upon to pay more than he does now, or to occupy a different class, merely in the supposed interest of unity. Why should he? For the future, it might be otherwise.

It is to be trusted that the question of altering the constitution of the organization by leaving out a whole order of members and associates who were made welcome in 1881 will be settled without undue regard to any awkwardnesses of handling, such as might very naturally ruffle susceptibilities. This is a very delicate and difficult business, in the conduct of which it is easy enough to trip; and we understand that a good deal of "feeling" has been created by clumsy treatment of some wholly unnecessary negotiations supposed to have been needed to clear the way to amalgamation of the Societies. If this is the case, those who perpetrated the blunder will, in due course, discover and feel their error; but it would be a greater mistake to jeopardize the whole scheme on account of some person's foolishness or thoughtlessness. The problem of drafting proper qualifications is doubtless a troublesome one to settle to everybody's satisfaction; but it should not be impossible to find a form of words that will satisfy the majority. Then it would be much better to invite applications for registry from those who can claim to be eligible, than to require others to sign themselves off. There is a right and courteous as well as a wrong and stupid way of doing these things.

Finally, with regard to the name of the new organization, nothing that is merely verbal should be permitted to stand in the way of an agreed union. We have already stated what there is to be said in favour of the title which refers to the original of all such societies. There can be nothing crisper than the present name of the older body; but if the proposed organization is to be a sectional and not a comprehensive one, some alteration of the name will become expedient. It is difficult to suggest better names than those now in use; but a different title from either of the old ones seems to be called for. The philologically-minded among our readers had better turn the subject over in their thoughts between now and next month, and send us the fruits of their cogitations. One can always decide such a matter easier for seeing the suggestion in print.

In Committee on the London Gas Companies Bill.

The Committee of which Mr. Oldroyd is Chairman resumed on Tuesday last the hearing of the promoters' case in regard to the London Gas Companies Bill. The proceedings were continued for three whole days; thus finishing the evidence in support of the proposal to legalize the portable photometer for penalty testing of the Metropolitan Gas Supply, and developing the main lines of the Companies' defence. Although the Bill does not discriminate between the three Companies to whom it would apply, and therefore the threatened undertakings have a common cause to unite their forces in opposition to it, they are acting independently on the defensive. This is probably the best way for all and sundry, inasmuch as it leaves to the many keen minds engaged in opposing the Bill complete freedom of action, while every independent success damages the common enemy. On the resumption of the proceedings, Dr. Clowes was recalled, with the object of further strengthening the case sought to be made out for the need and the merit of portable photometer testing. He was followed by Mr. Thomas Fairley, the Leeds Gas Examiner, whose evidence went to establish the identity of indications given at a Board School trial of two portable photometers. Next came Mr. C. R. Bellamy, the Liverpool Gas Examiner, whose testimony to the value and acceptability to all parties of portable photometer testing was looked forward to with much interest, by reason of the alleged fact that in Liverpool a system of this character has long been practised with the consent of the Gas Company. Mr. Bellamy duly gave out his opinion that photometric tests of gas at fixed places and times are not sufficient protection for the consumer. This, of course, is one of the main contentions which the London County Council are now endeavouring to establish. Then Mr. Bellamy was led to explain the Liverpool system; but when the story was told, it bore a very different moral to that which the general statement that the Liverpool Gas Company had accepted the portable photometer had held out to general expectation. It was confessed that the arrangement was a purely voluntary one, entered into in 1894 between the Company and the Corporation, by virtue of which the Company are relieved from all statutory or penalty testing—to which they are liable under their Act of the year 1865—and, in substitution therefor, they consent "that the Gas Examiner of "the Corporation may from time to time send to the Gas "Company a record of the result of tests made by him by "means of a portable photometer, and that if those tests "show that the gas at the time and place of testing was "under the standard power or purity, then the Directors "undertake to thoroughly investigate the matter, and use "every endeavour—if they find reason to think that the "tests are correct—to remedy the defect for the future!" Besides, it also came out that, as a matter of fact, the so-called peripatetic testings are so only in name; it having become the practice to confine the operations to about six particular places found by experience to be suitable—informal testing-stations, in effect. Mr. Bellamy's evidence was certainly a flattering testimonial to the Liverpool Gas Company.

This completed the promoters' evidence. The Gaslight and Coke Company's case was immediately opened by Mr. Pope, who deferred his speech until his witnesses had been heard. Mr. G. C. Trewby was first called; and his calm, straightforward account of the way in which the huge output of the Company is produced and distributed, made the scarcely-veiled insinuation of the County Council—that one quality of gas is sent to the fixed testing-stations while another is supplied to the public—shrink into its proper scale and place. As to the insufficiency of the existing system and arrangement of testing at the stations, Mr. Trewby explained once more that the Gas Referees are empowered to require as many stations to be provided (at the expense of the Companies) as they please, where they please, and to keep them going every hour of the twenty-four if they please. Out of 21,259 such tests made of Chartered gas during the last five years, only two bad ones were proved against the Company. Mr. Trewby described the practical requirements for a satisfactory testing-station; and as he did so, the fancy of the County Council that a room picked out hap-hazard at any Board School would answer the purpose, faded away. When the witness came to the portentous catalogue of low portable photometer readings put in by the promoters, they wilted under his dispassionate handling. Low readings at Board Schools? Certainly—what else could you expect? The conditions are utterly inimical to reliable testing, and the results are consequently out of accord with those that are obtained at the proper testing-stations, where every care is taken to ensure accurate work. Who says that the Gas Referees prescribe anything unnecessary or insignificant in the equipment and service of the stations? Mr. Worsley Taylor cross-examined Mr. Trewby with great pertinacity, chiefly with the object of getting him to admit that his objections to portable photometer testing as proposed in the Bill would be removed if the Gas Referees were entrusted with the prescription of the class of places to be used for the purpose. Counsel failed to shake the witness's evidence-in-chief on this point. Instead, he succeeded in bringing out some new and striking observations as to the effect of the temperature of the room on photometrical experiments. Against Mr. Trewby's massive resistance, all the gimcrack assumptions and presumptions advanced by Counsel could make no headway. It began to emerge at

this stage of the inquiry that the establishment of testing stations at the gas-works would be an effectual further check, if such is needed, on the quality of the output.

On Wednesday, Mr. Corbet Woodall was called, and gave the Gas Companies' view of the nature of the parliamentary obligation under which they are to supply gas of the statutory illuminating power. He also complained of the offensive suggestion contained in the "detective" clause of the Bill, and condemned the whole scheme of the measure as flippant, crude, and unsatisfactory to the last degree. Mr. Worsley Taylor, in cross-examination, led Mr. Woodall over much the same line of country as he had taken to with Mr. Trewby on the previous day, with the same general result. Only that the "flippancy" of which the witness had accused the framers of the Bill seemed, as he went on, to infect Counsel, who led his own plea for portable testing to the *reductio ad absurdum* of the possible prescription by the Referees of a "pantechnicon "van" for the purpose. Mr. Greville Williams followed with some pertinent observations as to the determination of the illuminating power of gas being an operation of great delicacy. He illustrated and supported Mr. Trewby's point about the temperature—not as affecting the bulk of the gas, but the photometrical apparatus. He also disputed the assumption that any possible irregularity of the portable photometer might be corrected by making some predetermined allowance.

Then Mr. W. C. Young, the well-known professional Gas Examiner, gave evidence bearing upon the difficulty of securing concordant readings of portable photometers; and he was succeeded in the chair by Professor V. B. Lewes, who had originally attended the inquiry in his capacity of Chief Gas Examiner for the Corporation of London. The Corporation having withdrawn, Professor Lewes was served with a Speaker's Warrant to give his evidence at the instance of the Gaslight and Coke Company. Professor James Dewar completed the indictment of the scheme of peripatetic testing; and this strong expert evidence finished the case of the Gaslight and Coke Company. Indeed, after Mr. Pope had briefly addressed the Committee, the Chairman announced that they did not want any more scientific evidence on the subject of the portable photometer, but would prefer the evidence offered on behalf of the other Companies to be limited to their special objections to the Bill. Mr. Livesey then expounded, with his accustomed force and point, the position of the South Metropolitan Gas Company in regard to the Bill, and what had transpired during the inquiry. The temptation to comment upon this evidence is great; but it must be resisted.

[Yesterday afternoon the Committee on the Bill declared the preamble of Part 2 of the Bill—that relating to the proposed legalization of the testing of gas by the portable photometer—not proved. The Bill of the Gas Light and Coke Company will be taken by the same Committee to-morrow.]

The Question of the Price of Coal.

Mr. Helps, in his address to the Institution of Gas Engineers last week, naturally referred to the question which is of paramount interest and importance to the gas industry at the present moment—namely, the price of coal, the extraordinary rise in which was due, he said, to causes that, in his judgment, have never been satisfactorily explained. Such, we have observed, is the attitude of mind to be found among coal consumers in general, and certainly among gas managers in particular. All are willing to grant that the flourishing state of trade, the activity in the iron and steel markets, and the foreign demand for coal, are conditions tending naturally to a rise in the price of fuel; but no one can explain (so we hear on every hand) why the rise should be so enormous as, in the case of gas coal, to amount to something like 80 per cent. over last year's rates. There has been no falling off in output—1899 was, far and away, the record year for coal raising; and there has been no question of the demand vastly and patently exceeding the supply, though it is admitted that the supply has not been fully equal to the demand. Why, then, it is asked, should a moderate excess of requirement over output so immoderately increase the price?

The explanation lies, we venture to think, in a fact which is obvious, but is often forgotten—namely, that the purposes for which the bulk of the coal raised in this and every other country is employed, are such that the obtaining of adequate supplies of coal is so vital to the prosecution of the business of the user that, if there be any serious doubt as to the quantity available in the market "going round," the industrial consumer will, temporarily at least, pay any price rather than run the risk of being the one to go short. The first instinct—in the case of Gas Companies with statutory obligations to fulfil, the first duty—is to ensure supplies; cheaply if may be, dearly if must. The question of reducing the volume of business, or of shutting down entirely, is naturally the last to be considered; and, indeed, so far as the gas industry is concerned, it is beyond the control of the direct user. Railway companies, iron and steel works, steamship owners, the Admiralty, gas and electric lighting companies, take nearly one-half of the output between them. Which of these can possibly afford to wait for cheaper times, if their stores be empty and coalowners unanimously ask high prices?

That is wherein coal differs so widely in its economics from other commodities. If cigars be dear, the smoker can immediately cut down his allowance; if food go up in price, it is possible for most people—and would be well for some—to live more simply; if clothes be more expensive, the silk hat has to do duty a month or two longer. But the consumption of coal cannot be so readily adjusted to the state of the market. The restrictive tendency of high prices is slower in taking effect. One result of dear coal is, indeed, to send people to the Gas Company for a heating stove! The fact that gas is a product of coal does not always occur to the average householder; and even when the price of gas is raised, he does not really notice it until the first winter quarter's bill comes in. Then, and not before, comes the more careful consumption, and the check to gas business; so that we should not be surprised to hear of very good outputs from gas-works this side of next Christmas, if the winter be at all severe.

It is, then, the absolute necessity of immediate and constant supplies to the industrial consumer of coal, and the complete absence of stocks in the hands of either buyer or seller—a state of things inevitably resulting sooner or later from even a small excess of demand over production—that have combined to place the market at the mercy of the coalowners. In such a state of a market governed by the conditions peculiar to the coal trade, the only limit to the price demandable is the cohesive strength of the producers and the fear of competition from abroad. The price of coal this spring has, it must be admitted, been carried well up to that limit. Whether this has been wise policy on the part of the coalowners is another question. Our present point is that there is nothing mysterious about their having been able to pursue it. It is some consolation to know that riding such an advantage at top speed is certain to bring a more rapid and complete reaction than would have followed from a reasonable treatment of consumers. But it is difficult beyond measure for producers to combine to be reasonable. Each thinks only of lining his nest while feathers are plentiful.

Settlement of the Bradford Bill.

The Bradford Corporation Bill was in Committee again last week, when the promoters had to report progress in regard to the suggestion thrown out by the Chairman, before the recess, that the Corporation and the Gas Companies whom they proposed to forcibly expropriate should try to come to terms. Unfortunately, the only possible report was that matters had come to a deadlock, with the sole exception of the case of the North Bierley Company, who had agreed to sell. The Airedale and Eccleshill Companies stood out for certain terms which they said they understood the Corporation had been willing to give, but of which, when it came to the point, the Corporation denied all knowledge. Thereupon, in accordance with the hint given before Easter, the Committee declined to entertain the proposal for compulsory purchase of the undertakings against the desire of the Companies. On the question of principle, the decision is to be warmly applauded. It is one of the most valuable precedents on the point that has ever been given by a Parliamentary Committee. As regards the particular interests of the objecting Companies, it is probable that they are sorry they overstood their market. It is too late now. There is every reason to believe that the terms which the Corporation of Bradford were prepared to offer to the Gas Companies were better than they may feel disposed to give again, if only for the sake of rounding off their tedious and expensive extension scheme. We have been accused

locally of putting the claims of these Companies to generous treatment on too high a level. We have never ventured to price the property, however, and can say, once and for all, that we should have been disposed to esteem fair and reasonable any firm offer which the able advisers of the Corporation in this business might have found themselves in a position to support in the circumstances. As it is, the Companies are to be pitied in one sense, although all other Gas Companies must rejoice that through them the principle of the sacredness of private property has been defended. We would not be misunderstood on this point. Of course, private gas and any other description of real property is subject to the power of Parliament to order a compulsory purchase by the public body in the public interest. But this is a very different matter from the idea that a trading Municipality, with reference to its trade interest, should have greater privileges than anybody else in trade for compulsorily acquiring a coveted concern. It is to this idea that Lord E. Fitzmaurice's Committee have entertained so strong an objection; and for their decided action in discountenancing it, all Gas Companies will be sincerely thankful.

The Affairs of the Imperial Continental Gas Association.

THE business at the half-yearly meeting of the Imperial Continental Gas Association last Tuesday consisted practically entirely of the interesting comments of the Chairman, Mr. T. H. G. Newton, on the full report on the affairs of the Association presented by the Board, and given in another column. It may therefore be assumed that, though the effects of the troublous times through which the undertaking has lately passed are clearly seen from the Directors' statement, they are not regarded by the proprietors as being of such a nature as to call for criticism of the management. And, in point of fact, such criticism would be unfair, as, owing to the ability with which the business has been conducted, the loss sustained by the Association through the acquisition of the Amsterdam station by the City and the establishment of municipal gas-works by Vienna has been compensated for by an increased production of gas at the other stations to the extent of an average of 7·83 per cent. Of course, the Chairman had much to say on the coal question, which is a serious one enough for Gas Companies in this country, who have the power of raising their charges to meet the extra outlay for their raw material, but is a far more important matter for those abroad, who work under the concession system. With a hard-and-fast price fixed at not too high a figure when coal is cheap, a company may have the pleasure of contemplating the absorption of all their profit when coal is dear. Mr. Newton brought this point home to the shareholders by stating that a rise of 6s. per ton net would be equivalant to the Association paying £120,000 more for coal in a half year, and that, as a consequence, the profits would be reduced by this amount. But he reassured them by reminding them of the existence of the Association's equalization of dividend fund, amounting to nearly a year's dividend at the rate of 10 per cent. Though dear coal may necessitate a temporary dip into this fund, Mr. Newton looks forward confidently to the time when, the prevalent famine over, the stations still in the hands of the Association will, without strain, be equal to the provision of the customary dividend.

American Coal for Russia.—According to a Reuter telegram despatched from Philadelphia on the 3rd inst., and published in the "Financial News" on Friday, the steamship *Accomac* will shortly carry 3500 tons of anthracite coal to Kronstadt; being the first consignment of a large quantity destined for the Russian Baltic ports. So far as can be recalled, this is, says the telegram, the first shipment of anthracite sent to Russia.

The Consumption of Gas in Paris during the Exhibitions.—In the year of the first Exhibition in Paris (1855) the annual consumption of gas in the city was about 1440 million cubic feet, of which the Exhibition and public buildings only used a very small portion. In 1867, however, the annual outsend was 4820 million cubic feet, of which no less a quantity than 503 million cubic feet was burnt at the Exhibition for illumination. In 1878 the consumption was regarded as fabulous—732 million cubic feet out of the annual total of 7484 millions. In 1889 the total bulk of gas sent out was 11,023 cubic feet—the maximum hitherto attained; but, at the Exhibition, only 512 millions were burnt. For 1900 the total consumption in the city is estimated at nearly 35 million cubic feet per diem; the total to be used during the Exhibition, with its illuminations and extraordinary consumption, being estimated at about 883 million cubic feet. This will be the maximum attained since the invention of gas.

INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS,

MAY 1ST AND 2ND, 1900.

Mr. J. W. HELPS, M.Inst.C.E., of Croydon, President.

REVIEW OF PROCEEDINGS.

The meeting of the Institution of Gas Engineers began, under most favourable auspices, last Tuesday. The weather was perfect, and the attendance tolerably good. Mr. F. D. Marshall, the Retiring President, took the chair betimes; and the small amount of preliminary business was quickly disposed of. Several new members and associate members were added to the roll of the Institution. Upon his retiring from the chair, Mr. Marshall was awarded the warmest thanks of the Institution for his conduct in the presidential office. Without delay, Mr. Helps proceeded to deliver his Inaugural Address, which we published last week.

The general verdict on the Presidential Address will be that it was worthy both of the speaker and of the occasion. Whether or not it is fated to be the last of the list of addresses with which the "few but fit" constituency of the Institution of Gas Engineers in its present form has embellished the literature of the profession, it deserves to be classified among the best extant models of this order of composition. This is no mean praise, seeing that for years past the standard of this class of writing has steadily risen. The present is not the occasion for discoursing at large upon the way in which the address of a president of a gas engineers' society should be written. It is enough to say here that Mr. Helps has successfully realized much of the desire of the most critical students of this order of technical literature, who are in the habit of demanding a satisfying dish of facts, as fresh as may be, piquantly flavoured by a personality.

The President began by making quite clear his position in respect of the amalgamation proceedings. Safely basing himself on the sound contention that a duplication of national technical Institutions is "unwarranted," he went on to argue that the superfluity of professional organizations is apt to become a positive hindrance to the advancement of the best of those interests which such organizations are meant to subserve. Much of what the President had to say in this part of the Address is better discussed in connection with the subsequent debate upon the proposed reunion.

Naturally, the first technical point taken up by the President was the extraordinary rise in the price of coal, which he regarded as quite unjustifiable, and as due to causes which have never been satisfactorily explained. In this trenchant declaration, Mr. Helps only expressed the common opinion of his audience. No generalities of the so-called science of Political Economy will suffice to recommend such an increase in the price of coal as the country has had to pay these last two years. It is possible to understand how and why a commodity like coal or oil, which is at once a necessary of civilized life and a staple product of the country, may grow progressively dearer as the supply falls off. We have had plenty of academic assurances that this is the way in which the inevitable exhaustion of the native coal resources will begin to make itself felt. There is to be no sudden leap upward to famime prices; but British coal is to become ever dearer and yet dearer as the expenses of winning it grow heavier, and the best and most easily-worked seams are emptied one after another. With all due respect to the academic Economists, be it said, the British gas manager could stand this gradual enhancement of coal values fairly well; especially as the most alarmist predictions on the subject (such as those of Mr. Forster Brown, which we were discussing in the "JOURNAL." at this time last year), put fifty years hence as the nearest date for the bad time coming. English gas engineers have never yet seen any good cause for lying awake o' nights to ponder the eventuality of the exhaustion

of the native coal measures; but they have in many cases this year passed through some "bad quarters of an hour" in consequence of the difficulty of getting supplies, and the exorbitant prices asked by the contractors for renewal engagements. Most of us fail to see any Political Economy in all this. Gas managers call it simply hard bargaining on the part of the coalowners—all very capital for them, no doubt, but only rendered possible by the coincidence of foreign demands and the circumstance that gas coal contracts must be made at the regular season. If this view turns out correct, coal prices are bound to tumble before the summer is out.

Mr. Helps fears that the necessary step of putting up the price of gas to partly meet the advanced cost of the raw materials of manufacture will have a prejudicial effect on the consumption of gas. This is not greatly to be feared. A patently temporary increase in the cost of a necessary of life, for market reasons, does not have the same effect on the demand as a constant, rooted conviction in the public mind that the commodity is kept dear through the unwillingness or inability of the privileged vendors to sell it cheap. It is as well to make this point, because otherwise it is possible that some whose judgment is not wholly to be trusted in this regard may argue from the possible fact that a temporarily raised price of gas does not noticeably check the demand, to the false conclusion that the people do not care whether gas is cheap or dear. The truth is that, in the long run, they do care, and show it; but they will pay more for it at a pinch, with a grumble. What is unfortunately more to the point is the reflection that if the price of coal does fall heavily this summer, the value of coke will go down as well, and the gas manufacturer will be hit in two tender places at once.

The President's careful exposition of the economics of carburetted water-gas manufacture, for enrichment and auxiliary purposes, was a valuable addition to the available stock of information on the subject. To this he added a novel supplement in the shape of a statement of the points in regard to which carburetted water-gas compares unfavourably with coal gas. This new departure leads straight into that debateable land where the gas calorimeter looms larger than the photometer. The pioneers into this country are few; but they will have a numerous following ere long. Oddly enough, the President stopped short of making the discovery to which all his prospecting pointed—the supreme importance of the calorific value of town's gas. Still more remarkably, he even "threw back" to the suggested desirability of the introduction of a "burner of the ordinary type"—meaning, it is to be imagined, of the luminous-flame kind—for improving the illuminating power of the mixed gases. To this suggestion it is possible to reply with all emphasis, Never! The incandescent, which is nothing but a fuel-gas burner, is too far ahead of any known luminous-flame burner to encourage any hope that the latter can ever be brought up alongside of it, with any kind of town's gas.

Next, the President warmed to his work of grappling with the naphthalene problem, with which—as he would admit with a sigh—he is only too much at home. There has always been naphthalene in the Croydon town's gas, he remarks; and the tenour of his observations seems to bear the interpretation that he believes there ever will be. Many of the passages of the address dealing with this puzzling question, while conveying much definite information, are even more valuable for their element of suggestiveness. Take, for example, the remark that at certain times the illuminating power of the gas suffers no reduction in travelling from the works to the testing-station in the town, two miles distant. How often has the question indicated in the latter part of the statement been raised—generally without a thought that the answer might be affected by any consideration of time or season?

Indeed, this part of the address strikingly recalls the profound observations of another President, Sir Michael Foster, at the Dover meeting of the British Association. The gas industry, on the other hand, affords a good illustration of the state of science, and of the mind of the scientific inquirer, contemplated by Sir Michael Foster. He said: "The truthfulness of Nature is not wholly the same as that which man sometimes calls truthfulness. It is far more imperious, far more exacting, than man, unscientific man, who is often content with 'the nearly,' and 'the almost.' Nature never is. It is not her way to call the same two things which differ, though the difference may be measured by less than the thousandth of a milligramme or of a millimetre, or by any other like standard of minuteness. And the man who, carrying the ways of the world into the domain of science, thinks that he may treat Nature's differences in any other way than she treats them herself, will find that she resents his conduct. If he, in carelessness or in disdain, overlooks the minute difference which she holds out to him as a signal to guide him in his search—the projecting tip, as it were, of some buried treasure—he is bound to go astray; and the more strenuously he struggles on, the farther will he find himself from his true goal."

So the gas industry is a business the main lines for the conduct of which are familiar to the merest tyro. But it has its mysteries which the most expert practitioner can never fathom; and the puzzle of naphthalene is one of these. The importance of the question is of the first magnitude, inasmuch as it involves the point of reliability of the supply. All the indications so far go to show that a complete understanding of the subject will be the prize of him who, as Sir Michael Foster says, takes heed of the smallest significant evidence. There is surely something at Croydon or at Redhill to account for the apparently irreconcilable behaviour of naphthalene at the two neighbouring places.

After a brief return to the carburetted water-gas factory for the purpose of giving his views on the vexed question of the relative advantages of leaving the carbonic acid in and taking it out, the President explained the position of the two prepayment systems in vogue in the Croydon and Carshalton districts. It is interesting to note that he awards the preference to the less fashionable, but older system, which, we believe, is that accredited to the name of Mr. W. A. Valon. The President's testimony should at any rate serve to remind the technical world that there are at least two methods of popularizing gas among the large class of consumers whom it is expedient to deal with on a strictly cash basis. This candid piece of evidence brought to a conclusion an address which cannot fail to enhance the President's reputation of being a gas engineer of singularly well-balanced mind and clear views, with ample gifts of pleasing and convincing exposition.

After the manifestation of approval which marked the termination of the Address, the President again rose and entered upon a very complete explanation of the proceedings connected with the drafting of the proposed rules for a united organization. Thanks chiefly to the President's tactful style of dealing with the thorny parts of the subject, only little (and that a very mild) discussion took place on this occasion; the meeting accepting unanimously the principles of the solution proposed by the Joint Committee.

The first paper to be read was Mr. Livesey's somewhat argumentatively-named presentment of the case for correcting the character of English town's gas by dropping the practice of enrichment. This and Dr. Colman's paper on gas calorimetry, and Mr. C. C. Carpenter's communication on the carbonizing plant at the Bankside works, filled up the first day very profitably. Unfortunately, the fact that the Committee on the London Gas Bills reassembled on the same day after the recess, took away a notable contingent of leading members of the Institution.

Wednesday's business commenced with an impressive lecture by Professor Vivian B. Lewes, on the most recent developments of water-gas technics. This was quite one of Professor Lewes's best efforts, and was most attentively followed and warmly applauded. It contained a suggestion of practical improvement in carbonization which seems calculated to have important consequences to the industry.

The remaining papers were taken afterwards. They all contained points of interest, some of which will conveniently come forward for further discussion later. Altogether, so far as the technical quality of the Institution transactions is concerned, this meeting was a distinct improvement on the last, although none of the papers, with the exception perhaps of Mr. Livesey's, can be truly said to be addressed to the consideration of subjects of the first importance. And even this paper only opened up questions which must be answered elsewhere.

The dinner of the Institution on Tuesday, at the Café Royal, was a very pleasant function. The principal guests were Dr. Haldane and Dr. Clowes. The excursion to Woolwich, to inspect the Arsenal and Royal Laboratory, and the subsequent drive to the Crystal Palace, was well conceived, and was but slightly marred by showery weather.

THE PROCEEDINGS SUMMARIZED.

[*The usual full Report commences on p.* 1190.]

A brilliant May-day morning, important business, and the expectation that this might possibly be the last annual meeting of the Institution of Gas Engineers as such, no doubt all contributed to the bringing together of the good attendance at the opening sitting. There were gentlemen present whose names appear in the early reports of the old British Association of Gas Managers; several who are members of both the Institution and the Institute; and others who are only members of the latter body—but all of whom will, it is hoped and believed, soon be members of one united association.

There was only a little formal business calling for attention—simply the adoption of the report and accounts, and the Scrutineers' report—before the retiring President (Mr. F. D. Marshall, of Copenhagen) vacated the chair. In two or three of those happy phrases which he has always at command, he introduced his successor (Mr. J. W. Helps, of Croydon); at the same time expressing the hope that if he had, during his own year of office, left undone anything that he ought to have done, the members would pardon him. There was no room for doubt as to the opinion of the members on the point; for they very heartily endorsed the encomiums passed upon Mr. Marshall's services by Mr. Foulis and Mr. Lacey.

The New President and His Address.

The entrance of Mr. Helps into his high office was marked by much enthusiasm. He at once proceeded to deliver his Inaugural Address, which was published last week, and is commented upon in the foregoing "Review." It is therefore unnecessary to further deal with it here. The honour of thanking the President for his address fell to Mr. Fletcher Stevenson, who referred first to the many points in the composition which merited study on the part of the gas profession, and, secondly, to the full confidence that the members have that their President will guide them safely through the critical time before them. The well-expressed sentiments of the speaker were heartily approved.

Unity and Amalgamation—The Scheme Adopted.

An acknowledgment by the President of the thanks of the members led to the item on the *agenda* in which, of all other matters for the time being, perhaps the greatest general interest is taken—that is, the now well-advanced project for amalgamation with the Gas Institute. The results of the conferences up to the present point, and the rules which have been framed as a basis on which the two bodies may become one, are matters of public knowledge; but the President, to pave the way for discussion, gave a *résumé* of what had been done. He showed that the Council had in no way pledged the members to any special course. All they were asked to do on this occasion was to approve of the Council's action and also of the rules; and then, if the scheme were adopted at the meeting of the Gas Institute, another meeting of the Institution would be immediately called, in order to pass a resolution for dissolution. He appealed to the members, in expressing their opinions, to keep the welfare of the gas industry prominently in the front. The discussion was appropriately opened by Mr. George Livesey. To see the gas industry thoroughly united, he said, had been one of the objects he had wished for for many years. Evidently with a desire to give honour where honour is due, he mentioned what is now a matter of history—the mediation of Mr. Charles Sellers and the honourable action of Mr. George Bray which had removed a barrier to reunion. The rules and suggestions, Mr. Livesey regarded as most complete and comprehensive; and the only improvement he could suggest was that some provision should be made for enlisting the pecuniary support of gas undertakings, both companies' and local authorities'. Mr. Foulis fully concurred as to the wisdom of joining the Institution and Institute, and characterized the rules drawn up by the Joint Committee as "admirable." He thought, however, it should be perfectly understood that there must be no attempt to go beyond these rules. The Joint Committee were congratulated by Mr. T. Banbury Ball upon the rules; and Mr. Charles Hunt also expressed his approval. For the consideration of the Council, he suggested the desirability of admitting to the Council of the new Institution the Chairmen and Secretaries of any Local Sections that might be formed; and he favoured as the title for the new body "The Institution of Gas Engineers and Managers." Mr. S. Y. Shoubridge, pointing out that the new rules excluded the associate and extraordinary members of the sister body, was anxious to know whether they had been consulted; but obviously this was a question for another time and place. As one of the original members of the fast-thinning ranks of the old British Association of Gas Managers, Mr. Robert Morton was glad to hear of the probability of there being a fusion of the two bodies. Mr. W. R. Cooper was afraid that, if they held out a "cast-iron" set of rules to the Institute, as suggested by Mr. Foulis, they would not be adopted by that body. With gratifying unanimity, a resolution, proposed by the President, and seconded by Mr. Fletcher Stevenson, was then passed, recording the opinion of the members that it was to the best interests of the industry that amalgamation with the Institute should be brought about, approving of the action of the Council and of the rules drawn up, and desiring that the necessary steps should be taken to carry out the proposed scheme in accordance with the rules as submitted.

This momentous question satisfactorily disposed of, the members settled down to the consideration and discussion of the papers. The first one was on

The Enrichment of Coal Gas.

Mr. George Livesey was the author, and it will be observed that he has somewhat modified the title since the issue of the programme by the elimination of the expressive word "adulteration." The question raised by the author is whether the object of gas manufacturers should not be to supply gas at the lowest possible price regardless of its illuminating power—in fact, he goes further, and asks whether the time is not within measurable distance when non-luminous gas will be the great *desideratum* of the public. If so, and if the best is to be done to meet the needs of the consumers of gas, ignorance and prejudice must be conquered, and the policy of half a century reversed. He examines the three systems of enrichment in general use, and inquires into their relative effectiveness as to uniformity, reliability or permanence, and cost. The conclusion he comes to is that there are serious objections to all three systems; for while the cost of cannel puts it out of court, spirit is useless from its want of permanence, and carburetted water gas is objectionable from its nature and the difficulty and uncertainty of mixing. The recent more than doubling of the price of oil (which Mr. Livesey thinks is far more likely to be permanent than the present increase in the price of coal) will, in his opinion, very likely render the continuous use of carburetted water gas impracticable. He asserts that no one can seriously argue that the slightly higher calorific value of enriched gas, even if the enrichment reaches the consumer, is desirable for either heating or manufacturing purposes. A lower price rather than the higher quality is what consumers want; and as to incandescent lighting, experiments made in Germany, and corroborated in England, have proved that, with a Welsbach burner, the light actually increases as the illuminating power of the gas diminishes. Consumers, he points out, have it in their power, even with ordinary burners, to increase or diminish the light obtained from the gas to a far greater extent than the difference produced by enrichment. Another strong reason against enrichment is that the best kinds of gas coal are now getting scarce, and inferior gas-making seams are becoming more and more the source of supply. If, therefore, the policy of pressing for higher illuminating power is continued, or even the present standard is maintained, the cost of gas must rise, and gas undertakings must necessarily drift more and more into the power of the coalowners. Towards the close of the paper are a few timely words of warning to these gentlemen.

Although the speakers did not confine themselves to the main point and object of the paper, the discussion contained many interesting features. Mr. Foulis related his experience in dropping the illuminating power of the gas in Glasgow from 25 to 20 candles, and pointed out that the fears entertained by some people that the pipes would be too small for the lower-quality gas, and that the accounts would be increased, proved groundless. Mr. S. Meunier agreed that in industrial centres "a lower price rather than a higher quality is what the consumers want;"

and Mr. W. R. Herring held that the illuminating power of the gas supplied should be the cheapest that could be produced from the gas coal in closest proximity to their own locality. A notable point in Mr. Herring's remarks was the statement that, under his coal contracts, the difference in cost between the 15-candle gas from common coal and the 25-candle gas supplied was only about 3d. for the 10 candles. The common coal cost hm 15s. 6d. per ton; the cannel, 28s.; and the average cost of the coal used worked out to 18s. 6d. per ton. Mr. James Stelfox, referring to the author's remarks on water gas, pointed out that the rise in the price of coal amounted to much more than the increase in the price of oil. Mr. Samuel Glover criticized several points; but generally he saw many objections to the illuminating power of gas being altered from what people were accustomed to. Mr. C. E. Botley found it cheaper to enrich by cannel last winter rather than by carburetted water gas; and he thought that testing for illuminating power should not be enforced, but only testing for impurities. Mr. Marshall made some interesting remarks, which disclosed his view that the days of cheap oil have departed never to come again. Mr. E. A. Harman made a few remarks on the question of coal; and Mr. Charles Hunt agreed with the policy enunciated in the paper as a measure of permanent economy. In time, they were going to be told, gas would be judged not by its illuminating power but by its heating qualities. In his reply, Mr. Livesey further emphasized some of the points in his paper. What Mr. Marshall had told them about oil confirmed the information he had been able to gather himself; but he did not believe the price of coal would be permanently high.

The Calorific Power of Illuminating Gas.

The second paper was by Dr. H. G. Colman, and it is a perfect companion to that supplied by Mr. Livesey. The author's aim is to show that a large and constantly increasing proportion of the output of gas is employed for purposes in which the calorific power is of greater importance than the illuminating power; and, therefore, the necessity for an accurate knowledge of the former has largely increased. It is, indeed, in Dr. Colman's opinion, quite possible that before long the heating power of the gas supply may become of even greater importance than its illuminating value. After several years' experience, the author pronounces the Junkers calorimeter to be an instrument that does afford a quick and accurate method of ascertaining the heating power of gas. From the point of view of testing, he maintains that the determination of the latter is much more satisfactory than that of the former. In spite of all improvements, an absolutely accurate and constant standard of light has yet to be discovered; and, further, illuminating power varies according to the construction of the burner employed, and the rate at which the gas is consumed. Moreover, the unavoidable personal error is much greater in determining the equality of the light of two illuminated surfaces than in reading off the height of a thermometer, or in measuring the volume of the weight of water used, as in the case of the calorimeter. The author gives, in tabular form, a number of results obtained with the instrument, together with the illuminating power of the gas examined; the chief object of the investigation being to determine the manner in which the calorific power of gas corresponds with the light-giving power. We will not attempt to summarize his figures here; but one or two points affecting water gas are especially interesting. It is usually stated that carburetted water gas has about 5 per cent. less calorific power than coal gas of the same illuminating value; but, from Dr. Colman's results, it would appear that for the quality of gas experimented upon—16·5 to 18 candles—10 per cent. is more nearly correct. He also brings out the point that the admixture of 10 to 20 per cent. of carburetted water gas does not affect the calorific power to an extent which will materially interfere with consumers. Tests made with coal gas at the works and two miles away also reveal the fact that there is no falling off in the calorific power of the gas through traversing the main. These are only a few of the features of an extremely interesting paper.

The discussion was to the point. Mr. Hunt was afraid Dr. Colman had not arrived at a satisfactory ratio between the calorific value of gas and its illuminating power. He noticed in one of the author's tables that the two gases of lowest illuminating power—16·47 and 16·34 candles—gave the highest number of calories per candle, and the gas of highest illuminating power—18 candles—gave almost if not quite, the lowest; and in another table it was very marked. The conclusion to be drawn from this was that the heating value of gas of low illuminating power was greater in proportion than gas of high illuminating power. Mr. Marshall believed the calorimeter should be used with the photometer. He said they found it a vast help at their works in checking the "personal error," which could not be avoided in using the photometer. He was astonished that the calorimeter was not used to a greater extent in English laboratories. Figures which Mr. Marshall gave confirmed the previous statements—that the lower the illuminating power, the greater the efficiency in the calories developed per cubic foot of gas consumed. He also urged the importance, in ordering a gas-engine, of letting the makers know the average calorific value of the gas; and he believed the day would soon be past when gas manufacturers would pin their faith to the photometer. Mr. Forbes Carpenter also remarked upon the usefulness of knowing more of the calorific value of gas with its growing use for power purposes. Some comparative calorimetric tests made by Mr. Leicester Greville were quoted by Mr. William King; but he did not comment upon them. It seemed to Mr. Harman that one of the long-established convictions of gas managers—that gas lost in illuminating power at a distance from the works—was being knocked on the head. He thought it was generally conceded by gas-engine users that the better the illuminating power of the gas, the easier it was to work the gas-engine. In connection with a question put by Mr. D. H. Helps, it was considered possible by the President that the constituents added to a gas to increase its illuminating power, or which were in the gas of a high illuminating power, might have something to do with the lower calorific value of the gas—that was to say, that the added constituents might not be so high in calorific power as those of a gas of low illuminating power. Dr. Colman, in reply, dealt fully with the various points raised; and he emphasized his assertion that errors are far and away greater with the photometer than they are with the calorimeter.

Inclined Retorts at Bankside.

The next paper was by Mr. C. C. Carpenter; and it was very generally regretted that his duties in connection with the County Council Gas-Testing Bill in Parliament prevented him being present to deal with the severe criticism to which the inclined retort installation at Bankside was subjected. The settings were designed to fit an existing building as it stood; and this explains certain characteristics of the arrangement. There are eight retorts in a setting, four high in two vertical rows. The retorts are 20 feet long, and provided with one 6-inch ascension-pipe at the lower end. The author, for reasons stated, decided against taper retorts, and adopted parallel ones—a modified ⌂; the minimum of radius being given to the lower corners. They are 24 inches wide, sides 7 inches high, and rise of crown 6 inches, set at an angle of 32°. The setting itself is completely divided by a middle wall into two independent sections; this being a ready means of adjusting the heat requirements either of the upper or the lower portions. Each producer supplies gas to three settings—that is, to 48 mouthpieces. The producers occupy the space under the charging-stage, and are quite independent of the retort-benches, to which they supply their gas by 18-inch cast-iron pipes. The weight of coal carbonized is ten times that of the fuel put into the producer. The coal-charging shoots are arranged after the Brentford pattern. Only the lower door of the measuring-chamber is operated by hand; and the upper doors are attached by means of a long rod to a crank-pin fixed to give the required stroke on a worm-wheel. The worm-wheels are in right and left handed pairs, driven off corresponding worms keyed upon a longitudinal shaft running the length of the bench. The entire set of doors is operated by one of West's smallest-sized motors. The coal is brought into the retort-house by an overhead railway. At the discharging end of the settings, the bottom row of mouthpieces is worked entirely from the ground—the three upper ones from a light trolley, the wheels of which run on metals kept clear of the coke heaps during each "draw." The retorts were put to work during February, 1898. High and regular heats were obtained, and charges averaging 6½ to 7 cwt. were worked off with ease. The make of gas per ton, however, fell. Long and careful investigation was made; and eventually it was found that,

no matter how carefully the coal was laid, in the process of burning off it slid down to the lower extremity of the retort. The next step forward was to trace this effect to certain kinds of coal, and a selection was made of those varieties which gave no trouble. The make of gas rose to about 10,300 cubic feet per ton; and it has remained at about this figure since. The paper includes the expenses of working; and the author states that the entire installation cost from the floor-line slightly under £14,400, or (say) £100 per 20-foot retort.

In opening the discussion, Mr. Herring described the paper as an elementary treatise on a subject which had now become old. He could not see why Mr. Carpenter did not adopt settings of nines; but he agreed with him that the advantages of the taper retort were not what appeared on the face. As to the outside producers, he could not see that they could be any cheaper than inside ones; and he should like to have some comparative figures as to their cost of working. In his opinion, Mr. Carpenter had not employed the best charging-shoot; and as to the mechanism used to operate the measuring chambers, the author had introduced unnecessary complications in a process that was intended to do away with mechanism. Mr. Carpenter also appeared to have overcome the "slip" in the same way that everybody else did. Mr. Marshall stated that with taper retorts he had found over-carbonization at the top point, and did not get the charge properly carbonized at the bottom. In his own case, he found the slipping due principally to fine coal; and by using coal in a larger condition it was easy to avoid slipping. He also wondered why Mr. Carpenter adopted eight retorts instead of nine; and he considered that in studying the author's diagrams they were making a retrograde movement. The experience of Mr. R. Brown was that equally good results were obtained with retorts of the same size throughout as with tapered ones; that he had no difficulty with the creeping of coals; and that inclined retorts did not cause depreciation of illuminating power. A few remarks on the general question by Mr. Meunier were followed by the most severe criticism of Mr. C. E. Brackenbury. He was anxious to know why the London gas engineers lagged so much behind their provincial brethren in the matter of inclined retorts; and, further, he wished to be enlightened as to what guided Mr. Carpenter in putting up such an installation as the one described. Taper retorts, he also remarked, must have taper heats; and this seemed a little inconsistent. The measuring chambers adopted by the author were really beyond comprehension. In a ground-floor house, there must be a great deal of wasted labour and money spent; and going back to a single-stage house was a retrograde step. He had had experience with 15-feet retorts; and he always understood the slipping of the coal depended upon the angle at which the retorts were set, and on the nature of the coal. At the Continental works where he had had experience, the average make, using fine coal, was 10,600 cubic feet of 17½-candle gas. Mr. Marshall interposed that, in his experience, the length of the retort had nothing to do with the slipping of coal. Mr. J. Tysoe explained that the installation had been successful in its results. The station was previously one of the dearest of the South Metropolitan Company in regard to carbonizing wages. It was now one of the cheapest; and much credit was due to Mr. Carpenter for the way in which he had carried out the work in the face of great difficulties. It was also pointed out by Mr. Shoubridge that Mr. Carpenter did not set this up as an ideal installation of inclined retorts; the space at command at Bankside being very cramped indeed. In his (the speaker's) experience, tapered retorts justified their introduction; they did facilitate the discharging.

This concluded the first day's proceedings; and in the evening the members dined at the Café Royal.

The summary so far has shown that the meeting was full of matters of technical interest; but Wednesday morning opened with one of its brightest features. It was a lecture by Professor Vivian B. Lewes, delivered with his well-known fluency, without a note before him. The title he gave to the discourse was

Water Gas, and Its Recent Continental Developments.

The lecturer first traced the gradual growth of water gas during the past ten years, in which growth there had, he said, been a doubling of the amount of water gas produced for the same amount of carbonaceous fuel used. Then came the engrossing part of the lecture. He entered upon it by referring to the great decline in the price of benzol from 15s. to 5½d. and 6d. per gallon. The process of coking coals for metallurgical purposes had brought this about. From the coking furnaces, more than 5 million gallons per annum were being produced; and the quantity might increase fourfold during the next few years. At Königsberg, benzolized water gas had been introduced. Two Dellwik-Fleischer generators had been put up, each capable of producing 20,000 cubic feet of gas per hour. The benzol was converted into benzol vapour and allowed to flow into the water gas in constant quantity as it passed from the relief holder; the benzolized water gas and coal gas being mixed at the entrance to the main gasholders. The illuminating power of the finished gas was from 18 to 19·5 candles. At Erfurt, the blue water gas was passed into the foul main during the process of gas making. This resulted in the use of less benzol, as the water gas took up some of the benzol in the tar vapours. As to the expense of manufacture, supposing 16-candle coal gas cost 11d. per 1000 cubic feet in the holder, and it was intended to increase the quantity by 25 per cent. Then 7500 cubic feet of coal gas at 11d. per 1000 cubic feet would be equal to 6s. 10½d.; and 2500 cubic feet of gas produced by the Dellwik process, at 3½d., would be 8¾d. In mixing the two gases, the illuminating power would be brought down from 16 to 12½ candles. In order to raise it again to 16 candles, they had to put in a gallon of benzol per 10,000 cubic feet of the mixture; and the benzol cost at Königsberg about 10d. per gallon. Then putting the charges on the carburetting apparatus, &c., at ¾d., they had 8s. 6d. as the price of the 10,000 cubic feet, which worked out to 10·2d. per 1000 cubic feet. So that nearly ¾d. per 1000 cubic feet was saved, and the same illuminating power obtained as at the start; and this, taking the benzol at the price of 10d. per gallon. Professor Lewes showed that the figures could be absolutely verified. In benzolizing in this way, gas managers had a great prospective advantage; the enrichment only costing 0·3d. per candle per 1000 cubic feet. When coal gas was mixed with carburetted water gas, the flame was shortened. A 16-candle coal gas gave a 3-inch flame; but when the 16-candle gas had been obtained by carburetting with water gas, the flame was only 2·6 inches in length. With the benzolized water gas at Königsberg, he could not detect any difference in the height of two flames of equal value from coal gas and coal and benzolized water gas; and no trouble had been experienced there in regard to the carrying power of the gas. Carburetted water gas had in the past ten years lent great aid to gas manufacturers; but the unfortunate rise in the price of oil had limited its utility. It looked very much now as if benzolized water gas was going to take its place. But were there no means within the four walls of the gas-works that they could bring to their aid? It was all very well to go to outside enrichment of this character; but directly a big demand was created, there would be an upward movement. Had it ever occurred to gas engineers how small an amount of change had taken place in their process of carbonization? In that process he thought there was some point that could be altered. In the formation of coal tar in the retort, they had going on a process of the greatest complexity; and one of the most promising points in the whole of the manufacture of gas was the prevention of the formation of part of that tar. The formation of that portion of the tar which came from the overheating of the gas could be prevented. At the present time, at one end of the retort the coal gas was hurried out; and the gas from the other had to pass over some 10 feet of heated surface. Between the two ends of the retort, the gas passed out at every conceivable rate—there was no uniformity; and that was what must be altered to prevent the formation of part of the tar. In White's hydrocarbon process of the early '50's they had exactly what was wanted. They had the power of doing in a proper way what White had tried to do and failed. Make, said the lecturer, your water gas, lead it to the relief holder, from there by a main to the front of the bench of retorts, and then pass the gas to each mouthpiece, where it can be led in by the side of the ascension-pipe, and along the crown of the retort to the back end. On the underside of the delivery-pipe, small holes are drilled, and means provided for regulating the supply of water gas in accordance

with the make of the coal gas. The water gas would be superheated by travelling up the retorts; and it would hurry up from the retorts the gas from the coals undergoing distillation. Though the experiments he had made had only been on a small laboratory scale, from what he had seen he thought by this means gas managers could get something like a 40 per cent. gain. If they could by this process make 13,000 or 14,000 cubic feet of gas of the same or a candle better illuminating power from their gas coal, they had a factor which would enable them to look with more equanimity on the present position.

The foregoing is merely a short indication of the points of the lecture prepared from notes made during its delivery; but it sufficiently shows that the full text published elsewhere is packed with interest for the gas manufacturer. For the lecture, which was listened to with rapt attention, Professor Lewes was heartily thanked.

Naphthalene in Coal Gas: Its Detection and Extraction.

At the close of the lecture, attention was called for Mr. Wilfred Irwin, who had undertaken a paper on the above subject. As its preparation proceeded, the scope widened; and the author dealt with the whole question of condensable products in coal gas. His remarks under this head we must leave to the reader's study when the text of the paper is published. It is to be gathered that the author's opinion is that the naphthalene trouble is entirely dependent on climatic variations—always supposing, of course, that ample condensing power exists at the gas-works. His connection with the Burnley experiments, in conjunction with Mr. J. P. Leather, forms the subject of the most attractive part of the paper from a gas engineer's point of view. To prevent the deposits, he suggested the washing of the gas with oil, to which a quantity of benzene is added to prevent any deterioration in the quality of the gas. To first obtain an approximate idea of the amount of naphthalene in the gas, the author proposed the passing of a large volume—say, 400 or 500 cubic feet—through benzene or toluene contained in two absorption flasks consecutively. In this operation, all the higher boiling hydrocarbons are caught in the flasks, and benzene takes their place in the gas. The contents of the flasks are submitted to fractional distillation through a dephlegmating column, and the naphthalene is crystallized out from the last residue by cooling. By this test, the Burnley gas was found to contain 0·13 lb. of naphthalene per 10,000 cubic feet. Experiments with a spare scrubber and various oils showed that oil will absorb naphthalene from the gas until it contains 10 per cent., when it has to be changed. Hence it follows that, according to the temperature, from 13 to 40 gallons of oil per million cubic feet of gas is the amount necessary to extract the naphthalene, and the addition of rather more than 8 per cent. of benzene prevents any loss of illuminating power in the gas. Briefly, the process patented by Mr. Leather and the author jointly is this: That the gas, after it has been thoroughly cooled and freed from tar, is treated with a small quantity of a mixed liquid capable of absorbing the naphthalene, and which, at the same time, will not deteriorate the quality of the gas by absorbing benzene or other illuminating substances therefrom. Suitable mixtures are blast-furnace oil 92 per cent., and benzene 8 per cent.; or heavy tar oil 92 per cent., and benzene 8 per cent. Gas at 60° Fahr. requires 15 gallons per million cubic feet, at 70° Fahr. 25 gallons, at 80° Fahr. 40 gallons. The plant recommended is a washer in which the liquid can travel in a direction contrary to that of the gas through a series of chambers, in each of which it can be brought into intimate contact. Messrs. Young and Glover having a patent in which the principle of washing gas with oil for the extraction of naphthalene appeared to be foreshadowed, the patentees of the Burnley process are working in unison with them. Much additional useful information will be found in the paper when published.

Mr. A. F. Browne led off the discussion, criticizing several points raised by the author; but the only objection he could see to the method itself was that it required special apparatus. One mechanical objection was that, a washer being employed, the pressure on the works would be increased several inches. It appeared to him they were getting on the right track in regard to dealing with naphthalene; and his advice was "take and wash the thing out, and have done with it." The members were reminded by Mr. Thomas Glover that in 1897 he published the opinion that naphthalene was essentially a high temperature product, and that the best way to get rid of it was to wash it out of the gas. He thought the method suggested was one which would commend itself to every practical gas engineer. Mr. W. E. Price, having been advised by a tar distiller that creosote oil would probably be more suitable for removing naphthalene than green oil, as it contained less naphthalene, he tried it on a somewhat large scale. He arranged a Walker's purifying-machine so that the top tray could be filled with creosote oil. About 300 gallons of oil was required to fill the chamber; and roughly speaking, he passed 15 million cubic feet of gas through it. He withdrew the oil when he found he was obtaining naphthalene complaints; but during the time it was in use, there was a distinct reduction in the number of complaints. The quantity of oil employed worked out to twice that mentioned in the paper. He used no extra enrichment; and he did not see there was any great drop in illuminating power—certainly not more than ½ candle. Mr. C. E. Botley was in agreement with the author as to the effect of climatic changes on naphthalene; and remarked that, whatever steps were taken, condensation could not be absolutely controlled. He also gave his reasons for preferring the carburation process as applied at Hastings. In the opinion of Dr. Colman, these processes did not form the final solution of the difficulty. They were simply methods of cure. They took the naphthalene out because it was not removed in the condensers. In his opinion, the system of condensation would finally be so arranged that the whole of the naphthalene would be taken out in the condensers. Mr. Samuel Glover was of opinion that, if Mr. Price had employed an apparatus more suitable for the purpose in view, and given the gas successive washings, it would have removed the naphthalene more thoroughly. The quantity of washing oil required was dependent upon the amount of naphthalene in the gas. The washer referred to by the author was now being erected at St. Helens. Mr. C. F. Botley considered Mr. Price's experience, that creosote oil did not affect the illuminating power more than ½ candle, was extraordinary. Personally, he did not think it necessary to extract all naphthalene to prevent trouble. Mr. Lacey suggested the use of the oil-washing apparatus before the washer and scrubber; so that the naphthalene might be removed previous to the ammonia. This point the President also considered an important one; seeing that naphthalene created great difficulty on the works as well as in the distribution system. In his reply, the author mentioned that the cost of the system only amounted to a fraction of 1d. per 10,000 cubic feet, if all conditions were right. It worked perfectly satisfactorily at Burnley.

The Carbonization of Cannel and Shales for Gas-Making Purposes.

Mr. S. Glover read a carefully prepared account of the results of his studies into the question of the carbonization of cannel and shales. In carbonizing cannel, the primary object aimed at is not production of volume, but to carbonize it at such a temperature as will produce the maximum enrichment value. His investigations go to show that, by the usual method of using cannel, its full enrichment value is not obtained; the temperature at which it is carbonized is much higher than that necessary to produce the maximum yield of products capable of enriching the large volume of bituminous gases; and the condensed tars from cannels are less able to act as solvents for the naphthalene. And both these losses are still further increased during the process of condensation. But by carbonizing the cannel separately, the temperature best suited to a particular cannel used can be adjusted to produce the higher yield of enrichment; and by separately condensing the products out of the gas produced from the bituminous coal carbonized at high temperatures, the accompanying naphthalene and solvent oils are nearly all removed—not one-hundredth part of the naphthalene being left in diffusion in the gas. On bringing the gas so purified from condensable products into intimate contact with the products from the cannel carbonized at the lower temperature, the gases are free to take up their full load of carburetting hydrocarbons present in the cannel products; and the denser hydrocarbons from the cannel, being practically free from naphthalene themselves, form excellent solvents for the naphthalene still present after condensation in the large volume of

high temperature gases. The great advantage to be derived from the separate carbonization of coal to produce volume, and of cannel to produce enrichment, and the separate condensation of the high temperature gases and their subsequent contact and treatment with the cannel products, are thus fairly evident. The results the author has obtained at St. Helens throughout the last two-and-a-half years' continuous working with cannel carbonized in separate retorts and mixed as described in the paper communicated to the Institution by the author and his brother in 1898, have resulted in the enrichment of the gas (the bulk of which was made from the cheapest quality of coal) in the most economical and satisfactory manner.

Opening the discussion, Mr. Fletcher Stevenson admitted that he was so fascinated with this process when it first came out, that he tried it at the Effingham Street works at Sheffield. The details and results which he gave of the experiments made must be left until we publish our full report; but, it may be mentioned, the general outcome was that Mr. Stevenson could not see from his figures anything very special to show that the process was a success. He could not find any advantage in enrichment, because the results realized were about the average of those produced in the ordinary way. During the use of the process, the naphthalene troubles increased; but he did not attribute this to the process, as other districts supplied from the other stations were similarly affected. Mr. A. F. Browne was much disappointed that Mr. Stevenson's practical trial had not been so successful as could have been wished. Mr. Meunier's experience was that, when he carbonized coal and cannel in separate retorts, he obtained better results than by carbonizing them mixed. Mr. T. May, Mr. R. Beynon, and Mr. Foulis also joined in the discussion. The President was of opinion, from the information given by Professor Lewes and Mr. Glover, that the subject of carbonization would in the future receive far more consideration than it had done in the past. It was remarkable that Mr. Stevenson's experiments should be so absolutely at variance with those of Mr. Glover; but there was not the slightest reason why the same results should be obtained in every situation and place. Mr. Glover, in reply, said Mr. Foulis had stated that he found it necessary to employ high heats to evolve the gas from shales; but perhaps if he treated them in another way, he might get hydrocarbons which might be very useful to him in enriching the bulk of the gas to the high illuminating power which he had to supply in Glasgow. He (Mr. Glover) allowed that Mr. Stevenson had tried some "experiments;" but he did not work a sufficiently long time, nor in a satisfactory manner. The arrangement was cheaply put together; and he pointed out some of the respects which, in his opinion, had brought about the results stated by Mr. Stevenson. Mr. Meunier's experience confirmed his own, that there was something in carbonizing coal and cannel at different temperatures.

Asphalt in Tank Construction.

The next contribution was from the pen of Mr. Fletcher W. Stevenson. It gave examples of tank construction which occurred in the course of the author's work at Sheffield; but its main purpose was to show the success he achieved in rendering tanks water-tight by the use of asphalt. Two of the examples were gasholder tanks; and the third twin tar and liquor tanks. The asphalt employed was prepared from pitch containing a portion of the heavy tar oils; the distillation of the tar having been stopped at a lower temperature than is usual with tar distillers. Natural rock asphalt consists of soft limestone impregnated with bitumen; and as this soft limestone cannot be obtained for the artificial asphalt, finely ground soft chalk is mixed with the comparatively soft pitch. This, when required for use, is melted and raised to a high temperature; and a considerable proportion of fine dry sand is mixed with it. The author gives instances of the remarkable elasticity of the asphalt. The cost of the asphalt and lining to maintain it in position is, of course, more costly than clay puddle, and considerably more than cement rendering; and Mr. Stevenson does not by any means recommend its universal application. The use of the asphalt is not confined to tanks; it is equally suitable for flat roofs, wet basements of buildings, or floors on which wet processes are conducted. A few questions were put to the author; and, in his reply, he amplified some of the particulars given in the paper.

An Experiment with a Concrete and Expanded-Metal Structure.

The final paper was by Mr. A. Baker; and it described an experiment carried out at Beckton, under the instructions of Mr. G. C. Trewby, with an expanded-metal and concrete slab. The economic principles which this method of construction can undoubtedly lay claim to have been but slowly recognized by the gas profession. As the author points out, the manufacture of expanded metal is very ingenious, and consists in forming streets of trellis or net-like metal out of solid plates of iron, steel, &c., by mechanically slitting and opening out the sheets, so as to produce diamond-shaped meshes of any size and thickness. In the experiment described, the point of destruction or breaking strain was not reached owing to the foundations sinking. The expanded metal used was in sheets 17 ft. by 5 ft. 6 in. wide, 3 inch mesh, $\frac{1}{4}$ inch by $\frac{3}{16}$ inch strands. The completed structure consisted of a 6-inch slab of concrete, 17 feet clear span by 10 feet wide, supported on three jack arches spaced at 4 ft. 9 in. centres. After setting 34 days, weight was gradually applied, until the total evenly distributed over the whole structure was 128 tons 5 cwt., equal to 15·09 cwt. per square foot. The slab was carefully examined at this stage, and found quite intact, with a deflection in the centre of $\frac{1}{2}$ inch. Expanded metal has been used in many of the new buildings at Beckton for some time now, with satisfactory results. The paper did not lend itself to discussion. But Mr. Herring stated that he had arranged for a similarly constructed floor in a purifier-house, and had used expanded metal in connection with the concrete bottom of a gasholder tank. The President also mentioned that he had given instructions for the construction of an overhead revivifying-floor on this principle.

The Autumn Meeting and the International Conference in Paris.

The last matters of importance upon which the President invited the members to express their opinions were the holding of an autumn meeting, and the acceptance of the invitation of the Société Technique to attend the International Conference to be held in Paris in September in connection with the Gas Section of the Exhibition. The projected union with the Gas Institute rather complicated the matter; but the members got over the difficulty for the time in the easiest manner possible—first, by endorsing the action of the Council in accepting the invitation of the Société Technique, and, secondly, by authorizing them, if a sufficient number of members signify their intention of attending, to hold a meeting in Paris in the autumn.

A few votes of thanks terminated a meeting which, for the uniform quality of the proceedings and the sustained interest of the members, has, it is not too much to say, never been exceeded in the history of the Institution.

On Thursday, the members and a few friends paid a visit to the Woolwich Arsenal, where they were privileged to view several of the departments not usually opened to the public. Lunch was served at the Royal Mortar Hotel; and, in the afternoon, brakes conveyed the party to the Crystal Palace, where in the evening they dined together. Unfortunately, there was a break in the beautiful weather of the two previous days; and this slightly disturbed the happiness of the occasion.

GENERAL REPORT.

The General Meeting of the Institution was held last Tuesday and Wednesday, in the Hall of the Institution of Civil Engineers, Great George Street, Westminster.

Mr. F. D. Marshall (Copenhagen), the Retiring President, occupied the chair at the commencement of the proceedings.

Annual Report and Accounts.

The Chairman opened the business by moving that the annual report and statement of accounts, which had been circulated among the members (see *ante*, p. 998), be received and adopted.

Mr. T. May (Richmond) seconded the motion; and it was carried unanimously.

Additions to the Roll.

The following list of new members and associates, who had been unanimously elected, was then read :—

MEMBERS.

Anderson, Eugene E. J., Gas-Works, Ripon.
Morland, W. S., Gas-Works, Hempstead, Gloucester.
Richmond, Christopher, Gas-Works, Nechells, Birmingham.
Rutter, C. H., Gas-Works, Mill Hill, N.W.

ASSOCIATES.

Franks, C. F., Bankside.
Green, B. R., Mitcham.
Kindler, H. K., Maidstone.
Paterson, J., Gloucester.
Pettigrew, W. E., Leeds.
Sharp, M. H., Bexhill.
West, C. B., Vauxhall.

The New President.

The Chairman said it only remained for him to thank the members for the kind support they had all given him during his year of office, and to express the hope that if he had left undone any things which he ought to have done, or done things which he ought not to have done, he would be forgiven. He had now simply to introduce his successor, Mr. Helps, which he did with very great pleasure, and in the hope that he would be as cordially received as he (Mr. Marshall) had been himself.

Mr. James W. Helps, M.Inst.C.E. (Croydon), then took the chair.

Thanks to the Past-President.

Mr. W. Foulis (Glasgow) moved a hearty vote of thanks to Mr. Marshall for the admirable way in which he had conducted the business of the Institution during his year of office. They all, he said, remembered the way he presided over the meeting last year, and especially the pleasant trip in the autumn, the great success of which was entirely due to the exertions of Mr. Marshall.

Mr. T. S. Lacey (Pimlico) seconded the motion with much pleasure ; and it was carried with acclamation.

President's Address.

The President then read his Inaugural Address, which was given in the "Journal" last week (pp. 1109-1114).

Mr. F. W. Stevenson (London) said the address was a most instructive one, bristling with points of interest ; and it would be read very carefully when published. He had not known the President for so many years as some of the members had, but for two or three he had enjoyed an intimate acquaintance with him ; and he felt, when he was proposed as President, that no better man could have been selected, and that the prestige of the Institution would be maintained, if not enhanced, in his hands. Whatever difficulties might lie before them in the coming year, he was quite sure the President would guide them safely through them ; and he (Mr. Stevenson) had great pleasure in moving that the best thanks of the meeting be given to him for his address.

Mr. W. R. Herring (Edinburgh) expressed his pleasure in seconding the motion, which was carried unanimously.

The Proposed Amalgamation.

The President, having acknowledged the vote of thanks, said the next business before the meeting—and it was a matter of very great importance—was the question of the suggested amalgamation with the Gas Institute. Before asking for any expression of opinion on the subject, it might be well for him to give some slight outline of the reasons which prompted the Council to take action in this matter. If there were any present who thought the Council had gone too far, he trusted he might be able to show that they had not in any way pledged either themselves or the members to any special course of action. It came to their knowledge, early last November, that the governing body of the Gas Institute were prepared to discuss the question of amalgamation, and he, as President, was requested to seek an interview with the President of the Gas Institute, and ascertain his views. This he did ; and he also met the Honorary Secretary. On talking over matters, he was pleased to find that there apparently existed no reason why an amalgamation should not be brought about. He reported on the matter in a letter which was considered at a meeting of the Council, to which all former members and Past-Presidents were invited, so that it was a very representative gathering. The subject was carefully discussed, and a resolution was proposed (a copy of which was sent to the President of the Gas Institute) that, in the opinion of the Institution of Gas Engineers, provided that satisfactory rules governing the qualification of membership were drawn up, reunion or amalgamation was advisable. The Gas Institute adopted a similar course ; and a Joint Committee was formed, which met on several occasions, and drew up the set of rules which had been distributed among the members. And it now only rested with them to say whether they approved the action of the Council so far. It was not proposed on this occasion to pass any special resolution pledging themselves to dissolution, which was practically a *sine quâ non* to amalgamation. According to the rules of both Associations, it was impossible to deal with the funds of either except in one way. Any funds remaining, after paying all working expenses, were to be handed over to some Institution having similar aims and objects. It was therefore necessary that some Institution should be formed before the present ones were formally dissolved. It was therefore proposed that day to submit a resolution simply pledging themselves to the general principle that it was advisable, under certain conditions, that steps should be taken to bring about an amalgamation. The course which would then have to be taken was this : They would first have to call a special meeting to be held immediately after the meeting of the Gas Institute in June (providing that at that meeting the members of the Institute showed themselves willing and anxious to meet them in the matter), at which a resolution would be passed pledging themselves to dissolve. Meanwhile, steps would have to be taken for the formation of a new Institute. Not less than fourteen days, and not more than a month, afterwards it would be necessary to hold a confirmatory meeting (probably the two Institutions would hold such meetings at about the same time), when the resolution need only be carried by a bare majority. In the first place it would have to be carried by two-thirds of those present. Assuming that the meeting to-day decided that the scheme as proposed by the Council was the right thing, and that the Gas Institute did nothing to alter the circumstances, it would be a matter of course for the whole project to go through at the special meeting to be called in June. It only remained for him now to ask the members to express their opinions on this very important subject ; and he would ask them to do so with the welfare of the gas industry principally in mind—putting aside any personal motives.

Mr. George Livesey said, as he was one of the chief "delinquents" in causing the disruption, it might be appropriate that he should commence the discussion. It had been one of the great objects of his desire for many years to see the gas industry thoroughly united. Happily those who were separated into two distinct organizations still retained their old friendships. He thought it was due to one gentleman not present that he should say a word with reference to the possibility of reunion. He was informed some time ago by their old friend Mr. Sellers, that Mr. Bray would be quite ready to shake hands. Of course, as soon as he heard this he told him that he (Mr. Livesey) should be ready too. Letters passed between them ; and he must say that Mr. Bray, whom he had always regarded as an honest man, met him in a most honourable and fair manner. Not only that, but he went to the last meeting of the Gas Institute and told them that it was for them to command and for him to obey ; and, in the most handsome manner, he removed all possibility of difficulty on his part—in fact he (Mr. Livesey) believed him to have been an honest man all through. He did not know that he need say much more about the matter, except to give this movement his most hearty approval. He had read the rules suggested, and he must say he considered they were most complete and comprehensive. There was only one point which he thought could be improved, and that was that there might be some provision for enlisting the pecuniary support, at any rate, of gas undertakings—corporations and gas companies themselves. As far as he could see at present, the funds were to be provided entirely by the members. He had put a query against the annual subscription of two guineas. This, however, was a mere matter of detail ; but he thought it would be advisable to have some means of obtaining the pecuniary support of gas undertakings. He had received a letter the previous day from Mr. Cripps,

in which he put forward some very good ideas. His proposal was that the new Gas Institute, or whatever it was to be called, should be the leading technical representative of the gas industry throughout the world. He (Mr. Livesey) heartily agreed with that; and he could only express the hope that the labours of the President and Council, and that of the sister Association, might result in something of the sort. It was very necessary that they should be united, especially at the present time, when the difficulties which surrounded the gas industry were greater than ever. Thirty years ago, they had an absolute monopoly of lighting. Now they were met by the fiercest competition; and above all things it was necessary to present a united front, so as to maintain intact the great industry in which they were engaged, and not only that, but to see that it progressed with the times, and served the wants of the whole community better than it had ever done before.

Mr. W. Foulis (Glasgow) said he well remembered the separation of the two Associations, and what led up to it, for he believed he was President that year; and he considered Mr. Livesey had perhaps taken too much blame to himself when he said he was the greatest "delinquent." He believed that what led to the rupture was simply an incident. It had really nothing to do with the feeling which they all had as to the particular circumstances in which the Institute was placed. He had full sympathy with the two Associations joining, and thought the rules which had been drawn up by the Joint Committee were admirable. As far as he could see, they were rules under which an amalgamation might be effected with satisfaction to both bodies. One thing, however, should be perfectly understood—that, while they were prepared to amalgamate under these rules, there must be no attempt to go beyond that which might alter the whole condition of things.

Mr. T. B. Ball (Rochdale) thought, in the event of the discussion proving favourable to the abstract principle, the Council would submit a resolution to the meeting. He took it that they were not then going to discuss the draft rules which had been submitted, but to confine themselves exclusively to the question of amalgamation, assuming that the terms suggested were those on which it should be carried out.

The President remarked that, at the same time, if anybody objected to the rules, or had an improvement in them to suggest, it would be well to make it. The whole question was open for discussion.

Mr. Ball said, so far as they were concerned, he took it that any material alteration of the rules by the Gas Institute would leave them perfectly free to rescind any resolution passed that morning in favour of amalgamation. He thought they were all agreed that, in the abstract, amalgamation was desirable. They all retained their old friendship for members of the other Association; and he thought, with the rules as now drafted, such unhappy incidents as occurred previously would be practically impossible. Personally, he could see no objection to them; and he congratulated those who had drafted them on the success of their efforts. He should be happy to see the time when, under such rules, the members of the gas profession were all united in one body.

Mr. Charles Hunt (Birmingham) said he agreed with the previous speakers, and thought their thanks were due to the President and those who had co-operated with him in bringing forward a scheme which promised so well, though there were one or two slight matters to which he should like to draw attention. With regard to the last clause, providing for the formation of Local Sections, he should like to suggest that it might be desirable to provide for the representation of the Sections by the admission to the Council of the Chairmen and Secretaries. Then as to the name. It had been suggested that the name should be "The Institution of Gas Engineers and Managers." He quite understood the object of this; but, without any liking for the present name simply because it was the existing one, he thought it was preferable—either that or "The Gas Institute." The objection he should urge to the name "The Gas Institute" was that it implied a somewhat heterogeneous, and not a homogeneous, assembly such as they should hope to have hereafter. He belonged to the Iron and Steel Institute, which in that case seemed a perfectly appropriate name. The members were not all steel makers or iron makers; they consisted of anybody who had the remotest connection with iron, steel, or even coal. But in their particular case they had one object; and therefore he thought "Institution" would be the proper name.

Mr. R. Beynon (Torquay) said he was entirely favourable to the scheme; but he should like to know whether it would have any effect on the Gas Companies' Protection Association—whether it was intended that the new Institution should take up the duties of that Association as well.

Mr. Livesey said there was a difficulty about the duties of the Gas Companies' Protection Association being taken up by the Gas Institute or the Institution of Gas Engineers, because the Association was simply for the protection of Gas Companies; whereas the gas industry included almost an equal number of Corporations who were not members of the Association at all. When the Association was being formed, there were some members who expressed themselves rather strongly on this point—that if corporations were to be admitted to membership, they would not join. Unfortunately, Corporations and Gas Companies were too often in the position of antagonists—he did not say Corporations supplying gas, but those in towns where Gas Companies existed were very often in antagonism to them; and the Gas Companies' Protection Association might often have to oppose Corporations. He should like to see the whole thing all in one; but he was afraid this could not very well be.

The President then moved the following resolution: "That the members of the Institution of Gas Engineers, having considered the question of an amalgamation being brought about with the Gas Institute, are of opinion that it would be to the best interests of the gas industry that such a course should be adopted; and they therefore wish to express their approval of the action of the Council in the matter, and their desire that the necessary steps should be taken to carry out the proposed scheme."

Mr. S. Y. Shoubridge (Lower Sydenham) asked whether the small class of members, the associate members and extraordinary members, had been consulted in this matter, and had signified their approval.

The President said the Institution had only one honorary member—Baron Auer von Welsbach.

Mr. Shoubridge remarked that the Gas Institute had a large number.

The President said he could not attempt any explanation with regard to the Gas Institute.

Mr. Ball remarked that there was no reference in the resolution to the conditions under which the amalgamation should take place.

The President said he should take it, that, if they expressed approval of the action of the Council, it practically included the suggested rules.

Mr. Foulis thought they would all agree to amalgate on these terms; but this should be made quite plain.

Mr. Livesey pointed out that it was very common, when a Company were going to Parliament, to pass a resolution that the meeting approved of the Bill, subject to such alterations as Parliament might insist upon and the Directors might agree to. He said they did not want to bind themselves absolutely to the rules submitted, but only to the principle.

Mr. Foulis said the rules were not drawn up by them alone, but by a combined Committee of the two Associations. These were the rules submitted, and these were the conditions under which the Institution were willing to amalgamate. But they could not bind themselves to say they would amalgamate under any altered rules.

Mr. R. Morton (London) said they could not bind the Council not to interfere in the slightest degree with these rules. As one of the original members of the British Association of Gas Managers, he felt very keenly the disruption which took place some years ago; and he was very glad now to think there was a probability of there being a fusion of the two bodies.

The President thereupon read the following amended resolution: "That the members of the Institution of Gas Engineers, having considered the question of an amalgamation being brought about with the Gas Institute, are of opinion that it would be to the best interests of the gas industry that such a course should be adopted. They therefore wish to express their approval of the action of the Council, and of the rules drawn up by the Joint Committee; and they desire that the necessary steps should be

taken to carry out the proposed scheme, in accordance with the principles of the draft rules submitted to the meeting."

Mr. F. W. Stevenson (London) seconded the resolution. He said he had felt all along that the time would come when the two Associations would be amalgamated. It did not seem right that the gas industry should have two Associations; and now, as they all seemed to be of the same opinion, it would be a great pity if any hitch should occur. He believed the resolution would meet the feelings of the Council and of the members.

Mr. W. R. Cooper (Banbury), as one of the older members, greatly sympathized with any step which could be taken to bring the two bodies together; but he could not quite endorse the remarks of Mr. Foulis, when he said they must not in the slightest degree depart from the rules drawn up. The members of the Gas Institute were very different from their own members; and he was afraid that, if the rules as now submitted were to be held to as a cast-iron set of rules, they would not pass that body. He should therefore like it to be understood that they were holding out the olive-branch to the other Institute, and would do all they possibly could to meet them, and bring about a spirit of conciliation between the two, so that old friendships might be renewed, and that they might work harmoniously as one body, and become, as Mr. Livesey had said, the finest Gas Institution in the world.

The President said he quite appreciated the remarks of the last speaker; but he thought the resolution, as now worded, would allow the Gas Institute to make certain alterations without departing from the principle embodied in the draft rules.

The resolution was then put and carried unanimously.

Reading of Papers.

The reading of papers was then commenced. They were taken in the following order :—

Tuesday.—(1) "The Enrichment of Coal Gas." By George Livesey. (2) "The Calorific Power of Illuminating Gas." By Harold G. Colman. (3) "Inclined Retorts at Bankside." By C. C. Carpenter.

Wednesday.—(4) "Water Gas and its Recent Continental Developments." A Lecture by Vivian B. Lewes, F.I.C., F.C.S. (5) "The Presence of Naphthalene in Coal Gas: Its Detection and Extraction." By Wilfred Irwin. (6) "Notes on the Carbonization of Cannel and Shales for Gas-Making Purposes." By Samuel Glover. (7) "Some Examples of Tank Construction." By Fletcher W. Stevenson. (8) "An Experiment with a Concrete and Expanded-Metal Structure." By A. Baker.

The papers by Mr. Livesey and Dr. Colman, with the discussions thereon, and the lecture by Professor Lewes, will be found in another part of the "Journal." The rest will be given next week.

At the close of the discussions on Wednesday afternoon, the general business was resumed.

Appointment of Scrutineers.

The President said the Scrutineers last year were Mr. A. E. Broadberry, Mr. H. Iago, and Mr. W. E. Price; and he would propose that these gentlemen be re-elected.

The proposition was carried unanimously.

The Autumn Meeting and the Paris Conference.

The President said he had now to bring forward a matter which was of some importance—that of the autumn meeting. The question whether they should have such a meeting was somewhat complicated by the uncertainty which must naturally exist as to whether, when the time for it came, there would be such an Institution in existence as that of the Gas Engineers. From the unanimous manner in which the resolution had been passed on the previous day, he gathered that they all hoped there would be no such Institution. Still they must provide for the future. The question also raised a point of more importance than perhaps some might think—one of almost international importance. As most of them were aware, the Institution received some time ago an invitation from the gas authorities in France to attend and join in an International Conference to be held in September next in connection with the Paris Exhibition. A great many different opinions had been expressed, both in private and in public, as to whether Englishmen ought to go to Paris. The matter had engaged the very serious attention of the Council on more than one occasion; but it had been decided that they should formally accept the invitation of M. Vautier, the President of the Société Technique du Gaz, and he should like to hear from the members whether or not they approved of the action of the Council in this matter. It was useless to disguise the fact that great diversity of opinion existed in consequence of the action of a certain section of the Press in France in connection with political affairs and the war in South Africa. Personally, he did not agree with those who desired to gauge the character of the French people by the vapourings of the lower section of the Press, because he thought Englishmen would be very sorry to have their characters gauged by certain papers which they might see on the bookstalls any day, but which they certainly did not read, and took no more notice of than the better section of the French did of the wretched prints to which he had referred. There was some reason, no doubt, for the fact that Englishmen just at present were not in very good odour on the Continent, because the feeling was not confined to France. Almost everywhere there was a very great *consensus* of opinion on the question of the South African war. It was not for him to discuss this question; but he did think that in all matters connected with science, literature, or their own immediate industry, no attention should be paid to what had been said by some sections of the foreign Press. He should like the meeting to express an opinion that they would do all they could, by their presence and otherwise, to help to bring to a successful issue the International Conference in connection with the gas industry at the Paris Exhibition. The Institution had been invited; but it would be quite impossible for them all, as a body, to accept the invitation. There would be certain functions, no doubt, which would have to be attended, and a certain amount of hospitality would be offered; and therefore it would be necessary to dissever the two matters—the autumn meeting and the acceptance of the invitation by the French authorities. The members might decide to hold an autumn meeting in Paris; but it should be thoroughly understood that any acceptance of the invitation from the French Society would be simply confined to a deputation to be appointed in some way by the Council. He believed that other engineering and kindred Associations had adopted this principle of appointing a deputation to represent their particular industries; and no doubt this would be the case with the Institution. He would ask the members, therefore, first to express their opinion on the subject of an autumn meeting; and then he trusted they would be able to pass a unanimous vote in favour of the acceptance of the invitation of the Société Technique to the International Conference. He might add that the authorities in France were very anxious, among other things, to obtain photographs of gas-works in England; and if any gentlemen had views of their works, he should be obliged if they would send copies to M. Lebon, who was collecting them. The Council had appointed two corresponding members, of whom he was one and Mr. Marshall the other; and he found that among their duties they had either to prepare for, or read at, the conference a paper which it was preferred should be in French. He was afraid that neither Mr. Marshall nor himself was prepared to do this; but he had a letter from M. Vautier saying that they might get substitutes. If there was a member who had a subject which he could deal with in such a manner as to reflect credit upon the industry, he (the President) would be very glad if he would undertake to prepare and read it. It would be accepted in English, although it would be preferred in French. He regretted that Mr. Marshall was not present, because he knew he felt very strongly on this subject; and he had spoken lately with several people in high positions in England, who felt that they would be doing an injustice to themselves and to the country if they did anything which would militate against the success of the conference.

Mr. C. Gandon said that, from some knowledge of the Continent, he felt sure that, whatever was done by a certain section of the Press would not have any influence on the visit of the Institution. He was sorry to see that any suggestion should be made that, on account of what some people called the "gutter" Press, not only the Institution but Englishmen generally should abstain from visiting the Paris Exhibition. He thought this was a most

erroneous idea; and he felt quite certain that anyone who visited Paris would meet with a cordial reception. It occurred to him that scientific societies had no business to mix themselves up in politics. He should strongly support an autumn visit to Paris, and the acceptance of the invitation which had been received.

Mr. W. KING (Liverpool) quite agreed with the remarks of the President and Mr. Gandon that it would be very wrong to judge of their scientific French brethren from the outpourings of the vilest portion of the French Press. It was a matter which ought not to be discussed any longer. With regard to the other point, personally he had always received such kind hospitality from those connected with the Paris Gas Company, that he should look forward with great pleasure to a visit to the city. He did not think they could do better than abandon the idea of an autumn meeting, but either individually or collectively take part in this International Gas Congress which might be substituted for the autumn gathering. He hoped the Council would take steps to see that the Institution were represented and took part in the congress, which must be calculated to increase the good feeling between gas engineers of all nations.

Mr. C. E. BOTLEY (Hastings) said he was perfectly certain that whoever might be appointed to represent the Institution in France or Germany would be received with the greatest courtesy and hospitality. They ought not to mix themselves up with the attacks which had been made on the Queen or the Government by the "gutter" Press, but should follow the example of the Prince of Wales, who, he saw, had expressed his intention of going to Paris.

The PRESIDENT then moved the following resolution: "That this meeting endorses the action of the Council in accepting the invitation of the Société Technique du Gaz to attend the International Conference to be held in Paris in connection with the French Exhibition."

Mr. GANDON seconded the motion; and it was carried unanimously

The PRESIDENT said the next question was whether or not they should hold an autumn meeting.

Mr. BOTLEY suggested this should be left in the hands of the Council.

Mr. W. E. PRICE (Hampton Wick) supported the suggestion.

Mr. T. B. BALL (Rochdale) remarked that this would leave the matter in a state of uncertainty up to almost the last moment.

The PRESIDENT said the question seemed to be whether they should definitely decide to have an autumn meeting, and leave the arrangements in the hands of the Council, or leave with them the whole decision whether or not to have an autumn meeting.

Mr. T. MAY (Richmond) thought the latter question had better be decided now.

Mr. W. R. HERRING (Edinburgh) suggested that as the Gas Institute would be holding their meeting next month, the matter should be left in the hands of the Council to come to a decision before the end of June. In the event of an amalgamation of the two bodies taking place, it would probably be necessary to make arrangements for all the members visiting Paris at the same time, even though they might not be a united Institution by then.

The PRESIDENT said he believed the Gas Institute were going to take their excursion to Paris at the end of the June meeting.

Mr. HERRING said he understood there was some doubt about that. Possibly they might delay it a little.

The PRESIDENT said he thought Mr. Ball's suggestion was the best—that the matter should be left in the hands of the Council, with the understanding that, if there were an autumn meeting, it should be held in Paris some time during September.

Mr. BOTLEY said he would agree to this.

The resolution, in this form, was put and carried.

VOTES OF THANKS.

The PRESIDENT then proposed that the best thanks of the meeting be given to the President and Council of the Institution of Civil Engineers for their kindness in granting the use of the rooms of the Institution for the purpose of the meeting.

This was seconded by Mr. GLOVER, and carried.

The PRESIDENT then moved that the best thanks of the meeting be accorded to the authors of the papers, which this year had, he said, been an extremely good set, and had given rise to very useful discussions.

Mr. C. F. BOTLEY seconded the motion, and it was carried unanimously.

The services of the Honorary Auditor (Mr. Magnus Ohren) having been acknowledged,

Mr. G. P. LEWIS proposed a vote of thanks to the Council for their management of the affairs of the Institution in the past year.

Mr. GLOVER seconded the proposition; and it was unanimously agreed to.

Mr. BALL moved that the best thanks of the meeting be given to the President for his conduct in the chair.

Mr. GLOVER seconded the motion; and it was carried unanimously.

The PRESIDENT having expressed his heartfelt thanks for this renewed mark of confidence on the part of the members, and for the kind manner in which they had supported him during the past year, moved a vote of thanks to the Secretary (Mr. Thomas Cole).

The compliment having been suitably acknowledged by Mr. COLE, the proceedings closed.

THE LECTURE.

WATER GAS AND ITS RECENT CONTINENTAL DEVELOPMENTS.

BY VIVIAN B. LEWES, F.I.C., F.C.S.

Your President has honoured me by asking me to bring before you the details of the Dellwik-Fleischer process, which has practically revolutionized the use of water gas on the Continent for industrial purposes, and which is now playing an important part in several Continental gas-works. It was at the Bath meeting of the Gas Institute, in 1897, that I introduced the new-born babe to the notice of the English gas industry; and since then I have watched its early steps with increasing interest. The time having now arrived when all doubt with regard to it has been dispelled, I gladly accept the opportunity of detailing to you the most recent developments in Continental gas making practice, and the part which water gas is playing in regard to it.

I do not wish to weary you with an historical essay on the growth of water gas from Fontana's memorable experiment in 1770 to the present time; but I must ask you to bear with me while I go into the details of the European water-gas practice during the past fifteen years, in order to make clear to you the important developments the last decade has brought forth, and why it is that water gas now occupies a far different position to that which it did ten years ago.

Water gas, which is the name given to the mixture of gaseous products obtained by decomposing steam by incandescent carbon, consists of hydrogen and carbon monoxide as its main constituents, with traces of carbon dioxide, methane, and nitrogen as its impurities; and the early attempts to make it on a large scale all consisted of retort processes, in which charcoal or coke was heated to the highest attainable temperature while steam was passed through the incandescent mass.

The amount of heat, however, absorbed by the decomposition of the water so far exceeded the temperature generated by the formation of the carbon monoxide, that the exterior heat was seldom sufficient to keep the mass at a bright red heat, and the temperature of the fuel always rapidly fell; and as it was reduced, so the quantity of carbon dioxide in the gaseous mixture increased—the result being that no continuous retort process has up to the present time proved successful. It was only when Gillard, in 1849, first introduced the idea of blowing up the carbon to incandescence by means of an air blast, and then steaming the incandescent fuel to form water gas until the temperature fell to the point at which carbon dioxide began to appear, that any successful issue seemed probable in forming a completely combustible gaseous fuel from the solid carbon. After many vicissitudes in Europe and America, several Continental works, during the eighties, set up generators upon this principle of "blow and run." Perhaps the most successful form of generator was that adopted by Messrs. Schultz, Knaudt, and Co., at Essen, who employed the gas for

welding tubular boilers, and for lighting by means of the Fahnehjelm incandescent combs.

The form of apparatus installed by them, and which is still in use, consisted of what is practically a cupola furnace lined with firebrick, and with a constriction a short distance above the hearth; the firebrick being protected at this point by a water-cooled ring. The usual size of the generator was about 20 feet in height and 7 feet in diameter. The air blast was admitted below the water-cooled ring; and by "blowing" for about 10 minutes the ignited fuel was raised to incandescence, when the air blast was cut off and steam admitted above the top of the fuel. This, passing down through it, was converted into water gas, which escaped by the same opening through which the air blast was admitted; the inlet and outlet being opened and closed by means of a water-cooled valve slide of such construction that it was impossible for any explosive mixture of water gas and air to be formed.

This process was introduced in 1887-8 at the Leeds Forge, where, as at Essen, it was used for welding purposes; and also, to a limited extent, in the manufacture of steel by the Siemens-Martin process. In these installations, the fuel is first raised to incandescence by an air blast, which causes the combustion of a portion of the fuel and yields as a gaseous product the so-called "producer gas," which has the average composition—

	Per Cent.
Nitrogen	63·64
Carbon monoxide	29·33
Carbon dioxide	4·15
Hydrogen	2·88
	100·00

and which, although it only contains 32 per cent. of combustible matter, can be used as a fuel gas, provided it is burnt while still hot. In order to ensure the temperature of the fuel being raised sufficiently high for the production of 1000 cubic feet of water gas, the air blast has to be used for such a lengthened period that no less than 4000 cubic feet of producer gas is formed, which requires the combustion of over 44 lbs. of carbon from the fuel; and as the 1000 cubic feet of water gas contain about 15 lbs. of carbon, it will be seen that each 1000 cubic feet of water gas means the consumption of about 60 lbs. of carbon. These data have been calculated from analyses of the producer and water gas; but they have proved correct in practice. If the percentage of carbon in the coke used be taken in pounds per ton and divided by 60, the resulting figures will approximate very closely to the actual yield of water gas obtained from the particular quality of coke by the old process.

The average yield of water gas per ton of coke may be taken as 34,000 cubic feet; and although some observers have given lower figures, the quality of the coke must be taken into consideration. For instance, with a dirty and crumbly coke a longer blow is required, which, of course, means increased consumption of fuel.

A thousand cubic feet of water gas contain as the combustible constituents hydrogen, 2·75 lbs.; carbon monoxide, 30·00 lbs. The thermal value will be represented by—

$$(2{\cdot}75 \times 34{,}400) + (30 \times 2400) = 155{,}600 \text{ units};$$

while the thermal value of the 60 lbs. of coke used would be—

$$8080 \times 60 = 484{,}800 \text{ units.}$$

So that the thermal value of the water gas is only 34 per cent. of that of the carbon from which it was formed; and it is this loss which has proved so great a drawback to the economic utilization of the gas.

If, however, the producer gas can be utilized while it is hot, another 223,328 thermal units will be obtained; bringing the total calorific value of the two mixtures to 80 per cent. of the value of the carbon consumed in their formation. If this could have been carried out in practice, water gas would have no doubt proved successful. But when one considers that the processes of making producer and water gas are intermittent, and that four times the volume of producer gas is obtained as of water gas, it is evident that these drawbacks are difficult to overcome, as the producer gas would have required enormous storage space, and, after cooling down, is hardly worth burning.

When the present process for the manufacture of carburetted water gas was introduced, it became at once apparent that the producer gas—the loss of which had crippled all previous water-gas processes—could be utilized for raising chambers filled with chequer brickwork to a high temperature, in order to decompose the oils, to yield the oil gas which, mixed with the water gas, rendered the latter luminous; and it was in this way—by making the carburetted water-gas plant a perfect heat-machine—that its great success was achieved. In raising the fuel to incandescence, the producer gas, with all its heat in it, was at once burnt with a fresh supply of air in the superheating chambers; the practical loss of heat taking place throughout the whole apparatus being reduced to a minimum.

In 1896, Mr. Carl Dellwik introduced a modification in the process of making water gas, which entirely altered the whole aspect of the industry. In all the attempts to make water gas which had seen the light up to that date, the incandescence of the fuel has always been obtained by "blowing" so deep a bed of fuel that carbon monoxide and the residual nitrogen of the air formed the chief products; and it must be remembered that in the formation of carbon monoxide in producer gas, only 2400 heat units are developed per pound of carbon, but if sufficient air be present to burn the carbon to carbon dioxide, 8080 heat units are obtained—an amount which is 3·37 times as great. This is the principle upon which Dellwik devised his process, the main point of which is the adjustment of the air supply to the fuel in the generator in such a way that carbon dioxide is formed instead of carbon monoxide.

Under these conditions, the producer gas ceases to exist as a bye-product, and the products of the blow consist merely of the incombustible products of complete combustion—carbon dioxide and nitrogen; the result being that more than three times the heat is developed for the combustion of the same amount of fuel, and double the quantity of water gas can be made per pound of fuel than was before possible, and the runs or times of steaming can be continued for longer periods. In the old "European" process, it was necessary to blow for nearly ten minutes in order to bring the fuel to the correct temperature; while the period of steaming only lasted for from four to five minutes. But in the Dellwik process, the blow rarely exceeds two minutes; and it is possible to steam for from seven to ten minutes.

At first sight, it would appear that this plan must result in the formation of a considerable amount of carbon dioxide; but an examination of the gas soon corrects this idea, as is shown by analyses of samples taken at intervals during a run.

	I.	II.	III.
Hydrogen	52·43	50·09	52·76
Carbon monoxide	38·30	39·95	37·50
Carbon dioxide	4·73	5·38	4·08
Oxygen	0·74	1·22	0·46
Nitrogen	3·80	3·36	5·20

and as 5 per cent. of carbon dioxide in the unpurified gas may be looked upon as a fair average when using the old "European" process, these results are distinctly good. In order to make sure that no mistake was being made, analyses were taken during a long series of runs, and also from the gas in the holder, when it was found that the average came out at 4·58 per cent.; the highest being 4·9 per cent., and the lowest 4·2 per cent.

The Dellwik process has come at a moment when the general views as to the actions taking place during the combustion of carbon are undergoing a radical change; and no better example could be found to illustrate these views than the cycle of operations taking place in the generator during the two processes of blowing and steaming. The old theory is that when carbon is burned carbon dioxide is formed, and this carbon dioxide, in contact with more incandescent carbon, becomes reduced to double its volume of carbon monoxide. All such theory is now changed; and the work of Dixon, Baker, and others shows us that the direct combustion of carbon with oxygen yields only one oxide (carbon monoxide), and that this is the primary product of combustion, while this carbon monoxide, in contact with oxygen or any oxidizing substance, forms carbon dioxide.

Working under the old theory, a deep bed of fuel was taken in the generator, and the air current was driven into it; and it was considered that the dioxide was formed at the bottom of the generator, where the air was in excess, and that as the oxygen was used, so this became reduced to carbon monoxide, which was found in the producer gas in the upper portion of the layer. However, at the present time we know that, as long as there is no air in excess, carbon monoxide can be the only product of the action; and in all the old generators, a large excess of carbon as compared to the air being present, the temperature which could be produced was merely the temperature of the formation of carbon monoxide.

In the Dellwik plant, however, the conditions are reversed; and by lowering the height of the bed of fuel, keeping it at a constant level, and increasing the pressure under which the blast is driven through the heated coke, the air is kept always in excess, so that as carbon monoxide is formed by the primary combustion of the carbon, there is always sufficient oxygen present to oxidize the carbon monoxide to dioxide, and the total heating effect is increased more than threefold for the same combustion of carbon. In this lies one of the great secrets of the Dellwik process, as the fuel burnt for the same increment of temperature is less than a third of that used in the old process.

In the same way our ideas as to the chemical actions taking place during the formation of the water gas, as the steam passes over the incandescent fuel during a run, need modification. The formation of carbon dioxide in the water gas has always been explained by the assumption that there is a variation in the actions which take place according to the temperature of the fuel, and that at high temperatures the decomposition of the steam may be represented as :—

Steam. Carbon. Carbon Monoxide. Hydrogen.

$$H_2O + C = CO + H_2$$

while as the temperature of the fuel bed falls, the action approximates more and more closely to—

Carbon Dioxide. Hydrogen.

$$2H_2O + C = CO_2 + 2H_2$$

This view is, however, incorrect, and the carbon dioxide is not formed by the action of steam directly on carbon at all, but by the oxidation of the carbon monoxide first formed, and the actions should be represented by the equations—

$$(1)\ H_2O + C = CO + H_2$$
$$(2)\ H_2 + CO = CO_2 + H_2$$

Carbon monoxide begins to decompose steam, with conversion into carbon dioxide and liberation of hydrogen, at a temperature of 625° C.; so that at any temperature above this point, and below the temperature at which carbon dioxide dissociates, you always produce dioxide if an excess of steam is used, while at any temperature above that at which carbon decomposes steam, carbon monoxide only is formed, as long as no excess of steam is present.

The result of all this is that if as the temperature falls and the area of carbon sufficiently heated to decompose the steam becomes less and less, we reduce the inlet of steam in a slightly greater ratio, it is possible to make water gas from end to end of the run without any carbon dioxide at all—the only secret being that no excess of steam shall be present at any period of the operation. The result of the beautiful welding of theory and practice in this form of generator, gives us the power of producing 70,000 cubic feet of water gas per ton of carbon, as against 34,000 cubic feet with the old process; and, in consequence, a most important cheapening in the manufacture of the gas is achieved, and water gas is now the most important factor for economically obtaining high temperatures that the world possesses.

Leaving, now, the theory and practice of the water-gas generator, let us turn to the way in which the Dellwik process has been utilized on the Continent as an adjunct in coal-gas manufacture. In Germany, the duty on carburetting oils, and their consequent high price, has rendered the beautiful carburetted water-gas processes which have been so largely employed in England, practically impossible; and here we are now face to face with much the same kind of trouble. Owing to various causes, carburetting oil has increased in price to a pitch which threatens to make its commercial utility as an enricher practically *nil*. But, luckily for the gas manager, he is not bound down to any one process of enrichment; and when increased consumption or supposed security on the part of financial operators have led to an undue increase in price in one enricher, he can flit to another form of enrichment until the balance of supply and demand has once more had time to right itself. Cannel enrichment went up until carburetted water gas came in. Now, in turn, carburetting oils have all of them risen and we are beginning to look round to see what will enter by the door so opened.

During the past fifteen years, the gas manager has been lamenting the falling off in his profits, due to the rapid decrease in the price of benzol, which has been brought about by the large quantities produced in the coke-ovens which, in the old days, used to be burnt to waste, but is now recovered in the processes of coking which are becoming more and more universal. The amount of benzol which at the present time is being produced in Germany totals up to about 5 million gallons per annum; and this quantity will be increased more than fourfold as the various coke-works, which at present do not recover the bye-products, are forced by competition to erect recovery plant.

The wonderful carburetting power of benzol is well known, as we all recognize that a very large proportion of the total illuminating power of coal gas is due to the presence of a minute trace of its vapour carried in suspension; and with 90 per cent. benzol at its present price, it is far and away the cheapest enriching material that can be obtained. At several Continental works, they are making good use of the present low price to utilize it in the most effective possible way for cheapening and increasing their gas production.

Away on the shores of the Baltic, in Northern Prussia, close to the Russian frontier, stands the picturesque old town of Königsberg, celebrated in literature as the dwelling place of the great philosopher Kant; and here the scientific ability of Herr Director Krieger and of Herr Kobbert, the Chief Engineer of the Corporation Gas-Works, have led the way in the introduction of benzolized water gas as an adjunct to the gas manufacture. Producing the water gas from a pair of Dellwik-Fleisher generators, each capable of yielding 20,000 cubic feet per hour, the gas is passed through a scrubber into a relief holder. The water gas then flows in from the relief holder to the benzolizing-house, in which benzol supplied from a "Munich" reservoir at a suitable rate of flow, is vapourized in a Leybolt carburettor, and the vapour mixed with the water gas.

The benzolized water gas and the coal gas are at these works mixed at the entrance to the main gasholders, which ensures greater uniformity in composition in the finished gas. But it would, of course, be equally possible to mix the blue water gas and the coal gas as they enter the holder, and to benzolize the mixture as it left the holder for distribution, as is often done with Maxim-Clark carburine enrichment.

At the Königsberg works, they are blessed with a well-appointed chemical laboratory, into which pipes from the water-gas holder, benzolized water-gas main, coal-gas main, and outlet of holder are led, so that it is possible to check every stage in the process and to determine exactly what is taking place; and I have to acknowledge my indebtedness to the Director and Herr Kobbert for placing the experimental laboratory at my disposal, and rendering me every assistance in their power during my visit to Königsberg.

The conditions which led to the introduction of water-gas plant were that the works had grown to their full limit, and the holder capacity was only about 30 per cent. of the output. The water-gas plant is, therefore, used during the hours of consumption to add to the output. The candle power of the coal gas varies from 16 to 18·6 candles (18 to 21 Hefners), and the mixture as sent out varies from 18 to 19·5 candles (20·3 to 22 Hefners). This result is attained by the use of 20 grammes of benzol per cubic metre of mixed gas, or 0·139 gallon per 1000 cubic feet.

At the gas-works at Erfurt, which I have also personally visited and where I received the greatest courtesy from Herr Director Martin, the same process is in use with one small but important modification, and that is that the blue water gas, instead of being benzolized and then added to the coal gas, is passed into the foul main during the process of gas making. This was found to give a distinct saving in the amount of benzol afterwards needed in raising the candle power of the mixed coal and water gas, owing to the water gas becoming to a slight extent carburetted with the benzol in the tar vapours which otherwise would condense with the tar. The factors which may be taken into consideration in arriving at the economic value of the process for English practice are best stated as follows.

Using a good English gas coal and the ordinary heats, 10,000 cubic feet of 16-candle gas are obtained per ton of coal. Mixing this with 25 per cent. of blue water gas, the illuminating value is reduced to 12·4 candles; and to carburet this up to 16 candles once more, a gallon of benzol is required per 10,000 cubic feet of the mixture :—

7500 cubic feet of coal gas in holder at 11d. per 1000	6s.	10½d.
2500 cubic feet of water gas at 3½d. per 1000, including royalty	0	8¾
* 1 gallon benzol	0	10
Charges on carburettor, mixing plant, &c.	0	0¾
Cost of 10,000 cubic feet of mixed gas	8s.	6d.
Or 10·2d. per 1000 cubic feet.		

* I have taken the price of 90 per cent. benzol at 10d. per gallon; but it is quoted this week at 6d., and last week was even lower.

So that, when increase in volume and not enrichment is the desideratum, it may be taken that a saving of ¾d. per 1000 cubic feet is obtained; and where the initial cost of coal gas is greater than 11d. per 1000 cubic feet in the holder, the saving is, of course, increased.

It is well at this point to consider how far the experiments which have from time to time been carried out on enrichment by means of benzol support these really wonderful results, which seem to show that at the present moment, when any other form of enrichment costs from 1d. per candle per 1000 cubic feet upwards, 3·5 candles may be obtained at the same price by means of benzol. Benzol has a specific gravity of ·85. There are, therefore, 8·5 lbs. to the gallon, or 59·500 grains; and a cubic foot of benzol vapour, at 60° Fahr. and 30 inches pressure, weighs 1444 grains.

In a research upon the illuminating and enrichment value of hydrocarbons made about twenty years ago by Dr. Knublauch, then Chemist at the Cologne Gas-Works, he found that benzol, when used to enrich coal gas, had a value of 14·15 candles for a consumption of 120 grains; and taking these figures, a gallon of benzol has an enrichment value of 7017 candles.

In the Erfurt practice, one gallon of benzol is added to 10,000 cubic feet of the mixture of coal gas and water gas in order to raise it from 12·5 to 16 candles—*i.e.*, 3·5 candles, and $\frac{10{,}000}{5} \times 3{\cdot}5 = 7000$ candles, which is in exact accordance with Dr. Knublauch's determination. When it is desired to raise the candle power, enrichment will cost with benzol at 10d. per gallon, 0·3d. per candle per 1000 cubic feet; so that by this process a full 16-candle gas could be put into the holder at the same price as a 16-candle gas made directly from coal.

It must be clearly borne in mind that these enrichment figures are for the mixture of coal gas with 25 per cent. of water gas, and not for water gas alone. As early as 1878, the late Sir Edward Frankland and Dr. Thorne showed that when a definite quantity of benzol vapour was mixed with methane it gave approximately 33 per cent. more light than when mixed with hydrogen or carbon monoxide. Later on, Dr. Percy F. Frankland showed that the same phenomenon held good in diluting ethylene; while I have shown that with acetylene it is the same. In every case a higher illuminating power is obtained when a highly luminous hydrocarbon is added to methane, or a mixture containing a fairly high proportion of methane, than when hydrogen or carbon monoxide is used as the diluting gas. This, of course, holds good for water gas; a far higher illuminating power being obtained from the addition of a given quantity of benzol to coal gas with its 34 per cent. of methane than could be obtained from water gas by the addition of the same quantity—the original candle power of the coal gas being left out of the question.

When water gas is benzolized before admixture with coal gas, as is done at Königsberg, if the candle power is taken it is found to be only about 9 candles. Yet the addition of from 17 to 20 per cent. of this to the coal gas having a value of 16 candles will yield a mixture of over 17 candle power; the methane in the coal gas having brought out the illuminating value of the benzol in the water gas. It has been more than once suggested that a town supply of water gas carburetted with benzol might be sent out without admixture with coal gas; but this would require so much benzol that a carburetted water gas made by such a process as the "Humphrey and Glasgow" would be much more economical, as the oil gas used in this case to enrich the water gas contains sufficient methane to bring out the illuminating power of the unsaturated hydrocarbons present.

The flame of coal gas enriched by carburetted water gas is shorter and brighter than a flame of the same lighting power of coal gas alone. For instance, when burnt in the London argand at the rate of 5 cubic feet per hour, the flame given by a 16-candle pure coal gas is 3 inches in height; while when enrichment is secured by mixing with it 30 per cent. of a 22-candle power carburetted water gas, the 16-candle flame is only 2·6 inches in height. From this, it seemed highly probable that, when coal gas was diluted with benzolized water gas, the same shortening action on the flame might take place; but from experiments made at Königsberg, I was unable to detect any difference in the height of the two flames of equal illuminating value—one flame being the undiluted coal gas, and the other coal gas and benzolized water gas.

Another point of difference that must be borne in mind between carburetted water gas and benzolized water gas is that, with carburetted water gas of 22-candle power used as an enricher, almost any percentage may be used in admixture with coal gas without upsetting in any way the combustion of atmospheric burners such as are so largely used now for incandescent mantle lighting. While with benzolized water gas, it is inadvisable to use more than 30 per cent., as above that percentage atmospheric burners begin to show a tendency to flash back—*i.e.*, for the gas to fire at the gas injector at the bottom of the burner tube.

In connection with the process of benzolizing water gas, the question naturally arises as to how the enriched gas compares in travelling power with gas enriched by any other process. You have nearly all had experience in carburetting gas with carburine; and I think it may be accepted that it requires 1·25 gallons of this light hydrocarbon to enrich 10,000 cubic feet of coal gas one candle, while the same result can be obtained with 0·3 gallon of benzol. In other words, benzol is four times as valuable an enricher.

The vapour tensions of carburine and benzol, upon which their carrying properties depend, were given by Mr. T. S. Lacey in a valuable paper read before the Institution in 1892, as follows:—

Vapour Tension in Inches of Mercury.

Temperature. Deg. Fahr.	Carburine.	Benzol.
32	2·5	1·1
40	3·0	1·5
50	3·9	2·0
60	4·9	2·7
70	6·1	3·5
80	7·5	4·7
90	9·3	5·7

This shows that at the freezing point the gas will only carry less than one-half as much benzol vapour as carburine vapour. But as the benzol has four times the illuminating value of the carburine, the gas will show nearly twice as much enrichment with benzol under these circumstances as with carburine.

As regards the use of the mixture of coal gas and benzolized water gas for fuel and power, the difference in practice would be hardly perceptible—

Net Calorific Value.

Blue water gas	280·8 B.T.U.
Coal gas	573·0 ,,
Benzolized water gas	359·0 ,,
Mixture	544·8 ,,

I have only visited Königsberg and Erfurt; but I am informed that the process is either at work, or plant is in course of erection, at six other places, including Lyons. All the time that the price of carburetting oil remained at a reasonable figure, carburetted water gas has been a valuable ally to the gas manager; but now that its universal increase in price has caused gas men, even in America, to look with doubt upon the possibility of continuing its use, benzolized water gas bids fair to take its place, and to tide the gas manufacturer over the trying time that seems to be in store for him.

Great as has been the help afforded to the gas manager during the past ten years by the aid of water gas carburetted by the decomposition of oils in such perfectly arranged generators as those given us by the ingenuity and ability of American engineers, and great as the success of the present European practice of benzolizing a mixture of coal gas mixed with 20 to 30 per cent. of blue water gas promises to be, yet I feel that we now only stand upon the threshold of the domain in which water gas will prove itself an ally more powerful than any the gas manager has yet had.

So far, coal gas has well held its own. Confronted by the powerful rivalry of the electric light, the gas manager has developed the use of gas for fuel purposes, and by the aid of the incandescent mantle has carried the war well into the enemy's camp. But this was only possible with cheap gas. Any serious increase in price must of necessity militate against the gas industry; and with the rise in the cost of coal, one's thoughts are naturally turned with almost feverish anxiety to the possibility of reducing the cost of manufacture.

The day may come when all coal will be converted into gaseous matter at the pit's mouth, and the atmosphere cleansed by the universal adoption of gas as a fuel and a source of power. But the time is not yet ripe; and vested interests are too strong to make this likely in the near future. Any help that comes must be within the four walls of our

own gas-works, and to be of lasting service must be free from the uncertainty due to the fluctuating price of enriching materials. We hoped much from carburetted water gas, and we got a good deal; and now the rising price of oil has limited its utility. We hope more from benzolized water gas; and I have shown you the grounds for thinking that it will remain at a usable price. But are there no points that we have overlooked in our own practice? Is there no method by which we can more fully utilize the illuminating materials stored within the coals that we carbonize? I think the answer is in the affirmative.

The process of carbonization, which is the heart of the whole system, has undergone no practical change from the inception of the industry to the present time. Iron has given way to fireclay as the material of which our retorts are made, and, as a further tribute to progress, some of us tilt our retorts to allow gravity to take some of the work off our hands. But the changes going on within the retort as heat divorces the constituents of the coal into the products we know so well, are so complex, and so beyond our ken, that we have looked upon carbonization as something too sacred to tamper with. We know that as we distil the coal about 17 per cent. of its weight comes off as gas, and that another 5 per cent. goes to form tar; and many have been the attempts to utilize tar once more for the production of hydrocarbon gases—it being realized that there was more carbon combined with hydrogen in the 140 odd compounds that go to build up the 10 gallons of tar than was present in the 10,000 cubic feet of coal gas that we obtain from the ton of coal, and that if this tar could be again gasified, an enormous gain in illuminating power could be achieved. I need not dwell upon the result of these experiments, as you all have them by heart. But there is another side to the question at present practically untouched, which shows a wonderful field of promise.

Any worker in the laboratory will tell you that the addition of a small quantity of a solvent to a liquid will often prevent the formation of a precipitate; while, when once the precipitate is formed, far greater difficulty is experienced in obtaining its solution. We may apply this to many of the constituents of tar which, formed by the overheating of the gases distilling from the coal as they pass along the crown of the retort, can never again be properly gasified; while had the proper means been taken to prevent their formation, the constituents would have remained as valuable illuminants in the gas, and have been ten times the value to the gas manager that their products are to the tar distiller.

If bituminous coal is distilled at a low temperature, the tar is found to contain considerable quantities of light paraffin oils; and there is no doubt that paraffin hydrocarbons are present in the original coal. These paraffins, under the influence of heat, split up into simpler members of the same series and into olefines; and if we imagine the action in its simplest form, we should have the gases as they were evolved consisting of (say) ethane and ethylene. These have now to pass down the heated retort on their way to the ascension-pipe, and the contact with the heated sides of the retort, and the baking from the radiant heat in the retort, set up an infinity of changes.

Ethane, when heated to this degree, splits up into ethylene and hydrogen; while ethylene decomposes to methane and acetylene, and the acetylene at once polymerizes to benzene, styrolene, retene, &c. A portion also at the same time condenses and, losing some hydrogen, becomes naphthalene, and the compounds so formed by interactions among themselves build up the remainder of the hydrocarbons present in the coal tar; while the organic substances containing oxygen in the coal break down, and cause the formation of the phenols in the tar.

There is very little doubt that the general course of the decomposition follows these lines. But any such simple explanation of the actions taking place is rendered impossible by the fact that, instead of the breaking down of the hydrocarbons being completed in the coal, and only secondary reactions taking place in the retort, in practice the hydrocarbons to a great extent leave the coal as the vapours of condensable hydrocarbons, and that the breaking down of these to such simple gaseous compounds as ethylene is proceeding in the retort at the same time as the breaking up of the ethylene already formed into acetylene and methane, and the polymerization of the former into higher compounds. Starting with a solid hydrocarbon of definite composition, it would be theoretically possible to entirely decompose it into carbon, ethylene, methane, and hydrogen, and, by rapidly removing these from the heating zone before any secondary actions took place, to prevent the formation of tar. But any such ideal is quite hopeless in practice, as the coal is not a definite compound, and it is impossible to subject it to a fixed temperature.

If the retorts are at a temperature of 1000° C. when the charge of coal is put in, the temperature of the distillation will vary from about 800° C. close to the walls, to about 400° C. in the centre of the coal; and in the same way in the space above the coal the products which come in contact with the sides of the retort are heated to 1000° C., while the gas near the coal is probably only heated to 600° C. Hence we find that the tar is formed of two distinct sets of products—the first due to incomplete decomposition, and the second to secondary reaction due to the products of the decomposition being kept too long in the zone of heat.

We can at present do nothing to prevent the formation of the primary products in the tar. But I believe it is easy and possible to prevent the building up of the secondary compounds, and this would at once give a great increase in illuminating power to the gas. Consider for one moment the conditions existing in the retort, and then ask yourselves how it is possible to look upon the present method of carbonization as a rational process likely to give uniform or satisfactory results. Every foot of gas that comes from your retort has been subjected to different conditions of temperature—partly radiant heat and partly heating by contact with the red-hot sides and top of the retort—and every portion of the gas has been exposed to the heat for a varying length of time.

The portion of gas yielded by the first few feet of coal in the retort is hurried out by the rush of gas from the coal behind it, and reaches the ascension-pipe in nearly the condition in which it left the coal; having only been exposed to heating in the gaseous or vaporized state for probably one or two seconds at most. On the other hand, the portion of gas from the charge farthest from the mouth of the retort has had at first nothing to hurry it on, and only begins to travel quickly in the retort as its bulk is swelled by mingling with gas from the portions of the coal over which it has to pass, with the result that it takes probably a minute before it reaches the ascension pipe. During this period, it is not only baked by the radiant heat, but is also decomposed by contact with the heated retort surface during a travel of something like 10 feet. Between these two extremes, every portion of the gas is made under different conditions of time and temperature, while, if the coal is not fed properly and banked at the end of the retort, or if you are using machine-fed double-ended retorts and there is a slack portion or space between the ends of the two charges, you have the finest naphthalene factory in the world.

You know by experience that if you fill your retorts so as to leave only the minimum of space above the coal, the naphthalene trouble disappears simply because the area for the passage of the gas is small and the gas-yielding material large in quantity, with the result that the rate of flow of the gas is rapid and the period of baking minimized; and you also many of you know that if you only put a 3-inch layer of coal at the bottom of your retort, and use the same temperatures, you would have a surfeit of choked ascension pipes and naphthalene all over the district, because, by increasing the area for the passage of the gas, you slow down its flow and expose it to the baking for a longer period.

If you could divide the charge in the retort into three portions, and could keep the rate of flow the same as at present, and yet keep the gases from each portion separate, you would find that the portion nearest the mouthpiece gave you nearly all the unsaturated hydrocarbons present in the gas; from the second you would obtain methane and a trace of benzene; while the back end of the retort would yield practically nothing but hydrogen, naphthalene, pitch, lamp black, and retort carbon—in other words, you are wasting half the illuminants obtainable from the coal.

I have been for some years making experiments and collecting the data which bear me out in the facts I am now bringing before you; and in bringing forward what I consider a satisfactory solution to this important phase of gas manufacture, I shall not propose any radical alterations in your plant or methods that would entail any prohibitive or even great expenditure.

In a paper I had the honour to read before you in 1892, on the use of oil for carburetting gas, I pointed out that "on a manufacturing scale, better results may be obtained by 'cracking' the oil vapours in an inert gas—such as

hydrogen, carbon monoxide, or water gas—which, by separating and partly protecting the molecules during their decomposition by heat, increase the range of temperature within which the best results can be obtained, and prevent excessive breaking down of the hydrocarbons and consequent loss of illuminating value." That this is the case, is shown by the following experiment. A known volume of coal gas was taken and passed through a porcelain tube, packed with broken pieces of the same material, and heated to a bright redness. A copious deposition of carbon was the result; and the gas, after cooling, burnt with an almost non-luminous flame. The same volume of coal gas was now diluted with twice the volume of hydrogen, and was passed, at the same rate of flow as before, through the tube heated to the same temperature, when only 1-200th of the amount of carbon was deposited.

Ample verification of this interesting and important fact can be obtained from data collected in carburetting water gas in several of the best-known systems, in which the oil vapours are carried by the hot water gas through heated chambers in which the decomposition of the oil vapours to permanent gases is effected, and yields results which could not be approached by making the oil gas and water gas separately and afterwards mixing the two.

Taking, for instance, the Russian distillate oil, the best results obtained by cracking it by itself were 92 cubic feet of 46-candle power gas per gallon, which is equal to 846·4 candles per gallon; while the same oil, when cracked in a current of water gas in the improved Lowe apparatus at Beckton, yields, according to the figures given by Mr. Goulden in his paper read before this Institution in May, 1891, no less than 1200 candles per gallon, or an increase of nearly 42 per cent.

The working from which Mr. Goulden quotes these results, however, was on a very large scale, and under the best conditions. In order, therefore, to obtain comparative results, it was necessary to contrast the result obtained by cracking the oil alone and also in the presence of an inert gas under precisely similar conditions.

For this purpose, oil was cracked alone in a short experimental retort and collected; while, after a time—the rate of flow of oil and temperature being kept constant—a slow current of hydrogen was allowed to flow in known quantity through the retort, and the resulting mixture of gases collected in a separate holder. The results so obtained were—

Distillate oil cracked alone yielded per gallon 84 cubic feet of 42·2-candle power gas = 709 candles.

Distillate oil, cracked in an atmosphere of inert gas, yielded 92 cubic feet of 53·8 candle power gas = 989·9 candles.

There is no doubt but that this method of obviating over-decomposition by heat can equally well be applied to coal gas. Indeed, fifty years ago the secret of making this considerable saving was nearly won; and had there been anyone at that time who clearly grasped the actions taking place during carbonization, I should not have had the pleasure of bringing these ideas before you to-day.

Some of you will still remember White's hydrocarbon gas, over which a heated controversy raged in the early fifties. White connected two retorts end to end, heated them to the highest temperature he could, and made water gas in one by passing steam over red-hot charcoal. He then decomposed resin in the second retort, and washed out the resin gas as it was formed by the water gas mixed with steam. At a later date, he abandoned resin and substituted cannel coal. The late Sir Edward Frankland, then commencing his career as a Chemist, made an exhaustive series of experiments with the plant, and obtained such remarkable results that attention was fully aroused to its importance. But the results obtained by other observers did not bear out the promise of its youth. Later on, Mr. Thomas G. Barlow fully examined the process and found the cause of the discrepancies, but showed that the technical drawbacks then existing rendered its practical application extremely difficult, and the process sank into the lumber room of the past. Fifty years of work, however, have wrought a great change, and the difficulties then existent have now disappeared. The mistakes made by White are perfectly manifest; and the time is ripe, knowing what we are aiming at, for us to utilize the principle that underlay his method.

It is clear that what he was doing was to hurry the products of the destructive distillation of the coal out of the baking influence of the retort, by pushing them forward by the stream of water gas, which not only increased their rate of flow, but, by diluting the hydrocarbon molecules, prevented them from polymerizing and breaking down.

Some of the results obtained by Frankland were extraordinary. For instance, retorting Methil cannel under ordinary conditions in his experimental retort, he obtained 9560 cubic feet of 27·8-candle power gas per ton; while using water gas, he got 26,400 cubic feet per ton of 21-candle power gas. Mr. Barlow did not obtain such good results, but still came to the conclusion that properly worked the gain would be 40 to 50 per cent. in the total illuminating value.

Looking back to the methods employed, the wonder is not that observers differed, but that they got any result at all. Instead of being able to exactly apportion the volume of water gas to the volume of cannel gas distilling from the coal-retort, the supply of water gas was most irregular, varying from 160 to 870 cubic feet per hour, and generally giving the largest yield when the smallest quantity was required; while the cardinal error that wrecked the whole process was that steam was injected with the water gas under the impression that it would attack and destroy the tarry matter. In point of fact, it partly attacked the illuminants, but chiefly devoted itself to oxidizing the carbon monoxide into carbon dioxide, with the result that 16 to 20 per cent. of the latter was often found in the gas, and had to be removed by lime purification before satisfactory illumination could be obtained—a detail which effectually also removed the profitable bearing of the scheme.

In order to successfully carry out the process that I now bring before you, and which consists in hurrying the gas out of the zone of heat and diluting it by a stream of water gas, the water gas used must contain but little carbon dioxide and no free steam, and must be heated to nearly the temperature of the gas in the retort. For this purpose, the Dellwik-Fleischer water-gas generator offers enormous advantages, as not only does it produce the water gas at one-half the price of an ordinary generator, but, properly worked, it does so with a remarkably small percentage of carbon dioxide. Many of the experiments I have made with it give less than about 3 per cent., while the average, working over a long space of time, is below 5 per cent., and by a very slight modification in the handling of the plant it could be reduced down to the same amount as is present in crude coal gas. Moreover, should there be even 5 per cent. of carbon dioxide in the water gas, contact with the hot tar vapours in the retort would reduce it to carbon monoxide, so that this would not add anything to the cost of purification.

From the generator, the water gas is led, as usual, to the relief holder, which need only be of comparatively small size, as it is intended to act more as a regulator than as a store. From this, mains are led along the front of the bench of retorts; a pipe passing from the main to each mouthpiece, where it can be led in by the side of the ascension pipe and along the crown of the retort in such a way as not to interfere with charging and drawing. Some 2 or 3 feet from the mouth of the retort, small holes are drilled in the underside of the delivery pipe; and these holes are continued at intervals of some 6 inches to the end of the pipe, which is left open, and is either at the rear of a single-ended retort or at the middle of a double-ended one. While between the water-gas main and the mouthpiece of the retort is a valve by which the supply of water gas can be cut off or regulated.

In carbonizing, as soon as the lid is made tight, the water gas is turned on, and the flow regulated in amount to about 20 to 30 per cent. of the yield of gas from the coal in the retort; and for the first four hours of the carbonization the water gas is kept flowing at about this rate. At the end of that period, the water gas can be reduced, either to a very small flow or cut off altogether. As the gas yielded during the last hours of the charge is only coming from the small portions of uncarbonized material in the centre of the lumps of coal, and having to pass through the casing of red-hot coke that surrounds it, it is rendered practically worthless except for bulk before it escapes from the mass.

From this brief description of my ideas, you will see at once that the expense and the amount of alteration necessary are very small; and I firmly believe that the gain will go far towards neutralizing any loss that the increase in the price of coal may entail in the near future. It must be remembered, however, that results such as those obtained by Frankland, who showed a gain amounting sometimes to nearly 200 per cent., must not be expected, as you are

dealing with ordinary gas coal and not with a rich cannel; and I think you will agree with me that if this modification of the process of distillation will enable you to make 13,000 to 14,000 cubic feet of gas per ton of coal of the same, or 1 candle better, quality than you are now producing, and with the increment in volume only costing 3d. to 4d. per 1000 cubic feet, a step of the most enormous importance will have been taken, while any further increase of illuminating power that is needed can easily be obtained by merely benzolizing the gas.

I conceive that the function of a lecture such as I have had the honour of delivering to you this morning is either to bring before you the details of new processes which have been employed beyond the range of your personal observation, or to afford food for thought and experiment during the quiet period before us, and I can only hope that on the present occasion I have succeeded in doing both.

The PRESIDENT proposed a hearty vote of thanks to Professor Lewes for his lecture. The members had not only had an intellectual treat, but had heard something which had interested them, and had put into their minds hopes for the future. He could not help saying that what Professor Lewes had stated would in all probability be tried before very long by many of them. It was, of course, easy to tell them how a thing ought to be done; but it was not so easy for them to put it into practice. He had shown them that the theory of the thing was correct; and he (the President) had no doubt that in a few years he would see it put into practice.

Mr. GEORGE LIVESEY, in seconding the proposition, said he thought he was the only one who knew practically anything of Stephen White's process. It was one of his first duties, as a lad under his father, to record the experiments made under that process. He could well remember Stephen White and Dr. Frankland, as he then was, carrying out these experiments. There was one thing he desired to point out. They tried to remove the oxygen by passing it over red-hot iron. They filled the retorts with red-hot old iron chains, &c.; but he had never before heard the version of carbonic oxide as set up by Professor Lewes. He thought they were very much indebted to the lecturer for bringing out this point. It was just what they wanted—the means of making gas on their own premises in large quantities without being so largely dependent on the supplies of coal. Professor Lewes said the theory about the tar was to prevent its formation. Forty years ago it was said that the lines on which they ought to work were to prevent the tar from being produced. The increased scientific knowledge which Professor Lewes had brought to bear on the subject now confirmed this view. He (Mr. Livesey) had great pleasure in seconding the vote of thanks. They were much indebted to the Professor, and he hoped good results would follow from his lecture.

The resolution having been carried unanimously, amid loud applause,

Professor LEWES said he had to thank the members, as he had so often done in the past, for their kindness in listening to him. He could assure them they had at the present time an epoch in gas manufacture, when they had a demand for theory as well as practice. They had reached a point in gas making where they knew almost everything that was to be known in methods; and the opening of new doors must to a considerable extent depend on theorizing. He hoped he had not let his hobby-horse run too freely; but he thought that, in the ideas he had put before them, they really had the gist and the germ of a most important point of progress. It was interesting to him to know that Mr. Livesey had to do with White's process in the early fifties. As long as they had the water gas hot, and put in the right proportion, while they had a rush of gas coming off the retort, they would find that they would be doing what they required—they would be getting over the naphthalene trouble. If they filled up their retorts, they would have no naphthalene produced; but if they put 3 inches of coal in them, they would have a glut in the ascension-pipes, as there was no time for the taking up of naphthalene. If there were 3 inches of coal in the retort, they had a big area; and the baking of naphthalene went on briskly. If they left a space between the two ends, he thought the practice would tell them they got naphthalene formed in very considerable quantities. He tendered his thanks for the hearty vote accorded to him by the members of the Institution.

PAPERS READ.

THE ENRICHMENT OF COAL GAS.

By GEORGE LIVESEY.

The original object of this paper was to question the advisability of supplying gas of higher quality than can be obtained from the available supply of coal. A wider scope may, however, be given to the inquiry, because the great extension of the uses of gas now in progress, and the enormous development of its light-giving power by the incandescent system, raise the question whether the object should not be to supply gas at the lowest possible price regardless of its illuminating power. In short, is not the time within measurable distance when non-luminous gas will be the great desideratum of the public? If so, should not the necessary educative process be energetically undertaken, and at once? Our Transvaal of ignorance and prejudice, manifested in the antagonism of local authorities towards gas companies, must be conquered if the best is to be done to meet the needs of the consumers of gas.

The policy of half-a-century has to be reversed. The question of illuminating power was first brought into prominence by the advent of the Great Central Gas Company, for the supply of the City of London in 1850, when gas of 12 wax or 10 sperm candle power at 4s. per 1000 cubic feet was offered in competition with the gas of the Chartered and the City Gas Companies at 6s. per 1000 cubic feet. In 1853 special voluntary arrangements for testing were made by the four South London Companies when they districted; and by the Metropolis Gas Act of 1860, a standard of 12 sperm candles, and provisions for testing, were adopted. Since that date Parliament has recognized as a public necessity that the gas supply must be a monopoly; and almost always local authorities have opposed the grant of parliamentary powers to gas companies, with the object of restricting capital, reducing price, and increasing illuminating power. With the last mentioned they have been particularly successful, presumably because it has been most erroneously supposed that the cost of any increase of illuminating power must be borne by the companies; and the result now is that almost everywhere, and particularly in London, partly by alterations of the photometer, enrichment is increasingly necessary—the required quality not being obtainable from the available supply of coal.

To ascertain whether such enrichment is advisable, the following questions need an answer: 1. What are the various forms or methods of enrichment? 2. What is their relative effectiveness as to (*a*) Uniformity? (*b*) Reliability or permanence? (*c*) Cost? 3. Is the enrichment worth to the consumer what it costs him?

1.—Many methods of enrichment have been tried—the idea of getting it from coal tar has fascinated many minds, and is as old as the public supply of gas; but it never has held, and certainly does not now hold, the field in any of its forms. The direct destructive distillation of oil has also given promise of satisfactory results, but has made very little headway. There are, in short, only three systems in general use—viz., by an admixture of cannel with the coal to be distilled; by the injection of the vapour of petroleum spirit into the gas prior to its being sent into the district; and by the manufacture of a percentage of carburetted water gas.

2. Relative effectiveness. Cannel secures uniformity in the quality of the mixture, and is both reliable and permanent; but its cost puts it out of court. When cannel was available at the price of ten to twenty years ago, it was generally considered that the cost—taking into consideration its price and the loss on coke, &c.—of each additional candle was quite 2d. per 1000 cubic feet. It went out of use because the increasing demand put up the price to a prohibitive figure, and would do so again immediately if it were to come into demand as an enricher.

Enrichment by petroleum spirit costs about 1d. per 1000 cubic feet per added candle. Benzol at its present price is perhaps a little cheaper; but although, probably, spirit vapour can be mixed with tolerable uniformity, it appears to be unreliable, and cannot be regarded as permanent—that is, there is no certainty that the gas will carry this vapour enrichment throughout the area of supply, and in condensing it probably carries down with it some of the hydrocarbon of the gas. Reliable evidence as to its want of efficiency is furnished by the fortnight's experiment in

1894, when all the South Metropolitan gas was sent out unenriched, and the succeeding fortnight, when it was enriched with spirit as usual. The tests by the portable photometer were practically the same in both cases. The portable photometer results—although, as an instrument, it corresponds exactly with the official photometer—cannot be accepted as accurate, because the instrument is used under improper conditions. Still, when compared with itself under similar conditions (as in these two series of tests), the comparison holds good. Therefore, if this complete practical experiment gave, as is believed, reliable results, the conclusion is inevitable that enrichment by spirit vapour is useless, and simply a waste of the consumers' money.

Enrichment by carburetted water gas is involved in some obscurity as to cost. Those who use it, for some reason, carefully abstain from giving the necessary particulars in their published accounts. The suspicion consequently arises that it is not so cheap as its advocates wish it to appear. But suppose, for the purpose of this paper, and in order to avoid discussion on this interesting point, that its cost is about the same per added candle as petroleum spirit, or 1d. per 1000 cubic feet, which, in itself, would not be a serious objection to its use as an enricher. Neither can it be urged that it is not a permanent gas. The objections to its use lie in other directions—viz., the public prejudice as to the danger of its use, owing to the deleterious nature of carbonic oxide; its greater specific gravity and lower calorific value; and the practical difficulty of ensuring uniformity in the mixture of coal gas and water gas, when the latter is used as an enricher. For instance, 75 per cent. of 14-candle coal gas would need 25 per cent. of 22-candle water gas to give an average 16 candles by calculation, or perhaps rather more in practice, if (and this is the point) uniformly mixed. But how can this uniform mixing be ensured? The quality will, in all probability, be constantly varying, owing, it may be, to the difficulty of mixing, or, it has been said, to stratification while standing in the gasholders.

At any rate, there are serious objections to all three methods of enrichment; for while the cost of cannel puts it out of court, spirit is useless from its uncertainty and want of permanence; and carburetted water gas is objectionable from its nature and the difficulty and uncertainty of mixing. And although hitherto its cost may not have been excessive, the recent more than doubling of the price of oil (which is far more likely to be permanent than the present increase in the price of coal) will very likely render the continuous use of carburetted water gas impracticable.

Such are the principal objections and disadvantages of enrichment. The arguments in its favour must be left to its advocates. Certain it is that for a very large proportion of the gas consumed, it is a useless expense. No one can seriously argue that the slightly higher calorific value of enriched gas, even if the enrichment reaches the consumers, is desirable for heating, cooking, power and trade, or manufacturing purposes. A lower price rather than the higher quality is what consumers want; and as to incandescent lighting, experiments made in Germany (and corroborated in England) have proved that with the Welsbach burner the light actually increases as the illuminating power of the gas diminishes.

To illustrate this point, diagrams showing the result of the German and the English experiments have been prepared; for to a fact of such great importance special prominence must be given. Further, consumers have it in their power, even with ordinary burners, to increase or diminish the light obtained from the gas to a far greater extent than the difference produced by enrichment.

In illustration of this point, the burners (flat flame) of fifty consumers taken indiscriminately, who lately complained of a bad light, were tested. The illuminating power yielded by these burners ranges from 6 to 17 candles. The gas used was of 16-candle power, burnt on the best conditions as to pressure and quantity for obtaining the most light—more than the consumers would obtain, because they would not burn under those conditions. Of the fifty burners, the highest result per foot of gas, calculated to 5 feet per hour, was 16·9 candles, and the lowest was 6 candles. There were three over 16 candles, two under 7 candles, and 15 (or 30 per cent.) under 10 candles. These complaints, as is the case with all others, were remedied, not by increasing the illuminating power of the gas, but either by changing the burners or improving the supply of gas. To this audience it is unnecessary to refute the absurd statements of Mr. Dibdin in his recent evidence—that, with flat-flame burners, a reduction of 1 candle necessitates the use of 18 per cent. more gas to obtain the same amount of light, and 35 per cent. more for 2 candles below 16 candles. At this rate, by the time the gas reaches 10 candles, with the standard argand, it is an interesting question whether there would be any light with a flat-flame burner. This is a striking instance of what some men imagine they can prove by their experiments.

There is yet another strong reason against enrichment. The best kinds of gas coal are becoming scarce, and inferior gas-making seams are becoming more and more the source of supply. If, therefore, the policy of pressing for higher illuminating power is continued, or even if the present standard is maintained, the cost of coal must permanently increase. The price of gas must rise, and gas undertakings generally must necessarily drift more and more into the power of the coalowners. They are just now giving us an idea how they would use that power.

Lighting Effect by Incandescent Burners, and Fuel Value of Coal Gas Deprived of Illuminating Power.

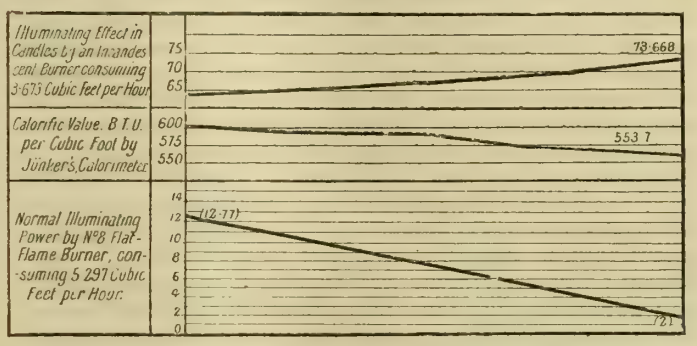
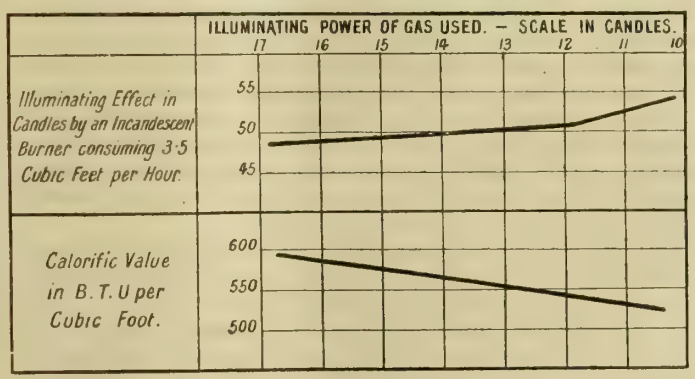


Diagram prepared from experiments made at Dessau, in May, 1899, by Herr Schaeffer, under the direction of Herr W. von Oechelhaeuser, with an Auer mantle previously used for 300 hours. The gas was progressively deprived of its benzol by being passed through "green oil."



Tests made by the South Metropolitan Gas Company, April, 1900.

Present experience shows that when coalowners have the power they do not scruple to use it, with few exceptions, without the slightest consideration for their old customers who have treated them fairly in the past. Their present conduct will not be forgotten when the inevitable depression in trade returns; and they will probably have cause to rue it. The moral for the gas industry is that it must, by all means in its power, free itself from their grasp, by widening the area whence it draws its raw material.

Everything, happily, points to the reversal of the policy of high illuminating power of the last half-century. Enrichment is costly, difficult, and uncertain. Consumers do not want it. Their desideratum now is an abundant supply of cheap gas of low illuminating power—its calorific value having become its most necessary quality; while the slowly increasing difficulty of getting suitable coal, renders a reduction necessary. The conviction in its favour among gas manufacturers has grown most strikingly during the last six or seven years; and it is for them to take the lead in the movement, for they are the only men who understand the question. Attacked intelligently and persistently by them, prejudice and ignorance must yield, though it may be some time before the entanglement of our Ladysmith is relieved. The gas industry is hampered and confined by the bonds which were thought

necessary to protect the public from a monopoly 30 or 40 years ago. Gas supply then was truly a monopoly; for as a means of producing artificial light gas was practically without a competitor, and it was used for little else than lighting. Within the last 30 years, two active and formidable lighting competitors have entered the field; and gas is, as it were, bound with the grave clothes of the dead past, while its opponents are free. Gas asks for fair play—for the abolition of useless restrictions that hamper its development, and that were imposed in the supposed interest of the public; but whatever may have been their use in time past, they certainly now (heating gas being chiefly wanted) work to the public disadvantage. The chief of these restrictions is the requirement to give a higher nominal illuminating power than can be obtained from the available supply of coal; and the removal of this limitation to freedom of action is the pressing necessity of the immediate future.

Discussion.

Mr. W. Foulis (Glasgow) said one thing had struck him—viz., that the experiments the results of which appeared on the diagram certainly did not correspond with some which he made several years ago. Probably the difference was due to the method of adjusting the air and gas supplied to suit the different qualities of gas. He found that, within certain limits, there was a slight increase as the quality rose, and this was what one naturally expected. But unless the air supply of the bunsen burner were properly adjusted, one could quite understand that there would be a reduction in the illuminating power. He had great sympathy with what Mr. Livesey had said. In Scotland they had not yet reached so low as 16-candle gas; but he well remembered that some years ago, when the parliamentary standard was 25 candles, and he proposed that it should be reduced to 20 candles, he was opposed by nearly every gas engineer in the North—and he was not sure that some in the South did not also object; and it was with the greatest difficulty that they fought the question through Parliament. It was said that what would happen would be something terrible—the pipes would be too small, the consumption would go up some 25 per cent., the works would be inadequate, and generally the whole of the gas affairs in Glasgow were to be revolutionized. However, they reduced the quality from 25 to 20 candles; and the pipes were not too small, the accounts did not increase, and the complaints diminished enormously. There might be a difficulty in reducing from 16 candles to something less; but he certainly did think that making a rich quality of gas with a rapidly diminishing supply of the material for producing it, was not to the advantage of the consumers themselves.

Mr. S. Meunier (Stockport) said he thought the most important remark in the paper was: "A lower price rather than a higher quality is what consumers want." This was amply borne out by experience. Coal and oil had increased enormously, and other expenses had also gone up generally. Then, on the top of this, the gas consumer, especially the one who used gas for industrial purposes, had a further bill to pay. He (Mr. Meunier) did not know how far it would affect the southern districts; but in manufacturing towns, where large quantities of gas were used, and where they had industrial consumers paying from £500 to £1000 per annum for gas, it was a very material question. In the cotton-spinning industry, especially in the doubling and gassing departments, there was an enormous quantity of gas used; and he felt certain that a very much lower quality than that now supplied would be of far greater advantage to these consumers. The cost to them of an increase in price would be enormous; and if they could overcome the present need of a higher price by slightly reducing the illuminating power, it would not be only to the interest of the consumers but to that of the companies. He did not wish to say anything about the cost of carburetted water gas, but he should like to add one remark—that, although they might not appear in print, careful accounts were kept; and he had been surprised, in comparing notes with some of his friends, to find how closely they approximated. He quite confirmed the experience of the South Metropolitan Gas Company with regard to the poor burners generally used by consumers as being one of the main conditions incident to lowering the quality of gas. In his own town, they supplied 18½-candle gas; but the light afforded to many of the houses was nothing like what it ought to be. It was quite a common occurrence to have complaints, which they rather encouraged—not that the gas was bad, but that the light was bad; and almost invariably, when the burners had been attended to, they never had a recurrence of the complaint. He could not help thinking that the plumbers were very much to blame for simply putting on the first thing that came to hand. The cost of gas need not be so high, especially considering that they now had the incandescent mantle, that coal was not likely ever to be again so cheap as it had been, and in view of the difficulties they would have to contend with in the opposition of the electric light, which was rapidly improving.

Mr. W. R. Herring (Edinburgh) thought the members would all agree with the general principle propounded in the paper. Some months ago he was prepared to raise the question of reducing the illuminating power of his gas from 25 to 20 candles; but he had not then seen the current year's coal contracts. They revealed the startling fact that the difference between his supplying 15-candle gas, such as they obtained from the ordinary coal they used, and the present 25-candle gas only amounted to 3d. for the 10 candles. The ordinary coal cost 15s. 6d., and the average worked out to 18s. 6d. per ton. They were in a peculiar position, being near the cannel-fields. Cannel cost 28s. a ton; and he found from experience that the so-called 30-candle cannel gave an enriching value of about 40 candles. It was nonsense to suggest reducing the illuminating power under conditions like these. But where people were far away from the cannel-fields, no doubt they should be allowed to supply gas from the coal most suitable in the locality. He believed that if the money now spent upon testing-stations and experts were allotted to gas inspectors at £2 a week, to go about with their pockets full of gas-burners, it would do far more good to the public.

Mr. J. Stelfox (Belfast) said the author, with his usual ability, had been advocating the reduction of the illuminating power of gas; and probably he was quite right, from his point of view. But he (Mr. Stelfox) could not say that his experience agreed with Mr. Livesey's that the public were satisfied with lower-power gas.

Mr. Livesey remarked that the public did not ask for a lower-power gas; they wanted cheap gas. They did not know anything about the power.

Mr. Stelfox said they thought they did, and that was worse. When managers had to give 17 or 18 candle gas, it became a question which was the cheapest form of enrichment. He did not know why Mr. Livesey should suppose that coal was going to come down and oil to stop up; and he saw no reason to think that one would be more permanent in price than the other. At the present moment, the rise in the price of coal meant much more than the advance in the cost of oil. This was borne out by the fact that corporations and companies were almost weekly rushing in for water-gas plant in order to get rid of the coal difficulty. He was about equally interested in the two materials, and should be glad to see both come down to a normal figure. It was very awkward when one had to go from large contracts for oil at 2d. per gallon up to 3¼d., and in a few weeks to 4¾d., and in some cases higher. He believed, even to the London Gas Companies, 6s. or 7s. a ton in the price of coal would mean more than doubling the cost of oil. A remark had been made about the price being about equal for water gas and coal gas; but in these figures the water gas, as he understood, gave 4 or 5 candles more illuminating power than the coal gas, and therefore did not get as much credit as it should do. They were not now buying cannel, and were thus relieving the coal gas from an expense which would otherwise increase its cost.

Mr. S. Glover (St. Helens) said he could not agree with the principle of reducing the illuminating power of gas, though he thought it would be right to proportion it so as to enable gas companies to use to the best advantage the supply of coal in their own neighbourhood. He could not accept the statement that they were within a measurable distance of the time when non-luminous gas would be required, because he could not get over the fact that local authorities who supplied their own gas took blame to themselves when, from some mishap, they found they were not supplying the quality they were accustomed to. In London, the general practice of using bad burners perhaps required alteration; but it was a fact that consumers very commonly found out when the quality of gas was reduced, as gas engineers who represented corporations well knew. The author had almost ignored the present position of

benzol, because it did not support the argument about the desirability of doing away with enrichment, and also the possibility that when scientific men were faced with a difficulty they found other ways out of it than running away. The conditions regarding the use of cannel had been altogether altered by recent practice. There was no doubt benzol was being produced in very large quantities; and its present price was certainly lower than that of petroleum spirit. He was surprised to find they were asked to assume that there was no argument to be adduced to show that carburetted water gas was not permanent. The experience of Mr. Botley at Hastings was that, even when turning out his conglomeration of oil vapour and water gas, a certain scrubbing effect was going on in his mains, which prevented the need for so much oil being vaporized by his special apparatus. This proved, as it appeared to him (Mr. Glover), that carburetted water gas was not permanent. He did not think that enrichment to the proper point was useless to the consumer. He certainly agreed with Mr. Foulis's remark with regard to the results attained by different experimenters from incandescent gas-burners. It must be known to everybody of experience that the results which were obtained could be affected very largely by altering either the air supply or the gas supply; and he should conclude that in the German experiments the supply of the gas and air to the burner was not perfect, and even in the case of Mr. Carpenter's experiments with gas from 17 to 12 candles, probably the proportion of gas to air for the quality of gas used was not right for the particular burner. The heat-giving power of a flame must be useful when it was properly developed. There was one point which had been ignored perhaps too much in discussing this question, but he was always reminded of it when competition with the electric light was mentioned. If one did not maintain a supply of gas of good quality, the poorer gas had to be burnt in much larger quantity; and they were therefore turning into the rooms of the consumers very much greater quantities of the products of combustion, which they ought to try to prevent. Mr. Stelfox had referred to the difficulties he had experienced from the increase in the price of enrichers in proportion to that of the ordinary quality of coal which was employed to make the bulk of gas. But the consumers wanted good gas which would give them good illuminating power when used with proper burners; and they obtained greater efficiency from a smaller quantity of gas of high illuminating power than from a larger quantity of lower. In fact, there were many strong objections to reducing the illuminating power from that to which people were accustomed.

Mr. C. E. Botley (Hastings) said it had not been his intention to take any part in the discussion; but he could not allow the statement made by Mr. Glover to go unchallenged. He certainly had a "conglomeration" of ideas on this subject. If he (Mr. Botley) had claimed anything, it was that carburetted water gas should be made permanent; and in a discussion which took place some time ago with regard to another matter, he said it was quite possible to make it *un*permanent. They, however did not do this at Hastings. The various modes of enrichment, which unfortunately they had to employ, would depend on the circumstances of the particular locality. In the South they were differently placed from anyone in the North. Their general standard of illuminating power was 15 candles; and during last winter, owing to the difficulty of getting coal, he found the cheapest mode of enrichment was the use of cannel. Not having the coal, he was obliged to make more use of oil; and, in order to bring his gas up to the proper illuminating power, he had to enrich with cannel, and he found, to his astonishment, that it was cheaper than enriching it with carburetted water gas. He had been very pleased to listen to the paper. As usual, Mr. Livesey had struck out some new ideas. He (Mr. Botley) had thought many times that the old views of testing imposed upon them should not be maintained now that the monopoly no longer existed. They had great competitors, and why should they not be put in the same position as any other trader—that they should give the best they could to the public, and let the public judge? If they could get gas cheaper than the electric light, and as good, they would use it; if not, they would use the newer light. He thought possibly the time might be approaching when tests for illuminating power should not be enforced, but only those for purity.

Mr. F. D. Marshall (Copenhagen) said he might add one remark on the question of oil. To find the origin of the rise in price, he must go back to the blessed Peace Congress at the Hague. Ever since that, the world had never seen such preparations for armaments going on as they were witnessing at the present time; and the result was that there was a shortage of fuel all over the globe. Russian agents were going everywhere to obtain fuel, and could not get anything like the amount they wished for. America was also short. The boom in the steel trade was something enormous; and, as long as this was going on—and it seemed likely to continue for some years—there must be scarcity of fuel. The crude oil at one time was almost a waste product; and he remembered buying it at 2d. a gallon. But they would never see this price again, because Russia, who had really the largest supply, was putting a restriction on the export, and would continue to do so. She had been seeking to supply with coal her ports in the China Sea and her coal depôts, but was absolutely unable to do it; and Germany was trying to do the same thing. The coal supply failing them, they were having recourse to the natural product of their own country—oil; and he was afraid, in case of preparations for war in this country, the export of oil from Russia would be permanently stopped. They had America to fall back upon; but the boom in the steel trade in America was colossal, and the American engineers, finding the shortage of coal, were turning their attention to altering the flues of their furnaces so as to utilize oil. He believed the days of cheap oil had departed never to come back. He had coquetted with water gas for many years, but had never screwed up his courage to propose; and he did not think he should be able to do so now.

Mr. E. A. Harman (Huddersfield) said he could scarcely follow the argument of the author, that if the policy of pressing for higher illuminating power was continued, or even if the present standard was maintained, the cost of coal gas must permanently increase. It seemed to him that if they were to make poorer gas from inferior coal they would require a very much larger quantity of material; and therefore the demand for coal would be greater than if they were making a higher quality of gas.

Mr. Charles Hunt (Birmingham) said he did not agree with the last speaker on the coal question. The demand for a higher quality of gas meant a demand for a better class of coal; and as this was worked out, they were driven more and more to the inferior coal, which produced an equal quantity of gas of lower illuminating power. He quite agreed with the policy enunciated in the paper, as a measure of permanent economy—that enrichment should be avoided as far as practicable, and that gas should be supplied of the quality which could be derived from the coal generally in use without enrichment. They would shortly be told that the time was coming when gas would not be judged by its illuminating power, but by its heating properties; and he thought they ought to be prepared for this, even at the present time. The rapid strides which the incandescent system was making proved that the heating value of gas was what had to be considered; and there could be no question whatever that gas of lower illuminating power gave proportionately higher calorific value than rich gas. If, however, they were driven to use means of enrichment, he thought the least satisfactory was carburine—the light spirit derived from American petroleum. Some years ago, when they employed it rather largely, he frequently had samples brought to him, from the syphons in the vicinity of the works, showing that there was a deposit of hydrocarbons immediately beyond the works. He did not think this was the case with benzene; and he felt sure it was not with carburetted water gas. The difficulties which might be expected in the future with regard to the latter gas had been referred to; and this only showed that they must not pin their faith too much to any one thing. They heard last winter of a company's undertaking where carburetted water gas had been applied in the hope that it would save them from a coal famine; but they had an oil famine instead. Gas managers must therefore apply themselves to any form of enrichment or manufacture which might be presented to them, and use it as opportunity served and price allowed.

Mr. Livesey, in reply, said he must express himself as very pleased indeed with the discussion, and was glad there had been something said on both sides. What Mr. Foulis had stated about the supply of air to the incandescent burner was perfectly true; but the point he (Mr. Livesey)

made was that, taking the 16 or 16½ candle gas with which the consumer was supplied in London, or the 13-candle gas sent out in Germany, reducing the illuminating power with the burner the consumer used he obtained more light. The inference seemed to be that, with the burner as sold by the makers for use with these qualities of gas, the supply of air and gas was not properly adjusted, and that by reducing the luminosity of the gas they got a proper adjustment—at any rate, the consumer would benefit.

Mr. GLOVER asked by what means the illuminating power of the gas was reduced.

Mr. LIVESEY said he believed it was by passing it through heavy oils. At any rate, some of the hydrocarbons were taken out. Of course, they could not make gas of 10-candle power under the present arrangements. His point was that, with a lower quality of gas, with the ordinary burner, the consumer got a better light than he did with gas of the normal quality. He had read with great interest Mr. Herring's paper before the Royal Scottish Society of Arts, and there saw that he suggested a reduction in the illuminating power. He (Mr. Livesey) was in perfect accord with him. If any enrichment was necessary, they must use those means which enabled them to attain it most effectively and cheaply. Mr. Botley found last winter that cannel was cheaper than water gas, and used it; and Mr. Herring found cannel was relatively cheaper than common coal at the present price, but at the ordinary figure common coal would be much cheaper. Cannel had not gone up in price anything like proportionately with common coal; but if everybody were to use cannel for enrichment, things would be very different. The only reason why cannel had gone down somewhat from the figure of ten years ago was because carburine and other things had taken its place. With reference to non-luminous gas, he had been told by Mr. Webber, who had lately visited North Germany, that they were going strongly in that direction, and that 85 per cent. of the lighting was done by incandescent gas-burners. If they had 85 per cent. of the lighting and all who used gas for manufacturing purposes, and required only calorific value, high quality ought not to be kept up. The remaining 15 per cent. of the consumers would have to fall in line with the rest, who wanted gas as cheap as ever they could get it. Mr. Hunt said he thought benzol did carry; but gas would only carry a limited amount of benzol. The remark about carburetted water gas being estimated at 1d. per candle for each candle added was based on their own cost of coal gas. It all depended on the circumstances in which it was used. Enrichment was very troublesome and unnecessary; and it would be to the interest of the consumer to do away with it. What Mr. Marshall had said about the price of oil entirely confirmed the information he (Mr. Livesey) had been able to obtain. He had been in communication with large importers of oil, and they told him that the American supply was not sufficient, that it was falling off and that the demand was greater than ever, and that the Russian Government were increasingly using it as fuel; and his friend said he thought there was no probability of oil ever coming down to its old price. Now, he did not believe that coal would be permanently higher; he thought the time would come when there would be a depression in trade. He was informed about a month ago, by an official connected with the iron trade, that they had passed the summit. Meeting him again a few weeks after, and asking him if he still held the same opinion, he said he did, emphatically. Then he (Mr. Livesey) put another question: "Would the American supply of iron come in?" His friend said he wished he could answer that inquiry; but his emphatic opinion—and he was a man who knew as much about the iron trade as anyone—was that the trade had passed the summit. He (Mr. Livesey) therefore quite thought they might expect a reduction in the price of coal within a reasonable period.

THE CALORIFIC POWER OF ILLUMINATING GAS.

By HAROLD G. COLMAN.

In the earlier days of gas lighting, when the gas was used almost entirely for illuminating purposes, the physical property which was of the first importance was its illuminating power; and endeavours were continuously made to determine this with as high a degree of accuracy as possible. At the present time, however, a very large and constantly increasing proportion of the gas output is employed for purposes in which calorific power is of greater importance than illuminating power; and the importance of an accurate knowledge of the former has therefore greatly increased. It is, indeed, quite possible that before long the calorific power of the gas supply may become of even greater importance than its illuminating power. Until comparatively recently, no simple and rapid method of directly determining the former has been available, although the calorific power of various gases, including coal gas, has been ascertained by several scientific investigators, including Favre and Silbermann, Berthelot, and Stohmann. The apparatus then employed was not, however, suitable for technical purposes, although a modification of Berthelot's calorimeter, devised by M. Mahler, has been employed in France, by M. Aguitton,* who examined the calorific power of gas, the illuminating power of which varied from 5 to 15 candles. In most cases where it has been desired to estimate the calorific power, this has been done by making a complete analysis of the gas, and calculating the calorific power of the gas from that of its constituents. This method is far from satisfactory, as not only is the making of a complete analysis of the gas a tedious process, but it is not easy to get accurate values for those constituents which have to be determined by explosion. Further, no means are known of determining the exact composition of the hydrocarbons absorbed by bromine or fuming sulphuric acid; and as these have, for equal volumes, the highest calorific value of any of the constituents, a considerable error is possible in the calculated value.

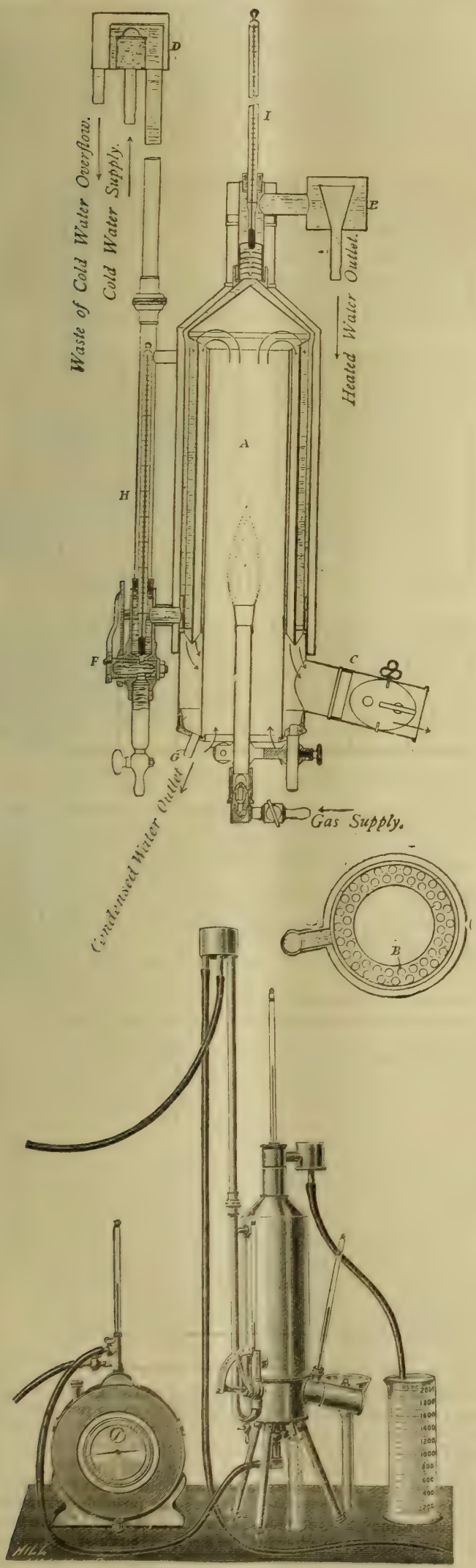
About ten years ago a new calorimeter was devised by Herr Junkers, of Dessau, which, from the published description, appeared likely to afford a quick and accurate method of ascertaining the calorific power of gases. After several years' experience, the author finds that the instrument does satisfactorily accomplish this end; the time required to complete a test being about the same as for an illuminating power test with candles. As the instrument may not be familiar to everyone present, a description of its construction and method of working is here given.

The principle on which the apparatus acts is that the heat generated by the flame of the burning gas is transmitted to a current of water flowing at a constant rate; and measurements are made of (1) the quantity of gas burned, (2) the quantity of water passed through the apparatus, (3) the difference in the temperature of the water on entering and leaving the apparatus, and (4) the amount of water condensed from the products of combustion. The construction of the apparatus will be readily seen from the accompanying illustrations. The flame of burning gas is introduced into a combustion chamber formed by an annular copper vessel A; the annular space being traversed by a considerable number of copper tubes B, connecting the roof with the bottom of the chamber. The products of combustion pass through these tubes in a downward direction; while the water current passes outside them in the opposite direction. The waste gases are thus completely cooled to the temperature of the water, and pass through the side-conduit C into the atmosphere. The water which condenses from the products of combustion falls to the bottom of the apparatus, and thence through the small tube H into a measuring glass.

The pressure of water is kept constant by means of the two overflows D and E; the water being run into the upper one D, at a greater rate than it passes through the calorimeter, the excess running to waste through the overflow-pipe. Similarly, the water on leaving the apparatus has to pass over the top of the funnel in E; thus maintaining a constant head of water, resulting in a uniform flow of the liquid through the apparatus. The rate of flow is regulated by the cock F. Before entering the calorimeter, the water passes over the bulb of the inlet thermometer H; and after traversing the annular chamber, flows through a series of baffle-plates to ensure thorough mixing before it reaches the thermometer I. Thence it reaches the overflow E, and is collected and measured. To prevent radiation, the whole body of the instrument is enclosed in an air-jacket formed by a polished or plated copper cylinder.

In making a test, the water is first turned on, and when it is running from both overflows, the gas is lighted and

* See "Comptes Rendus," CXVII., p. 56; also "JOURNAL," Vol. LXII., pp. 355, 402.



JUNKER'S CALORIMETER.

burnt at a rate of 4 to 8 feet per hour, and the speed of the water regulated by the cock F; so that the difference in temperature between the inlet and outlet thermometers is 10° to 20° C. As soon as the difference is nearly constant, and the condensed water is dripping regularly from the pipe G, the test may be commenced. This is done by waiting till the gas-meter index passes any particular point (which is noted down), and then quickly introducing the outlet water-tube into the measuring vessel, and placing a measuring cylinder under the condensed water outlet. Readings of the inlet and outlet thermometers are then frequently taken. The author's practice is to read the former every minute, and the latter every half-minute, and to continue the test until about 1 cubic foot of gas has passed; a measuring vessel being chosen for the water which holds the requisite amount. As soon as this is filled to a fixed mark, the gas is shut off and the measuring cylinder removed from the condensed water-pipe.

The calculations are extremely simple. The unit taken is the larger calorie, which is the amount of heat required to raise a kilogramme of water 1° C., and the results are calculated to the number of calories yielded by the combustion of 1 cubic foot of gas. The calorific power is therefore found by the equation:—

$$\left.\begin{matrix}\text{Cal. power of} \\ \text{1 cubic foot}\end{matrix}\right\} = \frac{\text{vol. of water in litres} \times \text{diff. in temp.}}{\text{gas consumed.}}$$

Taking a particular example, the following figures were obtained:

Temperature of gas, 62°; barometer, 29·8; water used, 8·0 litres; gas consumed, 0·935 cubic foot = 0·924 at 60° and 30-inch barometer; condensed water, 21 cc.

Therefore the gross calorific power

$$= \frac{8{\cdot}0 \times 18{\cdot}3}{0{\cdot}924} = 158{\cdot}4 \text{ calories per cubic foot.}$$

This, therefore, is the calorific power of the gas when the water formed by the combustion is converted into the liquid state in the calorimeter. In the condensation of the aqueous vapour, the whole of the latent heat of the latter is given to the water flowing through the instrument, and this is therefore included in the gross value. As, however, this latent heat of the aqueous vapour is scarcely ever utilized in industrial processes, it is necessary, in order to obtain the true calorific power with all the water formed escaping as steam, to deduct from the gross value an amount corresponding to the quantity of condensed water. Each cubic centimetre of condensed water has evolved a quantity of heat which may, for most purposes, be taken with sufficient accuracy as 0·6 calorie; and therefore this number multiplied by the number of cubic centimetres of water condensed, and divided by the gas consumed, gives the amount which must be deducted from the gross value to obtain the calorific power with the steam remaining in the gaseous state, usually termed the net calorific power. Thus, in the above example, 21 cc. of water were condensed, and the quantity to be deducted is—

$$\frac{0{\cdot}6 \times 21}{0{\cdot}924} = 13{\cdot}6 \text{ calories;}$$

making the net calorific value 158·4 − 13·6 = 144·8 calories. If it is desired to express the results in British thermal units, the number of calories must be multiplied by 3·97.

From the point of view of testing, the determination of the calorific power is much more satisfactory than that of illuminating power. In the latter case, in spite of all improvements, an absolutely accurate and constant standard of light has yet to be discovered; and, further, the illuminating power of the same gas varies according to the construction of the burner employed and the rate at which the gas is burned. The measure of the calorific power is the number of degrees by which the temperature of a certain weight of water is raised; and both of these can be ascertained with very great accuracy. The calorific power is also independent of the burner and rate of burning, so long as combustion is complete. Moreover, the unavoidable personal error is much greater in determining the equality of light of two illuminated surfaces than in reading off the height of a thermometer, or in measuring the volume or weight of water used. Photometrical observations are considerably affected by atmospheric conditions; but these have hardly any effect on the net calorific value, as determined by the calorimeter, although an error of 1 per cent. or so may be made in the determina-

tion of the gross value, if the atmosphere be exceptionally dry.

In the tables given in the appendix will be found a number of results obtained with the instrument, together with the illuminating power of the gas examined; the chief object of the investigation being to determine the manner in which the calorific power of gas corresponds with the illuminating power. The first column in Tables I. to IV. gives the illuminating power, determined with the Methven screen, and the second and third the gross and net calorific power. The number of calories (gross and net) corresponding to each candle of illuminating power are given in the fourth and fifth columns, and show the variation in the calorific power for the same illuminating power. For convenience, these figures giving the calories per candle may be described as the "calorific" ratio.

Table Ia. gives the results of a month's test of the gas sent out from one works. It will be seen that, for the same illuminating power, the gross and net calorific ratio varies to the extent of about 11 per cent. This variation is rendered very evident if the results are plotted into a curve; the curves for the gross and net ratios being, as would be expected, of a very similar character. The tests here given are only a small portion of those which have been made; but these all show very similar results, and the average of all tests of coal gas, which is given at the bottom of the table, very nearly agrees with the average of those given in detail.

Table Ib. gives the results with the coal gas supplied from a second works, using different coals. The average calorific ratio is distinctly higher than in the first case; but the variation is rather greater—viz., 12 per cent. in the gross and 13 per cent. in the net value. Here also the curves for the net and gross ratios are of a similar character.

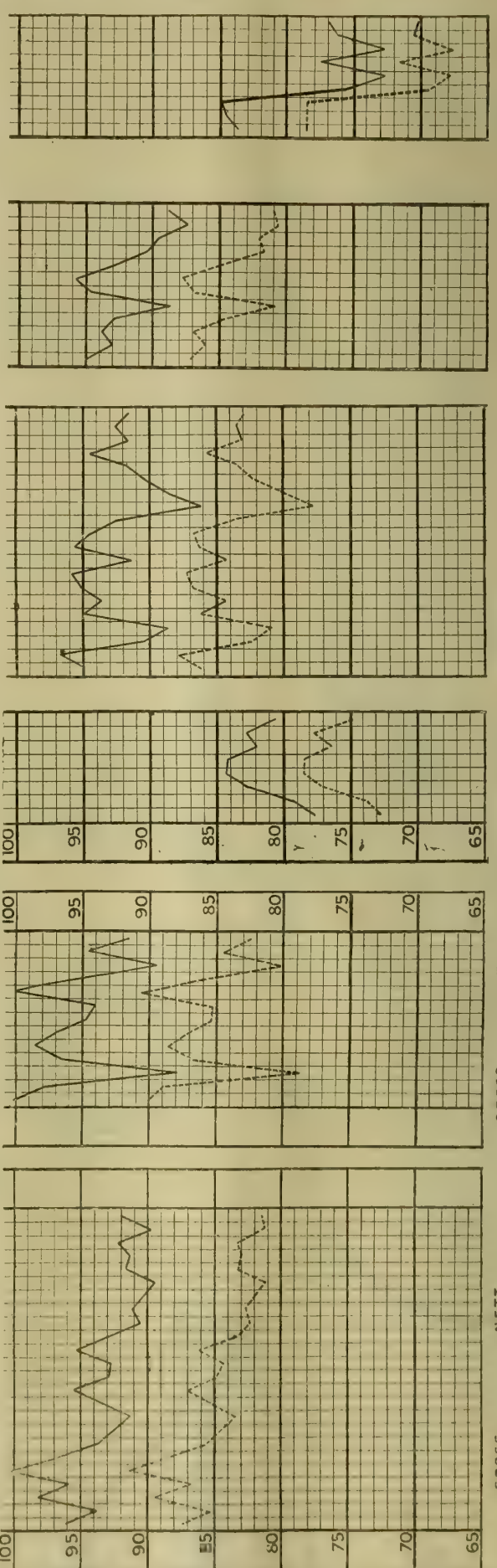
In Table II. will be found the tests of the illuminating and calorific powers of the gas from a number of different coals and cannels; these being tabulated in order of their illuminating power. The average value of the gross calorific ratio in the case of the coal gases is rather lower than that shown in Table I., while that of the net ratio is almost the same. It will be noticed that, in the case of gases having an illuminating power of about 18 candles, the calorific ratio has a falling tendency, which is very much more marked when we come to cannel gases having an illuminating power of 22 to 33 candles; these showing, on the average, 11 per cent. gross and 14·5 per cent. net less calorific power than the coal gases. Between the cannel gas showing the lowest ratio and the coal gas showing the highest, there is a difference of no less than 24 per cent. gross and 23 per cent. net.

The above results are not in agreement with those of M. Aguitton, which have been already referred to. He examined the illuminating and calorific power of gases varying in quality from 5 to 15 candles, and found that the calorific ratio was almost constant. Possibly this may be the case with gas of low quality; but it certainly is not true of gas having an illuminating power of 17 candles upwards.

Turning from coal gas, Table III. contains a few results obtained with carburetted water gas, the quality of which was in most cases from 16·5 to 18 candles. As this gas gives less water on combustion than coal gas of equal illuminating power, the difference between the gross and net values is less—viz., 7 per cent. instead of 9 per cent. It is usually stated that carburetted water gas has about 5 per cent. less calorific power than coal gas of the same illuminating power. But from these results, it would appear that, for the above quality, 10 per cent. is more nearly correct. The same variations in the calorific ratio are evident as in the case of coal gas. It may also be pointed out that the average gross calorific ratio is almost identical with the average of the same figure for the cannel gases; while the net figure is nearly 6 per cent. higher.

In Table IV. will be found the figures for a mixture of coal gas with a quantity of carburetted water gas, varying from 10 to 20 per cent. These differ very little from the corresponding coal-gas tests, although, calculated from the figures given above for the two gases separately, the calorific power should have been about 2 calories lower for 17-candle gas. It was not possible to take the calorific power of the coal gas at the same time; and it is probable that the calorific ratio of this was rather higher than when the above coal-gas tests were made, which compensated for the lower ratio of the carburetted water gas. In any case, it appears that the admixture of 10 to 20 per cent. of carburetted water gas does not affect the calorific power to an extent which would materially affect consumers.

Finally, in Table V. will be found a series of tests made with coal gas at the works, and an hour or so later at a distance of two miles away. It was not possible to ensure that the same gas was tested in both cases, and hence the daily tests show considerable variation; the calorific power at the works being sometimes greater and sometimes less than in the district. The average result is, however, nearly the same at both places; showing that there was



no appreciable falling off in the calorific power of the gas through traversing the main. It may reasonably be concluded that if there was no falling off in the calorific power, there was little or none in the illuminating power; as the illuminating hydrocarbons are those which have the greatest effect on the calorific power, and any diminution in their quantity would appreciably lower the latter value. In fact, for the reasons already given, the author believes that, for the purpose of comparing the quality of the gas in the works and in the district, the calorimeter is a far more satisfactory instrument than the photometer, portable or otherwise.

It must be borne in mind that although the calorific power is the most important factor in determining the relative value of a gas for heating purposes, there are other factors which have considerable influence. Thus, for example, in the case of incandescent burners, and of open gas-fires which effect the heating of a room in part by radiant heat, the temperature of the flame is of great importance. This is very much influenced by the construction of the burner, which is, however, a matter hardly falling within the scope of the present paper. Assuming a thoroughly efficient burner, the temperature of the flame depends very considerably on the relative volume of air required for its complete combustion, as well as on the calorific power. The smaller the amount of air required, the less will be the quantity of nitrogen whose temperature has to be raised, and the higher the resulting temperature for the same calorific power. Thus, uncarburetted water gas has a calorific power of only about two-fifths that of coal gas of 16-candle power; but as it only requires about 2·5 volumes of air for its complete combustion, the temperature of the flame is very high. Although the author cannot yet quote any actual experiments on the subject, there is but little doubt that the illuminating power of water gas in an incandescent burner would be decidedly higher than two-fifths that of 16-candle coal gas.

With gas-engines, matters are rather different. The efficiency of the gas depends upon the pressure caused by the explosion, which is determined in part by the calorific power of the gas, the composition of the gases remaining after the explosion—viz., steam, carbonic acid, nitrogen, and oxygen—and their specific heats. It is at present impossible to calculate from these data any reliable figures, as so little is yet known of the specific heat of gases at temperatures anywhere near those of combustion; and for this reason, among others, temperatures of combustion or of pressure caused by explosion calculated from the calorific power of a gas, and the relative quantities and specific heats of its products of combustion, are quite fallacious—the figures being generally more than double the highest ever experimentally obtained.

Until more light is thrown on this subject, therefore, the calorific power of a gas is the only property of a gas which can be experimentally determined to judge of its relative efficiency in gas-engines; but it should always be remembered that there are other factors whose relative amount it is not yet possible to ascertain.

Discussion.

The PRESIDENT said there was no doubt the subject before the meeting was one of very great and growing importance. It was fortunate that the paper came after the one previously read, because the two ran on very similar lines; and the statement Dr. Colman had made, that the future of coal gas would rest as much on its calorific as on its illuminating power was one which required a great deal of attention.

Mr. CHARLES HUNT (Birmingham) said the paper might be regarded as a sign of the stage at which they had arrived in the development of the uses of coal gas; and their thanks were due to Dr. Colman for having brought forward his interesting series of experiments. The object he had in view had been to establish, if possible, a kind of ratio between the calorific value of gas and its illuminating power; but, seeing that there was a difference of about 10 per cent. in the experiments, he was afraid he had not arrived at a very satisfactory result. It appeared, moreover, that as the heating property of gas varied according to the illuminating power, the calorific value of different gases must be ascertained for each—15, 16, or 17 candle gas must be taken by itself. But there was another point of view from which these experiments were

APPENDIX.

TABLE IA.—*Illuminating and Calorific Power of Coal Gas (Works A).*

Illuminating Power.	Gross Calorific Power.	Net Calorific Power.	Calories per Candle Gross.	Calories per Candle Net.
17·24	165·6	150·8	9·61	8·74
17·16	160·9	146·2	9·38	8·52
16·47	161·9	147·2	9·83	8·94
17·15	164·4	148·7	9·59	8·67
16·34	164·0	149·4	10·03	9·14
17·17	165·8	151·2	9·66	8·80
17·64	165·3	151·3	9·37	8·57
17·41	161·3	147·1	9·26	8·45
17·56	160·4	146·6	9·13	8·35
17·34	161·0	147·3	9·28	8·49
17·51	167·2	152·3	9·55	8·70
17·34	161·1	147·0	9·29	8·48
17·60	163·3	148·4	9·28	8·43
17·26	164·4	148·5	9·53	8·61
17·42	161·8	144·9	9·29	8·32
17·17	155·6	141·3	9·06	8·23
17·28	157·4	142·8	9·11	8·26
17·38	157·0	142·3	9·03	8·19
17·22	154·1	139·9	8·95	8·12
17·10	156·9	142·1	9·17	8·31
17·46	159·7	144·9	9·15	8·30
17·30	159·5	144·2	9·22	8·34
18·00	161·4	146·3	8·97	8·13
17·47	160·7	142·2	9·20	8·14
Average				
17·29	161·3	146·4	9·33	8·47
Average of all coal-gas tests made at Works A.				
17·33	160·0	145·6	9·23	8·40

TABLE IB.—*Illuminating and Calorific Power of Coal Gas (Works B).*

Illuminating Power.	Gross Calorific Power.	Net Calorific Power.	Calories per Candle Gross.	Calories per Candle Net.
16·24	162·8	146·2	10·02	9·00
16·36	160·1	145·6	9·79	8·90
17·12	150·4	134·8	8·79	7·87
16·56	160·1	143·4	9·66	8·66
16·42	162·0	145·3	9·86	8·85
16·46	159·7	143·3	9·70	8·71
16·57	157·1	141·5	9·48	8·54
16·76	157·7	142·8	9·41	8·52
16·11	160·9	146·1	9·99	9·07
16·42	157·1	141·6	9·57	8·62
17·50	156·3	140·2	8·93	8·01
16·72	158·1	141·2	9·46	8·45
17·14	156·9	141·3	9·15	8·24
Average				
16·65	158·4	142·6	9·51	8·56

TABLE II.—*Illuminating and Calorific Power of Gas from Various Kinds of Coal and Cannel.*

Illuminating Power.	Gross Calorific Power.	Net Calorific Power.	Calories per Candle Gross.	Calories per Candle Net.
Coal Gas.				
16·04	152·2	139·7	9·49	8·71
16·75	156·4	144·2	9·30	8·61
16·92	158·8	147·1	9·38	8·69
16·98	157·8	144·2	9·29	8·49
17·14	152·0	138·6	8·87	8·09
17·22	163·1	149·7	9·47	8·69
17·25	165·0	151·4	9·57	8·78
17·42	161·8	148·1	9·29	8·56
17·82	161·1	145·6	9·04	8·17
17·93	159·8	147·2	8·90	8·20
18·00	157·4	145·3	8·74	8·07
18·20	161·7	147·3	8·88	8·09
Average				
17·31	158·9	145·7	9·18	8·42
Cannel Gas.				
22·89	191·9	179·6	8·38	7·85
23·80	201·3	186·8	8·46	7·85
25·04	212·6	196·5	8·49	7·85
29·30	221·1	203·4	7·55	6·94
29·46	214·0	199·7	7·26	6·78
31·24	242·0	223·2	7·75	7·15
31·51	229·0	212·9	7·27	6·76
31·80	241·8	224·2	7·61	7·05
33·30	255·8	233·9	7·68	7·02
Average				
28·70	234·4	206·7	8·17	7·20

TABLE III.—*Illuminating and Calorific Power of Carburetted Water Gas.*

Illuminating Power.	Gross Calorific Power.	Net Calorific Power.	Calories per Candle Gross.	Calories per Candle Net.
17·96	139·6	130·7	7·77	7·28
18·03	142·8	133·0	7·93	7·38
17·49	144·6	134·8	8·27	7·71
16·66	140·5	130·7	8·43	7·85
16·80	141·4	131·8	8·42	7·85
16·94	138·9	129·4	8·20	7·64
16·88	139·7	131·3	8·28	7·78
18·93	152·6	141·7	8·06	7·49
		Average		
17·46	142·5	132·9	8·16	7·61

TABLE IV.—*Illuminating and Calorific Power of Mixed Coal Gas and Carburetted Water Gas.*

Illuminating Power.	Gross Calorific Power.	Net Calorific Power.	Calories per Candle Gross.	Calories per Candle Net.
17·08	162·3	147·3	9·50	8·62
17·02	164·8	149·6	9·68	8·79
17·48	159·7	144·0	9·14	8·24
17·75	157·3	143·7	8·86	8·10
16·61	157·6	143·1	9·49	8·61
17·00	159·3	142·6	9·37	8·54
16·68	158·6	144·8	9·51	8·68
16·66	159·6	145·2	9·58	8·72
17·17	158·5	144·8	9·23	8·43
16·73	159·9	144·3	9·56	8·63
17·08	161·4	148·1	9·45	8·67
17·00	157·5	142·3	9·26	8·37
17·07	147·0	132·7	8·61	7·78
16·93	149·9	135·4	8 85	8·00
17·56	158·3	144·2	9·02	8·21
17·33	159·0	144·4	9·17	8·33
17·29	163·3	148·2	9·45	8·57
17·07	156·5	141·9	9·17	8·31
17·09	158·0	142·7	9·25	8·35
17·32	158·8	143·8	9·17	8·30
		Average		
17·09	158·4	143·6	9·27	8·40

TABLE V.—*Calorific Power of Gas at the Works and at a Distance of Two Miles Away.*

At Works.		Two Miles Away.		Difference.	
Gross Calorific Power.	Net Calorific Power.	Gross Calorific Power.	Net Calorific Power.	Gross.	Net.
166·9	151·8	169·3	154·3	+ 2·4	+ 2·5
162·4	147·6	158·3	146·1	− 4·1	− 1·5
155·4	138·9	163·3	149·2	+ 7·9	+10·3
156·8	141·3	155·0	140·9	− 1·8	+− 0·4
159·4	143·8	163·1	148·7	+ 3·7	+ 4·9
160·2	146·1	158·1	144·9	− 2·1	− 1·2
157·8	138·0	155·5	142·0	− 2·3	+ 4·0
159·4	144·2	152·6	139·8	− 6·8	− 4·4
157·9	142·1	159·8	146·2	+ 1·9	+ 4·1
158·8	144·9	152·4	140·6	− 6·4	− 4·3
159·3	144·1	161·0	146·8	+ 1·7	+ 2·7
163·0	147·7	155·4	141·4	− 7·6	− 6·3
		Average			
159·7	144·2	158·7	145·1	− 1·0	+ 0·9

interesting, and that was the light they threw on the value for heating purposes of gases of low illuminating power. He was sorry the author had not been able to extend his experiments to 14 or 15 candle gas; but so far as they went they were extremely interesting. One curious feature about them was this: He noticed that in the first table the two gases of lowest light-giving value—16·47 and 16·34 candles—gave the highest number of calories per candle; and the gas of the highest value (18 candles) gave almost the lowest. Turning to Table 1B, the difference was more marked. The three gases lowest in illuminating power gave absolutely the highest value for heating purposes, and the three highest in illuminating power were absolutely the lowest in calorific value. There was only one conclusion to be drawn—that the heating value of gas of low illuminating power was greater in proportion than that of high-power gas. This was not the first time this had been pointed out. The late Dr. Wallace many years ago published experiments showing the great falling off in the heating value of cannel gas; and some trials which he (Mr. Hunt) made in 1882, in connection with a gas-engine, had proved the same thing, and also that gases down to 12-candle power were of greater proportionate value for heating purposes than those of 15 or 17 candles, although the difference was not so marked as would appear from the tables. He assumed that Table V. was for the purpose of checking the accuracy of the illuminating power tests. Knowing the conditions under which the tests were made, he might say that these were taken in order to verify or otherwise the accuracy of the illuminating power tests, which did not accord with those taken at the works. A considerable falling off was experienced at the testing-station in the town; and in order to trace it, if possible, these tests were made. Those taken for the heating value showed the gas to be practically identical; and the only inference to be drawn was that the tests for illuminating power varied, on account of the conditions under which they were carried out. This showed that, in order to make accurate tests, the conditions must be absolutely reproduced at every point, or else they were not reliable. He might say further that since the room in which the tests were taken had been abandoned in favour of another built under more modern conditions, the discrepancy no longer appeared.

Mr. F. D. MARSHALL (Copenhagen) remarked that in his address last year he had said he believed that in future the calorimeter would play a greater part in the daily testing of gas than the photometer itself; and he was every day more convinced that this would be so. He had for the last five years—in fact, ever since the instrument was made—been using it daily in conjunction with the photometer, because he believed these two instruments should always be employed together; and they found that in many ways it had been a great help, because they had been able to check what was called the "personal error." It was now recognized that, however beautiful the photometer might be, and however carefully it was used, one could not avoid this personal error. But with the little instrument before them, the error was reduced to the minimum. It was so simple that a child could work it; and it was astonishing that so few were used in English laboratories. Dr. Colman had only given the range of gases between 17 and 22 candles; but he (Mr. Marshall) was able to present a larger range—viz., from 18 down to 12 candles, although he had not had time to work all the figures through. He would, however, give the salient points. Dr. Colman had worked out his calories at per cubic foot. On the Continent, they worked them out per cubic metre; and he must express his regret, seeing that the instrument was based on the metric system, that this had not been followed out in the calculations. For 18-candle gas, Dr. Colman gave a net value of 146 calories. Their experiments showed a slightly higher result—viz., 150 calories; so that there must have been a large amount of personal error in the reading of the photometer. For 17½-candle gas, Dr. Colman's figure was 151; and theirs, as the result of some thousands of experiments, 148—again showing a considerable personal error. For 16-candle gas, Dr. Colman's figure was 146, and their experiments 147. Coming to gas of lower quality, there was the remarkable result that for 13 candles he obtained 135, and for 12 candles 137 calories. If they took a higher quality gas—say, 18-candle—they only had 8 calories per candle; but with 12-candle gas it was 11 calories. It seemed to him that this amplified much which Mr. Livesey had been trying to convey to them—that the lower they went in illuminating power the greater efficiency they obtained in the calories developed per cubic foot of gas consumed. If they could communicate these facts to the gentlemen sitting not very far off, it might possibly have some good results. The calorific value of gas would play an important part in the future, especially to the users and makers of gas-engines. He was constantly receiving forms to fill up, stating the calorific value of the gas in different towns of which he had cognizance, because manufacturers of gas-engines said they had to make their machines to suit the value of the gas to be employed. Formerly, they used to return the illuminating power; but the engine makers said this was not of much value—they wanted the calorific power. He thought the day would soon be past when they pinned their faith to the photometer; and when that fetish was destroyed, they would be able to supply the quality of gas really most useful.

Mr. D. H. HELPS (Redhill) asked if it were not possible to have two gases, each of 15-candle power, but of totally different composition; and, if so, would it follow that their calorific value would be the same?

Mr. FORBES CARPENTER said the paper before them was one of special interest, and he should like to ask whether, with high illuminating powers, such as those described in

the second table, they could ensure the perfect combustion of the gas. One could understand an instrument being made with absolute scientific accuracy and skill; and yet with gas of high illuminating power the combustion chamber might not be large enough to get into play the full effect in calories. The point shown by Table II. was most important, and emphasized what experience he had had. He had seen the instrument in operation at very large works (not gas-works) in the North; and they would not be without it on any account. It was an establishment where producer gas was in extensive use; and with the instrument they found they were able to keep a complete check on the operations which had to be performed. With the increasing use of gas-engines and producer gas, it might be said that gas of lower illuminating power would lend itself better to the gas engineer, on account of the greater compression of the load when gas of this kind was used; and the liquid hydrocarbons did not separate and tend to decompose in the valves. On a former occasion, Mr. Livesey had said something about the difference between illuminating power and illuminating effect; and in listening to this paper the same idea occurred to him—that there was a difference between calorific power as ascertained by such an instrument as the one before them, and calorific effect when the flame was burnt for heating purposes in a room, depending very largely on the size of the flame for its radiant effect.

Mr. W. King (Liverpool) remarked that about five years ago he was much interested in this question, and also in the instrument exhibited; and so he requested Mr. Leicester Greville to undertake some experiments for him with it. The figures handed to him by Mr. Greville as the result were as follows: With London gas, 15·6 candles (he presumed it was tested in the argand burner under ordinary conditions), the British thermal units yielded were 641; while 16-candle gas of the same description gave 653 units. They then tried a gas of 20·1 candles; and the result was 706 units. Carburetted water gas of 20-candle power was also tried (in these two cases the illuminating power was ascertained at a consumption of 5 cubic feet per hour in a batswing burner); and the result obtained was 627 units.

The President asked if these figures were gross or net.

Mr. King said they were the gross figures—the condensed water not being allowed for.

Mr. E. A. Harman (Huddersfield) said it seemed to him that one of their long-established convictions was being knocked on the head—viz., that the illuminating power of the gas at a distance from the works was somewhat less than it was at the works; but, according to Table V., the tests made two miles away did not show any diminution in quality, because it was argued that, as there was no falling off in calorific power, there was little or none in illuminating power. But Mr. Marshall's figures proved that this hardly held good, inasmuch as the calorific power of higher and lower grade gases varied so strangely. Mr. Hunt had also used the same argument—that there was no falling off in the quality of the gas at a distance of two miles; whereas they usually admitted that there was a diminution, which was generally reckoned at about a quarter of a candle per mile. With regard to the last two paragraphs of the paper, they seemed to cancel one another. Dr. Colman said it was at present impossible to calculate, from the data he had before him, anything at all reliable respecting gas for use in gas-engines; but in the next paragraph he stated that the calorific power of gas was the only property which could be experimentally determined, to judge of its relative efficiency. It would be generally conceded by the users of gas-engines that the better the illuminating power of the gas, the easier it was to work an engine. He had had in his own experience an instance in which they had considerable difficulty in starting an engine; and, having set it going, much greater difficulty in keeping it running. Every kind of experiment was tried to see what was the matter; and it was eventually found that in a small holder there was a quantity of "church gas"—made on a Sunday night, after the retorts had been standing all day—and this gas of low illuminating power was quite unable to do anything with the engine. Having changed the holder, and put on 17 instead of 15 candle gas, they had no difficulty whatever.

Mr. F. D. Marshall (Copenhagen) said the case mentioned by the last speaker was an instance of an engine being adjusted to a higher quality of gas. According to his experience, the lower-quality gas was the better. The engine ran longer with 14 or 16 candle gas, there was no wearing of the valves, and no deposit. In fact, manufacturers had told him they would rather supply gas-engines to towns using gas of low quality than to Scotland. Some time ago, they had from Scotland two of Clerk's engines, which turned out to be failures. They had run very well in Scotland; but he could not get any work out of them, and ultimately converted them into steam-engines.

The President said the paper was especially important, and one which seemed likely to upset many preconceived ideas; but he could not help thinking that most of the speakers, in remarking on the question of the increased calorific power per candle of the gas, according as the quality decreased, had in their minds what had been described as the "personal error." Mr. Marshall and several other speakers said it was particularly difficult to avoid this error in dealing with the illuminating power of gas. They, however, stated that the beautiful instrument before them was absolutely incapable of making a mistake. Mr. Douglas Helps had asked a very pertinent question—whether it was not possible to have two gases identical with regard to illuminating power, but of very different constitution; and whether these gases would be of the same calorific power. It seemed to him (the President) to be quite possible that the reason for the differences which had been noticed might arise in two ways. One might be that the constituents which were in, or were added to, gas of high illuminating power might not be so high in calorific power as the constituents which went to make up gas of lower illuminating power. This would be proved to a certain extent by the fact that Dr. Colman showed that a gas lost in illuminating power in travelling several miles. Was it not possible that in its course certain of its constituents had dropped out, which, while reducing the illuminating power, did not affect very much its calorific value? Again, he could not help thinking that there might possibly be a great deal of truth in what Mr. Forbes Carpenter said, that Junkers calorimeter might not always be suitable for gases of varying illuminating power.

Dr. Colman, in reply, said, with regard to the question raised by Mr. Hunt and Mr. Marshall, as to the calorific ratios of gases of less than 16-candle power, he was sorry to be unable to give them, simply because he had not had the opportunity of submitting such gases to a test. He had been obliged to test what gases he had come across; and he had given the results. It was quite true that, generally speaking, even within the limits of 16 or 18 candles, there was a prevalent tendency for the calorific ratio to become higher as the illuminating power decreased. It appeared, from Mr. Marshall's statistics, that, as the quality went lower, this was much more marked; and, finally, at 12 candles they had a calorific ratio of 11 instead of something like 8 or 9. With regard to the question of variations, the daily changes in the calorific ratio might, under unfavourable circumstances, rise to as much as 10 per cent.; but it was quite true that the whole of the errors of observation, whether of the calorimeter or the photometer, were dealt with. He had indicated his belief that the errors were far greater with the photometer than with the calorimeter, and any errors of the former instrument tending to bring the gas out higher or lower would tend also to exaggerate the daily variation. With regard to the question put by Mr. Douglas Helps, as to gases having similar illuminating power with different compositions, he should say they would not have the same calorific power, and that this was the cause of the variations found—that, although the illuminating power might have been something like the same, the composition of the gas was very different. In fact, if daily tests were made of the hydrocarbons present in gas which were absorbable by bromine—chiefly ethylene and benzol—it would be found that the amount varied exceedingly, though the quality of the gas might not vary more than half a candle. With their own gas, the percentage of hydrocarbons absorbable by bromine varied from 3·5 to 4·5, and even more. Nothing in regard to illuminating power could be deduced from analysis, because the hydrocarbons which had the greatest effect—ethylene and benzol—had to be determined together; and one had no means of determining their relative proportions. Benzol had much greater effect on the illuminating than on the calorific power of gas. This brought him to another point in connection with the apparent drop in the illuminating power. Assuming that it had dropped between the works and the district, if gas was carrying

along with it suspended particles of hydrocarbons which were condensed in liquid form, they might drop out as the gas passed along; but after being subjected to filtration in the purifiers, the amount of this could not be very great. However, he knew of no determinations on this subject. If there was a drop of the substances actually present as vapour in the gas, the one specially likely to be condensed was, of course, benzol. Ethylene was a gas at a temperature far below the freezing-point, and there was no fear of any of it falling out; so that any drop of illuminating power not due to mechanically carried particles must be due to a diminution in the amount of benzol vapour. In connection with the experiments at a distance of 2 miles, they were undertaken because the illuminating power tests were not coming out at all satisfactorily, in spite of the fact that, to all appearance, the gas was the same. The height of the flame in the argand burner was exactly the same as at the works, nevertheless it was coming out two or three candles lower. These experiments with the calorimeter were made to determine whether there was any drop in the calorific power of the gas; and they showed that there was none. The point he wished to raise was rather different from that which Mr. Helps had mentioned. His belief was that there was no falling off, or next to none, in the illuminating power; and that the low results obtained in the photometer were simply due to the gas being tested under wrong conditions. The room was extremely small, had a sloping roof, and was lower at the end where the argand burner was than at the candle end. From experiments made with other photometers, he believed that this was largely the cause of the low tests given. He found that the more the argand burner was boxed in, the lower would be the results obtained with the same gas. It was extremely important that the burner should have as free an air supply as possible. With regard to complete combustion in the calorimeter, as far as he had found there was no difficulty whatever. When testing cannel gas of as high quality as 33 candles, the combustion had been perfect. The flame of the burner never came in contact with any solid matter until it was completely burnt. It had air all round it. One could not, however, consume cannel at the same rate as ordinary gas. With the latter, the consumption might be 4 to 8 cubic feet per hour; with cannel it was something like 2·5 cubic feet.

Mr. Forbes Carpenter remarked that the temperature of 20° C. seemed rather high.

Dr. Colman said, as a matter of fact, the general temperature difference was 17° to 18°; but one might work within a limit of 20°, and still have the waste gases leaving the apparatus at a temperature within one or two degrees of the water. One really might go higher—to 22° or 23°; but, at any rate, 20° was a safe limit. A question had arisen whether some enrichers did not have more effect on the illuminating than on the calorific power of gas. He had hoped to make a series of experiments on this point, but had been prevented from doing so. The results he had obtained so far showed that benzol affected the illuminating power three times as much as carburine; whereas the effect on the calorific power was exactly the same. Benzol raised the illuminating power of the gas three times as much as its calorific power. If these figures were confirmed, they accounted to a large extent for the higher calorific ratio found in the case of lower light-giving value, as the cause of the difference in illuminating power was largely due to the amount of benzol vapour present in the gas. Mr. Hunt was quite correct in supposing that he (the speaker) had hoped to find that the calorific power varied very closely with the illuminating power, and that it would be possible to say: "Here is an instrument that is better than the photometer, and the results are parallel." The results showed, however, that a variation of 10 per cent. was possible in the calorific ratio. Still, if they took the first table, giving a month's tests, it would be seen that the extremes of illuminating power were 16·47 and 18·0—a variation of some 9 per cent. during the month, while the calorific power in the same time varied 7½ per cent.; so that, although the tests were not parallel from day to day, the variations in the two values over a longer period were pretty much of the same order.

The Franklin Institute have awarded a John Scott medal and premium to Mr. A. M. Hopkins, for his pneumatic system of preventing the bursting of water-pipes by freezing.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1240.)

Business on the Stock Exchange last week continued to be very limited indeed; and the tendency to inaction was aggravated by the usual May Day holiday. The general condition was flat; and the dulness of the week was only slightly relieved at the close by favourable war rumours. Prices all through the list are decidedly lower, with hardly a single advance anywhere to chequer the array. The most interesting incident for gas shareholders was the fall in the railway market, owing to a 50 per cent. advance in the prices of the new coal contracts. Gas men who are smarting under the exactions of the coal-owners, can sympathize with railway men here. In the Money Market, the demand was strong, and rates continued very stiff, though towards the close there was a little relaxation of the stringency. Business in the Gas Market was very irregular. On some days it would remain almost as quiet as could be; but in between quiet days an active one would be sandwiched. Taken altogether, it was a busier week than its predecessor. With one exception, all changes in quotation are downward, as might be expected; but these changes are not considerable in extent, except in the case of one Company, where a substantial reduction was made in view of the fact that the next dividend declared must necessarily be at a lower rate. What this rate may be, however, remains to be seen at a distant date. In Gaslight issues, dealings were at times very brisk in the ordinary; but they brought about no change—prices ruling at about 102 steadily. The secured issues also were unchanged. South Metropolitan promised at one time to be active, but soon quieted down. After touching 130, it fell to 127; and the quotation was lowered a point. In Commercials, only one "special" bargain was marked in the new; but both issues had their quotations put down with a rather liberal hand. There was a little more business done in the Suburban and Provincial group; and Brighton, British, and Crystal Palace gave way slightly. The Continental Companies were quieter than they have been for a long while; and there was no change in price beyond a fall in Tuscan. The remoter undertakings furnished a contrast, Australian scoring a rise; but Buenos Ayres was lower. In the Water Companies, business was extremely quiet and devoid of all feature. For the second week running all quotations have remained unchanged.

The daily operations were: Business in Gas on Monday was very quiet; and the only move was a fall of ½ in Tuscan. On Tuesday, the Exchange was closed. Wednesday was very brisk, with much dealing in Gaslight ordinary and South Metropolitan. Australian rose 1½; but Brighton ordinary receded 3, South Metropolitan 1, and British ½. Business fell quiet again on Thursday. Australian rose ½; but Commercial old fell 7½, ditto new 12½, and Buenos Ayres ½. Activity was renewed on Friday; being mostly in Gaslight ordinary, which held steady. Commercial old fell 10, ditto new 5, and Crystal Palace 1. Saturday was almost lifeless; and nothing moved.

ELECTRIC LIGHTING MEMORANDA.

A Serious Misstatement—Asserted Superiority of Electricity-Meters to Gas-Meters—A Flat Denial—Shareholders of Public Companies and the Membership of Local Authorities.

It is not often that we have to seriously complain of misstatements on matters of fact by our electrical contemporaries. We thoroughly understand each other's position, as a rule, and usually confine our differences of statement to matters of opinion. They, of course, advocate electric lighting and other applications of electricity for all these are worth; while it is our business to exhibit the "seamy side" of the same subjects. There is no pretence on either side to an impartiality which cannot possibly exist, and would be useless if it did. Impartiality is only another name for lack of interest; and without interest in the subject, it is impossible to do journalistic justice to any special branch of science or business. This being understood, it was with some disappointment that we saw in the current number of the "Electrician" a deliberate and quite gratuitous misstatement respecting the relative trustworthiness of gas and electricity meters. This occurs in a paragraph relating to some statistics as to the employment of electricity meters in Germany. The statistics themselves are rather curious. They are based upon returns collected by the German Physikalische-Technische Reichsanstalt, which has circularized the manufacturers and known users of electricity-meters in the empire, in order to find out how many, and what sizes of meters, are actually in use.

The figures thus collected exhibit a remarkable discrepancy. Nine firms of meter manufacturers reported that on July 1 last 126,000 meters were in use in Germany. The 950 central and private stations applied to, however, could only account for about 60,000 among them. The difference is charitably explained by reference to the number of meters in stock and not put into use, to those used for testing purpose, and to those exported. It occurs to one that the last-named class of trade

would not naturally be included in the tale of meters returned as being in use; but anyhow the unaccounted-for margin is wide enough to support the suggestion that the manufacturers must have taken a very generous view of the extent of their custom. Whatever the degree of accuracy of this part of the report, however, our contemporary, referring to a question put as to the permissible error, goes on to state that on this point—figure not given—"the makers and the larger supply stations were in agreement; but smaller works considered a greater degree of accuracy desirable, and one that is not attained in practice. *Of course, in all circumstances, the electricity-meter is more accurate than the gas-meter.*" We have italicized this statement, and declare it to be an absolute falsehood.

This matter, as the "Electrician" is well aware, is of great technical and commercial importance. Why, if it was deemed necessary to give the electricity-meter a general certificate of extreme accuracy, was the amount of error considered permissible by "the makers and the larger supply stations" omitted? What is it that these witnesses are agreed upon; and why should the smaller works desire a greater degree of accuracy, "and one that is not attained in practice?" Perhaps our contemporary is in ignorance of the degree of accuracy legally required of a gas-meter, and actually realized by the ordinary run of these instruments. We can inform the electricians that they have to compete with an appliance which, before being stamped for use, must register within the statutory limits of 2 per cent. fast, and 3 per cent. slow, and which, in fact, is rarely over 1 per cent. wrong. Moreover, the causes of error that do exist in either wet or dry gas-meters are such as to be more often and more considerably in favour of the consumer than of the supplier of gas. The official returns of gas undertakings throughout the country show that, while the proportion of the output of the works that cannot be accounted for is capable with good management of being brought down to about 4 per cent. under favourable conditions, it is not possible to get much nearer to a perfect balance-sheet; and this fact of itself testifies to the general accuracy of the meters. Last, but not by any means least, these articles cost only a few shillings, for the smaller sizes chiefly in use.

Now, on the face of the "Electrician's" own statement, we challenge it for its proofs of the assertion that "in all circumstances the electricity-meter is more accurate than the gas-meter." Let us have this contention established on irrefragable evidence; and when done, we will gladly acknowledge the truth, and call on the gas-meter trade to look to its reputation. We do not mean to let our contemporary off from this task.

A remarkable law-suit has been going on between the City of London Electric Lighting Company and the Corporation of London over the question of the validity of the City lighting contracts, which was impugned for reasons that will be within the recollection of our readers. It was a question, primarily, of the construction of the Acts of Parliament relating to the constitution of the now obsolete Commission of Sewers, which contained clauses to nullify any contract between this body and any firm in which a member of the Commission might be interested. The facts were not in dispute; the only point for the Court to decide was whether the interest of an ordinary shareholder of a public company was sufficient to come within the meaning of the Acts. The judgment of Mr. Justice Farwell is that this interest is not sufficient to nullify a contract for such a matter as the supply of electricity, gas, or water. The Court distinguished between contracts for construction works, and for public supplies of the kind specified—holding that the reasonable interpretation of the Act was that it could not be meant to prohibit the Commissioners from entering into a contract with a Gas Company for the supply of the City because one Commissioner happened to possess a single share in the Company. After this, let nobody indiscriminately repeat the immortal Bumble's qualification of the law.

Gas-Engines for Electric Traction.—The electric funicular tramway at Tibidabo, Barcelona, will employ a Crossley gas-engine of 300-horse power fed with Dowson gas.

The Price of Coal.—The Coalowners' Association have decided upon a minimum advance after June of 5s. per ton on the rates of the corresponding period of last year. They regard the alteration in the percentage of delivery referred to last week as reasonable, in order to ensure more regular working at the pits.

The Gas Section of the Paris Exhibition.—Our readers are aware that the Organizing Committee of the Gas Section at the Paris Exhibition are desirous that a portion of their collective exhibit should represent the history of the discovery of gas in different countries. This, they think, could be best done by photographs or copies of historical documents, patents, drawings, models, &c. Up to the present, notwithstanding the efforts made by the Committee, nothing has been received from England in connection with this matter, though this country has claimed so large a share in invention of gas lighting. The Committee suggest that England should at all events bring forward whatever title she is able to furnish in support of her claim. They therefore ask us to invite those of our readers who may be possessed of anything which will bear testimony to what their country has done in the way of helping forward, by improved processes, the science of gas lighting, to forward it without delay to the President of the Committee, M. Eugène Lebon, at No. 26, Rue de Londres, Paris.

ARBITRATION IN TRADE DISPUTES.

THERE constantly arises in the thoughts of the humane and reflecting among us, a deep sense of horror that war should be the only means of settling international disputes. Quarrels between individuals it is no longer lawful to resolve by mortal combat; the arbitrament of the law is practically the only remedy. Why then should not mankind agree to settle all disputes by means of arbitration? Such is the very natural cry of many—a cry that led to the enacting of that solemn farce, the Peace Conference at the Hague last summer, of which the value in preventing an appeal to arms has been so speedily made manifest. Similar feelings undoubtedly exist in the minds of all thoughtful men, as to the intensely unsatisfactory character of war considered as a method of solving differences between employers and employed. The same evils characterize the method in both cases. The cost to both parties, usually out of all proportion to the end gained; the misery and suffering entailed, not merely upon the actual disputants, but also upon those innocent of the quarrel and helpless to prevent or terminate it; the possible injustice of the outcome, through might prevailing over right—these, and more also, are common evils attendant upon international and industrial warfare alike. Is the prospect of substituting the peaceful method of arbitration for that of combat as dark in regard to industrial disputes, as it appears to be in regard to those between one nation and another? We think not; neither, however, do we think that it will ever be possible to bring about an entire displacement of strikes and lock-outs by the universal adoption of conciliation or arbitration organizations for the settlement of trade disputes. The determination of individual quarrels by duelling is prevented, partly by the intervention of the law (which is organized public opinion), aud partly by the fact that the person launching the quarrel stands to suffer directly by its reference to arms. International combat, on the other hand, remains as a determinant of disputes because there is no international police force to separate the combatants, and no tribunal before which to hale them; nor, even were there such a tribunal, would there be any means (except by war) of enforcing its decisions. Moreover, war may be, and has been, brought about for personal aggrandizement, by a statesman or a monarch who runs little or no risk of standing the racket. Industrial disputes may be said to lie between the two extremes; being checked by public opinion (both organized—that is to say, the law—and unorganized) and by the fear of self-injury, to a lesser degree than the individual, but to a greater extent than the nation.

When, therefore, we ask ourselves what obstacles lie in the way of the general adoption of conciliation or arbitration for the settlement of trade disputes, we find a partial answer in the fact that it is impossible to compel the parties to resort to such means, and in the absence of means to ensure the due observance by both sides of the terms of an arbitrator's award. (When we say "impossible to compel," we mean that the *primâ facie* case against any system of compulsory arbitration is so strong, while the results of such a system in actual working have been only recently shown to have been so deplorable,* that the possibility of the adoption of any such law in this country is outside the range of practical politics.) The remainder of the answer can best be found by considering—as we will briefly do—what circumstances and conditions are most favourable to the establishment and successful working of the machinery of arbitration.

Our attention has been drawn afresh to the subject, which is one of perennial interest, by a particularly able and thoughtful article which occupied the premier position in the "Edinburgh Review" for January; and we propose to confine ourselves mainly to a consideration of the suggestions contained therein. The writer (we need scarcely remind our readers that articles in the "Edinburgh" are unsigned), though primarily reviewing the question of "Conciliation and Arbitration in Trade Disputes," devotes the greater part of his article to a consideration of some of the causes which contribute to such disputes—choosing the present time as favourable to a dispassionate examination of the subject, on account of the comparative immunity from labour troubles now being enjoyed. In common with ourselves, the writer does not attribute that immunity, in any great degree, to anything but the general activity of trade; and therefore he deems it wise to consider—before the conditions tending to a recrudescence of disputes shall arise—whether any extension is possible of the methods available for the determination of differences when they may occur. The article is distinguished by the success with which the writer has attained to a detached and unpartisan view of his subject; though we do not say he has achieved complete impartiality. That is a gift beyond human reach.

The reviewer prefaces his discussion of the subject by claiming recognition for the fact that, be their faults what they may, Trade Unions have come to stay, and, moreover, constitute a powerful factor in the industrial world which must be reckoned with in any consideration of future possibilities. "The State could no more put down Trades Unions, or interfere with the right of workmen to combine, than it could interfere with the freedom of the Press or of speech." Recognition of the logical corollary of this right of combination—which corollary is rarely or never admitted by those who most strenuously defend that

* See "JOURNAL," Vol. LXXIV., p. 993.

right—is claimed with equal certainty of voice, and with a welcome vigour of expression. "The action of the State in supporting the rights as citizens of men who are opprobriously and unreasonably called 'scabs' and 'blacklegs,' has been half-hearted and unenergetic. It is otherwise in the United States, where liberty is as much cherished as in Great Britain. Unless freedom of labour involves freedom to work at will, as well as freedom to be idle at will, the operation of economical laws is unduly checked. The State, in our opinion, fails in its duty if it refuses or neglects to afford the necessary protection against illegal exercise of force to men or women desirous of accepting employment on terms satisfactory to themselves, if distasteful to others. And dread of temporary unpopularity ought not to influence those who direct the action of the State in this respect."

Trade Unionism being premised as an inevitable factor in the industrial problem, the writer proceeds to examine such of its methods and tendencies as are calculated to lead to a breach of the peace between men and masters. Reference is made to Sidney and Beatrice Webb's "Industrial Democracy," in order to demonstrate the deplorable "disposition to regard Trade Unions as belligerents continually seeking to alter the conditions of their employment under guise of improving the condition of a class, and leaving no stone unturned in the promotion of discontent and unrest." This disposition runs through the whole of the work referred to, and is shown especially in the attitude taken up by the authors, as the exponents of Trade Unionism, towards Benefit Societies instituted and supported by employers, and towards the introduction of profit-sharing. The objection urged against employers' Benefit Societies by these Trade Union advocates is that it tends to create amicable relations between men and masters—to the detriment of the sacred cause of Unionism. "It renders men indisposed to pay again to the Trade Union . . . . It holds out to them a strong and growing inducement to remain where they are, and thus accept employers' terms. . . . Any general adoption of employers' Benefit Societies would, in fact, go far to render Trade Unionism impossible." So with profit-sharing. Such arrangements between particular firms and their men "destroy community of interest"—that is to say, the employees of a "specially benevolent firm with a really generous profit-sharing scheme will not be disposed to join heartily with the rest in any movement for higher wages."

The comment of the Edinburgh Reviewer upon this attitude of the leaders of Trade Unionism is as follows (it is quoted at length as being the deliberate opinion of one obviously not prejudiced against Unionism in the abstract): "In other words," he says, "the wisest and most benevolent efforts of employers to help their workmen, to improve their condition, to make them contented, and to diminish the consequences of sickness or the expenses connected with death, are to be resisted and banned, lest the individuality of the workman should be kept unimpaired, and the slavish sacrifice of his own interests inculcated by the Union made to appear in its real colours. If individual freedom means anything, or has any value, the option of workmen to accept advantageous terms, to profit by the benevolence which softens the rigour of industrial life and gives workmen a direct interest in the success of the business at which they work, should be encouraged, not tabooed. The opposite policy can only tend to reduce men to the position of mechanical units, to curtail their judgment, to oust their discretion, and to set up a tyranny far more irksome than any which can be brought about by a despotic foreman, or a narrow-minded employer. We have always thought," concludes the writer, "that the charge brought against Trade Unions, of reducing men to slavery, annihilating their free will, and destroying, not only all contentment, but all disposition to be ambitious of progress and advancement, was greatly exaggerated. But the chapter [in 'Industrial Democracy'] from which we have made . . . extracts does little to disprove it."

The reviewer then points out, by means of quotation, how the defenders of Unionism naively admit "that Trade Unions fight at the greatest advantage, make many men bankrupt, and ruin trusts, when workmen are combined and employers are not. There is," he remarks, "no pause to consider whether it is for the advantage of trade that business firms should be bankrupt or companies ruined, or whether the sufferings of the wives and children of workmen during a long period of enforced idleness is not a wholly disproportionate price to pay for the attainment of limited concessions. All that is considered is the 'strategic advantage,' and the opportunity which it confers, not for peaceful progress, but for 'embittered and obstinate' war." Reference is next made to the fact that, although Trade Unions are slowly learning by experience, many "still adhere to their belief in two fallacies—the first, that wages regulate prices; and the second, that artificial limitation of output is for the advantage of wage-earners." The second is truly said to be most mischievous in its results, especially in regard to the opposition of men to the introduction of labour-saving machinery. The consequence of the greater stupidity of the English than the American workman in this respect, "is that an inventive nation is rapidly pushing invention, and that not only the British manufacturer is damnified, but also the workman he employs."

Having touched lightly upon other unlovely aspects of Trade Unionism conducing to labour disputes, and having expressed his opinion that employers should recognize Trade Unions, and negotiate when necessary with their leaders, and that they would act far more wisely by turning the influence of Trade Unions into proper channels [how easy that sounds on paper!] than by futile efforts to crush it—opinions that have never found acceptance in the "JOURNAL"—the writer discusses how best to accomplish the diminishing of strikes and lock-outs, and the bringing about of a more general acceptance of arbitration as a means of settling disputes.

The suggestion made is, briefly, that peace can best be preserved by armament. Just as in international affairs it is true that to be prepared for war is often the best means whereby to secure immunity therefrom, so it is suggested that the best hope of industrial peace lies in effective combination of employers. The history of the disputes in the engineering trade and in the South Wales coal-fields proved the strategic value of such combination; and in face of associations of the employers in each industry throughout the country, Trade Unions would find themselves powerless to conduct guerilla warfare against individual firms. Here we find the "circumstances and conditions most favourable to the establishment and successful working of the machinery of arbitration;" for between combinations mutually respecting each other's strength arbitration would certainly be more possible.

The difficulty remains of how to secure the due observance of awards. To remove this obstacle, the suggestion made by some of the Labour Commissioners, in a memorandum appended to the report of the Royal Commission, is recalled and endorsed—the suggestion, namely, that trade associations, whether of men or masters, should be allowed and encouraged to make themselves bodies corporate by registration, and should put themselves into a position of being sueable and able to sue. The successful working of the "settlement" in the boot and shoe trade—a voluntary arrangement by which either men or masters are fined for breach of the agreement, each side depositing £1000 as security for such fines—is instanced to show that arbitration can be made to run on these lines. The depositing of security is certainly a most essential feature of the arrangement, for it would be no use sueing a bankrupt Union.

We have now given a bare outline of an article which is worthy of careful perusal, and which we only wish could be studied by all the thick-and-thin supporters of militant Trade Unionism. There is, however, one point to which we think the writer should have given more consideration in his search for methods whereby industrial strife may be diminished. We mean to the possibilities of profit-sharing as a means to that end. The peace ensured by combination of man with master in the joint pursuit of their common interests, is based on a far more certain foundation than that subsisting between armed camps of employers and employed ranged over against one another. But, by whatever means ensured, peace is increasingly essential to the maintenance of our position in the commercial world; and every effort to secure a fuller measure thereof is welcome.

PERSONAL.

Mr. HUGH M'NAIR, of Wishaw, has been appointed Manager of the Strathaven Gas Company, in succession to Mr. John Stewart, who has gone to Lanark.

Mr. G. B. SMEDLEY, jun., Assistant-Manager of the Buxton Gas-Works, has obtained the appointment of Gas Manager and Surveyor to the New Mills District Council, in succession to Mr. E. Jones, resigned.

Out of 35 applicants, Mr. T. R. MURRAY, of the Halifax Corporation Gas-Works, has obtained the appointment of Assistant-Engineer to the Tottenham and Edmonton Gas Company, advertised in the "JOURNAL" some weeks since.

At the meeting of the Royal Institution last Tuesday, the list of officers elected for the ensuing year contained the names of Sir F. ABEL, Sir F. BRAMWELL, Dr. LUDWIG MOND, and Mr. A. SIEMENS among the Managers of the Institution.

With reference to the paragraph in the "JOURNAL" for March 13 (p. 671) on the subject of the appointment of Water Engineer to the City of Cape Town, we are informed that the position obtained by Mr. F. W. WARD HOLLAND is that of Engineering Assistant to the Water-Works Department.

On the occasion of the announcement of the results of the examinations in "Gas Manufacture" at the Polytechnic Institution last Tuesday evening, the conductor of the class, Mr. WALTER GRAFTON, F.I.C., F.C.S., was presented with a set of ebony hair-brushes and comb, in a morocco case, as a testimony of the appreciative regard of the students. The presentation was made by Mr. W. H. Johns, who, as mentioned in another part of the "JOURNAL," took the second prize in the Honours Grade. Mr. Grafton suitably acknowledged the gift.

We learn that at a meeting of the Directors of the Derby Gas Company held last Wednesday, Mr. HERBERT BULLIVANT was appointed Secretary, in succession to Mr. R. Fisher, who, as recently announced, is retiring from the service of the Company, with which he has been connected for more than half a century. Mr. Bullivant has been associated with the Company's clerical staff for upwards of 27 years; and for some considerable time he has assisted Mr. Fisher in the discharge of his secretarial duties. He will enter upon his new position on the 1st of July.

Mr. THOMAS WILSON, who for 47 years has been a most zealous officer of the gas and electric lighting undertaking of the Corpora-

tion of Leicester, was last Tuesday presented with a handsome inlaid rosewood cabinet desk and writing-case, fitted complete, upon his retirement from the post of Superintendent of the Belgrave Gate works. The presentation was made at the works by the Engineer and Manager of the department (Mr. Alfred Colson, M.Inst.C.E.), in the presence of the heads of the staff and representatives of the workmen. Mr. Wilson was greatly touched with the gift, and with the kindly expressions, both of regret at his retirement and of good wishes for a long and happy enjoyment of greater ease, by which it was accompanied.

We regret to learn that Mr. A. E. Broadberry, Engineer of the Tottenham and Edmonton Gas Company, met with a serious accident on Monday afternoon last week through falling from a scaffold on the works. He has sustained severe laceration of the muscles of the lower part of the back, and is compelled to remain in bed. We are pleased, however, to be in a position to state that on Saturday the report of the medical man in attendance was favourable; and the hope was entertained that Mr. Broadberry would soon be restored to his usual health. In this hope we most cordially join; and we are sure those of our readers who know Mr. Broadberry will unite with us in expressing sincere sympathy with him in an illness which we all trust may be but of short duration.

The announcement which appeared in the "Journal" last week of the desire of the Directors of the Midland Railway Company to receive applications for the position of Gas Engineer was necessitated, we regret to learn, by the resignation of the present occupant, Mr. James Brooks, on account of ill-health. Mr. Brooks, it may be said, was born in a gas-works; his father, the late Mr. J. Brooks, having been Superintendent of the Litchurch works of the Derby Gas Company. Mr. Brooks commenced his business life under that Company, and worked his way up through the various offices to the position of Superintendent of the outdoor department, under the Engineer (Mr. Charles Taylor). This he held till December, 1885, when he was appointed Gas Engineer to the Midland Railway Company. Mr. Brooks resides in Nottingham; but his chief office is at Derby, where, in addition to having an oil-gas works, the Railway Company make considerably more than 100 million cubic feet of coal gas for their own use in the extensive carriage and locomotive works there. The whole of the numerous coal and oil gas-works on the Midland system were under his charge.

Mr. B. W. Smith, of Smethwick, has obtained the appointment, advertised in the "Journal" a few weeks ago, of Gas Engineer to the Walsall Corporation, in succession to Mr. W. Gorse, who took the position on the resignation of Mr. John Tindall. Mr. Smith has been at Smethwick nearly nineteen years; having entered upon his duties on July 11, 1881, and started the works, which were in the first place designed and erected under Sir Frederick Bramwell. Since he has been Engineer, the make of gas has increased from 123½ to 264¼ million cubic feet per annum; and under his supervision the interior of the old retort-house has been practically reconstructed, a new retort-house on the inclined principle erected, and the machinery and other portions of the works duplicated. At present the Committee have placed contracts, from his designs and specifications, for an elevated railway siding into the works, the bridge of which over the canal has a span of 158 feet, by which means a very large saving will be effected in handling the coal, both as regards cartage and wages in the works. They have also placed an order for four purifiers, 24 ft. by 36 ft. and 6 feet deep, and foundations. Before going to Smethwick, Mr. Smith was for upwards of seven years with Mr. Hack at Saltley—first as draughtsman, then as chemist and general analyst, and finally as general assistant. Prior to that he was for a short time in the laboratory at Fulham under Mr. Kirkham, having gone there from Pará where he had served five years as a gas engineer under Mr. A. F. Wilson. Mr. Smith is a member of the Midland Association of Gas Managers, before which body he has read several papers; and he was President in 1893. Walsall's new Gas Engineer has therefore had a good record.

OBITUARY.

The recent death is announced of Mr. A. T. Squarey, Solicitor to the Mersey Docks and Harbour Board. The sad event is noticed here from the fact that it was the deceased who some years ago got up the case for the Board in their action against the Liverpool Gas Company, which formed so expensive a sequel to the destruction of the Landing Stage by fire.

Mr. J. R. Tall, Manager of the Dartmouth Gas-Works, died last Sunday week at the age of 53. Mr. Tall had filled the position of Manager for 22 years, and had the confidence and esteem not only of the Directors of the Company but of the town at large. The funeral, which took place on Wednesday, was attended by the Mayor and Corporation, the Directors of the Company, and a large number of the tradesmen of the town.

The death took place on Saturday, the 21st ult., at the age of 62, of Sir Francis Marindin, K.C.M.G., Senior Inspector of Railways to the Board of Trade. Our readers may remember that deceased conducted a few years ago some inquiries in regard to the development of electric lighting undertakings in London. He obtained his C.M.G. in recognition of his services in connection with the Egyptian State Railways; and on the occasion of the Diamond Jubilee he was made a Knight of the Order.

TECHNICAL RECORD.

OHIO GASLIGHT ASSOCIATION.

(*Concluded from p.* 1124.)

Mr. B. E. Chollar, of St. Louis, Mass., read a paper entitled "Some New Ideas about Oxide Purification." In order to get good results, both gas and oxide must be free from tar or other foreign matter, and clean in a mechanical sense. It was commonly supposed that the hydrated sesquioxide was the best form, and that anhydrous oxides were comparatively inefficient. But in his experience, which was supported by others, the anhydrous oxide was by far the better; and when the hydrated forms were used, they were to a great extent rendered anhydrous during the first regeneration. If air was not present sulphuretted hydrogen combined with the oxide to form ferrous sulphide; and if the fresh spent material was treated with dilute sulphuric acid, the sulphuretted hydrogen was set free. But when air was admitted with the gas, the fresh spent oxide showed little indication of the presence of ferrous sulphide, and when treated with sulphuric acid, gave off little or no sulphuretted hydrogen. It revivified more slowly; and while the ferrous sulphide could not be treated with an air-blast for revivification *in situ* without risk of everheating and fire, this variety of spent oxide could be so dealt with, and with comparatively no risk. When air was admitted in proper proportion, and the direction of the flow through the oxide reversed at proper intervals, a new process was effected. The foul gas and air attacked the ferric oxide, reducing it to ferrous sulphide and ferrous oxide; and the ferrous sulphide was immediately converted into ferrous oxide, with separation of free sulphur. Ferrous oxide would not combine with hydrogen sulphide, and air would not oxidize it to ferric oxide if a large proportion of hydrogen sulphide was present. As the gas flowed through the oxide, the proportion of sulphuretted hydrogen would be reduced, while the air remained the same, and therefore the intake part would be reduced to ferrous oxide before the remainder had lost its activity. If under these conditions the flow of gas was reversed, the clean half would remove the impurity as before; leaving the air free to oxidize the ferrous oxide in the part of the bed that had previously been fouled. This also held true with one or with any number of boxes. When one was foul and the other able to do the work, the foul box could be placed last in the series, and revived to an active state ready for another reversal. The clean gas would not absorb impurity from the foul oxide. The author illustrated his remarks by producing samples of oxide treated in the manner indicated.

In the course of discussion, Mr. Hayward remarked that oak, poplar, or white wood shavings, or sawdust, should not be mixed with oxide, because they contained a form of tannic acid; and it was fatal to the action of the oxide, which should always give an alkaline reaction. The acid also encouraged fermentation, which was attended with further formation of acid. In order to guard against the possible presence of acids, it was a good plan to mix lime with the oxide. Even when thoroughly carbonated, the lime would still neutralize acid. He, therefore, preferred either pine or spruce shavings. Other speakers were of opinion that the use of oak shavings had a bad effect on the quality of the gas. Mr. Stone thought that the troubles ascribed to oak were really due to the presence of free iron, or of insufficient oxidation of the new material. Mr. Doherty pointed out the importance of maintaining a proper temperature in the purifying-house, or of covering the boxes with non-conducting material in cold weather. Mr. Hayward further added that the troubles caused by oak shavings must not be confounded with those due to the use of new and incompletely oxidized material. They were all familiar with the formation and properties of iron carbonyl. Not only should they take care to get good oxide, but it was a simple matter to avoid the use of new oxide in the last purifier, or to use a check purifier charged with well matured oxide. Anything in the way of a close filter would take out the iron carbonyl; and even a layer of lime a few inches thick, which could easily be added, would be a preventative.

A paper by Mr. Peter Young, of Detroit, Mich., was read by the Secretary, in the absence of the author. The title was "Bye-Product Coke-Ovens as a Source of Gas Supply." Progress in the utilization of bye-products from coke-ovens had been slow—partly because the market values of the products had been low, and partly because the earlier efforts were not altogether satisfactory in regard to the quality of the coke. The principal difficulty was the neglect to proportion the several parts of the oven to the quality of coal to be treated, which had only recently been corrected. But with the advantage of correct dimensions in the retort coke-ovens, their use had largely extended. They were costly in the first place, and could not be operated with advantage on a small scale. A further encouragement to their adoption was afforded by the lessened production of tar and ammonia at ordinary gas-works, due to the introduction of carburetted water gas. Though there were at least a dozen retort coke-oven plants in America, only two were supplying illuminating gas to the public—in Halifax and in Boston; and it might be questioned whether, as gas-producers, they were operated as efficiently and economically as a well equipped modern gas-works. But at present prices of residuals, coke

could be produced cheaper by the retort oven than by the beehive pattern; and, therefore, in any locality where coke was being produced by the beehive-ovens at a profit, it would pay to introduce retort ovens. The minimum size of a coke-oven plant that could be made to pay was one producing 500,000 cubic feet of gas per day. The cost of such a plant, which would include twenty-five ovens, would be about £21,000, exclusive of buildings. A coal-gas plant of equal productive power, including ten beds of sixes, would cost about £6500. Coal-handling machinery would be a necessity in the first case, but scarcely worth adopting in the second. The bye-products obtained, after providing for fuel, would be 4000 cubic feet of 16-candle gas and 1400 lbs. of coke from the ovens, and 10,000 cubic feet of 16-candle gas and 990 lbs. of coke from the retorts—the yield of tar and liquor being the same in each case. From these figures, the relative values of the processes could be calculated for any locality, always remembering that the coke ovens must be run to their full capacity, with a regular production of coke and of gas, throughout the year. So the question would be whether to build a coke-oven plant equal to the minimum consumption only and to take care of the variations with a water-gas plant or retorts; or to make the coke-oven plant equal to the maximum demand, and to utilize the surplus gas in various ways. The state of trade, the severity of the winter, and other causes, led to a much greater variation in the coke trade than was experienced with gas; and the question arose, "Will it pay better to go into the coke trade, to sell gas, or to stay in the gas business, and sell coke?" In nearly all localities gas coke realized as good prices for domestic use as oven coke; but where a steady demand for oven coke could be created, at better prices, then the coke-ovens would be a judicious investment. The average cost of labour in a coke-oven plant was about 1s. 3d. per ton of coal; but he had heard that inclined retorts had been erected subject to a guarantee to take the coal from the trucks, and load the coke on rail, for 9d. per ton. After allowing for purification and other labour, this compared very favourably with the ovens. It was claimed that the ovens would use slack and other small coals that could not be dealt with in retorts. With the ovens, two sets of holders would be necessary—one for the illuminating and the other for the fuel gas—and also two sets of hydraulics, condensing, and purifying apparatus, though in a small works these might be dispensed with. And to supply 500,000 cubic feet of gas to the consumers, it would be necessary to treat 125 tons of coal in the ovens and only 50 tons in the retorts, which meant 2½ times the quantity of products to be disposed of. At Halifax, endeavours had been made to render the total production of gas saleable by enriching the fuel gas; but it proved unprofitable, as over 2 gallons of oil per 1000 cubic feet of gas were required. At Halifax, the whole of the gas was saleable; and the production had to be supplemented by ordinary retorts. But at Boston, the surplus gas was sold to neighbouring gas-works at 10d. per 1000 cubic feet in the holder—quality not less than 14 candles. There was now an excellent demand for coke of all classes, and he understood that the Boston Company had made contracts for several years forward, based on current prices; and he thought coke would largely displace anthracite coal. As coke producers, the retort ovens were a success; but as gas producers, they could not compete with ordinary gas-works. It required 60 per cent. of the gas to accomplish the work done by 25 per cent. of coke, which might be valued as 24s. for the gas and 4s. for the coke. Another defect was want of elasticity, as the oven plant must be operated at full capacity to make it profitable.

Discussion being invited, Mr. Lynn said that the paper was valuable as coming from one who had practical experience with coke-ovens. On the basis of the figures given, the interest on the increased investment alone would be £2 16s. per day, which would have to be credited to the gas. Figuring on a fair average value for oven coke, the revenue per ton of coal would be £1 11s. 6d. from the ovens and £2 13s. from the gas-works. But using 2½ times as much coal, the ovens would yield a greater return per diem than the retorts. He thought that gas coke as a rule realized much better prices than oven coke. It appeared from the paper that coke-ovens were out of the question for a production less than 500,000 cubic feet of gas per day. Even in large works, it might be found that the expense of running the ovens during the summer was greater than that of working retorts. Mr. Butterworth said that the Columbus Gas Company were looking forward to erect bye-product coke-ovens so soon as the supply of natural gas should fail or materially decrease. He had visited the New England Gas and Coke Works, near Boston, and thought they were doing excellently and had good prospects. They were making 1500 tons of coke per day, all of which was sold in advance, and were preparing to increase the output. They were supplying 18-candle gas, taking for this quality 35 per cent. of the total production. He understood producers were to be erected to maintain the temperature of the ovens in cold weather, and to admit of a greater proportion of the gas being sold in times of large demand. There was considerable demand for coke in the neighbourhood of Columbus; and he thought they could venture on the enterprise with a fair hope of success.

In the discussion on the contents of the Question Box, there was a general agreement that cannel was a cheaper agent for enriching gas than naphtha or oil at present prices. In the course of a reply to an inquiry as to the advantage of enriching gas above 18 or 19 candles, Gen. Hickenlooper expressed a decided preference for straight 17-candle coal gas, which contained the greatest number of heat units, and was therefore most serviceable for stoves and for Welsbach burners. Mr. G. D. Roper said that the lower power gas required a good pressure—say 2½ to 3 inches—and with that it yielded better results than high power gas at lower pressures. It was not so much a question of economy of gas, as of time in doing the work. In boiling water, the consumption of gas would be about the same, at varying pressures; but the higher the pressure the shorter the time occupied. Mr. Doherty remarked that the construction of the burner had a great deal to do with that. The higher pressure made a better and more complete mixture of gas and air, and this could be obtained at a lower pressure by a more careful consideration of the structure of the burner. Also, it was not sufficient to get all the heat out of the gas, as the question of the temperature of the flame and the intensity of the combustion had a great deal to do with the practical results. The higher pressure secured a higher flame temperature, and therefore better results in practice. Especially was this the case as regards the Welsbach burner. A question having been asked as to the practicability of utilizing the waste heat from retort-benches by means of the Yaryan system, Mr. Doherty explained that the system named was an arrangement for utilizing the heat in waste steam or furnace gases, by causing it to heat water contained in a large tank having a circulation system extending to the premises where the heat was to be supplied, and a pump for sending the water through the pipes. An ordinary retort furnace gave off 400,000 or 500,000 cubic feet of waste gases per day at a temperature of not less than 800°; and the heat thus wasted represented that afforded by 3 to 5 cwt. of coal. His idea was that this heat could be absorbed by a kind of gigantic instantaneous water heater, in which the water came into direct contact with the hot gases. He favoured the appointment of a Committee to inquire into this process; and he further remarked that the extent of waste heat above named, indicated that the limits of fuel economy and waste heat regeneration were not yet exhausted. Of course, they were not pinned to the use of water—steam might be found preferable. But several electric light companies had turned attention to the utilization of waste steam heat in this manner; and the retort-bench had the advantage, as compared with the boiler furnace, of a constant regular production of heat during the twenty-four hours. The Yaryan system was in successful operation, and many electric companies were recovering the cost of their coal from the waste heat of their steam. No doubt there was a large amount of low temperature waste heat in all factories, forging works, &c.; but very few of them had the advantage of a steady 24 hours' production. He proposed the appointment of a Committee of Inquiry, which was seconded and carried. Answering another inquiry, Mr. Andrews said that the waste in crushing coke was anywhere between 5 and 15 per cent., and that "egg-sized coke" was that which would not pass a 1¼-inch screen, "nut coke" would not pass a ¾-in. to 1¼ in. screen, and "pea coke" would not pass a ⅜ in. to ¾ in. screen. A revolving screen was of advantage, as the stationary ones were so apt to choke.

The usual executive session was held, at which members only were present, and the proceedings are not recorded for publication. As the result of a long discussion, a deputation was unanimously appointed to confer with other Gas Associations, as to the creation of a fund by the Associations, or by gas companies, for the establisment of a National Advertising Bureau, for the purpose of advertising the advantages of gas appliances. Another deputation was appointed to confer with Electrical Associations on the subject of municipal ownership. A Committee was appointed to deal with the question of electrolysis in connection with other Associations and otherwise.

The usual votes of thanks were passed, and the meeting closed.

EXAMINATIONS IN GAS MANUFACTURE.

At the Meeting of the Manchester and District Junior Gas Association on the 28th ult., Mr. S. E. Halliwell, of Littleborough, read a paper on the above subject.

The author commenced by pointing out the importance of the examination question for educational purposes, and its interest to Associations such as the one whose members he was addressing. He referred to the value to students of the certificate in "Gas Manufacture" of the City and Guilds of London Institute, and expressed regret that it was not more appreciated by companies and corporations. He thought he was right in assuming that, in some cases, influence was a more powerful factor than merit when positions were being filled; and he considered this was to be deplored, as the highest standard of efficiency could not be attained under such a system. He did not for a moment contend that successful candidates at an examination in "Gas Manufacture" were necessarily qualified for the more responsible positions; but the very fact of passing proved, he thought, a knowledge of the subject, while the determination to compete evinced a desire for self-improvement. Moreover, the efforts put forth for such examinations necessarily increased one's technical knowledge, and rendered the student more capable of taking a position of responsibility. He reminded his audience that the certificate in "Telegraphy" of the City and Guilds of London Institute was recognized by the Post Office as qualifying

the holder for increased remuneration; and he thought that if the Institute's certificate in "Gas Manufacture" obtained similar recognition, the effect would be to encourage closer study of the scientific principles underlying the manufacture of coal gas.

Having referred to the increased popularity of the examinations in the subject referred to, as shown by statistics supplied to him by Sir Philip Magnus, the Institute's Superintendent of Technological Examinations, Mr. Halliwell pointed out that while the number of entries in the Ordinary Grade had risen from 40 in 1889 to 103 in 1899, and in the Honours Grade from 19 to 65, the percentage of failures had also risen from 12·5 to 42·7 per cent. in the former, and from 26·3 to 66·1 per cent. in the latter grade. He considered there were many factors which might, to some extent, account for this large proportion of failures; one being, no doubt, the increased difficulty of the papers set, especially in the Honours Grade—many subjects being now comprised in the syllabus which have not hitherto been included, such as the production of carburetted water gas, the various methods of enrichment, labour-saving appliances, &c. Moreover, there was in many districts an absence of local assistance in the shape of classes, as many educational authorities did not care to undertake their formation, owing to the small number of students who would be likely to attend them. Another reason for the high percentage of failures was lack of preparation. This applied even where classes had been formed; for mere attendance was not sufficient. Many students who entered as candidates for examination considered preparation superfluous. The author maintained, however, that it was absolutely indispensable for the attainment of any degree of success, especially at the present time.

Without attempting to deal with the working out of an examination paper, Mr. Halliwell proceeded to indicate several points which he thought would be acknowledged to be essentials for a pass. In the first place, sketching was no doubt a very important factor, as it was a most ready means of proving a student's knowledge. He quoted the remarks on this subject contained in the "Journal" for Nov. 1, 1898, based on the report for that year of the Examiner, Mr. Alfred Colson, who said that, while many of the candidates' sketches were excellent, there was considerable room for improvement. Mr. Colson also commented on the all-round knowledge of the students, as evidenced by the papers of those who passed; and he recognized that attention was being paid to his reiterated warning that "one-sided knowledge, either in the engineering or the chemical branch of the industry, is not sufficient to merit a certificate." Mr. Halliwell thought it might therefore be fairly concluded that "good sketching, good composition, and an all-round knowledge of the subjects, are necessary, if good results are to be attained; and that to attain any degree of efficiency in these essentials, thorough preparation is necessary." As to the time allowed for the Honours paper, he regarded it as insufficient for giving exhaustive answers to the questions; and he considered the Examiner ought not to expect model replies and sketches made with mathematical accuracy in the short period of three hours. Having cited the questions in last year's Honours paper in support of his views on this point, he expressed the opinion that the syllabus in this grade covers too wide a range of subjects to be dealt with in a one-night examination with anything approaching satisfaction; and he supported our own suggestion that it should extend over two nights. We proposed that one paper should cover the ground from the retort-house to the station meter, including the analysis of coal and gases; and that a second paper should deal with the apparatus from the gasholder to the consumers' burner, including the testing of gas and the treatment of bye-products. Mr. Halliwell's view was that the whole subject might be divided into two sections—"Engineering" and "Chemical"—one night to be devoted to each, and certificates to be granted in each section. He thought this would be a more thorough test of a student's knowledge in both sections than that afforded by the present system.

The author passed on to deal with the lack of facilities offered to students for acquiring a sound scientific knowledge of gas making apart from the every-day routine of their own particular works. He advocated the extension of the class system, or even tuition through the post. Referring to the scheme formulated by the Gas Institute in 1887 for the inauguration of lectureships in various towns, for the benefit of the younger members of the profession, and supported by grants from the funds, Mr. Halliwell regarded the step as a desirable one to take, and expressed the opinion that many districts would avail themselves of such an offer. Classes might, he thought, be formed where no educational facilities, as far as subjects connected with the gas industry are concerned, at present exist. In view of the competition of the electric light, he regarded it as highly necessary that the younger members of the gas profession should prepare themselves in every possible way for their future career. He quoted the remarks of Mr. W. Foulis, in his Inaugural Address to the Gas Institute in 1887, on the need of higher education, and of greater scientific accuracy and investigation in all the details of gas manufacture. Emphasizing these observations, he urged the importance of thorough training for those who intend to occupy responsible positions in the gas industry, in order that they might be able to keep pace with the ever-increasing competition of other illuminating and heating agents.

Turning to the social side of his subject, Mr. Halliwell alluded to the absence of facilities for intercourse between the younger members of the gas industry; and he advocated the formation of more Junior Associations. Their establisment would, he said, effect a blending of the knowledge of the members which would prove mutually beneficial, for, by means of papers read on various topics affecting the whole routine of gas manufacture, and the discussion thereof, visits to works, comparison of experiences, and, if possible, exchange of papers, a system of mutual educational improvement would be established which could not but have a good effect on the future of the gas industry, as it would create a higher standard of efficiency in assistants which would be decidedly advantageous in conducting gas undertakings.

VITRIFIED-CLAY PIPES FOR GAS AND WATER MAINS.

Reference has already been made in the "Journal" to the use for water-supply purposes of pipes made of vitrified clay. The utilization of this material for gas-mains was dealt with in an article in the "Iron and Coal Trades Review" for the 6th inst. The author states that the suitability of vitrified-clay pipe for the purpose mentioned is due to its possession of the following properties: Cheapness, durability, strength, slight susceptibility to changes of temperature, and non-porosity; and he considers these properties in the order named.

Cheapness.—Vitrified-clay pipes can be had, in quantity, in 4-feet lengths, and with large and strong sockets similar to the bowls of cast-iron gas-pipe, at much lower prices. The 4-feet lengths would, however, necessitate the making of three times as many cement joints in a line of clay pipes as in a line of cast-iron pipes of the usual 12-feet lengths. The following is, therefore, a rough but fair comparison of the costs of a mile of 6-inch vitrified-clay and cast-iron gas-mains, exclusive of excavating and refilling:—

	Fire-Clay.		Cast Iron.
Cost of pipe in trench, at 3d. and 1s. 5½d. per foot	£64	..	£370
Cost of making 1320 and 440 cement joints, at 12½d. each	66	..	22
Total cost	£130	..	£392

For sizes of main larger than 6 inches, the saving would be still greater.

Durability.—Vitrified-clay pipes are even more durable than those of cast iron, as they do not rust or corrode. No chemicals or substances in the earth, foreign or otherwise, seem to attack them. They are practically indestructible, and retain their strength and non-porosity indefinitely. The author recently examined a piece of vitrified sewer pipe that had been buried for 35 years, which, when cleaned by an experienced sewer-pipe manufacturer, could not be distinguished, whether by appearance or any other test, from freshly made pipe.

Strength.—While vitrified-clay pipe is not so strong as cast iron, it is nevertheless amply strong for gas-mains. These pipes do not break or crush when used for sewers; why should they do so when used for gas-mains? The tensile strength of vitrified pipe, whether of fire-clay or shale, is astonishingly great. Ordinary single-strength 6-inch vitrified fire-clay sewer pipes, with walls ⅝ inch thick, withstood an internal hydraulic pressure of from 90 to 120 lbs. per square inch; while 6-inch vitrified-shale pipes withstood from 140 to 180 lbs.—one piece not bursting even at the latter pressure—and 12-inch shale pipes, with walls 1¼ inch thick, have withstood an internal pressure of 220 lbs. A 2-feet length of 4-inch vitrified fire-clay pipe, selected at random, with walls ½ inch thick, was supported at both ends, and a weight of 2800 lbs. was suspended from the middle of the pipe before it broke. Vitrified-clay pipes may be brittle, as are also cast-iron pipes; and like them, they can be easily broken by a sharp blow, such as they would never receive when in use as gas-mains. But they are extremely strong, and do not readily break under a steady strain, such as they might be subjected to when buried in the earth. The difference between them and cast-iron pipes in this particular is not great, and the advantage is only slightly on the side of the cast iron.

Slight Susceptibility to Changes of Temperature.—The relatively high coefficients of expansion of iron constitutes a serious objection to the use of this material for mains. Iron mains frequently break, and their joints generally leak, on account of excessive expansion and contraction of the pipe due to changes of temperature. On the other hand, the expansion and contraction of vitrified-clay pipes, laid at the usual depth of gas-mains, would be very slight indeed—in fact, practically *nil*. Although the coefficient of expansion of vitrified clay has apparently never been determined, it is safe to assume that, inasmuch as it partakes more nearly of the nature of common brick than of glass, it is no higher than the average of the coefficients of these two materials, or (say) only one-third that of cast iron.

Non-Porosity.—Vitrified-clay pipes are, except possibly at enormous pressures, absolutely impervious to gas, while cast-iron pipes are more or less porous at ordinary gas pressures.

All things considered, there really seems to be no reason why pipes made of vitrified clay cannot be used, with satisfaction and great economy, for gas-mains. There would appear to be no difficulty in making good tight joints with cement, as the bowls can be formed exactly like those of cast-iron gas-pipe, with plenty of strength to withstand the calking in of jute or other packing. Of course, the vitrified-clay pipe must be selected and

laid with care, but not more carefully than cast-iron pipe, which is almost as nearly non-elastic, and which needs a firm and solid bearing throughout its entire length. The bottom of the trench should be scooped out to conform to the shape of the clay pipe, the earth should be thoroughly tamped round it, and a thin plank should preferably be laid over it to protect it from puncture by picks, &c. If the vitrified-clay pipe is laid as carefully as cast-iron pipe, the breakage due to settlements will be no greater, while that due to expansion and contraction will be less, as will also be the leakage. It may be found best also to use "ring" pipe without sockets, and employ a pitch or other flexible joint.

The following particulars in regard to a line of vitrified pipe to be laid for the supply of water to Hartford (Conn.) recently appeared in the "Engineering Record."

The water supply of Hartford is obtained from a series of connected reservoirs, which have recently become inadequate for the city's needs. An additional watershed is to be utilized; but, while this is in course of development, it is proposed to prevent the loss of water from existing sources as much as possible. Between two of the basins there is now an open channel about 3 miles long, which is believed to be far from water-tight along four-fifths of its route. Mr. Rudolph Hering was recently retained to suggest means of preventing this leakage, and he advises the use of a vitrified pipe-line under very slight pressure, although able to withstand a head of 10 feet occasionally, should such a pressure be necessary. The prevention of the leakage through the canal banks and bottom would involve either a masonry or a puddle lining, for it has been found impracticable to prevent it by running muddy water through the channel. Unless masonry is started below the frost-line, it will be injured, and thus fail to accomplish its purpose, which makes puddle the only practically useful material under the given conditions. This plan involves puddling the bottom and sides with at least 12 inches of clay, protected with not less than 8 inches of earth. If the work is carefully done, and the material is of the proper kind, the canal will not only become water-tight, but the frost will not permanently injure the lining. An estimate of the cost of this work has been made. Assuming that the bottom of the section is only 6 feet wide, and the entire puddled section of it is 22 feet wide, that no additional rock excavation is allowed for, that excavation is estimated at 50 c. per cubic yard and puddling at 8 c. per cubic foot, the cost would be $3 per foot run. Assuming, as before, that 80 per cent. of the canal length required such treatment, the cost would be $36,960.

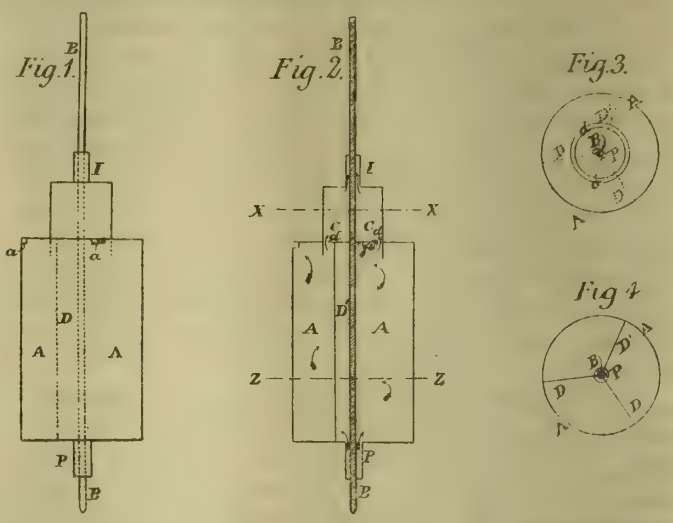
To repair the canal thoroughly in this manner would cause it to become water-tight; but it should be added that the conveyance of water for three miles in a shallow open ditch is not the best sanitary method of dealing with water for a potable supply. The only redeeming feature of this particular canal is the collection of rain water from a strip of territory draining into it, amounting to from one-half to two-thirds of a square mile. In view of the intention to increase the water supply for the city in other directions, this gain is not material. The aëration of the water in the ditch is of no advantage after the much greater aëration it has received in the large reservoir. It will not take out the solid organic matter or destroy bacteria. It removes iron when the water is impregnated with it, and gases when the water is polluted. For these reasons, it is held that a more satisfactory means of conveying the water from one basin to the other is afforded by closed conduits, in which the water is protected from dirt and heat—the latter a matter of some importance where the depth of water is slight.

If the total available head between the two reservoirs is utilized, then cast-iron pipe must be employed, according to Mr. Hering. If the head is not greater than 10 feet, then carefully selected and well-jointed double-strength vitrified pipe will answer. The latter is imperishable, and will retain a smooth interior; thus retaining also its original discharging capacity. Iron pipe will become tuberculated inside, and thus generally and gradually have its discharging capacity reduced. On account of this fact, and of the greater economy of vitrified pipe, the latter is given the preference in the Hartford case, even though a less head, and therefore a smaller discharge, is obtained by it. If the vitrified pipes are well selected, so as to fit without interior projections of more than $\frac{1}{8}$ inch, and thus reduce the fractional coefficient to a practical minimum (Kutter's $n = 0{\cdot}012$), the pipe, if laid at the lighter grade, will discharge 5,823,000 gallons per day; if laid with the better grade, it would discharge 8,583,000 gallons per day. In both cases it is assumed that the pipe does not run under a head. By giving the water a head of 10 feet above the pipe at its upper end (the greatest head to which it should ever be subjected) the discharge would respectively be 7,064,000 and 9,417,000 gallons per day. The estimated cost of the pipe of smaller capacity is $31,500, and that of the other $33,000. The latter was recommended; and the Water Board have decided to build it. The difference between its first cost and the expense of puddling the old canal is not the only favourable feature it presents. It will still leave the canal free to collect the run off from the adjoining district in times of drought; it will protect the water from injurious influences, as before stated; and it will be less expensive in maintenance and repairs.

REGISTER OF PATENTS.

Separating and Extracting Gases from a Gaseous Mixture, Purifying, Exhausting, and Compressing Gas, and Increasing its Illuminating Power.—Mazza, E. N., of Turin. No. 20,494; Oct. 12, 1899.

The mechanical apparatus forming the object of this specification has, says the patentee, been "suggested by the laws governing centrifugal force arising in bodies that are made to revolve on a point or on a right line. If a sufficiently rapid rotary movement is given to a gaseous mixture whose components are sensibly different in specific gravity (and so much the better as this difference is greater), by the action arising from centrifugal force, the denser gases will go to the periphery, and the lighter gases will gradually dispose themselves near the centre."



He then proceeds to describe the invention by means of drawings, in which fig. 1 is an elevation of the apparatus; fig. 2 is a vertical section; fig. 3 is a horizontal section on the line X of fig. 2; and fig. 4 is a horizontal section on the line Z.

A is a drum revolving on a shaft B, to which it is rigidly fixed by means of several diaphragms D, D^1, D^{11}. The drum (which revolves vertically on its shaft) is closed at the bottom, leaving a central inlet P for the gaseous mixture to be decomposed. It is divided into several compartments by these diaphragms; and it has one or more other compartments C, according as two or more constituents have to be separated from the mixture. If the shaft, and the drum and diaphragms with it, are made to revolve at a suitable speed, it will cause in the middle a rarefaction, which will result in the gaseous mixture rising through the central flue I. The diaphragms violently force the mixture towards the drum; and at the same time it ascends. Then, when it arrives at the upper part, the separation will be complete, and the gases of the mixture can be distributed in concentric rings according to their different densities. The denser will go out by the openings *a*, and the less dense by the openings *d*, and finally pass out at I.

In the specification, some practical applications of the invention are described; and some extended reference to these will be of interest. As is known, common illuminating coal gas (the patentee remarks) is essentially a mixture two-thirds of which are hydrocarbons that give the illuminating power, and the remaining one-third is hydrogen giving only heat. The same illuminating gas is employed for lighting, heating, motive power, and, in some cases, for smelting, &c. In the first instance, it would be desirable to have it of great illuminating power, which, if necessary, is artificially increased (for instance, by carburetting the gas). For the other applications, it would be preferable if it were of great heating power. Several means have already been invented for increasing the illuminating power; but, on account of the facility with which, by means of the separator and extractor here described, centrifugal force can be applied to totally or partially collect the hydrogen of coal gas, it is proposed to extract by this apparatus a sufficient portion of it, in order that the remaining hydrocarbons could give the desired greater illuminating power. In this way, the problem of adding some carburetting substances to increase the illuminating power of a gaseous mixture on ignition, would be substituted by "the simpler and also less expensive one" of taking away a portion of the hydrogen (which by its presence would lower the light of the mixed incandescent hydrocarbons), and so indirectly increase the luminosity of the hydrocarbons. Therefore the physical and mechanical process and the apparatus here referred to, "make it possible to separate, with very little expense," the pure hydrogen gas from the hydrocarbons as soon as they issue from the retorts in which they are produced, and then to forward them to two distinct reservoirs—one to be applied to lighting, and the other to industrial uses.

It is a known mechanical law that the resistance of bodies to the fluids striking them, changes proportionally to the square of the speed for the same surface. Consequently, the motive power necessary for obtaining a given amount of work would be saved in proportion as the striking surface of the bodies and fluids would be lessened. In the compressing extractors now in use, the shock of the gas against the vanes is produced on the two lateral surfaces and on the imaginary belt that would envelop the vanes. On the contrary, in the apparatus here described (in which the diaphragms take the place of the vanes with the same object of imparting a rotary velocity to the gas molecules), the fluid is struck by the diaphragms only in the inlet and outlet openings strictly calculated, and in the whole passage in the drum there is only the transporting in the interior and the friction on the exterior face of the drum. Then, before acting as a separator, the apparatus acts as a rotary extractor by the aspiration produced near its axis by centrifugal force acting at the periphery; and consequently in its greatest intensity between the axis and the periphery of the revolving fluid cylinder, there is not, and cannot be, any interruption.

The centrifugal force to which the fluid is submitted when in the moving drum, produces the separation of its components of different density; and the gas, by the acquired rotation, escaping from the drum will have a projecting velocity that can always be utilized for augmenting the pressure, so that the apparatus can be used as a compressor. It would be sufficient to enclose it in a strong, fixed, gas-proof casing, having at its two ends the necessary orifices for the gaseous mixture at first, and for its constituents after the operation of the rotary motion.

Then, as a compressing extractor, the apparatus is distinguished from any other actually in use by having the vanes or diaphragms rotating with the drum; and the shock of the fluid or gas being only produced at the orifices of the inlet and outlet on a surface that is always less than that of the vanes against which the fluid or gas strikes in the ordinary apparatus. At the same time, the apparatus could always be used as a separator, if the coal employed in the production of the gas was of inferior quality, or giving a gas without the necessary degree of luminosity; and it would not be necessary to have two different systems of pipes, but it would be sufficient to have two gasholders.

In gas-works, the apparatus could be used in "an important manner and more continually." As it is known, the greater impurities of illuminating gas (say, tar, carbonic acid, and hydrogen sulphide) are all denser than the illuminating gas itself. It would thus be easy, by means of the apparatus, to collect the whole mass of the impurities in a single operation, or in two consecutive operations. In this way, the condensers and the purifiers "would be abolished," with the consequent economy of the power necessary to work them. The impurities could also be collected and utilized better than at present. The cyanogen collected could be made into cyanides; and the hydrogen sulphide into sulphuric acid (without needing the special furnaces now used for the sulphides and sulphates). Another advantage for gas-works would be in "the suppression of the washing of the heavy hydrocarbons in order to obtain the ammonia mixed with them." The ammonia, by the action of centrifugal force, would be separated with the hydrogen, and the methane, which would not be affected by washing in ammoniacal liquor, while the heavy hydrocarbons would lose about 5 per cent. of their illuminating power.

Regenerative Coke-Ovens on the Everett System.—Schniewind, F. W. C., of Everett, Mass., U.S.A. No. 3335; Feb. 20, 1900.

This invention relates to coke-ovens of the kind in which regenerative chambers heated by the escaping products of combustion from furnaces used in heating the ovens are employed to preheat the air which is passed to the furnace to support combustion; and, generally speaking, it may be said to consist "in connecting the cooling-flues with the conduits leading to the regenerators, providing means for directing the hot air coming from the cooling-flues into the proper regenerator, and means for retaining a proper draught through the cooling-flues to at once ensure their proper action and a proper supply of air to the regenerators." Fig. 1 is a sectional elevation taken through a bank of furnaces provided with regenerators and cooling-flues—the section being taken in the rear of the transverse flue J, as (for instance) on the irregular line at the left of fig. 2. Fig. 2 is a plan view, showing the ends of two adjacent banks of coke-ovens.

Fig. 1.

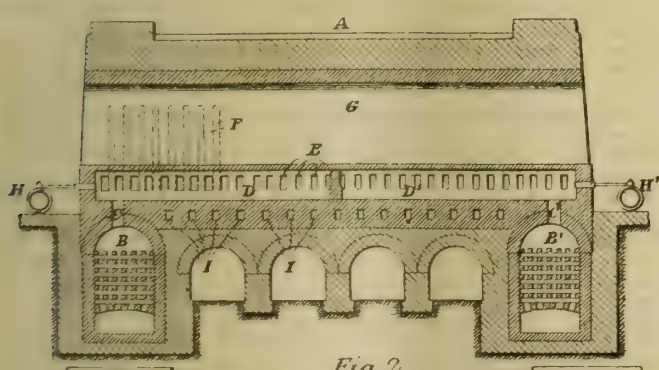


Fig. 2.

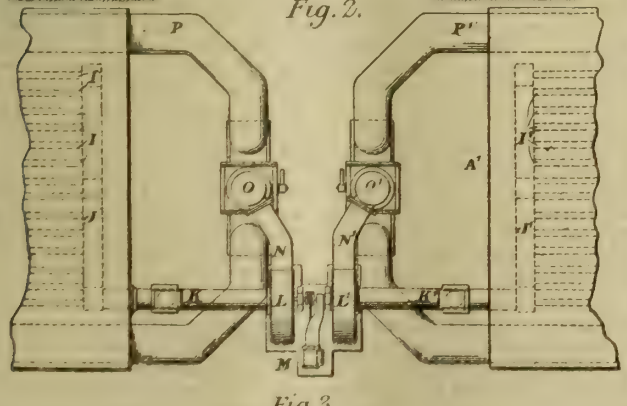


Fig. 3.

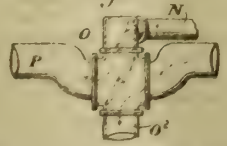


Fig. 3 is a sectional view of a valve by which the air from the cooling-flues is brought to each bank of ovens, and out of the other regenerator into the slack.

A A^1 indicate banks of ovens; B B^1 regenerative chambers situated in the front and rear of each bank and connecting through passages C C^1 with the combustion chambers D D^1. In fig. 1, the combustion chambers connect through flues E with vertical partitions, indicated by the dotted lines F, which, in turn, are situated in heating-flues extending between each adjacent pair of ovens. The view of fig. 1 is taken through one of the ovens, indicated at G. H H^1 are mains supplying gas to the combustion chambers through burners. I I indicate cooling-flues formed in the masonry beneath the ovens or furnaces and combustion chambers. These flues are usually open at one end, and connected at their other ends with vertical chimneys or flues leading out of the top of the masonry bank, and which maintain a draught through the cooling-flues. The flues I may be led into the common collecting flue J or J^1, from which, in turn, lead pipes K K^1, connecting with suction fans L L^1. N N^1 are discharge-pipes of the fans which lead to a valve-chamber O or O^1, in each of which is a butterfly-valve, as shown in fig. 3. With the chamber O are connected the conduits P leading to the lower part of the regenerative chambers B B^1 of one bank of ovens; and with the chamber O^1 are connected the conduits leading to the regenerative chambers of the other bank.

In operation, the fans L keep a constant current of air passing through the cooling-flues, which are freely open to the atmosphere at the ends opposite to those terminating in the common flues J J^1; and too energetic cooling of the masonry bank is avoided by admitting cool air in such quantity as may be desirable to proportionately diminish the flow through the cooling-flues I, and the adjustments of the valve, indicated in fig. 3, will cause the hot air to pass through the valve-chamber and thence to the regenerative chamber B or B^1 as desired.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Gas Institute Visit to Paris.

Sir,—The Council desire to announce that a sufficient number of names having been received, the visit to Paris in connection with the forthcoming meeting of the Gas Institute, will take place in accordance with the notice issued to the members. At present, the respective number for each route—Dover-Calais and Newhaven-Dieppe—is about equal.

It has come to the knowledge of the Council that there are still others who wish to accompany the excursion, but who have not yet returned the reply form; it being impossible for them to say with certainty, so long beforehand, that they would be able to go. Messrs. Cook have therefore been asked, and have consented, to extend the time for the receipt of the final list of the party to May 30, *which is the very latest possible date they can offer*.

Members to whom this notification applies, are requested to send here their names, and those of friends (ladies or gentlemen), without delay; mentioning the route selected, and remitting the requisite registration fee.

The Incorporated Gas Institute, Walter T. Dunn,
13, *Victoria Street, Westminster, S.W.,* Secretary.
May 7, 1900.

Patent Law Reforms.

Sir,—In the article on the above subject in your last issue, you say the Institute of Patent Agents "condemn the German and United States systems of Patent Office procedure," and you express the belief that an "eminent authority objects equally to the issue of Letters Patent at an applicant's own risk," &c. These matters are doubtless debateable ones; but for the Crown to take fees from an applicant who deposits a specification containing the following claims is beyond question unjust:—(1) The idea is absolutely my own; (2) that it will clean out any wooden pipe, no matter how badly corroded; and (3) make it equal to new." I submit that surely the applicant's attention ought to be drawn to the matter, and at least an opportunity given to amend. Rule 16 seems to provide for this: "Any irregularity in procedure, which, in the opinion of the Comptroller, may be obviated without detriment to the interests of any person, may be corrected, if and on such terms as the Comptroller may think fit."

Your remarks as to the stamping of agreements can hardly be said to apply, as the Crown authorities have no hand in their preparation, whereas they have in specifications, and they "direct" that claims be made. "Suggestions" are submitted by the Patent Office officials to applicants as to the title; why not, therefore, as to claims?

161, *Albion Road, N., May* 2, 1900. Arthur Clarke.

Directors v. Auditors.

Sir,—The attention of my Directors has been drawn to the article, under this head, in your issue of 24th ult., which contains the following statement of proceedings at the recent meeting of this Company: "The majority of shareholders present supported the Auditors; but, by the aid of proxies, the Directors carried their point, and, moreover, obtained the dismissal of the Auditors from the service of the Company."

The Directors desire me to point out that the whole of that statement is absolutely untrue. The Auditors were rejected upon a show of hands only. Proxies were not used for the purpose.

The academic conclusions of your article—formed, as they are, upon the above false premiss—are equally erroneous.

The Directors refrain from comment upon the strange assumption running through the article in question—to the effect that, in a controversy between directors and auditors, the latter must necessarily be right and the former wrong—but request the favour of your insertion of this letter as a matter of simple justice.

Horseferry Road, S.W., May 3, 1900. G. B. Gladding, Secretary, Golden Grain Bread Company, Limited.

[Upon referring to "The Times" report of the proceedings at the meetings in question, we find that, at the first meeting, held on the 3rd ult., an amendment to the motion to adopt the report of the Directors was moved, proposing the appointment of a Committee of three share-

holders "to investigate and report to the shareholders upon the differences which have so long existed between the Board and the Auditors," and that the meeting should be adjourned, pending such Committee's report. This was obviously a motion of "no confidence" in the Board, and was so opposed by them. The Chairman "afterwards put the amendment, which was carried on the show of hands, but was declared lost by the Chairman, who stated that the Directors had received proxies from 283 shareholders, representing 43,975 shares and 7223 votes." A poll was taken; and the result was subsequently declared by Mr. Gladding (according to "The Times" report) to be "that 16 shareholders—15 in person and one by proxy—holding 7951 shares and entitled to 1033 votes, voted for the amendment, and that 241 shareholders—11 in person and 230 by proxy—holding 45,217 shares and entitled to 7348 votes, voted against the amendment." Mr. Gladding now declares that our statement, that "the Directors carried their point by the aid of proxies," is "absolutely untrue." Perhaps he will furnish us with the correct figures as to the result of the poll. Those reported in "The Times" do not bear out his contradiction. As to the dismissal of the Auditors, that, as we were aware, was declared carried by 22 to 17. If, as appears, our account was taken to mean that proxies were used to obtain that dismissal, we can only express regret that our language was ambiguous. At the same time, we must observe that the apparent indignation of the Directors at being, as they imagined, represented as using proxies for such a purpose, is somewhat discounted by the fact that, according to the report before us, "the Chairman, in answer to a shareholder, stated that, if a poll were demanded, it would be his duty to use the proxies."—Ed. J.G.L.]

Local Authorities and the Price of Gas.

A correspondent writes: "It would be very interesting and instructive to know what the majority of the Local Authorities who own gas undertakings intend doing to meet the great increase in the cost of gas manufacture arising out of the enhanced cost of coal and other materials used. As you know, it has been customary to look to the gas undertaking for a good sum towards the reduction of the rates. Will the ratepayers now be willing to forego the benefit, and pay higher rates, or will the gas consumer be called upon to pay a higher price for his gas to still relieve Mr. Ratepayer?" Our correspondent thinks this is a question which could very well be ventilated through the medium of the "Journal."

PARLIAMENTARY INTELLIGENCE.

Gleanings from the Committee Rooms.

After an unusually long Easter recess, the Parliamentary Committees resumed work last Tuesday. The members of Mr. Oldroyd's Committee passed with good grace from their leisure to the uncongenial task of inquiring into the sufficiency or otherwise of the present system of gas examination in London, which is the question raised by the Gas Testing Bill of the County Council. The Committee sat three days; and looking back over the mass of evidence they heard, one cannot but sympathize with them in being called upon to judge a case of such an intricate nature. Before the vacation, the County Council set themselves to prove to the Committee the need for a change in the gas-testing arrangements in London by legalizing the use of the portable photometer; and last Tuesday the efforts of the Council's witnesses were directed to showing that the instrument in question is a trustworthy one. In trying to convince the Committee that, to ensure the consumers received gas of 16-candle power, an alteration was necessary, witnesses asserted that, when the portable photometer was used side by side with an ordinary photometer in a properly appointed testing-station, equivalent results were obtained; but when the portable photometer was taken to other buildings, serious lapses in illuminating power were discovered. Strange to say, the testimonials which were put in last Tuesday as to the good and reliable character of the portable photometer showed that gas tested by it in a private house and Board schools in the Gaslight and Coke Company's district were well above the standard. This was so in all cases, except in tests made on April 26, at a Board school in Clerkenwell. There the Gas Company had fixed up two portable photometers in adjoining rooms with the view of proving that the instruments would give variable results even in the same building. But Dr. Clowes, who, as the chief representative in this matter for the County Council, was invited to experiment with these photometers, obtained concordant readings within 0·09 candle—the average of several readings being with one photometer 15·25 candles and with the other 15·34 candles. But on the preceding evening, the Company had found a divergence of 2 candles in the results from the two rooms. On ten days between April 13 and 28, Dr. Clowes and his assistant made tests, contemporaneously or nearly so, in different rooms in a private house in the north-western district, and there was practically no difference in the illuminating power; the average of the trials being above 16 candles and some above 17 candles. Further tests in a Board school yesterday week gave similar results. The same evening Mr. Thomas Fairley, the Gas Examiner to the City of Leeds, made simultaneous tests with Mr. Dibdin at the Netley Street Board School, and obtained average readings with one photometer of 16·58 candles and with the other of 16·7 candles—a difference of only 0·12 candle. Then in different rooms of unequal size, the average readings were 16·42 candles and 16·43 candles. All this taken alone is a very good argument against there being any necessity for an alteration in the gas-testing arrangements of London; but when the figures are placed side by side with those given before the adjournment, they are truly perplexing.

The three witnesses who were examined on Tuesday in support of the Bill were Dr. Clowes, Mr. Fairley, and Mr. C. R. Bellamy, the Gas Examiner of Liverpool. It is the opinion of Mr. Fairley that the portable photometer will give results equally accurate to a fixed table photometer. There are points of peculiar interest about Mr. Bellamy's evidence. He has had several years' experience with the working of the portable photometer at Liverpool. Down to 1894, he found discrepancies between the results given by the portable photometer and the official testing-stations averaging something like 1·26 candles; but since 1895, the testings have been practically uniform. His experience in Liverpool, however, has been with a different instrument from the one proposed to be adopted in London; and, moreover, he finds that testing with it in six places in the city secures a fair average of the whole supply. It is evident that there is no likeness between Mr. Bellamy's practice and the conditions the County Council would impose on the London Companies. He was called to bless the Bill; but left the chair with condemnation of random photometry on his lips.

The honour of opening the attack on the Bill fell to the Gaslight and Coke Company; and their first four witnesses were, given in the order in which they were examined, Mr. G. C. Trewby, Mr. Corbet Woodall, Mr. Greville Williams, and Mr. W. G. Young. In form and substance, the evidence of all the witnesses was admirable and impressive. It was shown that in the Company's area there are fifteen testing-stations; and these are considered quite sufficient to safeguard the interests of the consumers—in fact, there is no other place in the world where the system of testing is so stringent as it is in London. At the fifteen stations, during the past five years, no less than 21,000 odd tests have been made. In only 16 have the Gas Examiners reported against the Company; and in all but two, the Company's appeals have been allowed. Any suggestion that the gas supply to the testing-stations is manipulated is indignantly resented; and Mr. Corbet Woodall regards as very offensive the clause in the Bill which provides that notices to the Company of tests by the portable photometer shall not disclose where such tests are to be made. There certainly appears to be some connection between this clause and the insinuation as to manipulation. Very naturally the discrepancies between the tests with the portable photometer and those made at the official stations are ascribed to the dissimilar conditions under which they were made, and to local causes; and tests made by the Company support this view. For instance, Mr. Young cited tests which he had made with two portable photometers, under identical conditions and taking all precautions, showing variations between ½ candle and 2 candles. He and the other witnesses emphatically declare that the portable photometers could not be relied on. Mr. Woodall made a good point when he said that some confusion arises owing to the want of a proper appreciation of what is 16-candle gas. It is a gas which, measured under certain express conditions, will give a light of 16-candle power; and the conditions can only be obtained at a properly equipped testing-station. Therefore, any departure from the prescribed conditions is objectionable to the Company. The witnesses made it clear that the Company have not any antipathy to the multiplication of the testing-stations, notwitwstanding the expense, if it is considered necessary to increase them; nor have they any objection to tests being made at the various works.

Very valuable was the testimony given by Professor Vivian B. Lewes, who attended as a witness on the Speaker's warrant. He had found that, under the worst conditions of distribution in the City—in an office situated at the extreme end of the main from the Bow Common works—the mean average illuminating power, taken day by day and year by year, was 15·6 candles, while at the testing-station the illuminating power was 16·6 candles. When the office was removed into a more favourable position—nearer the main pipe—the average illuminating power was 16 candles; while at the testing-station it remained at practically 16·6 candles. Although admitting that the portable photometer is in itself an excellent form of instrument, Professor Lewes deliberately says: "My own opinion is that the requirements, to obtain good results from it, are so delicate that you would have to come back to certified stations." The present system of fixed stations, he believes, practically secures the consumers; but testing-stations at each works would afford far greater security. If, however, the present Bill is passed, it will render absolutely necessary the enriching of the gas by at least 3 candles in order that, in cross mains in which the gas stands, it should hold up its illuminating value sufficiently to give 16 candles, when tested by the portable photometer. To obtain this extra 3 candles of enrichment, the Companies would have to expend at least 3d. per 1000 cubic feet on the gas, and the main part of this would undoubtedly fall on the consumer. Such are the weighty opinions of Professor Lewes. It is also, in Professor Dewar's judgment, impossible to make tests taken as a standard comparable with a test taken at a Board school or in any public building; and he supports the view that the present method of testing is the best practicable security to the consumer that can be desired. With Professor Dewar, the evidence for the Gaslight and Coke Company concluded. Mr. Pope's address to the Committee was well-conceived and powerful; and he whipped the County Council with their own rod, by pledging his clients to accept, if the Council liked to approach them, the arrangement existing at Liverpool, under which no penalties are inflicted, but information is given to the Company to enable them to remedy defects.

The last witness before the Committee adjourned on Thursday until yesterday, was Mr. George Livesey; and his evidence covered many questions pertinent to the inquiry. The obligation on the Companies to supply gas of 16-candle power as defined by specific tests he admits; and he shows how that illuminating power would be varied by a variation of the conditions under which the gas is tested. If such a system as the portable photometer is applied, the Companies, he assures the Committee, would not be safe unless they sent out gas of about 19-candle power. The effects of this would be endless complaints and an addition of £126,000 to the consumers' charges in the South Metropolitan Company's district. The enrichment of gas, the burners used by consumers, and the violation by the Board of Trade of the requirements of Parliament in connection with the appointment of the Gas Referees are matters which also came under his lash. In connection with the serious defections in illuminating power which Dr. Clowes and others found in the neighbourhood of the Bankside works, as testified to at the sittings before the holidays, and upon which there has been a good deal of comment, Mr. Livesey states that the County Council representatives had an idea beforehand of the fluctuating state of things existing at that station;

and, like true sportsmen, they went where they were likely to meet with game. Much is expressed and explained in these few words.

[After hearing further evidence yesterday, the Committee declared the preamble of the Bill not proved so far as it relates to the testing of gas by the portable photometer.]

Municipalization is not by any means having all its own way in the Committee rooms this session. The wholesale absorption of neighbouring gas undertakings by Bradford, which most people thought a certainty after the expression of opinion by Lord E. Fitzmaurice at the close of the sittings of his Committee before Easter, is not to be accomplished yet. For the second time the Corporation have been told in connection with this matter, if not in such precise words, that "Parliament need not be expected to do anything except sanction that which the Corporation, by voluntary agreement with those concerned, have already in effect done for themselves." That is their real position. The Committee have accepted a clause providing for the transfer of the North Bierley Company's undertaking on the terms agreed upon before the Easter recess; but in regard to the Airedale, Eccleshill, and Clayton Companies, as no agreement has been arrived at, the Committee, without hesitation, have eliminated all the gas clauses from the Bill. Something in the nature of terms were negotiated with the Airedale and Clayton Companies by Mr. E. H. Stevenson, who was one of the expert witnesses for the Corporation; and what he did the Companies considered binding. But if a definite arrangement was made, it is clear that Mr. Stevenson exceeded his authority; and the Corporation straightway repudiated the finality of such a settlement. It is hardly credible that Mr. Stevenson with his experience can have overstepped the mark in this way; and no doubt the truth of the matter is that all he did was to negotiate terms which he felt he could recommend the Corporation to accept, and that the Companies were under a misapprehension as to the nature of his power and position in the matter. In connection with the North Bierley agreement, the Cleckheaton District Council made an effort to secure advantageous conditions in regard to the purchase of the portion of the concern in their own district, but failed; and they were likewise unsuccessful in obtaining the insertion in the Bill of a provision for equality of price within and outside the borough.

HOUSE OF LORDS.

The following further progress was made with Private Bills last week:—

Bills brought from the Commons, read the first time, and referred to the Examiners: Gas Orders Confirmation Bill, No. 1 (Abergele, Irthlingborough, Littlehampton, Mablethorpe and Sutton, and Romford Orders), Gas Orders Confirmation Bill, No. 2 (Dungannon Gas), Glastonbury Corporation Gas Bill, Maidenhead Gas Bill, Water Orders Confirmation Bill (East Surrey, Hayling, Maidenhead, Sevenoaks, South-West Suburban, and Tonbridge Orders).

Bill read a second time: Gas and Water Orders Confirmation Bill.

Bills read a second time and committed: Airdrie, Coatbridge, and District Water Trust Bill, Morecambe Urban District Council (Gas) Bill, North Warwickshire Water Bill, Southport Water Bill, Spalding Urban District Council (Water) Bill.

Bills read the third time and passed: Glyncorrwg Urban District Council Gas Bill, Hemel Hempstead Corporation (Water) Bill, Rugeley Gas Bill.

The Margate Corporation Bill and the Westgate and Birchington Water Bill were referred to a Select Committee, consisting of Lord Brougham and Vaux (Chairman), Lord De Manley, Lord Wrottesley, Lord Glenesk, and Lord Cranworth; to meet on Wednesday, May 9.

HOUSE OF COMMONS.

The following further progress was made with Private Bills last week:—

Bills read the first time and referred to the Examiners: Gas Provisional Orders Bill, No. 3 (Wath-upon-Dearne and District Gas Order), Glyncorrwg Urban District Council Gas Bill [Lords], Hemel Hempstead Corporation (Water) Bill [Lords].

Lords Bills read a second time and committed: East Stirlingshire Water Bill, Kingston-upon-Thames Gas Bill, Newtown and Llanllwchaiarn Urban District Gas Bill, Paignton Urban District Water Bill.

Bills reported, with amendments: Bedford Gas Bill, Bradford Corporation Bill, Newport (Mon.) Gas Bill [Lords], St. Albans Water Bill, Wolverhampton Gas Bill, Woodbridge Water Bill.

Dispute at the Newport (Mon.) Gas-Works.—A labour dispute has arisen at the Newport Gas-Works, owing to the introduction of "Rapid" charging-machines. The stokers and wheelers, of whom there are 24, did not take kindly to the new arrangement, and ultimately refused to use the appliances, although no one was displaced thereby. The Company, in the face of insubordination, paid the men off, and gave them a week's wages in lieu of notice; supplying their places with other workmen imported from a distance. The stokers received 35s. per week (eight hours per day), and the wheelers 26s. 3d., and about half-pay during illness. The police were guarding the works last week, in consequence of the fear of reprisals.

Gas Profits at Wigan.—The minutes presented by the Gas Committee at the meeting of the Wigan Town Council last Wednesday showed a profit on the gas undertaking for the past year of £14,078. The Chairman (Alderman Holmes) said, though the profits were good, the outlook was not so encouraging, as he believed that the Federated Coalowners intended to increase the price of coal 4s. or 5s. a ton. It would be a serious matter indeed, if the advance in coal should be carried to such an extreme as that suggested. Mr. Seagrave thought it was time the Council considered the question of reducing the price of gas. He saw it was proposed that the sum of £13,200 be transferred to the credit of the general district fund. He asked that the Committee should take this minute back, and consider what steps could be taken to reduce the price of gas. The minutes were eventually confirmed.

HOUSE OF COMMONS COMMITTEE.

Tuesday, May 1.

(*Before Mr.* Oldroyd, *Chairman, Mr.* Emmott, *Mr.* Nicol, *and Mr.* Stanley Leighton.)

THE GASLIGHT AND COKE, COMMERCIAL GAS, AND SOUTH METROPOLITAN GAS COMPANIES BILL.

The Bill promoted by the London County Council to make further provision with regard to testing the illuminating power of the gas supplied in the Metropolis, and to confer power on the Board of Trade to regulate the charge for, and the supply of, prepayment meters and fittings, which came before the above-named Committee before the Easter recess (*ante*, p. 937), was further considered by them to-day.

Mr. Worsley Taylor, Q.C., Mr. Talbot, and Mr. B. Wilkinson, appeared for the County Council. The other Counsel engaged were: Mr. Littler, Q.C., and Mr. H. A. Rigg, for the Corporation of the City of London; Mr. Pope, Q.C., Mr. Claude Baggallay, Q.C., Mr. Danckwerts, Q.C., and Mr. R. J. Neville, for the Gaslight and Coke Company; Mr. Littler, Q.C., Mr. Baggallay, Q.C., and Mr. Snagge, for the Commercial Gas Company; and Mr. Balfour Browne, Q.C., Lord Robert Cecil, Q.C., and Mr. L. W. S. Rostron, for the South Metropolitan Gas Company.

Dr. *Clowes*, re-called and examined by Mr. Worsley Taylor.

Witness handed in a diagram showing the fluctuations in the illuminating power of the gas supplied by the London Companies during his term of office (which dated from 1897), in continuation of the diagram supplied to the Committee by Mr. Dibdin. The diagram showed that, at the time Mr. Dibdin left office, the illuminating power of the gas of the Gaslight and Coke Company was 15·1 candles. At the end of 1897 it had risen to 15·7 candles; at the end of 1898 it had fallen to 15·3 candles; and at the end of 1899 it had fallen to 15·2 candles. In all these years, the illuminating power was below 16 candles; and it had fluctuated in amount. In the case of the Commercial Gas Company, when Mr. Dibdin left office the illuminating power of the gas was 15·7 candles; at the end of 1897 it had fallen to 14·3 candles; at the end of 1895 it had risen to 15 candles; and at the end of 1899 it had fallen to 14·7 candles. In the case of the South Metropolitan Company, at the end of Mr. Dibdin's term of office the illuminating power of the gas stood at 14·9 candles; at the end of 1897 it had fallen to 14·6 candles; at the end of 1898 it had risen to 14·75 candles; and at the end of 1899 it had fallen to 14 candles—the lowest on record.

By Mr. Pope: He had worked out his diagram in precisely the same way as Mr. Dibdin had worked out his.

Mr. Worsley Taylor said he believed that experiments had been made during the parliamentary recess; and he asked witness whether it was not the fact that one or other of the Gas Companies had suggested to him that they were going to make tests with the portable photometer, and had invited him to be present.

Witness replied in the affirmative. He had received the following letter:—

The Gaslight and Coke Company,
Horseferry Road, Westminster, S.W.,
April 26, 1900.

Dr. F. Clowes.

Dear Sir,—We have been making tests with the two table portable photometers at two of the Board Schools, and for the last two nights at the Board School in Compton Street, St. John's Road, Clerkenwell, with the result that the two photometers placed side by side in one room agree, and removing one of them to another room in the same building the results are very different. I write to ask whether you would like to witness the tests again to-night, or whether you would like to send a representative. The testings so far go to show that without having a room properly arranged considerable variations will take place in the results.

I should be glad to know by bearer whether you or your representative will be able to attend at the above school to-night. We should be quite ready to commence testing at 8 o'clock—in fact, our people will be there certainly not later than 7.—I remain, yours faithfully,

(Signed) G. C. Trewby.

Mr. Worsley Taylor: There is a suggestion that this portable photometer is not to be relied on?

Witness: Yes.

What did you therefore do?—I went to the place where the experiments were being made, and found two portable photometers placed in similar positions in two large adjoining rooms in the school. In one of the rooms the windows were all closed, and in the other the windows were all open. At my request, the windows were closed, so as to bring the two rooms under precisely similar conditions. On examining the instruments, I found that there were small alterations desirable as to fittings. The gas was brought from pendants to the table by means of metal composition tubes, commonly so called. But this tubing was connected with the pendants and photometers by india-rubber joints; and in the case of one photometer, the tubing was joined by means of rubber. That is a state of things not allowed in fitting a photometer, as it is thought that gas loses a certain amount of illuminating power by coming in contact with india-rubber. I do not lay much stress on this, as I do not think that the use of the india-rubber affected the result very materially. Both the photometers were fitted in the same way. We should never allow such a form of fitting in the case of our own photometers. I requested that I might be allowed to carefully examine the adjustment of each of the instruments, because the results depend very largely on the accurate adjustment of the apparatus; and I was permitted to do this. I found the adjustment of one of the instruments satisfactory, and that of the other satisfactory save that the standard burner was going to be used in a condition which I could certainly not approve of.

Asked to explain the condition to which he took exception, witness said that the distance of the chimney of the standard lamp from the burner was distinctly too great. The Gas Referees furnished a little block of wood of the right height to measure its space; and after the chimney was adjusted, this block of wood must pass through the space, rubbing considerably against the burner and the bottom of the chimney. In the condition in which he saw the burner fitted, the block of wood would have had considerable play, which would make a great difference

in the value of the standard flame. He had called attention to this, and had got a proper adjustment made. He was then asked what programme he wished to adopt. Witness suggested that he and Mr. Grimwood should carry out the tests, take a series of readings with one of the photometers, and that the representatives of the Gas Company should simultaneously carry out tests with the second photometer; and that then they should change places. This was done. The first test was made at 8.45 with No. 1 photometer; and the corrected illuminating power, which they obtained as the average of several readings, was 15·25 candles. At 8.52, he moved to No. 2 photometer in the other room, and obtained a corrected average reading of 15·34 candles; the difference between the readings of the two instruments in the two rooms being 0·09 candle, which came well within the variation due to two different people reading instruments.

Mr. Worsley Taylor: Substantially, then, we may say the two, read as nearly as possible at the same time, gave the same results?

Witness: Yes.

Does this confirm your opinion as to the portable photometer being a trustworthy agent?—Absolutely; it simply confirms our previous experience.

A fair means under fair conditions of testing gas?—Yes.

I think Mr. Grimwood, your assistant, who has had great experience in these matters, and you jointly have carried out a further series of experiments, somewhat on the lines suggested by one of the Companies—that is, you went into a private house and tested with a portable photometer in, I think, three rooms in the same house?—Yes; the dining-room, a bed-room, and the garret.

And seeing, so far as you could, that the conditions were reasonable?—That is so. The house was No. 41, Lady Margaret Road, N.W., in the Gaslight and Coke Company's district. The gas was taken from pendants in the room, by means of wholly metallic connections. The experiments were made on April 13, 14, 15, 16, 17, 18, 21, 23, 27, and 28.

What, shortly, is the result, as showing that the portable photometer is to be relied on to give similar results under what I call similar circumstances?—I will give the differences between contemporary readings in two rooms. On April 13, a series of readings were made in the dining-room and bedroom, very nearly contemporaneously, and the difference was 0·11 candle. On the same day, tests were made in the dining-room and bed-room; and the difference was 0·02 candle. On the 14th, dining-room and bedroom, difference 0·04 candle; on the 15th, dining-room and bedroom, difference 0·06 candle; on the 15th, dining-room and bedroom, difference 0·07 candle; on the 16th, dining-room and garret (a little room with a sloping roof, hardly suitable for testing purposes), difference 0·11 candle; on the same day, dining-room and garret, difference 0·14 candle; on the 17th, dining-room and garret, difference 0·03 candle; on the 18th, dining-room and garret, difference 0·01 candle; on the 21st, dining-room and garret, difference 0·08 candle; and on the 21st, dining-room and garret, difference 0·32 candle—this figure being the largest difference obtained. On the 23rd, tests made in the dining-room and bedroom showed a difference of 0·12 candle; on the 27th, dining-room and drawing-room, difference 0·01 candle; on the 28th, dining-room and drawing-room, difference 0·01 candle; and on the same day, dining-room and drawing-room, difference 0·09 candle.

To sum it up?—We say there is practically no difference.

The Chairman: Can you state what was the average candle power at these trials?

Witness: I can only give it you roughly. It would be something over 16, I think; some are over 17.

Mr. Pope: Can you give the state of the gas at the testing-station at the same time?

Witness: Unfortunately, the testing-station in this district was closed. The tests were simply made to see if there was any difference in the value of the gas in one room as compared with what it was in another—not as to the absolute value of the gas.

Mr. Worsley Taylor: To see whether the portable photometer was to be relied on.

Witness: Yes; in different rooms. Continuing, he said that on the previous night (April 30) he made some further tests, the general result of which was similar to others already made. They were tests with the same photometer in different rooms of a board-school.

Mr. Balfour Browne: Suppose darkened walls are necessary for testing. In none of the three rooms had you that?

Witness: We had what practically amounted to a darkened wall. We had a special black screen in the direction in which we were looking. Sometimes we had the black screen; in other cases we abolished it. We found there was no difference.

Supposing I am right in suggesting there may be something in a wet meter or dry meter, whatever gas you tested in that house was open to the same difficulty about that matter?—I should say so.

Have you tested gas in an ordinary testing-station with an ordinary photometer, and tested gas from the same mains in an ordinary consumer's place with a portable photometer; and can you tell us the difference in the gas?—Yes. We have tests made at the same time, on the same night, in the same district, in a house adjoining the testing-station.

But not necessarily from what you have ascertained to be the same make?—We can only say they are close.

By Mr. Baggallay: He was not aware that the Gas Companies were required by statute to keep maps, open to the inspection of anyone interested, of mains throughout their districts. He did not know that if he had wished to know whether the two tests he was taking—one in a testing-place, and the other elsewhere—were from the same main, he could have obtained the information. He had understood from his predecessor that it was practically impossible to get such information; and he never tried. He was informed that in some cases, although he presumed he was working with the same gas, he was not.

Mr. Leighton: Did I understand that the Gas Company reported to you that they made experiments and found different results in the same rooms in the same house?

Witness: In the same school.

Then you went with the representatives of the Company to this board-school, with the results you told us?—Yes.

They made tests with the same instrument at the same time?—Yes.

Were they the same?—They give the results a little higher—the difference was again trivial.

When they tested gas with you, they found the same result in the different rooms in the same house?—Practically. I think they will acknowledge that.

But it had been different, when not with you?—On the preceding evenings there was a difference, I think, of 2 candles.

Mr. *Thomas Fairley*, examined by Mr. Wilkinson.

Witness said he was Gas Examiner to the city of Leeds. He had had experience in the testing of gas with photometers of both the old and new type, and also with the portable photometer. As a result of his experience, he considered the portable photometer gave results equally accurate with the fixed table photometer. On many occasions he had accompanied the witnesses who had given evidence on their visits to board-schools, and had himself checked the tests they had made with the portable photometer. Tests were made the previous night (April 30) at Netley Street Board-School, some little distance north of Euston Road, which, he believed, was in the Gaslight and Coke Company's district of supply.

Mr. Wilkinson: Will you tell the Committee the results?

Witness: We had two table portable photometers in the same large school-room on the ground floor. Mr. Dibdin and I made tests, and checked each other's work; and we took the tests between 8.40 and a little after 9 p.m. Simultaneous readings by Mr. Dibdin and myself gave 16·38 and 16·48 candles; the second reading, 16·63 and 16·54 candles; the third reading, 16·73 and 16·79 candles; and the fourth reading 16·59 and 16·99 candles. The last two were the only pair where the times were not simultaneous; there was 15 minutes' interval.

The greatest difference between the readings of the two photometers was one-tenth of a candle?—About that. The average of the whole four readings in each case was: Photometer A, 16·58; Photometer B, 16·7—a difference of 0·12 candle.

Then you proceeded to take tests with two photometers in two different rooms?—Yes; we removed Photometer B upstairs into a small room not one-fifth of the size of the other. The simultaneous readings were: Photometer A 16·46, B 16·30; A 16·36, B 16·46; A 16·43, B 16·70. The average of photometer A was 16·42, and of B 16·43 candles.

Did you take any precautions about testing the accuracy of the two instruments which you used, so as to make them exactly alike?—We tested every part of the apparatus each time it was set up; and when we moved the photometer into the upper room, we tested it all over again.

So that you are perfectly convinced the two instruments were the same?—As near as we could tell.

Mr. Pope: I do not understand you to have tested for the quality of the gas, but simply to show that, as between the two instruments in different rooms, there was practical identity?

Witness: That was all; the quality of the gas was all right.

Is it not a fact that they do not allow this portable photometer in Leeds, but that the tests are made at the works?—At the works and at my office at any time of the day or night. The portable photometer has not been proposed to be used. In the last two or three months, the gas at Leeds has not been quite up to 18 candles, because of the difficulty of procuring cannel coal.

You say the gas is tested at testing-stations and at your office?—Yes; and sometimes at my house.

Are the testing-stations at the works?—No.

Is not your statutory obligation to supply 18-candle gas at the works?—It may be so.

Mr. Emmott: You say you have tested at the stations, at your office, and then sometimes at your house. Have you found any material difference between the one place and the other at any time?

Witness: Not exceeding ¼ candle or thereabouts.

Nothing to make you suppose that there was any difference owing to the fact of the gas having travelled from the works to your house, wherever that may be?—That is so.

Mr. Leighton: How many testing-stations are there in Leeds?

Witness: Three. The gas supplied throughout the district—a very large one—is not tested in the district. As supplied in the district, it might be different from that supplied at the stations.

The Chairman: You have had experience with this portable photometer, and you believe it is as accurate as the ordinary bar photometer?

Witness: Yes. My office is about 1 mile, and my house 2 or 3 miles, from the works.

And notwithstanding this considerable distance, you find the tests the same?—About the same.

Taking the differences over a period of time, you did not find any difference between the tests at your own house 3 miles away and at your office 1 mile from the works, which might lead you to suppose that the gas either gained or lost in its illuminating power in the process of travelling?—They are practically the same.

Mr. Leighton: Do you enrich the gas?

Witness: With cannel. We are now proposing to use benzol.

Mr. Nicol: The Corporation have not asked you to select areas in Leeds to set up testing-stations for your own guidance?

Witness: No.

Then the tests that you have taken at your own house and at your office are personal tests, for your own guidance?—Yes; but I report my results to the Corporation, and where I find the gas below the standard, I report immediately—in the same hour.

You do not take tests at other places besides your house or office?—Occasionally. I do not attend myself.

You have stations?—Yes.

And officials under you who go to these stations?—Yes. Over the whole area of Leeds, there were three stations, situate about a mile from the works. Each was generally supplied from two works—possibly from three; and the power of the gas at these stations was 18 candles—sometimes over and sometimes under. One of the photometers at Leeds had been used as a portable photometer; for all ordinary tests the bar photometer was used.

Mr. *C. R. Bellamy*, examined by Mr. Talbot.

Witness said he was Gas Examiner to the borough of Liverpool, which office he had held for 18 years. He had had considerable experience in gas testing in Liverpool and other places; and, in his judgment, such tests at fixed places and at fixed times were not sufficient to secure to the consumers the quality of gas required to be supplied by statute. In

Liverpool, the standard of illumination fixed by law was 20 candles, with an ordinary batswing or fishtail burner; and the testing-stations had to be 1000 yards from the works—such stations being under the joint control of the Corporation of Liverpool and the Gas Company. There was only one official statutory testing-station. There had been practical difficulties connected with the joint control. By an arrangement between the Corporation and the Company, a room not actually an official room was used; and joint control was interpreted to mean that each party should have a lock to the door. As a result, the station was used only twice in twenty years. There were loud complaints in Liverpool as to the illuminating power of the gas; and he had therefore made tests in different parts of the borough by means of a Dibdin portable photometer. He had found that in this way different results were obtained to those secured at the fixed testing-station. The procedure adopted in Liverpool was based to a large extent on Mr. Dibdin's experience in London. A Special Committee of the Corporation of Liverpool were appointed to deal with the matter; and they ordered different tests to be made by means of the portable photometer at certain public buildings throughout the city. The results obtained did not agree with those secured at the fixed stations.

Mr. TALBOT: As the outcome of that, a proposal was made, I think, that there should be additional testing-stations set up?

Witness: Yes.

And the Company objected?—They did not exactly object; but there were negotiations, and in the end an agreement was arrived at by which portable photometers were adopted. The portable photometer tests were not in way substituted for the official tests; but it was arranged that the Corporation should get information as to the illuminating power of the gas, and report to the Company as to the results obtained. The Company said, in fact: "We are anxious to comply with our statutory obligations, and you shall make tests with the portable photometer; and if you find that the gas is not of the proper quality, you shall report to us, and we will inquire into the matter and do our best to rectify the deficiency." Down to the end of 1894, the discrepancy between the portable photometer tests and the official tests continued. The discrepancy averaged something like 1·26 candles; and this was communicated to the Company.

What happened in 1895?—The two kinds of testings practically agreed. Those at the central office were about 21 candles, and those by the portable photometer 20·77 candles. Since then the results have been—

Year.	Official Photometer.	Portable Photometer.
1896	20·96	20·75
1897	20·83	20·68
1898	20·41	20·69
1899	20·74	20·72

In one year, you will see the portable photometer test showed better gas by about ¼ candle than that shown by the official test.

How were the tests made?—At any public buildings that were available. Suitable rooms were selected for the purpose; regard being had to proper ventilation and other conditions.

The result was that you found gas of substantially the same illuminating power circulating all over Liverpool?—Yes.

Do you find that the Company have any objection to your mode of testing?—None whatever. We have made our reports, and they have been accepted by the Company. Our length of mains is about 1000 miles. The Company's Engineer had expressed himself as thoroughly satisfied with the results of the system of testing adopted.

What was the maximum distance from the works of the places selected for the tests?—3½ miles.

Have you read the Bill before the Committee?—Yes.

Do you think it would be difficult to work such a Bill properly?—No. I see no difficulty in adopting a portable photometer; and I base that opinion on my experience in Liverpool.

Cross-examined by Mr. POPE: By an Act of 1865, the Liverpool Gas Company were bound to supply gas of not less than 20-candle power. In 1894, the Company agreed to the use of the portable photometer, though they could not come under any liability in regard to testing other than at the official testing-station.

Mr. POPE: And since then the system has gone on in Liverpool without complaint on the part either of the Corporation or Company?

Witness: That is so.

What photometer do you use?—The Dibdin bar photometer.

Your experience is based upon a different photometer to that suggested for use here?—Yes.

Mr. POPE: You tried the one proposed and found it unsatisfactory?

Mr. TALBOT: There is no "proposed" photometer.

Mr. POPE: Well, the one exhibited downstairs.

Witness: I tried a portable photometer, and did not get satisfactory results from it, comparing it with my own photometer. We use the bar portable photometer with batswing or fishtail burners, such as our customers use, but made with the greatest care.

All you say is that at Liverpool a particular portable photometer has been used, but not the one we are discussing now?—I have had no experience of the photometer discussed here. But the one sent to me, to which I have referred, was not the one that it is proposed to use in London.

You do not endorse the proposed method of testing?—I have had no experience of it.

The photometer that you returned in June, 1899, as unsatisfactory was the very one used by the County Council for their experiments, was it not?—I cannot say.

Cross-examined by Mr. BAGGALLAY: The deposit of naphthalene in the mains decreased with the rise of illuminating power. Of course, if there was a deposit of naphthalene, there was an effect produced on the illuminating power of the gas. They got a little naphthalene in Liverpool; but he could not say whether, if they increased the illuminating power of the gas, they would get more.

Cross-examined by Lord R. CECIL: The Corporation of Liverpool had a converted Evans photometer and a photometer by Wright and Co., of London, at their testing-station; and they also had a portable photometer. As a result of their experience, the Corporation selected about six positions where they usually tested, covering the whole area of the city; but from time to time he had visited a number of board-schools, fire-stations, and other public buildings, and made tests at them.

Lord R. CECIL: The six places you mostly use are known to the Gas Company, I suppose?

Witness: I do not know. We do not announce the places, and we change them from time to time. We usually make two tests at each place.

What was the nature of the complaints as to the quality of the gas in 1894?—The consumers complained of bad light, or want of light. Letters appeared in the newspapers on the subject, and others were addressed to the Corporation. There was a great deal of discontent on the part of the consumers.

What was the burden of the complaint—that the light was unsatisfactory, or that water gas was introduced?—Water gas was introduced at that time.

For enrichment?—No; I think not.

What for?—To take the place of coal gas—to supplement the supply.

It would be practically for enriching?—It could be used for that purpose. The public objected to the use of water gas. It is used at the present time, and without objection. It is sent out mixed with coal gas. At the time of the trouble, it was sent out without being so mixed.

Re-examined by Mr. TALBOT: All that the Bill provided for was the use of a portable photometer if the Gas Referees consented to its adoption. The Referees could insist on the use of a proper apparatus; and no doubt they would object to tests being made with such an apparatus as the one he had first tried at Liverpool.

Mr. NICOL: Is the portable photometer used in the area outside the city of Liverpool?

Witness: There really are no tests there.

In the use of the portable photometer in Liverpool, is there any arrangement between you and the Gas Company as to the distances from the gas-works and the places at which the tests shall be made, or as to the class of building in which the photometer shall be used for testing?—None whatever. The Company impose no restrictions.

And at no time is a representative of the Company present?—No.

So that the use of the portable photometer is entirely in your hands?—Yes; we use it when and how we like.

And you make a return to the Gas Company of the result of your tests?—Yes.

You do not test from house to house?—We have done that; but we do not make a practice of it. We test at about six places now.

And the testings you think give a fair average of the whole supply?—Yes.

Mr. NICOL (to Mr. Talbot): If the Company do not meet the complaints as to the quality of the gas, what liability is thrown on them—have the Corporation power to prosecute?

Mr. TALBOT: I should think not.

Witness: We have no power to prosecute under the terms of our arrangement.

The CHAIRMAN: The whole thing is a private arrangement.

Mr. POPE: Yes; quite voluntary, and not under statute.

The CHAIRMAN: And the London County Council are endeavouring to get such a system laid down by law in London as is working voluntarily in Liverpool?

Mr. TALBOT: Yes. We produce this evidence to show that the thing will work out in effect. The Corporation have power to go before the Recorder of Liverpool at any moment, and say that there ought to be further testing-stations.

The CHAIRMAN: I understand that it was on an application for the provision of further testing-stations that the present arrangement was entered into.

Mr. POPE: No additional testing-stations could be adopted while the present arrangement holds good.

Mr. NICOL: There is a penalty under the present Bill?

Mr. TALBOT: Yes.

Mr. NICOL: But there is none in Liverpool.

Mr. TALBOT: There may be a penalty exacted in connection with the tests at the official testing-stations. But in making the present arrangement, the Corporation wished to try peaceful methods before resorting to those of war.

Mr. NICOL (to witness): Did you make tests inside houses?

Witness: Yes.

How did these tests compare with those made in public buildings?—We have found no difference.

You have not made a test of the gas taken directly from the mains?—Not of gas taken directly from the mains, because we have had no means of doing that.

A MEMBER OF THE COMMITTEE: Do you find any difference in the test in the case of gas which has travelled a long distance from the works?

Witness was understood to reply in the negative.

The CHAIRMAN asked what was the method of enriching the gas practised in Liverpool.

Witness said they used cannel coal and oil.

The CHAIRMAN: I understand that the Liverpool Gas Company are renowned, if I may say so, for their liberal use of cannel coal?

Witness: That is so.

Have you sufficient knowledge of the manufacture of gas, having followed these experiments for many years, to speak as to the varying quality of the gas according to the distance travelled, or according to other peculiar circumstances which may be present from time to time?—According to my experience, the distance travelled does not affect the quality of the gas in any way.

Mr. TALBOT: That concludes the case for the promoters—at any rate, on this part of the Bill.

Mr. POPE: I now propose to put before the Committee the case of the Gaslight and Coke Company; and I think it would be convenient that I should call my witnesses before making any observations.

Mr. *G. C. Trewby*, examined by Mr. DANCKWERTS.

Witness said he had been with the Gaslight and Coke Company 35 years, and had been the first Resident Engineer at the Beckton works, which were the largest gas-works in the world. He had had special charge of the arrangements for testing the Company's gas; it being part of his duty to advise the Directors as to the testing arrangements. They had, he thought, ten or eleven manufacturing stations. These gas

making stations were mostly on the river, or on canals. There were fifteen testing-stations in the Company's area of supply, where the gas was tested every day. During the last five years, at these fifteen stations there had been no fewer than 21,000 odd tests made.

Mr. DANCKWERTS: In how many cases have the Gas Examiners reported against you out of that number?

Witness: In sixteen; but we appealed against the reports, and in all but two instances the appeals were allowed. After our gas is manufactured at the Beckton works, it is brought to London in 48-inch mains. The gas goes first from Beckton to Bromley; and then it passes round the North of London to Westminster. We have high-pressure mains.

I believe you have 21 miles of high-pressure mains. What is the object of high-pressure mains?—To get a larger quantity of gas over the mains into the gasholders, whence the gas is distributed through low-pressure mains. We work three shifts of men eight hours at our works. It is our object to get the illuminating power as uniform as possible; and that is the system we adopt at all our stations. At Beckton and some other stations, the ordinary enrichment for the gas is carburetted water gas, which is mixed with the ordinary coal gas. The mixing takes place in the works before the gas is sent into the holders from the high-pressure mains. By the Act of 1868, under which the Beckton works were constructed, only one testing-station was prescribed, and that was 1000 yards from the works. It was found some years ago that, after the gas had travelled 1000 yards, what was called the accidental enrichment was deposited, and the gas became of permanent quality; and that was why 1000 yards from the works was fixed upon as the position for the testing-station. At that time, however, gas was not manufactured on scientific principles. It is made on those principles now; and we find practically no difference in the quality of the gas in the works and its quality when it reaches a distance from the works. The photometer that we adopted originally was the Evans box photometer. Our Act does not mention any kind of photometer; but that was the one in use at the time the testing provisions were decided upon. That photometer remained in use till 1886, when the Referees prescribed a new form to be used at the new testing-stations. The Act of 1868, I should say, was the first Act which appointed the Gas Referees. There were to be three Referees, impartial persons, one of whom was to have had a personal knowledge of the manufacture and distribution of gas. As a matter of fact, among the three first Referees was Mr. Evans; but since his retirement, there has been no such person fulfilling the requisite qualification. Mr. Evans died twenty years ago; but he retired from the position some time before that. The Referees have power to prescribe the apparatus and the mode of testing. In 1876, we had an Act which laid down the new system, and that Act gives the Referees power to prescribe the number of testing-places. Under the Act of 1868, the hours of testing were laid down; but the Act of 1876 altered that arrangement. Under the latter Act, the Gas Examiners are to make at the testing-places daily such a number of tests as the Referees may prescribe. There is nothing whatever, as things stand, to prevent tests being made every minute during the twenty-four hours of the day. Before 1880, all the Metropolitan Gas Companies were under their own Acts as to testing; but in that year, an agreed Bill between the Companies and the Authorities was passed, and the system of testing therein laid down was that which is applicable to any Company, and which has already been spoken of.

Do you manipulate your gas?—Certainly not.

Could you do so?—No; we cannot.

Why not?—Well, take the case of Beckton. The gas supplied there is from one holder; and the gas must come out at one uniform quality at the mains. The mains are taken together to various points between Beckton and London, and in one uniform quality is delivered to the consumers.

In point of fact, does the same gas that is tested at the various testing-stations go to the consumer?—Yes.

Goes to him at the same time, in the same way, and under the conditions you have described?—Yes.

Every effort being made to keep it uniform throughout the twenty-four hours?—Yes.

Supposing you knew the time when the test was to be made, could you do anything to increase the illuminating power in readiness for that test?—Certainly not, as far as Beckton is concerned. At the other works, being nearer the testing-stations, it would be possible, in the course of a few hours, to raise the quality of the gas sent away; but it would take hours to do it.

In the present system, is there any necessity for the Examiners or Referees to give notice of the time of the test?—No. It was only in case of discrepancies that the Company asked to be allowed to make experiments at the same time.

Are your officers always present?—No.

Or do you ask to be present?—No. There were six stations for testing Beckton gas, the nearest being 7½ miles and the furthest 10½ miles from the works, and there were also testing-places for each of the other works of the Company situated at considerable distances from those works. There was difficulty in procuring suitable premises as testing-places, several conditions having to be considered—such as the absence of vibration, good ventilation with no drafts, and darkened walls—and it was also desirable to have the stations in communication with a live main, one where there was a regular flow of gas.

The usual thing is that the Gas Referees tell you to have a station, and you look out for one?—Yes.

And when you have found one, you ask them to come and inspect?—Yes.

I believe you are obliged by law to keep maps showing accurately your mains; and these maps are open to everybody, including the Gas Referees?—Yes.

When they approve of a place, they put a figure on your plan and thus know where the gas at that station comes from?—Yes.

You have no mains used for testing-stations and not for consumers?—Certainly not.

There is nothing on earth except the difficulty of obtaining the station to prevent the Referees from giving as many stations as they wish? They prescribe as many stations as they think necessary to safeguard the interests of the consumers. Under statutory powers, the Company have a right to have a station of their own alongside the official station; and they have availed themselves of this right in three cases—at Dorset Buildings, Spring Gardens, and George Street, Hampstead Road.

What are the essentials of a room in which testings are to be made?—It should be perfectly free from vibration, by which I mean traffic, and it should be properly warmed and properly ventilated without any undue drafts. Then, another thing, which does not matter with the box photometer, but does with the new photometer, it is necessary to exclude all reflected light. That would not be merely secured by putting up a black screen in the direction in which you were looking.

Do you find as a matter of fact that vibration or ill-ventilation or variations from temperature and reflected light are liable to introduce error into the testings?—Yes; all that has been brought to my knowledge frequently by the testers who are from day to day in communication with me.

In connection with the pipe which brings the gas from the main into the testing-station, what precaution is taken?—The Referees in their prescription have laid down most completely what is to be done. The pipe is to be brought straight away from the main into the testing-room without communication with any other pipe; the object being to bring gas direct from the main up to the testing-place.

Is the pipe protected?—Yes; against frost.

Has the gas to be kept circulating freely in the pipe?—Yes.

I see that three of your stations are fitted as double stations—that is to say, supplies from two of your mains are brought into the same station. What is the reason of that?—I do not know. There is no reason why they should not test every day at each of these mains—in fact, we would prefer that they did so. Witness further explained that no testings took place from Friday to Monday; the result being sometimes that gas of low quality was shown.

There is a suggestion that there was a testing-place in Battersea prescribed by the Gas Referees in 1893 and not yet provided?—The Referees said they had this communication from the County Council. They asked us to furnish them with a plan of our mains, and we did so. They satisfied themselves that the same gas which they were asked to test at Battersea was passing over the bridge to the Carlyle Square testing-station on the other side of the water, and therefore they thought it totally unnecessary to put up another station, and cancelled their prescription.

What does the fact that tests by the portable photometer show illuminating power less than that at the testing-stations (having regard to your knowledge of the system of supply and that sort of thing, and the way in which your business is transacted) convey to your mind?—It conveys to my mind that the testings are possibly most of them made in the winter months, and that, from causes beyond our control, such as the service-pipe being exposed to cold, they may get different results at the consumer's premises than they do at the testing-places. Another thing is that the portable photometer, as far as our experiments go, unless under the same conditions as exist at the testing-stations, is likely to give discordant results.

So far as you can tell, have you any reason whatever to believe that the gas tested by this portable photometer is any different from that tested at the testing-stations?—None whatever. All the gas we send out must go to one or other of the testing-stations. There is no difference whatever.

So that any defect must be due either to the conditions under which the instrument is used, or to some local cause?—Yes.

The only three possible causes are: First, that something is wrong with the conditions under which the instrument is used; second, that something takes place between the main and the place where the gas is tested, owing to some defect in the service-pipe or something of that sort; or, third, manipulation. There is no other possible cause?—No.

You deny manipulation most emphatically?—Yes.

The Bill practically transfers the power of appointing testing-places from the Gas Referees to the Gas Examiners?—That is so, under the Bill as it stands.

Since the adjournment over Easter, have you had certain tests made?—Yes.

You have been assisted I presume by others?—Yes; by special outside and totally independent persons. In one case, at Lordship Park, the County Council put in evidence (but not verbally) as to the low quality of the gas. He had had tests made which showed that the gas there was fully up to 16 candles. This was at a small private house; and apparently the County Council made their tests after Jan. 31, 1899, between 10 and 12 in the daytime. The house was supplied from a 3-inch main; there being a service-pipe 40 feet long from the main to the meter, and about 24 feet more of pipe from the meter to the ground floor, where the test took place, so that there was nearly 70 feet of pipe for the gas to pass through, where all sorts of difficulties might occur. In a house of this kind, there would be a very low consumption of gas. The very same gas was distributed in London from Beckton, and was tested at Kinghorn Street, Dorset Street, and Spring Gardens, and found to be over 16-candle power, or nearly 3 candles more than the County Council test at Lordship Park showed it to be. On April 18, between 8 and 10 o'clock in the morning, he had tests made at the same place as the London County Council; and they turned out to be 16·73 and 16·66 candles. The testings at the official testing-station of the same gas was 16·8 and 16·2 candles. He attributed the result obtained by the London County Council to the accidental presence of some matter in the gas. Mr. Dibdin had handed in a table showing the differences between the official tests and the tests made by the portable photometer; but the Gas Company had not been able to discover any difference in the gas they had supplied. All their gas was tested before it left the works. They had the same tests at the works as there were at the stations; and these tests were made twice every hour. There were, in fact, persons at the gas-works doing no other work but testing; and owing to the precautions taken, the gas sent out from the works was practically of a uniform quality. He laid stress on the observance of precautionary measures as to ventilation, heat, reflective capacity of the walls, and so forth, in carrying out testing operations. So far as he knew, the Gas Referees had made no suggestion as to the adoption of portable photometers.

In regard to errors, what margin in the illuminating power of the gas would you allow in the case of the portable photometer?—I think 2 candles should be allowed—that is to say, 1½ candles in addition to the ½ candle allowed at the fixed station.

What do you work up to?—16½ candles.

You attribute the errors which occur in the testings made by means of the portable photometer to variations in the conditions of use?—Yes; variations in the conditions of the surroundings. I agree with Professor Vernon Harcourt that, under proper conditions, the portable photometer should give the same results as the photometer used at the official testing-stations and at our works.

How is the illuminating power of gas affected?—It is affected by the cold weather. We have had gas returned below 16 candles, especially when the service-pipe was long. In such cases, the naphthalene held in the gas is deposited. But when the weather has become warm, the naphthalene has been again taken up.

Do you see any reason why the existing testing does not guarantee to the public that the gas in the mains is of the quality you are bound to supply?—No; the conditions under which the official testing takes place are quite sufficient to safeguard the interests of the public. The fall in illuminating power is due to something that occurs after the gas leaves the mains—that is to say, to passing through defective mains or burners or other fittings. The deposit of hydrocarbons in cold weather not only impoverishes the gas, but there is another result. The hydrocarbons fill up bends in pipes, and prevent the gas flowing freely, with the result that the illuminating power of the gas is impaired. The free flow of the gas being impeded, less arrives from the main. Consequently, there is deficient pressure. As things at present stand, we have nothing to do with the service-pipes inside a building. The present regulations as to testing secure to the consumer gas of proper illuminating power up to the point at which our works end.

The Chairman: There is a lodgment of hydrocarbons in the bends of the pipes. Do they remain in the pipes, or are they re-absorbed?

Witness: Small deposits are re-absorbed when the weather becomes warm; but in the winter they sometimes have to be pumped. What one usually sees being pumped from gas-mains by a special instrument is moisture that collects in the pipes. Naphthalene sometimes has to be blown from the pipes back into the main.

Mr. Danckwerts: There is a special apparatus used for cleansing the service-pipes. (To witness:) Do you think that the multiplication of testing-stations would cover all the testing needed in the consumers' interests?

Witness: Yes.

Under your Act, the Referees have power to come to your works and inspect your gas at any time?—Yes.

And your Company are bound to give them and their servants access at any time?—That is so.

Suppose the Gas Referees had the right to bring testing-stations near your ten or eleven manufacturing works, they would know exactly what gas you sent out?—Yes. They would know whether it was below the illuminating standard. By planting testing-stations near the works, all opportunity to the Company of tampering with the quality of the gas to the detriment of the public would be prevented.

It has been suggested that the more testing-stations there are, the greater the expense to you. Would you be prepared to bear the expense for the sake of establishing a fair system of testing?—Yes.

You have no objection to any system of testing that is fair?—None whatever.

But if the travelling photometer were in use, you would never be certain that the testing would not take place under conditions which would indicate a decreased illuminating power?—That is so. Take the case put forward by the London County Council. The testing at Lordship Park had shown 3 candles less than the Company knew to be the illuminating power of the gas.

To adopt the travelling photometer would be to introduce a great element of uncertainty, would it not?—Yes.

And it would not secure the consumer?—It would not.

It would not give anything like the security that would be given by the system at present in force with a multiplication of testing-stations?—That is so.

Supposing you had, in order to meet any possibility of being saddled with a penalty, to raise your illuminating power 2 candles, what would that mean in annual expenditure?—If you calculate it at the rate of 1d. per candle, it would cost £190,000, which would have to be put on the price of gas, and increase the price to the consumer.

Mr. Nicol: Would you divide that figure between the consumer and the shareholder?

Mr. Danckwerts: According to some authorities, 4d. out of 5d. is borne by the consumer; according to others, it is 6d. out of every 7d. About £160,000 would fall on the consumer and £30,000 on the shareholder.

Witness: It would mean a reduction of the dividend of ½ per cent. Continuing, he handed in returns of the average illuminating power of gas supplied from the Company's works at the official testing-stations. The gas supplied from Beckton ranged from 16·6 to 16·2 candle power; and in the cases of the other works, both at the works and testing-stations, the averages were above the standard. The tests since the adjournment were on instructions witness gave; and they were made, among others, by Mr. Young (one of the testers of the City Corporation), who was entirely unconnected with the Company, except that he tested the Company's gas in the City. The tests proved that taking the same gas, under like conditions, one obtained side by side at times concordant results; but if one of the photometers was taken into another room of the same size, the result differed as much as $\frac{8}{10}$ candle. If the conditions under which the photometers were used were varied, the results varied correspondingly.

Cross-examined by Mr. Worsley Taylor: The Company had eleven manufacturing stations, each having a district allotted to it. There were small safety mains between one district and another, so that if (say) the pressure were reduced in one, a second could be connected to get the matter right.

Mr. Worsley Taylor: You would agree that these tests were designed in the interest of the consumer, with the object of showing that he shall have an opportunity of drawing 16-candle gas all over your district?

Witness: Drawing from a main supplying 16-candle gas in the area of our supply.

And all over that area?—Yes; practically. There are cases where you have small mains where at times you do not get 16 candles.

The object of testing is to see that this is ensured, and that the consumer may know it is ensured?—Yes.

If he does not get 16-candle gas all over, in that way, it is not right?—If he does not get 16-candle gas in our leading mains, he ought to get it.

You would have no objection to any system of testing with a view to ensuring that?—I consider the present system fair.

You are satisfied with the present system, because you say that it is fair between Company and consumer?—Yes; and very stringent, too.

You do not object to any fair system of testing with the view of securing the result that ought to be secured—16-candle gas?—No.

And you suggest that the testing-stations at your works, at your cost, would secure that?—Yes.

Have you any objection to tests being made at any time without notice?—None whatever.

Then you are perfectly willing that there should be a certain alteration in the present conditions of testing?—The Gas Referees have full power under the present statute of fixing testing-stations at the works.

A testing-station to test at any place and at any time?—Yes.

Supposing the portable photometer to be, in fact, a fair method of testing, you have no objection to it?—The photometer by itself is identically the same as in the fixed testing-stations.

You would not object to testing at other places than the fixed testing-stations if those places were fair?—If the rooms in which the testing was made and the conditions were fair.

Now then we are agreed: Instrument right, time right, another room right, provided the conditions in that room are right?—Yes; and the supply to the room is right. I mean, in order to test the gas properly, you must have the service-pipe brought from the main in strict accordance with what is laid down by the Referees. Witness objected to the provision of the Bill under which power was given to make a test "at any place." The place should be fitted up as a testing-station like the existing fifteen testing-stations. Without the whole of the machinery in the existing testing-places, a fair result could not be obtained. Witness was pressed to acknowledge that, having fixed the present testing-stations and the conditions there, the Gas Referees were competent to fix the conditions under which peripatetic tests might be made; but that he declared would be giving them too much power. If gas passed through a consumer's meter, even if the tester were satisfied as to the state of the meter, the result would be vitiated. Very often the consumer's meter was exposed; and probably, therefore, the result of the gas passing through would be that its illuminating power would, in cold weather, be diminished. The effect of temperature on gas did not seem to be very well known; even Mr. Vernon Harcourt did not seem to be aware of it. There were no data on which an adjustment could be made for a pipe being exposed. The question of ventilation was a very delicate matter; it could only be gauged by the test of the gas.

Do you say that you cannot go into a room to test the gas with the portable photometer and depend upon getting a test within ½ candle of the true illuminating power?—Yes. We have made experiments by going from one room to another, and have found as much as 1 candle difference between the results in the different places. We are confident that you cannot make a reliable test without having a room properly fitted up for the purpose.

You say deliberately that an expert cannot go into a room and state with confidence: "This is a room in which we can make a proper test?"—I have never met with such a man yet.

Are you acquainted with the result of the testing in Liverpool?—Yes; but it is of no statutory value. Even in the case of Liverpool, however, they have six testing-places; and I have no doubt that care has been taken to see that they are proper rooms. The system of photometry has altered during the past twelve months; and it is more important than ever to have the conditions of each of the testing-stations corresponding with those of the others.

You agree with Professor Vernon Harcourt on some points. Do you agree with him that the present system of examination at the stations is not so perfect a security for the public as it should be?—I think our arrangements are sufficient to safeguard the interests of consumers.

Professor Vernon Harcourt said it would be left to the Referees to prescribe the apparatus to be used, and the mode of using it. Do you agree with that?—I maintain that if you wish to take a photometer into a room for the purpose of making a test, you must adopt the precaution to fit that room up as a testing-station. I do not agree with what the Professor said as to the Referees being able to do that.

He said that the effect of the Bill would be to provide complete security for the consumer. Do you agree with that?—I do not.

Re-examined by Mr Danckwerts: He was certain the peripatetic photometer would not secure the consumer. It was a very uncertain method of testing.

By Mr. Emmott: He attached great value to the temperature.

Can you tell me the difference between a room where it is 52° and another where it is 60° with gas of the same quality?—It is difficult; but I should think it would make a difference of one candle. In cases where from some reason the Gas Examiner had not been able to keep up the temperature of the room, the results had been bad. In sixteen cases in which it was said the Company's gas was below the standard of illuminating power at the stations, there were appeals; and in only two cases judgment went against the Company. He could not give particulars of the cases.

Mr. Nicol: In reference to this peripatetic photometer, you admit that if the Gas Referees decided that more testing-stations were required, you would be quite prepared to meet the increased liability?—Yes.

Assume that authority was given to the Gas Referees to adopt the portable photometer, would you object to that, provided the place where the test was to take place was one which would meet all the conditions you have set out as necessary to give a fair return?—If they have rooms properly fitted up in the same way as the present stations are, to ensure perfect results, then it can be done.

All the difference would be that, instead of having a table photometer, you would have a portable photometer?—Yes.

Supposing that the supply was taken from the service-pipe, and the portable photometer was used in that room, which met with all the requirements you say are necessary to get a fair and adequate result, would you have any objection then?—Yes; it is highly essential that the gas should be brought up from the main in the same condition as it exists there, and to do that, you must have a special service-pipe.

Do you mean that the gas might be contaminated or have its illuminating power reduced between the service-pipe and the main?—Yes.

By the CHAIRMAN: He had heard evidence as to delay in securing the completion of a testing-station; but that was contradicted by Mr. Vernon Harcourt, who said he believed no undue delay had occurred.

The CHAIRMAN: You think that if the gas at the testing-station gives an illuminating power of 16 candles, it will do so universally over the district of supply?

Witness: Over the area of supply, except in the case of dead-ends, and so on. At all the Company's works the gas was tested before being sent out.

Do you find any difference between your tests there and at the testing-stations?—On the average, they agree.

Is the fluctuation much?—No; we endeavour to keep it as even as possible. The test at the works was as nearly as possible the same as at the testing-stations.

With this portable photometer, you think the uncertainties are so great as not to warrant its use in determining the quality of gas, the result of which might be a serious financial fine on the Companies?—Yes; that is our firm conviction.

That the photometer itself is not sufficiently reliable to be moved from place to place; and also that the conditions surrounding the photometer may vary so much as to make the test practically worthless?—Yes.

Mr. NICOL: You have stated that it was impossible for the Company, from its source of supply, at any moment, at any place or time, to either lower or raise the standard of the gas?

Witness: It would take a very long time to do it.

If it could be done, you have not attempted such a policy as that?—No.

To put it plainly, you have had no intention to deceive the Gas Examiner when he came on his rounds and took testings at the testing-places?—No; certainly not.

Mr. DANCKWERTS: Such a policy would be defeated by having a testing-station at the works?—Yes.

Wednesday, May 2.

Mr. *Corbet Woodall*, examined by Mr. BAGGALLAY.

Witness said until the amalgamation of the Phœnix with the South Metropolitan Company in 1880, he was Chief Engineer to the former Company. He was now a Director of the Gaslight Company.

Mr. BAGGALLAY: Would you tell the Committee your opinion as to whether any alterations in the method of testing the illuminating power of London gas are called for?

Witness: In my opinion they are not.

Are there defects which you are aware of in the present system of testing gas?—I think the present system is very excellently designed for securing the uniform supply of gas of the contract quality throughout London.

You used the word "contract." Would you explain what you mean?—The quality named in the Act of Parliament governing the respective Companies.

The contract which was made between the Companies and the public under the sanction of Parliament when the candle power was fixed and the sliding-scale and other matters, including the standard price, were arranged?—Quite so.

All these matters being considered prior to the legislation of 1876 by Committees of Parliament?—Yes; that is, I understand from you that the illuminating power of the gas was one element in the contract which included the price of the gas.

That was the 16-candle power at the testing-places, wherever, and as many as the Gas Referees might fix?—Yes. As the Committee are aware, the right to place testing-stations at any part of the district was an alteration from the original arrangement, under which the testing-place was to be as nearly as possible 1000 yards from the place of origin of the gas.

The CHAIRMAN: I should like to know whether, in this matter, you limit the Act to which you are now referring to the supply of 16-candle power gas to the testing-stations.

Mr. BAGGALLAY: Yes.

The CHAIRMAN: Is it not implied that the gas will be of the same quality when it gets to the individual consumer?

Mr. BAGGALLAY: I do not think so. Of course, it may be. The construction we put upon the Act is that the gas was to be 16 candles at the testing-place; the testing-places to be so situated as to make it probable that approximately 16 candles would be given throughout the area (except under exceptional circumstances of dead-ends, and so on) which that testing-place was supposed to govern.

The CHAIRMAN: And since then Parliament has given the Gas Referees the right of increasing indefinitely the number of testing-places, and locating them in any part of the district?

Mr. BAGGALLAY: Yes.

Witness: That has been so since 1876.

Mr. BAGGALLAY: The right would be exercised frequently.

Mr. NICOL: That 16-candle power was only over the service-pipe?

Mr. BAGGALLAY: Yes; we could not be responsible for what might be done with the gas after it left our pipes. (To witness:) Testing at the testing-place for the prescribed number of candles of illumination, I take it, is the universal law throughout the United Kingdom?

Witness: Yes.

In almost all cases there is only one testing-place provided?—In over 90 per cent. of the cases the tests are conducted at the gas-works.

London being a large area, you would naturally require more testing-places?—Yes. I think some confusion arises from the want of appreciation of what 16-candle gas means. It is not as if it were something that was always the same. The 16-candle gas is 16-candle gas under the express conditions laid down for testing. The kind of burner used may make a difference.

The CHAIRMAN: The details are all prescribed?

Witness: Yes.

They have to pass the Gas Referees?—Yes. The adoption of a proper burner, the regulation of the room, and so forth, are conditions which are essential to the realization of the standard 16-candle gas.

You act, I believe, as Engineer or Consulting Engineer in respect of some gas-works on the Continent?—Yes. I am Consulting Engineer to the Imperial Continental Gas Association, who supply a large number of the principal cities on the Continent.

Taking Europe generally, is there such a costly system of testing to be found anywhere as that which prevails in London?—There is not; neither is there any country where the standard of illumination is so high.

Even in the United Kingdom, except in London, there is no control of the testing by Gas Referees, is there?—No. There are Gas Examiners in most of the large towns.

Mr. BAGGALLAY: That is under the general law. If the company provide the gas, the local authority can appoint an examiner; and if the local authority supply the gas, five consumers can apply to the justices to appoint a person to examine it.

The CHAIRMAN: Does the witness throw any doubt on the efficacy of the examination. He says that 16-candle gas is a thing of uncertain and indefinite meaning?

Witness: I did not mean to convey that. It is a definite and clearly measurable quantity under the conditions laid down; but if you take the same gas and pass it through different kinds of burners, you can get the gas down to 8 candles, or even lower.

The same gas may differ as to illuminating power according to the way it is treated in the testing; but I suppose we are safe in the form of testing that has been adopted. We cannot imagine that the whole course of legislation has been proceeding in the dark?—Not at all.

The CHAIRMAN: I understand the point, and we will leave it now.

Mr. BAGGALLAY (to witness): You say the existing system is satisfactory?

Witness: Yes. It is a rigorous system. It only allows a very small margin for failure of illuminating power before penalties are incurred—only a 3 per cent. margin is allowed.

Have you considered the proposal of the Bill to allow testing to take place in other than certified testing-places?—Yes.

Unless you were certain of the conditions at the testing-place, could you be sure of your results?—No. The trials which we have made show that you cannot be sure of the results. It would be an extraordinary thing if, after all these years of patient development of the present method of testing, it turned out that all the precautions we have taken are unnecessary. To say that they are unnecessary would be a very flippant way of treating a system of testing which has been developed with great care during many years.

In your opinion, are the conditions—such as temperature and freedom from draught—necessary to ensure proper testing?—Yes; I know that they are from my own observations. Draughts that flicker the flame must affect the result. It is essential that you should have proper conditions as to the room, and also as to the method of abstracting the gas from the main. Deposits of hydrocarbons in small pipes affect the illuminating power; and over a large area, a great many small pipes have to be used. All this tends to affect the quality of the gas to a slight extent in testing for the illuminating quality. As a matter of fact, the variations in the quality of the gas over the whole area of the Gaslight and Coke Company are very slight, except under peculiar circumstances.

The CHAIRMAN: You say that the deposits in small pipes affect the illuminating power. Do you not think that the deposits in large mains would have the same effect?

Witness said the deposits in large mains would not be so material.

By Mr. BAGGALLAY: The number of testing-places required by the Referees had been increased whenever they had thought that another testing-place should be provided in the interest of the consumers. He did not know what the reasons had been which had led to this. The Referees had added to the number of testing-places from time to time as they thought necessary. They had asked for additional stations; and the Company, under the Act of Parliament, were bound to supply them.

The CHAIRMAN: How has the increase proceeded?

Mr. BAGGALLAY: I have not the details; but I know that two have been added in the last eight years.

Witness said that in Paris the testing-station was within 1000 metres of the works, and ½ per cent. candle power was allowed for each additional kilometre.

The CHAIRMAN: That is about 1½ per cent. per mile?

Witness: Yes. I point this out to show that depreciation of quality in relation to distance of supply is generally recognized.

Why is that?—There is a certain amount of depreciation of quality in a certain temperature. The hydrocarbons are thrown down at a low temperature; but these influences are slight.

Morally, do you say that the Company recognize their obligation to supply 16-candle gas?—I do, distinctly.

In reply to further questions, witness said the difference between the quality of the gas at Beckton and when it reached London was appreciable—from ½ to ¾ candle.

The CHAIRMAN: Out of the seven stations connected with the Beckton works, we have only one that shows any decrease in the illuminating power as compared with the test at the works. The works test is 16·4 candles, and these are the figures following: Kinghorn Street 16·5, Dorset Buildings 16·4, George Street 16·3, Graham Road 16·4, Vincent Terrace 16·4, and Vinery Villas, 16·2. These are miles away.

Mr. NEVILLE: Those are averages during the whole year.

The CHAIRMAN: That does not alter my point at all. It is all the more accurate a test. If during the whole year the average has been 16·4 candles at the works, and then at one of these places, 6, 8, or 10 miles away, it is on the average about the same, or if anything above, it seems utterly inconsistent with the theory that gas loses a percentage of the illuminating power per mile. My point is that we have got no diminution at all. Of course, I admit it is under this high pressure, and that there is a very large volume.

Mr. BAGGALLAY: I was going to say it is almost like a gasholder. There is so little skin friction, owing to the large volume of gas and its high velocity.

Witness: I am sure the difference would be an appreciable difference in the gas sent by the minor distributing mains. I hope you understand I do not desire to place any importance or weight upon that. All I say is that provision is made for that; gas is sent out of sufficiently high quality to make up for that.

The CHAIRMAN: As a theorist, you say some diminution of illuminating power will take place?—Yes.

As a practical man, and as a representative of the Company who are now answering the case of the promoters, you say you do not wish to be bound down by this circumstance?—Yes.

In further examination, witness said that during winter the gas, as it passed through the mains, made deposits, which were taken up more or less in the summer; but even in summer time, there were sometimes deposits. The process of taking up the deposits was very slow. He had taken from mains many tons of naphthalene which would never have been absorbed under any circumstances. Naphthalene was deposited in some weathers, and then later on, under other conditions of temperature, evaporated. It might be that on the day when deposit took place the quality would be reduced.

Mr. Baggallay: It comes to this—that where you get a very large main with a high velocity and a constant current, the variation will be much less than in the smaller distributing mains where, during many hours of the day, the passage of the gas is slack, where elbows and joints are frequent, and where the proportion of skin surface to the amount of gas passing is great?

Witness: That is so.

As you go down in the size of your pipes, and you get into the distributing areas, you get much greater variations?—You do get greater variations.

In your opinion, are the existing testing-stations which have been fixed by the Referees well situated for control of the districts?—I think they are.

Witness handed in at this point a map showing the district mains, the high-pressure mains, and the testing-stations of the Gaslight and Coke Company. He had not seen the map before entering the box that morning; but it seemed to show that the Gas Referees had wisely located the testing-stations, which were placed so that, as far as possible, they should be on the leading mains from each of the works. The limitation of 1000 yards in regard to the testing-stations had not been adhered to. These places were fitted up under the direction of the Referees, and were inspected and passed before being used for testing.

Mr. Baggallay: You would have no objection, if it were thought proper, to alter the positions of some of the testing-places? You would see no objection to substituting other places, if it were considered right by the Referees?

Witness: I do not think any remonstrance has ever been addressed to the Referees with regard to the testing-stations.

If further tests were thought desirable, in order to be able to compare the exact condition of the gas as it left the works with the condition of the gas at other testing-places, do you see any objection to adding other testing-places at or near the works?—No.

Except as to expense?—Quite so. If some of these stations are thought to be badly placed they can be removed. After all, the cost of a station is not very much—about £200 a year.

The multiplication of testing-places like that would be nothing as compared with the increased cost that would be put on you to provide 16-candle gas at any place where the portable photometer might be taken?—That might be an enormous sum.

The Chairman: That would depend upon the efficiency of the photometer.

Witness: About the photometer there is no question whatever.

The Chairman: I mean the practical efficiency.

Mr. Baggallay: Assuming that the photometer were all right, and the conditions could be got all right, if you had to guarantee the 16-candle power at any point where a test might be taken, it would necessitate very great enrichment beyond what is now necessary at the works, would it not?

Witness: If I followed your question—No. If the photometer is all right, and the conditions at the testing-place are all right, I have said we already recognize our duty to supply 16-candle power gas.

What I meant was that you got the gas from a fairly active main, and not from one of these smaller places?—Certainly.

I want you to look at Clause 5 of the Bill for a moment. There is a paragraph that "No person shall disclose to such Company, by such notice or otherwise, the place at which any such tests are to be made." What do you take that to mean?—I am bound to say I regard it as a very offensive suggestion.

Is there any construction you can put upon it other than that it means they are afraid of your having notice, because they fear your tampering with the gas, or doing something which may affect the test?—I can see no other meaning to put upon it.

Have you in the past ever known or suspected any tampering with the gas which was being sent to any station for the purpose of testing?—Certainly not.

Have you any officer who you believe would be capable of such a thing?—We have not; and I say distinctly that if such instructions were given to the officers of the Company, I should expect from many of them that their resignations would be sent in rather than that they would carry them out.

Is it practicable?—With regard to the Gaslight and Coke Company, it is almost silliness. With so large a proportion of the gas brought up from Beckton, it is childish to suggest the possibility of doctoring the gas for the testing-stations.

Your gas, I think, has been tested in the City at all times?—I believe it has. At any rate, the Referees, the Examiners, and the County Council all know that we desire to exercise no supervision over the testing—that we are perfectly willing the gas should be tested as we test it ourselves. There are tests every hour and half hour at the works.

By Mr. Nicol: The testing in London was more severe than anywhere else; and because of that, it was necessary to keep constant watch on the gas, and make the tests at the works every half hour.

Further examined by Mr. Baggallay: The Company used a good many different qualities of coal, and so had to employ various enriching materials, and to test to see the result of different combinations. The bulk of the ordinary coal used did not produce 16-candle gas; so it had to be enriched to the standard, and beyond it, in order to make the gas perfectly safe.

Mr. Baggallay: So that to protect yourselves against the penal clauses of the testing Acts you have to keep up constant testing?

Witness: Yes.

Supposing there had been any deviation whatever which would justify those lines in that clause of the Bill, it was open, I take it, to those who suspected you to have applied to the Referees to ask for another testing-place near your works?—Certainly.

Which would have dealt with the whole matter?—Although it is quite new to me, it does appear to me that if testing-stations were established practically at the gas-works that would meet the case completely. But I say again, I see no reason whatever for any departure from the system as it now exists. Continuing, he said the evidence did not by any means support the clause. In several cases it had been admitted that some care would have to be taken in the selection of the places, and in the manner of fixing up the apparatus used. That was very different indeed from the claim made here, of power to test at any place at any time. Mr. Dibdin suggested that, in order to cover any chances of error or variation, an extra candle (three times the present margin) should be allowed as a margin before penalties fell upon the Companies. Such a suggestion was damnatory of the scheme submitted.

It shows that there are variations which they themselves anticipate, and for which they feel they cannot in fairness do otherwise than provide three times the margin they have at present?—It seems to me to confirm the view I take. It was a proposal to substitute a rule-of-thumb arrangement for a scientific arrangement.

Mr. Worsley Taylor said Mr. Didbin referred to an outside limit of a candle, not an extra candle.

Mr. Baggallay remarked that it did not matter, for the purpose of his argument.

Witness, further examined, said the suggestion was evidence of the necessity of further investigation by a specially constituted Committee able to make tests, as to the results to be obtained by a portable photometer before it was put upon the Companies, even though a *primâ facie* case might be made out. Absolutely no case had been made out with regard to the Gaslight and Coke Company, because Mr. Trewby showed that out of the enormous number of testings there were only two below the standard in which penalties were imposed. The question of standards was under consideration three or four years ago; and then a Committee were specially appointed by the Board of Trade, who made thousands of experiments before arriving at a conclusion.

Mr. Worsley Taylor, in cross-examination: I think you agree that the object of testing for illuminating power is to secure the opportunity to the consumer to draw from the mains of the Company 16-candle power gas—meaning by 16-candle power, 16-candle power gas as tested under the Act?

Witness: Yes. It all depends upon the main system. The Company recognize the obligation in the fullest way, and are fulfilling it—providing an excess over the 16 candles.

There is no undue burden on you?—I think the quality of 16-candle power is extravagantly high, and that it would be better if reduced; but so long as the standard is 16 candles, so long we will continue to supply it. At all points of the system where the mains were a fair size, and there was a fair passage of gas through them, such gas was supplied. It was open to the Referees to prescribe as many more testing-stations at as many more places as they thought fit and fair; and the Company were content with the obligation. The size of the mains on which the testing-places were located varied considerably. Thus, the Vinery Villas station was supplied from a 3-inch main. Witness, however, stated that if the map referred to, showing the positions of the testing-stations, had been prepared for the purposes of this inquiry, it would have given a little more information. The 3-inch main came off a 24-inch main, and was probably connected with another large main at the other end. At Graham Road, the station was supplied from a 5-inch main; but here, again, the main came off a 24-inch main, and was probably connected at the other end also with a large main. No doubt in locating these stations the Referees intended to secure a supply through leading mains.

I see that, although the gas is drawn from a somewhat small main, it is perfectly satisfactory, for it appears from the return that at Vinery Villas it is 16·2 candles and at Graham Road 16·8 candles. In other words, whether you take it from a 3-inch, a 5-inch, or a larger main, you get the same result?—Yes. If the Committee were satisfied that the method provided did not secure the carrying out of the contract between the Company and the consumers, then by all means let there be a better system.

With regard to illuminating power, with the exception of the 5 feet an hour, the burning in an argand burner, and the fact that there are to be fixed testing-places, are not the whole of the conditions of testing at these testing-places in the hands of the Gas Referees?—They are.

With that contract you are satisfied?—Yes.

The whole of the regulations necessary to secure fair conditions to the Company and consumer alike are advisedly, and with your consent, left to the discretion of the Gas Referees?—Yes.

And hitherto they have settled fair conditions for the Companies and the consumers?—Yes.

Have you any reason to doubt that, if a like discretion were given them hereafter, but with the sole variation practically of moveable as compared with fixed testing-places, they would not be able to prescribe equally fair conditions as between the Company and the consumer?—I say that, if they prescribe equal conditions of temperature, of draught, and of testing with regard to mains, we have nothing whatever to say. They are perfectly at liberty to do it.

If they do that, and apply the test of the portable photometer, the portable photometer under proper conditions would give an accurate result?—I have already stated that the portable photometer gives practically identical results. Continuing, witness said the proposal to alter the method of testing was flippant. The clause, even with the addition of words to show that the Gas Examiner should not go to "any place," which might include unfit place, but should only go to places falling within the category which the Gas Referees decided to be fair, would still be flippant. They could not possibly lay down in that room a description of the class of building, and the method of fitting, so clearly and distinctly as to make the Act suitable and proper.

Do you mean to tell me that the Gas Referees, who are competent to decide all the details under your existing contracts, are not competent to decide the conditions under this Bill?—I think it is too much to ask the Companies to make such an extended reference.

The Referees at present are able to prescribe, to the satisfaction of the Companies, conditions with regard to the existing conditions of testing.

Why are they not equally competent with regard to this proposed alteration in the matter?—I would not think of questioning the competency of the Referees. What I say is that the new method of testing suggested will take the testing away from stations where, as the result of years of experience, it has been shown that the testing can be safely carried on, and bring it to places where it may not be satisfactory—in fact, where we know it will not be satisfactory.

Did you hear Professor Vernon Harcourt, the Gas Referee, say he saw no difficulty in prescribing conditions under which fair tests could be made with the portable photometer?—I did not. I read his evidence, however, and it seemed to me that he pointed out the necessity for a considerable number of precautionary measures.

It showed that his mind was alive to the necessity for these measures?—I should say he was not consulted before the clause was drawn.

He has been consulted here. He says he sees no difficulty in applying precautionary measures?—I say that the adoption of adequate precautionary measures would simply mean the institution of similar testing-stations to those we have at present in use.

Professor Vernon Harcourt was asked if he thought it desirable to have testing-stations established anywhere in the district that might be thought desirable; and he said he did not consider it would be advisable to largely multiply such testing-stations as at present exist. Do you follow that?—I say it is not desirable to increase the expense by enlarging the number of existing testing-stations. If there are some stations which are not desirable, they could be dispensed with, and others could be established in their place in different and more advantageous positions.

Professor Vernon Harcourt said that if they could get five times as many testing-places as they had, they would go a long way towards securing what was desired; though he did not think that even that would be as effective a method of testing as going from place to place?—I was not aware of that statement. All I can say is that I differ from him as to the effect of the present system.

Then you differ from the authority you think we ought to have consulted?—I say you ought to have consulted the Gas Referees as to testing at any time and at any place.

You differ from the authority who is responsible for the testing now?—Yes.

If the Bill is to pass, you do not object to the absence of notice as to tests taking place. You object to the imputation which the words of the clause convey?—Yes; I do object.

Do you want the reference to notice in the Bill or not?—I want the words out, with the suggestion they contain, most certainly.

Then if we put on the face of the Bill that it is not intended to cast an imputation on the Gas Companies, you would be satisfied?—No; I should not.

If you had your photometer at a proper place and the tests checked by the Company, what injury would the Company suffer if a fair allowance is made for unavoidable variation?—You propose a method intricate and open to disputation and subsequent inquiry, in place of a method that is unattended by any of these troubles, and which has been proved to be absolutely reliable and satisfactory. It seems to me that what you have to do is to make out a case to show why a system which is free from intricacy should be superseded.

I agree. Where does intricacy come in?—Well, wandering about, more or less, in dark alleys to take the testings.

There, surely, are no dark alleys in the district of the County Council?—Yes there are. Then, you must have a proper room in which to conduct the test, the gas must come from a proper service-pipe, and you must know that the gas comes direct from the main and where it goes to from the main.

What is there in the Bill to prevent the Gas Referees from prescribing the room. If you do not like the Gas Examiners wandering about dark alleys, would it meet your view if they went into a pantechnicon van?—Yes; if it were a place duly appointed and properly equipped.

Re-examined by Mr. Ralph Neville: You have had considerable experience in connection with testing-stations?

Witness: Yes.

Is it a fact that you do not know whether or not a testing-station is a proper one until a large number of tests have been made in it?—Yes.

If the board-school rooms are certified as proper places, I take it that you would have no objection to the process of testing which my learned friend suggests being adopted?—I cannot imagine the Gas Referees certifying those places; but if they did, we should have to accept their decision.

You think it a wholly impracticable suggestion?—I do.

As to increasing the testing-places, you say that, in your view, if there were testing-places set up at the works, they should be testing-places which would ensure that all the gas that went out from each of the manufacturing works was properly tested?—Yes.

Would you have any objection to such testing-places being set up?—Not at all.

And if they were set up, would they meet the case and provide for gas sent out of the works being of the standard quality?—I maintain that the testing-places as they exist give that security. It is impossible to have testing-places everywhere; but if they were brought down close to the works, it would be impossible to test the whole of the gas.

You do bring your gas at the works to over 16 candles?—Yes.

In order that it may be of 16-candle power 10 miles away from the Beckton works?—Yes; and to provide for the difference of observation on the part of different testers.

You think that 0·25 candle would be the illuminating power that would give the personal equation for the testers?—Provision of that kind would have to be made for the personal equation.

The tests differ?—Yes.

The first test is not necessarily the same as the second?—No. The first test may take place too soon after the lighting of the candle.

The fact of the Company being deprived of notice would prevent their officials being able to look at the plans of the mains to see where the gas that was being tested was coming from?—Yes; and also prevent them from looking at the pipes leading to the premises from the main and the pipes on the premises.

The Chairman: They would be able to inspect those afterwards. But I should not think that the County Council officials would be so idiotic as to trip themselves up by making their tests at a dead-end or something of that kind.

Mr. Neville: It would not be known under what conditions the test was made.

The Chairman: The officials would be very foolish if they took advantage of abnormal conditions.

Witness was understood to say that if the proposal of the Bill were adopted, and it had the effect of causing the Gas Companies to raise the present illuminating power of the gas, he should regard it as a serious breach of the contract entered into between the public and the Companies, when the standard quality and price of the gas were fixed. If the 16-candle gas now supplied was rendered 14 or 15 candle gas by the adoption of a new method of testing, the Companies would have to raise it up to 18-candle gas from the point of view of the present method of testing. This would impose enormous obligations on the Companies.

Mr. Leighton: One of your objections to taking the portable photometer to any house, is that the service-pipes or connections may not be in good order; and that, therefore, the gas supplied in the house may be of a lower quality to that in the main?

Witness: What would happen would be this: You might take the photometer into a board-school room, and you might there get gas for the purpose of testing which had been lying in the service-pipes for weeks.

That would be obviated by blowing out the gas?—That would not be an easy matter. You would have to take off the meter, too.

Supposing the difficulty as to the service-pipe was got over?—Then there would remain the difficulty as to the room.

I understand that, in your view, many of the service-pipes are not in good order?—That is so.

And they are not under your control?—They are not. We supply the service-pipes; but I refer to the pipes that are on the property of the consumer. In every house there are certain pipes through which the gas flows after it leaves our mains, and over which pipes we have no control.

Would your objection fall to the ground with regard to testing with the portable photometer if the testing took place where the prepayment system is adopted, and where the pipes are under your own control?—No; because there would still be service-pipes through which the gas would pass. Those pipes might be dirty and full of deposit.

You cannot put forward as an objection to the consumer having 16-candle gas that the service-pipes you yourselves provide are out of order?—If one case of a defective service-pipe occurs in a thousand, there is nothing for the Company to be ashamed of.

I say your objection would fall to the ground if the test were made on premises to which you yourselves supply the fittings?—If the premises were connected with a live main.

But it is your business to provide proper fittings?—The pipes may have been in use twenty years.

Then, why not replace them? You take payment for them?—We take payment for the gas carried through them.

But the fittings are yours?—If complaint is made that they are out of order, they are put right. To a certain extent, I am with you that where we do put in the pipes they ought to be in such a condition that the gas for testing could be taken from them.

Mr. Nicol: You admit your obligation as regards the supply of 16-candle gas, not only in reference to the main, but also in reference to the service and other pipes outside and inside the house, when connected with fittings that you put in?

Witness: No; we say that the mains we use should be suitable for connecting with the portable photometer.

I understand you to say that you are responsible for the supply to the consumer of 16-candle gas where you own the fittings?—No. The photometer would be connected, not with the fittings, but with the pipe that comes from the main. That pipe, in 99 cases out of 100, would be in good order.

Mr. Leighton: You do not consider that an obligation rests on you to provide to the private consumers 16-candle gas?

Witness: Our object is to supply in the testing-places directly from the mains 16-candle gas; but there are many causes which make the gas, as used in the houses, of less than 16-candle power.

Mr. Nicol: The machinery that brings the gas to the house may in many cases be faulty?

Witness: Yes.

Mr. Leighton: But you do not consider, as a Company, you are under obligation to supply to houses throughout the district 16-candle gas?

Witness: No; that would be going too far. But we do undertake to supply gas of 16-candle power in the mains.

If the connections are as they should be, the gas in the main would be the same as it is in the house?—There would be a very slight difference.

Mr. Leighton: Then, we come round to the same point. If the gas in the street is of 16-candle power, and the fittings are as they ought to be, the gas in the houses will be very little below 16-candle power.

The Chairman: Summing up your evidence, am I right in coming to the conclusion that you, as an expert, and as a Director of the Gaslight and Coke Company, have no objection whatever to any increase in the number of testing-stations that the Gas Referees may prescribe?

Witness: Our only objection would be as to cost.

You said the cost of a station would be about £200 a year?—Not including the salary of the tester, which is paid by the London County Council.

Can you not estimate it at less?—No.

You have no objection to the increase of the testing-stations?—No.

The Chairman: And so far as the peripatetic photometer is concerned, *qua* photometer, you have no objection to that?

Mr. Pope: As an instrument.

Witness: I have not.

The Chairman: The use of that photometer for the purpose of testing the gas would meet with your approval, if the conditions under which the instrument was used were satisfactory?

Witness: Yes.

But having regard to the expressions in clause 3 of the Bill, enabling the Gas Examiners to make inspections at any place, you think the Company would not have a satisfactory guarantee of the conditions of the use of the peripatetic photometer?—Yes.

Therefore, your objection is not to the photometer itself, nor is it owing to doubt in your own mind that the gas supplied by your Company in the mains is unsatisfactory and below the standard, but your objection is because you have no reliance on the conditions of use of the peripatetic photometer?—Yes.

And you think that, whereas the use of this peripatetic photometer would be a sufficient reason for notification to you so that you might use means to remedy any defect, it would not be sufficiently safe to constitute a basis for the imposition of a penalty?—Having in view the use of an efficient machine to make the test, that is my view.

Mr. *Greville Williams*, examined by Mr. Pope.

Witness said he was one of the Chemists of the Gaslight and Coke Company. The determination of the illuminating power of gas required great care. With the existing photometer, it was necessary that the conditions of the use of it should be carefully settled, in order to obtain a proper result.

Mr. Pope: What do you say to the use of the portable photometer. In your judgment, is it possible to secure such conditions as would bring about accuracy, whatever the instrument might be?

Witness: The portable photometer, properly used, is a scientific and accurate instrument.

Would you say that, to obtain conditions such as to secure accuracy, would be difficult?—I do not say that it would be difficult; but it would necessitate the taking of many minute precautions.

What conditions?—There must be no draughts. If there are, you get irregular results. The 16-candle argand burner is liable to be affected by draughts. I cannot estimate the amount of influence that draughts have; but I know that they produce irregular results.

You cannot say how much, scientifically, should be allowed in respect of that?—No. There are photometer users who altogether ignore the question of draughts.

What is the next cause of error?—Another one, and the most serious of all, is the atmosphere of the room. On every occasion when the photometer has been in a very cold room, the results have been low.

I should like an illustration of that?—I took as an experiment the meter of a photometer, and cooled it moderately with ice. I did not make it very cold, but produced in it the temperature you would have on a cold day—that is to say, I reduced the heat to 11° Fahr. The illuminating power of the gas at once went down ¼ candle. I reduced the power altogether ¾ candle. The evils to be guarded against in using the photometer are cumulative.

What is the third condition affecting the accuracy of results?—There is the personal equation of the operator. There are some men who instinctively read a little high, and some who read a little low.

And some who read what they want to read. I usually notice in scientific observation that the observer finds what he wants to find?—I do not say that. I say we very often try to find something, and do not succeed.

That is in honest observation, of course. What is the next condition of error?—I do not know that there is anything else. The cold is the main thing. It not only affects the photometer, but the gas itself. Gas, when cold, loses some of its illuminants. If you pass coal gas through pipes in ice, there is a condensation of the benzene and ethylene.

Can you fix any allowance representing the permanent risk of inaccuracy in the proposed mode of effecting the test?—No.

Without that, it would be an unfair mode of testing to apply a penalty to?—Certainly. If you take the portable photometer into a cold room, you do a very serious injustice to the gas. A question had been raised as to whether a wet meter was more injurious to gas than a dry one. The two acted in different ways; but even a dry meter was injurious to the gas. The result of his investigations and experiments showed that, in order to make a test satisfactory and accurate, it ought to be in a fixed and properly prepared station. If he took any photometer into a different place, under different conditions, he would get different results.

You cannot get an accurate result without providing against all these dangers that you refer to?—Most decidedly not.

Mr. Nicol: To do that, you must practically use a fixed or stationary photometer?

Witness: Yes.

Mr. Talbot (in cross-examination): With the old photometer, there was no need for a particular room?

Witness: Well, as a matter of fact we were very careful even with the old photometer; but they were much more protected, because they were in cases.

Were they satisfactory instruments?—I and other men of great experience say "Yes, if you used them properly."

Of course, there would be nothing under the Bill to prevent the Referees prescribing a test with that class of instrument?—I do not think there is the slightest chance of the Referees ever going back to the old system of candles. I think the present table photometer is a distinct advance. It is a scientific instrument. Gas, to be properly tested, should never fall below 65°. The Gas Referees could prescribe the temperature, though he believed they did not do so. Mr. Vernon Harcourt, in expressing approval of the portable photometer, had not had the disastrous experience of it which witness had.

Mr. *W. C. Young*, examined by Mr. Pope.

Witness said he was Gas Examiner to the Corporation of the City of London, to West Ham, and to many other corporations and companies. For the purposes of the Bill, he had made a series of experiments, one set being at No. 37, Lordship Park—one of the houses referred to by the London County Council—on April 18 last. The tests were made with two absolutely identical photometers, placed side by side on the ground floor to prevent draughts; only five persons, all experienced in the use of the instrument, being in the room. The temperature varied from 65° to 71° Fahr. With one photometer, the tests varied more than a candle, and with the other by about half-a-candle. The difference in the tests under his personal observation was 1·1 candles with one instrument, and 0·6 candle with the other. The difference between the means of all the tests taken with one instrument, compared with the mean of all the tests taken with the other, was 0·11 candle. Thus the results brought out that the two photometers were pretty well identical.

Mr. Pope: You made an experiment at Central Street, St. Luke's, with the same instruments, and employed the same means of testing; taking all precautions to see that the photometers were accurately set up and that the proper conditions were observed?

Witness: Yes; taking care to limit errors as far as we possibly could.

Does the result show accuracy or inaccuracy?—The first showed very great inaccuracy. One photometer gave lower results than the other. One photometer gave 15·67 candles; the other 17·71 candles—a difference of 2 candles. The test was carried out with the same instruments as those used at Lordship Park. The different tests were made with an interval of five minutes.

Mr. Neville: Can you account for the difference?

Witness: No; I cannot. So far as I could observe, the tests were made under identical conditions.

Mr. Pope: What conclusion do you draw?

Witness: That the instrument is altogether unsuitable for hurried testing.

That hurried testing does not enable you to get conditions that ensure accuracy?—That is so.

Mr. Nicol: You made these experiments without notice?

Mr. Pope: They were made by us.

Mr. Nicol: Quite so, but the Company's officials did not know at what time and at what place the experiments were to take place?

Mr. Pope: Not so as to manipulate the gas.

Witness: The tests were made for the Gas Company.

The Chairman: Was the condition of the two machines identical?

Witness: Yes.

Each adjusted in the interest of truth?—Yes.

And you were there to ascertain the real illuminating power of the gas?—Yes.

And a difference, practically, of 2 candles is the result of your inquiry?—Yes.

Do you suppose that the difference of 2-candle power would have been caused by some change in the quality of the gas in five minutes?—No.

To what do you attribute it?—It must have been attributable to a defect of some kind that I could not observe—some defect in the argand burner, or in the standard flame with which the gas was compared.

Was it in a closed room?—Yes.

And the conditions as to draught were identical?—Yes.

And the conditions of temperature?—Yes.

And these being the chief sources of deviation, according to the last witness, I suppose the balance of inequality arises from the personal equation?—Yes.

And you say that in this case it was unbiassed?—Yes.

Therefore, as an expert, you cannot tell us what the cause of this thing was?—No; I tried to find out, but could not.

If you had been at an official testing-station, and you had had these two photometers at different tables, the same difference would have occurred?—I cannot say. One was at the corner of the room, and the other was at the door; and whether or not there was a current of air which reached the one or the other, I cannot say.

The Chairman: There might have been some strange disposition in the mind of the photometer—the one in the corner was perhaps not quite so cheery as the other.

By Mr. Neville: In all the experiments made by these gentlemen—Mr. Ford and Mr. Taplay—the difference was the same. Of the 2-candle difference, ½ candle was explained by the position of the photometer in the room, and the other 1½ candles was due to something in the instrument. There was another series of experiments in which the photometers were changed. Generally speaking, he should say, as to the suitability of any school-board room or anywhere else for taking tests, that such places were most unsuitable without previous trial. Trial and experiment was necessary to find if a room was a suitable place for testing gas. This was always done in the case of a fixed testing-station, before the place was decided upon and approved by the Gas Referees.

Mr. Neville: You have known of a case where the premises on trial were found to be unsuitable?

Witness: Yes.

And something was done to make the place suitable?—Yes. I have also known a place regarded as suitable given up after a long series of experiments and investigations had taken place.

Witness went on to say that he was present when the tests spoken to by Dr. Clowes took place at Compton Street. They were conducted in the same way as the tests of which he had been speaking. They took place during three days; and he had been present during the first and last day. As to the results of the tests, the photometers were placed side by side in the room, and the results were practically identical—showing that the instruments could be relied on, under suitable conditions, to give equal results. Then one of the photometers was taken away to another room. In one case, the flame of the burner was so unsteady that the reading of it was only approximate. One was shifted to a place between the door and the open window, and the other was in a through draught; but there was very little difference between the results.

Do you think these photometers can be relied on to give accurate results?—I do not.

On the third day, the tests were fairly in accord?—Yes.

Do you consider, from the experiments, that these photometers can be relied on?—You get different results, according to the room in which you place the photometer. The instruments were adjusted as I myself should have adjusted them to obtain as accurate a test as possible. He had seen the series of experiments published by the London County Council, showing an illuminating power of less than 16 candles. They were made with the old form of photometer. The candles should be burning at least 15 minutes before the taking of a test. A test taken after the expiration of 10 minutes, generally gave a much lower result than one taken after the expiration of 20 or 25 minutes, and the latter would be lower than a third taken after the expiration of 30 minutes. Half-an-hour or 40 minutes after the candles were lighted, they gave practically uniform results. Then photometric results of tests taken by candles depended largely on the length of time the candles were burning before the tests were made. This was so true that, in testing where the first result was low, he invariably went on and took three tests, and then assumed that the average was the quality of the gas. A fourth series of tests was made at Clerkenwell; and they showed that the two photometers were more discordant than ever before.

Mr. Wilkinson (in cross-examination): You consider that the portable photometers as instruments are satisfactory?

Witness: Undoubtedly.

The fault you find is that the rooms in which you tested them yourself were all unsuitable?—Yes.

They were not a class of room which you, as an experienced man, would choose to test with a portable photometer?—I should not decide that until I had made a number of tests.

But you will agree with me that the Gas Referees, who are experienced men in these matters, would not be likely to choose a room to make tests of the portable photometer which was unsuitable for the use of the apparatus?—Our experience of the Gas Referees goes to show that they are open to conviction in the matter of the selection of the rooms.

Mr. Nicol: If the Referees have to increase the number of testing-stations, whatever instrument is used, the place will have to be specially prepared, and experiments made to see if it is suitable for use with this or any other photometer, so as to get an accurate result?—Yes.

By Mr. Leighton: He was employed to test in a number of towns in the provinces, and took his own apparatus. He had never used the portable photometer unless it had been fixed and the gas passing through for at least 24 hours.

The Chairman: How would you arrive at the conclusion in your own mind as to whether a place is fit or not?

Witness: I should judge by the temperature and the absence of draughts, as far as I could.

Are not those conditions ascertainable before you proceed with your experiments?—No; I am afraid not. One might decide that a place is perfectly suitable, and find out afterwards that it was not.

You would declare its suitableness or unsuitableness by ascertaining whether it indicated that the Gaslight and Coke Company's gas was 16 candles?—Yes; or was the quality they expected to find at that spot.

It is rather a peculiar index?—But as a matter of practice, it is the fact that the results come out below the requirements. That raises a suspicion as to the suitability of the place.

According to your answer, you come into the room with the certainty that the gas in the main is 16-candle gas. You come in in an informal sort of way to make an investigation. You say this is air-tight, and is at the proper temperature; there is sufficient oxygen in the atmosphere; and I will proceed to light my apparatus, and make a test. If the test agrees with the 16 candles, the place is a good one?—Yes.

If it does not, the place is a bad one?—No; the place may be a bad one.

Do you proceed to condemn it forthwith, because your stupid photometer does not indicate 16 candles?—Well, in that case we would have previously ascertained that the gas near the spot, and at some other place, gave a higher result. Witness went on to refer to instances in which low readings at a station were checked by other tests taken close to the station, but for which the Company would have been penalized.

Professor *Vivian B. Lewes*, examined by Mr. Dancкwerts.

Witness said he was Chief Superintending Gas Examiner to the Corporation of the City of London. He attended to give evidence on a Speaker's warrant; being subpœnaed on behalf of the Gas Company. He had officially tested the gas supplied in the City by the Gaslight and Coke Company since 1879.

Mr. Dancкwerts: In the City of London, has any such thing come under your notice as there being a variation in gas at the time the test was expected?

Witness: None whatever.

I think in the City of London the Company never attend the testing?—I believe it has only occurred once in the last ten years. Nor had they ever asked for notice to be given of the time the tests were going to be made. It was in the City of London, in 1892 and 1893, that the two instances occurred when the gas was below the standard. The cause was entirely an accident. The Company were then introducing carburetted water gas for enrichment; and they did not quite get the working of the generator, which they overheated, in the absence of the Manager, and really burnt up all the oil. The gas was tested in the City at all times, whenever was thought fit. Besides the testing-stations in the City, he had a room fitted up in exactly the same way as the testing-stations, and there he made tests which, although not official, were on all-fours with those at the stations.

Do they confirm the tests at the stations?—Not altogether. They are slightly lower.

Why is that?—Because they are some little distance from the mains. I have had two of these places, which gave me an opportunity of judging really what the loss of power in normal distribution may be taken to be. During 1892-5, I had an office in Guildhall Chambers, at the bottom of the yard leading out of Basinghall Street. This was at the extreme end of the Bow Common main, which will represent the worst conditions of distribution in which you will get gas in the City. The mean average illuminating power of the gas, taken day by day, and year by year, there was 15·6 candles. At the gas-testing station during that period, the illuminating power was 16·6 candles—1 candle higher. At the present time, the office is removed to Whitecross Street; and there we are nearer the main than was the case with the other building. My average tests are 16 candles there; while at the testing-station the average remains about 16·6 candles.

What is the difference due to?—To the difference in the rate of flow of gas. All the time that you have gas flowing through big mains, there is no deterioration. When you get down to the smaller mains, as long as the gas is continuing at a fair rate of flow there is still only a very small diminution in the illuminating power. But directly you go from the distributing mains to the cross-services, in which the rate of flow becomes extremely slow, you begin to get a diminution; and it is under these conditions that you go down from 16·6 to 16 candles. Where you have anything approaching a dead-end or stagnation in the flow of the gas, you reach your lowest results; and it was at an end of that kind that I had my office in Guildhall Chambers. That is a matter which the Company cannot control.

With respect to the variation found by the use of the portable photometer, have you formed any conclusion? The portable photometer, as at present suggested, is a very excellent form of photometer. It is identical with the form of photometer which we are having at present fitted in the chief testing stations. There is not a word to be said against it as an instrument; but I do consider it would be extremely dangerous, without a very long series of carefully considered experiments made by experts, to suggest that the photometer might be accepted under any conditions. My own opinion is that the requirements, to obtain good results from it, are so delicate that you would have to come back to certified stations.

Would you think that, carried about from place to place, and fixed in any house (say, a school-board), it would give good results?—I should view results obtained in that way with very grave suspicion.

The gas which you get in the City comes mainly from Beckton?—From Beckton and Bow Common.

Do you think it would be possible to manipulate the gas so as to alter the reading of the instruments?—I do not. My reason for saying so is that if you take, for example, the gas of Beckton, you have it flowing in from Beckton in 48-inch mains, a distance of something like 8 miles. These mains will contain half-a-million cubic feet of gas, which means many hours' consumption; and any alteration of the illuminating power will take hours before it is felt at the testing-stations.

Mr. Pope: If it were tested at the works, you could always tell what went into the mains?

Witness: If it were tested at the works, there would have been none of this trouble arising at all.

Further examined by Mr. Dancкwerts: At one time, he had a testing-station at Jewry Street; but it was moved, because there was considerable variation in the illuminating power of the gas. Early in the morning, or after standing some time, low tests were obtained; and then after awhile the power would go up. Though this was a common phenomenon, it took place to an excessive degree. He and the Company made a very careful examination; but no explanation could be found, and the result was that the station was moved to Fenchurch Street. After the removal, the main which fed this station was taken up, and found to be thickly lined with the crystalline hydrocarbon, naphthalene—matter of such a kind that if the gas had stood in it undoubtedly a great deal of the illuminating power would have been abstracted. In the City, gas was largely used for heating, and also for motor purposes in the crowded neighbourhood round Fleet Street, where there was no room for steam power. For this kind of use, illuminating power was not so important. The reason it was impossible to get a uniform supply over a large area was that the illuminating power of gas varied with the length of time it was in a pipe—the rate of flow. If gas stood in the cross pipes from night till the next day, there would be a very serious diminution in power. Board-schools were often placed in back streets, and would therefore be peculiarly liable to be supplied from dead-ends where there would not be probably a constant flow in the main.

Mr. Dancкwerts: Does the system of fixed stations for testing purposes, with power to the Referees to prescribe further stations, amply secure the consumer?

Witness: I should say it secures the consumer as far as the consumer can be practically secured.

Supposing a testing-station were fixed at every works, so that all the gas issuing from each works could be tested, would that afford security?—It would afford far greater security than the present method of having the stations in the area supplied. This was fully pointed out in the evidence which was heard at the time the stations were fixed in the area. At that time, Dr. Pole, who was an ideal Gas Referee, gave evidence on the case; and he pointed out that you would have far greater protection by having the testing-stations at the works, or within a short distance of the works, than in the area because you would do away with all chance of the Gas Companies sending out other mains over a district not tested.

[An extract from the evidence of Dr. Pole given on June 28, 1875, bearing on the point, was handed in by Counsel.]

If it be correct to say that in passing long distances in big mains gas does not lose illuminating power, by testing-stations at the works the consumer would be protected?—Yes.

Have you formed any opinion about the desirability of this Bill?—It is a Bill which I look upon with considerable doubt. I think it is a Bill which will not be very much in the consumer's favour.

Can you explain why you come to this conclusion?—If the Bill was to be passed into law, it would render absolutely necessary the enriching of the gas by at least, I should think, 3 candles, in order that in such cross mains as you have the gas standing in it should hold up sufficiently its illuminating value to give 16 candles when tested by the portable photometer. In order to get this 3 candles of enrichment, the Gas Companies would have to expend at least 3d. per 1000 cubic feet on the gas, and the chief part of this would undoubtedly fall on the consumer. Presuming they put up the price of gas 3d., this, on the price charged in the City by the Gaslight and Coke Company, would be an advance of 8½ per cent., and on the South Metropolitan price it would mean an advance of 12 per cent. The advantages which the consumer would get would not be at all commensurate. If the whole of the consumers of London had 15-candle gas, and it were then increased by the passing of this Act to 16 candles, the benefit they would obtain would not be equivalent to the percentage added to the cost. I base my opinion on this point on the following facts: If you take the general consumption of gas over the whole area of London, you may take it that 50 per cent. of the gas is burnt for fuel and motor purposes, 15 per cent. more is burnt in incandescent lighting, and the remaining 35 per cent. is consumed in flat-flame and other forms of burners. Now, with an incandescent mantle the difference between 16 and 15 candle gas is 3·1 per cent. That is to say, you get 3·1 per cent. less light with 15 than with 16 candle gas—that is, if you carefully regulate the air supply and so forth. When you come to gas-fires, you find a 3·1 per cent. calorific difference between 15 and 16 candle gas. Passing to flat-flame burners, it is there that you find the greatest loss. These flat-flames are not fitted for the low quality of gas; and the difference between 15 and 16 candle gas is over 15 per cent. Taking all these percentages together, you find that they amount to 7·6. That would be a loss, as against which you would have to pay 8·6 per cent.; so that there would be a final loss on the whole transaction of 1 per cent.

That assumes that the peripatetic photometer would secure the results you have mentioned?—Yes.

Mr. Wilkinson (in cross-examination): To what cause do you attribute the loss of 0·6 candle in your testing?

Witness: To the gas lying in stagnant cross-distributing pipes.

The class of place is to be prescribed by the Referees?—The right way to prescribe them would be to say that they should be on a flowing main.

You have found two suitable rooms in the city at which you have conducted proper tests?—The rooms are not satisfactorily situated, as they are not on a flowing main.

But the conditions are satisfactory?—Oh, yes.

Mr. LEIGHTON: If the fittings in the houses are in proper order, ought not the gas to have the same illuminating power as that in the main?

Witness: Yes.

The contract of the Company with the public is to supply gas of a certain value within a certain area?—Yes.

What is the gas value?—16 candles.

You say that the Bill, if passed, would require an addition of 3 candles to be made to that 16 candles?—Yes; to make sure that the gas on the cross-mains was 16-candle gas, you would have to raise the power by at least 3 candles.

You admit, then, that the gas now supplied, when it reaches the houses of the consumers, is under 16 candles?—In the city we divided the consumers into three classes—viz., those who receive gas of ½ candle over 16 candles, those who receive gas of the right quality, and the class who receive gas ½ candle below 16 candles.

So far, then, the Companies have failed in their contract to supply 16-candle gas?—No. Their contract is to supply it in the area, and that they have done.

But in a portion of the area they fail to supply 16-candle gas?—It comes to that.

Mr. DANCKWERTS: Is it humanly possible to supply gas of one quality throughout the mains.

Witness: If the Company send out 20-candle gas, I will guarantee to still find places where it does not reach 16-candle power.

By Mr. EMMOTT: He had not made any experiments *ad hoc* beyond the two described.

By the CHAIRMAN: He did not think the proposals of the Bill, if it were carried, would be serviceable. The operation of gas-testing, in his opinion, was so delicate a one that it required more elaborate preparation of the place for carrying the work on than was contemplated in the measure. As a scientific expert, speaking in the interest of correctness and truth, he thought that accurate tests could not be secured by the adoption of a system of testing at any point which might meet with the approval of the Referees.

The CHAIRMAN: Would not the approval of the Referees be a protection to the Company?

Witness: If they examined the places of inspection, and gave certificates for them, it would be a protection; but this would mean the present system. I do not believe that the Referees would approve of tests taken in the cross or "gridiron" mains. If tests were made promiscuously, the Company would not know where the gas came from. In many instances, it would only be the gas-distributing engineers who would know.

Thursday, May 3.

Professor *Dewar*, examined by Mr. POPE.

Witness said he had acquainted himself with the system hitherto adopted for determining the illuminating power of gas in the Metropolis, and the suggestions that were made in connection with this inquiry.

Mr. POPE: In your judgment, is it possible to have a satisfactory test of illuminating power by means of a portable photometer taken from place to place?

Witness: No; not as compared with the present mode of testing the illuminating power at a central station. It is well known, scientifically, that the photometric method of testing in itself is a very delicate one. Most careful precautions must be taken; and I think I could not do better than read a passage from a most quoted and recent book on photometric measurement. It is a treatise on "Industrial Photometry," by A. Palaz, who is a Professor at Lausanne University; and in Chapter IV., on "General Equipment and Auxiliary Apparatus of Practical Photometry," he says:—

The preceding chapters have been devoted to the study of photometric apparatus and units of measurement. There remains to be found the best manner of arranging them for measurements, and the precautions which must be taken to obtain satisfactory precision. In every laboratory where it is desired to make photometric measurements, there should be set apart a special place judiciously chosen, and satisfying the following fundamental conditions. The photometry-room should be large enough. It is a great error to crowd the photometric apparatus into a small room, especially when photometric standards based on combustion are used—*e.g.*, carcel, Hefner, petroleum lamps, candles, &c. The luminous intensity of these photometric standards varies greatly with the degree of purity of the surrounding air; it diminishes in proportion as the quantity of carbonic acid gas in the air increases. For instance, at the end of an hour the products of respiration of two people are sufficient to vitiate the air in a large room so as to produce a very noticeable diminution in the luminous intensity. Further, the presence of lights brings about an elevation of temperature which contribute to render the measurements less exact, owing to the fatigue of the observer. This can be remedied only imperfectly in a photometer-room of small dimensions, by introducing a little stronger system of ventilation. No attempt should be made to use ventilating apparatus during the measurements themselves, for the photometric standards should be free from even the smallest currents of air. Recourse should be had to it between measurements, which, however, produces each time a disturbance in the regulation of the standard lamp. We do not know then whether the luminous intensity of the lamp returns to its initial value or not. The photometry-room should have its walls painted a dull black; and it should be possible to obtain complete darkness. This condition is indispensable if the photometric-screen is to receive only such light as comes from the two sources to be compared. It, moreover, permits the eye to rest in the interval between the measurements. The light necessary for reading the apparatus and making notes should be furnished by lamps of small intensity fitted with reflectors which do not allow the light to be diffused over the room.

That, I say, sums up the exact position of modern science in regard to photometric measurements.

Speaking now, not as a scientific man, but as one of the public, that seems to me to show it is very difficult to secure perfect conditions with photometric exactitude?—That is true.

Therefore the most that you can do, as a practical question, is to approach as nearly as possible to the conditions which have been laid down?—Yes.

Assume, for instance, that either the Referees or Examiners, or anybody else, were, for the purpose of fixing the penalty by the attaining of an average, to avail themselves of an opportunity to use photometric apparatus, I may call it haphazard, at a board-school, a dwelling-house, or a large theatre, would the conditions be such as to deprive those results of all practical value?—I say they would. I say there is no possibility, in my judgment, after hearing the evidence that has been given, to account for any such deterioration as 2 candles difference, or even 2 candles difference between the central stations, on the ground of the mere difference in the photometer—the mere instrument itself. It must be the conditions of use, and in the sampling of the material being tested.

I gather that, in many of the cases in which results have been given to us, the gas has been taken, not from the mains where it was lively, but from the burner in the room where the test is about to be made—no doubt with a view to ascertain the quality at the burner itself?—Yes.

Are those conditions such as may be fairly comparable?—I say there is no possibility, in my judgment, of making the tests taken as a standard at the central stations comparable with a test taken, for instance, at a board-school, as has been described, or any public building. In the case of the testing-station, there is always a moving current of gas taken direct, as nearly as possible, from the large supply in the main. You go into a building of the kind mentioned (say) with 200 lights, with small pipes, and the gas has not been used for some hours. There are 200 lights; and a diffusion of air is taking place by the lighting of this gas. This is entirely different from anything that will occur at the central station. The consequence is that you will require to burn the gas, in order to get a sample comparable with what you take at the central station. Then probably you will not get it.

Do you think, therefore, that the result (though not by any means scientifically perfect) obtained by the present system of testing in central stations, is better than it could possibly be by the use of the portable photometer?—I have no hesitation in saying, "Yes, undoubtedly."

When you are dealing with questions of imposing a penalty for the non-performance of an obligation, as a matter of course you must have an accurate test, or you would be in danger of committing injustice?—Yes; if you mean that the accurate test is to be still judged by the values obtained at the central station. But by the evidence, I thought it had been admitted that, while at the present time a penal position was thrown upon the Company by a variation of 3 per cent., it was suggested that 6 or 9 per cent. might be judiciously given if you had a peripatetic photometric system as proposed.

Have you any means of ascertaining whether that would be a fair allowance to secure accuracy?—No one could do that, except after an exhaustive inquiry and a large number of experiments.

It is possible to make allowance in scientific experiments for causes of inaccuracy; but you must ascertain beforehand what proportions mean inaccuracy?—Yes. You may say with certainty that it is an absolutely different mode of sampling the gas to go into a large building, where the gas is not in active use, and take it from the small pipes at a place where there are 200 lights, and to test the gas at a central station. If you took the gas from the other side of the meter, you would have the nearest approach to the sampling of the gas at a fixed station.

If you introduce the conditions you require at a board-school testing-place, you would transform that room into a fixed station?—Yes; to some extent.

Witness went on to say that it was one thing to use a portable photometer as a means of inquiry only, and, from the results, to give a moral warning to the Gas Company as to deterioration or any peculiarity in the gas in a district—in fact, to co-operate with the Company in remedying an evil—but the suggestion in the Bill was quite another thing. The present method of testing was the best practicable security to the consumer that could be devised.

Cross-examined by Mr. WILKINSON: The quarrel you have with the tests as proposed in the Bill is that you do not consider that the conditions under which they will be taken will be satisfactory?

Witness: That is so.

You are familiar with the notifications which the Gas Referees make in prescribing the conditions under which the tests shall be made at the fixed stations?—Yes.

In one part of the interesting extract you read, it was said that, to make a satisfactory test, the walls of the testing-place should be black?—I say that now.

You know that, in the requirements of the Gas Referees, there is nothing as to a black wall?—I am aware of that. I have given the results of recent scientific investigation. All the photometer rooms of the Welsbach Company have blackened walls. Of course, screens are a sort of equivalent for blackened walls.

You would, speaking generally, accept the conditions that the Gas Referees would prescribe?—I might not like the conditions they laid down, or might not consider them very scientific; but the Companies would have to accept them. The Referees might prefer screens; whereas I should prefer blackening the walls. They would be adopting the same principle as myself, only using it in a different way.

Do you think that the conditions in which a test is made in a board-school could be so settled as to render such a place a fit one for making a test?—Yes. You could blacken the rooms, no doubt; and if you were to select proper rooms and heat them, you could control the temperature.

The conditions being satisfactory, you would agree to the fairness of the test?—If the conditions were satisfactory as to the mere photometer, the results, I should say, would be correct.

Speaking generally, you would not dispute the capacity of the Referees to prescribe the conditions?—Certainly not.

The CHAIRMAN: The witness speaks of absolute accuracy as a scientist; whereas the Referees merely desire to obtain practical accuracy.

Mr. WILKINSON: That is so.

Mr. POPE: Yes; that is so. (To witness:) You could not, with the portable photometer, secure accurate tests?

Witness: The tests could never be as accurate as those at a fixed, specially fitted laboratory.

Mr. LEIGHTON: One of the objections to testing the gas in varying places, is that the gas in the main is different to that in the consumer's house?—Yes.

How long would it take to exhaust the gas in a house?—It is not possible to say, especially in the case of a board-school.

Do you believe that the gas distributed over the district is of the same illuminating power as that found at the fixed testing-station?—Yes; unless there is some want of active circulation.

So far as the Company are concerned, if the test were correct they would not be injured?—No; if you take a sound method of testing the gas. You must then arrive at a fair allowance to make of difference between the results at the varying testing-places and those at the fixed stations, before exacting a penalty. No one can say whether it should be 3, 6, 9, or even 15 per cent. At present, there are no means of fixing the allowance in connection with the portable photometer.

If, by some new process, you could show the true value of the gas, the Company would not be penalized?—That depends upon whether you are going to take up the position that gas is to be supplied of 16-candle power at any time or any place, whatever the ramifications of the gas may be—whether you are to take it from outside the house, or with from 2 to 5 per cent. of air in it.

Then the gas is not the same all over the district as it is at the fixed stations?—No; owing to diffusion of air and to deterioration through stagnation.

May I take it that the gas is not the same in the district as in the mains?—It is the same in the chief mains, but not in the subsidiary ones.

If the new processes of testing are just and fair, the result would be the same—you would find 16-candle gas?—Yes; if you made the portable photometric tests comparable to the tests made at the fixed stations, you would get the same results.

You do not object to the new tests in themselves, but as to the justice and fairness of their conditions?—I deal with two propositions, the change in the conditions of using the photometer and the change in the conditions as to the mode of supplying the gas. I compare the new conditions with the old ones. Which is to be the proper standard?

Mr. Leighton: You are bound to supply 16-candle gas.

Mr. Pope: The definition of 16-candle gas is 16 candles as ascertained under the provisions of the statute.

Mr. Leighton: That is the method of testing the gas. There is nothing about the testing-station there——

Mr. Pope: I think there is.

Mr. Leighton: I had not finished. There is nothing about that in the section that gives authority to provide 16-candle gas?

Mr. Pope: Yes; there is.

Mr. Leighton: No; it comes afterwards.

Mr. Wilkinson: There is nothing about testing in the section that creates the obligation to give gas of a certain number of candles.

Witness said it had struck him, from the evidence, that the impression was conveyed that the gas was 16 candles all over the district. He was not surprised at there being a diminution of ½ candle in some places; but this did not show him that there was not 16-candle gas in the mains.

The Chairman: If the portable photometer showed 18-candle gas, would that convince you that the gas was above 16 candles?—Oh! yes.

Witness (continuing) said the conditions of deposition were so complicated and uncertain, that no one could tell why the deposits were made, or why they should occur more in one place than another. One could not predict where they would occur.

Mr. Emmott: Did I understand you rightly that you considered the limits of error in observing the photometer tests were as much as 1 candle out of 16?

Witness: No; I never suggested such a thing. I only said 1 per cent. They are suggesting that we ought to have 6 or 9 per cent. I say: Who is to determine whether we ought not to have 12 or 15 per cent. by this mode of testing?

The Chairman: I gather, from your evidence as a strict scientist, that you consider the selection *ad captandum* of places for inspecting gas would, in practice, be misleading?

Witness: Deliberately I say so—misleading in the sense of the results.

And it would be misleading on the ground that the conditions at the spots so chosen would be practically uncertain?—That is so.

And that the conditions are so subject to modification by a variety of circumstances, that you could not, as an exact scientist, take for granted that the results were truly indicative of the condition of the gas as an illuminant?—That is so.

You lay considerable stress upon this—that such a loose method of selection of a site for investigation would be misleading, on the ground that there could not be any reliance on the fact that the gas taken from the main was truly representative of that supplied by the Companies?—That is so.

As regards the photometer itself, as an instrument, you would have quite as much confidence in it as in the table photometer now adopted in the stations?—Yes.

But with the conditions surrounding the photometer at the moment of use for this purpose, it would be, from a scientific point of view, unreliable?—Yes.

More unreliable because of the conditions being more variable?—The conditions being varied from what they are at a district testing-station.

May I ask you to divest your mind now of the scientific aspect, and turn to the practical aspect—as a practical matter in which we do not deal with decimals of four points? As a practical issue, having regard to the London consumer of gas, do you still think that the conditions applying to the question as to whether we get a fair sample of the gas supplied would still be unsatisfactory as a commercial test?—Do you mean if the Bill were passed?

If the Bill were passed?—It would be unfair.

I will not say if the Bill were passed, but if the selection of places were made in the broad *ad captandum* style suggested?—I say it would be unfair, because unreliable on the two points of the difference in the conditions of use and the difference in the conditions of sampling.

You think your position as a witness to-day is confirmed by the action in Liverpool, which has resulted from experience in settling down to six chosen places instead of the miscellaneous choice that was first opened being the arrangement?—That is my view. The evidence in regard to Liverpool was a proof of the advantage to be derived from the central arrangements.

You spoke of the absorption of air?—The diffusion of air.

Is it true that gas not only escapes, but air always comes in?—Always; but minute diffusion is a question of time.

My experience is this: If I am in town for a long time, and I go back to the country and turn the tap on, the gas does not light until it has been on a certain time?—That is due to the diffusion of air.

I presume that, to a greater or lesser extent, this process is going on in all fittings?—It is in the fittings where it comes in.

Are leaden pipes more subject to this than iron ones?—I do not think so.

Are they less?—It is a question that has never occurred to me before.

I was asking you, because I take it that fittings in houses are principally lead, whereas outside the meter they are invariably iron?—Yes.

As a scientist, would you consider it satisfactory to take a test in a board-school, in a room like this? Suppose they have a true sample by going beyond the meter, that there are two windows, that they draw down the blinds, and that it is dusk or just approaching darkness outside, would you think the modicum of light in the room would be, not from a scientific, but from a commercial point of view, an appreciable element?—Undoubtedly, it would be.

Your conclusion, as a scientist, is this: That justice between the gas producers and gas consumers will be better secured by a proper scientific investigation, both as to the quality of the gas drawn for the purpose and as to the conditions under which the tests are made—it will be better in the public interest that this should be done under the conditions you set out than under the more or less uncertain conditions with the 6 or 9 per cent.?—That is a very difficult question to answer. It probes the whole matter to the bottom. I think you must define the limits you are going to give the Companies after examination and observation—as to whether it should be 9, 10, or 12 per cent.

You say the best method of all is to eliminate the uncertainty, and then to proceed on strictly scientific lines, and penalize on a very small margin of defection from the standard?—Yes. What is done now is the most rigid, the most severe, and the most certain; but if you are going to change the conditions, I say you can only do it after experiment and observation as to what allowance should be made under the new conditions.

This concluded the evidence for the Gaslight and Coke Company.

Mr. Pope then addressed the Committee for the Company. He said they were engaged in the business of practical legislation; and the ordinary rules that governed parliamentary procedure should apply to the present case, as well as to all others. The Committee were asked to put a violent hand on the existing system of gas-testing. The only justification for this would be the promoters proving to the Committee that the existing system did not effect its purpose, or was not sufficient. It seemed to him that the measure was an ill-conceived one, on the face of it. It showed traces of the desire on the part of the London County Council to harass the Companies rather than to harbour an intelligent appreciation of the interests of those they professed to represent—the gas consumers. The County Council, unlike the Local Authorities of (say) Liverpool, seemed to think that gas and water and other large undertakings would be better in the hands of the public body than in those of private companies. But the Committee had to look to what was proposed in the Bill. In the preamble, the promoters said: "Whereas it has been found that the illuminating power of the gas supplied by the said Companies in their districts generally cannot be satisfactorily or sufficiently tested by tests made only at certain prescribed testing-places: And whereas it is desirable that powers should be given to the Gas Examiners to make additional tests of the illuminating power of gas elsewhere in the districts of the said Companies, in manner to be prescribed by the Gas Referees." This indicated the view that the quality of the gas supplied to the public was not satisfactory. Well, the Company under the Act accepted responsibility for the supply of gas of the statutory quality. They accepted responsibility for the quality of the gas in what was called the "flowing main;" but they did not hold themselves responsible to see that every consumer received at his burners 16-candle gas. The Act regulating their procedure required that 16-candle gas should be supplied at the fixed testing-stations.

The Chairman asked if it was not the fact that the number of candles stipulated for in the various Acts varied from 12 to 20.

Mr. Pope replied in the affirmative. The illuminating power required by the Liverpool Act was the highest; the number of candles being 20. The illuminating power varied according to the accessibility of cannel coal to the producing agency of the gas. Cannel coal was the enriching agency used formerly; and it was only recently that other materials had been adopted, which others were, perhaps, not of so stable a character as cannel. The Company recognized their liability as to the supply of 16-candle gas; and the object of the Bill was to amend the machinery by which the performance of that obligation was to be secured. So that he had no need to discuss at any length the nature of the obligation resting on the Gas Company. The question was whether there was any immediate necessity for changing the system of enforcing it, so as justify the new legislation. No Committee of Parliament, he maintained, would change an existing state of things, unless there was a manifest reason why the change should take place. Therefore, they would consider whether the system of a fixed testing-station, with all the machinery employed, had failed to secure the desired result—viz., that of securing that 16-candle gas was supplied at all the fixed testing-stations. He did not think he should be justified in saying that the work of the Gas Referees was not of a satisfactory character. All he would say was that a good deal depended on the practical knowledge of the Referees. And here he must point out that they had not had the advantage of having on the body of Referees a Gas Engineer, since the retirement of the late Mr. Evans. Well, what was the evidence? To justify legislation, the Committee should have proved before them not only want of legislation, but the efficiency of the legislation proposed. Before the Bill was passed, the Committee should be satisfied that the measure would do what the existing system did not do. The enacting part of the Bill said, in clause 3: "Any Gas Examiner may at any time make, at any place within the district supplied by any of the Companies, tests for ascertaining whether the illuminating power of the gas supplied by such Company at such place is that required by law." Then it dealt with the apparatus, and said: "The apparatus to be employed in such tests, and the mode of conducting

such tests and recording the results thereof, shall be from time to time prescribed by the Gas Referees; and the Gas Referees shall from time to time make regulations with respect to those matters, and shall send to the Council, the Corporation, and each of the Companies a copy of such regulations." In what single respect did these proposals differ from the existing system? A Gas Examiner could examine anywhere; but he could only do it subject to the decision of the Referees as to the apparatus to be employed, the mode of applying the test, and the class of places at which it should be applied. What was the use of such legislation as this? What was the use of encumbering the Statute Book with an enactment which would alter the law so little? The Referees had power to fix the testing-station anywhere, and to order the Examiner to make a test at any time they chose. The Bill was, therefore, unnecessary. But beyond this, it was vicious, because it introduced into a Penal Act of Parliament, an item of uncertainty which would, unless corrected, work injustice. The only alteration that would be made in the powers of the existing Gas Referees by the Bill, would be one for the worse, because it would introduce an element of greater uncertainty in the result than existed at present, and therefore an element of greater danger to both the consumer and the Company. The Company would not object to any such arrangement between themselves and the public authority, as that which existed at Liverpool. They would not object to tests being made by a portable photometer, if the result were to be that they would receive reports, and that the information obtained, though not strictly accurate, would be given to the Company for their guidance—to enable them, it might be, to remedy something that had gone wrong in the process of manufacture. But when it was proposed to exact penalties, the element of uncertainty made the thing unjust. The Companies did not object to being under obligation to supply 16-candle gas, and to being under a penalty if they neglected to do it, provided the illuminating power of the gas were ascertained in a satisfactory manner. They preferred to be left under the liability at present resting on them—that of the existing system of testing, which, after all, was the most certain and regular, and the most to be relied on. Manifestly, unless they could settle the amount of corrective allowance to be made in the testing, the case for the promoters showed that the Bill ought not to pass. They admitted that the element of uncertainty which existed required an additional corrective allowance to be made; but what that was, no one had yet been able to ascertain. Until it was settled, it would be unjust to submit the Gas Companies to the liability of being chargeable with breach of contract. The case for the Companies was that they gave the consumer the best protection they could in respect of the supply of 16-candle gas. He contended that this could only be ascertained with certainty and satisfaction to either side by a system involving the settlement of particular places and stations for the examination of the gas; and this contention was really borne out by the Liverpool experience, where, after "peripateticizing" all over the borough, they had settled down to fixed stations for the purpose of examination. The Liverpool arrangement, however, was not penal, but was one which gave to the Company certain advantages. It was a mutual agreement by which the Corporation should not insist upon more places, while the Company were to deal in a friendly way with the information obtained by the Corporation at these stations. If the London County Council liked to approach the Gaslight and Coke Company with any such arrangement, he pledged the Company to at once meet them, and to agree to some such plan—the County Council not to inflict penalties, but to furnish information which would enable the Company to remedy defects. In the interests of the Company, as well as in those of the consumer, the Committee should not pass this Bill, or any modification of it, because it involved the infliction of penalties by reason of the existing system not having been efficient, and the substitution of a still more inefficient system—one involving a greater amount of uncertainty, and therefore greater injustice.

The CHAIRMAN: I should like to make one suggestion. The Committee feel that they have already had abundant evidence on the subject of the portable photometer—scientific evidence as to the conditions, &c. We are saturated with evidence on that subject. We would therefore suggest—we merely make the suggestion, and leave it to your discretion—that in taking the South Metropolitan Company's case you should limit yourself to such matter as constitutes the difference between your own Company and the Company whose case we have just heard. The general matter of the question before us is already in our minds. If you have any point in which your own interests vary, or are differently affected by the proposed Bill, other than the interests of the Company whose case we have already heard, we should be glad to hear it; but I should like you, if you can, without prejudice to your Company or injury to the case, to limit it to those points.

Lord R. CECIL: It is a little difficult to be quite certain that in the evidence I shall call I am not repeating anything; but I will do my best.

Mr. *George Livesey*, examined by Lord R. CECIL.

Witness, in opening, said he wished to clear the memory of a man who had gone beyond all gas testing. He referred to a statement by Mr. Dibdin in regard to three occasions on which sulphur had appeared in the gas; the inference being that the gas had been "dodged." The explanation was that at the works concerned—those at East Greenwich—they made three times as much gas as was used in the district; the result being that, while the Company were actually bad in respect of sulphur on one day, it appeared that they were bad on three days. It was inevitable, and was not done to "dodge."

The CHAIRMAN said the impression left on his mind had been that if dodgery had been intended it would be possible.

Witness: It is our misfortune. Continuing, he said that he entered the service of the South Metropolitan Company fifty years ago, and in 1871 became Secretary, as well as Engineer. In 1882, he went on the Board; and since 1885, he had been Chairman. The photometric examination of gas was not an exact science—a mathematical operation. The illuminating power varied according to the method of testing.

Lord R. CECIL: The variations in the value of the gas depend upon the conditions under which it is tested?

Witness: Quite so. That is why the conditions are specified.

The CHAIRMAN: I suppose you mean, not that the illuminating power varies, but that the ascertained illuminating power varies under the conditions in which it is tested.

Lord R. CECIL: That is what I mean.

Witness: I am afraid the illuminating power varies too. It is impossible to make gas of perfectly uniform quality. It varies within certain narrow limits.

The CHAIRMAN: I take it that the margin which is allowed under the Act is indicative of general consciousness, at the time the investigation was made and the candle power determined, that, practically speaking, mathematical accuracy in the production of gas was an impossibility.

Lord R. CECIL: Yes.

The CHAIRMAN: Therefore a margin was allowed to make provision for that uncertainty. If it were mathematically possible to make gas of precise illuminating power, you would never go one decimal point above the prescribed power.

Witness: Quite so.

Lord R. CECIL: In addition to the operation connected with the manufacture of gas, a certain loss may take place in consequence of its passing through small mains, for instance, or mains that are not in good condition?

Witness: Yes. Deposition took place at some times and not at others; and a good deal of that which was deposited would be pumped out of the mains.

I think you are Chairman of the Crystal Palace Company?—Yes.

There, I believe, you have had some experience of the curious effects that may be produced on gas?—Speaking broadly, the gas supplied at Beckenham is tested 2 miles from the works. Sometimes there is a diminution of $\frac{3}{4}$ candle, and usually of $\frac{1}{2}$ candle. At other times, there is an increase—the gas is better at Beckenham than at the works.

The CHAIRMAN: Arising from the circumstances you are now describing?—Exactly.

Lord R. CECIL: Thus what Mr. Vernon Harcourt said is quite true—it may pick up illuminating power?—Unfortunately, if we lose something to-day we are penalized; we do not get the credit of its being better to-morrow.

Those facts are very well known, and have been well known since 1860?—Yes.

I think you are familiar with the proceedings that took place before the Committee on the Metropolitan Gas Act of 1860?—Yes.

Do you remember the evidence that Dr. Letheby gave?—Shortly, Dr. Letheby made a number of experiments on the gas supplied to the City from the Bow Common works. He was Professor of Chemistry at the London Hospital; and he made tests there and in the City, and found there was a loss of 2 candles between the works and the City. He found also that the greater part of the loss took place between Bow Common and the London Hospital. I think the conditions were rather adverse, because there ought not to be a loss of 2 candles in that district.

The method of testing adopted in 1860, and since enforced on the Companies, was adopted with a view to these irregularities of gas which were well known at that time?—Yes. Parliament had distinctly recognized the fact that gas under certain circumstances did lose in travelling, for in the Pendlebury and Salford case they enacted that the gas, which was to be 18 candles at the works, need only be 17 candles in the district.

Was it in 1860 that this system of gas-testing stations in London was established?—It came about in this way: Prior to 1853, competition was universal, and there was no trouble taken about gas-testing stations. In 1853, the Gas Companies supplying South London, and in 1858 the Companies supplying the North, amalgamated. Parliament legalized the arrangement; and, that being so, it was felt that protection was necessary for the consumers. This was the first time, I think, an Act was passed requiring gas to be tested.

Was it pointed out that frost and stagnation also had an important effect on the illuminating power of gas?—Yes; by the Act of 1860 the testing-stations were fixed at 1000 yards, as near as may be, from the works. In 1876, that provision was repealed, because in the interim the Beckton works had been built.

The CHAIRMAN: In other words, the central area of London said: "We must have the 16-candle gas on the spot, though you may have the works miles away?"

Witness: Yes.

I suppose you would agree that the high-pressure service from Beckton in the 48-inch pipes, with the strong currents, is a distinct advantage to that Company in securing the maintenance of the quality of the gas at a distance?—I have tried to make a calculation on that point. The condensation and reduction of illuminating power is due to the contact with the surface; and I came to the conclusion that in a small main there is 150 times as much contact with the surface as in these big ones, because they send through such large volumes.

Lord R. CECIL: As a matter of fact, I think the testing-stations in your Company's district are about 1000 yards from the works?

Witness: The Referees have still acted on the principle of placing a testing-station on the leading mains, in order to get samples of the bulk of the gas; and in five out of our six stations that is so. In the case of the Greenwich works, we have one station on a 3-inch main.

When were the gas-testing stations first established—the system of having testing-stations for each Company?—I think we were the first to do it. We did it voluntarily in or about 1860.

Since 1860, substantially, has the principle for testing London gas always been the same—I mean in a station prepared for the purpose?—Always.

And all the capital subscribed for the Gas Companies in London has been subscribed under that condition?—Yes; and everywhere else, as far as I am aware, except at Liverpool.

Do you think that the portable photometer would be a fair way of testing your gas?—I think if the portable photometer were adopted, it would render the position of gas managers perfectly intolerable. I was Engineer from 1869 to 1882; and in the first part of the time our quality was 14 candles, and we were able to supply 16 candles without any trouble. But after we were put up to 16 candles in 1876, it was an anxiety every morning when we went to the works to look at the test-papers. If the portable photometer were adopted, the position would be so intolerable that I do not know what we should do.

The CHAIRMAN: I suppose it is a crucial point?

Witness: It is not a crucial point; it is all nonsense. The gas was just as good when there were no tests as it is now. The crucial point is whether the consumers shall have gas at all—not whether it shall be a candle more or less. The largest gas-works in London were recently

within six hours of exhausting their supplies of coal. We have been hovering for weeks on two days' supply; and what we are to do this year, I do not know.

Lord R. CECIL: I want to get it clear what your objection is. It is not to the instrument itself, but to its being carried about?

Witness: The instruments are the same. The conditions under which they are used are undesirable. I cannot add anything to Professor Dewar's evidence.

You admit that you are bound to supply 16-candle gas?—As defined by the tests. I have always regarded it as our obligation that we should supply good 16-candle gas from the works, and the orders of the Directors to the Managers have been to give this full 16 candles. On one occasion, there was a deficiency in the gas from one station. An extract from the minutes of the Board meeting of Dec. 19, 1888, stated that the Engineer reported the official tests during the previous week, some being bad. The Board regarded this report, the minute went on, with great dissatisfaction, and ordered that the attention of the official concerned should be directed to the instructions given repeatedly to the Managers of the stations that their first duty was to take care that the quality of the gas was maintained above 16 candles, whatever the quantity of cannel required for the purpose. The Company always sent out gas of over 16-candle power. He had never understood that they were to supply 16-candle gas to every consumer, but that it was to be 16 candles as sent out from the works, and that gas of 16-candle power was to be found at the testing-stations. He also understood that Parliament knew there would be a diminution due to the gas having travelled.

What you have always understood is that, where the gas can be fairly considered to be in bulk (that is, in the leading mains), it must be 16 candles?—Yes.

But when it gets into the small by-ways of your system, you do not regard yourself as under obligation as to the 16 candles?—Yes.

By the CHAIRMAN: He believed the South Metropolitan gas was ½ candle lower than that of the Gaslight and Coke Company; but the policy the South Metropolitan Company had pursued had been rather different from that of the Gaslight and Coke Company. The South Metropolitan Company's policy had been to give consumers an abundant supply of gas at the lowest possible cost. The price was a consideration; and the result was that they had been able to sell their gas at a very much lower price than their neighbours.

Lord R. CECIL: Do you differ from the view expressed here, as to the obligation on the Gas Companies, by the Gaslight and Coke Company?

Witness: As I read the Act of Parliament, I do not agree. It is to be 16 candles tested in the ordinary way; and Parliament, in making the provision, knew that it would be less in the district.

The CHAIRMAN: That is purely a matter of your opinion?

Witness: That is so. My opinion is that if Parliament had intended 16-candle gas to be given everywhere, it would have required us to supply 17 candles.

Lord R. CECIL: If such a system as the portable photometer were put upon you, would you, to be safe, have to make a very much higher quality of gas?

Witness: We should not be safe unless we sent out 19-candle gas.

What would be the effect upon the consumer?—In the first place, a good many consumers would get 19-candle gas, and we should have any number of complaints of the smokiness of the gas and of the headaches which it would produce. If you have a rich gas supplied where they have been accustomed to a poor gas, it does not get properly consumed, and there is a great deal of smoke. If the combustion is not quite complete, you have a quantity of carbonic oxide, and that is the real cause of headaches, I believe, in schools. That is the effect on the consumer. The other effect would be to enormously increase the cost of making gas. We should have to raise our price at least 3d. per 1000 cubic feet. This would add £126,000 a year to the consumers' charges. It would not take anything from our dividends. We are entitled to a much larger dividend than we have been paying. We have been paying on a dividend due to a price of 2s. 1d., whereas we are entitled to a dividend due to a price of 2s. 5d. He added, however, that this year they would have to lose dividend.

Have the consumers asked for an increase in the illuminating power of the gas?—No.

I think that is an important matter?—Very little has been said about the consumer. The County Council said they were moved by complaints from various consumers; and on application they furnished some particulars going back to 1891. These complaints were contained in letters from the Vestries of Battersea and Rotherhithe, the Lee District Board, and a Mr. John Burgess, a resident in Lavender Hill, who asked earnest attention to the quality of the gas, and said its lighting power had been very poor, and that it made his eyes ache to read by it. The Company had applied to the districts for the details of these complaints, but could not get them.

The CHAIRMAN: May I ask whether in this Lavender Hill complaint you have made any investigation as to the fittings, or anything of that sort?

Witness: I cannot say. I have got a number of our own complaints, which we have investigated. Sometimes we have to tell the people that it is the fittings, sometimes it is a stoppage in the service.

Lord R. CECIL: Was this complaint of John Burgess forwarded to you by the London County Council at the time?

Witness: No.

So you could not possibly make any inquiry?—No. Continuing, he said that in the week ending Jan. 27 last, out of the Company's 200,000 customers they had about 700 complaints. There were 68 of bad light, 143 of bad supply, 148 of no gas, 97 requesting the Company to see to the gas, 175 requesting the Company to see to the meter, 9 of bad gas, 3 of gas burning badly at stoves, 23 of lights jumping, 7 of low pressure, 9 requests for clear service, and 6 requests to blow the pipes. In one case, the Company took away the burner and found that with 16-candle gas it only gave a light of 11¾ candles. He put in a table of 49 instances in which burners had been tested under the best conditions with 16 candle gas; the result being to show a power varying from 16·9 to 6 candles. The defect was always due to faults in the fittings, naphthalene in the pipe, something wrong with the pressure, or something of that kind. As regarded the pressure, very often gas was laid on in a house for a certain number of burners, and then a gas stove or more burners were connected, without any alteration of the pipes—the result being a greatly diminished pressure. It was no uncommon thing to find a considerable quantity of naphthalene in the service-pipes. He had suffered from this in his own house; naphthalene having been deposited in the pipes while no such thing happened in the pipes of his neighbours.

The actual tests under the most favourable conditions by photometer show considerable variations of this nature?—Yes.

I believe that three separate tests are taken on each occasion, and that each test consists of ten observations?—Yes.

So that you get thirty observations to make one series of tests?—Yes.

And these observations differ considerably from each other?—That is so; and the three tests themselves differ very materially.

Give us a case?—From the East Greenwich works we supply Woolwich and Plumstead; and no other gas whatever by us supplied reaches those districts. The testing-place is at Burridge Road. During the last twelve months, we have taken out three tests there. The first gave 15·6 candles, the second 16 something, and the third 16·6. There was an interval of one hour between the second and the first, and of two hours between the third and the first. It was impossible that there could be any difference in the gas, though the first test showed 1 candle less than the others. This would prove that the first test was not a fair one; the results being better after the gas had been burning one hour and two hours.

The CHAIRMAN: I understand, from the diagram, that the testing-place is on the 10-inch main?

Lord R. CECIL: That is so.

Witness: At the Bloomfield Place Board-School, we made a test on May 3, 1894, when we supplied unenriched gas. The test showed 13·9-candle gas; and on the same day the same gas at the official testing-place gave us 15·7, or a difference of 1·8 candles. It was impossible, in that case, that the gas could be different at the two places. The same thing was observable with enriched gas. We got 15·6 candles at the board-school, and 16 candles at the official testing-place.

Lord R. CECIL: Can you put before the Committee your views as to the desirability of enriching at all?

The CHAIRMAN asked whether that evidence would appertain to the Bill.

Lord R. CECIL said he would not press it, if the Chairman did not think it desirable.

The CHAIRMAN said he did not think about the matter at all; he only asked the question.

Witness said he would deal with the point very briefly. He held that all the trouble that was engaging the attention of the Committee was caused from excessive enrichment; and the portable photometer did not adequately deal with the matter. It had given enriched gas at 15 candles and unenriched gas at 14·85. This was testing the portable photometer against itself. The observations he would make in regard to enrichment were these: There were several methods of enrichment. There was, first, that of using cannel coal. Cannel coal was not to be had now; its price was prohibitive. It was cheap enough at the present moment, no doubt; but this was because the Gas Companies had ceased to use it. If the Companies started to employ it again, no doubt the price would go up. The other methods of enrichment were by pretroleum spirit and carburetted water gas. Pretroleum spirit was a vapour which was put into the gas by means of steaming out; and it was more likely to condense out of the gas than carburetted water gas. It was possible that when it was put in at one end of a district, by the time the gas reached the other end the pretroleum spirit would be gone, and have taken something else away with it. At his works, they had not adopted water gas. No doubt enrichment by means of cannel coal was perfect.

The CHAIRMAN: In the case of petroleum spirit, it is a mechanical mixture of two different substances?

Witness said that was so; and they could not be certain of it. His experience of enrichment was that it was a sheer waste. The consumer had to pay for it, but would be much better without it.

The CHAIRMAN said that they no doubt had heard Mr. Livesey's views, not only there, but outside the room. He doubted, however, whether this evidence was relative to the question before them. At any rate, they need not go too elaborately into it.

Lord R. CECIL remarked that he did not propose to do so.

Witness went on to say that his Company understood they were bound to supply a good 16-candle gas when tested at the station; and 16-candle gas was sent out of the works in sufficient bulk to give 16 candles or a little more at the testing-stations.

Lord R. CECIL: It is not a fact that you supply a special kind of gas at the testing-stations which does not go to the consumer?

Witness: Certainly not. Some people suspect that we do; but we do not. I think that even the Gas Referees suspect it, having regard to their last order.

But it is not done?—No; we have never done it, and have never thought of doing it.

You do not manipulate the gas to produce a better result at the time of testing?—No; in five cases out of six we do not know when the test is to take place.

The CHAIRMAN: You do not attend them.

Mr. EMMOTT: How long would it take your gas to travel from the works to the Burridge Road testing-station?

Witness said he could not answer the question; but it would be some hours.

The CHAIRMAN: It would be freshly-made gas, but would go to the testing-place from the holders?

Witness: That is so.

You never clear out the whole of the holders?—We do not clear them. Continuing, witness said he had once a singular complaint—namely, that the gas in a certain district went out—and on investigation it was found that it was owing to trouble with a purifier. It was discovered that, in clearing it out, the air had not been got rid of, and that 2000 or 3000 feet of air had got into the works. At the Bankside testing-station, they had obtained tests by the photometer showing variations between 15 and 17 candles; and they could not always help it. Though they were enriching the gas up to 17 candles at the works, it would sometimes be 15 candles at Bankside. They supplied from these works 2 million cubic feet per day, or 4 per cent. of their total output. When the tests showed such variation, there must have been some disturbing cause. At the time of the low test, they were experimenting with different kinds of coal. The gas

did not go from a holder at Bankside to the consumers, but straight from the works. They sent gas to the holder at Kennington in the daytime; but at night they wanted all they could get for the consumers.

The CHAIRMAN: Have you had complaints from the inhabitants in the neighbourhood of the station?

Witness: None at all.

Lord R. CECIL: Is it not a fact that the illuminating power of the gas is not now-a-days so important as it used to be.

Witness said that was so, because formerly gas was used for lighting purposes only, but now 50 per cent. or more was employed for heating. The Welsbach burner was coming very commonly into use; and for this a poorer quality of gas was suitable.

Mr. EMMOTT: Looking at your diagram, I see that 2-candle power gas is said to be better for purposes of this illumination than 13-candle gas.

Lord R. CECIL said he understood that the nearer approach they got to pure carbon, the greater the heating power of the gas; and as the illumination of the Welsbach burner was caused by the heating of the mantle, a lower quality of gas gave the better results. (To witness:) Do you think this is a favourable time for throwing fresh burdens on the Gas Companies?

Witness said it was a very bad time. Every burden thrown on the Companies really fell on their partners, the consumers.

Cross-examined by Mr. TALBOT: His Company had not had many proceedings for penalties brought against them. There had been none in respect of the fall in the illuminating power of the gas at the Bankside station of which he had spoken.

Mr. TALBOT: Have the tests at that station always given satisfactory results?

Witness: Not so satisfactory as at other stations.

At any rate, they have given satisfaction?—Yes; but they fluctuate more than we like.

How do you put things right when the test shows a low illuminating power?—We enrich the gas with petroleum spirit; and we are constantly doing that, and watching the gas from time to time. We have a test flame always burning; and according to the results we get from that, we enrich or not as is required. Sometimes we enrich too much; and in that way the flame is constantly going up or down.

You secure a satisfactory gas by enriching at the works from time to time?—Yes.

What is the distance from the works to the testing-station?—Three-quarters of a mile.

How soon can you rectify a fall in the illuminating power of (say) ½ candle?—We have found that when the full supply of gas was on, we could do it in a little over half-an-hour.

The late Mr. Stevenson, in 1875, said his experience was that the illuminating power of the gas could be changed quickly. He said that he himself would undertake to change it from the Beckton works to the first testing-station, which was 1000 yards away, in 20 minutes?—He never had that experience. He did not do it, and could not have done it. He was a good Gas Engineer, but was not a practical gas man. The only method of enriching then was by cannel coal; and this had to be put into the retorts. Spirit enrichment was not known at that time.

Mr, Stevenson was asked about his previous experience; and he spoke of experiments made at Uxbridge, in 1855. He had checked the illuminating power of the gas as it was going into the town?—Yes. He was speaking of the works at Uxbridge, which you could have put in your hat; and was comparing them with works which Hyde Park would not hold. I have no doubt he could alter the illuminating power at Uxbridge in 20 minutes. On our system, we never tried what could be done in this respect until last week, when we made an experiment at Bankside.

Do you know that Dr. Clowes and the others who conducted testing experiments at Bankside about which evidence has been given were not aware beforehand of the fluctuating state of things existing there?—They did know of it.

Will you take it from me that they did not know of it?—Certainly. But the County Council had an idea where the greatest irregularity was to be found; and, like true sportsmen, they went where they were likely to meet with game.

Take it from me that they happened to stumble on the place where these irregularities existed?—Then I take it from you they did stumble on it. Continuing, witness said that when the enriching process was carried out, it was effected, not by the Manager of the works, but by a workman who acted under orders and turned on the enriching material according to the fluctuations in the flame at the Company's testing-station. The directions issued to the workmen were that a good 16-candle gas was to be sent out of the works. The gas sent out was usually 16½, and sometimes 17 candles.

Would you regard it as impossible to enrich the gas so as to comply with the parliamentary requirements at the testing-place?—I should consider it impossible. It would be contrary to the orders of the Company if a man were to enrich the gas at one station and nowhere else.

Witness was asked whether it was not his theory that at a distance from the works a smaller candle power should be exacted than at a station near the works; and he replied in the affirmative. He added that if the Referees fixed the testing-station at the extreme end of a main, which they had power to do, he should regard it as very unfair. If the Referees fixed the testing-station at the end of the main in a wide district, and insisted on having 16-candle gas, the Company would point-blank refuse to supply it.

Mr. TALBOT: Whatever the standard, we desire that it should be ascertained at a point near where it reaches the consumer, and not at a fancy place.

Witness said that this matter had been gone into fully; and it had been shown that there could be no certainty as to the quality of the gas as it reached the consumer. Forty-nine per cent. of the County Council tests had been made in the daytime. This could not be fair, as it would not be at a time when there was a full flow of gas.

Mr. TALBOT: The Referees would prescribe the time?

Witness: Then I must talk a little about the Referees. The Board of Trade have deliberately ignored the requirements of Parliament as to appointing among the Referees a practical Gas Engineer. I have been to them more than once, and made representations to them as to what they were doing. Not one of the Referees has ever had any experience or knowledge of the manufacture or distribution of gas.

Why do you not mandamus the Board of Trade to get a proper man?—We may come to that. The appointment of the Referees has been an unmitigated disadvantage to the consumer. It was thought, when they were appointed, that their jurisdiction would be extended; but they have never gone beyond London. They have done no good.

I gather that you object to the machinery that Parliament has thought fit to set up?—I do not object to the testing. We want a free hand to fight our competitors. Depend upon it, if the restrictions were removed the Gas Companies would supply the best gas the consumers could desire. If they did not, the consumers would leave them.

So that you would prefer that the whole matter of the illuminating power of the gas should be left to the Companies. Your contention is that these portable tests increase the obligation on the Companies, because they are not trustworthy?—I say that in all gas tests there is a great element of uncertainty; and when you introduce the portable photometer, you make the uncertainty still greater.

Do you say the portable photometer is open to greater objections on that score than the fixed photometer?—Yes.

How do you account for the fact that at Liverpool tests taken for four years by this method have coincided, within a minute fraction, with the official tests?—I understand the portable photometers are in fixed testing-places.

No?—Then I may say the Liverpool case is different from ours. Witness went on to explain that in Liverpool they made over 21-candle gas from a mixture of coal and cannel, and supplemented it with water gas of 21-candle power, so that there was no mixture of qualities. Unenriched gas in London was of from 15 to 15½ candle power; and the enrichment which was added was of different quality. The circumstances under which gas was tested with the portable photometer were not fair; and then the method of enrichment by petroleum spirit was not certain and safe.

The remedy would be to do without the enrichment, and have a lower standard; and if this were done, it would meet your objection?—Yes; and then I say there would be no necessity whatever to test anywhere except at the works. The gas would be of uniform quality, and it would always lose a certain known amount.

As a matter of fact, is it the case that an ordinary consumer's burner would only give 11 candles illuminating power, with gas which with the statutory burner would give 16 candles?—The table produced shows that the ordinary burner gave from 6 to 17 candles.

Take 16-candle gas, as tested, would that give 17 candles with an ordinary consumer's burner?—It did so in one case. Speaking generally, the burner in ordinary use (the flat-flame burner) was a good one. One of Bray's or Sugg's burners would give 16-candle gas, perhaps 2 candles less; but if you get down to 11 or 12 candles, you have got bad burners.

Re-examined by Lord R. CECIL: The Company had found out that they could carry gas considerable distances without alteration, if in large mains.

Lord R. CECIL: It was the discovery of this fact which induced Parliament to do away with that safeguard—the provision of testing-stations 1000 yards from the works?

Witness: I believe it was done away with by agreement. The Companies raised no objection.

That was largely because of the experience they had had?—Yes.

The reason you brought that before the Committee was that from the very outset Parliament recognized that the gas to be tested was not necessarily to be the gas as supplied throughout the district?—Quite so. In the Salford case, it was put at 18 candles at the works, and 17 in the district.

It has been suggested that the portable photometer should be applied in board-schools. Would this secure fairness?—Mr. Vernon Harcourt said that nearly always board-schools were on the main thoroughfares. If you look at the plan, you will see that, out of about twenty, only four, I think, are on main thoroughfares; the others are in back streets. Board-schools in themselves, I believe, are most unsuitable places; and the mains from which they draw gas would not be fair.

By Mr. LEIGHTON: The Company held it to be their duty to keep the service-pipes clear from the main up to the meter. With the ordinary consumer, the Company supplied the meter, but had no responsibility with regard to it. He objected to the enrichment of gas, and thought petroleum spirit used for the purpose spent itself to some extent with the lapse of time.

Mr. LEIGHTON: You disapprove of all testing?

Witness: No; I will not go as far as that. I say it has been of no benefit to the consumer.

You are acting entirely in the interests of the consumer, because the consumer will have to pay the costs, and not your Company?—Well, I have here what I said 25 years ago: "I contend that the interests of the Gas Companies are so closely bound up with the interests of their customers, that their interests are identical." Continuing, he said on an average the South Metropolitan Company had one fine a year imposed for the gas not being up to the standard.

The CHAIRMAN: You say that your penalties have not been numerous?

Witness: No.

But you are not so immaculate as the Gaslight and Coke Company?—We are about the same, I think.

Out of 20,000 tests, they have only had two cases of penalties?—I do not think we have had more than two or three in the last few years. The best form of enrichment was cannel coal. Water gas would cost more than his present form of enrichment. He believed petroleum spirit was satisfactory. The difference would not be taken account of practically.

And the condensation, assuming it does take place, is confined or obtains principally in the small mains?—Yes; and it depends on the weather.

You do not think an enriching method which so loses its effect in travelling is a fraud upon the consumers?—No; it is not a fraud upon the consumers. There is nothing but water gas or petroleum spirit for keeping it up.

Do you think that the stations now in use in the Metropolitan area are sufficiently representative of the various conditions of gas in the localities?—I think they get a fair sample of the gas.

The Committee then adjourned till Monday (yesterday).

HOUSE OF COMMONS COMMITTEE ON POLICE AND SANITARY REGULATIONS BILLS.

Tuesday, May 1.

(*Before Lord* E. FITZMAURICE, *Mr.* H. BEMROSE, *Mr.* BILL, *Mr.* HEYWOOD, *Mr.* JOHNSTONE, *Mr.* LEUTY, *Mr.* M'KENNA, *Mr.* H. J. WILSON, *Mr.* J. W. WILSON, *and Mr.* WYLIE.)

BRADFORD CORPORATION BILL.

This Bill, which is to authorize the Corporation of Bradford, among other things, to acquire land for the protection of their water supply, to purchase the undertakings of the Clayton, Allerton, and Thornton Gas Company, and the North Bierley, Eccleshill and Bolton, and Airedale Gas Companies, and to purchase gas from the Drighlington and Gildersome Gas Company, was further considered (*ante*, p. 1008) by the above-named Committee to-day.

The following Counsel were engaged in the case: For the promoters, Mr. BALFOUR BROWNE, Q.C., Mr. FREEMAN, Q.C., and Mr. WAUGH; for the Drighlington and Gildersome Gas Company, Mr. WORSLEY TAYLOR, Q.C., and Mr. GERALD FITZGERALD; for the Airedale Gas Company and the Clayton, Allerton, and Thornton Gas Company, Mr. J. D. FITZGERALD, Q.C., and Mr. MOON; for the North Bierley Gas Company, Mr. WEDDERBURN, Q.C., and Mr. H. LLOYD; and for the Eccleshill and Bolton Gas Company, Mr. CLAUDE BAGGALLAY, Q.C., and Mr. LLOYD. In the case of other petitioners, Counsel were reserved.

The CHAIRMAN asked if there had been any result of the suggestion which the Committee threw out at the last meeting that the parties should come to an agreement regarding the gas clauses of the Bill.

Mr. FREEMAN said he was just about to ask leave to make a statement with reference to what had happened on the question of the purchase of the Gas Companies since the Committee rose. Of course, after his Lordship's statement at the last meeting, the Corporation's advisers immediately addressed a communication to the Airedale, Eccleshill, and Clayton Companies, asking representatives to meet them and discuss the terms of a possible settlement. As he announced to the Committee on the last occasion, they had already come to terms with the North Bierley Company. These terms had been embodied in a proper agreement which had been exchanged between the parties; and the North Bierley Company were therefore satisfied. After writing this letter, they received an answer from the Airedale, and one in very much the same terms from the Clayton Company, which surprised the Corporation very much, because it practically came to this: They both said that Mr. Stevenson (who the Committee would recollect was one of the witnesses for the promoters) had negotiated certain terms, as they understood it, on behalf of the Corporation, which they considered binding, and which they were prepared to carry out. That was the first time the Corporation had heard of anything of the sort; and they immediately wrote to the Companies, and said that there was some complete misunderstanding; that Mr. Stevenson was not in a position to negotiate anything final, and all they understood was that the Companies had made certain suggestions, which they were prepared to accept, and Mr. Stevenson had forwarded them to the Corporation; and that the Corporation were perfectly prepared to discuss the matter, and hoped to come to some arrangement. The reply to this was that the Companies considered that the Corporation were going back on something which their agent had negotiated; that they would leave the correspondence with the Committee; and that they declined to further discuss terms. There the matter ended. The Corporation were perfectly prepared to discuss the matter, and to come to any reasonable agreement; but the Companies, on the other hand, refused to meet them—being no doubt under a *bonâ fide* misapprehension as to what Mr. Stevenson had done. Mr. Stevenson had no authority from the Corporation to settle matters. The Corporation were in that position still. They were perfectly prepared to meet and negotiate; and he submitted that, under these circumstances, the clause in the Bill should stand, which would still leave negotiation open to them to arrange terms if possible, and if they could not arrange terms, then that it should be left to an arbitrator under the Lands Clauses Act to settle the price at which the undertakings should be acquired. There could be no question between them now, except as to price, and how many years' purchase of profits should be paid. The terms which they thought Mr. Stevenson had arranged to accept were higher than the Corporation were inclined to give; but they were still prepared to negotiate. To one of the Companies—the Gildersome Company—his observations did not apply. The Corporation were not proposing to buy that undertaking, but only to take gas in bulk from them on terms to be arranged. This Company had not negotiated with the Corporation at all, but declined to have anything to do with the matter. With regard to the other Companies, the only question was as to whether they were to have a certain price or whether the figure was to be fixed by arbitration; and he asked the Committee to say that the clause in the Bill met the case.

The CHAIRMAN: Then I may take it from you that you have only succeeded in coming to terms with the North Bierley Company.

Mr. FREEMAN: That is so.

The room was then cleared, and after the Committee had been a short time in private consultation,

The CHAIRMAN said: I have to inform you, on behalf of the Committee, that we cannot agree to pass the gas clauses of this Bill. The Committee are very glad to learn that an agreement has been come to between the Bradford Corporation and the North Bierley Company; and no doubt the agreement will be put into a separate schedule and inserted in the Bill. But the remainder of the clauses we cannot pass, although we have no doubt that, with a little further negotiation, there is nothing which cannot be got over.

Mr. LANKESTER (for the Cleckheaton District Council) said that there ought to be a clause brought up to enable the Council to buy that portion of the works which was within their district.

Mr. FREEMAN said that the Cleckheaton Council asked for a modification of the clause, which he was instructed to resist absolutely.

The remaining clauses of the Bill having been gone through and settled,

The CHAIRMAN inquired if it was likely that the Cleckheaton Council and the Corporation would be able to come to any agreement.

Mr. WAUGH said they had not had the Council's clause submitted to them; but if it was what he was afraid his friend contended for, they would not be able to agree, and the Committee would have to settle the matter between them. The Corporation were to purchase the works as a going concern; and then the Council sought to repurchase that portion outside the city, not as a going concern, but simply as old metal.

The CHAIRMAN said if that was the case, as much time as possible ought to be given to permit of the parties coming to an agreement. The further proceedings would therefore be adjourned.

Wednesday, May 2.

When the Committee sat this morning, the agreement between the North Bierley Company and the Corporation was submitted, by which it was provided that the Corporation should pay to the Company thirty years' purchase of the maximum statutory dividends, and take over the mortgage loan of £11,375. The Company are to pay the costs of the opposition to the Bill, and the winding-up expenses, out of a reserve fund of £2000 which is invested in the undertaking.

Mr. FREEMAN, addressing the Committee, said that the Corporation had agreed with the Company for the purchase of the undertaking as a whole, at its fair commercial value. The District Council of Cleckheaton sought to purchase the portion of the concern within their district, which was a very reasonable thing; but instead of re-purchasing on the same basis of commercial value which the Corporation paid, they asked to be allowed to do so by paying merely for the value of the pipes and mains. On the broad ground of justice, this was perfectly unreasonable; and he urged that there was no reason why they should not pay on the same basis of value as the Corporation had to pay.

Mr. LANKESTER said it was in the interest of small local authorities that they should be allowed, on the best possible terms, to come in and get control of their gas and water; and for many years the Model Clause had provided for the local authority buying such portion as laid within their district upon the basis of the value of the works and plant without regard to its profit-earning value. This was the clause which he asked the Committee to insert in the Bill. He admitted that in many cases, attention having been drawn to the hardship of a local authority buying at the mere price of plant and works, when the original purchasing authority had paid for profit-earning value, a variation had been made in the clause, such as putting in the word "undertaking" or that "the Arbitrator in deciding the value of the works and plant shall have regard to the circumstances under which the original authority purchased," so as to bring in some element of profit-earning value, because they had themselves purchased on that basis. But in this case, the District Council of Cleckheaton would be asked to pay a price, not for mains and pipes really, because there were none they could purchase; the pipes and mains in the district being for the supply of areas beyond. If the clause were adopted as the Corporation wished, and they reduced the price of gas within the city, they would obtain £4500 extra in rates from the Bierley district, and supply the gas at a loss or without profit. Then before the Arbitrator they might urge that the Cleckheaton district was the only revenue-earning portion of the concern; and Cleckheaton would have to pay a largely enhanced price for the portion of the undertaking within their district.

Mr. FREEMAN, in reply, contended that the usual practice was that the sub-purchaser should pay on the same basis as the original purchasing corporation paid, and that any other course would be unjust and unfair.

After consultation in private,

The CHAIRMAN said that the Committee would accept the clause as proposed by the Corporation.

Mr. LANKESTER then brought up a clause providing for equality of charge for the supply of gas within and outside the borough.

Mr. WAUGH objected that this point was not raised in the petition.

The CHAIRMAN said that, as the whole clause was practically new matter, it was not unreasonable that this question should be gone into.

Mr. LANKESTER said what he proposed was that the charge made by the Corporation should be the same to all consumers, and that no preference should be given to the consumers within the city over those outside. Such a clause had been placed in many other Acts; and it was important for the protection of Cleckheaton that some such provision should be made. Unless they were protected in this way, it would be open to the Corporation to charge a very low price within the city, while they maintained a higher price outside in order to recoup themselves for the loss that they made inside. This would be very unfair to their outside consumers, especially as there was a direct inducement to supply inside the city at the lowest possible price—or even at a loss—in order that they might be recouped by the extra rating. A similar clause was inserted in the case of the Glastonbury Bill, for the protection of the Street Urban District Council.

Mr. WAUGH said that such a proposal was not resisted by the promoters in the Glastonbury case. The effect of Mr. Lankester's suggestion would be that the Bradford Corporation would be bound to supply Cleckheaton at a loss; and then they would be able to go before the Arbitrator and say that, although the Corporation purchased on the basis of a profit-earning concern, the profit-earning had disappeared, and the basis could not be taken for the repurchase. Mr. Lankester was endeavouring, by this clause, to get round the decision of the Committee on the last clause. The value of the reduction of 10d. per 1000 cubic feet which Cleckheaton were asking for, would represent £20,300. The District Council were asking to so depreciate the value of the undertaking that, when they came to purchase a portion of it, they would practically be able to buy it for nothing. The reason why the Corporation could supply North Bierley at 2s. 1d. per 1000 cubic feet was because they were going to wipe out the existing works, and supply them from the new undertaking which they were going to establish in the centre. They never could be supplied from the existing undertaking at 2s. 1d. It was only because of the immense amount of capital which the citizens of Bradford had sunk in their whole undertaking, that they were able to furnish gas at so cheap a price; and now Cleckheaton coolly came in and sought to get the benefit of the great expenditure which the ratepayers of Bradford had incurred. He submitted that it would not be fair to compel the Corporation to supply outsiders at the same price as they charged their own ratepayers.

Mr. LANKESTER, in reply, said that Cleckheaton would have been willing to pay some slight difference of price (such as 3d. per 1000 cubic feet),

if it had been suggested that there was extra cost incurred by reason of the extra distance from the works. But it had not been suggested that there was any such extra cost. There was no reason why more should be charged outside than inside the borough; and unless some protective clause were given, it would be most unfair and onerous upon the consumers of gas in the Cleckheaton district.

The Committee, after further private consultation, decided not to accept the clause.

The remaining clauses of the Bill were then formally disposed of; and the Committee ordered the Bill to be reported for third reading.

LEGAL INTELLIGENCE.

SOUTH-WESTERN POLICE COURT.—Tuesday, May 1.

(*Before Mr.* E. W. Garrett.)

London County Council v. Wandsworth and Putney Gas Company.

This was a summons taken out by the London County Council against the Wandsworth and Putney Gas Company for non-compliance with a notice requiring them to set back a new building to the distance prescribed by the London Building Act. It was originally heard on Nov. 14, 1899; and was dismissed. The Council appealed on the 2nd ult., and were successful; and the matter was sent back to be dealt with by the Magistrate (*ante*, p. 950).

Mr. Chilvers appeared for the London County Council; Mr. Cooper represented the Company.

Mr. Chilvers remarked that his Worship had already had an order from the High Court in regard to the matter before him, and said a case had been decided just prior to this one coming into Court. It was heard on the 25th of October.

Mr. Garrett said it was not cited to him.

Mr. Chilvers went on to say that since the decision of the High Court, nothing had been done by the defendants; and he asked his Worship to inflict a penalty under section 200, sub-section 2, of the Act, which set forth that "every person who neglects or refuses for 28 days after service of a notice requiring a new building to be set back, &c., shall be liable to a penalty of not less than 40s. and not more than £5, and a daily penalty of 40s." The summons was not for a daily penalty. He applied for costs, and reminded his Worship that he allowed the defendants 10 guineas costs after his previous decision.

Mr. Cooper asked for the infliction of the smallest possible penalty. He said the defendants had done nothing, because it was thought that the better course would be to hear his Worship's decision. The Company were applying to Parliament in the present session to stop up the two roads concerned; and the matter was absolutely before a Parliamentary Committee. After his Worship's decision, the defendants would write to the London County Council, and suggest that no further proceedings be taken until the Committee had decided the question before them.

Mr. Garrett: So far as the present application is concerned, I shall have to inflict a penalty.

Mr. Cooper: It is a question of law, purely and simply. We thought we were right, and the Judges expressed some doubt about it, and said they would have allowed us an appeal if it had been possible.

Mr. Garrett: It is a case which would come under the heading of "Criminal Appeal." I shall impose a penalty of 40s., with 10 guineas costs.

Mr. Cooper: I do not know whether you can say you will not issue any summons until the Parliamentary Committee have reported.

Mr. Garrett: If it is issued, I should think it would be desirable to adjourn the matter pending the decision of the Parliamentary Committee.

The Charge for Water for Street-Cleansing Purposes.

At the North London Police Court last Saturday, Mr. Fordham gave his decision in a dispute between the Hackney Vestry and the East London Water Company as to the charge for water for street-cleansing purposes. The Company at present charge 9d. per 1000 gallons, whereas the New River Company, who serve a portion of the district, charge 6d.; and the Vestry applied for a reduction, which the Company refused on the ground of the expense entailed in furnishing the supply. Mr. Fordham decided that 6d. per 1000 gallons would leave the Company a fair and reasonable trading profit; and he made an order that this price should be charged. We shall notice the case more fully in a subsequent issue.

The London Electric Supply Corporation Fined.

At the Greenwich Police Court last Friday, Mr. Kennedy gave judgment in the case in which Mr. Shaddick, of the Dover Castle, Deptford, summoned the London Electric Supply Corporation for failure to supply electrical energy to his premises. The summonses were seven in number. When the case was before the Court on the 24th ult. (*ante*, p. 1135) the default was admitted; the defence being that it was essential that some part of the district of the Corporation should be cut off, because the supply was deficient owing to unavoidable causes, and that Deptford was selected as causing the least public inconvenience. The defence of *force majeure* was raised; but Mr. Kennedy held that it did not apply. His Worship said he was doubtful whether the Corporation allowed sufficient time to overhaul the boilers, especially when they knew of the hardness of the water, and that the boilers would not last many weeks. He did not, however, rest his judgment so much upon this ground as upon their taking Mr. Shaddick as a new customer when they knew that, through the failure of the contractors to supply new boilers, and their inability to overhaul the old ones, it was, to say the least, doubtful whether they could adequately supply Mr. Shaddick with the electric light. The penalty was singularly inadequate; and therefore he must inflict the full one of 40s. in each of the seven cases, with 20 guineas costs in the first case, and 2s. costs in each of the others—making £35 12s. in all.

MISCELLANEOUS NEWS.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

The Half-Yearly General Meeting of this Association was held last Tuesday, at the Cannon Street Hotel—Mr. T. H. G. Newton in the chair.

The Secretary (Mr. R. W. Wilson) read the notice convening the meeting, and also the following report of the Directors:—

The present half-yearly ordinary general meeting of the proprietors has been convened, in conformity with the Association's Acts of Parliament, for the purpose of receiving a report from the Directors upon the affairs of the Company, and of declaring a dividend for the half year ended the 31st of December last.

The following summary shows the results of the Association's operations during that period: The quantity of gas made in the half year was 4445 million cubic feet; while the quantity made in the corresponding half of 1898 was 4672 millions—a decrease of 227 millions. It should be mentioned, however, that the decrease in the production of gas at Vienna, due to the surrender in November of the supply of gas in the Inner Districts, amounted to 410 millions, and that the returns of the second half of 1898 include 72 millions made during six weeks' working at Amsterdam. The increase in the production of gas at the other stations, excluding Vienna and Amsterdam, amounted to 255 millions; giving an average rate of increase of 7·83 per cent.

The total number of lights on the 31st of December last was 2,160,071. At the close of the corresponding half year, the number of lights, including 629,910 in the Inner Districts of Vienna, was 2,591,097—a net decrease of 431,026. The entire length of mains in use on the 31st of December last was 1650 miles. The length of mains on Dec. 31, 1898, was 1925, but it included 343 miles of mains in the Inner Districts of Vienna, giving a net decrease of 275; 68 miles of new mains having been laid during the past year at the other stations.

The number of consumers on the books of the Association on the 31st of December last was 179,970, as compared with 217,200 on Dec. 31, 1898, or a decrease of only 37,230, notwithstanding the loss of 56,000 consumers in the Inner Districts of Vienna.

The decrease in the sale of gas at Vienna during the past half year, and the fact that the returns of the corresponding half year include six weeks' working at Amsterdam, render difficult any useful comparison of either the financial or the technical statistics. The receipts for gas and the profit for the half year under review were naturally proportionately less.

Although there was an average increase of 8½d. per ton in the gross cost of coal, the net cost was only 2½d. per ton more than in the second half of 1898—a result chiefly due to the considerable improvement in the value of coke, but also to some extent to the economy in fuel resulting from the improved furnaces recently erected at different stations. A decrease in the revenue from tar was practically counterbalanced by an improvement in the values of sulphate and other products of ammoniacal liquor.

The plant and mains at all the stations were maintained at their usual high state of efficiency.

At Aix-la-Chapelle, the renewal of the condensing and washing plant was completed. At Antwerp, the introduction of incandescent burners for the public lighting has given general satisfaction. On the 31st of December, some 2000 public lamps, out of a total of about 8000, had already been fitted with these burners. The recent reduction in the price of gas has been fully justified by the subsequent increase in the consumption.

At Berlin, the erection of additional inclined retorts and accessory plant at the Gitschinerstrasse works was completed in time to meet the heavy demands of the winter months. The new purifier-house and purifiers at the Schöneberg works were completed and put in action. The buildings devoted to the manufacture of meters at the Gitschinerstrasse works having become inadequate, the Directors decided to erect a new and commodious factory on the Mariendorf site, and a commencement has already been made with the erection of the buildings.

At Brussels, considerable extensions of the tar-distilling plant at Forest became necessary, and were completed during the half year. The adaptation of the new premises recently acquired in the Chaussée d'Ixelles to the purposes of new offices and show-room, workshops, &c., was proceeded with. In the commune of Uccle, the prices of gas were reduced to those supplied in the neighbouring commune of Koekelberg; the Association receiving in return a monopoly of the right to supply electricity. The erection of an electric lighting station at Woluwe St. Pierre was proceeded with. The Directors disposed of a plot of land not required at Forest.

At Flushing, additional purifying plant was required; and the disused purifiers from the Esplanade works, Antwerp, were utilized. At Flushing, also, increased storage capacity was required, and a new three-lift telescopic holder will be erected in the tank of an existing 60-feet two-lift holder.

At Frankfort-on-the-Main, the construction of new offices and workshops at the Obermainstrasse and of a new dwelling-house at the Bockenheim Gas-Works was proceeded with. At Hanover, a contract giving a monopoly of the gas supply for 25 years was concluded with the independent suburban commune of Ahlem. At Vienna, the Municipal Gas-Works were inaugurated on the 2nd of November, and on the 11th of that month the connection of the consumers' meters in the Inner Districts with the municipal system of mains was commenced, and the transfer was finally completed on the 30th of December, on which date 58,400 of the Association's meters had passed into the possession of the Municipality by sale. The manufacture of gas at the Erdberg, Tabor, and Belvedere works was discontinued, and arrangements have been made for clearing the sites.

The Directors have secured a monopoly of the gas supply for thirty years in the communes of Kagran and Lang Enzersdorf, supplied from the works in Floridsdorf—an independent commune on the opposite side of the Danube to that on which Vienna is situated. Some land for which there was no further use at Vienna was disposed of to advantage.

The transfer of the small stations of Essegg and Neutra to a new Hungarian Company, styled the Central Gas and Electricity Company, in return for shares equal to the capital value of these stations, was duly effected on the 31st of December.

The Directors have to report that the £234,200 of 4 per cent. debentures, which became due on the 1st of August last, have been paid off; leaving a charge on the assets of the Association of £473,600 of 3½ per cent. debenture stock, which is redeemable, at the option of the Association, at any time after the 1st of August next, upon giving six months' notice.

The Directors desire, in conclusion, to draw the attention of the proprietors to the accounts for the half year ended the 31st of December last. These have been duly audited, and from them the Directors have, in accordance with the provisions of the Companies' Clauses Consolidation Act, prepared a scheme showing the profit of the Association for the half year, and the portion thereof applicable to the purposes of dividend, which they recommend now to be declared—viz., a dividend of 5 per cent. for the half

year ended the 31st of December last, payable, free of income-tax, on and after Tuesday, the 8th of May.

The Directors who go out of office by rotation are Sir Charles James Jessel, Bart., John Henry Birchenough, Esq., and Sir James Morse Carmichael, Bart. These gentlemen are eligible for re-election, and offer themselves accordingly. The Auditor who goes out of office by rotation is Montagu Somes Pilcher, Esq., who is eligible for re-election, and offers himself accordingly.

The CHAIRMAN, after apologizing for the absence of Mr. Arthur Lucas, one of the Directors, who was abroad, moved that the report be received, adopted, and entered upon the minutes. In doing so, he said: In making a few remarks upon the report, I may well echo a statement contained in it—that it is most difficult to make useful comparisons between the financial and technical statistics of the past half year and those of the corresponding period of last year, because the returns of the corresponding half year include the full workings of Vienna and a portion of those at Amsterdam. But there is one very important matter, in considering which, comparisons can be made quite independently of the shrinkage in the volume of business, which renders so difficult useful comparisons in other directions. I refer to the cost of coal. The report states most correctly that the gross cost of coal increased by 8½d. per ton, and the net cost by 2½d. per ton, as compared with the corresponding half year in 1898; and we may hope that in the current half year the net cost may be even less than in the corresponding half of last year. This may seem paradoxical in the midst of a coal famine which, I may inform you, extends to the Continent. But the explanation is simple; and it is well it should be borne in mind. The coal carbonized in a given half year has been bought, it may be a year in advance, and therefore, in such a case, not at famine prices; while much of the coke produced by that coal may have been sold as fuel in competition with household coal at famine prices. Hence the net cost of coal, being the gross cost less the residuals, may be less at the beginning of a coal famine than before it commenced; while, of course, at the end of it the sales of coke, being in competition with cheapening fuel, retard the beneficial effect of the lower cost of coal to a gas company. This increase in the cost of coal is already recognized as a serious question for gas companies operating in this country; but it is a far more serious question for those operating abroad. In this country, particularly in London, the sliding-scale, though beneficial to the consumer when gas companies are prosperous, throws upon him a large share of the loss resulting from excessive increases in the cost of production of gas—a necessary result of dear coal. Besides, in many towns in England, where there is no sliding-scale, but where the lighting is in the hands of long-established gas companies, the price of gas may be below its maximum, and can be, and is, increased in price in such circumstances by the gas company. But, under the foreign system of contracts and concessions, such arrangements are practically unknown. Under this system, the gas is supplied by the gas company for a certain term of years, usually comparatively short, at a certain fixed price, which is none too high, indeed, when coal is cheap, but which may absorb all profit when coal is dear. The importance to us is seen when I remind you that a rise of 6s. per ton in the net cost of coal is equivalent to our paying £120,000 more for the coal carbonized by the Association in a half year, and consequently in a reduction of profit by this amount. This is no mere theory as to the course and effect of a coal famine. Such a famine in the early seventies, which culminated in 1873 in its effects upon the Association, is duly recorded in our annals, and is within my personal experience as a Director; and we will hope that this famine will not be more serious in its effects than that proved to be. Thus we see that gas companies operating abroad have to take all the risks of abnormally high coal prices and consequent loss of profit; but I may remind you that our Association has to a considerable extent ensured itself against such losses by the institution of the dividend equalization fund, which amounts to nearly a year's dividend at the rate of 10 per cent. Reviewing the stations in order, at Berlin, since the close of the half year, a supplementary gas contract and an electric lighting contract have been concluded with the suburban commune of Gross-Lichterfelde. At Brussels, since the close of the half year, the Association has acquired a controlling interest in the undertaking of the Ixelles Electric Light Company. At Vienna, the report states, the Inner Districts ceased to be a profit-bearing portion of the undertaking in November last. At the end of the half year, as the circumstances were exceptional—the loss at Vienna being no longer contingent, but real and palpable—the Directors decided to take an exceptional but a truly businesslike course, and consider the value of the works and business left to us for some years to come at this station; and as this value was found to be considerably less than the corresponding figures in the books of the Association, it was resolved to correct it, and write down the book value to this value. In doing this, a sum was utilized which in the ordinary course would have been absorbed in the contingency fund. The proprietors must not forget that with the loss of Vienna, although there is an enormous decrease in the gross returns which have been derived therefrom in times past, the net effect will not, I hope, be so much felt, because the heavy charges in the nature of amortization, which the station has had to bear in recent years, will now cease. The Board have granted suitable gratuities and pensions to members of the salaried staff and workmen no longer required at Vienna, but who had moral claims on the Association. And in this connection, I may mention that Mr. Lindon, to whom I alluded in eulogy at our last meeting, retired from the service of the Association with an adequate pension as from the 1st of January last. He is, I am sorry to say, in bad health, to improve which he is now travelling abroad. Since the close of the half year, more land no longer required at Vienna has been sold. And now I am sorry to tell you that a well-intentioned effort on the part of the Association to benefit the city of Vienna, and to save its inhabitants from a recurrence of the chaos which reigned when the city mains were being laid, has not met with the success which it deserved. As you are aware, we have an immense length of mains (343 miles) under the soil of the Inner City of Vienna; and, having ascertained, by careful computation, the very lowest net value which the Association could get for these if it took them up, the Board offered them to the City at a still lower sum. According to a telegram received to-day from Dr. Teltscher, the Town Council have rejected the Association's proposal, and we must now proceed to realize the utmost value we possibly can for this asset. The great change we have experienced at Vienna points out that, although this may not be a time for making comparisons with the past in many ways, it is nevertheless very opportune for us to put our house, so to speak, in order, and to consider our present position. To this end, the million odd sterling which we own in English, Indian, and Colonial securities has been written down to the market value of such securities as on the 31st of December last; and I can assure the proprietors that the various items which represent the other capital assets of the Association are at least of their face value. This includes nearly £900,000 invested in the shares of other gas and electric lighting companies, forming to this extent, in the spreading of risks over a large area, what might be called a Gas and Electric Trust. In the result as to capital, after making due allowance for what we owe our debenture stock holders and our various creditors, I find that a net sum of capital assets remains, representing not only the £3,800,000 capital stock of the Association, but also a premium upon it of more than 70 per cent. in tangible securities—a position few companies in the City of London can claim. As to income, I do not fear that six months hence we shall have to dip appreciably into the dividend equalization fund for a 10 per cent. dividend. Later, as I have pointed out, dearer coal may for a time require this. But with the coal famine over, the stations left to us ought, without strain, to provide a 10 per cent. dividend; and we must not forget that we possess a large sum of liquid assets bearing a low rate of interest, which, when opportunity offers for their re-investment, can be made to produce for the proprietors of this Association in the future a far larger return than they do at present.

Mr. JOHN HORSLEY PALMER seconded the motion, and it was carried unanimously.

It was next unanimously resolved, on the motion of the CHAIRMAN, seconded by Mr. CLARENCE PIGOU—"That a dividend of 5 per cent. for the half year ended the 31st of December last be declared on the £3,800,000 stock of the Association, and that the same be payable, free of income-tax, on and after Tuesday, the 8th inst."

The retiring Directors (Sir Charles Jessel, Bart, Mr. J. H. Birchenough, and Sir James Carmichael, Bart.) and Auditor (Mr. Montagu Somes Pilcher) having been re-elected,

Cordial votes of thanks were passed to the Directors, for their able management of the affairs of the Association; to the Chairman, for his conduct in the chair; and to the staff at home and abroad.

The proceedings then terminated.

BUENOS AYRES (NEW) GAS COMPANY, LIMITED.

The Annual Meeting of this Company was held yesterday week, at the London Offices, No. 1, East India Avenue, E.C.—Mr. F. J. HESELTINE in the chair.

The report and accounts (which were noticed in the "JOURNAL" for the 24th ult.), having been taken as read,

The CHAIRMAN opened his address with a sympathetic reference to the enforced retirement of Sir Wilford Brett from the chairmanship, and expressed the keen regret of all connected with the Company. Turning to the accounts, he said it was proposed to add £15,000 to the reserve fund; bringing it up to £40,000. In the accounts for 1898, they added £14,488 to previous reserves; making £20,000, which sum stood at the credit of a special reserve account against discount and expenses of issue of debenture stock and contingencies. After careful consideration, the Board had decided not to act in the drastic manner at first proposed; but to extinguish the discount and expenses account by spreading the amount over a series of ten years. This was a liberal arrangement, seeing that the new debenture stock had 28 years to run. To make clear the benefit derived by the issue of this stock and the cancelment of the 6 per cent. debentures, he said the 6 per cent. debentures fell due, and were extinguished, at the end of 1897; and the annual interest thereon amounted to £12,000. The present 4 per cent. debenture stock amounted to £8800; thus relieving the revenue account to the extent of £3200 annually. As this 4 per cent. stock was not repayable for 28 years, the total saving to the shareholders was £70,694, after paying off the whole of the expenses connected with the issue. On the creditor side of the balance-sheet, £7476 had been added to the value of the property by extensions and additions; and the greater part of this was for inclined retorts. The sum of £6000 had been written off the year's revenue for depreciation of services and meters; £1946 for new plant; and £1890 for discount and expenses *re* issue of debenture stock. With £569 transferred to the reserve fund, these items together amounted to £10,406; and made up the reserve to £40,000. Sundry debtors, which stood at £26,108 in 1898, had been reduced to £18,037. Their relations with the Municipality were most cordial; while the small amount of their indebtedness to the Company showed how punctually they met their financial engagements with them. In connection with the South Barracas Gas-Works, it would be observed that £21,749 had been spent on the Lomas extension. The profits already derived from the South Barracas works were not only sufficient to meet the guaranteed dividend on that Company's shares, and the interest on the debentures held by this Company against the advances made for the Lomas extension, but a substantial balance was left. The whole of the outlay of £21,000 on the Lomas extension was made out of revenue, and had been secured by the issue of debenture stock. Given time to develop, they looked to this extension being a valuable addition to their business. Up to the present, by an expenditure of 40 per cent., they had gained an increase of 70 per cent. in lighting. Following the policy of endeavouring to keep pace with such improvements in manufacture as would enable the Company to give the most economical and efficient supply of gas, the Directors entered into a contract with Messrs. Dempster, of Manchester, for the erection of several benches of inclined retorts and a retort-house. These were near completion, and would be ready for use about June—the commencement of the Argentine winter. With other improvements, they had already reduced wages considerably, and the inclined retorts would reduce them still more. Another advantage was that the price of cannel had lately fallen; and oil having materially advanced, they had nearly arrived at a period when it would not pay to use oil for enrichment. Referring to the use of electricity, he said people were found to be returning to gas, especially as the incandescent mantle had become much cheaper. The Company had, therefore, set themselves to show what gas could do; and a number of street-lamps of the Berlin pattern had been put up, and were,

according to the Manager's report, a complete success. It was therefore expected that, when the new municipal tender was called for, a large number of these lamps would be required. The past year had been an exceedingly trying one to the management of gas undertakings, owing to the rapid and abnormal advance in the price of coal, oil, and other articles. In their own case, they had to face a considerable depreciation in the value of the currency in which they received payment for their gas and products; and the increase in taxation had brought the item up to £15,000. The Custom House had affected the industry in regard to the imported articles used—excepting coal and naphtha—such as glass, galvanized iron, tools, and meters, all of which had had an increase of 25 per cent. placed on them, in addition to the rise in price on this side. Notwithstanding all these adverse circumstances, it was satisfactory to be able to tell the shareholders that, by the economies introduced, they had manufactured gas at 2d. per 1000 cubic feet less than in 1898. The Directors had satisfaction in reporting that they had entered into contracts for the whole of their coal for the present year's working at a slightly lower figure than that of last year—that was, taking the coal and freight together. Products, unfortunately, were a drug; and £5700 less than in 1898 was received for them. This was due in great measure to the price of coke, which fell heavily in March on account of the keen competition with the imported article. They had since been able to advance rates considerably owing to the high price of coal, which had driven their competitor out of the field. He ventured to think the shareholders would not consider the result of the year's trading unfavourable, as it enabled the Directors to recommend the payment of a dividend of 6 per cent., and after payment of all fixed charges, and making provision for bad and doubtful debts, to carry forward £3224. Concerning the keen competition that took place in Buenos Ayres between the Companies interested in supplying gas, he said that for some time past, the Board had, through their representatives, shown the folly and reckless waste of money to all concerned in this competition, and had pointed out the advantages to be derived by coming to a districting arrangement. This matter fell more particularly within the province of the Local Committee and the Manager (Mr. Obarrio). It was very gratifying to the Board to find how energetically and zealously their opinions had been supported; and by an interchange of views with the other Companies, they had, the Board believed, brought them to their way of thinking. He concluded by proposing the adoption of the report and the declaration of a dividend at the rate of 6 per cent., 2½ per cent. of which has already been distributed.

Mr. J. C. Im Thurn seconded the motion.

Mr. S. Spencer remarked that the balance-sheet was the best they had had during his connection with the Company. It was particularly pleasant to hear that on the question of a working arrangement among the Companies, they were arriving at harmonious views. If they had got to that point, their prospects must be considerably improved.

The motion was unanimously adopted.

The retiring Directors, Mr. R. Nesham and Mr. F. C. Im Thurn (the latter of whom succeeds Sir Wilford Brett on the Board) were re-elected.

The Auditors having been re-appointed, the usual complimentary votes were passed. A resolution was also passed recording the shareholders' deep regret at the retirement of Sir Wilford Brett from the chairmanship—a post which he had occupied since the establishment of the Company.

SOUTHAMPTON GAS COMPANY.

The Half-Yearly General Meeting of this Company was held last Wednesday—Mr. R. C. Hankinson, J.P., in the chair.

The Secretary (Mr. C. Crowther Smith) having read the notice convening the meeting, the report of the Directors was presented. It set forth that during the six months ending Dec. 31 last there was an extra sale of 14,942,000 cubic feet of gas, as compared with the corresponding half of 1898; while for the entire year 1899, the increase was 24,712,000 cubic feet—the maximum yet attained by the Company. This has necessitated the provision of more storage; and plans have been approved for the construction of a holder to contain 2 million cubic feet of gas, which will double the present storage. The profit and loss account showed that the amount available for distribution was £10,710; and the Directors recommended the payment of maximum dividends, amounting to £9006, for the half year on the ordinary stock, less income-tax. This would leave £1704 to be carried forward. An intimation was given that the shareholders would be asked to sanction the raising of further capital for the general purposes of the undertaking, including the development of the prepayment meter system. Reference was made to the coal question, and the Directors stated that in consequence of the enhanced price the charge for gas would inevitably have to be considerably increased.

The Chairman, in moving the adoption of the report, said the first item to be noticed was the augmented sale of gas in the past half year, which represented something like £2600 money value, and the increase for the year represented 5·78 per cent. over the preceding twelve months. A continually growing business like theirs required, of course, extra expenditure; and this was the reason why the Directors were from time to time obliged to raise fresh capital. They had to look to it that the provision for the storage of gas was in right proportion to the business they had to do. But theirs was not what it ought to be, and the Directors had taken steps to provide a new holder, which would double the capacity. This was absolutely necessary; but at the same time it was a very expensive matter. With regard to the profit and loss account, the shareholders would remember that for some time, until the past half year, the Company had not been able to earn their maximum dividends. They had now been able to do so, and carry forward rather more than £1700. The coal supply had been a very anxious subject with the Directors—he did not mean as regards price, because they had a good contract, which would not come to an end till the 30th of June—but the difficulty of getting the coal delivered. The contractors had done their very best; but it was with some difficulty that they had fulfilled their contract. It was still a rather anxious time—the price of coals having gone up to such an extent; and he ought to add a word of warning—that although the Company had had a satisfactory half year, and though the current one was likely to be equally so, the Directors, in consequence of the increased cost of coal, would have to raise the charge for gas. They were unwilling to do this; but such a course was inevitable. Another item of interest was that there had been 308 new consumers added to their ordinary customers, not taking into account the prepayment meter supplies. There were, in addition, upwards of 1500 consumers on the latter system, nearly all of whom used gas cooking-stoves; and there were also a large number of applicants waiting to be supplied. Gas-fires and heating-stoves continued to be very popular, and there were something like 3000 cooking-stoves now in use in the town. The Directors always had it in their mind to keep the works in the highest state of efficiency. They spared no pains and no money to attain this end, for they believed it to be the most economical policy to adopt.

Dr. Sampson seconded the motion; and it was carried.

The payment of the maximum dividends having been authorized,

A special meeting was held at which the raising of further capital to the amount of £50,000 of ordinary 5 per cent. stock and £20,000 of 4 per cent. debenture stock was formally sanctioned.

The proceedings closed with the usual complimentary votes to the Chairman and Directors, Secretary, Auditors, and staff, for their services during the half year.

THE PROPOSED ROYAL COMMISSION ON COAL.

Unworked Stores of the Mineral.

The proposal put forward by Mr. Provand, M.P., for the appointment of a Royal Commission to inquire into the probable duration of the British coalfields and the disposal of the coal (see *ante*, p. 881), has resulted in some interesting correspondence in the "Iron and Coal Trades Review." Sir Alfred Hickman, of Wolverhampton, says that the result of his observation is that new and hitherto unknown seams of coal are being discovered quite as fast as the old ones are exhausted. The deposit recently found at Penkridge, in his opinion, includes practically the whole of Central Staffordshire in the coalfields; and it has been proved that the Warwickshire deposits are much more extensive than actual demonstration has hitherto shown them to be. An authority on this subject—Mr. A. L. Steavenson, of Durham, a former President of the Northern Institution of Mining Engineers, who has been working coal for about half-a-century—states that in one field upon which he has lately had his eyes there is, he believes, as much untouched coal as would provide for a continuance of the present output of 220 million tons per annum for the next 250 years. Another writer—Mr. G. W. Walker, of the Wharncliffe Silkstone Collieries—considers it has been proved that the Yorkshire seams extend to the Trent, and also eastward throughout a large area of Lincolnshire. A less optimistic view is taken by Mr. J. A. Longden, of the Stanton Iron-Works Company, Nottingham, who reiterates an opinion expressed nearly twelve months ago, that the cheaply-worked coal of this country will be exhausted in fifty years. He considers that the enhanced cost of mining, owing to increased wages, shorter hours, thinner seams, deeper mines, &c., will in all probability be permanent. One of the latest writers on the subject is Mr. W. H. Chambers, whose letter is as follows: "I do not see that any useful purpose would be served by the inquiry. Mr. Provand alludes to the very erroneous conclusions arrived at by a similar Committee whose report was founded upon investigations made in the years 1866 to 1871. To show the value of these inquiries, there is at present more coal available for working than the Commission believed to exist at the time their report was made, which is proved by borings and sinkings over the last twenty years. Taking the Yorkshire coalfield as an example, the continuation of the coal seams at a workable depth has been proved by the borings to extend to some 12 miles east of any colliery now working in the district. This shows, as I mentioned last June at the meeting of the Midland Institute of Mining, Civil, and Mechanical Engineers, of which I am President, the existence of an area of coal, in addition to that available to present collieries, which will produce upwards of 10,000,000 million tons, capable of maintaining the present output of Yorkshire for more than 400 years. It is, however, well known that coalfields lie in basins, and these borings are probably near the bottom of the basin. This must be so unless the coal suddenly ceases in the centre of the earth, which has never been known in the history of mining; so that, unless Nature has departed from her hitherto invariable course, there must necessarily be some 40 to 50 miles of coal seams rising to the east, in addition to the area absolutely proved upon which I have based my calculations. An export duty on coal would certainly result, in ordinary times, in the closing of many collieries, and the locking up of our resources of mineral wealth and general prosperity. Miners would be thrown out of work, and would necessarily emigrate to new coalfields in foreign countries, which are even now being only too quickly opened up to meet the world's demands. If England must eventually become an agricultural country, why should it be necessary to precipitate that condition? There always were, and always will be, some people who would reduce the nation to the condition of mind which caused the wealthy miser to starve himself to death for fear he might die in the workhouse."

Gas Profits at Rochdale.—The returns presented to the Gas Committee of the Rochdale Corporation for the year 1899-1900 show that the gas-works, which are under the supervision of Mr. T. Banbury Ball, will furnish a sum to be handed over for the relief of the rates which is the largest on record. The receipts for gas, residuals, &c., amount to £83,272, against £70,883 for the preceding year, showing an increase of £12,389. Of the profits, it is proposed to place £13,000 for the relief of the rates, and to put £3000 to the reserve fund. The former amount is £4016 in excess of that of last year, and but for this increase in profits the rates, would have had to be materially increased. A rate of 1d. in the pound at Rochdale realizes about £1000; so that the gas profits are equal to more than a 1s. rate. The receipts from gas are nearly £30,000 in excess of what they were a decade ago; and during the last ten years no less than £87,531 from the gas profits has gone to the relief of rates, and £25,500 to the reserve fund—making a total of £113,031.

THE EXAMINATIONS IN GAS MANUFACTURE.

The Question Papers at the City and Guilds of London Institute Examinations.

The examinations in "Gas Manufacture" conducted by the City and Guilds of London Institute were held last Wednesday. The following were the questions set by the Examiner, Mr. Alfred Colson, M.Inst.C.E.

ORDINARY GRADE.

1. Give a sketch showing the construction of a bed of six retorts, heated by direct fire. 2. What is the effect of condensation on the hot crude coal gas, and how are the results affected by the rate of cooling? 3. Give a short account of the liquid products obtained by the distillation of coal. 4. Explain the construction of the tower scrubber. How would you test the gas at the outlet to ascertain if it was free from ammonia; and, if not, how would you determine the amount passing? 5. What is the use of syphons in connection with the manufacturing plant? Show, by means of diagrams, the level of the liquid in a syphon (*a*) when the pressure of the gas is less than that of the atmosphere, and (*b*) when it is greater. 6. Describe the method adopted for the removal of sulphuretted hydrogen and carbonic acid from crude coal gas. 7. What advantages are gained by the use of an exhauster? 8. Give a sketch showing the construction of a consumer's wet gas-meter. What precautions are adopted to maintain its accuracy? 9. Show by means of a sketch the construction of any form of governor burner. What is the advantage of such burners? 10. What is the meaning of the term "corrected for temperature and atmospheric pressure;" and what are the principles according to which the correction is made?

HONOURS GRADE.

1. Describe, with the aid of diagrams, the construction of a regenerative furnace for heating a bed of gas-retorts. What should be the approximate composition of the producer and waste gases, and how may this be regulated? 2. Explain the objects of the hydraulic main, and give a sketch of this apparatus, showing the method of removing the tar and liquor which separate in it. 3. What is the effect of varying retort temperatures on the composition of the products of distillation? 4. At what points, and by what means, is the removal effected of the ammonia contained in the crude gas issuing from the retorts? What other impurities are simultaneously removed, wholly or in part? 5. Give a sketch showing the construction of any one form of rotary washer-scrubber. What are the comparative advantages and disadvantages of such apparatus and the tower scrubber? 6. Give an account of the method adopted for the removal of carbon bisulphide from coal gas, and of the necessary precautions to ensure a fairly complete elimination of this impurity. 7. Explain, with the aid of sketches, the construction of a trussed and untrussed gasholder crown, and also of any one form of gasholder without columns. 8. Give a description of the method of manufacturing carburetted water gas (exclusive of condensation and purification). What differences exist between the tar obtained from the oil and coal tar? 9. What is meant by "unaccounted-for gas?" State as fully as you can the various items of which this is made up. 10. Give an account of the method of determining the illuminating power of gas (*a*) by the Lethebe-Bunsen photometer, and (*b*) by the London Gas Referees' table photometer, with especial reference to differences in the method of testing by means of the two photometers.

In the Ordinary Grade, 40 marks were allowed for Nos. 1, 4, 6, 8, and 10; 35 for No. 2; and 30 for the rest. In the Honours Grade, 40 marks were allowed for Nos. 1, 4, 5, 6, 7, and 8; 35 for Nos. 3 and 10; and 30 for Nos. 2 and 9. Only eight questions were to be answered in either grade.

The Polytechnic Examinations.

As our readers are aware, the class for "Gas Manufacture" at the Polytechnic Institution is conducted by Mr. W. Grafton, F.I.C., F.C.S. (of Beckton). The examinations took place on the 25th of March; and the results were made known last Tuesday. The following were the questions set by the Examiner.

ORDINARY GRADE.

1. Give a sketch of the Referees' test for sulphur, and explain its use. 2. Give a detailed description of the process called "Condensation." 3. How would you purify gas from CO_2 and SH_2 simultaneously? 4. Describe fully, with sketch, the hydraulic main and dip-pipe. 5. How and where would you detect CO_2, SH_2, CS_2, and NH_3 on a gas-works? 6. Give a sketch of the "open" joint for gas-mains, and state why syphons have to be used. 7. Wherein lies the difference between a bunsen and a luminous burner? State the nature of the products resulting from the combustion of gas by each. 8. Describe a pressure and an exhaust register, and state what is the use of them. 9. By what method would you ascertain the illuminating power of coal gas? 10. How would you test ammoniacal liquor for ammonia?

HONOURS GRADE.

1. Describe some form of carburetted water-gas plant. 2. How would you effect complete purification of coal gas, having regard to economical results? 3. Describe the scrubbing plant used on a gas-works; and give a part sectional sketch of the one you think best. 4. Describe, and illustrate by sketches, a setting of inclined retorts, stating the advantage over the horizontal type. 5. How would you determine the percentage of CO in a sample mixture of carburetted water gas and coal gas; and what amount of this impurity would you expect to find? 6. What are the constituents of purified coal gas and carburetted water gas? Indicate the relative proportions in which these constituents are present in each, and show where the difference exists between the two gases. 7. Describe the principal gas-burners in use. Draw a comparison between each. 8. Describe, with outline sketch, a setting of eight retorts and fittings on the generator system. 9. Describe the Referees' new method of ascertaining the illuminating power of gas. 10. Give some account of three principal kinds of coal, and the quantity of gas, tar, &c., produced per ton from any one.

The following are the names of the successful candidates: Honours Grade—Mr. D. J. Winslow (silver medal), Mr. W. J. Johns (certificate and books of the value of 10s.), Mr. P. F. Scarth (certificate and books of the value of 5s.), Mr. A. F. Ball, and Mr. A. Mead. Ordinary Grade—Mr. Whyte (bronze medal), Mr. Eldred (certificate and 10s. in books), Mr. Holland (certificate and 5s. in books), and Mr. Mead, junr. Mr. Winslow headed the list in the Honours Grade with 88 per cent. of marks; Mr. Johns following him closely with 86 per cent.; and Mr. Scarth taking 68 per cent. In the Ordinary Grade, the bronze medallist secured 85 per cent. of marks; the other prize winners running each other close with 80 and 79 per cent. respectively.

MANCHESTER CORPORATION GAS, ELECTRICITY, AND WATER SUPPLY.

The Estimates for the Ensuing Year.

At the Meeting of the Manchester City Council last Wednesday, the estimates for the ensuing year, prepared by the various Departmental Committees, were brought up for consideration. The Chairman of the Finance Committee (Alderman King) submitted the financial reports and estimates of the several Committees, other than the Water Committee, with the comments of his own Committee thereon.

Gas Committee.—The profit and loss account of this Committee showed a total income of £643,341 for the year ending March 31 last, against an estimate of £612,000; the actual and estimated receipts being as follows: Gas-rents, actual £512,437, estimate £510,000; coke, actual £64,470, estimate £51,000; tar, actual £34,497, estimate £25,500; ammoniacal liquor, actual £31,140, estimate £25,000; sundries, actual £797, estimate £500. The expenditure for the year was £581,191; leaving a surplus of £62,150, as compared with an estimate of £560,000 expenditure and £52,000 surplus. The principal items of expenditure were: Cannel, coal, and oil, actual £253,294, estimate £250,000; carbonization (retort men's wages, &c.), actual £56,808, estimate £51,500; retorts, actual £13,138, estimate £13,500; purification (less sales of spent material), actual £9176, estimate £9000; repair and maintenance of works and mains, &c., actual £67,019, estimate £63,000; renewals of plant, actual £27,492, estimate £23,500; salaries and wages of clerks and inspectors, actual £34,110, estimate £34,000; rates and sundry taxes, actual £27,235, estimate £27,000; interest on loans, &c., actual £37,980, estimate £38,007; sinking fund (for liquidation of debt), actual £36,686, estimate £36,642. The estimated income for the year ending March 31, 1901, is as follows: Gas-rents (including £33,500 for city lamps), £520,000; coke, £65,000; tar, £35,000; ammoniacal liquor, £32,000; sundries, £1000—total, £653,000. The estimated expenditure is £643,100; the principal items being as follows: Cannel, coal, and oil, £300,000; carbonization, £60,000; retorts, £14,000; purification, £10,000; repair and maintenance of works and mains, &c., £68,000; renewals of plant, £25,000; salaries and wages of clerks and inspectors, £36,000; rates and sundry taxes, £38,200; interest on loans, &c., £38,028; sinking fund (for liquidation of debt), £37,421. The estimated surplus is £9900, which, added to the amount transferred from the profits for the past financial year (£10,100), would make a total of £20,000 payable to the city fund in aid of the rates. The estimated expenditure on capital account for the ensuing year is £123,510; the principal items being £44,612 at the Bradford Road station, £12,930 at the Poland Street stores, £15,000 for street mains, £20,000 for hired meters, and £15,000 for hired stoves. The amount spent last year was £72,972, on an estimate of £91,800. The estimated expenditure for street lighting is £46,908, to be raised out of the city rates, which means an average rate of 3·78d. in the pound. This represents an increase of £1790 on the amount paid during the past year.

Electricity Department.—The department anticipates an income of £100,300; the principal item being £99,800 for sales of current (including £2000 receivable from the city fund for street lighting). The income for the year ending the 31st of March last was £85,589. The estimated expenditure for the current year is £100,300, including coals, £18,160; wages, £8260; repairs and maintenance of buildings, machinery, mains, &c., renewals of plant account—amount transferred, £11,000; interest on mortgage debt, &c., £21,600; sinking fund, £18,280. The expenditure during the past year was £77,589. The Committee do not anticipate being able to pay anything to the city fund. Last year they handed over £10,000 towards the relief of the rates. The estimate for capital expenditure is £310,018; including £116,568 for mains, and £175,000 for buildings, machinery, &c.

Alderman KING, in commenting on the estimates, said the chief increases were in the Gas and Electricity Departments. The Gas Committee expected to be able to pay only £10,000 instead of £52,000 in aid of the rates; the principal reason for this being the extra cost of cannel, coal, and oil, without a corresponding increase in the revenue. On the electricity account, it was estimated that the profit for the year would be absorbed in payment of the interest and sinking-fund charges, in capital outlay for new buildings and machinery, and in laying mains in the city and adjoining districts; so that the Committee would have nothing to hand over in aid of the rates.

It was agreed to postpone the consideration of the estimates to a special meeting of the Council; and a suggestion was made that the Committees might, in the meantime, reconsider their estimates, with a view of relieving the city rates. In the course of an informal discussion, however,

Sir BOSDIN LEECH observed that, as the Gas Committee would not be able to contribute anything like the usual amount towards the relief of the rates, perhaps the question of raising the price of gas might be considered.

Alderman RUSHWORTH remarked that there was a growing feeling in the direction indicated.

Alderman GRIFFIN said he did not see much prospect of the Gas Committee keeping the expenditure down. The price of coal had gone up considerably—not less than 4s. or 5s. per ton; and there was little prospect that they would be able to do anything to relieve the rates.

The Lord MAYOR (Right Hon. Thomas Briggs), the Deputy-Chairman of the Gas Committee, said if they advanced the price of gas 3d. per 1000 cubic feet from the 24th of June next, it would mean £12,000 extra for the year ending March, 1901; and of this amount the out townships would pay £7100. If the price were raised 3d. per 1000 cubic feet early

in September, the extra receipts would be £33,000, including £5700 from the out-townships. If they were compelled to buy coal to carry them on from the 31st of March this year to the corresponding date in 1901, it would cost about £120,000; but they had nine months' consumption already purchased, and only three months' supply to buy, which would cost them about £30,000. If they did not advance the price of gas 3d. this year, they would have to raise it 6d. or 7d. next, because there was no probability of any reduction taking place in the price of coal.

Mr. SUTTON reminded the Council that, although the price of coal had gone up 50 per cent., the men who "got" the coal only received 15 per cent. increase in their wages.

Water Committee.—The profit and loss account for the year ending March 31, 1900, showed a deficiency of £3199; but there was a surplus from the previous year of £44,976—making a net surplus of £41,777. The estimated income for the year is £329,577, including £47,000 to be raised by the domestic and public rates; and the estimated excess of expenditure over income is £3328. Deducting this from the previous surplus, the balance will be £38,449.

On the motion of Sir JOHN HARWOOD, the Committee's reports, estimates, and accounts were adopted; and it was agreed to levy a domestic water-rate of 8d., and a public water-rate of 1d. in the pound, upon all property assessable thereto, for the year ending April 1, 1901.

The presentation of the minutes of the Electricity Committee gave rise to a discussion, in the course of which

Mr. HAMPSON asked why it was the consumers had so small a supply of electricity in the north and north-east districts. While the main had been laid as far as Didsbury in the one direction, it had not been laid along Cheetham Hill Road. In that district, there were many works which could do with an electric supply. It was a scandal that the mains should be placed in localities outside the city, where they were yielding no revenue, while remunerative districts in the city were neglected. It was painful to him, as a business man, that this great undertaking, which cost between £300,000 and £400,000, should be down in the estimates as returning no revenue. If a private concern had been worked on the same principles, it would have been in the Bankruptcy Court. The street explosions which had been going on for some time showed that the mains were a permanent source of danger in Manchester. He was of opinion that they were more or less using the funds of the Corporation for teaching and giving information which ought to have been gathered by people in a responsible position before they came there.

Alderman RICHARDS also criticized the Committee, and said it would be advisable to have a return of what they would probably get from the out-districts to which they were supplying electricity.

Mr. WILSON referred to the frequent breaking up of the streets for the purpose of laying mains.

Sir JOHN HARWOOD said he was Chairman of the Electricity Committee when the cables which had proved defective were put down. They were laid on the best expert advice available; and the Committee were not to blame if knowledge which was not then to be obtained had since come to light.

Alderman HIGGINBOTTOM, Chairman of the Committee, said the main had not been laid in Cheetham Hill Road because the existing plant would not have given the requisite voltage. He would remind those who criticized the Committee that they had, since 1893, handed over £68,000 to the city fund, and had built up a reserve of £40,000. The cables were laid under the best advice obtainable. It had been found, however, that the climate of Manchester would not allow the Silvertown cable to "live" there. This had happened in other places where that cable had been used. It was only these cables which had proved defective; and he did not think they would have any trouble from those by which they had been replaced. These were of a type specially made to prevent ill-effects from moisture or other outside influences. They were not worse off in Manchester than in other parts of the country; and he did not think the Committee should be condemned because of the explosions. As to the policy of going to outside districts and taking over their local Orders, this matter had been fully explained to the Council when they gave the Committee power to adopt it. They acted on the broad principle of extending the electric light service, and ultimately working the whole of the tramways in the outside districts in connection with the electric lighting. It was a right policy, and would repay the city a hundredfold within a very few years. They would never have heard any complaints had it not been for the fact that they did not expect to be able to pay £10,000 or £12,000 to the city fund this year. They could pay it if they wanted to; but they did not wish to do it on a false basis. Coal had risen 50 per cent. They had made good contracts; but these had run out, and instead of 8s. 6d., they would have to pay 14s. 6d. per ton. This had made a difference of over £6000 in the estimated revenue. The other was due to the sinking fund, and interest on expenditure for mains laid in the city and some parts of the outside area. These had not yet resulted in any adequate return; but he would undertake to say there were some parts of the outside districts which would in time give them a much better return than some parts of the city itself. If the new mains did not within the next few years repay them for their expenditure, the Committee would say they had made a mistake, and ask the Council to increase the price of the current because it was cut down below the remunerative limit.

The minutes were approved.

STALYBRIDGE CORPORATION GAS SUPPLY.

Mr. Carr's Salary Increased.

At the Meeting of the Stalybridge Town Council last Tuesday, a resolution of the Gas Committee that the salary of the Engineer and Manager (Mr. William Carr) should be increased by £100 per annum came up for confirmation. The adoption of the Committee's minutes having been moved and seconded, Mr. Hopwood commented upon the absence of the Chairman and Deputy-Chairman of the Committee, because he thought they should have told the Council, in the presence of the representatives of the Press (so that it would get to the ratepayers, who found the money) something about the abilities that Mr. Carr possessed, and to show that the advance was really a proper thing to make, which he personally fully believed, and which they could, he thought, satisfactorily explain. He supported the proposal in Committee on the strength of what the Chairman and the Deputy-Chairman said; and if he were entitled to the information in Committee, the ratepayers were entitled to it. But not a word was said about it; and he had heard an abundance of complaints outside—not that Mr. Carr was not worth £500 a year, or that he had not splendid abilities, but that Stalybridge was not big enough to pay such a salary. Alderman Ridyard thought he might make a few remarks on the subject. Mr. Carr was appointed as Engineer and Manager to the Gas Committee. When new works were carried out during the time of Mr. Loam, he had an allowance, over and above his salary, for any work he did as Engineer. Mr. Carr had carried out very extensive and very profitable works, for which he had had no allowance whatever. If these works had been undertaken by an Engineer, he would have required an allowance which would have come to more than four years' payment of the advance to Mr. Carr. A Manager was not like an ordinary workman. There was no limit to the sphere of a Manager. His control extended over all the items of the establishment, both human and mechanical; and the consequence was that a man of exceptional ability was worth an exceptional salary. But the benefits Mr. Carr had achieved warranted them, in his (the speaker's) opinion, in paying such salary. When Mr. Carr came to Stalybridge, the price of gas was 2s. 10d. per 1000 cubic feet; and now, under circumstances which were infinitely worse, the price had been reduced to 2s. 3d. They might not know it already, but this was an actual present to the ratepayers of Stalybridge of £4500 a year. He thought they could afford to pay an advance of from £300 (the late Manager's salary) to £500 when they were getting such a present. In addition to this, Mr. Carr had done a great deal at the gas-works which had been put to the revenue account; but if it had been placed to the capital account, the profits would have been considerably larger than they were. He regarded it—and he would emphasize the point—that the salary of £500 a year was exceptional; and he voted for it because he considered that Mr. Carr had secured exceptional benefits for Stalybridge, and that he deserved such a salary on account of his special abilities. Mr. Sidebottom, referring to a remark which had fallen from Alderman Ridyard, said that while there was no limit to what a good man could do, it should have been added that there was no limit to what a bad one might do. The minutes were passed.

LINCOLN CORPORATION GAS AND WATER SUPPLY.

The Annual Reports.

At the Meeting of the Lincoln Town Council last Tuesday, the annual financial statements of the Gas and Water Committees were submitted.

Mr. WALLIS laid before the members the figures referring to the Gas Department. He said that the expenditure had been £33,893, as against £27,580 in the previous year. Coal had cost them £17,985, as compared with £15,130. Repairs, maintenance of plant, renewals, &c., required £2632, as against £2881. Repairs, maintenance, and renewal of mains and service-pipes, &c., proved the most important matter in the whole report. Last year in this direction £3665 was spent; while in the preceding year the figure was only about £700. This was chiefly for new mains, which had cost some £2900. On the receipt side, he found gas produced £26,617, as against £25,617 in 1898-9—about £1000 more. But for part of the year the gas charges were reduced from 2s. 3d. to 2s. 1d., which made a difference to the account of about £800. Thus, if they had maintained the same rate all the year, the receipts would have been some £1800 more than the previous twelve months. The sales of coke, tar, and sulphate of ammonia showed that the receipts had increased considerably—something like £3000. Coke alone showed an increase of £2000, and sulphate of ammonia £500 or so more. The total receipts were £41,755, as against £37,684. Thus £7851 was carried over to the profit and loss account, in comparison with £10,103. The year had been quite as profitable; but they had had to pay so much more for coal, and had had to spend so much in pipes, &c. The gas trading account showed that £8525 had been spent on the usual fixed charges of the department; and the Committee had only the £7851 in hand—leaving a deficiency of £663 for the year, as against a surplus profit in 1898-9 of £1922. The working statistics showed that 2000 tons more coal had been used, and 15 million cubic feet more gas made. The gas sold showed about the same increase—some 14¾ millions. The position of the concern was thus this: The amount of reserve fund was £20,000; and £18,000 had been invested. They required for water-gas plant £13,500; and this at present they had no power to borrow. The Local Government Board had not, in their unwisdom, agreed to allow them to borrow it. As this was a necessary scheme, the Committee decided that, wherever the money came from, they would do the work; and therefore they would have to find it out of the £20,000. The working capital amounted to £9830. In the first instance they were burdened with the whole concern, and nothing to work with. They had, by sticking to business, and by having a good Manager, not only got the £20,000, but £9830 as a floating capital. They also had £2000 out of the £20,000, so that really there remained £11,800 as floating capital. He was very sorry to say they must have £600 out of the floating capital to meet the expenses of the present year. They would in all likelihood have to pay 5s. per ton more for the coal. During the past year, the cost of the coal had been nearly £3000 more than in the previous year; and the year before that it was several hundreds up. This year £7500 would be the total; but they would make certain savings, and were looking forward to securing £1000 more out of coke, tar, &c. Before concluding, he foreshadowed a rise in the price of gas during the year.

The report was adopted.

Dr. COLLIER submitted the report of the Water Committee. Among other particulars, it showed that the number of houses supplied on March 25 last was 11,715; and the quantity of water pumped was equal to an average daily consumption per head of 25·7 gallons. The income had been very satisfactory; the net increase having been £539. The balance in hand was £4803; the profit for the year having been £2315. But this had been ear-marked; new filter beds and engines being required.

The report was adopted, as was also a recommendation that application be made to the Local Government Board for sanction to borrow £16,000 in connection with proposed new works.

STOCKTON GAS-WORKS ACCOUNTS.

At the Meeting of the Stockton Town Council last Tuesday, the Gas Manager (Mr. W. Ford) reported that the total make of gas during the past year had been 386,106,000 cubic feet, or an increase of 25,516,000 feet, which was equivalent to 7 per cent. The unaccounted-for gas had been 4·54 per cent., against 5 per cent. the previous year. The average illuminating power had been 17·10 candles, with no trace of sulphuretted hydrogen; and other sulphur compounds only averaged 11·68 grains per 100 cubic feet, which showed that the purity of the gas supply had been maintained in a favourable manner. There were now 4041 gas-cookers on hire, or an increase of 290. The Accountant (Mr. J. Reay) also presented a statement of the gas revenue account, showing that the profit during the year had been £4610, against £4098 in 1899. It appeared from this that, while the expenditure on coke, coal, oil, and wages had risen from £18,791 to £23,157, there had been large increases in the income from the sale of the gas products—£1600 in the case of coke alone, and £600 in tar. Mr. Meggeson remarked that he was pleased to find there was an increased profit of £500. It showed there was not the justification held out for the recent increase in the price of gas.

WEST BROMWICH CORPORATION GAS SUPPLY.

Probable Increased Charges.

At the Meeting of the West Bromwich Town Council last Wednesday—the Mayor (Mr. S. Pitt) presiding—the Gas Committee reported that the sales of gas during the financial year ending the 31st of March last were 295,874,900 cubic feet; being an increase of 23,602,200 cubic feet over the previous year. The amount of the gas-rental for the same period was £37,545, an increase of £3209. In submitting the report, Mr. Wilson pointed out that in the amount received for gas during the year there was an increase of 8¾ per cent. It might be interesting to the Council to know that at the present time there were 5220 ordinary meters and 4810 prepayment meters in use in the borough. The augmentation in the consumption of gas was due very largely to the extensive adoption of the latter class of meters. He was afraid, however, they could not hope for so large an increase in the future from this source. When they remembered that out of the 13,702 houses in the town only about 4000 of them were at present without a supply of gas, they would see that they had reached about as high as they could. There was a large increase in the quantity of gas consumed for ordinary purposes during the year; while that supplied for motive power had gone up by 24½ per cent. The total increase in the consumption in the borough for the last two years had been 18¼ per cent. Though this was very gratifying to the Committee, they were fully alive to the fact that it also added to their responsibility. They had to make further provision for the future; and at present he confessed they were somewhat in the dark as to what that future would be. Something would certainly have to be done very soon to prevent the town from suffering from any lack of gas. The Committee therefore hoped to come before the Council shortly with a scheme for the extension of the productive capacity of the works. He did not see how it was possible to escape an increase in the charge for gas during the coming twelve months. The price of coal had gone up; and the Committee had accepted contracts at largely increased amounts. They would, however, take care that there should be no increase but that which was absolutely necessary. The report was approved.

ROTHERHAM CORPORATION GAS SUPPLY.

At the Quarterly Meeting of the Rotherham Town Council last Wednesday,

The Mayor (Mr. G. Gummer) made his annual statement on the affairs of the Gas Department. He congratulated the Committee on the successful year's working, considering the difficulties they had had from time to time. At one period of the year they had had the greatest trouble in obtaining supplies of coal; and the coal they did get was not of the quality they had a right to expect. Under the circumstances, he thought the gross profit of £11,545, as against £9829, was very satisfactory. They had had to pay an average price of 11s. per ton for coal, as compared with 9s. 7d. per ton. The working expenses, renewals, and repairs had been abnormally high, and had cost £5095. Then extensions and alterations of mains had cost £2177. Other items of a sundry character had absorbed £1850. These made a total charge to the revenue of £9122. Fortunately, they had a contingency fund; and they had drawn upon it. They had carried to a suspense account £4500; leaving a balance against revenue of £4622. The increased make of gas was 9½ per cent., as against 8½ per cent. in the previous year; and the increased consumption was 12 per cent. This was accounted for by the decreased leakage; and he thought the Engineer should be complimented upon the manner in which he had tackled this question. The number of coin-meters in use was 5720; being an increase of 574 during the year. The percentage of increased consumption in the coin-meters was 23, as against 10 in the ordinary meters, which numbered 4275. Out of the gross profit of £11,545 they had paid £5140 for dividend on stock and redemption instalments, £300 to sinking fund, £1009 interest on mortgages, £905 in bank interest, and £2154 for public lighting—leaving a surplus of £2034. The capital of the gas-works was £173,283, as against £144,878 last year. In the minutes there was a resolution appointing a Committee to decide as to the increase in the price of gas, and to make further inquiries before fixing the amount. Leeds, Bradford, Hull, Halifax, and Keighley had found the demands of the coal owners so exorbitant—they were anticipating an increase of 5s. per ton in the cost of coal—that they had amalgamated for the purpose, if possible, of doing something to prevent such a great increase. It was even proposed, wisely or unwisely, to start a municipal colliery, with a view of making an attempt to stop these increased charges. Another matter the Committee would have to consider was the restrictions likely

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1210.

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 11	10½	Alliance & Dublin 10 p. c.	20—21	..	5 0 0
100,000	10	,,	7½	Do. 7 p. c.	13½—14½	..	5 3 5
300,000	100	Jan. 2	5	Australian 5 p. c. Deb.	102—104	+2	4 16 2
200,000	5	Nov. 15	6	Bombay, Ltd.	6½—6¾	..	4 8 11
40,000	5	,,	4	Do. New, £4 paid	4½—4¾	..	5 1 1
380,000	Stk.	Feb. 23	12	Brentford Consolidated	250—260	..	4 12 4
270,000	,,	,,	9	Do. New	195—200	..	4 10 0
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb.	118—123	..	3 5 1
220,000	Stk.	Mar. 14	11½	Brighton & Hove Orig.	237—242	..	4 15 0
226,320	,,	,,	8½	Do. A. Ord. Stk.	177—182	−3	4 13 5
909,500	Stk.	Feb. 23	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Mar. 29	10	British	41—42	−½	4 15 3
50,000	10	Feb. 23	12	Bromley, Ord. 10 p. c.	24—26	..	4 12 4
79,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	Oct. 18	6	Buenos Ayres (New) Ltd.	9½—10	−¼	6 0 0
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	99—101	..	3 19 3
150,000	20	Mar. 14	8½	Cagliari, Ltd.	24—26	..	6 6 11
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	14—15	..	5 6 8
50,000	50	May 2	6	Do. 6 p. c. 1st Mort.	55—57*	..	5 5 3
550,000	Stk.	Apl. 11	13½	Commercial Old Stock.	275—285	−17½	4 14 9
236,425	,,	,,	10½	Do. New do.	210—220	−17½	4 15 5
288,237	,,	Dec. 14	4½	Do. 4½ p. c. Deb.	142—145	..	3 2 1
800,000	Stk.	Dec. 14	9	Continental Union, Ltd.	160—170	..	5 5 11
200,000	,,	,,	7	Do. 7 p. c. Pref.	175—180	..	3 17 9
51,600	Stk.	Feb. 23	14	Croydon A 10 p. c.	335—340	..	4 2 4
173,400	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
555,000	Stk.	Feb. 23	5½	Crystal Palace Ord. 5 p. c.	117—122	−1	4 6 1
60,000	,,	,,	5	Do. 5 p. c. Pref.	130—135	..	3 14 1
486,000	10	Jan. 26	11	European, Ltd.	19½—20½	..	5 7 4
854,060	10	,,	11	Do. £7 10s. paid	14½—15½	..	5 6 5
14,993,075	Stk.	Feb. 9	4½	Gas-light and Coke	4 p. c. Ord.	..	4 15 1
2,600,000	,,	,,	8½		3½ p. c. max.	..	3 10 8
3,799,785	,,	,,	4		4 p. c. Con. Pref.	..	3 6 8
3,993,975	,,	Dec. 14	3		3 p. c. Con. Deb.	..	3 0 0
70,000	10	Nov. 15	8	Hongkong & China, Ltd.	13½—14½	..	5 10 4
3,800,000	Stk.	Nov. 15	10	Imperial Continental	210—215	..	4 13 11
478,600	Stk.	Feb. 9	8½	Do. 8½ p. c. Deb. Red.	100—103	..	3 8 0
75,000	5	Dec. 14	6	Malta & Medn., Ltd.	4½—5½	..	5 9 1
560,000	100	Apl. 2	5	Met. of Melbourne	5 p. c. Deb.	..	4 11 9
250,000	100	,,	4½		4½ p. c. Deb.	..	4 4 1
541,920	20	Nov. 15	3	Monte Video, Ltd.		..	5 4 4
667,946	Stk.	Feb. 23	9½	Newc'tle & Gateesh'd Con.		..	4 4 1
299,855	Stk.	Dec. 29	8½	Do. 8½ p. c. Deb.	104—107	..	3 5 5
150,000	5	Nov. 30	8	Oriental, Ltd.	7—7½	..	5 6 8
135,000	5	,,	8	Do. New, £4 10s. pd.	6¾—6⅞	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.	1½—1¾	..	4 11 5

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
60,000	5	Feb. 23	7	Ottoman, Ltd.	5—5½	..	6 7 3
500,000	100	Dec. 1	6	People's Gas of Chicago 2nd Mtg. Bonds	102—106	..	5 13 2
851,070	10	Apl. 27	7	River Plate Ord.	10¾—11¼*	..	6 4 5
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	100—102	..	3 18 5
250,000	10	Apl. 11	8	San Paulo, Ltd.	11½—12½	..	6 8 0
135,000	Stk.	Mar. 14	10	Sheffield A.	246—247	..	4 1 0
209,063	,,	,,	10	Do. B.	244—246	..	4 1 4
447,427	,,	,,	10	Do. C.	244—246	..	4 1 4
5,600,000	Stk.	Feb. 23	5⅓	South Metrop., 4 p.c. Ord.	127—130	−1	4 2 0
1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb.	99—101	..	2 19 5
380,940	Stk.	Nov. 30	5	Southampton Ord.	117—122	..	4 2 0
70,825	,,	Dec. 29	4	Do. 4 p.c. Deb.	120—125	..	3 4 0
120,000	Stk.	Mar. 14	6	Tottenham and A. 5 p.c. B. 3½ p.c.	139—141	..	4 5 1
250,520	,,	,,	4½		100—102	..	4 8 3
55,160	,,	Dec. 14	4	Edmonton 4 p. c. Deb.	113—117	..	3 8 5
182,380	10	Jan. 12	5	Tuscan, Ltd.	7⅞—8½	−⅛	5 17 8
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.	101—104	..	4 16 2
				WATER COMPANIES.			
780,399	Stk.	Dec. 29	11	Chelsea, Ord.	305—310	..	3 11 0
150,000	,,	,,	5	Do. 5 p. c. Pref.	157—162	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	145—150	..	3 0 0
175,785	,,	Mar. 29	4½	Do. 4½ p. c. Deb.	145—150	..	3 0 0
1,720,560	Stk.	Apl. 11	7	East London, Ord.	195—200	..	3 10 0
654,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb.	145—150	..	3 0 0
390,000	,,	,,	3	Do. 3 p. c. Deb.	99—101	..	2 19 5
700,000	50	Dec. 14	7½	Grand Junction 10 p. c. max.	106—108	..	3 9 5
310,000	Stk.	Mar. 29	4		4 p. c. Deb.	130—135	..	2 19 3
708,000	Stk.	Feb. 23	14	Kent	307—312	..	4 9 9
160,000	,,	,,	7	Do. New, 7 p. c. max.	200—210	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.	294—299	..	3 10 3
406,200	100	,,	8	Do. 7½ p. c. max.	212—217	..	3 13 9
350,000	Stk.	Mar. 29	4	Do. 4 p. c. Deb.	130—133	..	3 0 2
500,000	100	Feb. 23	13½	New River, New Shares	418—423	..	3 3 9
1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb.	132—137	..	2 18 5
902,200	Stk.	Dec. 14	7½	South-wark and Ord. 7½ p. c. max. 5 p. c. Pref.	200—205	..	3 13 2
126,500	100	,,	7½		190—195	..	3 16 11
489,333	Stk.	,,	5		160—165	..	3 0 7
1,019,585	,,	Apl. 11	4	Vauxhall 4 p. c. A Deb.	129—134	..	2 19 9
1,155,066	Stk.	Dec. 14	10	West Middlesex	287—292	..	3 8 6
300,000	,,	,,	4½	Do. 4½ p. c. Deb.	147—152	..	2 19 3
200,000	,,	Mar. 14	8	Do. 8 p. c. Deb.	99—101	..	2 19 5

*10x div.

to take place with regard to deliveries. During the winter months, they took deliveries under contract of something like 70 per cent., and in the summer months of 30 per cent. The colliery owners, and particularly those dealing with the five towns mentioned, were asking that the deliveries should be over equal periods. This meant that they would have to find storage accommodation, and would have to stock the coal at a probable cost of 1s. 6d. per ton, and that the coal when taken to the retorts would be very much deteriorated. These things would have to be taken into calculation when the Committee met to consider the increase in the price of gas. It was anticipated that the amount required in order to deal with the increased cost of coal would be something like £7000; and the lowest increase, putting it down at 3d. per 1000 feet on the consumers now paying 2s. 3d. and 2s. 6d., would only produce £1400, leaving out the ordinary consumers at 2s. 9d., and the automatic meters. Seeing they had had an abnormal year in repairs, it was possible that these might be something like £2000 less next year, and that the coke contracts which would have to be entered into in a short time would make £2000 more than last year, and adding to these figures the present surplus profit of £2000, they would get an amount about equal to the extra cost of coal.

Alderman J. Mason seconded the motion, which was passed.

THE WORK OF THE PUBLIC HEALTH DEPARTMENT OF THE CORPORATION OF LONDON IN THE PAST YEAR.

The report of the Engineer of the Public Health Department of the Corporation of London (Mr. D. J. Ross, M.Inst.C.E.), on the works executed during the past year, has lately been issued. It contains, as usual, particulars in regard to the lighting of the City streets by gas and electricity, and the use of water for sanitary purposes, &c.

The charge for gas in the first half of the year was 2s. 2d. per 1000 cubic feet; but at Midsummer it was reduced to 2s. 1d. The number of lighting hours was 4300. The effect of this change is shown in the following table, which gives the total annual charge per lamp for gas, lighting, and repairing, at the two prices:—

Size.	Description.	Annual Charge at 2s. 2d.	Annual Charge at 2s. 1d.
4 feet	Incandescent	£1 17 3	£1 15 10
5 ,,	Square	3 4 7	3 2 10
5 ,,	Circular	3 8 10	3 7 1
6 ,,	,,	3 18 2	3 16 0
8 ,,	Square	4 12 6	4 9 8
8 ,,	Circular	4 16 9	4 13 11
10 ,,	,,	5 15 5	5 11 10
15 ,,	,,	8 2 0	7 16 8
25 ,,	Special	13 2 11	12 14 0
50 ,,	,,	24 15 10	23 17 11

The charge for repairing the square lamps is 3s., and the circular lamps 7s. 3d. per annum; the difference in charge being due to the additional expense incurred in cleaning and maintaining the round lanterns. There are no charges for lighting and repairing the incandescent lamps. A sum of 15s. per lamp is charged for lighting the lamps up to 20 feet consumption per hour; the charge for the 25 and 50 feet lamps being £1 10s. each. The number of defective gas-lights observed during the year was 192. Returns of these are made daily by the City Police, and include only those lamps in which defective lighting is very noticeable. The number of gas-lamps paid for by the Corporation at the end of the year was 1906; about one-third having been removed, in consequence of the main thoroughfares being lighted by electric lamps. The 36 meters attached to the public lamps in various parts of the City show that the full contract quantity of gas is given at these lamps. The Inspector of Gas Lighting is of opinion that the contract quantity is furnished generally throughout the City, and that the regulators of the lamps are kept in proper condition. The public lamps, both gas and electric, were lighted, in accordance with the general instructions in force for many years past, whenever fog or unusual darkness occurred. This happened on nineteen days during the year. The experimental lighting in Wood Street with the Welsbach incandescent gas-lamps, and in Great St. Helen's with the same system, was continued throughout the year. The Denayrouze burners in the refuge lamps at Great St. Helen's and Blackfriars Bridge Approach were removed at the end of November in favour of the Welsbach Company's No. 4 Kern burners. Basinghall Street has been lighted experimentally, since Nov. 14, 1898, with the Sunlight Company's new incandescent gas-burners and lanterns; the experiment being conducted at the expense of the Company. In December, Fetter Lane was experimentally lighted by incandescent gas-lamps with Kern burners. The Engineer says these lamps are "a great improvement on the old system of lighting." The lamps are 24 in number, including one in Fleur-de-Lis Court. The cost of maintenance and gas supplied is £73 15s. per annum, as compared with £79 12s. by the old system; and the illuminating power claimed for the lamps is 90 candles each, as compared with the 14-candle power of the old lamps. Instructions have recently been given for the experimental incandescent lamps and burners in Wood Street and Great St. Helen's to be removed, and replaced with Kern burners.

Reference is made to the proceedings in Parliament on the Bill of the Gaslight and Coke Company to enable them to raise additional capital to the amount of £3,500,000; and to the inquiry by a Committee of the House of Commons into the charges of the Metropolitan Gas Companies. The progress of these inquiries was watched by a Sub-Committee of the Streets Committee, and the latter presented a report. The Sub-Committee and the Corporation officials co-operated with the London County Council; and they congratulated the Corporation on being able to assist the gas consumers, not only within the City, but in nearly the whole of the Metropolis on the north side of the Thames, representing a population of 2,389,000, and a rateable value of £25,660,000. The Committee went on to say: "The difference in price between the two Companies represents a sum of £800,000 per annum on

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	Cubic Feet Daily.
BLACKBURN	1,250,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000
SALTLEY WORKS, BIRMINGHAM	2,000,000
COLCHESTER	300,000
BIRKENHEAD	2,250,000
SWINDON (New Swindon Gas Co.)	120,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000
WINDSOR ST., BIRMINGHAM (Second Cont.)	2,000,000
HALIFAX	1,000,000
TORONTO	250,000
OTTAWA	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
TORONTO (Second Contract; Remodelled)	2,000,000
BELLEVILLE	250,000
OTTAWA (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000

	Cubic Feet Daily.
BUFFALO, N.Y.	2,000,000
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.,	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
LEICESTER	2,000,000
ENSCHEDE (HOLLAND)	150,000
BUENOS AYRES (RIVER PLATE CO.)	700,000
BURNLEY	1,500,000
KINGSTON-ON-THAMES	1,750,000
ACCRINGTON	500,000
TONBRIDGE	300,000
STRETFORD	500,000
OLDBURY	300,000
TODMORDEN	500,000
SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
YORK (Second Contract)	750,000

the Gaslight and Coke Company's yearly output of about 21,000 million cubic feet, of which sum the Corporation pay annually nearly £3000. This large sum of money is the extra annual burden upon the gas consumers north of the Thames. Why gas should cost on the north side of the Thames nearly 3s. per 1000 cubic feet, and only 2s. 2d. per 1000 cubic feet on the south side,* is a mystery yet to be solved; but it is clear that this monopolist Company must either reduce its charge, or, in common fairness to the citizens, competition must be allowed, at least to the extent of permitting the South Metropolitan Gas Company to cross the Thames and supply those who desire it with gas at 2s. 2d. per 1000 feet."

With regard to the electric lighting of the City, this system was in use in the main thoroughfares throughout the year; the number of lamps in service on Dec. 31 being 507. The question of lighting the side streets by electricity is still under consideration. The number of defective electric lamps observed during the year was 896. Returns on this matter are made daily to the Engineer by the police; and the City of London Electric Light Company are fined for each failure.

The cost of water used for flushing and other purposes last year was £3737 4s. 3d., as compared with £3736 0s. 11d. in 1898. Owing to the action taken by the Streets Committee, the charge for water supplied by the New River Company for street-watering purposes has been reduced from 8½d. to 6d. per 1000 gallons for quantities over 200,000 gallons; and this is the charge now for all water supplied by the Company for public purposes. In order to save the expense of the Company's men attending to check the quantity of water taken from the street hydrants, 25 experimental hydrants have been fixed with meters attached. The results of this experiment are still under consideration. The quantity of water used during the year for washing the streets and courts was 29,439,551 gallons; the number of nights on which it was employed being 285. The streets were washed more frequently last year than ever before.

As in previous reports, information is furnished with regard to the extent to which the subways for gas, water, and other pipes in the City streets are used, especially in view of the Bill of the Corporation, in which this is a prominent feature, now before Parliament. Beneath the thoroughfares under the control of the Corporation there exist at the present time about 2540 lineal yards, or 1½ miles, of subways. The lengths of gas, water, and hydraulic mains, telegraph and pneumatic tubes, and electric lighting conduits laid in these subways amount to over 8 miles. The electric light and telegraph conduits contain about 447 miles of wires and cables. The Engineer states that "the usefulness of these subways is evidenced by the fact that in the streets beneath which they have been constructed no openings have been made for access to pipes, &c., except those for taking pipes into the ends of the subways, since they were constructed." Access, under proper supervision, is given to the officers and workmen of the various companies. The Inspector of Subways reports that 4736 workmen and others were admitted during the year. A new subway, about 440 feet in length, was formed last year under the new thoroughfare known as "Lloyd's Avenue."

* Subsequently to the date of the report, the price was reduced to 2s. 1d. —Ed. J.G.L.

ELECTRIC LIGHTING NOTES.

The Longton Corporation have resolved to apply for sanction to a loan of £28,500 for an electric light installation for the borough.

The Electricity Committee of the Bradford Corporation have decided to fix the charge for electricity for motive power with continuous user through the working hours of the day at 1d. per unit, and for intermittent user at 2d. per unit.

The Worcester City Council have resolved to apply to the Local Government Board for a loan of £1000 to enable them to carry on the system of free wiring for private users of the electric light—the Free Wiring Company being dissatisfied with the terms. It is stated that, if the loan is granted, Worcester will be the first Corporation to do free wiring.

The Electrical Engineer of the Cardiff Corporation (Mr. N. Appelbee) has reported to his Committee that the increase in the number of private lamps connected last year was equal to the increase of the two preceding years. The quantity of electricity sold was 509,000 units; while in the preceding year it was 405,000 units. The charge during the quarter was 4½d. per unit; and there was a deficit of £1000, which appears to be due to the public lighting. Mr. Appelbee urges the consideration of the provision of additional plant, as at the present rate of progress the existing station will be fully occupied in two or three years' time. In his opinion, a new station should be erected, in preference to extending on the present site.

Mr. E. A. Sandford Fawcett, of the Local Government Board, held an inquiry at Redditch last Thursday, respecting an application by the District Council for permission to borrow £8000 for work in connection with the electric lighting scheme. The Clerk (Mr. J. W. Hobson) said the reasons for making this application shortly after the sanction to a loan of £10,911, were excess of expenditure over the former loan, and success of the undertaking. The pressure on the plant was equal to 80 per cent. of its total capacity, and extensions were absolutely necessary. Plans of the proposed improvements and extensions were submitted by the Engineer; and the Inspector said he did not think it necessary to call further evidence.

The report of the Calcutta Electric Supply Corporation, Limited, for 1899 states that the supply of electrical energy began on April 17, 1899, and at the 31st of December there were connected to the Company's mains an equivalent of 9463 lamps of 8-candle power, of which 8170 lamps were for lighting purposes, and the equivalent of 1293 lamps for power. 54,897 units were sold (42,947 for lighting and 14,850 for power), and the gross revenue was £2041, while the costs, after charging the management and administration expenses to revenue, amounted to £1389, leaving a net profit of £651, which it is proposed to carry forward. Additional mains have been laid in many of the streets in Calcutta beyond those comprised in the original contract; and the report states that many more will soon be required, and further considerable capital expenditure will have to be incurred for the supply to the new districts. Under these circumstances, the Directors propose that the nominal capital of the Company shall be increased to £200,000 by the creation of 20,000 additional shares of £5 each.

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Tar-Distilling Plants. Valves. Claus' Sulphur-Recovery Plants.

SULPHATE OF AMMONIA PLANTS.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Edinburgh and Leith Gas Commissioners, on Monday, entered into their contracts for the year. A discreet silence was maintained by them as to the prices agreed upon for coal and oil. Their resolution was to contract for coal for either six or twelve months, as might seem most advantageous. The contracts which have been fixed are for twelve months. They have contracted for, in all, 122,500 tons of coal, and 3000 tons of oil. The oil is the same in quantity as last year, so it is evident that there is no intention to increase the output of carburetted water gas. The coal is considerably less in quantity than last year. In the course of the twelve months which expired at May 15 last year, the quantity of coal carbonized was 154,000 tons. This would point to the Commissioners either having a large stock of coal on hand, or to their trusting to buy during the next year, as the market offers. I think that, on mature reflection, they have done well to contract for the whole year. For the 122,500 tons which the Edinburgh and Leith Commissioners have contracted, there are eight contractors. The Lothian Coal Company hold the contract for 20,000 tons; Messrs. A. Russell and Co., of Glasgow, for 32,500 tons; the Niddrie and Benhar Coal Company, for 43,000 tons; Messrs. J. M'Kelvie and Co., of Edinburgh, for 10,000 tons; Messrs. Henry Ness and Co., of Fife, for 3000 tons; Messrs. Gavin Paul and Sons, of Edinburgh, for 10,000 tons; Messrs. James Sword and Son, of Leith, for 3000 tons; and the Lochore and Capledrae Coal Company, for 1000 tons. I have given the list of contractors, to let it be seen how careful the Commissioners have been to lay in coal which is won in their own district, thereby doing away with heavy railway charges. Now that these have been raised, the item would have been a considerable one. As the coal will be delivered free, it is probable that West of Scotland coal has been prejudiced, in this contract, by the railway charges. I understand that the subject of the raising of the railway rates is to be referred to the Railway Commission. But their decision cannot be expected before July, or even October; and it will thus be too late to affect prices in the contracting season this year. The contracts for Edinburgh and Leith consist of 37,000 tons of high-class cannels, 10,000 tons of shale, and the balance is chiefly splints. The oil contract has been secured, as last year, by the Broxburn Oil Company.

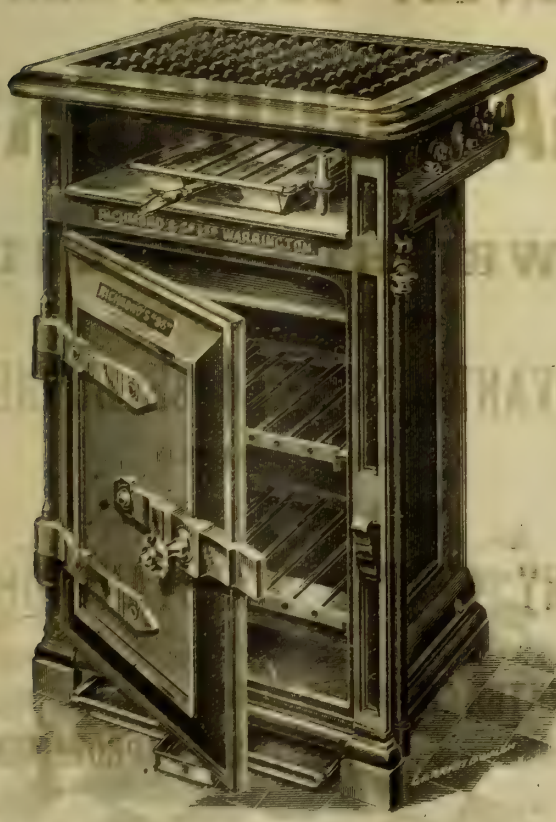
The Commissioners had before them a report by the Works Committee upon the subject of the lighting of streets by incandescent gas-lamps, and they instructed that the report, along with a tender by Messrs. James Milne and Son, to supply large quantities of lanterns, should be communicated to the Corporations of Edinburgh and Leith. The cost will be £3 0s. 6d. per lamp, which is the amount calculated by the Engineer (Mr. W. R. Herring) for supplying and fitting up lanterns. Mr. Herring also reported to the Committee that the destruction of mantles during one year had been in the following percentage: Lutton Place 6·2, Meadow Walk 4, Drummond Street 5·6, Melville Street 6·2, St. Andrew Square 4, New Street 5·6, and Leith Docks 5·16. These figures are instructive. In Meadow Walk there is no vehicular traffic; and in St. Andrew Square the incandescent lamps are fitted upon pillars of great mass and substantiality. These are the two lowest in the matter of breakages. It is thus apparent that vibration has a great deal to do with the life of an incandescent mantle.

The Commissioners agreed to provide gas to the Corporations of Edinburgh and Leith for a year, for street and common stair lighting, at the rate of 2s. 8d. per 1000 cubic feet. This is 4d. per 1000 feet below the present ordinary rate.

It was reported that the output of gas during March showed an increase upon the corresponding month of last year of 11,979,000 cubic feet; and that since May 16, the increase over the corresponding period of last year had been 95,886,000 cubic feet. Speaking to these figures, Judge Kinloch Anderson said that the increase during March was at the rate of 7·6 per cent.; and since May 16 at the rate of 5·80 per cent. He considered the results to be satisfactory.

A Committee of the Edinburgh Town Council have this week fixed the estimate for the lighting of the city during the year from May 15, at £37,000. I have not the figures by me; but I recollect that twelve years ago the estimate was about £14,000. The city has not increased in the same ratio; but we live in more luxurious times.

There are no people in the world who are so selfish as those who essay to represent the working classes. We had in Dundee, this week, the body styling themselves the Dundee Trades and Labour Council, formally adopting a protest against the proposal by the Town Council to advance the salary of Mr. W. M'Crae, the Gas Manager, by £50 a year. The resolution was transmitted to the Town Council, who had the subject before them on the succeeding day, as a recommendation from their Gas Committee. There the resolution of the Trades and Labour Council found the support of two members only. These gentlemen appeared to have been red-hot in their profession of labourism; for they could not wait till the recommendation was moved, but as soon as the subject was reached moved the rejection of the proposal. Of course, the approval was then moved. There was no argument against the granting of the increase; and the only argument in its favour was the sufficient one that a great deal of extra work had been thrown upon Mr. M'Crae. The increase was thus granted. This, in ordinary circumstances, would be all I should say upon the subject; but I began by referring to the selfishness of the working-class representatives. At the meeting of the Trades and Labour Council, the theory of the opposition was not that the increase was not warranted, but that there was a mania for increasing salaries at present. The doctrine was that, as members of trades unions would have to contribute to the increase of the salary of the Gas Manager, therefore it must be opposed. And this, too, by people who are continually moving for more wages for themselves, whenever the opportunity offers—whether a rise be warranted or not. The species of logic which appeals to working men is of a very crude sort. The speaker would like to know why gas was so much dearer in Dundee than it was in other places, and he thought there should be a strict investigation into the management, with a view to finding that out. The insinuation was that the Manager was to blame for the high price of the gas, which is not the case, as a few minutes' study of the history of the town would have



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satisfied him. It is known to all who care to look into the matter that, in the departments of both gas and water, Dundee has been unfortunate; but the reason for this has lain with the public men of the place, and not with the officials. Even yet there is a lack of foresight among Dundee public men, because, at this week's meeting of the Town Council, a proposal to pave one of the leading streets with wood was rejected by a large majority, on the score of expense. The equipment of the town is not of so much consequence as the keeping down of the cost. This would be a slight departure from my subject, were it not that the same spirit has overhung all the steps which are being taken at present for the reconstruction of the gas-works. It is right, however, to acknowledge that they have shown a proper spirit this time. Mr. M'Crae evidently has the confidence of the Council, and upon this he is to be congratulated more than upon the addition to his salary.

The Finance Sub-Committee of the Water Committee of the Glasgow Corporation recommend that the water rates and charges remain the same during the ensuing year as at present. The domestic rate within the compulsory area is 5d. in the pound, and outside the compulsory area it is 10d.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May 5.*

Sulphate of Ammonia.—The market has been fairly steady; and the closing quotations are £11 5s. to £11 8s. 9d. per ton, delivered f.o.b. at the ports. There has been more inquiry; but the efforts of buyers are being directed to securing still further concessions in prices. These have been partly successful; there being speculative offering abroad at below the equivalent of makers' quotations. The smaller makes offered have been disposed of, mostly at a slight decline; but some of the larger makes are being firmly held for the chance of some recovery in values as the month progresses. In the forward position, Scotch makers are very firm; but in London there is some disposition to meet buyers. There is still good inquiry for summer months; and prompt prices would be paid for June-August delivery.

Nitrate of Soda is decidedly firmer on spot; the quotations being 8s. 4½d. per cwt. for ordinary, and 8s. 7½d. for fine quality. Hamburg is getting short; and still higher prices would be paid for cargoes arrived at port of call.

LONDON, *May 5.*

Tar Products.—In sympathy with the advanced prices of fuel everywhere, pitch is strong for prompt delivery; and for forward delivery higher prices are being asked. There is an excellent business in carbolic acid, which is now again scarce. A better market exists for solvent and heavy naphthas; but there is no improvement in price. A good deal more inquiry comes to hand for benzol; and it is important to remember that makers have no stocks of this. In one notable instance, it is reported that there has been large over-selling. Anthracene is steady, with a reducing production; while for naphthalene there is a firm market at rates quoted below. For tar rich in carbolic and other tar acids, stiff prices are being paid; but this only applies to country tars, as east coast and London tars contain little or no phenols.

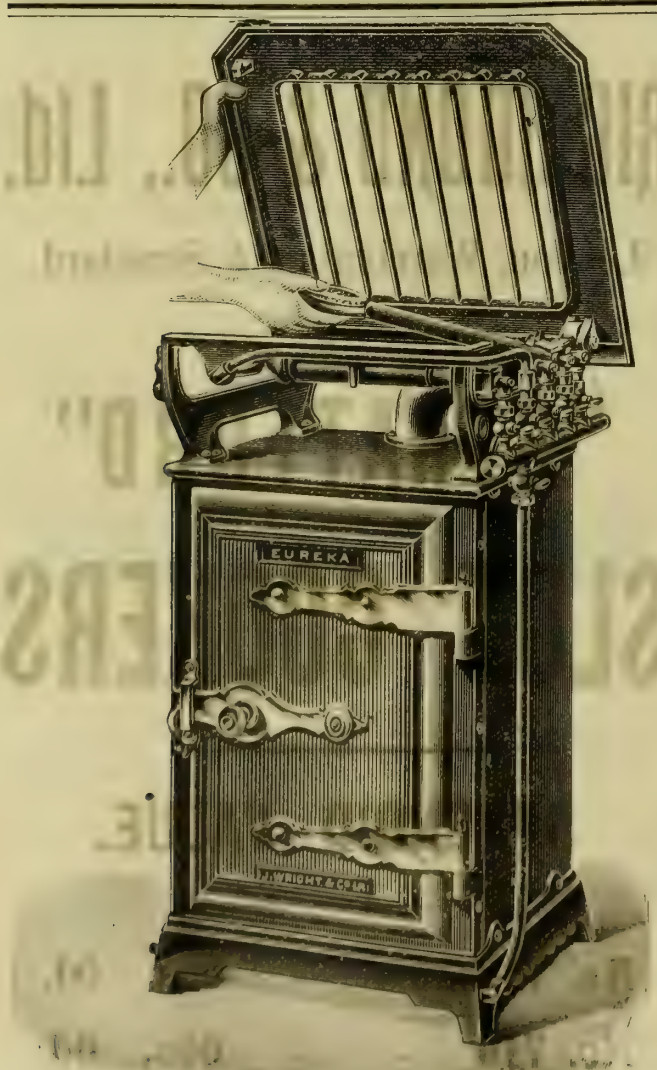
The average values obtaining during the week are: Tar, 17s. 6d. to 27s. 6d. Pitch, east coast, 38s.; west coast, 35s. Benzol, 90's, 6d.; special qualities for gas, 8d.; 50's, 8d. Toluol, 90's, 1s. Solvent naphtha, 1s. 1d. Crude naphtha, 3½d. Heavy naphtha, 11d. Creosote, 2¾d. Heavy oils, 3¼d. Carbolic acid, 50's, 2s. 3d.; 60's, 2s. 9d. Naphthalene, 55s. to 75s. Anthracene, "A," 4d.; "B," 3d.

Sulphate of Ammonia is dull. There seems to be a conspiracy of silence on the part of buyers, and particularly of middlemen, who are interested in lower prices. Fortunately, very little stuff is offering; and it is felt that the serious fall in value which has taken place can only be of a temporary character. Quotations to-day are nominal only, no business being reported; but they may be recorded at an average of £11 5s. per ton, less 3½ per cent.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Business is gradually coming forward in gas coal; and some further contracts have been settled during the past week, on the full basis of 5s. a ton over last year's rates. In fact, in one instance as much as 6s. over the 1899 contract price is reported to have been obtained; but in this case, no doubt, last year's figures were somewhat below the average. With respect to other descriptions of fuel, the position remains very much as recently recorded. Supplies all round continue short; and collieries have more than they can do, with their present output, to keep up deliveries to customers. The extraordinary feature is that house-fire requirements are taking away all the better qualities of round coal that collieries have to offer, and that some local coalowners are still compelled to purchase in other districts to meet the needs of their customers. Steam and forge coals and engine fuel are in much the same pressing demand as for some time past; and no difficulty has been experienced in getting the advance upon the slack. But it can scarcely be said that, on current sales, the advance of 6s. per ton over last year's contract prices for steam and forge coals has so far been established on inland sales for present delivery, though coalowners are declining to sell forward except at the full basis. The result is that buying is to a considerable extent restricted to present requirements; consumers not caring to commit themselves very far ahead at the high prices now ruling. But whether they will gain any advantage by waiting, seems to be more than doubtful. At the pit, best Arley coals average 15s. to 15s. 6d. per ton, medium sorts and Pemberton four-feet 13s. 6d. to 14s. 6d., steam and forge coal 12s. 6d. to 13s., and slack from 10s. 6d. up to 11s. 6d. Only a moderate business comes forward in the shipping trade; and though the official price for steam coal at Mersey ports is still 16s. per ton, there are continued reports that some concession on this figure is being made in isolated cases to secure orders. Coke is in



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pressing request, with makers short of supplies to meet customers' requirements, and prices firm with a hardening tendency.

Northern Coal Trade.—There is again a strong demand both for steam and gas coals; and though the movements in prices have not been very great, the tendency has been decidedly to firmness. Best Northumbrian steam coals are firm at about 19s. per ton f.o.b.; and steam smalls are 13s. to 13s. 6d.—the latter being very scarce. The commencement of the Baltic season is giving increased briskness to the demand for Northumbrian coals generally. Gas coals are in good demand; and there are heavy shipments, both on old contracts and on some of those that have been recently concluded. For best Durham gas coals, the price is about 17s. per ton f.o.b. for occasional cargoes; while most of the contracts that have been named of late are now settled on a basis that is generally from 15s. 9d. to 16s. 3d. per ton f.o.b., or equal to some such price, if allowance is made for the freight, when that is included. The advance just conceded to the Durham miners will help to stiffen the prices of all classes of Durham coals. In the coke trade, there is considerable briskness for home use and export. Gas coke is now in rather reduced production; and the stocks are low. Prices are still based on about 16s. per ton f.o.b.; but it is expected that the next contracts may see higher prices for gas coke.

Scotch Coal Trade.—The demand for all classes continues, and prices are fully maintained. There are several gas coal contracts still to be completed; and the prospect is not very encouraging to managers. The prices quoted are: Main 14s. to 14s. 3d. per ton f.o.b. Glasgow, ell 15s. 6d. to 16s. 9d., and splint 14s. 9d. to 15s. The shipments for the week amounted to 213,736 tons—an increase of 6268 tons upon the preceding week, and of 23,421 tons upon the corresponding week of last year. For the year to date, the total shipments have been 3,105,582 tons—an increase of 653,556 tons upon the same period of last year.

Sales of Stock and Shares.—At the Mart, Tokenhouse Yard, E.C., last Wednesday, Mr. Alfred Richards sold by auction 2500 fully-paid £10 ordinary (7 per cent.) shares in the West Ham Gas Company, at from £11 5s. to £13 15s. each; the average being £11 13s. 11d., which will yield the purchaser £5 19s. 8d. per cent. The total amount produced by the sale was £29,243. At a sale of £1500 of "E" stock on the previous day, the prices realized were at the rate of £190 per £100 nominal. The dividend under the sliding-scale is 8½ per cent. per annum.

A Cumberland Water Scheme.—The Overwater and High Ellen water scheme—the biggest of its kind yet contemplated by Cumberland Councils—was revived at last Tuesday's meeting of the Wigton Rural District Council. It is proposed to supply the Wigton, Aspatria, Holme, Cultram, and neighbouring districts from Lake Overwater and the upper reaches of the River Ellen. Engineers estimate the cost of the trunk main at £30,000. The Wigton Council were now asked to state whether they intended to support the comprehensive scheme, or leave it to private enterprise. Before arriving at any definite conclusion, it was decided to approach the Wigton District Council, with a view to a supply of water being secured from their mains for the districts below Wigton.

Sale of the Old Hull Gas-Works.—The unsold portions of the old gas-works in Broadley Street, Hull, which were to have been disposed of by public auction, have been purchased privately by Messrs. Mordaunt, Lawson, and Co., of Middlesbrough, for breaking-up purposes. They have been allowed three months for clearing them away. It is locally reported that the price which the Corporation will receive exceeds by several hundred pounds the amount which the sale by auction was expected to realize.

Georgetown (British Guiana) Gas Company.—The report of the Directors submitted at the half-yearly meeting of the Company last Tuesday stated that the profit for the half year ended Dec. 31 last amounted to £50 7s. 11d., and after adding the balance from the previous six months and transferring the sum of £100 from the reserve fund, the balance remaining, after deducting interest on bonds, &c., was £3 14s. The Directors were therefore unable to recommend the payment of any dividend. The report and accounts were adopted without comment; and the retiring Directors (Messrs. Alfred Lass and H. W. Andrews) and Auditor (Mr. H. J. Hartley) were re-elected. Owing to the small attendance at the meeting, it was agreed, on the suggestion of the Chairman (Mr. Charles Gandon), to adjourn the proceedings till the 29th inst., when it was hoped that as many of the shareholders as possible would make it convenient to attend.

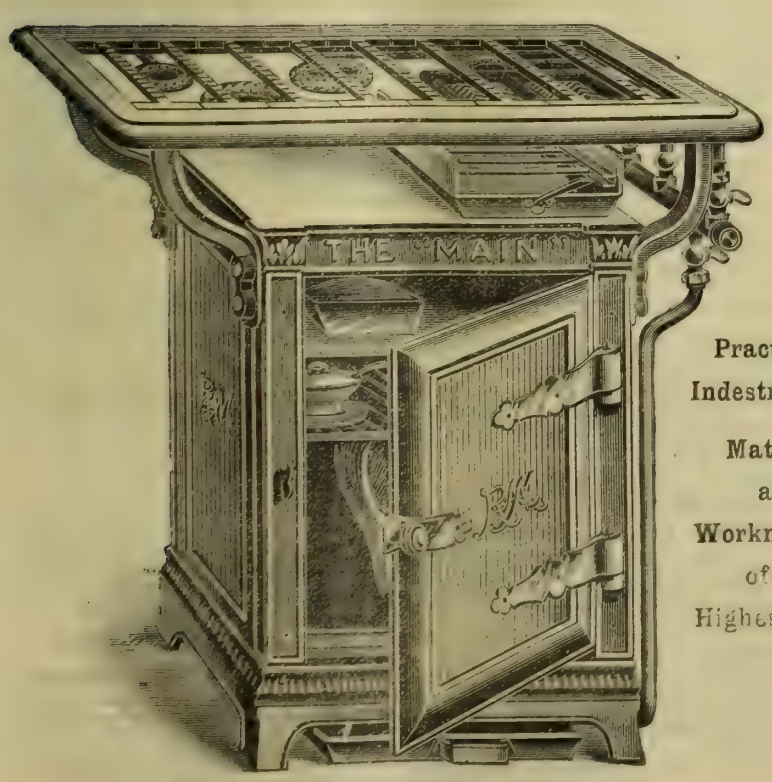
Fatality at the Beckton Gas-Works.—Last Tuesday, Mr. George E. Hilleary concluded an inquiry into the death of John Lavis, 38, lately a labourer in the purifying department of the Beckton Gas-Works, who returned home from work on the afternoon of the 11th ult., complaining of being ill. He began vomiting large quanities of blood, and died on the following morning. Mr. Thomas Goulden, the Superintendent of the works, said he heard of nothing unusual on the day in question, when deceased and a number of other men were engaged in cleaning out one of the purifiers; in fact, he had never before known of men getting "gassed" in the purifiers. Since Lavis's death, two other men had suffered through the gas, and had not been able to come back to work. Before the men entered the purifier to cleanse it, the cover was taken off and air blown through it for six hours. He did not think that after that time there would be any dangerous places. Dr. Jordan Harvey stated that at a *post-mortem* examination he found the body was stained a yellowish green colour, while all the internal organs were a dark grey. Death was due to shock through some noxious agent in the blood, but it was not ptomaine poisoning, although he was unable to say what the agent was. Dr. Atkins Grogono, who, in company with Dr. Pepper, of St. Mary's Hospital, made a subsequent examination, partly agreed as to the staining of the body, and said the cause of death was sulphuretted hydrogen poisoning through inhaling the gas. The symptoms were not consistent with ptomaine poisoning. Dr. Pepper disagreed with this, and said that, in his opinion, the appearances pointed to ptomaine poisoning; while Mr. Goulden (recalled) said that it was impossible for deceased to have inhaled the sulphuretted hydrogen gas in the purifier. The Jury returned a verdict that deceased died from sulphuretted hydrogen poisoning, and added a rider that, in their opinion, sufficient precautions were not taken in purifying the house in which deceased worked.

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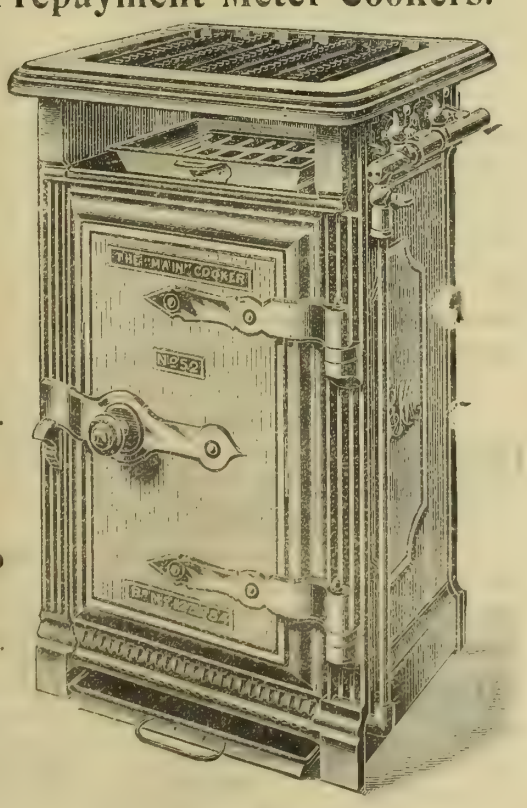


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Lambeth Water-Works Company.—The Directors of this Company have decided, subject to audit, to transfer £10,000 to the contingency fund, and to recommend the payment of a dividend for the past half year at the prescribed rates of 10 per cent. and 7½ per cent. per annum respectively on the share capital of the Company, together with a further payment at the rate of ½ per cent. per annum on both classes of shares on account of arrears of previous dividends; leaving about £2000 to be carried forward after making provision for the statutory payment to the sinking fund.

Brixham Water Supply.—After some months of unavailing effort, the members of the Brixham District Council have decided to abandon the search for water for the supply of the locality. Half of the loan of £500 sanctioned for the purpose of finding a water supply has been expended, and the charges in respect of this involve a rate of 1d. in the pound. The Water Committee, who formerly had oversight of the operations, were in favour of continuing them; but the Committee appointed after the recent election of the Council decided to abandon the works, and a majority of the Council have approved of this course.

Okehampton Water Supply.—Proposals for improving the water supply of Okehampton have been under the consideration of the Town Council for a considerable time, and recently a scheme which is to cost £1600 was adopted, subject to the approval of the Local Government Board. At a meeting of the Council last Wednesday week, it was stated by the Mayor (Mr. R. F. Brealy) that the question of the supply of water was becoming very pressing. A meeting of the ratepayers had been held, at which resolutions were passed calling upon the Council to urge the Local Government Board to sanction the scheme as soon as possible, and in the meantime to take steps to stop the leakage, and make the best of the present supply. Many of the pipes were undoubtedly worn out, and the system generally was very defective. It was decided to consult a water engineer both as to the present supply and the proposed scheme.

Suggested Purchase of the Aldershot Gas and Water Works by the District Council.—At the meeting of the Aldershot District Council last Wednesday, the youngest member of the body—Mr. C. A. L. Calvert—distinguished himself by submitting a proposal for the purchase of the undertaking of the Gas and Water Company. He did not, however, appear to have very seriously considered the financial aspect of the question; and his proposal was severely criticized by one of the members. In the result, the question was referred to a Special Committee. The suggestion is not being favourably regarded by the local Press. It is estimated that the purchase would cost about £400,000, and entail an annual expenditure of £14,300; and the ratepayers will probably hesitate to take this burden upon themselves in face of the Council's scheme of electric lighting, and the possibility of the Government providing their own water supply, and extending their already formulated project for putting in the electric light.

Slough Gas Company.—The half-yearly general meeting of this Company was held last Tuesday—Mr. R. Martin in the chair. The Directors reported that the net profit for the six months covered by the accounts would enable them to recommend the payment of the statutory dividends. In moving the adoption of the report, the Chairman said the Directors had already lowered the price of gas 3d. per 1000 cubic feet, and they had intended to reduce it another 3d.; but they found they could not do it, as coals had gone up to such an extent that the cost to them would be increased £800 a year. Coals which they had been buying at 15s. 11d. a ton had gone up to 24s. 6d. He attributed this to a "ring" of the coalowners, and he hoped they would burn their fingers with it. He thought the Directors would be able to pull through without raising the charge for gas; but he found that all round the neighbourhood the gas companies were putting up their price 6d., 9d., and 1s. per 1000 cubic feet. The report was adopted.

The Dorking Local Authorities and the Water Company's Bill.—At the last meeting of the Dorking Urban District Council, Mr. Palmer reported the result of the joint action of the Committees of the Urban and Rural Councils in regard to the Bill of the Dorking Water Company. Having read the new clauses, he proceeded to point out that it had been suggested to him whether provision could be obtained whereby it would be unnecessary for the Council to apply to Parliament in future—in other words, whether the present Act should include provisions under which the Council could purchase. He instructed the Clerk to place the matter before their Parliamentary Agents, who replied that the suggestion could not be carried out, as it would practically make the Bill one for compulsorily obtaining the undertaking of the Company. It therefore went through with the clauses prepared by the Sub-Committee. Mr. Palmer further stated that the Council were empowered to apply for a Bill in the next or the succeeding session; and after this Bill was passed, they had power within, he believed, twelve months to exercise their option. He took it that it would be advisable for the new Council to seriously consider the advisability of bringing the matter to an issue at once.

Progress of the Birmingham Water Scheme.—The Chairman (Alderman Lawley Parker) and members of the Water Committee of the Birmingham Corporation left the city for Wales on the 26th ult., for the purpose of inspecting the progress of the work in connection with the Elan water supply. On their arrival, a consultation took place with the Engineer (Mr. J. Mansergh), the Town Clerk (Mr. E. O. Smith), and the Resident Engineer (Mr. Yourdi). An early start was made on Friday, and the Committee first inspected the submerged dam at Caregddu, where the viaduct arches present a marked feature—stretching nearly across the valley. Subsequently the party visited the dams at Craig Coch and Pen-y-Gareg, at both of which places a good idea can now be formed of the ultimate height of the dams. Returning to the Caban Coch, an inspection was made of the dam. Here the masonry of the centre and final section has recently been commenced. The afternoon was spent in a visit to the village and the works in the Claerwen Valley, above Nantgwillt, where the boring of the tunnel to carry the waters of the Claerwen to the Caban reservoir above the submerged dam is now in progress. The Chairman took the opportunity, on behalf of the Committee, of congratulating Mr. Mansergh on his appointment to the presidency of the Institution of Civil Engineers. The party returned to Birmingham on Saturday.

The Malvern District Council have decided to apply for a further loan of £3000 for the purchase of gas cooking-stoves and slot meters.

The issue of 1500 new ordinary £10 shares by the Pontypridd Water-Works Company has resulted in a premium of about £5600. The issue was over applied for by £10,000.

Mr. Joseph Eden, of Workington, has been appointed Engineer for the new water-works of the Corporation at a salary of £650 per annum; and he is to have the assistance of Mr. E. M. Eaton, M.Inst.C.E., for consultation purposes.

We have received from the Commissioner for Labour (Mr. H. Llewellyn Smith) a copy of the "Directory of Industrial Associations in the United Kingdom, including Employers' Associations, Trade Unions, Boards of Conciliation and Arbitration, and Workmen's Co-operative Societies," recently issued by the Labour Department of the Board of Trade.

Mr. H. Simmonds, the Engineer and Manager of the Bury Corporation Gas-Works, has had his salary raised by £150 per annum. In submitting the proposal at the meeting of the Council last Thursday, the Mayor (Mr. Byrom) made a very appreciatory reference to the work of Mr. Simmonds during the two years he has been in the service of the Corporation.

The Local Government Board have definitely decided that they have no power to sanction a loan to defray the costs incurred by the Newhaven District Council in promoting and opposing Water Bills in Parliament. The amount is £2462; and it is calculated that this practically means a 2s. 6d. rate. The Council have referred the matter to the General Purposes Committee for their consideration.

The death recently occurred in Paris of an aëronaut from poisoning by hydrogen arsenide, which escaped from his balloon. The occurrence, says "La Nature," points to the necessity of purifying the hydrogen used for balloon purposes. The balloon was filled in the ordinary way, and nothing peculiar was noticed in the character of the gas; but some hours afterwards the persons who had assisted in the operation were taken seriously ill, and one of them did not recover.

Exhibitions of gas appliances have lately been held by the following firms: The Davis Gas-Stove Company, Limited, in Bristol; Messrs. Fletcher, Russell, and Co., at Gorleston, Newcastle, Norwich, and St. Helens; Messrs. R. & A. Main, Limited, in Bristol and Dundee; Messrs. John Wright and Co., Limited, at Leeds and Norwich; and Messrs. Wilson and Mathieson, Limited, at Bury. Lectures and demonstrations for the various firms were given by Miss Dodds, Mrs. Fennah, Mrs. C. Laughton, Mrs. C. F. Pitcher, Mrs. H. M. Young, and Misses Betts, Birkett, Brown, Holroyd, and Wilkinson.

The Otto Hilgenstock Bye-Product and Non-Bye-Product Coke-Ovens and Coal-Washing Company, Limited, has been formed with a capital of £100,000, in £5 shares, to adopt and carry into effect an agreement for the acquisition of certain patents relating to improvements in the construction of coke-ovens, and to develop and turn them to account; further, to "roast, prepare, and otherwise deal with" coal, sand, cannel, &c.; to make coke and extract tar, oil, gas, and other residual products from the same; to construct and maintain coke-ovens, furnaces, gas-works, retorts, works, plant, and machinery, with or without rail or tram roads, and for other purposes.

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CONTENTS.

EDITORIAL NOTES:—

GAS, LIGHTING, &c.— PAGE.

Rejection of the Portable Photometer Bill. 1271
The Prepayment Meter Part of the London County Council Bill. 1272
The Gaslight and Coke Company's Bill in Committee 1272
Concerning an Export Duty on Coal 1272
The Coal and Iron Markets 1273
Examinations in Gas Manufacture 1273
The Fall in Gas Stocks 1274
Illicit Commissions Exposed. 1274
Housing the Working Classes of Towns 1275

INSTITUTION OF GAS ENGINEERS:—

GENERAL MEETING IN LONDON—
Papers and Discussions (*concluded*)—
Inclined Retorts at Banksîde. By C. C. Carpenter 1275
The Presence of Naphthalene in Coal Gas: Its Detection and Extraction. By Wilfred Irwin 1282
Notes on Carbonizing Cannel and Shales for Gas-Making Purposes. By S. Glover. 1286
Some Examples of Tank Construction. By F. W. Stevenson . 1290
An Experiment with a Concrete and Expanded Metal Structure. By A. Baker 1292

ESSAYS, COMMENTARIES, AND REVIEWS:—

Gas and Water Companies in the Stock Markets 1294
Electric Lighting Memoranda 1294
On the Tyranny of the Laboratory 1294
The Press and the High Price of Coal 1295
Recent Publications—"Iron Corrosion, Anti-Fouling, and Anti-Corrosive Paints;" "The Boroughs of the Metropolis: A Handbook to Local Administration in London under the London Government Act, 1899;" "Elementary Practical Physics;" "Elementary Practical Chemistry and Qualitative Analysis;" "Introduction to Physical Chemistry" 1296

NOTES:—

The Use of Oil for Laying Dust 1297
Collapse of a Concrete Bridge in Paris. 1297
Proper Position of Air Inlets and Outlets for Ventilation . . . 1297
Krypton 1298

COMMUNICATED ARTICLE:—

The Question of an Export Duty on Coal. By a Correspondent . 1298

TECHNICAL RECORD:—

The Incandescent Gas Mantle and Its Use. By Vivian B. Lewes, F.I.C., F.C.S. 1299
The De Brouwer Coke Conveying and Elevating Plant at the Crystal Palace Gas-Works 1302
The Manufacture and Application of Water Gas. By Carl Dellwik. 1303

CORRESPONDENCE:—

Mr. Carpenter's Paper on Inclined Retorts 1305
The Paris Exhibition 1305
Progress in Gas Matters 1306

PARLIAMENTARY INTELLIGENCE:—

Gleanings from the Committee Rooms. 1306
House of Commons Committees—
The Gaslight and Coke, Commercial Gas, and South Metropolitan Gas Companies Bill 1307
The Gaslight and Coke Company Bill 1313

LEGAL INTELLIGENCE:—

The Final Stage in the Sutton, Southcoates, and Drypool Gasholder Case. 1318
Central Criminal Court—Regina *v.* Norris; Serious Charge of Falsification of Accounts 1318
Unprotected Trenches 1318
Embezzlement by a Sheffield Gas Collector 1318

MISCELLANEOUS:—

Intensified Gas Lighting in Leeds 1319
Meeting of the Bombay Gas Company, Limited 1319
Dukinfield Gas Department—The Past Year's Working . . . 1319
Burslem Corporation Gas Supply 1319
Electric Lighting Notes 1320
Gas and Water Companies' Stock and Share List 1320
Notes from Scotland 1322
Current Sales of Gas Products 1323
Coal Trade Reports 1324

PARAGRAPHS:—

PERSONAL: Mr. W. H. Maxwell, Assoc.M.Inst.C.E.; Mr. H. C. Page; Mr. Walter Grafton; Mr. Andrew Dougall; Mr. Edward Sandeman. 1297
OBITUARY: Mr. Thomas Burt Haywood; Mr. Edward Willis; M. Eugéne Breittmayer 1297
A Lecture on "Artificial Lighting" 1275
Sunday Labour in Gas-Works—The Association of Gas and Water Engineers of Austria-Hungary 1293
The Visit of Gas Engineers to Woolwich Arsenal—German Association of Gas and Water Engineers 1298
The Wath and District Gas Company's Provisional Order . . . 1323
The Gas and Water Finances of Loughborough—Local Authorities and Incandescent Gas Lighting 1324
Suggested Advance in Price at Manchester—Gas Consumers' Complaints at Birmingham—Gas-Works in the Market—The Price of Gas at Totnes—Sales of Shares. 1325
Carburetted Water-Gas Plant for Oldham—Liverpool Gas-Fittings Company, Limited—Bathurst (N.S.W.) Gas Supply—Stratford-on-Avon Gas Committee and the Rates—Water-Works Extensions Required at Harrogate—A New Gasholder for Maidstone—Ipswich Corporation Water Department 1326
The Purchase of the Gainsborough Gas-Works—The Profits of the Heywood Gas Department—Retrospective Increases in Price—Mid-Sussex Water Supply—The Geltsdale Water-Works for Carlisle—Incandescent Street Lighting at Plymouth—The "Builder" Condemns the London County Council Testing Bill 1327
The Bolton Corporation Water-Works—The Cape Town District Water-Works Company and the Municipalities—The Honley District Council and the Gas-Works—Water under Cost Price to Large Consumers at Bradford—Bridgnorth Gas Supply and Electric Lighting—Evesham Corporation Gas Supply—Wallasey Water Supply—North Warwickshire Water Supply 1328

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

EDITORIAL NOTES.

Rejection of the Portable Photometer Bill.

THE rejection by a House of Commons Committee, after an exhaustive hearing, of the proposal of the London County Council to establish an auxiliary system of penalty testing of London gas by the means of portable photometers, is to be hailed as a notable act of deliverance of the gas industry of these kingdoms from what would have been intolerable and disastrous tyranny. Conceived in officialism, fostered by bureaucratic meddlesomeness, and nurtured upon the blindest obscurantism, the Portable Photometer Bill of the London County Council was one of the most mischievous of all the uncalled-for projects of legislation which this disappointing body have yet fathered. Reactionary to a degree, hopelessly contradictory of every dictate of the most enlightened intelligence, native and foreign, which has been occupied of late years with, and is still concentrated upon, the practical problem of making the very most and best use of town's gas as an aid to the advancement of material civilization, this proposal had just that colouring of plausibility which rendered it an attractive bait for those narrow-minded and short-sighted busybodies who style themselves "Progressives" in parish politics. Unquestionably it sounds perfectly fair and reasonable that every gas consumer in the length and breadth of London, or of any other gas district, should have supplied to him, wherever he wants it, town's gas of the illuminating power required by the Act of Parliament regulating the undertaking for the particular area. This contention being established, what more natural than that the Local Authority should ask to be empowered to see that the obligation is duly discharged? And how can this be done better than by testing the illuminating power of the gas anywhere and everywhere, by a proper and suitable instrument duly certified as a fit and accurate appliance by competent and impartial authority, and used in a fair and proper manner? This was the plea preferred by the London County Council; and a stiff one it was to meet with an uncompromising negative, on the face of things.

Besides, this *prima facie* case for peripatetic photometrical testing, as it might have been stated at the beginning of the practice of examining town's gas for illuminating power, was supported by evidence carefully prepared to prove that the actual system, of testing only at fixed stations, is unsatisfactory in its results. One of the Gas Referees (Mr. Vernon Harcourt), whose duty it is to see that the existing system is adequately and properly applied for the protection of the consumer, and who can with this object appoint as many testing-places as they choose, gave it as his opinion that the system is no guarantee that the gas supplied all over the district is up to the parliamentary standard. Several capable photometrists carried the case for supplementary testing a point further, by bearing witness to the fact that the gas commonly supplied to Board Schools and other buildings of a public character is not, as a rule, of so high an illuminating power, as shown by a portable photometer, as the gas at the statutory testing-places. It was also proved that the instrument employed to make these peripatetic tests is identical with that used at some of the regular testing-stations; and Mr. Vernon Harcourt himself said that he thought the conditions for the fair use of such an instrument could be satisfactorily prescribed. Other witnesses declared that they could see no reason why the gas in every house in London should not be of the same illuminating power as that found at the official testing-stations.

Having regard to all this portentous mass of presumption, assertion, opinion, and insinuation, it may be freely conceded that the onslaught on the London Gas Companies was not a contemptible one. If the cause had come before a tribunal composed of men who are carried away by the first tale they hear, so that their original state of innocence passes at a bound into bondage to a set prejudice—we have all met such men on juries—then the fate of the gas consumers of London would have been hard indeed. Happily, Parliament was justified by this Committee; and when the turn of the real gas experts came, their evidence crushed out flat the entire fabric which the promoters of the Bill had so laboriously erected. This fabric rested partly upon a distinct imputation of fraud, or double-dealing on the part of the Gas Companies. The promoters shrank from the responsibility of making this charge against the Companies or their officers, but a large bulk of the evidence offered had no other meaning. All

this part of the case quickly went to the winds. Next, the disparity between testings inside and outside the official stations was shown to be a matter of sampling and conditions of experiment. The idea suggested, rather than put in form, to the Committee, that 16-candle gas, or gas of any other illuminating power, is an entity like beer or butter, always to be had on tap, "of the nature and quality de- "manded by the purchaser," gradually vanished as knowledge grew of the number and importance of the conditions that go to the construction and use of a reliable photometer. At last, the Chairman incidentally talked of "dead" gas; and then the Counsel for the County Council began to think of their next engagements. Obviously, to admit one condition as essential to the satisfactory sampling of gas for testing, or the conduct of the test itself, opens a door which, as the French proverb has it, must be either open or shut. Once set it ajar, and in march the Referees, with all the pomp and circumstance of their statutory prescriptions, not one jot or tittle of which has any man condemned as superfluous. Rather is it questionable whether the Referees' system is sufficiently exacting.

Finally, the responsible heads of the three London Gas Companies came, one after another, to enlighten the Committee as to what they hold to be the nature of the Companies' obligation under the illuminating power clauses of the respective Acts, and how this is met. As Gas Companies, they are bound to provide gas of the character prescribed; and they do supply it, under the stipulated conditions. It is a matter of no business interest to a Gas Company whether Parliament requires the supply to be of 14, 16, or 20 candle power. The consumers have to pay accordingly; that is all. Illuminating power, price, and the allowed amount of profit for carrying on the business, are all part of one bargain; and no single element can be disturbed without destroying the balance of the whole. The factitious nature of this particular attempt to upset the gas settlement of London, the utter absence of any real need, or even any popular demand, for the provisions of the Bill, was exposed in scathing language by Mr. Littler; and in the event, this last desperate effort of the Old Guard of Official Photometry, as one hopes it will be—the Photometry which is nowhere without Penalties—was beaten off, with heavy loss. As Mr. Livesey said, in a passage which evidently impressed the Committee, Gas Companies do not require antiquated administrative machinery to keep them up to the mark set by their rivals in trade. The public want cheap gas, and plenty of it; and to offer them instead, at enormous expense, an immaculate record of official gas-testings, pleasingly set out with a list of fines testifying to the vigilance of the Gas Examiners, is a policy of mandarins, not of men of their time.

The Prepayment Meter Part of the London County Council Bill.

As had been arranged, that part of the Bill of the London County Council for the further regulation of the affairs of the Metropolitan Gas Companies which relates to prepayment meter supplies, was taken by Mr. Oldroyd's Committee immediately following the Gaslight and Coke Bill. These proposals are all of a piece with the meddling and muddling suggestions already rejected by the Committee. They proceed on the assumption that the Gas Companies need official regulation at every turn, and are peculiarly obnoxious, inasmuch as they could only obstruct and make more expensive an enterprise which is fraught with incalculable potentialities of benefit to the poorer classes of London householders. It is a new departure in business which the Gas Companies have made, altogether outside their statutory obligations; and the County Council want to be "down upon it," in the worst spirit of bureaucratic fussiness. Nobody can say what further or other modifications in their system of doing business the London or any other Gas Companies may be called upon to make, as time goes on. Ten years ago, the idea that the big London Gas Companies would be selling their product by the pennyworth, would have raised a smile anywhere. Why in the world cannot the London County Council leave it alone? Simply because they wish to be able to pose as champions of the poor gas consumer, whose real needs they know so little of that they wanted to make his gas dearer in the name of photometry. The only sound and wise policy for Parliament and Local Authorities to pursue in regard to the technical and administrative experimental developments of the gas industry, is to give them the fullest liberty and scope in all respects where the major interests of the public are not directly threatened. We see the influence of this new idea in the reluctance manifested by Government to act upon the findings of the Home Office Departmental Committee on Carburetted Water Gas. Liberty is the key to real progress—the liberty of the subject, as Sir James Fitzstephen finely put it. Nobody asks that the gas industry shall be lawless; but the less it is wrapped in the bands of red-tape, the better for its healthy development.

The Gaslight and Coke Company's Bill in Committee.

Mr. Oldroyd's Committee took a day off on Tuesday, at the request of Counsel, and sat again on Wednesday and Thursday to deal with the Gaslight and Coke Company's Bill. This Bill, as our readers have been informed, is for further capital; the amount asked for being £2,500,000, to be raised as 3 per cent. debenture stock. The Bill also seeks to regularize certain transactions of the Company in land; but this is incidental. Practically, it is a Money Bill pure and simple; and is in this respect a *replica* of the Bill which the House of Lords threw out last session. This identity of object was made a virtue of by the promoters, as indicating that they only ask for those additional capital powers which are indispensable to the future existence of the undertaking. The Company demand from Parliament that which has never been denied; and they engage to raise the money in the cheapest possible way. The opposition to the Bill, on the part of the Corporation of London and the London County Council, backed up by many Metropolitan Local Authorities, is based upon the contentions that the sum asked for is excessive, and that the Company ought to have made an effort to meet the recommendations of the Powers of Charge Committee. The opponents did not offer evidence, on the ground that there is nothing fresh in the Bill to differentiate the promoters' case from that which failed to obtain the approval of Parliament last session. To the Company's plea of urgent need of capital, the retort is made that having been away from Parliament, in this regard, since the session of 1876, the petitioners have only themselves to blame if they are driven into a corner. With regard to the amount of additional capital demanded, the opposition say that if they obtained it the Company could keep away from Parliament for another fifteen years, which would be against public policy and specifically counter to the recommendation of Sir James Rankin's Committee which suggests that Gas Companies ought to come before Parliament every five years. To the question why the Bill takes no notice of the findings of the Powers of Charge Committee, the Company's answer is that these relate to matters that do not arise on a question of a fresh issue of debenture capital. To this, the opposition reply that capital is capital, by whatever name it is called; and they do not mean to let the mere words "debenture stock" excuse the Company for what they describe as contemptuous treatment of the result of the labours of the Powers of Charge Committee. There, for the present, the matter rests; for after two days' hearing, and a prolonged consideration in the cleared room, the Committee announced that they would give their decision on the preamble to-morrow.

Concerning an Export Duty on Coal.

In another column we give the views of a correspondent on the question mooted in an "Editorial Note" on the 24th ult. as to whether an export duty on British coal could now be justified on economical grounds. He replies to the question in the negative; and the answer shall go without contradiction from us. We merely repeated a question that cropped up elsewhere; but it may be confessed that we were not oblivious of the particular case of gas coal, the prices of which had been reported to have hardened in consequence of heavy foreign purchases. Our correspondent, if he has a fault, has that of treating the whole question on generalities, without going sufficiently into detail proofs. Supposing that the obligation to pay a five-shilling duty on British coal were to keep a possible foreign buyer out of the British market just when prices were trembling in the balance, would not the coalowner come to easier terms with the home purchaser? It is a little difficult to understand, on the general principles of the political economy of the schools, why the price of such a commodity as gas coal should double itself within a couple of years. Was it too cheap in 1897, or is it too dear to-day? It is one of the unsatisfactory features of economical science that it does

not help the expert in its principles to make better bargains than the ignorant and foolish. Like the science of meteorology, which is all observation and statistics, it does not enable its votaries to foretell much within its own purview. This is the main reason why political economy is popularly regarded as chiefly for the use of schools. And when anyone speaks of the "laws of political economy," would it not be very much better to call them the laws of Political Economists?

There has been far too free a use of the word "law," when all that is meant is a probable deduction from more or less accurately observed and well understood data, reposing on faith in some individual. Dr. Poynting, in his address to the Mathematical and Physical Section of the British Association last year, confessed that most of the so-called physical laws of his acquaintance—including that of gravitation, instanced by our correspondent—are merely "brief descriptions of observed similarities." He wished to get rid of the term altogether. It can never be forgotten that the so-called "laws" of the Cobdenites were held by them to militate against the acceptability of the Factory Acts; and that so strong an Economist as the late Duke of Argyll drew the line at labour, in respect of the sanctification of the "law" of the "higgling of the "market" as determining value. Suppose this country possessed one vein of coal—a natural deposit, of altogether unique and superlative value for some particular purpose—should we be justified in retaining it for our own uses, or should we let the Frenchman have it for a higher bid of sixpence per ton? We may be wrong; but we entertain the suspicion that scholastic political economy has no answer for this question. If there is an answer in the writings of the Economists, it would be well to know it. Meanwhile, it is at least arguable that the only unmistakeable general "law" of economics is the same unique law that Clerk-Maxwell recognized in the world of physics—the law that "the greater of two forces controls the less." It is in the discernment of the forces that the difficulty lies.

The Coal and Iron Markets.

The announcement that the coalowners have decided to demand an all-round rise of 5s. per ton on their contracts with the Railway Companies has caused some considerable stir, not only in the commercial world, but among the public generally; far more so indeed than the knowledge that a similar, and even greater, increase is being obtained from the Gas Companies, who, as a matter of fact, are in the aggregate slightly bigger consumers of coal than the railways of the kingdom. This more noticeable flutter is probably due to the increase being announced somewhat in the form of an ultimatum, and in no small measure to the fact that—owing to the greater difficulties in the way of the Railway Companies shifting the burden of increased working expenses on to their customers—the effect upon railway dividends (never a very handsome return upon investments) will, if the coalowners get their way, be more severe than upon those of Gas Companies. Whether the increase demanded—equal to about 50 per cent. over the prices ruling in the contracts now expiring, and which were themselves higher than in previous years—will be acceded to by the Railway Companies remains to be seen; but there is no doubt the Companies will have to submit to a very material advance.

The economic effects of the state of the coal market—and, be it added, the determination of the coalowners to push their advantage to its utmost limits—are now beginning to be widely felt; and signs are not wanting of the approach of a decided reaction in the sister market, that of the iron and steel trades. The first quarter of that market to give evidence of the throttling effect of ruling prices is the shipbuilding trade, the activity in which during the past two or three years (and especially during 1899) was to no small degree instrumental in bringing about the high price of iron and steel. For the past two months, however, fresh orders for ships have been as rare as snow in summer; and, although the yards began the year very full of work, slack times are within measurable distance. Inevitably so; for no Shipping Company, unless driven to do so by necessity, would place orders for vessels while the present prices for material and labour are maintained. There is too much uncertainty in the freight world to induce merchants to embark upon new business with a permanent handicap of 50 per cent. more capital on which to earn profit per ton of shipping. The same consideration will naturally commend itself to the mercantile world (as we have more than once brought to the notice of gas people), and is even more forcible in its reasoning in the case of the former—namely, that the present is just the very worst possible time for the expenditure of capital.

Apart from this growing tendency of high prices to hamper trade and reduce the volume of business, another influence is at work which is likely to bring down the prices of iron and steel to a more reasonable level. We mean the fear of American competition. It has been well known for some time that American iron and steel manufacturers are only waiting for a lull in their home trade, or until they have increased their plant capacity so as to be able to manufacture more than the home market can consume, to make a determined attack upon the English and European markets. A series of articles, written by a correspondent who has recently visited the United States, is now appearing in "The Times" containing many interesting facts concerning the methods of American manufacturers, and their designs upon English trade, to which we shall probably later on refer at greater length. For the present, it is sufficient to note that reports of over-production in the States, and of purchases therefrom by English consumers, have of themselves been sufficient to cause something almost resembling a panic in the iron and steel markets not only here but in Germany, and prices are beginning to crumble.

We are far from imagining that anything like a return to normal prices is near at hand. Manufacturers are too well sold ahead, and stocks are too low—those in warrant stores stood at 299,971 tons on the 1st of this month, as compared with 710,916 tons and 652,837 tons on the 1st of May in each of the last two years—for anything but purely nominal and speculative prices to be affected in the near future. But it is interesting and promising to note the extreme sensitiveness of the market to the threat of American imports. A little competition would be a healthy thing; for it is bad for trade generally, as well as for the direct consumer, for the market to be at the mercy of the manufacturers.

Meantime the exportation of coal goes on apace, though, fortunately, the monthly returns for April do not show the same increase over 1899 that was seen throughout the first three months of the year. Indeed the quantity exported was only 3,448,517 tons, as compared with 3,455,109 tons in April, 1899; but last year the month contained one more working day. However, the quantity shipped for the use of steamers engaged in foreign trade fell from 958,073 tons to 860,084 tons; and it is noticeable that, apart from the exports to Russia, Sweden and Norway, Germany, Holland, and France, the shipments show a marked falling off. That is to say, the more distant markets are being supplied from other sources—probably America; and the trade so lost will be with difficulty recovered. But until the coal trade in Russia, Germany, and France becomes easier, the exports will continue to be greatly in excess of the normal. For the first four months of the year they exceeded the shipments during the same period in 1898 by $2\frac{3}{4}$ million tons; while the money value was more than double. There are worse fates than that of being a coal proprietor in this present year of grace.

Examinations in Gas Manufacture.

We published last week the questions set at the recent City and Guilds of London Institute Examination in "Gas Manufacture," and also an abstract of a paper on the subject of such examinations read the other day by Mr. S. E. Halliwell at a meeting of the Manchester and District Junior Gas Association. Mr. Halliwell expresses accord with the views advanced in the "Journal" last year, in reference to the Honours paper in the City and Guilds Examination—namely, that it is a physical impossibility for any but a lightning worker and draughtsman to do himself anything approaching justice in the attempt to answer, within the space of a bare three hours, ten questions of the scope and character which mark those set in the higher grade of that examination. Mr. Halliwell also endorses our opinion that there is sufficient work entailed in the answering of those questions to occupy students for twice the time allowed; and he makes, as an alternative proposal to that we put forward—of dividing the examination into two separate papers, dealing with "Manufacture" on one evening, and "Distribution" on another—the useful suggestion that the division might possibly be made into one paper on the

"Engineering" and one on the "Chemistry" side of the science of gas manufacture, with a separate certificate in respect of each section.

We are in no way bound down to the division originally outlined. What we are concerned with is the rendering of the Honours certificate accessible to the student with the requisite knowledge and ability to answer the questions were he given reasonable time to do so, and not merely to prodigies of rapid writing and drawing. We are, therefore, glad to see that—whether or not in consequence of our criticisms we do not know, nor does it matter—a step has been taken this year in the right direction. Whereas, formerly, the examinee was expected to answer all the ten questions in either grade in the space of rather less than three hours (for time is always lost in reading through the paper, getting under weigh, and revising the answers written) the candidate this year was only required to answer eight out of the ten questions set. This, as we have said, is a step in the right direction; but it does not go far enough. Let any of our engineering readers, who have never been through the mill of this examination, take the Honours questions on p. 1238, and attempt to write answers to them in $2\frac{3}{4}$ hours, especially noting how long they require to make presentable and intelligible sketches describing the construction (1) of a regenerative furnace for heating a bed of gas-retorts, (2) of (*a*) a trussed, and (*b*) an untrussed, gasholder crown, and (3) of a gasholder without columns.

Apart from the question of the time allotted to the work of answering the questions, we would venture to make a further suggestion in reference to the examination, as to the nature of the questions set. Those questions range over the whole field of the many processes involved in the production of illuminating gas of standard purity from the coal delivered at the works, and require a thorough theoretical knowledge for their answering. But can it be said that the man who could give correct replies to every question would thereby have proved himself to possess any practical knowledge whatever? We think not. The whole of the Honours paper this year could be answered by a well-crammed student who had never been inside a works, or seen a main or service laid. It is, we know, a difficult matter to gauge a man's practical knowledge by a written, as distinguished from a *viva voce*, examination; but would it not be some test if a question were occasionally set—as such questions are put to candidates for Board of Trade Navigation Certificates—requiring the candidate to explain what course he would pursue at times of difficulty and danger such as occur in the history of every gas undertaking? The fracture of a trunk main, the tilting of a governor bell, a big fire or explosion on the district—without going inside the retort-house it is easy to multiply instances of occasions when the merely book-learned man would be useless. May we not learn a lesson from our present national experiences as to the inefficiency of "Staff College" training only? It would certainly advance the certificates of the City and Guilds Institute along the road to wider acceptance by employers as evidence of usefulness and capacity on the part of the successful candidates, were marks of distinction given to students displaying practical as well as theoretical knowledge.

The Fall in Gas Stocks.

On Friday week the "Financial News" contained a leading article on the subject of the fall in the market price of gas stocks. Their remarks on the subject were well informed, and the advice given—to hold on to this class of investments regardless of all attacks on them—was unexceptionable. The statement of the amount of the depreciation of the prices of gas stocks in some instances cited by our contemporary was very startling. Quite possibly some timid people may be frightened at it, and so contribute, by selling, to the aggravation of a state of things which is not at all alarming to those who know what it all means. Naturally, no well-advised Gas Company will attempt to sell fresh capital until the clouds roll by. The reaction is bound to come. Meanwhile, the public will continue to think that gas is in a very bad way, because coal is dear and the price of gas in very many places will have to be raised accordingly. In London, the fact that the London County Council had chosen this happy moment for worrying the Gas Companies about candle power, doubtless helped to depress the gas-share market. But dear coal is really at the bottom of the trouble, such as it is. Mr. Helps spoke rather sadly on this very subject at the meeting of the Institution of Gas Engineers the previous week; and we may notice that an electrical print quotes his vaticinations with unholy joy. There is, however, no comfort in dear coal for electricians, as many electric lighting undertakings learnt to their cost last winter. When an electrician gets hold of a piece of coal, it goes off in energy and smoke. He has no residuals to bless himself with. The gas engineer, as everybody knows, has other products of carbonized coal to sell besides gas; and he wastes practically nothing. The coalowner may pinch him for a year or two; but things in due course work themselves down to a natural level. It is no bad thing, on the whole, that the prices of gas stocks should have been smartly shaken of late. We have long argued that they were overvalued, for purely industrial stocks, even with the advantage of statutory protection. It will not hurt the gas industry in the long run if stocks can be bought to pay 5 or even 6 per cent. This is only to return to the conditions ruling fifteen years ago; and the times were not then thought bad.

Illicit Commissions Exposed.

The canker of illicit commissions has been laid bare during the last few days in the course of two remarkable and important law cases. The first was an action brought in the Queen's Bench Division to recover the amount of secret commissions alleged to have been paid by the defendant to the plaintiffs' servants, and for the return of alleged overcharges for goods sold. The proceedings are a disheartening disclosure of the way in which a certain class of City firms do business with their customers' "buyers." The plaintiffs were "sundrymen;" and they dealt, among other goods, in tobacconists' wares. It was alleged that the defendants, who supplied plaintiffs with this class of goods, systematically paid commissions to the buyers, as part of their trade expenses. The facts were not disputed; but it was pleaded that there was no conspiracy to defraud the purchasers. "The way in which the presents began to be "given was that witness (the firm) noticed that the business "with the plaintiffs was increasing; and it was suggested that "it would be as well to be on good terms with the buyers. "Witness had no fraudulent intention in making these pre-"sents; and the prices did not vary in consequence. These "presents came out of their profits. They were not pro-"portionate to the business done." The charges made to the plaintiffs had not been increased thereby. One of the ex-buyers, now in independent business, testified to having received presents from the defendants, but denied that they had influenced him in any way. Others said very much the same. On the evidence, the Jury found that there was no fraudulent conspiracy to raise prices; that the prices were not excessive; but that the unknown commissions did have some effect on the minds of the buyers, being the plaintiffs' agents, in inducing them to give the orders and pay the prices stipulated for. Damages—one farthing! The conclusion of the findings was evidently influenced by the particular circumstances, with which we are not here concerned. The important thing to notice is that, for the first time, the legal issue was raised as to the nature of customary gifts—almost "tips"—given out of the merchant's own pocket to the agents of his customer, with a view to make things pleasant and easy all round. Still, the transactions were of a fraudulent character, although no specific harm was alleged. The commission system was seen here at its best, so to speak, although the defendant could not deny that he had often given what were called Christmas boxes at Midsummer. The somewhat confused verdict of the Jury testifies, as the Judge remarked, to the difficulty of dealing with cases of the kind. As there may be an appeal, it is better not to comment further on the findings.

The other case was the criminal prosecution of F. F. Norris, late Secretary and Cashier of Frank Wright's Prepayment Gas-Meter Corporation, Limited, on a charge of misappropriating money and making false entries in the books. He denied that he had used the money for his own purposes, and asserted that it had been expended in paying secret commissions in connection with the business of the Company. The Directors of the Company stated that they never gave any authority for the payment of secret commissions and had no knowledge whatever that such payments were made. In view of the possibilities of this case, we arranged for a special report of it to be taken; but, in the circumstances, we shall not give publicity to all that was said by the prisoner to exculpate himself. He was found guilty, and sentenced to five years' penal servitude. It is a sad record; and who shall say how far the prospect

of obtaining immunity from detection under the pretence of giving commissions tempted this wretched man to his fall? That is one of the very worst incidents of the whole rotten system. It is impossible to tell who is or is not honest, for money cannot be traced. If the Lord Chief Justice's Bill were law, the documents in such a case would be impounded with a view to further proceedings; and this consideration ought to act betimes as a deterrent to those who have been brought up in, or have fallen in with, the notion that tips, treats, and commissions "to ease the way of trade" are not reprehensible.

Housing the Working Classes of Towns.

The Government Bill for the Better Housing of the Working Classes in towns was discussed last Thursday in the House of Commons, and unfortunately not advanced. Most of the adverse criticism on the measure is directed to what it does not contain—a very cheap and handy form of fault-finding. It is so easy to say of any proposal for helping a movement of reform, that it is good so far as it goes, but that it does not go far enough. "Who goes softly, "goes safely," says the Italian proverb; and it is the greatest fault a Legislature can commit to pass laws ahead of public opinion, which is the only motive power that can be relied upon to carry them out. At this time, when the perfervid partisans of Municipalism are clamouring for all sorts of "trades" to be entrusted to Local Authorities, it is more than a little disconcerting to such thick-and-thin advocates to point out that in the matter of housing, Municipalities have failed to realize their powers, and have neglected their duty. It is very disappointing to find so-called Progressive Local Authorities exhausting their credit, and occupying their time, with a toy like electric lighting, when the same money might obliterate the plague-centres from their midst. The Government Bill proposes to enable Local Authorities to go outside their own areas to purchase land on which to erect workmen's dwellings. This is a step, and a considerable one, in a progress that must go by steps, if at all. The plain fact is that Urban Authorities generally have never taken up the cause of improved housing in a serious manner. Now and again some appalling statements about the number of people living in one room, and so forth, have been made in Parliament and upon platforms these many years past; and measures have been passed to enable Local Authorities to deal with the matter of over-crowding in various ways. But these powers have not been exercised. Any excuse has served to extenuate the neglect—difficulty of ascertaining the owners, difficulty of proving the existence of insanitary provisions, excessive cost of dealing with "areas." The real truth is that in hardly a single local government area in the country is the Medical Officer of Health properly supported, in the first place, or his recommendations wisely acted upon, in the second. Where Local Authorities have taken steps, it has usually resulted in the erection of huge barrack blocks, as to which, as Mr. Chaplin says, who knows how soon these structures will be condemned, even as the huge poor law schools of the last generation? An interesting point made by Mr. Chaplin was that the question of not requiring the money spent on land for building purposes to be repaid would be seriously considered by the Government. Another curious element in Thursday's debate was the readiness of members of Parliament to throw to the winds all the dictates of political economy when these conflicted with their other politics. The good old "law of supply and "demand" fared particularly badly on this occasion. Mr. Steadman advocated, with approval, a fair-rent court, which should dictate to landlords the amount of rent they are to take in cases where poor people are ready to bid against each other for accommodation. Where was the honoured shade of Cobden all this time?

A Lecture on "Artificial Lighting" was delivered, last Saturday week, before the Birmingham Association of Mechanical Engineers. The speaker, Mr. A. E. Edwards, dealt with several means of lighting, including the oil lamp, gas, electric, incandescent, acetylene, and arc lighting, and gave some interesting figures as to the lights obtainable by them. He spoke of the desirability of having workshops well lighted and painted with suitable colours; saying that if a room was coloured white, the lights in the room would give nearly 50 per cent. more illumination than they would do if the room were black. With reference to cost, the lecturer said that for small rooms incandescent gas lighting was at the present time the least expensive.

INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS,

MAY 1ST AND 2ND, 1900.

Mr. J. W. HELPS, M.Inst.C.E., of Croydon, President.

PAPERS READ.

[*Continued from p.* 1210.]

INCLINED RETORTS AT BANKSIDE.

By C. C. Carpenter, of London.

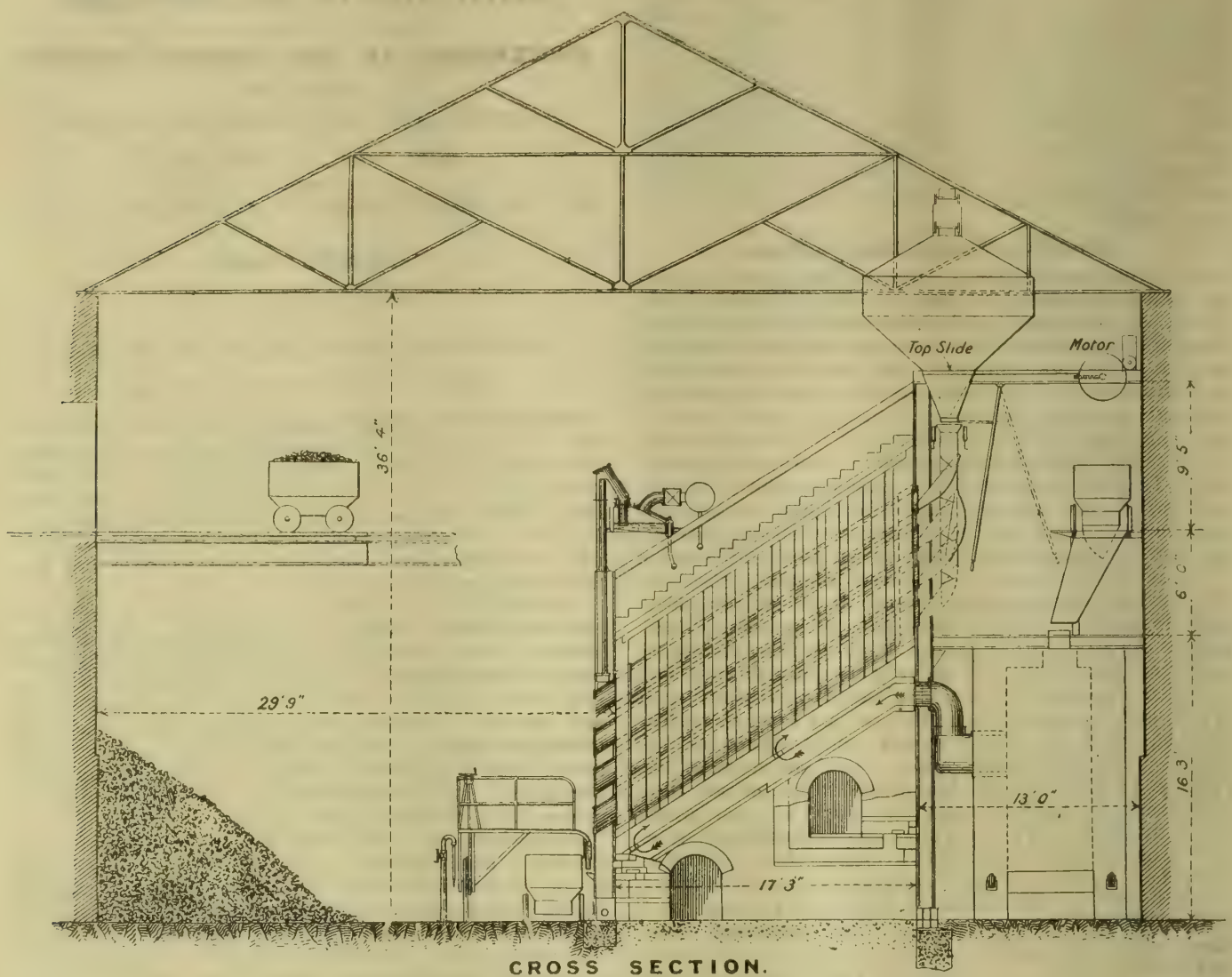
Bankside is the smallest works of the South Metropolitan Gas Company; their output being from $1\frac{3}{4}$ to 2 million cubic feet per day. They are worked for six months of the year at their full capacity, and for six months at half. Their size and absence of disturbance from "lighting up" or "letting down," render them extremely suitable as experimental works, for which purpose they have been considerably used.

In 1896, it became necessary to consider in what form the retort-benches should be renewed during the following summer. The alternatives were, of course, stoking machinery or inclined retorts. Several installations of the former had been applied at various of the Company's works; and their mechanical and gas-making efficiencies were thoroughly known. On the other hand, the only sloping retorts were in practical working in conjunction with horizontal ones; and it was possible to differentiate their efficiency during testing periods only.

Somewhere about this time, Mr. James Husband, who (with Mr. Frank Morris) made a good deal of the English history of inclined retorts at the Brentford and Southall works, gave the author several opportunities of inspecting the plant both in its early and late stages, and in course of its construction. The author takes this opportunity of expressing to both these gentlemen his thanks for the kindness and courtesy with which their works and working were invariably opened to his investigation. He saw various kinds of coal operated, large and small, dry and damp; and in the end he came to the conclusion that he could equally make inclined retorts a success, and therefore recommended their adoption at Bankside.

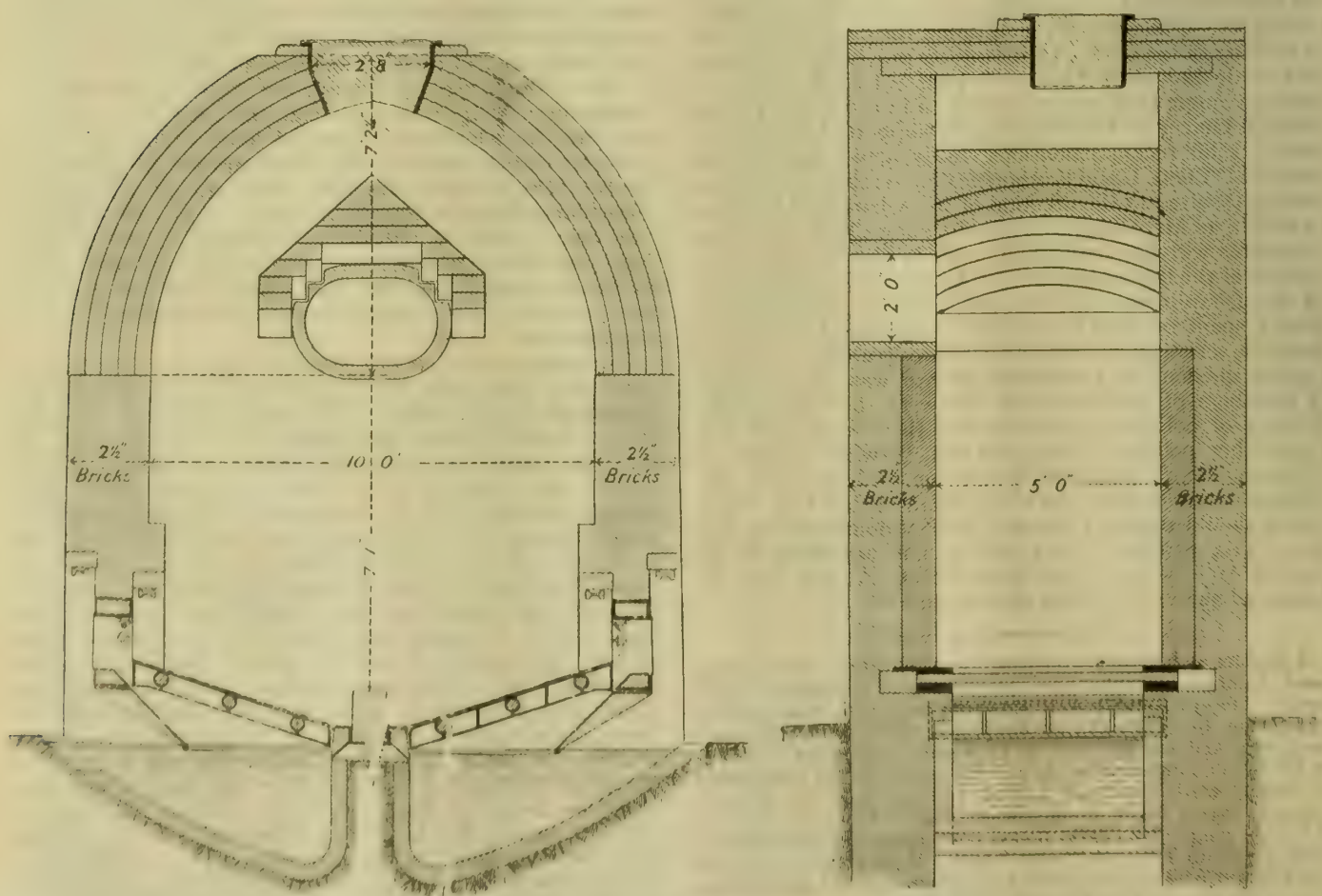
The retort-house was an old one built by the Phœnix Company in 1840. At some time or other in its history, the retort-benches had expanded horizontally and laterally and thrust the walls out of the upright, distorting to some extent the roof principles also. In substituting inclined for horizontal retorts, therefore, one of two courses was open, either to pull down the house to the ground-level and rebuild it with a new roof, or to design the retorts to fit the existing building as it stood. The latter course was adopted, and explains certain characteristics of the arrangement.

The general outlines are shown on pp. 1276-77; and in explaining these, the author proposes to state briefly the reasons for the adoption of the various details. The setting is of eight retorts, four high in two vertical rows. It was not possible to make the setting a complete "Imperial" one, owing to lack of necessary head-room. The author, therefore, had to be content with four superposed retorts, instead of five. The retorts are 20 feet long, and provided with one 6-inch ascension pipe at one (the lower) end. The late Mr. John Methven for many years worked his horizontal retorts at Nine Elms under similar conditions; while his make and quantity of gas per ton were among the highest in his Company. These facts were considered by the author sufficient justification for the dimensions he adopted. Having determined the length, it became necessary to consider the shape and size of the retorts. In many cases, these have been made taper to facilitate discharging; 4 inches in 20 feet being not an uncommon amount. This is, however, but one in sixty, or one-fifth inch to the foot; and it appeared to the author that, having regard to the distortion and cracking of retorts by use, such a variation from the parallel could not be of much moment either way. On the other hand, several

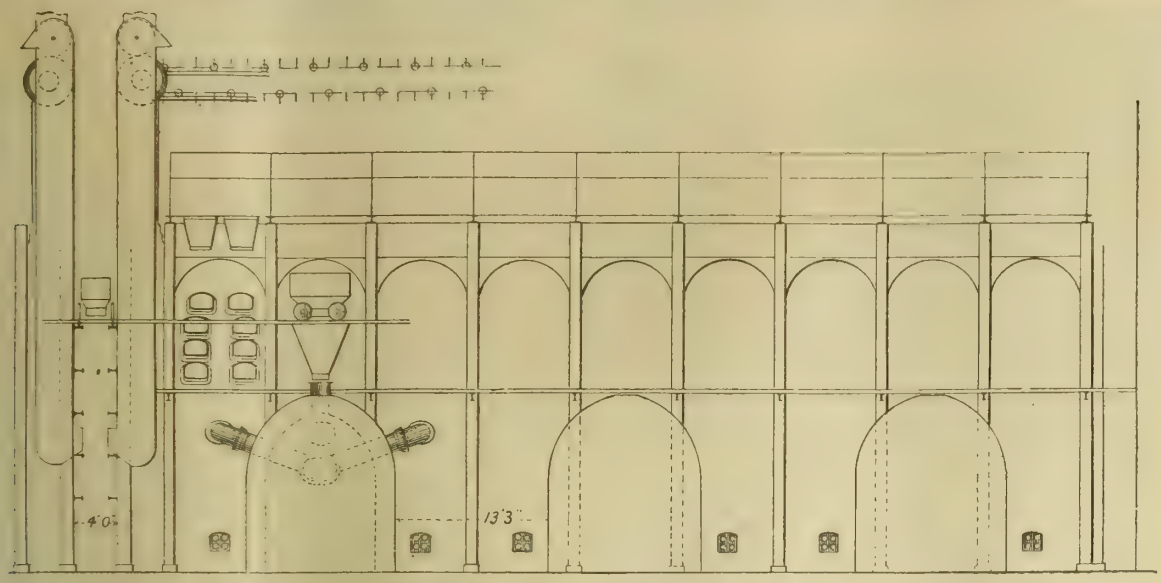


CROSS SECTION.

INCLINED RETORT-HOUSE—SOUTH METROPOLITAN (BANKSIDE) GAS-WORKS.



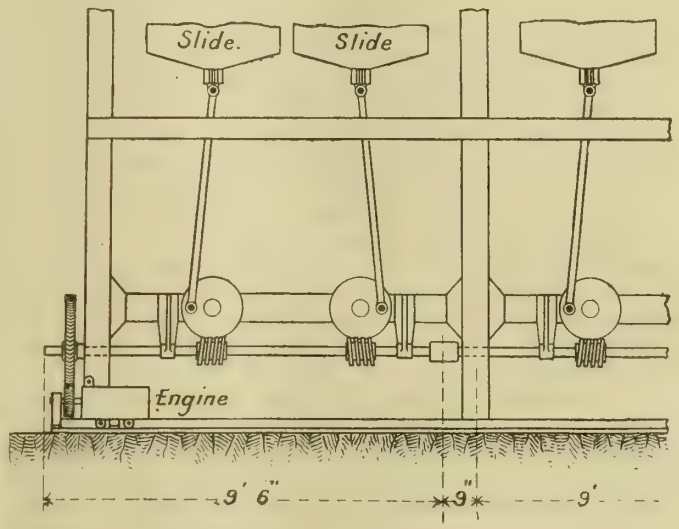
PRODUCER FOR THREE BENCHES OF EIGHT INCLINED RETORTS.



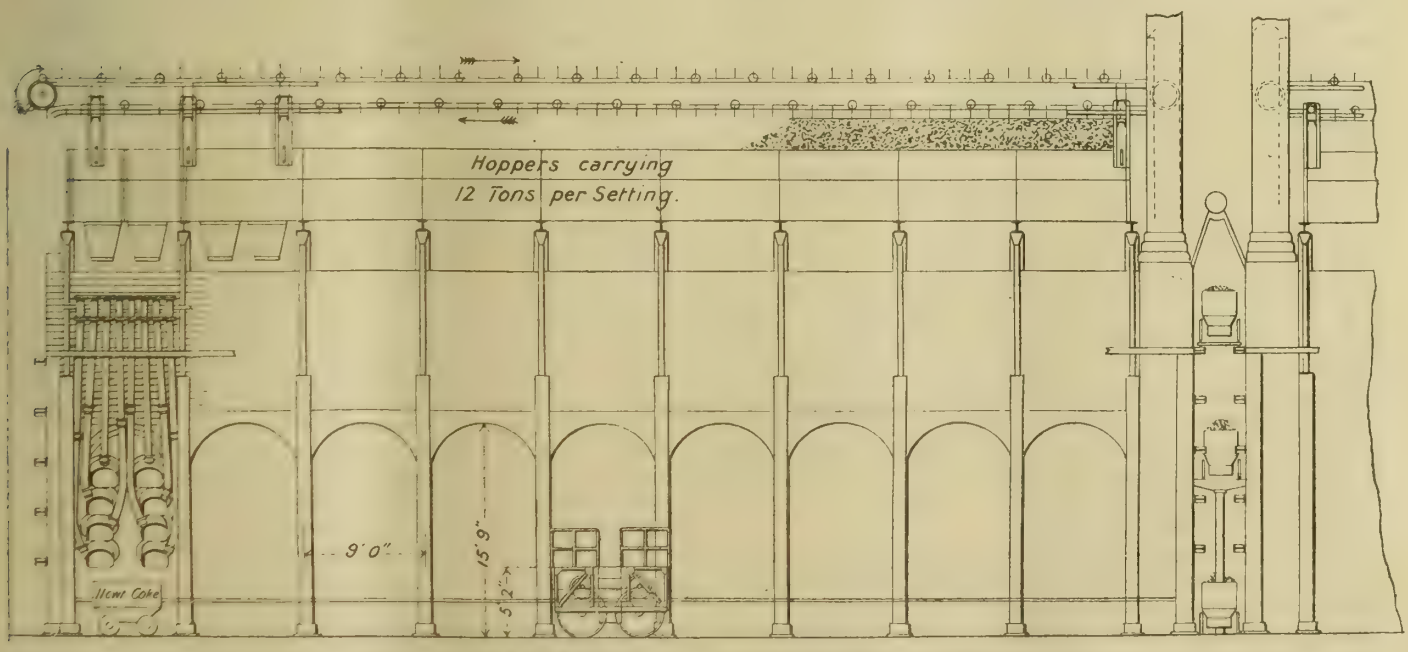
ELEVATION CHARGING SIDE

disturbing conditions are introduced by the employment of taper retorts.

In the first place, it cannot be so easy to make a true taper retort as a true parallel one; and the latter can be made a better job of in setting. But the more important condition is that a set of taper charges in the retorts of the setting should mean a set of "taper" heats—surely a retrograde step in the proper carbonizing of coals, even if such a requirement was easy of attainment, which, compared with uniformity, it is not. Parallel retorts were therefore decided upon; and the author has no reason to regret his choice. The retorts are a modified ⌂ shape; the minimum of radius being given to the lower corners. The sides are vertical, in order that the charge, as it is carbonized, may freely rise, and not jamb against the crown in discharging. As it would (nominally) be unnecessary to use stoking tools, there was no occasion to leave more room above the charge than was required for the passage of the evolved gas. The space therefore could be reduced to a minimum, and the time of "rest" for the gas in the retort



General Arrangement of Top-Slide Gear—Plan.



ELEVATION. DISCHARGING SIDE

largely lessened. The retorts are 24 inches wide, sides 7 inches high, rise of crown 6 inches. They are set at an angle of 32°.

The setting itself is completely divided, by a middle wall, into two complete independent settings. The credit for this arrangement belongs, the author believes, to Messrs. Morris and Husband, and is a ready means of adjusting the heat requirements either of the upper or lower portions. At Brentford this was attained by leaving an opening in the middle wall, which could be increased or reduced at will by the use of tiles or bricks, thus admitting more or less heat to the upper end, as might be required. The middle wall in the Bankside settings is solid—no arrangement having been made, or found necessary, for regulation of the heat. The inclined gas-flue from the producer returns upwards again from its lowermost point, and is provided with two openings which supply gas to the lower end of each gas-flue in which the nostrils are formed. These are all of one size, as are also the ports supplying them with secondary air. All the regulation, therefore, that is possible is obtained by the four exit-dampers at each corner of the setting. It is

found in practice that with such an arrangement of flues none other is required.

The secondary air-heating flues are formed in steps, each of which carries one of the cross-walls. These cross-walls are made of 9-inch bricks laid to the retort angle and to 15-inch centres. For this arrangement of air-heating flues, the author is indebted to the ingenuity of Mr. John Brown, his foreman retort-setter, who suggested it as a more stable foundation for the retorts than the sloping flues originally contemplated. There are two main flues and two shafts. The former are a convenient means of reducing the quantity of brickwork below the floor-line. The dampers and secondary air-shutters are conveniently arranged for access and cleaning. Each producer supplies gas to three settings—*i.e.*, 48 mouthpieces. The producers occupy the space under the charging stage, which forms a very convenient position. They are quite independent of the retort-benches, to which they supply their gas by means of 18-inch cast-iron pipes. Butterfly valves are provided to check the draught when the doors are open for clinkering. The charging-doors are 19 ft. 6 in. above the ground working floor. The take-off pipe can therefore be fixed a considerable distance below the upper part of the producer; and this space forms a hopper for the cold fuel which automatically falls, and keeps the fuel-bed at one level between the periods of charging. No cold air is admitted during this operation. All the coke required for the producer has to be raised from the ground floor to the producer mouth-level. To this disadvantage, there are several sets-off, apart from the fact that, with the house in question, owing to the limited head-room, no other arrangement was possible. The weight of coal carbonized is ten times that of the fuel put into the producer. To charge the latter by gravitation, would necessitate lifting the whole of the raw material a sufficiently greater height to allow one-tenth of it, in the form of coke, to fall into the producer. The author uses a hydraulic waggon-lift as a substitute. The working costs are set out in the table appearing at the end of this paper.

The coal-charging shoots are arranged after the Brentford pattern—*i.e.*, the measuring chamber is fixed at such a height above the top retort as to give sufficient fall with the worst description of coal used. With "livelier" coals, and for the lower retorts, a flap-check is provided in each shoot, actuated by a lever fixed to either end of a spindle on which it is mounted, working in a quadrant, by which it may be set at will to afford any "check" or "baffle" required. With any kind of coal, it is easy to lay a perfectly level charge in any retort by these means. In order that the flow of the coal stream from the measuring chamber to the retort should be regular and uniform, the width of the slide or door-opening and of the shoot were all kept the full width of the retort—namely, 24 inches. Only the lower door of the measuring chamber is operated by hand, and therefore under control of the stoker. The upper doors are attached, by means of a long rod, to a crank-pin fixed to give the required stroke on a worm-wheel, which is placed opposite. The worm-wheels are in right and left handed pairs, driven off corresponding worms keyed upon a longitudinal shaft running the length of the bench. As the worms are in right and left handed pairs, they balance one another, and produce no end thrust, so that the entire set of doors is easily operated simultaneously by one of Messrs. West and Co.'s smallest size motors. As a complete revolution of the worm-wheel must be made at every operation, each measuring chamber *must* always be entirely filled for each charge.

The coal is brought into the retort-house by an overhead railway, shot into the breaker, elevated, and conveyed to the overhead continuous hoppers in the usual way. The railway, by means of a turntable, is in connection with lines running at right angles, along which the coke-waggons run which feed the producers. These runs also serve the purpose of affording the "charging" stokers what access is required by the two upper rows of retorts; the two lower ones being reached, of course, from the stage. At the discharging end, the bottom row of mouthpieces is worked entirely from the ground, and the three upper ones from a light trolley, the wheels of which run on metals kept clear of the coke-heaps made during each "draw." The expense of a second stage is thus obviated. The coke is quenched and thrown back against the retort-house wall, where it forms a store, from which it is loaded into vans or carts as required.

As only one hydraulic main is used, it is made with double the usual area at the liquor-level. The tar is taken off from the bottom in the manner now usual. The hydraulic mains are made in single lengths, carried, as are the foul mains, from the diagonal H-iron tie.

The foregoing is a brief description of the Bankside plant. Some details of its working must now be given. The first three settings were put to work in February, 1898; the remainder of the nine benches (forming half the retort-house), two or three months later. At this time, one-half of the retorts in use still consisted of the old horizontal pattern. With the new inclined retorts, high and regular heats were obtained; and charges averaging 6½ to 7 cwt. were worked off with ease. The make of gas per ton fell off, however, instead of gaining, as is generally the case when a new set of retorts is put into action. It was assumed that the fault lay with the old section of horizontals, the renewal of which was considerably overdue. The drawing and charging of the inclined retorts promised well; and therefore the material for the second section was ordered, so as to complete the house. To proceed with this work, the horizontal retorts were put out of action, and the work of demolition proceeded with. But the make of gas per ton of coal was generally less, instead of better. Week by week, month by month, went by, and the search was unremitting of those concerned for the missing gas. One Sunday was given up to testing the station-meter. Then another for the soundness of the various valves. Then the bye-pass was taken out and sealed up. Then the washing and purifying plant put under pressure, and tested for soundness with a blower and meter. Observations were made to see if the make of gas fell when one or the other washing or purifying vessels was shut off for changing; and the mains and connections were also cleared and examined. The hydraulic seal was varied, and the retort-house vacuum altered; but without improvement. All this time coal had been drawn as usual from the Durham deliveries, and week by week the coal stock was anxiously taken. Sometimes the make of gas per ton would be a little over 9000 cubic feet, sometimes below. Meanwhile, earnest and continued attention was given to the retort-house. The pressure in the bottom mouthpieces and in the top ones, in the ascension-pipes, the arch-pipes, the dip-pipes, and the hydraulic mains was tested in all ways, but without throwing light on the cause of the trouble. Two observations stood out, however, beyond the others. One was that the retorts scurfed so rapidly that they had to stand off at no greater interval than once in three weeks. The other was that the irregularities in the thickness of the charges could not be laid at the door of any particular men. With the best of men sometimes matters went all right, and at others all wrong.

About this time, too, the suggestion was made that the heats were so good that the charges were slipping down in consequence. Since coal would rest in a cold retort, even if it slipped in a very hot one, it was argued that improvement would be attained by working nearer to that limit. It was thought, too, that irregularly shutting the doors produced the same effect; for charges which were watched and noted as being perfectly level were, when slacked out for drawing, found to completely fill the bottom of the retort. The appearance of charges was then noted by leaving the upper lid unclosed; and though perfectly level at first, yet in a period varying from ten seconds to a minute or two it was found that the coal had slipped down until it had risen to the crown of the retort. Here, then, was the clue to the mystery—that no matter how carefully the coal was laid, in the process of burning off it slid down to the lower extremity of the retort. The next step forward was to trace this effect to certain kinds of coal, which were diverted from Bankside, and a selection made of those varieties which gave no trouble in this respect. The result was most marked. The make of gas rose to about 10,300 cubic feet per ton, and has remained at about this figure since. For the purpose of this paper, trials were made with four of the principal descriptions of coal wrought in the Durham district and used by the South Metropolitan Gas Company. Each kind was used for two or three days prior to commencing the trial, so that all the conditions might previously become normal.

Each experiment consisted in carbonizing about 1000 tons of coal. The above coals produce, in average working, with horizontal retorts, from 10,200 to 10,600 cubic feet per ton. The whole of the difference in working is

that when carbonizing "A" quality the charges remain where placed. With "B," "C," and "D," they slipped while being worked off. The weight of charge and the heats worked were identical within practical limits.

Kind of Coal.	Gas per Ton at 60° and 30".	Coke Sold.
	Cubic Feet.	Cwt. per Ton.
A	10,392	10·4
B	8,736	10·9
C	9,093	11·0
D	9,420	10·6

Only one defect made itself apparent in the plant. It was important, and deserves notice. The coal-conveyor above the continuous hopper, as originally arranged, worked between two angle-iron guides placed about 10 inches apart, and running the entire length of the hoppers. The coal, as conveyed, fell through the space between, making its own angle, and as it piled up formed the continually extending bed along which the successive portions were scraped. If the quality or condition of the coal supplied to this conveyor varied during the process of filling the hopper, it would be arranged therein in an inclined stratified condition; the extent of each stratum being the angle of repose of the coal in the hopper, or only a few feet horizontally. So that if there were four changes of coal during the operation of filling the hopper, the first portion would have one quality, the second another, the third another, and so on. The retorts are charged in horizontal order, and under the above conditions four charges of coal might be used in operating but one row; and the shoot baffles, after having once set, would require two or three alterations and adjustments in travelling from end to end. This proved in practice a considerable disadvantage; but it was easily overcome by closing the bottom of the coal-conveyor and making a series of openings provided with adjustable slides. These regulate the amount of coal, and distribute it pretty evenly in *horizontal* strata in the hopper, so that whatever adjustment of charging-shoot is needed, it is maintained row by row.

The cost of working the bench of 144 retorts per twenty-four hours is as follows, working six-hour charges of 6 cwt. = 73 tons per day:—

		s.	d.	Per Ton. Pence.
Chargers	8 men at	7	1	11·19
Drawers	8 ,,	7	1	
Coke trimmers and quenchers	8 ,,	6	0	
Filling furnaces	4 ,,	6	0	3·63
Clinkering	2 ,,	7	1	
Emptying pans and wheeling out	2 ,,	7	1	
Screening and picking	1 ,,	7	1	0·98
Coal breaker and elevator	2 ,,	6	1	0·83
Mains and pipes	1 man at	6	2	0·43

The entire installation cost, from the floor-line, slightly under £14,400, or £100 per 20-foot retort.

Analyses of the producer gases are appended.

Percentage of Volume.

Test.	CO.	CO_2.	H.
1	26·0	6 0	8·4
2	26·4	4·0	8 0
3	25 2	6·0	7·8
4	25·6	4 8	7·4
5	26·4	4·2	8·4
6	25·6	5 0	8·6
7	25·2	5·6	7·4
Average	25·8	5·1	8·0

Discussion.

Mr. W. R. Herring (Edinburgh) said one felt at considerable disadvantage in discussing a paper of this kind in the absence of the author, especially as he intended to criticize it somewhat severely. His first impression was that it was a very elementary treatise on a subject which was now fast becoming old. It certainly traversed a good deal of ancient history. The author had accomplished in 1898 what had been done a great many years before; and, in his opinion, he had adopted a model which certainly did not possess all the advantages which were to be found in the system as adopted in some parts of the country. With regard to the general outline of the settings—which consisted of eights, in four tiers—this was a matter he should have particularly liked to discuss with the author. It was an open question whether they could not go four or five tiers high; but the point he wished particularly to get from him was why he did not adopt settings of nines. They must, of necessity, be cheaper per retort than settings of sixes; and if there were four rows, one had a setting of twelve instead of eight. Nine retorts was the common setting on the Continent; and he never put up anything else himself. Of course, if badly constructed, the central one would soon be burnt out; but it was easy to build them in such a way as to get less heat in the central retort than in the other part of the setting. The 20-feet length was all right; and a 6-inch ascension-pipe at the lower end was the general practice. He did not know of any setting that had two ascension-pipes; and he questioned whether, if there were two in a horizontal setting, they were ever both working together. It was almost physically impossible that they could. One could not have the same seal, and exactly the same pull, on the two opposite sides of the bench. Whether 6 inches was the proper size of pipe, was another question. He thought that a larger one might be better. An important question was raised as to the shape and size of the retorts. He had had considerable experience with most shaped retorts for inclined settings. Originally, he had parallel ones. He then substituted taper retorts, and was glad to agree with Mr. Carpenter that the advantage of the taper was not what appeared on the face of it. There was far more importance in the question as to the design of the cross-section. Mr. Carpenter had hit the mark very nearly in adopting vertical sides, and carrying them high enough to prevent the coke jamming in the crown; but if they were increased a little in the central line on the top of the charge, to 1 inch, he would find a considerable advantage. It was one of the secrets of success to make sure that the cross-section was carried through to the mouthpiece. Six inches might be a sufficient vertical line for the cross-section of a sloping retort; but when it was cut at an angle of 32°, one wanted 7½ inches in the vertical line, or to extend the line and continue the parallel side to the outside. Very often the charges stuck in the mouth of the iron mouthpiece. He could not agree that there was any difficulty about making taper retorts. There were two machines in existence by which taper retorts were made beautifully by an expanding die; so that there was no difficulty in getting them if they were of any advantage. With regard to the construction of the setting, credit had been given to Messrs. Morris and Husband for dividing it up by a central solid partition wall; but he really did not think the author could be serious in writing that, for such settings had been constructed almost from all time. Mr. Carpenter said he was indebted for the arrangement of the air-heating flues to Mr. Brown; and he was not sure whether he did not infer also for the foundation or floor of the setting being constructed of brickwork laid on the horizontal line, while some of the earlier installations might have been constructed on sloping walls. There were none certainly within the last seven or eight years where the brickwork had been so built. Entirely horizontal work should be laid as far as possible stepped back, and filled in to form the angle with splay bricks. There was an important question, again, with regard to the producer. From the diagram, he could scarcely see how the construction of these three beehive producers could be cheaper than, if as cheap as, the ordinary construction with the necessary number of independent furnaces beneath the sloping tiers of retorts. Although he got two flues in, in order to save some bricks, he still had an immense amount of solid brickwork beneath the upper ends of the sloping sides. In addition to this, he had a huge construction beneath the charging-stage, which must help to warm it up for the men, and make it uncomfortable. The producers must be strongly strapped with iron. There was one producer to three settings, and two furnace-doors to clinker. He should be very glad to have some exact figures as to the cost of working an outsider producer, as against an inside one. Again, the outside producer necessitated the lifting of the coke. A producer 10 feet deep would not be sufficient to generate gas for three or four settings; and he did not see what gain there could be with the arrangement. The charging-shoot was all ancient history; and he did not think Mr. Carpenter had the best one even now. Another important question arose, as to the method shown on the diagram by which the coal was brought from the storage-hopper into the measuring-chamber. It was worked by a series of worms and worm-wheels; and they all knew that, from a mechanical point of view, worms and worm-wheels

cost more, piece for piece, to manufacture than a silver watch. Why all this unnecessary mechanism had been introduced to move the slides—which were easily moved by a lever from the base—he could not conceive. It was introducing unnecessary complications in a process which was intended to do away with mechanical complication. Mr. Carpenter did not appear to connect the upper charging-door of the chamber with the lower one, as was common, so that on closing one the other was opened. He should like to have heard what Mr. Carpenter's object was in adopting such a mechanical device, when the work could easily have been done by a mere stroke of the lever cutting off the lower chamber from the charging shoot. The question of slip, Mr. Carpenter appeared to have overcome in the same way as everybody else. If he found some of the coal slip, he mixed it with coal which did not; but, at any rate, Mr. Carpenter appeared to have become a convert to the system.

Mr. F. D. Marshall (Copenhagen) also regretted that Mr. Carpenter was not present. He agreed that there was no advantage in using taper retorts. With regard to the cross-wall, it was always a debatable point why one should have a cross-wall in the centre of a setting. He was now putting up a large setting of 17-feet retorts without a cross-wall. Mr. Carpenter preferred putting his main flue inside the setting; but after many years of experience he (Mr. Marshall) had come to the conclusion that the outside was the place for the flue. If the flue gave way, it let down the whole superstructure; and he did not see any saving in expense. If the flue were outside, it could be easily got at; and the stability of the structure as a whole was greatly enhanced. In regard to the slipping of the coal, it had been a serious matter; and after numbers of experiments, he found it was due chiefly to using fine coal put in in a dusty condition. The gas making commenced immediately the coal touched the heated surface; and the gas, being unable to push itself through this compact mass, raised up small volcanoes or little hills. Thus one got a series of truncated cones over the whole surface, and there was a tendency to set the complete mass in motion. They got over this difficulty by putting in the coal in a less fine condition—not breaking it so small. If they had to depend on one description of coal for inclined retorts, they would be in a bad case, because the price would very soon be raised. He should be glad if Mr. Herring, or someone else, would take up the question of the cost of making gas by inclined retorts as compared with other methods. Why the author put in eight retorts instead of making three tiers and having nine, he did not quite understand. As a whole, there was little originality; and he thought they were really making a retrograde movement in studying the diagrams.

Mr. R. Brown (Cambridge) said that with regard to taper retorts, his own experience was there was nothing in them; one could do just as well with parallel ones. It was said the coke was got out better. That might be so at the start; but after the retorts were a bit worn, the coke required just as much tickling to get out as with the others. Mr. Carpenter had spoken of the reduction of cubic feet per ton produced, and the retorts scurfing so rapidly that they had to stand off at the end of three weeks. It appeared to him that they could not have been working the exhauster at a sufficient vacuum, or they must have been working with a very heavy seal. He never had anything of the sort. They scurfed not oftener than once in three months. There was no more scurfing required with inclined retorts than with horizontals. Then with regard to the charges creeping, about which Mr. Carpenter had said something two years ago, and now returned to the attack, with all his old vigour. After all, he did not think there was so much in this question as was made out; it was more of a bogey than anything else, put forward by the opponents of the system. He never had any difficulty. In fact, it was rather the other way. There had been some little difficulty in getting the coal to the bottom of the retorts; but they got over this by using a plate which the men on the charging-stage took along and placed in the mouthpieces. This allowed the coal to get more of a rebound. He should like to have asked if there was any depreciation in the illuminating power, which was another of the numerous bogies put forward. He had an opportunity last summer of working the inclined retorts alone, and sent out 16½-candle gas without any enrichment whatever. There was no doubt that some kinds of coal did answer better in inclined retorts than others; but with proper mixing, and knowing which coals would suit, there was no difficulty. He could not speak too highly of the system—more especially in gas-works of the size of those under his management. Now that the coalowners were putting their hands so freely into the pockets of gas companies, it was their duty to reduce the cost of production in every possible way; and he thought inclined retorts were the most economical and convenient system at the present day.

Mr. S. Meunier (Stockport) said he was rather glad to hear the criticisms on this paper; for when he first glanced at it, he began to think the step he had in view was likely to be a retrograde one. There was a certain amount of room in their retort-house, the output of which he wished to improve; and he had thought about doing this by the use of inclined retorts. But when he read the figures given in the paper, and compared them with his own actual working, he began to think that perhaps he was making a mistake. Mr. Carpenter had eight retorts in his setting, 20 feet long, 24 inch by 13 inch, and he only carbonized 9·12 tons in the 24 hours; whereas, with the same number of retorts 1 inch narrower and rather deeper, and of a similar length, he had no difficulty in dealing with at least 11 tons. He was rather struck some time ago with Mr. Carpenter's idea of one generator for a number of settings; but when he saw the figures given in the paper, he felt he should like to have some explanation from the author as to how it was that the cost of clinkering this generator appeared to be so high. It was 3·63d., which seemed very costly, even with the higher rate of wages paid in London. They could get it done with a single generator to each bed, instead of one to three beds, for 2d., though, of course, they did not pay the same wages.

Mr. C. E. Brackenbury (London) said when he first saw the title of the paper on the agenda it was "Inclined Retorts;" and he was led to suppose that the author was going to give a general review of the system in this country. Much to his regret, he found, instead of having the opportunity of discussing the general system, it was simply an account of the "Inclined Retorts at Bankside;" and he feared that the paper would not tend to remove, or even diminish, the generally accepted opinion that London gas engineers still lagged very much behind their Provincial brethren in this matter. Looking at the installation, they found that Mr. Carpenter had followed the Brentford gentleman, to whom every honour was due for having, in 1889, said the first word on inclined retorts in this country. They had not, however, said the last word; and there were other men, who were generally qualified to be considered pioneers, who had done a lot of practical work which had perfected the system. He should have liked to have asked Mr. Carpenter what steps he took before putting up this installation, and what works in the Provinces he visited, so that they might know what had guided him. The retort-house was an old one, in a most decrepit state; and ninety-nine engineers out of a hundred would have pulled it down, and put up a new one specially adapted to the plant proposed to be erected. As a consequence of this, there were eight retorts instead of nine or ten, and the considerable drawback of having only one stage instead of two. Under Mr. Herring, at Huddersfield, in 1892, a similar installation was put up; and, as it was not extended, it might be taken that it was not sufficiently successful to justify extension. The use of one ascension-pipe was many years old. With regard to taper, all the retorts he had had to do with were taper, and had given satisfaction as regarded facilitating the discharge of the coke, to a certain extent. He remembered, at Newcastle-under-Lyme, in 1894, a retort 16 feet long, with a taper of 6 inches, or 1 in 32, was put up, and reported on very favourably. There seemed to be some inconsistency about this question of taper, because in one place Mr. Carpenter remarked that "such a variation from parallel could not be of much moment either way," in connection with drawing the coke; and in the following paragraph he argued that "a set of taper charges in the retorts of the setting should mean a set of taper heats." It seemed to him that Mr. Carpenter was trying to have it both ways. If the taper could be ignored in one case, it certainly could be in the other. Theoretically it might be that if one had taper retorts one should have taper heats; but, as they all knew, it was a matter of no consequence in actual practice. The measuring chambers adopted were something beyond comprehension.

Why go to the trouble to have all the worm gearing for the purpose of opening the top doors of the measuring chambers simultaneously, so as to destroy at one blow the independent unit of the charging apparatus? He could not see any reason for it. He understood that all the measuring chambers were filled simultaneously by this gearing; and if, from any retort having dropped out of its ordinary rotation, one measuring chamber happened to be empty, it would be necessary to put in motion all the gearing to fill but one chamber. Why not adopt the plan usual in the Provinces, of having two slides with a single lever and "sure-feed" arrangement, so as to make the whole installation to a very large extent independent of the operator? There seemed to be a side light thrown on the difficulties experienced in working this installation, from the remark that the metals for the discharging trolleys "were kept clear of the coke-heaps made during each draw." They could understand from the arrangement of coke-heap against the retort-house wall, that they must have, on the ground floor of a house of this nature, a tremendous lot of wasted labour in keeping the rails clear, so as to facilitate the passing of the workmen, &c. The expense of a second stage was thus obviated, said Mr. Carpenter; but it also obviated its economy and convenience. Everybody agreed it was a retrograde step to go back to a single-stage house; and it was hardly worth pressing it further. The net result of the paper seemed to be that, out of four kinds of Durham coal, Mr. Carpenter had found one which he could use with inclined retorts. The Company he acted with used nothing but Durham coal; and this when charged was for the most part dust, so fine that many engineers would not care to use it. But in no single instance had there been the slightest complaint or trouble from slipping.

Mr. T. S. Lacey (London) asked what was the length of the retorts, and where the works were situated.

Mr. Brackenbury said they were 15-feet retorts. The works were on the Continent. It was not desirable to give the exact locality, as it was not a Company whose figures were obtainable; so that the mention of the name would not be of the slightest use. It was quite new to him that the creeping of the coal was found only in 20-feet retorts. He always understood that it depended on the angle, and the nature of the coal. The general length on the Continent was 15 feet; and this was the length of the retorts of which he had experience. Mr. Carpenter's make from his best-quality coal was 10,400 cubic feet per ton; and their average make from very small Durham coal was 10,600 cubic feet. He should like to know whether this installation was, in the author's opinion, a success or not. The general impression given him by the paper left him in doubt; but he hoped that Mr. Carpenter might soon have another opportunity of putting before them a better arrangement of inclined retorts, after having had experience in a house specially built for them.

Mr. Marshall said, according to his experience, the length of the retort had nothing to do with slipping.

Mr. J. Tysoe (East Greenwich) did not propose to enter into a general discussion of the paper, as it was a subject he was not practically acquainted with; but the installation had been very successful in its results. Previous to the introduction of the inclined retorts, the Bankside station was one of the dearest belonging to the Company in carbonizing wages; but it was now almost the cheapest. Great credit was due to Mr. Carpenter for the way in which he had carried out the work. He had encountered difficulties which were almost insurmountable; but he tackled the matter very pluckily, and brought it to a successful issue, as was proved by the results. It was not often they could get an authentic statement as to the cost of working inclined retorts. Indeed, it was a matter he had himself been looking at; for he could get no figures which it was possible to compare with stoking by machinery. But these figures, he believed, might be accepted as correct. At any rate, there were some champions of the inclined retort present; and no one had called the figures in question. He had taken out his own figures with regard to carbonizing machinery, in order to make a comparison between the two. Taking the cost per ton, the figures given by Mr. Carpenter, eliminating screening and picking, amounted to 16·08d. per ton of coal carbonized. With the machinery at his own works, the cost, taking precisely the same items, and working under practically the same conditions, was 11·91d.—in round numbers 1s., against 1s. 4d. But this did not exhaust the matter. The cost of the inclined retorts was given at £120 per 20-foot length, which he believed was about the usual. His own cost for the same work, including stage-floor, setting, and everything in connection with it apart from the building, and including the machinery necessary for working the retorts, amounted to £75 per 20-foot retort. This gave a a clear illustration of the fact that inclined retorts were not always superior to retorts worked by machinery. He had always held that machinery could be erected and worked cheaper than inclined retorts; and he had seen nothing up to the present to cause him to alter his opinion.

Mr. Herring asked what was the minimum quantity of gas made at the works where the cost came to 11·91d. The machinery must be worked up to its full capacity.

Mr. Tysoe replied that, in the case of the Bankside works, machinery was out of the question, on account of the smallness of the place. To make machinery successful, it should be always at work; and the full quantity of retorts should be charged. In his own case, the number of retorts served by one set of machines was 300.

Mr. Marshall said that Mr. Tysoe was rather unfair to those who had read papers before on this subject, in saying that no figures had been given. He had himself endeavoured to give the true state of the case.

Mr. S. Y. Shoubridge (Lower Sydenham) said Mr. Carpenter's design had been rather severely criticized; and it was a great pity he was not present to reply. The paper, so far as he had read it, did not assume that Bankside had an ideal installation. But Mr. Carpenter had been good enough to show what he had done there; and whether they agreed with the plan or not, they were quite as likely to learn from mistakes as from successes. At any rate, whether or not it was as successful as it might be, Mr. Carpenter had been good enough to put his design at their disposal; and he thought they were much obliged to him for it. With regard to the cost of working, this had been mentioned. If Mr. Tysoe would refer to the "Journal of Gas Lighting," he would find that inclusive figures had been given of the cost of working inclined retorts at several places. At Dewsbury, for instance, the total figure was given as 1s. 2d. per ton, including all charges, from the coal into the house to the coke into the yard.

Mr. Tysoe said what he meant was that he had no figures which could be compared with the cost of machine stoking he had given, until Mr. Carpenter supplied them in his paper. These were comparable, because both works belonged to the same Company, and the rates of wages were similar.

Mr. Shoubridge said it was hardly fair to compare such a splendid installation of stoking machinery as Mr. Tysoe had at East Greenwich with the admittedly cramped arrangement at Bankside. A fair comparison could only be made where all the conditions were equal. For this reason, he did not give, in the paper he had read before the Gas Institute, all the figures relating to cost, but simply those which were effected by the improvement in the system. The method of getting out coke varied in almost every works. In some it cost more than in others; and the same with the getting in of the coal. These things were not peculiar to the inclined retort system; and wherever they could be eliminated, they should be. To compare all-round figures was quite as misleading as to take them partially. With regard to taper retorts, being the first to use them, he should like to say that his experience had fully justified the alteration. The taper did facilitate the discharge of the coke very considerably, and did not affect the heats. Mr. Carpenter's assumption was therefore incorrect. Perhaps one reason why Mr. Carpenter had not attained full success with his setting was that he adopted a small retort. He reduced the height, because he was not going to put in rakes, and also because he adapted an arrangement for charging which was decidedly imperfect. These two things were the main causes of his want of complete success.

The President said a report of the discussion would be furnished in due course to Mr. Carpenter, who, he hoped, would be able to make some reply.

On the resumption of the proceedings next day,

The President stated that he had received a letter from Mr. Carpenter, stating that it was quite impossible for him to attend the meeting. He would, however, reply through the press. [Mr. Carpenter's remarks have since been received; and they appear in our "Correspondence" columns to-day, p. 1305.]

THE PRESENCE OF NAPHTHALENE IN COAL GAS: ITS DETECTION AND EXTRACTION.

By Wilfred Irwin, of Manchester.

When your President invited the writer to read a paper on the naphthalene question before the annual meeting of the Institution he hesitated at first, as it appeared to be presumptuous for an outsider, who is neither a gas engineer nor in any way officially connected with a gas-works, to try to instruct those who from their youth up have had ample means of studying the subject. Following, however, the advice of the late Master of Balliol, "Never apologize, never explain," the author will, without delay, plunge into the subject in hand.

Of the many hindrances which have stood in the way of the more rapid development of the gas industry, few perhaps have, of late years, caused more annoyance and irritation to the engineer than the deposition of naphthalene in a solid form in the mains and service-pipes. To describe a method of preventing these deposits, was the primary aim of this paper; but in its preparation the scope widened, and the writer came to the conclusion that, to deal with the whole question of condensable products in coal gas, would greatly assist in the proper understanding of the naphthalene trouble.

Naphthalene ($C_{10}H_8$) was first discovered in 1820, by Garden, in the fractions of coal-tar oils boiling between 200° and 250° C. It is a white crystalline solid, melting at 79° C.—boiling-point 218° C. When condensed from a vapour, it deposits in white thin rhomboidal crystals, which occupy an enormous amount of space, and a cubic foot of which, according to Rosere and Schoelemmer, only weighs ¼ oz. It forms one of the principal condensable constituents of coal gas; 1 ton of coal yielding as much as 13 lbs. of naphthalene. And here the writer will take the opportunity to bring before you a rather unusual aspect in which to regard ordinary coal gas as it leaves the retorts.

Leaving out of consideration the water and ammoniacal and sulphur products, it has usually been the custom to consider gas as it leaves the retorts as composed of permanent gas and tar—no account being taken of the fact that the former contains large quantities of condensable bodies. In place of this, let us regard it as a mixture: (1) Of gases, each of which by itself is a permanent gas at the ordinary temperature. (2) Of condensable constituents, by which are meant bodies liquid or solid at the ordinary temperature.

With the permanent gases—consisting chiefly of hydrogen, marsh gas, ethylene, and acetylene—we do not need to concern ourselves at present. It is the condensable constituents—their composition and properties—which the writer wishes to bring before your notice to-day. After the gas leaves the retorts, these mostly condense to form tar; but considerable quantities also remain in the gas—quantities dependent partly on the proportional amount present in the gas as it leaves the retorts, but chiefly on their vapour tensions.

Here, then, is a table prepared by the writer, in which:

Table *showing the Condensable Constituents of Gas produced by One Ton of Lancashire Coal Carbonized at High Temperatures.*

Name, with Formula and Boiling-Point.	1 Total Weight of Same.	2 Amount in Tar.	3 Amount in Gas.	4 Vapour Tension at 15° C.	5 Illuminating Power of the Gas due to the Presence of each Constituent (approximate).	6 Additional Gain to the Illuminating Power of the Gas if each of the Lighter Constituents was Transferred from the Tar to the Gas.	7 Percentage of Gas Saturated with each Product (approximate).	8 Solubility in 1000 parts of Water.
	Lbs.	Lbs.	Lbs.	Mm.	Candles.	Candles.	Per Cent.	
Benzene (C_6H_6, 80·4° C.)	18·80	0·8	18·00	61·00	8·60	0·40	10·1	1·45
Toluene ($C_6H_5CH_3$, 111° C.)	6·70	0·7	6·00	19·40	3·00	0·35	8·9	0·57
Three xylenes ($C_6H_4[CH_3]_2$, 137–141° C.)	1·40	1·0	0·40	6·30	0·20	0·60	1·6	0·12
Three bumenes ($C_6H_3[CH_3]_3$, 163–169° C.)	0·50	0·3	0·20	1·50	0·10	0·16	2·8	
Higher methyl derivatives of benzene	0·20	0·1	0·10	0·40 (?)	0·05	..	5·7	
Naphthalene ($C_{10}H_8$, 218° C.)	13·15	13·0	0·15	0·03	0·10	..	70·0	
Phenol (C_6H_5OH, 184° C.)	1·00	1·0	..	..	..	..	..	50·00
Three bresols ($C_6H_4CH_3OH$, 188–201° C.)	0·80	0·8	..	..	..	..	..	20·00
Pyridine and lower methyl derivatives (C_5H_5N, 117–140° C.)	0·30	0·3	..	..	..	..	..	very soluble
Phenanthrene ($C_{14}H_{10}$, 340° C.)	1·00	1·0						
Anthracene ($C_{14}H_{10}$, 360° C.)	0·30	0·3						
High boiling oils	22·70	22·7						
Pitch	93·00	93·0						
Totals	159·85	135·0	24·85	..	12·05	1·51	99·1	..

Note.—The pyridine and phenol, though having comparatively low boiling-points and vapour tensions, do not appear in the gas, as they a e extracted along with the ammonia salts, they being very soluble in water. The values for illuminating power were determined by means of the ordinary No. 4 union-jet burner. With the argand burner, the figures in column 5 would be something over half those given above, and those in column 6 would be considerably less than half.

Column 1 shows the quantity of each per ton of coal carbonized at fairly high temperature. Columns 2 and 3 show how they distribute themselves between the tar and gas. Column 4 shows the vapour tensions of the more volatile products, as determined by the writer. Column 5 shows the gain to the illuminating power of the gas due to the presence of each of the aforesaid products. Column 6 shows the additional gain in illuminating power of the gas, if all the lighter products were extracted from the tar and transferred to the gas. Column 7 shows the percentage of gas actually saturated with each of the lighter products. Column 8 shows their solubility in water.

The significance attaching to the table will be readily recognized. The first point to notice is the relatively large amount of the primary aromatic bodies, benzene and naphthalene, and the decreasing amounts of the methyl derivatives of benzene with each addition of methyl to the molecule.

The writer has found that the higher the temperature of carbonization, the greater does the proportional amount of both benzene and naphthalene become; the increase being at the expense of their methyl and phenol derivatives. This accounts for the increase in the naphthalene trouble, with the rise in the temperature of carbonization in recent years, for some of the aforesaid derivatives have vapour tensions near to that of naphthalene; hence the smaller the quantity of these in the gas, the greater likelihood there is that naphthalene will be deposited in a solid form.

The next point to notice is the small proportion of gas which is saturated at the ordinary temperature with the lighter liquid products—benzene and its derivatives—leaving the remainder to be, for the most part, saturated with vapour of solid naphthalene. This substance is the last with an appreciable vapour tension at ordinary temperatures; and it is present in very large quantities. Hence all the gas which is not saturated with the lighter products will be saturated with naphthalene. To examine minutely the conditions under which the various volatile bodies in coal gas as it leaves the retorts will distribute themselves between the gas and tar, would occupy too much time, as the question is very complicated; but we may take it that about 70 per cent. of ordinary coal gas at 15° C. will be saturated with naphthalene.

The law governing the whole process is known as Regnault's law of vapour tension, which states: "When two liquids dissolve in one another in all proportions, then the tension of the vapour of the mixed liquids is intermediate between the tensions of the separate liquids."

Another point to notice is the influence which each of these bodies has on the illuminating power of the gas. The estimations were made with a No. 4 union-jet burner. When they are all extracted, the residual gas has an illuminating power of about 1 candle; though if the ordinary standard argand were employed, it would test nearer 9 candles. If the latter burner had been used, the figures in Column 6 would be considerably under half the various

amounts given. From this we gather that, with the ordinary method of testing, the total possible gain to the illuminating power of the gas by the transference to it of everything of illuminating value in the tar, cannot represent more than 0·6 candle.

This clearly demonstrates the futility of all processes for raising the illuminating power of the gas based merely on alterations in the method of condensation; for under no conceivable circumstances (without resorting to distillation) could the quantity of lighter products in the tar be reduced by more than one-third.

The interest of the figures in Column 8 may not be apparent at first sight; but they were the result of a research by the writer into the cause of the loss of illuminating power by passing gas through a wet meter until the water had become saturated. The loss of illuminating power was proved to be due to the material solubility of benzene, &c., in water—a fact unknown before. The decrease in solubility with the addition of methyl to the benzene nucleus, was also an interesting fact brought out at the same time.

The whole table is a revised compilation from work done at various times by the writer, and communicated to the Society of Chemical Industry in Manchester during the past few years.

Cause of Naphthalene Deposits.

The writer's experiments showed that the vapour tension at 15° C. is 0·03 mm., at 25° C. 0·08 mm. Hence the quantity of naphthalene capable of being held in the form of vapour decreases very rapidly with a reduction in temperature. In this it follows the general rule, that the further a vapour is reduced in temperature from the boiling-point of the liquid, the greater is the proportional reduction in its tension for a given number of degrees of heat. At 25° C., gas may contain as much as 0·45 lb. per 10,000 cubic feet; at 15° C. it will only hold 0·15 lb. Hence if gas were sent out from the holder at 25° C. into the mains at 15° C., then 0·3 lb. of naphthalene per 10,000 cubic feet would be precipitated. This, of course, is an extreme case; and if plenty of time for thorough condensation be given at the works (so as to prevent the gas going forward in a supersaturated condition), and the temperature of the air never varied, the presence of a little naphthalene in the gas could not cause trouble. Such conditions, are, however, impossible, taking into consideration climatic variations, which may be roughly divided into (*a*) diurnal, (*b*) annual.

(*a*) *Diurnal.*—Gas made on a hot day is always liable to deposit naphthalene in the street-lamps on a cold night at any time during the year, but most commonly in the late spring, when diurnal variations in temperature are usually the greatest.

(*b*) *Annual.*—In the winter, the mains are often warmer than the gas leaving the works. Hence if the mains be clear to start with, little trouble from naphthalene is experienced. Through the summer the mains are cooler than the gas as it leaves the works; and naphthalene is continually depositing in them. But not much gas is being consumed, and its presence in the mains is often scarcely recognized. The temperature of the street-lamps is higher than the mains; so that naphthalene will be carried forward through them without deposition. As the nights begin to cool and lengthen, more gas is required, and the stoppages in the mains begin to be felt. The temperature of the street-lamps becomes lower than that of the mains. Hence, although the gas may be well cooled and free from naphthalene as it leaves the works, it will pick it up again from the mains and deposit it in the street-lamps and services.

From the above, it will be gathered that, in the opinion of the writer, the naphthalene trouble is entirely dependent on climatic variations—always supposing, of course, that ample condensing power exists at the gas-works. To account for all its vagaries in its choice of places of deposition would be very difficult; but in this it in no way differs from other deposits from supersaturated liquids or gases.

Prevention of Naphthalene Deposits.

Referring again to the table. All the condensable bodies —*i.e.*, those in Column 3—can be extracted from gas by washing it in a suitable apparatus with heavy tar oil. About eighteen years ago, the writer began experiments with a view to extracting them on a commercial scale, as the market was very favourable. The experiments were successful; and large quantities of benzene, toluene, &c., obtained from this source were soon placed on the market, which was materially affected thereby.

About 70 gallons of oil per ton of coal were found to be sufficient to extract the whole of the condensable constituents from the gas. If less than this amount were used, the more volatile bodies would pass on without condensation; and the writer soon discovered that it was only a matter of the quantity of oil employed, as to whether the whole or only the least volatile of the products were condensed.

In the autumn of 1898, his friend Mr. J. P. Leather, of the Burnley Gas-Works, consulted the writer as to the best method of preventing naphthalene deposits, with which he was troubled at the time; and relying on the experience just alluded to, he (the writer) suggested washing the gas with oil to which a quantity of benzene had been added, to prevent any deterioration in the quality of the gas.

The first obvious requirement, however, was to obtain an approximate idea of the amount of naphthalene which the gas contained. This is just what no previous experimenter had ever done—perhaps owing to the fact that no method of testing for the same had appeared in any work dealing with gas analysis. One had, therefore, to be devised; and the writer suggested the passing of a large volume of gas—say 400 or 500 cubic feet—through benzene or toluene contained in two absorption flasks arranged consecutively. A considerable amount of the solvent is required, as 400 cubic feet of gas will take up nearly half-a-gallon of benzene, though, of course, much less toluene. To start with, 400 c.c. of the solvent can be placed in each flask; and more can be added to supply that lost by evaporation. In this operation, all the higher boiling hydrocarbons are caught in the flasks, and benzene takes their place in the gas. The contents of the flasks are now submitted to fractional distillation through a dephlegmating column, and the naphthalene crystallized out from the last residue by cooling. The result was that the Burnley gas was found to contain 0·13 lb. of naphthalene per 10,000 cubic feet. The other high-boiling hydrocarbons may be estimated at the same time. This, of course, is not a scientifically accurate test; but it yields approximate results, and as a comparative test it is certainly very valuable. It yields the naphthalene in a form in which it can be seen and examined; and Mr. Leather and the writer have found it very serviceable in connection with their process for extracting naphthalene from gas.

A few months ago, Dr. Colman and Mr. Smith, of the Birmingham Gas-Works, applied Kustner's method of testing naphthalene to the estimation of the same in coal gas. They pass 100 cubic feet through a solution of picric acid in water; and from the weight of naphthalene picrate precipitated, the amount of naphthalene in the gas may be calculated. The only possible weak point about this test is the extent to which other picrates may be mixed with the precipitated naphthalene salt. If the precipitate is practically pure, the test will be most valuable; but the writer is of opinion the results will be rather too high.

The figures given above dispose of the idea that in extracting naphthalene one is in any material degree diminishing the illuminating power of the gas.

A spare scrubber was available at Burnley; and experiments with various oils showed that the oil absorbed naphthalene from the gas until it contained 10 per cent., when it had to be changed. Hence it follows that, according to the temperature, from 13 to 40 gallons of oil per million cubic feet of gas is the amount necessary to extract the naphthalene; and the addition of 8 per cent. of benzene prevents any loss of illuminating power in the gas.

The following, then, is the exact statement of the process, as patented by Mr. Leather and the writer: The gas, after it has been cooled and freed from tar, is treated with a small quantity of a mixed liquid capable of absorbing naphthalene, and which, at the same time, will not deteriorate the quality of the gas by absorbing benzene or other illuminating substances therefrom. The liquid to be used in the process must be—(*a*) Practically free from naphthalene. (*b*) Capable of dissolving naphthalene. (*c*) Must give off at the ordinary temperature a vapour whose tension and effect on the illuminating power of the gas is such that the loss of illuminating power occasioned by the extraction of naphthalene and other substances is more than compensated by the gain from other substances taken up by the gas from the liquid itself.

The following are suitable mixtures—

Blast-furnace oil 92 per cent. benzene 8 per cent.
Heavy tar oil 92 ditto benzene ditto

Gas at 60° Fahr. would require 15 gallons, at 70° Fahr. 25 gallons, and at 80° Fahr. 40 gallons of the above mixture per million cubic feet. After absorption of 10 per cent. of naphthalene, the low-boiling hydrocarbons may be extracted therefrom by distillation, and recovered for mixing with a fresh quantity of oil for future use.

The plant recommended is a washer in which the liquid can travel in a direction contrary to that of the gas, through a series of chambers in each of which it can be brought into intimate contact with the gas. An apparatus half the size of that usually employed for the extraction of ammonia will be found sufficient. (For economy, Mr. W. Young's washer, as supplied by the Oil-Gas Enrichment Company of Edinburgh, is recommended.)

After taking out the patent, it was discovered that the principle of washing a gas with oil for the extraction of naphthalene was foreshadowed in a patent taken out in 1896 by Messrs. Young and Glover; but no figures were given by them, and an arrangement has been arrived at between the patentees to work in unison.

Before concluding, it may be useful to note the effect on the illuminating power of gas by washing the same with (1) heavy tar oil, (2) heavy tar oil and 8 per cent. of benzene, (3) benzene alone, and (4) naphthalene. The first almost entirely robs it of its illuminating power, the second leaves it the same as it enters, the third enormously enriches it, and the fourth leaves it practically the same when in a solid form, though when dissolved in another solvent it acts as a powerful absorbent of benzene, and hence of the illuminating power. This demonstrates that the fears of some gas engineers, that solid naphthalene in the mains has a prejudicial action on the gas, are quite groundless.

Discussion.

Mr. A. F. Browne (Vauxhall) said it was some years since he first came across the records of Mr. Irwin's work in connection with the subject of the hydrocarbon vapours in coal gas; and Mr. Irwin had shown, as regarded commercial results, that the subject became more important as time went on. To-day Mr. Irwin had rounded off, as it were, their obligation to him, by bringing before them a paper which was of very great theoretical interest, and possessed, he thought, also considerable practical value and importance. The dominant note of the discussions during the meeting might be said to have been very candid criticism; but no man whose opinions were worth attention would object to that, and he only alluded to the matter for the purpose of saying that if he should be so unfortunate as to appear to transgress the limits of courtesy and good taste, he hoped he might be forgiven. They had in the paper a very plain statement that, inasmuch as 10,000 cubic feet of ordinary coal gas was saturated with the lighter hydrocarbon vapours to the extent of 30 per cent., the gas was therefore unable to be saturated beyond 70 per cent. of its volume with the vapour of naphthalene; and in support of this theory, Mr. Irwin had quoted Regnault's well-known law of vapour tension. But upon this, he would ask Mr. Irwin the very plain question, Did the law quoted necessarily compel the conclusion, or even support that contention? To put the matter as it would be put in the text-books, it appeared to him that Mr. Irwin's meaning was that the vapours of two hydrocarbons which dissolved one another in all proportions could not be saturated in the presence of each other in a given space at a given temperature. He would ask Mr. Irwin if he had any justification for his theory, because in the paper there seemed to be some slight ambiguity on the point. Mr. Irwin told them that 10,000 cubic feet of coal gas, at 15° C., was able to hold, in the form of vapour, 0·15 lb. of naphthalene; but in the table they also found the statement that 0·15 lb. of naphthalene was only able to saturate 70 per cent.—the remaining 30 per cent. being already saturated with the lighter hydrocarbon vapours. He had not asked the question to display his ignorance, but because he really wanted to know the truth of the matter; as it would be within the memory of those present that a very interesting paper had lately been read by Mr. Allen upon this very question, in which he made a statement of a precisely opposite character. The very interesting experiments detailed in Mr. Allen's paper went to show that, not only did coal gas at a certain temperature carry as much naphthalene vapour as did atmospheric air, hydrogen, carbonic oxide, or whatever it might be, but they showed that, if the atmospheric air was saturated at a temperature of 60° with the vapours of certain light hydrocarbons, and raised to 140°, it would carry more naphthalene vapour than air, hydrogen, marsh gas, &c., at 140° Fahr., but containing no hydrocarbon vapours. The experiments also went to show that coal gas itself, raised to a temperature of 140° Fahr., and then saturated with the vapours of the lighter hydrocarbons, and passed through tubes containing solid naphthalene, would, under those circumstances, carry a far larger quantity of naphthalene than it had done before at 140° Fahr., though, as one might suppose, this would be thrown down in the cooler parts of the apparatus, which would be choked by the precipitated naphthalene. Upon this point, it seemed to him that they had a difference between the statements of two scientific gentlemen on a very important matter, which, at this time of day, ought not to be in doubt, with reference to a subject which had created so much interest in the minds of gas engineers as that of naphthalene. Passing on to the causes of naphthalene deposits, he found it stated that, at a temperature of 60°, or thereabouts, 10,000 cubic feet would carry 0·15 lb. of naphthalene; and they were told that the naphthalene in a million cubic feet of gas could be washed out by the employment of a mixture of 92 per cent. of oil and 8 per cent. of benzene in a total quantity of 15 gallons—that was to say, that 1 gallon of the mixture would wash out 1 lb. of naphthalene. What was surprising about the statement, was that the quantities were so small; and not only was the total quantity small, but the percentage of benzene was very small indeed. Eight per cent.—or, say, 10 per cent.—of benzol, would mean that it was only necessary to employ a total quantity of 1½ gallons of benzene in the washing process, to get rid of the naphthalene from a million cubic feet of gas. If that was so, it was not only a very remarkable but a very cheap process, because the heavy oil could be returned to the tar-well; and naphthalene being a commercial product, the tar distiller would not at all object to it. With regard to this, he would like to ask a further very straightforward question—namely, whether this process had really been tried upon a commercial scale, and whether the figures given could be substantiated; because he found it stated that where liquid benzene was employed to dissolve out naphthalene in coal gas, 400 cubic feet of gas only would take up in the form of vapour ½ gallon of benzene. It was also said that the agent employed must be able to give off, at ordinary temperature, a vapour whose tension and effect upon the illuminating power of the gas were such that the loss of illuminating power occasioned by the abstraction of naphthalene and other substances was more than compensated. What was contemplated, therefore, was that the benzene should be given up to the gas to supply the place of the naphthalene and other substances. It appeared to him an extraordinary thing that 1½ gallons of benzene should do this work, and that there should be no depreciation of the hydrocarbons existing in the gas by the washing action of the heavy oils. The only possible objection to the proposal that he could see, was that it would require special apparatus. The first cost of apparatus was but a small consideration; it was the working charges which had to be considered. The only mechanical objection that he could find was that, a washer being employed, it was very likely that the pressure in the exhauster-house would be raised by several inches; and this might sometimes be a matter of considerable inconvenience. As to the author's statement about the value of naphthalene in coal gas as an illuminant, he thought many of them would have been loth to part with naphthalene if they could possibly have retained it, owing to their having had an exaggerated notion of its value as an enricher. But all the evidence, he thought, went to show that from this point of view it was not worth thinking about, and that it was to be regarded simply as a nuisance that should be got rid of as soon as possible. When they were plainly told that the illuminating value obtainable was really only 0·1 candle at 60° Fahr., it was obviously a mere bagatelle. He would like to add that it appeared to him that they were at last upon the right track as regarded the method to be employed in dealing with naphthalene.

Mr. T. Glover (West Bromwich) said that in 1897, in a discussion on this subject, he had ventured to throw out

some ideas as to the causes underlying the naphthalene trouble; and in the same year he read a paper before the Gas Institute, giving the ideas of himself and two colleagues as to the best methods to be employed in freeing coal gas from naphthalene. On that occasion, he believed he was the first to draw attention, before a body of gas engineers, to the fact that naphthalene was a high-temperature product, and to point out that the natural preventative for subsequent deposits was to wash it out with solvent oils. He purposely refrained at that time from giving figures as to the quantities of oil which might be required to do the work of naphthalene removal; but from that year to the present, he and his colleagues had never let the subject alone. As the members were well aware, the testing of new processes on a working scale always took considerable time. He was glad, however, that Mr. Irwin had, in his paper, confirmed the theories put forward in 1897. He (Mr. Glover) believed the methods employed would commend themselves to every thinking gas engineer. The laws as to the formation of naphthalene were now understood; and he believed the method of washing out, which was both simple and effective, would be appreciated. To compensate for the loss of illuminating power due to the absorption of illuminants by solvent oils, a small quantity of benzol was added to the washing agent; but this addition must not be considered as interfering in any way with the action of the oil, except to prevent the loss in illuminating power when the process was first started. Mr. Irwin had given them a figure which he had found suitable—viz., 8 per cent. of benzol. He (Mr. Glover) thought the thanks of the Institution were due to Mr. Irwin, who, he noticed, had spoken of himself as an outsider. But the Institution were always glad to welcome those who were working upon subjects similar to those engaging the attention of their own members.

Mr. W. E. Price (Hampton Wick) thought it might be of interest if he related an experiment which he had made after having studied Mr. Leather's paper read at the Gas Institute. He inquired as to what oil was available, green oil having been mentioned as being suitable; and he was advised by the tar distiller that creosote oil would probably be more suitable than green oil, as it contained less naphthalene. He tried it on a large scale, taking the whole of his gas; and he put it in the top tray of a Walker purifying machine. He arranged it so that the water, instead of going into the top tray, went into the second; and he filled the first tray with green creosote oil. This was in November last. Three hundred gallons of oil filled the chamber; and he passed, roughly speaking, 15 million cubic feet of gas through it. He then withdrew the oil, because he found he was getting naphthalene complaints. During the time the oil was used, naphthalene complaints most distinctly reduced in number. After a time, they increased; and he then withdrew the oil, and had sent it away to be analyzed. Unfortunately, at the present time he had not been able to ascertain the exact composition of the oil. That worked out at twice the quantity mentioned by Mr. Irwin. After this, he tried the same oil in a Kirkham's "Standard" washer; putting it in the last tray. He found it as useful. He thought they were on the right track in following this plan.

The President: May I ask whether you used any benzol.

Mr. Price said he used no benzol, nor any extra enrichment whatever. He had an enricher, using benzol, which was employed when required; but without that, he could say there was not a drop of half a candle in the illuminating power due to the use of creosote oil.

Mr. C. E. Botley (Hastings) said the paper was particularly interesting from two points of view. They had now put before them the quantity of naphthalene which might be discovered in coal gas, and the fact that the amount it contained had very little effect on the illuminating power. With the general contentions of Mr. Irwin's paper, he could thoroughly agree; and he was of the same opinion as to the effect of climatic conditions on the production of naphthalene. There was no doubt that, whatever steps they took, they could not control their condensation exactly as they would wish, owing to climatic conditions. At Hastings, they withdrew the excess of naphthalene before distributing the gas. He did not think that this was a washing process. Taking the hydrocarbon which they employed, if they washed the gas with it, they would take away a part of the illuminating power. If they took it and sprayed it into the gas, it would have very little effect on the illuminating power, and also on naphthalene deposits, except locally. In their own case, the oil was introduced in the form of minute atoms; and what was wanted was to carry these atoms to the extreme end of the district. This they did; and after six years' experience, he did not think it could be alleged that they made any mistake about it being so. There was one fact brought out by the paper, and that was that at the present time, whichever process might be employed, it was not open to say there was no cure for the naphthalene deposits which had been a bugbear to them all. He might be pardoned, however, for believing that the process they used at Hastings was more generally applicable; and it was certainly far simpler, and very much cheaper in application.

Mr. Price said he wished to add that, in his experiment, the quantity of oil used worked out at 20 gallons per million cubic feet.

Dr. H. G. Colman (Birmingham) said, with regard to abstracting naphthalene on a large scale, there appeared to be no doubt that either of the processes proposed by Mr. Irwin and Mr. Botley would effectively get rid of naphthalene; and the choice between the two depended largely on the cost. Neither of them, in his opinion, would form the final solution of the difficulty. Both were methods of "cure"—extracting the naphthalene which had escaped removal in the condensers—whereas, for thoroughness, he believed it was necessary to so modify the cooling process that the whole of the naphthalene should be retained in the tar. The question of the expense of the washers was a considerable one. Assuming that it took only one-half the washer area required for ammonia, the amount for interest on capital, depreciation, &c., would come to an item that was not inappreciable. With regard to the liquid used, Mr. Irwin gave 8 per cent. of benzene. This was at Burnley, where the illuminating power was 18 candles. Mr. Price, with 16-candle gas, did not find any appreciable diminution of illuminating power. The amount of benzene to be added to the oil would depend on the illuminating power of the gas and the kind of oil used. As to the quantity of naphthalene in coal gas, it might be of interest if he gave them the results which he had obtained during the past few months, although they were probably not as interesting as those they would get during the summer. From the time they had been able to work the picric acid test, all naphthalene trouble had disappeared, as was usually the case in Birmingham in the winter. In December, January, and February, naphthalene had varied from 1½ grains per 100 cubic feet to nothing. But during March, the quantity steadily rose from 2½ to 3½ grains; and in the middle of April, to 4½ grains. Ten days ago, there was a spell of warm weather; and the amount of naphthalene at once rose to 9 grains per 100 cubic feet. At the end of the week, when the weather was colder, it dropped again to 5 grains. At another works, no naphthalene had, up to the present, been detected in the gas. He should be extremely glad if others would obtain similar information as to the way in which naphthalene varied with the atmospheric temperature at their own works. There had not, he believed, been a single naphthalene stoppage reported in Birmingham this year; and in previous years there were not, as a rule, any complaints of stopped service-pipes up to the end of May.

Mr. S. Glover (St. Helens) said that, as one of the original workers of the process described, it had given him very great satisfaction to hear from professional brethren the experiences they had had, and the work they had been able to do, in this matter. They were all pleased to have the experience of Mr. Price; but he thought he failed to have complete success, owing to the apparatus he used. If he had carried out the process in a more correct form of apparatus, and had given it several washings, it would have been different. Mr. Irwin had stated the quantity of washing oil required. This might be left out, because it so depended on the quantity of naphthalene in the gas as it came from the gas-works; and it would have to be found out in each particular case what would be required to do the work completely. In 1874, Mr. Young read a paper before one of the Scottish Associations, in which he described the advantage of using heavy oils, as the hydrocarbon constituents could be then more rapidly and correctly obtained. The success of the process, as described by Mr. Irwin, was assured; and its simplicity would certainly recommend it.

Mr. C. F. Botley (Hastings) said that, having had experience in washing gas with oil, and getting into serious trouble in the matter, he could not help being struck with the view that it was a very ticklish thing to do. Mr. Price had given them his experience for a very brief period—brief in connection with naphthalene—wherein he found that washing with creosote oil did not affect the illuminating power by more than half a candle. That was extraordinary, from his (the speaker's) point of view; and considering the will-o'-the-wisp nature of naphthalene, there was nothing conclusive to be drawn from such a three months' test. It was not necessary to abstract all the naphthalene to prevent trouble with it.

Mr. T. S. Lacey (London) said naphthalene troubles did not confine themselves to the district supplied, but were often to be found at the works. He should like to ask if there was any difficulty in putting the apparatus at the inlet of the scrubbing apparatus, so that the naphthalene could be removed before the ammonia. If the process could be used before the scrubbers and washers, the spare scrubbers might be employed in some way to do the washing; and little extra expense would be entailed.

The President, in calling on Mr. Irwin to reply, said he wished to make no remarks of his own. He thought they had learned a good deal from the paper and discussion. The point Mr. Lacey had raised was an important one. Naphthalene did cause them some difficulty; but if they were going to take it out, they should take it out at the works.

Mr. Irwin, replying to the discussion, said, in answer to Mr. Browne, as to the amount of naphthalene which could be absorbed by gas, supposing two substances had exactly the same boiling-point, or near the same vapour tensions, then Regnault's law held absolutely. When they were as far apart as benzene and naphthalene, then Regnault's law was not quite correct. To a certain extent, benzene acted as a gas towards naphthalene. Therefore his calculations were not mathematically right; but they were near enough for all practical purposes. As to the figures, Mr. Browne had called attention to the fact that gas at 25° C. might contain 0·45 lb. per 10,000 cubic feet; while at 15° C. it would only hold 0·15 lb.

Mr. Browne said that the point he drew attention to was this—that at one part of the paper it was stated that 0·15 lb. of naphthalene would saturate 10,000 cubic feet of gas, but at another part of it it was said that it would saturate only 7000 cubic feet. The table gave the figure of 7000 cubic feet, and the paper said 10,000 cubic feet.

Mr. Irwin (continuing) said, with reference to the percentage of benzol required in the oil, he would point out that it was not the benzol that was extracting the naphthalene. Benzol was added to prevent the oil absorbing any more benzol from the gas. It required 70 gallons of oil per ton of coal to extract all the illuminating agents. Hence, the possibility of such accidents as Mr. Botley had predicted was very remote. The amount of benzol required varied with the quality of the oil, and of the gas. Mr. Glover's experiences were amply borne out by his (Mr. Irwin's). He should like to know if there was much naphthalene in the creosote oil used by Mr. Price.

Mr. Price: No.

Mr. Irwin (continuing) said, in the North of England their green oil was much freer from naphthalene than their creosote oil. Dealing with any loss of illuminating power from the presence of naphthalene in the service-pipes, he said it came to almost nothing; and the maximum loss could be easily determined. He could state absolutely that dry naphthalene did not absorb any of the illuminating power of the gas. Mixed with other oils, there was a slight absorption of benzene, and therefore of illuminating power. The cost of the process at Burnley was very small—a fraction of a penny per 10,000 cubic feet. It worked perfectly satisfactorily at Burnley, and as they had just heard, at Hampton Wick. Many gas engineers with whom he had corresponded had said that their principal trouble with naphthalene was on the works.

NOTES ON CARBONIZING CANNEL AND SHALES FOR GAS-MAKING PURPOSES.

By S. Glover, of St. Helens.

The main object in using cannel in the ordinary manufacture of illuminating gas, is to increase the illuminating power. The removal of naphthalene happens to be an accompanying advantage. The volume of the cannel gas is not so material an object as enrichment. This is shown by the fact that benzol (which adds an exceedingly small volume to the gas) is in many cases used in preference to cannel. In carbonizing cannel, it is therefore evident that the primary object to aim at is not production of volume, but to carbonize it at such a temperature as will produce the maximum enrichment value. It does not pay to crack-up the valuable enriching hydrocarbons to obtain volume of gas. This can be secured much more cheaply from the ordinary gas coals.

As you are aware, cannel coal and bituminous shales (such as are used to enrich coal gas), when destructively distilled or carbonized at the lowest possible temperatures, yield what is known as paraffin or shale oil. These oils contain such a small quantity of acid and basic hydrocarbons, and such a large quantity of hydrocarbons belonging to the paraffin and olefiant group of hydrocarbons, that they can be economically used for the production of lamp oil and paraffin wax.

Ordinary bituminous gas coals, when similarly carbonized at low temperatures, owing to their different structural constitution and percentages of the carbon, hydrogen, oxygen, nitrogen, &c., which they contain, yield very different kinds of oily products; and these hold such a low percentage of the paraffin and olefiant group of hydrocarbons, and such a large proportion of acid, basic, and other series of hydrocarbons, which have to be removed by chemicals, that they cannot be economically used in the manufacture of lamp oil and paraffin wax.

When oil from shale or cannel are cracked-up in retorts at gradually increasing temperatures, the volume of gas increases with the rises of temperature, and for a time (at the lower temperatures) so also does the illuminating power—or, at least, it does not decrease. But as the temperature is further raised, and the volume of gas increases, the illuminating power begins to decrease. For a time, it does not decrease so quickly as the volume increases; and consequently the gross illuminating value of the gas obtained from the oil continues to increase. At still higher temperatures, the illuminating power begins to decrease more quickly than the volume increases, when, of course, the gross illuminating value of the gas obtained from the oil is distinctly less.

In carbonizing oil by itself, the aim would therefore be to carbonize it at the temperature at which the volume and illuminating power were balanced—that is, when one portion of the oil had been cracked-up into volume of gas, to take up the remaining sufficiently volatile hydrocarbon vapours in diffusion, and prevent them being deposited in the tar.

Now it is evident that, when the gas was of highest illuminating power, and the volume of gas small, the tars would be largest in quantity and extremely rich in condensable vapours; for the illuminating power of the gas and the quality of the tars condensing from it bear a definite relation to each other—gas rich in illuminants, when condensed, depositing tars rich in illuminating vapours.

To render these illuminating vapours directly valuable to the gas manufacturer, it is necessary to bring gas in contact with them to take them up in diffusion; and one method adopted to get this gas is to use a higher temperature in the carbonization of the oil. But as this gas is obtained to a large extent by the cracking-up of what at the lower temperature would go to form the denser part of the tars, and as not only gas, but also certain quantities of volatile illuminating vapours, are produced, the loss is more than balanced by the gross gain. As the temperature of carbonization rises higher, however, the denser portions of the tar become more stable, and are not so readily cracked-up into gas; and the illuminating vapours are themselves cracked-up to a greater extent, until a temperature is reached when the volume of gas produced exceeds that required to take up the illuminating vapour simultaneously produced in diffusion, when the gross illuminating power of the gas obtained from the oil is diminished.

When carbonizing oil by itself, or shale or cannel by themselves, for the production of gas, it is therefore evident that the best temperature to employ is that which cracks-up the constituents of the oil, shale, or cannel, in such a manner that there is produced a balance between volume of gas and the illuminating hydrocarbon vapours that can

be taken up in diffusion through the gas. These facts are very clearly demonstrated by the results obtained from a series of experiments made by Mr. Pryce, under the direction of Mr. Hunt, at the Windsor Street Gas-Works, Birmingham, and published in the "Transactions" of the Institution of Gas Engineers for the year 1892.

The following is an extract from the tabulated results given :—

—	Russian Oils.							Shale Oils.			
	A. Lustre.				B. Solar Distillate.			C. As supplied to Rail. and Tram. Companies.		D. Obtained Direct.	
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(1)	(2)	(1)	(2)
Mean temperature of retort	1177	1410	1570	1592	1380	1445	1690	1521	1628	1447	1630
Gas produced in cubic feet per gallon of oil	44·3	74·5	101·3	117·1	58·0	82·9	120·3	82·5	94·6	66·6	83·1
Illuminating power	30·8	49·6	35·7	25·0	58·0	48·2	22·0	41·2	34·3	62·9	46·3
Multiple	1364	3695	3616	2927	3364	3996	2646	3399	3245	4189	3847
Condensed liquid products (fluid ounces per gallon)	89·5	26·5	4·1	0·5	52·4	65·5	0·5	32·2	9·5	43·2	16·2

Mr. Pryce remarks, regarding the above table: "It would appear from these experiments that at a particular temperature the oils give the best results. At temperatures below this, the value of the gas falls off, and, notwithstanding the increased volume at higher temperatures, the value is also less."

The conditions are very different when the volume of gas is supplied from a source outside the oil or the cannel. It is then no longer necessary to crack-up a portion of the oil or cannel to produce volume; the object being to produce the maximum possible quantity of hydrocarbons capable of enriching the volume of gas from outside sources. The temperature at which it is necessary to carbonize the oil or cannel to produce this latter result of maximum enrichment value, is very much lower than that required to produce the maximum illuminating value from the oil or cannel carbonized alone. The maximum illuminating value is obtained from the oil or cannel when the temperature of carbonization reaches the point at which the multiple of volume of gas and the illuminating power of the gas are at the maximum. The largest enrichment value obtainable from the oil carbonized by itself to produce the maximum of illuminating value to be thereafter mixed with coal gas, is from 900 to 1000 candles per gallon of oil. On the other hand, when the oils are carbonized at a lower temperature, so as to produce the maximum quantity of enriching hydrocarbons, and the gas to be enriched brought into contact with these enriching hydrocarbons, there may be obtained an enriching value of 1400 to 1600 candles per gallon of oil.

When the oily products obtained from the carbonizing of bituminous gas coals are cracked-up, at gradually increasing temperatures, results very similar to those got from the shale oils are obtained at first—that is, at the lower temperatures. But owing to the much smaller quantity of paraffins and olefines, in proportion to the other hydrocarbons present in these oily products from the coal, and from the different manner in which these other hydrocarbons crack-up, the gas obtained is at no temperature of the same illuminating power as that got from the cannel or shale oils; and the maximum illuminating power is reached before the paraffins present in the oily products have all been cracked-up. On the other hand, however, the illuminating power of the gas does not fall away so quickly with increased temperatures of carbonization as is the case with cannel or shale oils; and the gross illuminating value continues to rise. It is only when the temperatures are so high as to begin to crack-up the highly stable benzol, that the gross illuminating value falls away.

The temperature which is necessary to carbonize gas coals, to produce volume of gas combined with the gross illuminating value, is therefore very much higher than that suitable to carbonize cannel, to obtain from it the maximum of enriching hydrocarbons. It is therefore evident that, to carbonize cannel at those high heats, a large part of the enriching value must be lost; and therefore the convenience of carbonizing both together at the higher heat involves very considerable loss of enriching products.

The next point to consider is the method of bringing the large volume of gas from the coal and the enriching hydrocarbons from the oil or cannel into contact, as the manner in which this is effected has a considerable influence both upon the enrichment obtained and upon the removal of the naphthalene.

By the usual method of using cannel—carbonizing it along with, or at least at about the same temperature as, the coals—the cannel is not only over-cracked-up, but the resulting over-decomposed products are passed into, and mixed with, the whole of the products from the bituminous coal. The bituminous coal products contain large quantities of naphthalene, and also oils having a powerful solvent affinity for the volatile illuminating hydrocarbons—each 10,000 to 11,000 cubic feet of bituminous coal gas being accompanied by from 10 to 14 lbs. of the former and from 60 to 80 lbs. of the latter. During the process of condensation, the illuminating volatile vapours present in the products from the cannel are necessarily more or less subjected to the solvent influence of the coal tar, by which some of the illuminating vapours are absorbed; and the enormous quantity of naphthalene is sufficient to practically saturate the liquid tars from both cannel and bituminous coals, unless the proportion of cannel is very large. It is thus seen that, by the usual method of using the cannel, its full enrichment value is not obtained. The temperature at which it is carbonized is much higher than that necessary to produce the maximum yield of products capable of enriching the large volume of bituminous gases; and the condensed tars from the cannel are less able to act as solvents for the naphthalene. Both these losses are still further increased during the process of condensation, in the manner to which reference has just been made.

By carbonizing the cannel separately, the temperature best suited to the particular cannel used can be adjusted to produce the higher yield of enrichment; and by separately condensing the products out of the gas produced from the bituminous coal carbonized at high temperatures, the accompanying naphthalene and solvent oils are nearly all removed—not one-hundredth part of the naphthalene being left in diffusion in the gas. On bringing the gas so purified from condensable products into intimate contact with the products from the cannel carbonized at the lower temperature, the gases are free to take up their full load of carburetting hydrocarbons present in the cannel products; and the denser hydrocarbons from the cannel, being practically free from naphthalene themselves, form excellent solvents for the naphthalene still present after condensation in the large volume of high-temperature gases.

The great advantage to be derived from the separate carbonization of the coal to produce volume, and of the cannel to produce enrichment, and the separate condensation of the high-temperature gases and their subsequent contact and treatment with the cannel products, are thus fairly evident.

It gives me peculiar pleasure, in concluding this paper, to draw attention to some statements made by the late Mr. John Methven, in 1892, which, looked at from the standpoint of our late experiences, seem to have been quite prophetic—

> I have made some experiments on the subject dealt with by the papers we have heard this afternoon, which have convinced me that it is absolutely necessary, before we can get an economical result, to have a proper and effectual conveyor for the oils when they are cracked-up. My first experiments were made by mixing different oils with coal in an experimental retort; and I was very much disappointed with the low result of illuminating power which I obtained from that process. Repeated experiments eventually convinced me that there was some mischievous operation going on in the hydraulic main—that one of the hydrocarbons (possibly a heavier one) laid hold of the lighter ones which came off from the oil, and consequently absorbed the light-giving properties of the mixture. I extended my experiments, with the view of forming a conveyor or carrier for these hydrocarbons. Oil was injected into the retort by means of superheated steam; the oil gas

and coal gas being made alternately and mixed in the holder. These experiments gave better results than the first series. But still they were unsatisfactory; some of the hydrocarbons or light-giving material being lost. The next set of experiments I conducted were by passing purified coal gas into the ascension-pipe of the retort in which the oil was being carbonized or cracked-up. I may say that this series of experiments gave very much the best results. At first, we put the purified gas into the retort itself; but we found a decided loss took place from the action of the heated iron of the retort on the gas, so that plan was abandoned. Next, we conveyed a measured quantity of coal gas of known illuminating power into the ascension-pipe, where it met the vapours coming off from the oil; and I must say that the experiment gave results which were extremely satisfactory. I was hopeful of being able to try the experiment on a large scale before this meeting, and that I should have had some figures to lay before the members. But on some future occasion I hope to be able to do so. I cannot help thinking that this is the direction in which we must look for the economical use of oil as an enricher. There must be a conveyer for it. If we crack it up and put it with the gas in the hydraulic main, the heavy hydrocarbons in the uncondensed gas—the tar, and so forth—absorb the light-giving properties of the oil, a great deal of which is thus lost; but by providing at once a suitable conveyor, freed from absorbent hydrocarbons, a permanent gas can be made with very economical results.

The results obtained at St. Helens throughout the last two-and-a-half years' continuous working with cannel carbonized at suitable temperatures in separate retorts, and mixed as described in the paper communicated by my brother and myself in 1898, have enabled us to enrich our gas (the bulk of which is made from the cheapest quality of coal) in the most economical and satisfactory manner.

I desire to acknowledge the help of my friend Mr. William Young, of Peebles, in the investigation of this subject. He has guided me with his extensive and varied experience, in my search for a natural remedy for naphthalene troubles. In adopting the lower temperature for carbonizing cannel, we expected to get some amount of additional enrichment, as well as obtain solvents and carriers for naphthalene. The working results have more than realized our highest expectations; and I hope to have the pleasure of submitting some further experiences upon another occasion.

Discussion.

Mr. F. W. Stevenson (London) said the question of gas enrichment was of peculiar interest at present; and he was sure they must all feel grateful to those who investigated it in the manner which Mr. Glover had done. Any remarks that he might make, he hoped Mr. Glover would feel were not due to want of appreciation of his work in any way whatever; and if he agreed with him or not, it was simply because, in trying his process, the results he had obtained had not accorded with the statements made in the paper. He was fascinated with Mr. Glover's process when it first came out, because it was to give them the means of increasing enrichment with the same materials heretofore used. Then there was the very important point of the relief to be obtained from naphthalene troubles, which Mr. Glover had found in his own case. This being so, after consultation with Mr. Glover, and obtaining his permission to try the process at Sheffield, it was decided to make experiments at the Effingham Street works of the Company. The works were very suitable for the purpose, because from May to October each year one-quarter of the retorts were in operation continuously; so that there would be no disturbing influences to interfere with the experiments. These were made on eleven beds of eight through retorts, 21 in. by 15 in., making about a million cubic feet of gas per diem. He had tabulated the results, and would give an epitome of them. First, a twelve days' trial was made with the retorts working in the ordinary way; and 1215 tons of South Yorkshire coal and Nottingham and Derby cannel were carbonized. Of this, 20·82 per cent. was cannel; and the average illuminating power was 17·72 candles, with a make of 10,327 cubic feet of gas per ton. Then a twelve days' trial was made with Mr. Glover's process; and 1231 tons of coal and cannel were carbonized, 18·84 per cent. of which was cannel. From this, 10,337 cubic feet of gas per ton was obtained, with an illuminating power of 17·80 candles. At that time, Mr. Glover came over to Sheffield and saw the arrangements, and expressed himself as fairly satisfied with them. But he suggested that the temperature of the cannel retorts should be reduced, which was done, and the heats maintained at about 1400° Fahr. Into the cannel retorts, 3-cwt. charges were put, and run for about eight hours. After a slight alteration had been made, there was a further run of eight days without Mr. Glover's process. During this period 874 tons were carbonized, 20·48 per cent. being cannel; and 10,115 cubic feet of gas per ton was made, with an illuminating power of 17·73 candles. On an eight days' trial again, with Mr. Glover's process, very nearly the same results were obtained—837 tons were carbonized, of which 20·55 per cent. was cannel; 10,179 cubic feet of gas per ton was made, with an illuminating power of 17·63 candles. He should say that the whole of the cannel was not carbonized in the two beds. From 76 to 80 per cent. of the cannel was carbonized in the low-temperature retorts. After further trifling alterations, suggested by Mr. Glover and by his own experience, they went on continuous work. From June 13 to Sept. 4, they had 80 days' work with the process; and this, he thought, was a pretty fair trial. There was no alteration in the number of retorts; and each week there was an even quantity of coal and cannel carbonized—720 tons. The total was 8640 tons, and the percentage of cannel 19·12. The yield of gas per ton was 10,570 cubic feet; and the illuminating power was 18·04 candles. The yield was not exceptional for that time of year, when the work was going on continuously, and there was nothing unusual about the make. It might be interesting to know the average temperatures of the gas and atmosphere during the run. The coal gas was condensed, before any mixture with cannel gas, to 66° Fahr.; the average temperature of the cannel gas before mixture with coal gas was 138°; and the temperature of the mixed gases at the outlet of the condensers was 80°. The average temperature of the cannel retorts was 1400°, and the atmospheric temperature 67°. From these figures, there was nothing very special to show that the process was a success. Practically, he could not say there was any advantage in enrichment, because it was just about the usual average at these works. Then came the more important point of naphthalene. When they commenced the process, the complaints of stoppages in the district supplied from the works were about three a week; and they rose to 84 per week. It might be said that there were old deposits in the mains; but again and again he tried to detect naphthalene in the mains during the winter months, and he could never find any up to about eighteen months ago. He himself thought that the naphthalene was formed in the early spring, while this process was at work. The complaints, as he had said, rose to 84 per week; and as the process had been put in chiefly for the purpose of reducing naphthalene, they discontinued it. He did not believe that it increased the naphthalene complaints, because the other works were subject to about the same increase. For the remainder of that summer, little more was done. In the autumn he had an interview with Mr. Young, of Peebles; and he came to the conclusion that the difference between St. Helens and Sheffield was chiefly that at St. Helens they had horizontal condensers, and that the low-temperature gas mixed with the cannel gas near the inlet of the condensers. The gases travelled together through the condensers, and so a thoroughly good mixture was obtained. At Sheffield, the gases met one-third of the way through the vertical condensers; and the liquid products went into the tar-well at once. It was then suggested that they should construct a washer in which the proper mixture could be made; and he hoped to do this in the following summer. But he did not get the necessary permission; and he had to fall back on experimental work. They then made some trials at the experimental works with small cast-iron retorts taking 1¼-cwt. charges. Their first trial was a mixture of 80 per cent. coal and 20 per cent. cannel, working in the ordinary way. The coal and cannel were charged in separate retorts, which were all kept at a sharp heat; and the gas mixed in the hydraulic main. The average result of sixteen tests, of 4 or 5 cwt. each, was a yield of 11,116 cubic feet per ton, with an illuminating power of 17·93 candles, and 683 lbs. of sperm. This certainly did not bear out Mr. Glover's contention that a proper result in enrichment could not be obtained by mixing the coal and cannel, and carbonizing together at a high heat. They then made a further test in the same way; the only difference being that in the first test the gas was not washed. It passed direct from the condensers to the purifiers without washing; while in the second case, the gas was washed in a Livesey washer. The average result again of sixteen tests was a yield of 10,941 cubic feet per ton, an illuminating power of 17·73 candles, and 665 lbs. of sperm. In the next sixteen tests with Mr. Glover's process, the gas and liquid products mixed with the coal gas at the inlet to a Livesey washer; and the average make was 9976 cubic feet per ton, the illuminating power 18·83 candles, and the sperm result 644 lbs. This was very disappointing to him; and they

then made a special washer designed to effect intimate contact and mixture—thinking that the Livesey washer might not be effective. The average result of the tests with the special washer was a make of 10,152 cubic feet of gas per ton, an illuminating power of 18·30 candles, and 637 lbs. of sperm. Then they kept the temperature of the special washer at 130° Fahr., and obtained an average result of 10,359 cubic feet per ton, an illuminating power of 18·44 candles, and 654 lbs. of sperm. This was the result of his experiments. He was extremely disappointed with them. Of course, he might be wrong. Others might try it, and get different results; and he gave them his figures for what they were worth. It was not in any hostility to Mr. Glover that he had given these figures; but having obtained certain results, he could not withhold them from the members.

Mr. T. Holgate (Halifax) said he rose at the request of the President; but he had had no experience of Mr. Glover's process. He remembered that many years ago a somewhat similar suggestion was made under the name of Dr. Eveleigh's system. That gentleman proposed to carbonize cannel at a low temperature, and to use the low-temperature products for the enriching of gas produced from coal in high-temperature retorts. He (Mr. Holgate) believed the process failed because of the relatively small quantity of gas produced from the plant employed. In other words, the low-temperature retorts did so much less work than high-temperature retorts would have done; and, secondly, the labour in gas making and capital expenditure were both increased. He should have been pleased if Mr. Glover had given some description of the process itself, and the plant required in proportion to ordinary methods, as well as some figures as to working results. This information would form a desirable addition to the paper.

Mr. A. F. Browne (London) said he would like to ask one question with regard to this very interesting paper, which appeared to divide itself into two parts, which had just been discussed from a practical point of view by Mr. Stevenson. The paper itself put the matter in a very attractive light; and Mr. Stevenson admitted that he had been very much captivated with the process at the outset. He (Mr. Browne), for one, was also much disappointed that, on trial, the process had not been so successful as could have been wished. With regard to the purpose which the process was intended to effect in the removal of naphthalene, it appeared to him that its object would conflict with the purpose of using it as an enricher. As in the process which they had previously been discussing, the cost went up very rapidly with the temperature. It was evident that, during a great part of the year, it was impossible to keep the temperature of the gas down to as low a figure even as 60°; and this might even be a somewhat low temperature at some gas-works during the greater part of the year. The broad fact was that, as the temperature increased, the cost of the washing process which Mr. Irwin spoke about increased rapidly; and it appeared to him that this would be the case also in Mr. Glover's plant. And not only would it be so, but this curious condition of things made its appearance, that as the temperature went up, and the quantity of naphthalene to be removed by the process increased, so did the percentage of cannel increase. But that was just the time of the year when the percentage of cannel should go down. So that the object of the process in the removal of naphthalene, seemed to conflict with its object as an enricher of gas. It also appeared—though this was not apparent from the paper—that some modification of condensing plant might be requisite, in order to get the full advantage of the process for the removal of naphthalene. He would like to ask Mr. Glover how he got over the difficulty of being obliged to use more cannel than was required for the enrichment of the gas, for the purpose of removing the naphthalene.

Mr. S. Meunier (Stockport) said one point which was brought home to him rather seriously in his early days at Stockport, was the advisability of carbonizing coal and cannel in separate retorts. It appeared to him that, when he first went there in 1891, the percentage of cannel used was very large; and the coal which came into the works was mixed up with the cannel, and was carbonized in the same retorts. As they decreased the cannel, and increased the quantity of the coal, he found every time they mixed the two together they got less good results. The quantity of gas made was very much less than when they turned round and carbonized each in separate retorts. They had never taken particular notice of the temperatures of the retorts in which they used cannel; but, as a rule—and this might have some little bearing on the author's statement—the cannel was put in the bottom retorts, which were of rather lower temperature than the others. They undoubtedly obtained better results all round by keeping the coal and cannel in separate retorts for carbonization.

Mr. T. May (Richmond) said they had heard what was the result at Sheffield; and Mr. Glover had told them in general terms what happened at St. Helens. If Mr. Glover could state what was the comparative result of working with his process and working in the ordinary way, he would give them some basis on which to judge the system.

Mr. R. Beynon (Torquay) said it struck him, in thinking over the subject, that the quality of the coal used might have made a difference. Mr. Glover would employ Lancashire coals and cannels, and Mr. Stevenson would use Yorkshire. This might account for the different results.

Mr. W. Foulis (Glasgow) said the process was contrary to all their experience in carbonizing cannels and shales, as with these it was usually supposed that high heats were required. In his opinion a great deal depended, in the case of high-quality gas, upon getting the gas out of the retorts as quickly as possible, and not letting it hang about and so get decomposed. The discrepancies they had heard about might be accounted for in this way; and it would be well to know the duration and weight of the charge, and all that sort of thing, before giving any expression of opinion upon the process described in the paper.

The President said he did not think Mr. Glover would be disappointed because the discussion had not been as lengthy as it might have been. There had been a certain amount of overlapping in the paper he had read and that which immediately preceded it. There was, in his opinion, a good deal in what Professor Lewes had said that morning—that the question of carbonization of coal had received very scant consideration at the hands of engineers during past years. He was certain now, from what he said, and from information that they had received from Mr. Glover and others, that this subject would, in the immediate future, receive far more consideration than it had in the past. If only for this reason, he thought Mr. Glover's paper was one of the utmost importance. It was always well in a discussion that diverse opinions should be expressed. Simply because a gentleman read a paper, he must not expect everyone to agree with him. Local circumstances must be taken into consideration. It seemed, perhaps, rather remarkable that the experiments carried out by Mr. Stevenson should be so absolutely at variance with the experiences of Mr. Glover, because the local circumstances should not be so very greatly different between St. Helens and Sheffield. But still it did appear that they were very different. It struck him that Mr. Stevenson tackled the subject more with the idea of getting enrichment; while he (the President) understood the invention was to do away with the naphthalene trouble. There was great diversity of opinion on the question of how high-class coals should be cracked-up. It was a pity Mr. Glover was not able to give particulars of the cost of working out the process. But perhaps he did not care to put all his goods in the shop window. He had promised to give them other results on some future occasion. They would all look forward to these results with a great deal of pleasurable anticipation.

Mr. Glover, in reply, said he was not at all disappointed with the spirit of the discussion. What he was disappointed in was that members of the Institution failed to grasp the possibility that, by treating the same coals or shales in an entirely different manner, entirely different results would be obtained. It was disappointing to him that, after such a lecture as they had had that morning, in a meeting of engineers and members of a technical Institution, there should be such a want of appreciation of the possibility of different results being obtained when a process for obtaining such results was properly worked. With regard to the remarks of Mr. Foulis, if he had treated his shales in an entirely different manner, he might have got an entirely different group of hydrocarbons, which would have been much more useful to him in making the high illuminating power gas which he was called upon to supply in Glasgow. Mr. Stevenson started to say he had *worked* the process; but he subsequently altered this assertion by saying that he had *tried* it. If he had persisted in saying he had worked the process, he

(Mr. Glover) should reply that he never worked it properly. Mr. Stevenson mentioned his (Mr. Glover's) visit to Sheffield, and said he expressed himself as fairly satisfied with the arrangement. It certainly had been put together in a cheap and suitable sort of way; and there was no reason why he (Mr. Stevenson) should not get good results, if he worked it in a proper manner. At the same time, it was pointed out that the heat of the cannel retorts was altogether too high, and that the results were not likely to be good, because Mr. Stevenson brought the hot cannel products and mixed them with the coal gas, and immediately plunged them into vertical water-tube condensers, in which the mixing of these products had no chance whatever of taking place. The experiments contradicted themselves. The process was developed to serve two distinct purposes; and in finding solvents for naphthalene from coals differently carbonized, they also found a larger increase of enrichment than they expected. The process was fully described two years ago, when the proportion of cannel required was reduced to one-half of what it was when it was carbonized in the same retorts as coal. The process had been continued. The fuel was made from the lowest and cheapest quality of coal, and was enriched to 18½ to 19 candles by 10 per cent. of the cheapest local quality of cannel. He was quite sure he should never have thought of bringing before the members any assertion of what he had been getting without having good results; and those were the good results of works producing upwards of 300 million feet of gas.

SOME EXAMPLES OF TANK CONSTRUCTION.

By F. W. Stevenson, of London.

As the title of this paper indicates, it is not intended to deal with the subject of tank construction generally, but it is proposed to give examples which have occurred in the course of the author's work while constructing new works at the Grimesthorpe station of the Sheffield Gas Company.

The first is that of a gasholder tank originally intended to be 156 feet in diameter. The construction of this tank was commenced in the year 1867, and proceeded as far as building the wall and excavation of the dumpling. It was then found that the tank had tilted bodily, being 20 inches lower on one side than the other. It was then abandoned for many years.

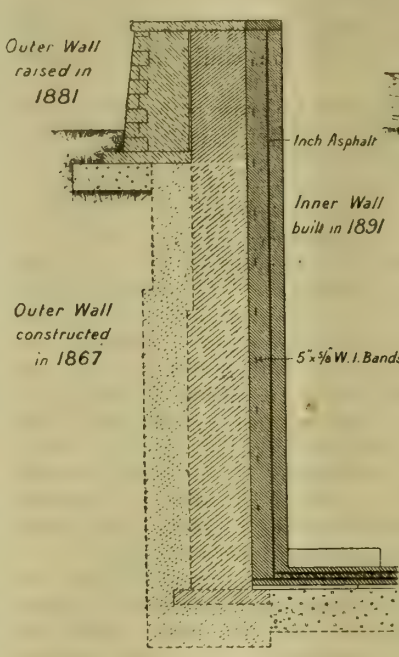
The cause of subsidence was due to colliery workings, which, if not in operation exactly underneath, were in very close proximity; while the particular direction of the settlement was no doubt due to the high dip of the sub-strata of about 1 in 2½, caused by the well-known great fault of the Don Valley, which extends for some miles on the north side of the river upon which the tank was constructed.

In the year 1881, the collieries having ceased operations, and the workings and pit-shaft filled with water to within about 12 feet of the surface, the author's predecessor took in hand the completion of the tank. The section of the wall, as designed and carried out by him, is shown in fig. 1. By this, it will be seen that the coping was raised 6 feet above the ground level; and to obtain the necessary strength, the original wall, which terminated 3 feet thick at ground level, was outbuilt just below the ground to make it 7 feet thick—terminating below the coping at 6 ft. 3 in. thick. An open vertical joint of 1 inch was left between the original wall and the outbuilt portion, but was grouted up before the coping was set; thus practically making the upper wall solid. The bottom of the tank was laid with concrete, and the whole carefully rendered with portland cement.

It was then filled with water to within 3 ft. 6 in. of the curb, when cracks appeared in the wall, and the water escaped faster than it could be put in; and though repeated attempts were made by caulking to stop the cracks, they invariably opened again when the water reached the 3 ft. 6 in. limit. Unquestionably, the outbuilt portion of the wall at the top, instead of being the source of strength for which it was intended, became a serious source of weakness, as by settlement on the comparatively soft ground outside, its weight tended to split the tank-wall, which it effected when assisted by the weight of water within.

For another ten years the completion of the tank stood in abeyance, until in 1891, when additional storage became a necessity, it was decided to make a third attempt. Careful levelling having shown that settlement, if any had taken place in the ten years, was infinitesimal, the author came to the conclusion that the only plan was to build an inner wall of sufficient strength to resist the outward pressure. At the same time, it was expected that considerable support would be obtained from the existing wall after so many years had elapsed for consolidation. Mr. George Livesey was then called in to advise; and he supported the view already taken by the author to build an inner wall. At the same time, he recommended the use of asphalt on account of its elasticity, instead of cement rendering.

Examples of Tank Construction. Sheffield United Gas Company.



Figs. 1 & 2.

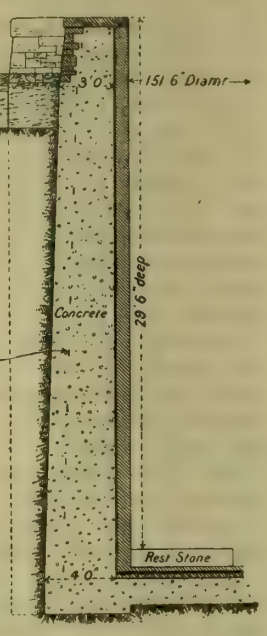


Fig. 3.

The use of asphalt was not, of course, original; Mr. King, of Liverpool, having adopted it in a large gasholder tank there, the construction of which he described in a paper read before the Gas Institute in 1874. Mr. King kindly furnished the author with a sketch showing the method he used in applying the asphalt; and this was adopted at Sheffield. Messrs. T. Atkin and Sons, of Liverpool, who executed the asphalt work for Mr. King, were entrusted with it also at Sheffield.

A section of the lining wall is given in fig. 2. It consists of two vertical walls with a 1-inch cavity between for the asphalt. The back wall was built close up to the inner face of the existing tank; the thickness varying very much as the original tank wall was much out of plumb, but it averaged 14 inches. It was kept as the work proceeded a few courses higher than the inner wall, which was 9 inches thick. Hot asphalt was run into the cavity at every two courses in height. Continuous wrought-iron hoops 5 inches by ⅝ inch, placed on edge, were built into the back wall at every 2 ft. 6 in. apart. The bottom was laid as shown, with two courses of brick flat, with open joints, and two layers of asphalt, each 1 inch thick. In the other tanks, one layer only of asphalt 1 inch thick was used. The result of this construction was most satisfactory, as, on testing, the tank proved bottle-tight; and this has been the experience of the author in every tank in which this asphalt was used.

The second example is that of a gasholder tank constructed alongside the first. Inside dimensions were the same in both cases—namely, 151 ft. 6 in. diameter by 29 ft. 6 in. deep to rest stones. A section of the wall of the second tank is given in fig. 3. A circular trench was excavated in the usual way, and the outer wall put in composed of 8 to 1 portland cement concrete. This wall was 4 feet thick at the bottom, diminishing to 3 feet thick at the top, with 18 column piers each 6 feet square. The curb was raised 6 feet above the existing ground level; the latter being afterwards made up 3 feet, and the exposed portion of the wall faced with random-course stone. Wrought-iron hoops, 5 inches by ⅝ inch, were inserted in the concrete wall every 3 feet in height. The concrete wall being constructed, the dumpling was excavated and the inner 9-inch brick wall, with asphalt lining at back, and the bottom were proceeded with. The Lewis stones for guide-rails were built into the 9-inch lining wall, so that throughout the envelope of asphalt was unbroken.

The cost of this tank and framing for supporting the gasholder crown, was as follows:—

	Totals.		Per 1000 Cubic Feet of Tank Capacity
Tank	£8564	..	£15 17 9
Framing	592	..	1 2 0
	£9156	..	£16 19 9

Being £5 4s. 8d. per 1000 cubic feet of gasholder capacity.

The capacity of the tank, taking the area by depth to the rest-stones, is 539,000 cubic feet. The gasholder was one with four lifts, of a capacity of 1¾ million cubic feet. An epitome of the schedule of quantities, with cost, is given in Appendix A.

The third and last example is that of twin tar and liquor tanks; the tar-tank being 50 feet by 50 feet, and the liquor tank 100 feet by 50 feet, and both 20 ft. 6 in. working depth. In constructing these, the trenches were first excavated for the three main outer walls, which were then constructed of concrete of the same description as was used for the gasholder tanks. When the inside of the tanks were excavated, the side walls presented an unbroken face 158 feet long by 24 feet deep, so that on the side on which the great thrust had to be borne from the dip of the subsoil, the wall was made exceptionally strong—being 5 feet thick at the bottom, diminishing to 3 feet at the top. On the other side, the wall was made 3 ft. 6 in. thick at the bottom and 2 ft. 6 in. at the top; the end wall being 2 ft. 6 in. thick throughout. The usual open-jointed drain-pipe was laid around the outside of the tank, to a sump from which an ordinary contractor's hand-pump was sufficient to keep the water down.

In this case, the 9-inch internal wall was strengthened by building piers at 10-feet centres, 18 inches long, and projecting 9 inches. At the same time that the lining wall was built, two division walls were also built—one to divide the larger and smaller tanks, and the other at the end of the larger one to provide for another tank when required. These divisions were each made of two walls 18 inches thick, with piers similar to the side walls, and having a cavity for asphalt between. The roof was constructed of a three-half-brick ring-arch, carried on cast-iron girders, and supported by cast-iron columns, placed 10 feet centres longitudinally by 6 ft. 4 in. transversely. The whole was sufficiently strong to allow a locomotive and loaded coke-trucks to pass over. A large cast-iron shaft, 3 feet in diameter and rising 15 feet above ground, was provided for the ventilation of each tank. The working capacity of the two tanks is 960,000 gallons; and the total cost was £6668, or £6 18s. per 1000 gallons. An epitome of the schedule of quantities, with cost, is given in Appendix B.

The asphalt employed in these examples was prepared from pitch which contained a portion of the heavy tar oils; the distillation of the tar having been stopped at a lower temperature than is usual with tar distillers. Natural rock asphalt consists of soft limestone impregnated with bitumen; and as this soft limestone cannot be obtained for the artificial asphalt, finely ground soft chalk is mixed with the comparatively soft pitch. This, when required for use, is melted and raised to a high temperature, and a considerable proportion of fine dry sand mixed with it.

Two instances which occurred during the construction of the tanks may be mentioned as illustrating the remarkable elasticity of the asphalt. The first occurred while the concrete wall of No. 2 gasholder tank was being put in—No. 1 being empty at the time—preparatory to the erection of timber framing for the gasholder crown. A thunderstorm, accompanied by heavy rain, caused the water to flood back through the main sewer into the sump adjoining, and drowned out the pumps; the water rising some 6 feet high. This lifted a portion of the floor in No. 1 tank about 12 inches over an area of 10 or 12 feet square. On clearing away the top course of bricks, it was found that the asphalt was not fractured; but to provide escape for the water underneath, and prevent further damage, the asphalt was pierced with a bar, when, instead of water, imprisoned air escaped with a whistling sound, and in two hours time the asphalt had settled down to its original position.

The second was of a similar nature, and occurred to the tar and liquor tank. It had been specified that when the bottom of the tank was complete and the whole of the iron-work on which the brick arches were to be turned had been erected, the pumping from the outside sump might be discontinued. On the pumps being stopped, the water rose about 3 feet above the level of the tank bottom; and it was found that the whole of the bottom of the larger tank had lifted, raising with it the concrete layer 12 inches thick, the base-stones of the columns, and the whole of the roof iron-work—altogether a weight of about 412 tons. The lifting was in the form of a bow springing from the sides, and having

Appendix A.

Epitome of Priced Schedule of Quantities of Gasholder Tank, 151 ft. 6 in. Diameter by 29 ft. 6 in. Deep, to Rest-Stones.

Quantities.	Description of Work.	Rate.	Amount.
		s. d.	£ s. d.
Cub. Yds. 18,000	Excavation	1 11	1724 0 0
	Drain-pipes laid round tank to sump	..	72 0 0
	Use of timber for shoring	..	20 0 0
3645	Concrete—8 to 1 portland cement	15 3¾	2790 7 8
Sup. Yds. 4200	One course brick flat over bottom	2 2	457 0 0
1600	One brick thick lining in wall	6 0	480 0 0
Cub. Ft. 1748	Ashlar stone, including all labour for dressing, sinking, and setting	3 9½	331 10 9
Sup. Yds. 188	Rock-faced wall stone outside tank above ground level	4 0	37 10 0
Cwt. 1056	In wrought-iron tank guides, hoops, and holding-down bolts, &c., including all labour for fixing	12 0½	635 6 3
Sup. Yds. 3826	Asphalt 1 inch thick	4 6	861 0 0
	Cartage of spoil from excavation to tip (about ¾ mile distant)	..	600 0 0
	30-inch diam. inlet and outlet pipes, including all labour for fixing	..	300 0 0
	Pumping and sundries	..	254 18 2
			8563 12 10
	Framing to Support Gasholder Crown.		
Cwt. Qrs. 1175 3	In castings for standards and heads for junction of rafters, including erection	7 1	415 14 4
60 1	In wrought-iron tie-rods, plates, &c., including erection	19 1	57 8 0
Cub. Ft. 934	In timber for framing, including all labour for cutting and fixing	2 6½	119 10 2
	Cost of framing	..	592 12 6
	Cost of tank	..	8563 12 10
	Total	..	9156 5 4

Appendix B.

Epitome of Priced Schedule of Quantities of Tar and Liquor Tanks, 150 feet Long by 50 feet Wide and 20 ft. 6 in. Deep = 960,000 gallons capacity.

Quantities.	Description of Work.	Rate.	Amount.
		£ s. d.	£ s. d.
Cub. Yds. 9300	Excavation, including use of timber for shoring	0 2 1	970 0 0
	Timber frames and moulds for concrete	..	63 0 0
Lin. Ft. 524	Drain-pipes laid round tank to sump	0 1 6	39 12 6
	Pumping	..	80 0 0
Cub. Yds. 1983	Cement concrete (as before)	0 15 4¼	1522 3 3
Sup. Yds. 2630	Brickwork in cement mortar reduced to one brick length, including all cutting, &c.	0 5 3¾	698 19 0
905	Segmental arches in three half-brick rings in cement mortar, including all cutting, &c, and centres	0 9 2¾	417 15 9
Cub. Ft. 569	Stone in padstones, base-stones, and kerbs, &c., with all labour	0 4 7	130 7 0
Tons 172½	In cast-iron columns and girders, manhole frames, &c., including painting and erecting	6 11 1	1130 12 0
3¾	In wrought-iron tie-rods, bolts, &c., including painting and erecting	22 15 8½	85 9 6
Sup. Yds. 2124	Asphalte 1 inch thick	0 4 10	513 6 0
	Carting surplus spoil to tip (about ¾ mile distant)	..	914 0 3
	Tar and liquor pipe connections	..	50 0 0
	Sundry items	..	51 18 8
			£6667 3 11

Note.—All labour and extra items of charge are added to amounts for description of work to which they apply, and from this the rate is calculated to the nearest farthing.

a rise in the centre of about 10 inches. The pump being set to work again, and the water lowered, the whole weight gradually settled back to its original position, without causing any fracture of the asphalt.

The cost of the asphalt and lining to maintain it in position is, of course, more than that of clay puddle, and considerably more than cement rendering; and the author does not by any means recommend its universal application. The duty of the engineer is clearly to make use of local material, when such is suitable for his work. But at Sheffield clay suitable for puddle cannot be procured in the neighbourhood; and with the peculiar stratification of the subsoil in this particular district, and where slight movement might take place, the author is convinced that sooner or later trouble would have arisen with cement rendering. Moreover, rendered tanks, though easy to make water-tight at first, will often give trouble when they come to be emptied for renewal of the gasholder, after a length of years. At any rate, such has been the author's experience with rendered tanks at Sheffield.

In conclusion, it may be said that the use of this asphalt is not confined to tanks. It is equally suitable for flat roofs, wet basements of buildings, or floors on which wet processes are in operation.

Discussion.

Mr. T. Holgate (Halifax) thought they should express their thanks to Mr. Stevenson for his lucid description of the work carried out, and for the completeness with which he had drawn up the appendices. From these schedules of prices and quantities, each engineer would be able to calculate for himself the relative cost of the asphalt method as against cement rendering. Mr. Stevenson had stated in the paper that rendered tanks which had remained tight while in use had become leaky after exposure to the air. He (Mr. Holgate) had wondered, while hearing the paper, what was the cause of leakage—whether it was some disintegration of the surface of the cement which had taken place while exposed to the air.

Mr. P. H. Fletcher (Evesham) said he would like to ask Mr. Stevenson if the asphalt would not hold itself on the wall without an inside lining.

The President said Mr. Stevenson had given them the paper as the result of his experience. It was more a paper of reference than anything else; and the members would read it again when they had anything to do with tank construction. They had all found difficulty in making water-tight tanks. He remembered some time ago he wanted to make a retaining wall water-tight; and put in asphalt between two brick walls; but it was not a success.

Mr. Stevenson, in reply, said he had not expected a very animated discussion on the paper; but it might be useful to the members at some future period. He was unfortunate in having at Sheffield two gasholder tanks, which had been rendered, leaking. Perhaps at Sheffield the atmosphere and the acidity of the air would account for it. There were very many cases of water-works tanks having been constructed with asphalt plastered on the face. Such construction would hardly be suitable for gasholder tanks, because the asphalt would be liable to be damaged by the ironwork, during erection, bruising the asphalt, and thus forming leakages. Whether the asphalt was affected by tar, he had not made experiments to show; but the makers themselves, who had done an enormous amount of work in this way at Liverpool, had lined with it their own store-tanks, which he understood were put down thirty or forty years ago, and were perfectly sound to-day.

AN EXPERIMENT WITH A CONCRETE AND EXPANDED METAL STRUCTURE.

By A. Baker, of Beckton.

Although expanded metal is now so extensively used by engineers and builders generally, the gas profession apparently is slow to recognize the economic principles which this metal, in conjunction with concrete, can undoubtedly lay claim to; and the following experiment, carried out at Beckton, under the instructions of Mr. G. C. Trewby, the Consulting and Constructing Engineer, may prove of some value to those engineers who at any time (in the future) may contemplate its introduction.

The manufacture of expanded metal is very ingenious, and consists in forming sheets of trellis or net-like metal out of solid plates of iron, steel, &c., by mechanically slitting and opening out the sheets, so as to produce diamond-shaped meshes of any size and thickness. There is no waste in the process, the product representing an iron trellis covering an area many times that of the plate operated upon.

The primary use of this expanded metal is for insertion in concrete structures subjected to tension, somewhat similar to the method of using a network or iron rods in the Monier system of cement construction. On examining samples, the peculiar form of the mesh will be noticed, and how admirably adapted it is for the purpose intended; and when one considers the remarkable manner in which structures are strengthened by inserting this metal, it is apparent what economies may be effected by its introduction.

The object of the experiment was to ascertain the strength of a 6-inch slab of concrete and expanded metal built on the channel-arch system, with a view of adopting the principle in a purifying-house floor. The result was quite satisfactory; but unfortunately the point of destruction or breaking strain was not reached, owing to the foundation subsiding. To some extent, therefore, the test was inconclusive.

Many tests of the kind have been made by various engineers, with remarkable results. The object has, however, generally been to obtain the very highest results out of the cement metal, regardless of the practicability on a large scale; and in comparing these tests with the experiment in question, the very short time the concrete was allowed to set must be borne in mind, and also the preparation and proportion of materials, which is of the utmost importance in the comparison.

The concrete consisted of ordinary Thames ballast, passed through a $\frac{3}{4}$-inch sieve, and portland cement of 112 lbs. per bushel, 10 per cent. residue on 2500-mesh sieve, 450 lbs. tensile strength after 28 days' immersion, in the proportion of one of cement to four of ballast. The expanded metal was in sheets 17 feet by 5 ft. 6 in. wide, 3-inch mesh, $\frac{1}{4}$-inch by $\frac{3}{16}$-inch strands.

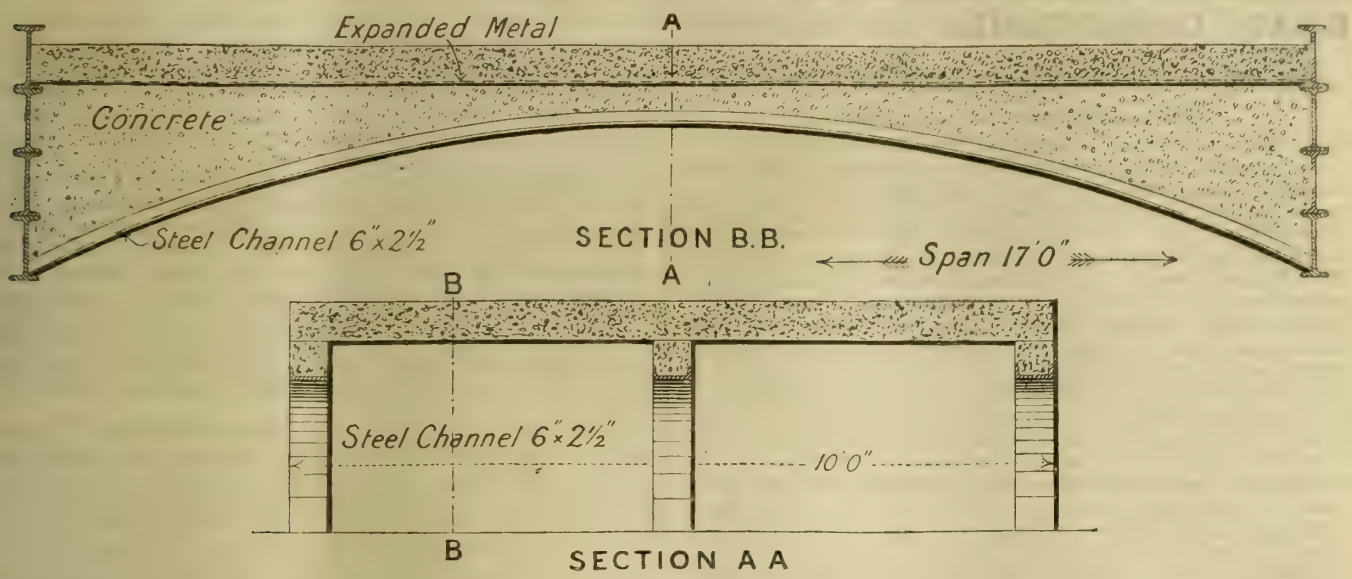
On referring to the diagram, it will be noticed that the structure consists of a 6-inch slab of concrete, 17 feet clear span by 10 feet wide, supported on three jack arches spaced at 4 ft. 9 in. centres. These arches are formed of curved channel-irons 6 inches by $2\frac{1}{2}$ inches section, at $12\frac{1}{2}$ lbs. per foot, with a rise of 2 feet in the 17-feet span, filled up with concrete 6 inches above the soffit; thus making a level bearing on which the slab rests.

The abutments were built with steel joists secured by five wrought-iron straps 4 inches by 1 inch; the foundation being ordinary railway sleepers, laid crosswise on the firmest ground that could be found.

The correct position for the expanded iron is at the bottom of the slab, as far from the neutral axis as possible, where the metal will meet with the greatest tension. In practice, the sheets are laid on top of the timber centering; the edges overlapping one another 3 inches. (To obtain a maximum of strength, the ends of the sheets should be welded together.) The concrete is then proceeded with in the ordinary way.

When the timber is struck, the metal will be found well embedded in the concrete, without any of the strands being exposed. After setting 34 days, weight, in the form of 56 lbs. per yard rails, was gradually applied. These rails were laid on top of a course of blue Staffordshire bricks, to ensure an evenly distributed load. With 27 tons on, a slight crack was observed running diagonally through the concrete of No. 1 arch about 6 feet from the north abutment, and a similar flaw was noticed in No. 3 arch in about the same position, when 38 tons had been put on. But as these did not widen out or extend in any way during the remainder of the test, very little importance need be attached to them, as no doubt they were caused by a slight spreading-out of the abutments. At this point, the average deflection of the three channels was $\frac{3}{16}$ inch. A certain number of rails were added each day until 100 tons—equivalent to 11·8 cwt. per superficial foot—was equally distributed over the slab; but this did not seem to have any effect on the structure—the deflection of the channel irons being 1 inch and the concrete slab barely $\frac{1}{2}$ inch. In places, the channel-irons parted a little from the concrete, but not more than $\frac{1}{4}$ inch.

After letting this weight remain for three weeks, an additional 26 tons were added; the result being a slightly increased deflection. Soon after commencing to load the next morning, it was seen that one corner of the foundation



was sinking, throwing the weight over on that side. No. 3 channel-iron showed signs of buckling close to the foot, and the concrete in the three arches began to disintegrate by the abutment; so that nothing more was to be gained by pursuing the experiment further. The total weight now evenly distributed over the structure was 128 tons 5 cwt., equal to 15·09 cwt. per square foot. The slab was carefully examined at this stage, and found to be quite intact, with a deflection in the centre of ½ inch. The average deflection of the channel-irons was $1\frac{3}{16}$ inches; all three keeping their shape very well indeed, with the full load on.

It may be of interest to hear that expanded metal has been used in many of the new buildings at Beckton for some time now, and with very satisfactory results. As an instance, the construction of eight concrete reservoirs for the bacteriological treatment of sewage may be mentioned. These were 60 feet by 37 ft. 6 in. by 4 feet deep; the walls of the reservoirs being entirely above ground, without any earth backing to resist the fluid pressure from within. Expanded metal was inserted, and the result was in every way most satisfactory.

Area of slab	170 square feet.
Structure finished	Nov. 2, 1899.
Commenced loading	Dec. 4, 1899.

Date.	Weight On.				Average Deflection.	Load per Square Foot.
1899.	Tons.	Cwt.	Qrs.	Lbs.	Inch.	Cwt.
Dec. 5	14	17	1	22	..	1·75
,, 6	27	10	3	22	⅛	3·24
,, 7	38	2	0	22	¼	4·48
,, 8	46	11	0	22	⅜	5·48
,, 12	54	14	0	22	$\frac{9}{16}$	6·44
,, 13	62	17	0	22	$\frac{11}{16}$	7·40
,, 14	71	0	0	22	¾	8·35
,, 15	79	3	0	22	$\frac{13}{16}$	9·30
,, 16	87	6	0	22	⅞	10·27
,, 18	91	7	2	22	$\frac{15}{16}$	10·75
,, 19	99	15	0	0	$1\frac{1}{16}$	11·74
,, 20	99	15	0	0	$1\frac{1}{8}$	11·74
1900.						
Jan. 16	126	9	3	0	$1\frac{7}{16}$	14·88
,, 17	128	5	3	0	$1\frac{1}{16}$	15·09

Discussion.

The PRESIDENT said this was not a paper which would probably require much discussion; but it was a statement of facts, and would be particularly useful to anyone who was thinking of carrying out similar work. He was sure Mr. Baker would be very glad to answer any questions, and would be pleased to hear the experience of anyone who had tried this or similar constructions.

Mr. S. GLOVER (St. Helens) asked in what position Mr. Baker put the expanded metal in the sewage tanks.

Mr. W. R. HERRING (Edinburgh) congratulated Mr. Baker on the lucid way in which he had laid the facts before the meeting. He had had the opportunity of seeing the experiment principally referred to in the paper, and was very interested in it. Some eighteen months ago, in designing a new purifier-house, he arranged for exactly the same kind of construction, except that his main girders were 20 feet apart, instead of 17 feet. With this exception, the diagram practically represented what he was about to do. He was glad to know that a floor with girders 17 feet apart was not seriously affected by a weight of 11 cwt. per foot. He was calculating on requiring a weight of only 4 cwt. The results of the experiments given had put all his doubts at rest; for he was quite sure the difference between 17 feet and 20 feet in the span would not counterbalance the difference between 11 cwt. and 4 cwt. in the load. He had also used the metal in conjunction with concrete at the bottom of a gasholder tank now just completed; the thickness of concrete round the base of the tank being 15 inches, rising over the cone to only 6 inches thick. It was a weak point; and it occurred to him to put in the expanded metal to strengthen it. He thought there could be no two opinions about the advantage of inserting a sheet of expanded metal which gave to concrete a diagonal and transverse bond, which without it concrete lacked. An entire building had been recently constructed at the Dublin Gas-Works with this metal. He had seen it used considerably in large warehouses in Manchester, both for partitions and floors. There was no doubt that the days of thick concrete floors and walls had gone by.

The PRESIDENT said that, like Mr. Herring, he was so struck with this method of constructing floors and buildings, that he lately recommended his Company to give an order for an overhead revivifying-floor built on this principle. He was about to erect a building with the walls made exactly on the same lines as had been described. Mr. Herring was quite right in saying that a very large building had lately been erected in Dublin on this principle; and he found that even on small buildings the price taken at per cubic foot worked out very favourably when compared with brickwork, while the weight put on the foundations was very much less.

Mr. BAKER, in reply, said that the only question put was that by Mr. Glover. The expanded metal in the case of the sewage reservoirs was placed within 3 inches of the surface of the outer walls.

Sunday Labour in Gas-Works.—We have received a copy of a pamphlet by Dr. Gritton and Mr. Peter Steel, entitled "Sunday Carbonizing in Gas-Works: Is it Necessary?" The chief feature in the present issue is that it appeals to Directors of Gas Companies, as well as to Managers. The compilers (it is taken entirely from professional sources—mainly from the "JOURNAL") hope that Directors may be induced to take an interest in this matter, and not leave the whole responsibility to their Managers. Those who plead insufficient storage accommodation may well refer to pp. 4 and 5 of the pamphlet, where appears a table of works (with moderate, or even small, storage) where Sunday rest is carried out. Copies of the pamphlet may be obtained by sending a post-card to Mr. Steel, 7, Carlton Road, Sidcup.

The Association of Gas and Water Engineers of Austria-Hungary.—The following is a list of the more important communications which will be made to this year's meeting of the Association, which, as already announced (*ante*, p. 798), takes place at Pressburg on May 24 and two following days: "An Account of the Gas and Water Works of Pressburg," by the Manager, Herr Berthold; "The Production and Use of Aërogene Gas, and High-Pressure Gas," by Herr C. F. Schweickhart, of Vienna; "Cooking by Gas," by Herr Schoene, of Dessau; "Practical Innovations," by Herr E. Blum, of Berlin; "Salzenberg's 'Kugel' or Ball Light," by Dr. W. Brix, of Vienna; "Governors," by Herr H. Kempler, of Vienna; "New Photometers," by Dr. A. Kauer, of Vienna; and "The Smoke Nuisance," by Professor A. Arche, of Vienna.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1320.)

BUSINESS on the Stock Exchange last week was almost suspended on the opening day, by reason of the reception of the Naval Brigade. However, there was little business to do, so it did not much matter. And thenceforward everything continued very quiet and very flat. The weak speculators for a rise were gradually squeezed out; and by the middle of the week prices were about at their lowest. A slight reaction then set in, as intelligence from the seat of war came out brighter; and Consols, which had frequently changed hands at par, had a quick recovery. Other departments all round were very flat, and prices show a uniform and pretty considerable shrinkage. When the present long account is closed, and if the war news continues satisfactory, it is possible an improvement may be effected this week. In the Money Market supplies were more abundant; and discount rates were lighter, especially towards the close of the week. In the Gas Market, transactions were more numerous than they have ruled for some weeks past; but they were to a very large extent confined to the leading big issues, especially Gaslight and Coke. It almost goes without saying that changes of quotation are lower all round; for while every department in the Exchange has been depressed, the Gas Market has the additional incubus of the coal famine. Still there were no extravagant falls in value. In Gaslight issues, the ordinary had many dealings. The price on the opening day was 102. But this was not touched again; and it fell till, on Thursday, the stock changed hands at a discount for the first time. The lowest point touched was 99 on Saturday. There were considerable dealings in the maximum also; and both it and the debenture receded a point. South Metropolitan was only moderately dealt in; but the quotation was substantially set back. Commercials were quite quiescent; and the prices were unchanged. Very limited were the dealings in the Suburban and Provincial group; but everywhere the tendency was to shrink. Brentford, British, and Crystal Palace had to take lower quotations. Actual dealings in the Continental undertakings were few; and they were mostly in Imperial, which had a slight fall. But Union and European held firm. Companies located in the remoter world came in for little notice; and only River Plate had a slight fall. There was rather more activity in the Water Companies; and quotations had a general but very moderate reduction.

The daily operations were: On Monday, there was great activity in Gaslight issues; but hardly anything else was touched. The ordinary fell 1, British 1, and South Metropolitan 2½. In Water, New River receded 1, and West Middlesex 2. Business was much quieter on Tuesday; and Gas prices were unchanged. In Water, Lambeth 7½ per cent. fell 4, Southwark ditto 3, and Grand Junction 1. Gas stocks were not much more brisk on Wednesday, but reduction proceeded. South Metropolitan and Crystal Palace relapsed 1½, Gaslight maximum 1, and Tuscan ½. Lambeth Water fell 1. The tendency was the same on Thursday. Gaslight ordinary and debenture dropped 1, South Metropolitan 1½, Imperial 2, and British ½. In Water, East London and Southwark fell 2, and Grand Junction and Lambeth 1. The lowering process was continued on Friday, when Brentford new was moved back 5, and River Plate ¼. Saturday was quiet and unchanged.

ELECTRIC LIGHTING MEMORANDA.

A View of the Paris Exhibition—Electricity at the Exhibition—Electric Automobiles—Electric Power Schemes in Parliament—The "Electrician" is Silent.

THE Paris Exhibition being more or less open, it follows naturally that the local correspondents of the principal English newspapers should begin to send over their valuable impressions of what there is already to be seen in the big show. International Exhibitions are familiar enough affairs now; and it is well understood that all enterprises of the kind appeal to two standards for judgment—first as a spectacle; secondly, as registering the height of achievement in the various classes of exhibits. As a spectacle, the present Paris Exhibition should be, and probably is, the finest thing of the kind yet produced. Comparisons can only be had with the famous "White City" of Chicago; and it is pretty safe to conclude that French taste, exercised at home, will show an improvement upon the exported sample of it which almost persuaded the Americans that they, too, are an artistic people. So far as the spectacular interest of the Exhibition goes, the ordinary newspaper correspondent is as well qualified as any, and better qualified than most, to pronounce an opinion on the merits. When it comes to the question of the merits of different classes of exhibits, however, the newspaper reporter is necessarily out of his depth in attempting to guide public opinion. This appears conspicuously in a recent article published by the "Daily News," which affects to describe what the Exhibition has to offer as a record of the progress of electricity.

We get here a statement that the Electrical Palace is the most striking building in the Champ de Mars, which is not far wrong. It is further remarked that the contents of the electrical sections of the World's Show are a marvellous justification of certain prophecies made in the "Daily News" eight years ago concerning the potentialities of electricity, "not only as a source of light, but even more as a source of mechanical power." The latter sentence, of course, gives the reporter away as belonging to the majority of those people who take the popular view of electricity as being a motive power as well as a form of energy. As regards the progress made of late years in electric lighting, it is asserted that even so recently as the Paris Exhibition of 1889 the methods and styles of lamps, and the fixtures generally, were "almost primitive in contrast with those now exhibited." This is, indeed, surprising; but there is more: "As regards motive power, the *trottoir roulant* is only a single instance of the manner in which the natural force may be used for public locomotion." After this, the observation that the electric tramcar is "one improvement which should be introduced with the least possible delay into English streets," lets the reporter down quite gently. He must have been fast asleep somewhere between the successive Paris Exhibitions.

Lastly, this witness marks the automobiles among the latest of all the glories of France. True, he mixes up together oil, gas, and electricity motors; but that is a detail. It is not very clear, from his account, whether electric carriages, self-contained, are or are not a strong feature of the collection now on view. Of course, we are informed of the views of a French electrician as to the part which electric road carriages "may yet" play in reviving travel in the sense in which the word was understood before the railway era changed its significance. People do not so much "travel" by railway, as go from place to place. There is no land travelling, properly so called, off the common highway. Is the electric carriage going to restore the road as a means of making oneself acquainted with men and cities? All that is told us to the purpose is that the electric carriage needs no horses, and is cheap. The first statement is true, if trite. The second is otherwise. It is admitted that the "electric machine" gets exhausted after a time, and must be replenished. Before it can be used on a really grand scale, "there must be established here, there, and everywhere depôts for the supply of electric energy." Why, if electricity is itself a motive power? If this artless reporter were to look around him, he would find more "depôts" where electric energy might be had, at a price, than electric cars to make locomotive use of it.

Electrical power and tramway schemes have kept the electricians busy at Westminster during the past week. Sir James Kitson's Committee have got fairly to work upon the Electricity Generation in Bulk Bills; while an interesting project for connecting Manchester and Liverpool by an express electric railway on the Lartigue mono-rail principle, was also brought forward. By the latter scheme, it is proposed to run trains every few minutes at a speed of 110 miles an hour; and the Bill is opposed by all the existing transport and local governing interests. The Tyneside Electric Power Bills were the first to be taken; and it is an illustration of the crowded industrial condition of this country, that the intrinsic merits of electrical power generation and supply in bulk hardly emerge from the incidental clashing of local and particular opposing interests. It is impossible to gather from the evidence so far given whether Parliament would be justified in handing over the important areas scheduled to the particular Companies promoting these Bills; but some strong testimony has been adduced to show that cheap electricity supplied on a large scale would revolutionize the industrial aspect of the northern "black country." One witness talked of taking a continuous supply of 5000-horse power for the manufacture of calcium carbide, at a price of little over half-a-farthing per unit. At this rate, almost anything is possible. Niagara, at any rate, would be out-classed.

The challenge we addressed last week to the "Electrician" to make good its astounding claim for superior accuracy of electricity-meters to gas-meters, has not been taken up in the current issue of our contemporary. We have scanned its columns carefully, without finding any notice of our imputation upon our contemporary's veracity or competence as a witness to the comparative accuracy of consumers' electricity and gas meters. A charge of this kind is only to be ignored at the price of a very obvious conclusion.

ON THE TYRANNY OF THE LABORATORY.

THE British Public have been treated of late years to much gratuitous advice as to the courses to be taken in order to enable the United Kingdom to keep its old place in the van of industrial and mercantile progress. We have been informed that our financial arrangements need amendment; that our patent system is wrong; that our principle of joint-stock enterprise is meretricious; that our workshop practice is antiquated; and that, in short, almost everything about English trades and manufactures is amiss. All this storm of criticism has, moreover, frequently risen to a hurricane in one regard—the asserted contempt of the English people as a whole for the imperative need of better education. We are assured by many clamorous voices that our workpeople want more schooling, and our leading hands and heads of industries more science. While far from denying the existence of some reason in this contention—of a great deal of reason, let us admit—it is equally certain that, unless British governing authorities and influential people generally keep their

heads in the multitude of these counsellors, the British Public will be in great danger of being sadly befooled from the other side. We have several times in these columns lamented the quality and the influence of that statutory system of elementary education with which the name of the late Mr. Forster is identified, and for which the nation pays in hard cash so much more than he ever expected. And now, with regard to the more recent agitation in favour of more science teaching for the chiefs of British industries, we venture to enter a protest against the growing and still more threatening Tyranny of the Laboratory Men.

We will not yield to anybody in respect for true science, for the scientific method, and for the men who give their lives to the search for, and the propagation of, the truths of science. But this sentiment of respect—of veneration—does not extend to the abuse which is occasionally made of the name of science, and of the recognized grade of membership of a scientific society, and merely means in many cases the acceptance of a title as a credential. Men, in their modern pride of progress, are accustomed to wonder at the fatuity of their benighted ancestors, who were content to entrust their greatest interests to a monarch, and after him to a nobleman, with touching confidence in the rectitude and ability of the crown or the hereditary peerage. Human nature, however, changes not, although its manifestations shift with the times. The faith which a Government Department no longer has in a lord, it reposes in a Fellow of the Royal Society. And many of the people are fascinated, not by the head of a man of science, but by his tail—of capitals.

We are moved to raise this subject here by something that transpired in the course of the recent Committee proceedings on the London County Council Bill for legalizing penalty gas testing by the portable photometer. It is a point that had better be taken separately, in this way, strictly as a question of general principle, without reference to persons. There are those who hold that all this pother would never have arisen, and that all the unnecessary outlay of public money on the promotion of and opposition to the Bill would have been spared, if the Board of Trade had not departed from the provisions of the City of London Gas Act, 1868, relating to the qualification of the members of the triumvirate called the Gas Referees. It should not be so commonly overlooked as it is, that this peculiar body exists solely by virtue of section 29 of the Act named, which runs as follows:—

> The Board of Trade shall as soon as may be after the passing of this Act, appoint three competent and impartial persons, one at least of them having practical knowledge and experience in the manufacture and supply of gas who shall be called the Gas Referees (and who are in this Act referred to as the Gas Referees), and in case of a vacancy happening among them by death, resignation, or otherwise, shall appoint a competent and impartial person to fill the vacancy, one at least of the three being always qualified as aforesaid.

It is unnecessary to specify the duties and responsibilities of the Gas Referees. These are stated in several Acts. In practice, they have come to be limited to affairs of gas-testing; but by the Gaslight and Coke Company's Act, 1876, section 28, the Referees have power to inspect the gas-works and take cognizance of the processes of manufacture "for preventing nuisance." The same power is enacted in the Commercial Gas Act, 1875, and the South Metropolitan Act, 1876.

The idea of this legislation obviously is that the Gas Referees should be a competent and impartial body of experts, having knowledge of the actual gas industry, as well as of the methods of the laboratory. It is notorious how the Board of Trade have lost sight of this ideal. The present Referees are Professor Vernon Harcourt, Professor Boys, and Dr. Haldane. Impartial persons, truly, and competent in their various specialities of chemistry, experimental physics, and physiology. But not one of them answers to the precise definition of the Acts of Parliament, which admits of no dispute. No man of business, or practical man of affairs, needs to be told of the consequences likely to follow—and which, as a matter of fact, have followed—from this ignoring of the practical and exaltation of the laboratory qualification for occupancy of a position of this nature. No man can jump off his own shadow. The London gas manager has to keep his holders afloat, send out good and clean gas, and pay shareholders their dividends. He has to think of how when, and where to buy coal, to sell coke and other commodities; and he has on his head the care of thousands of officers and men. And all the time he has to conform to the refined taste in testing of three honest and well-meaning gentlemen who need know no more about gas manufacture than about shoemaking.

Naturally, as are the Gas Referees, so are the Gas Examiners. The ordinary Gas Examiner may well be a chemist—not, perhaps, of the grade to which the complementary words "and druggist" usually belongs. But there is no statutory obligation, nor any common-sense reason, why any Gas Examiner, Superintending Gas Examiner, or Chief Gas Examiner should possess the peculiar qualification deemed necessary by Parliament in the case of the Referees. As the matter stands, however, they are all laboratory hands, with the defects of that in some respects excellent character. Their minds are apt to run in one groove. The weakness which besets them all is the tendency to overrate apparatus; and when the poison of officialism operates in them as well, there is the temptation to make a fetish of that which was only intended as a guide. What was originally a mere convention, comes to be regarded as one of those Laws of Science of which Dr. Poynting spoke so disrespectfully at Dover last year. We can see the result of too much laboratory and not enough out-door exercise in the bracing air of a gas-works, in the incessant fiddling with photometers and standards of light for use in connection therewith which has characterized the history of Gas Refereedom. Contrast this restlessness with the massive reliance of the French photometrists on the classic prescriptions of Dumas and Regnault, of 1860. Nobody can justly accuse French science of inferiority to the contemporary English studies in the same subjects; and if the methods and appliances of French gas photometry are the same to-day as they were forty years ago, there must be good reason for it.

This is not because the French believe these to be perfect. As the welcome extended to the suggestion of M. Violle shows, they admit that the national industrial standard of light—the carcel lamp—might be improved upon, from the point of view of pure science. But their legal gas photometry is a complete system, perfecty reliable for the purpose; and all parties know what they are about in respect to it. Consequently, the Paris gas testings are an unbroken series from the beginning; the returns for every "trimestre" being comparable one with another. For all industrial purposes, this is far preferable to the unsettled methods of Gas Refereedom. The French carcel lamp may not be a particularly good standard of light; but it is claimed to be uniform within 1 per cent. Similarly, the Bengel test-burner is an indifferent performer; but at least it does not vary. The Foucault photometer, and all the accessories, are work-a-day tools; and although the whole outfit is anything but portable, every Gas Examiner on the permanent staff can go, as he is ordered, from one testing-place to another, and obtain results which agree with those of the men who have preceded and will follow him. There is ample recognition in France of the essentially conditional character of the operation of determining the nominal illuminating power of town's gas by the photometer; and everybody concerned is satisfied to rest it on this basis.

It is scarcely necessary to inquire what would have been said if the Board of Trade had transgressed a statute requiring a member of a certifying authority to be an attorney, or a certificated medical practitioner, as the Department has ignored the requirement that at least one of the Gas Referees must be a person "having practical knowledge and experience in the manufacture and supply of gas." The London Gas Companies have been reluctant to insist upon their lawful rights in this regard; while the Metropolitan Authorities have been careful to use theirs to the utmost, and have tried to extend them. The Gas Companies, probably, have tacitly accepted the professors and doctors whom the Department have appointed to the office, in the faith that, as the duties have shrunk into affairs of the laboratory, men of the laboratory might be trusted to discharge them. But the recent proceedings in the Committee-room are calculated to rudely shake this confidence. Once more the common sense of a Parliamentary Committee has ventured to decide where doctors disagreed; and the erection of the photometer into a fetish has been stopped. Perhaps the Board of Trade may, by the same means, have been awakened to a sense of the obvious truth that the appointment to a Gas Refereeship is not necessarily an exception to the general rule for the interpretation of an Act of Parliament.

THE PRESS AND THE HIGH PRICE OF COAL.

The scarcity and high price of coal—coming at a time when the public interest was riveted upon the campaign in South Africa with a more complete preoccupation than is noticeable now that the stress and anxiety attending the early days of the war have given way to a justifiable hope of speedy and successful termination—received only languid and perfunctory notice in the Daily Press. The announcement that the Railway Companies would be called upon to pay something like 50 per cent. more for their coal supplies during the ensuing year, has, however, aroused more general attention to the subject of the price of coal; and the question is being debated on all hands.

"The Times," in a well-informed leading article yesterday week, referred to the possibility that a great advance in the price of fuel of all kinds is in store for us. (Gas companies, at any rate, have not that to fear. The advance is not "in store" for them; they have had to meet it at close quarters.) Such changes, says our contemporary, "never fail to give birth to somewhat wild proposals. We are sure to hear of suggestions that the export of coal should be artificially checked, either by taxation or some other direct or indirect means."

We shall be told that our home supply of coals should be kept as much as possible for home purposes. Excluding the case of Welsh smokeless coal, to which special considerations apply, it is needless to say that such measures are impracticable, and that, if they could be carried out, they would do mischief. Already foreign sources of supply are being made use of more and more by old customers, as we may only too soon experience. But for the present, no small part of our trade and our shipping depends on the fact that we can supply coal at rates which foreign consumers are still willing to pay. Any attempt to diminish the export of this article, would do ten times more harm than a sharp rise in the price at home. At the same time, such fluctuations are serious factors in the chief problems of industry. If every railway, if every large concern accustomed to make contracts for the supply of coal over a certain period is to pay 5s. a ton more, with a prospect of a still greater rise, there will be, as there ought to be, a disposition to try to shift the burden to other shoulders than the consumers of coal.

The article proceeds to point out that one of the chief lessons

of such a situation as that now existing is the need for improved methods of coal production, leading to economy and consequent lower prices.

The doubt which a large advance in the price of fuel must suggest to persons conversant with the number of days and hours which the miners work, or with the restrictions placed by trade rules, is whether the production might not be much more economical than it is. We might indicate a score of points at which there is room for improvement. One only need be referred to—the free application of labour-saving appliances, and extensive substitution of machinery for the manual labour. . . . With the latest advances, the [Durham] miners' wages stand 46½ per cent. above the wages of 1879. The point here suggested is not that this rise is unreasonable, having regard to the "boom" in certain trades and the great demand for coal; our doubt is whether, in regard to the production of coal, largely controlled by highly-organized bodies, there has been what comes in other industries in the wake of increased expenditure—a recasting of old methods, a free introduction of labour-saving appliances, and an abandonment of rules and practices which necessitate two men doing what one is competent to perform. A few years ago it would not have been worth while mooting the point, if only because Trade Societies would have taken alarm and resisted changes, however innocuous. Now that it is understood that there is no desire or design in any quarter to undermine such organizations, one might look for a fairer and freer consideration of the problem how to work coal mines with the utmost economy.

The leaders of the great Unions have of late, the writer adds, been not unjustly credited with a growing sense of the responsibilities of their position.

There could not be a better way of showing this than by recasting some of the rules which stand in the way of a rapid application of economical methods. . . . Just as employers ought to revise their modes of production and distribution, so ought the employed to reconsider not a few of the articles in their code of rules; and never was there a time in which this could be done with greater ease than the present, in more than one industry, including coal mining.

If the present state of the coal market should really demonstrate, in the manner suggested, an access of reasonableness to the counsels of the Trade Unions, some good would indeed have come out of the evil. But we will believe it when we see it.

The other leading morning paper to take up the question—the "Daily Telegraph"—printed on Tuesday last an article by their City Editor on "Coal Prices and their Effect." Referring to the threatened increase of 5s. on railway coal contracts, and the probable effects on railway dividends, he said—

Taking fifteen of the principal English lines, we find that the total consumption of coal for the past year amounted in money value to a little under £4,000,000, which was an increase on that of the year previous of nearly £700,000. If we are to assume that the aggregate coal bill will be increased 50 per cent., the total cost will mount up to the enormous sum of £6,000,000. . . . . It is hardly likely that increased cost of fuel can extend for an indefinite period. In the meantime, probably the different Boards will see fit to postpone outlay on improvements that are not immediately pressing until a more convenient period; and economies will probably also be introduced where possible. It may be that proprietors will have to submit to a reduction in their dividend; but there is no evidence as yet that this will be more than temporary.

As regards the effect upon shipping companies, it is added—

Much necessarily depends upon the stocks of coal derived from the Colonies, as well as upon the dates from which the new contracts run. We believe that in several cases supplies had been acquired before the last advance, which has caused so much excitement, was notified; but even so, the increased cost must still be very heavy. Taking the Peninsular and Oriental as a type of the big companies, we notice in their last report that the Directors stated the cost of fuel at the large total of £752,900, which exceeded that of the year previous by £116,050. There has been a suggestion that liquid fuel should be used in place of coal; and no doubt a considerable saving would be effected where a sufficiency of such fuel is obtainable. But it would involve some considerable outlay to adapt an existing fleet of old vessels to the new fuel, although we believe a new vessel could be fitted with all appliances for a few hundred pounds. Foreign shipping companies appear to be recognizing the advantages of the liquid fuel and utilizing them.

Another correspondent of the same journal discusses the question of how the Railway Companies are to meet such an increase in the cost of working. As regards the passenger traffic, he expresses the opinion that "it seems tolerably certain that the Companies will find it hard to secure recoupment from their passenger service." Will they be able to do so from their goods traffic? This question is of much importance to buyers of rail-borne coal.

It opens the whole subject of railway freight rates, and it would be impossible to discuss it adequately within the limits of a newspaper article. Suffice it to say that, while the companies may, and no doubt will, put up their rates on goods, and especially on coal, it must be remembered that their power to do so is regulated to a large extent by Act of Parliament, and that if traders are dissatisfied they can always appeal to the Railway and Canal Commission—a body not particularly sympathetic to increases in charges. It may be argued that the companies must reduce their expenses in other directions. But this is easier advice to give than to follow. Bitter experience has taught railway directors that curtailment of services, lowering of speeds, diminution of passengers' comfort, and so forth, are always false economies; for they cause a loss of traffic by no means commensurate with the saving effected. It is strange, but true, that the companies most lavish in their outlay are the most prosperous. The cutting down of expenditure must be done very warily indeed, or the result will be the reverse of what its authors intended. Enough has been said to show that the problem is one that bristles with difficulties of all kinds, and a solution will be hard to find. One remedy suggested is that the companies should purchase collieries and work them, using as much of the product as they need themselves, and selling the surplus to the public. Another, but far more drastic, suggestion, is for State limitation of the price of coal, together with abolition of the surface owners' right to royalties. There is a strong belief in most quarters that the present state of affairs will only be of a temporary nature, and that a drop in the price of coal may be looked for within a reasonable period. At present, however, there is no sign of a slump. On the contrary, the coal dealers appear to think that the top prices have not yet been reached.

Then, under the heading of "The Coalowners' Threat," the "Financial News" remarks that the 5s. per ton has so far only been asked, not agreed upon.

As there's many a slip 'twixt cup and lip, so there's many a contrary chance between threat and performance. It is the opinion of some that the coalowners are merely bluffing. For our part, we think there is a little more than mere bluff in the threat, though we do think, also, that bluff is a notable factor in the situation. The coalowners must have been irritated by the railway companies' recent threat to raise the rates for the carriage of coal; and this may be their reply in kind. Further, the colliers are clamouring for increased wages, and it may be that the coalowners are putting forward this threat of advance partly to recuperate themselves if they have to give way to the men's demands, and partly that they may have a good excuse for refusing the demands if the 50 per cent. advance in price is not brought off. The coalowners see trade very brisk and the values of all commodities rising; they have a practical monopoly of a most necessary commodity. Why should they not try to get as big a share of the plunder as possible? That is how they are reasoning. They mean to try for an increased price; but we can hardly think that they will, or that they anticipate that they will, get so big an advance as 50 per cent. upon their railway contracts, which were upon a handsome scale last year. We believe that, in the upshot, it will be found that the new contracts will be somewhat higher than the old, but will not be 50 per cent. higher. Another consideration worth noting by railway shareholders in quest of consolation, is that the present upward run of prices, whether in coal or in other commodities, is of temporary duration; so that, even though their dividends may be slightly affected for the next two, or two or three, half years, the depression will pass. In that way, it will help to steady dividends; for the high-priced coal will be bought during the exceptionally busy times we are now experiencing, and as these times die down, so will working expenses, as affected by the price of coal. But a word to the coalowners will be in season. Let them remember that sauce for the goose is sauce for the gander. The Legislature interferes with the rates of railway companies; it will only be fair that it shall interfere also with the coal trade, if that interest uses its monopoly power in an extortionate fashion. Meanwhile, no better politico-economic cry could be urged by the nation upon the Legislature than the reimposition of the export duty upon coal. That duty would moderate prices to the home consumer.

RECENT PUBLICATIONS.

Iron Corrosion, Anti-Fouling and Anti-Corrosive Paints. By Louis Edgar Andes. Translated from the German by Charles Salter. (Scott, Greenwood, and Co.)

Every gas engineer is interested in the subject dealt with by M. Andés in the above-named work; rust being one of those evils which is generally present with him. As the author points out, where it has once gained a footing, it is difficult, if not impossible, to eradicate it; and its formation in places inaccessible to periodical examination may, by the corrosion of screws and rivets, readily endanger the safety of an iron structure. The strength of a chain, as is perfectly well known, is that of its weakest link; consequently it is highly desirable that the deleterious action of rust should be reduced to a minimum. The author reviews, in a book of about 270 pages, the various anti-fouling and anti-corrosive compositions in use. Paints containing linseed oil or its derivative, linseed varnish, have, he says, been found to be the best of all protective media against rusting. For many purposes, however, the cost of oil paints is out of proportion to their durability—for example, the painting of iron pipes to be laid underground, ordinary cast-iron articles, &c. These objects, however, should not be left unpainted; and hence use is made of coal tar, or, better still, a solution of coal-tar pitch in benzene or petroleum. Before its use, however, for this purpose, the tar should have been purified from all constituents of an acid nature; otherwise the metal, instead of being protected, will be more readily rusted than ever, since even very weak acids give it a tendency to oxidation. Tar is highly suitable for filling in the interstices of screws, nuts, and rivets; and it will neither contribute to, nor allow the formation of, rust. The author goes fully into his subject, and the translator has been successful in reproducing in another language what he has to say. There are given in the text numerous illustrations of the rusting of iron, prepared in the course of a series of personal experiments on the formation of rust.

The Boroughs of the Metropolis: A Handbook to Local Administration in London under the London Government Act, 1899. By A. B. Hopkins, M.A. (Bemrose and Sons.)

The passing of an Act so honeycombed with references to other Statutes as the London Government Act of last year, is naturally followed by the publication of numerous handbooks to interpret the references, and to make intelligible the alterations to previously existing authorities, and the exact powers conferred, and duties imposed, upon the newly-created bodies. Of the books published for this purpose, none that we have seen is more complete than that compiled by Mr. Hopkins, whose term of office as Chairman of the Highways, Water, and County Rate Committees of the London County Council necessarily afforded him special opportunities for acquiring a thorough knowledge concerning the Metropolitan Local Government. The plan of the volume includes a historical introduction—recalling the horrible chaos existing in London government not so many years since—which is commendably brief and free from "padding;" the terms of the Act, explained by copious notes, and intercalated with the sections of the Statutes therein referred to; the text of the Act given by itself (a useful arrangement, as the sections scattered over 120 pages of notes and other matter are not convenient for reference when the text only is required); some dozen appendices; an index to cases cited;

one to Statutes cited; and a general index. The whole constitutes a very full and useful guide to the law which will come into operation next November.

Elementary Practical Physics. By Henry Stroud, M.A., D.Sc. (Methuen and Co.)

The series of text-books on Technology, published by Messrs. Methuen and Co. (under the editorship of Professor W. Garnett), to fulfil the requirements of students preparing for the examinations of the City and Guilds of London Institute, is distinguished by the success with which the volumes have been suited to their purpose—being neither too rudimentary in their teaching, nor too abstruse. Professor Stroud's treatise on Elementary Practical Physics possesses these characteristics to the full. The book is intended for guidance in practical work in a physical laboratory, and contains instructions for the conduct of numerous experiments which are designed to prepare the student for the more advanced laboratory work he has to undertake before he is fitted for the higher examinations in Physics. These instructions are illustrated by sketches of the required apparatus; the diagrams being very clearly and carefully executed. The arrangement of the matter is also good. The book is an excellent one for the use of student engineers.

Elementary Practical Chemistry and Qualitative Analysis. By Frank Clowes, D.Sc., and Professor J. B. Coleman. (J. & A. Churchill.)

This is a smaller and more rudimentary treatise than the work on Qualitative Analysis by the same authors, which is well established as a text-book for analytical chemists. It covers, moreover, the ground of elementary chemistry generally, and deals with quantitative as well as qualitative analysis. The reputations of Dr. Clowes as Chemical Adviser to the London County Council, and of Professor Coleman as the Professor of Chemistry at the South-West London Polytechnic, are sufficient guarantee of the practical value of the instruction contained in this volume. This instruction is designed rather for the student who requires to possess a knowledge of chemistry to assist him in the profession he intends to pursue, than for him who is qualifying for a professional and analytical chemist. For this purpose, the subject matter is well designed. The text is fully illustrated.

Introduction to Physical Chemistry. By James Walker, D.Sc., Ph.D. (Macmillan and Co.)

This, although designated and intended for an introduction to the study of physical chemistry, is by no means an elementary work, nor adapted to the use of a student unacquainted with first courses in chemistry and physics. To the more advanced student, it is most valuable—being a work not only displaying the results of very considerable chemical research, but, in the selection and manner of presentation of the subject-matter, giving evidence of being compiled by a teacher as well as a student. The book is distinguished by the lucidity with which the more abstruse theories are explained and discussed, and by the much higher literary quality it possesses than is generally characteristic of text-books. Such subjects as the "Phase Rule," Electrolysis, Electrolytic Dissociation, and the Rate of Chemical Transformation, are treated in a manner well calculated to make them—as the author sought to render his work—of interest and help to the student, instead of their consideration constituting "an additional burthen on the memory, which is, to all intents and purposes, utterly useless." Professor Walker's work is one which every enthusiastic student of chemistry would gladly possess, but which the dabbler may be advised to leave to others. It would be wasted on him.

PERSONAL.

Out of 118 candidates, Mr. W. H. Maxwell, Assoc.M.Inst.C.E., has secured the position of Borough Surveyor and Water Engineer to the Tunbridge Wells Town Council.

The Leigh Town Council have approved of a resolution of the Gas Committee that the resignation of Mr. H. C. Page, the Assistant Gas Manager, be accepted, and that he be congratulated upon his appointment as Engineer of the Canterbury Gas and Water Company.

By inadvertence the letters "F.I.C." were added in the "Journal" last week to the name of Mr. Walter Grafton—pp. 1212 and 1238. Our attention has been called to the fact that Mr. Grafton is a Fellow of the Chemical Society, but not of the Institute of Chemistry of Great Britain and Ireland.

Many of our readers will be pleased to learn that Mr. Andrew Dougall, the Engineer of the Hull station of the British Gaslight Company, who has been on the Continent in order to recruit his health, has returned to England very much benefited; and he hopes to resume his duties at Hull very shortly. Mr. Dougall spent two months at Cannes, and one month at Mentone.

The Derwent Valley Water Board have appointed Mr. Edward Sandeman, the Corporation Water Engineer of Plymouth, to be Engineer to the Board at a salary of £1200 per annum for the first three years, £1350 from the end of three years for the following two years, and thereafter £1500. Mr. Sandeman has been in Plymouth for nine years. He was Joint Engineer with Mr. James Mansergh of the Burrator storage reservoir, and also constructed the pipe-line which has superseded the "Leat," which was the means of water supply to the town for some 300 years. Prior to his appointment at Plymouth, Mr. Sandeman was Assistant Water Engineer at Blackburn.

OBITUARY.

The death occurred, on the 3rd inst., at his residence, "Woodhatch," Reigate, of Mr. Thomas Burt Haywood, fellow Director with Mr. S. B. Boulton in the firm of Messrs. Burt, Boulton, and Haywood, Limited, and for many years his partner in the old firm.

Mr. Edward Willis, one of the Directors, for nearly six years, of the Rochester, Chatham, and Strood Gaslight Company, died last Saturday week, at the age of 74, after a brief illness. Among those who attended the funeral on Wednesday last, were Mr. J. J. Foord, J.P., Director, Mr. J. M. Veevers, Secretary and Engineer, Mr. W. H. Day, Chief Clerk, and Mr. A. G. Grant, Collector of the Rochester &c., Gas Company. The Chairman and other Directors also were among those who gathered at the graveside.

After several months' illness of a painful nature, M. Eugéne Breittmayer, the President of the Compagnie l'Union des Gaz, passed away on the 8th inst. His death will be very greatly lamented by the gas industry in France, and by the numerous friends which he had made on this side of the Channel. He had been connected with the Union des Gaz from its early days. He was the Vice-President in 1889; and the following year his colleagues showed their estimation of his character by electing him President on the death of M. Toché. M. Breittmayer was a very active man, and was connected with the direction of other commercial enterprises, among them the Mulhouse Gas Company. He was a Chevalier de la Légion d'Honneur, and a member and Past-President of the Société Technique de l'Industrie du Gaz en France, which body held him in very great respect. The funeral took place last Friday.

NOTES.

The Use of Oil for Laying Dust.

Further information is desirable concerning the utility of oil as a corrective of excessively dusty roads. Several references to the application of waste oil to lay the dust of railways and common highways in the various "black countries" of the earth's surface have appeared in engineering journals; and it seems to have been rather too hastily assumed that this treatment is a cure for the evil of dust. According to a report of the Chief Engineer of the Massachusetts Highway Commission, however, success does not invariably reward experiment in this direction. A section of road at a place called Cottage City, was so peculiarly exposed to sweeping winds that the binding material was removed long before it ought to have been worn down by the traffic, so that it was difficult to maintain the road surface in proper condition. For this reason, it was decided to try oil sprinkling, which was accordingly done over a length of 1800 feet, on the basis of 50 gallons of oil per 100 lineal feet of 15 feet roadway. The oil was first used in June, and was at first thought to be a great success, as no dust blew from the section treated; while from the rest of the road it blew in clouds. The benefit was not lasting, however, as a month later the stone began to unbind, and fresh binding material had to be used. There was also some complaint that the dust was injurious to the clothing of wayfarers.

Collapse of a Concrete Bridge in Paris.

Very great interest has naturally been aroused in the disastrous fall of an armoured or reinforced concrete bridge at the Paris Exhibition. This is the first time that the reliability of this new material of construction has been seriously called in question. One of the chief recommendations ordinarily offered in regard to the material, or the combination of cement concrete and iron or steel wires, is that when it does collapse the fall is gradual and not complete. When, therefore, it became known that a bridge of this construction had fallen in Paris so suddenly as to kill a number of people who happened to be passing underneath it, the credit of the principle appeared to be shaken. From particulars specially reported in the "Engineer," it is possible to form an opinion as to whether the collapse of this bridge was due to the faulty method of construction or merely to particular and accidental causes. Apart from all questions of the design of the bridge, there is ample evidence to show that the centering was removed too soon; pieces of the concrete afterwards picked up being still pasty. This being so, it is unnecessary to carry the inquiry further as regards the trustworthiness of armoured concrete as a material of construction. It once more appears that good cement, and the utmost care in preparing the concrete, are of the essence of this method of building; and also, of course, that the setting cannot be hurried.

Proper Position of Air Inlets and Outlets for Ventilation.

Mr. Mervyn O'Gorman, in a paper on the ventilation of large buildings, admits the difficulty of a satisfactory solution of the

problem of bringing 1000 cubic feet of air past every person's breathing level in an hour, without creating the sensation of draught. Mr. O'Gorman's conditions of good ventilation include comfortable warming by radiant heat, not by hot air. The admitted air must all cross the breathing level; and the difference between the dry and the wet bulb thermometers must never be more than from 3° to 9° Fahr. Otherwise parching is felt, and rapid evaporation gives the feeling as of draughts. The pressure plenum system of ventilation is, he says, the only one which enables the necessary operations on the air to be fully controlled. The author advocates the plan of warming up churches, and similar buildings in occasional use, to 100° Fahr. before the people begin to enter. This prevents after-chills by the heated air coming into contact with the cold roofs and walls. The inflowing air should be washed by a water spray, preferably with the addition of a coke filter. The inlets should be trumpet-shaped. On the whole, the most efficient arrangement for getting the fresh air to move along the breathing line, where it is wanted, is stated to be by admission near the top, discharge at the bottom below the inlet. This disposition of inlets and outlets is given on the authority of experiments made in the United States by Mr. Warren Briggs. It is highly important, as it is capable of being applied both with plenum and with non-mechanical methods of ventilation. Confirmatory experiments are, however, desirable.

Krypton.

It is now some time since the world has heard anything fresh concerning the hidden elements in the atmosphere whose existence was demonstrated by Lord Rayleigh and Professor Ramsay. Recently news has come from Berlin respecting some work done by Professors Ladenburg and Kruegel, on the most recondite of the new elements—that named by Ramsay krypton, because it is so hard to get at. After working much with liquid air, the experimenters thought it possible to get hold of some krypton, with the intention of finding out more of its properties than Ramsay had been able to ascertain with his limited acquaintance with the strange element. After much trouble and many mishaps, the authors were able to procure 3 litres of the evaporated residue of 850 litres of liquid air. The gas from this was collected in large holders. The oxygen and nitrogen were separated out from the residue; and finally 3½ litres of nondescript gas remained. This was condensed in liquid air, which it did very easily and completely; the product being a transparent colourless fluid in which floated a small number of colourless crystals. The liquefied gas was fractionated into several holders, whence it was bottled off for spectroscopic examination. The contents of several of the bottles exhibited beautiful spectra of argon; and some of them showed the green and yellow krypton lines. One bottle, which was filled with the evaporation from crystals, proved to contain almost pure krypton, with a density of 58·8, which would give it a place just before copper in the periodic scale.

The Visit of Gas Engineers to Woolwich Arsenal.—A correspondent thinks it would be well for the members of the Institution of Gas Engineers who paid a visit to Woolwich Arsenal last Thursday week to know that the current number of the "Royal Magazine" (published by Pearsons) contains a very interesting article, well illustrated, on the operations there carried on for the manufacture of arms and armaments.

German Association of Gas and Water Engineers.—The programme of the fortieth annual meeting of this Association has now been issued; and we give a list of the more important papers and reports which are to be read. The meeting takes place, as already announced (*ante*, p. 862), on June 9 to 13 next, at Mayence, under the presidency of Herr W. von Oechelhaeuser, General Manager of the German Continental Gas Company. The General Secretary of the Association is Dr. H. Bunte, of Carlsruhe. Those attending the meeting will assemble on June 9 for an evening reception. The reading of the technical communications will take place on the three following days; and June 13 will be devoted to an excursion. The President will deliver an Inaugural Address; and this will be followed by papers and reports, the chief of which are as follows: "The Gas, Water, and Electricity Works of Mayence," by Herr Kuhn; "Mixed Gas," by Dr. H. Bunte; "Power Gas and Furnace Gas-Motors," by Professor E. Meyer, of Göttingen; "The Illuminating Value of Mantles," on the basis of tests made at the Imperial Physical-Technical Institute; "A New Method of Incandescent Gas Lighting," by Herr Mollberg, of Greiz; "Results of Working the Process for the Simultaneous Removal of Naphthalene and Cyanogen from Gas," by Dr. J. Bueb, of Dessau; "Coal Conveying Machinery," by Herr Weiss, of Zürich; "Storage and Spontaneous Ignition of Coal," by Herr Söhren, of Bonn; "The Use of Gas Coke," by Herr A. Oslender, of Düsseldorf; "The Use of Woltmann's Fan for Measuring Water," by Herr Rother, of Leipsic; and the reports of the several Committees of the Association on "Rules for the Protection of Gas and Water Mains from Electrolysis," "Gas-holders," "Photometry," "Heating," "Gas-Meters," "Water Statistics," "Water-Meters," and "Instruction." Visitors are invited to attend the meeting; and a special programme of arrangements is issued in the interest of any lady visitors who may attend the meeting.

COMMUNICATED ARTICLE.

THE QUESTION OF AN EXPORT DUTY ON COAL.

By A Correspondent.

The question which readers of the "Journal" have been invited to discuss—namely the advisability and wisdom, or otherwise, of imposing a heavy duty upon coal exports—is an important and interesting one, to which attention is naturally drawn by the present dearness and scarcity of coal; especially as the dearness and scarcity are largely due to the increased and increasing quantity of coal sent out of the country.

The suggestion to impose such a duty is (as has been shown in these columns of late) not a new one. Indeed, an export duty was actually put upon coal in 1842 by Sir Robert Peel, but was remitted by him in 1845—it being "admitted to be a failure"—and coal has been exported duty free, in increasing quantities, ever since. The question was revived in 1860, and much discussed by both Houses of Parliament—being made the subject of an amendment to the motion approving the Commercial Treaty with France, by the eleventh article of which the English Government undertook not to impose a duty upon exports of coal to France during the ten years following the notification of the treaty. Mr. Gladstone, who was then Chancellor of the Exchequer, declared that such an interference with the trade of the country as an export duty on coal would entail, could not be entertained. The report of the debates on the treaty (see "Hansard," 8 and 9 March, 1860) affords very interesting reading, and shows clearly the then prevailing ignorance respecting our coal supply. The estimates given to the House by Mr. Hussey Vivian (as he then was) as to the extent of the British coal resources decidedly erred upon the side of optimism. The Welsh coalfields alone, he said, contained 500,000 million tons, which computation does not exactly approximate to the subsequent estimates of the Royal Commissioners, who put the coal resources of the British Islands at less than 200,000 millions.

The Select Committee of 1873, with the report of the Royal Commission before them, adhered in their report (on the tone of which adverse comment has been made in the "Journal") to the decision of the House of Commons thirteen years previously—namely, that the true policy of this country is to leave the coal (as it leaves every other) trade free of duty restrictions. The question now proposed for discussion is, whether the experience of the quarter-of-a-century that has elapsed since the Committee reported justifies a reversal of its decision, and the imposition of a 50 per cent. *ad valorem* export duty on coal. I contend and will endeavour to show that the answer is in the negative.

The proposal for this discussion is accompanied by a general calling into question of the *dicta* of arm-chair Economists such as Ricardo and Mill, and a depreciation of Cobdenism as being commercialism cemented by enlightened selfishness. [Before passing to the examination of the main question, may one be allowed to express a small feeling of surprise and regret that so essentially level-headed and unsentimental a paper as the "Journal" is, should even appear to endorse the modern idea that commerce can defy the laws of economics with impunity.] The besetting weakness of arm-chair Economists is said to be their propensity to refer every particular question to general principles. Is it not rather true to say that there are certain laws governing commercial economy which the economists do but point out, not invent; that, like every other natural law, those laws cannot be defied with impunity; and that, therefore, it is but elementary wisdom to consider every particular question in the light of those laws? Isaac Newton had a way of binding every question of mechanics to the Procrustean bed of his general deduction from the falling apple; but one would not describe his refusal to ignore the law of gravitation as a besetting weakness. The statement of a contemporary that "if our exports of fuel fall off to the extent of a million sterling per annum, our imports must decrease correspondingly," is instanced as a piece of pure economic doctrine that is open to question. It is asked: "Is it certain that it is necessary to export coal in order to pay for foreign wheat, and cotton, and wine? Could not its value be made up by something else?" Surely not. We export coal because other nations ask for it; and if a man ask for coal, it is no use offering him a piano or a suit of clothes. It is demand that makes trade. It is true that part of our coal exports might be replaced by the export of the goods in the manufacture of which that coal would be used abroad—though only if the supply of labour was equal to producing a larger quantity of goods than before. But would not that be really equivalent to exporting the coal used in their manufacture at home? In fact, what argument can be adduced in favour of prohibiting or reducing the export of coal that could not be urged with equal force in favour of prohibiting or reducing the export of goods requiring coal for their manufacture?

But, further, assuming for the sake of argument that it would be possible to substitute for coal exports, manufactured goods that required little or no coal for the processes of their production, is it not obvious that, before these goods could be made, the raw material for their manufacture would have to be imported? What are you then going to export to pay for the additional imports? Coal, or what?

What would, then, be the effect of imposing, say, a 5s. duty on

exported coal? It would necessarily either be prohibitive of that export, or would reduce the export and raise the price on what was exported, or would raise the price 5s. on the whole quantity abroad. It obviously could not be prohibitive and revenue-producing at the same time. Assuming, first, that a duty was imposed such as would stop all exports, what would be the result? To reduce the price at home? "Yes," at the present time; but in the normal condition of the coal trade, when coal is sold at a price only sufficient to earn a bare margin of profit, "No." As, therefore, it is certain that in the ordinary course of events—increased production overtaking reduced consumption—the present high prices will give way to normal, an export duty imposed now could only be effective in hastening an inevitable fall. The consumer would, therefore, only benefit by the possible (though not certain) prevention of rarely-occurring periods of relative scarcity. How about the colliery-owner and the miners? The stoppage of exporting coal would throw out of work about 150,000 men; many collieries would have to shut down; and the owners would be ruined. For what purpose? That the exhaustion of the British coalfields might be postponed from, say, the year 2200 to the year 2250!

I have said that the prohibition of exports would not necessarily prevent periods of relative scarcity. That this is so will be seen on consideration; for it is obvious that the collieries of the country would be obliged to reduce their output to the home demand. That done, a sudden "boom" in the iron trade, and coal might be as relatively scarce and dear as it is at the present moment. What benefit would the gas industry reap, then, from the compulsory hoarding of our coal for the benefit of posterity? Absolutely none.

Meantime, the immediate effect on the nation generally would be that imports would be enhanced in price, while the buying capacity of the nation (its exports) would be lessened by about 20 millions a year—the value of the coal now exported. The imports would be enhanced in cost, first by the fact that coal would be scarce and dear in the countries that now import it from us, and goods manufactured (or corn grown) there would consequently be dearer by reason of increased cost of production in regard to the first, and of railway carriage in regard to both; and, secondly, by the higher charge for freight which the ships bringing the goods to this country would have to pay, owing to their being obliged to return without the cargo of coal which so many of them now carry on their outward voyage. That this is not merely the speculation of an arm-chair Economist, can be seen by a reference to a paragraph in a recent number of the "JOURNAL" (p. 1053), on the "Russian Coal Difficulty," in which it is stated that one of the consequences of the cessation of coal imports into the Black Sea—owing to the imposition of an import duty there, equal in effect, of course, to an export duty here—has been the rise of freights on grain. We import about 10 million pounds' worth of grain yearly from Russia.

If, however, we look to manufacturing or producing the goods instead of importing them—supposing that to be possible, and we cannot, for instance, produce silk or grow sufficient corn to feed ourselves—should we not be stimulating once more the production of coal, and defeat the aim of the duty, and moreover be resorting to protection, pure and simple? For we only import that which can be more cheaply produced abroad than at home. Let the truth be writ large that export duties are protective in character as clearly as are import duties, and are as damaging to trade.

Prohibition of coal exports would, therefore, seriously cripple the trade and impoverish the population of the country, without really, in the event, benefiting the consumer of coal. Were the duty restrictive merely, the same results would ensue in a lesser degree, with the same absence of real benefit to the consumer. In the improbable, if not impossible, event of the duty not reducing the volume of trade, an enhancement of import values would ensue in consequence of the increased cost of coal abroad; and the non-taxpaying classes would be taxed for the benefit of the taxpayer, unless import duties on tea, cocoa, tobacco, &c., were to be remitted out of the coal duty. But is it conceivable that a duty on coal exports would not reduce their volume; and even if it did not, what good end would be served by its imposition? It would be merely a piece of fiscal tinkering.

Look at it how one may, the conclusion is inevitable—that unless the British nation is prepared to say: "Our season of prosperity must end when our coal runs out; let us therefore now take a back-seat among the countries of the world, and, by keeping our coal to ourselves, live a second-rate existence in order that our posterity of three centuries hence shall have coal to use" (by which time the distance of the coal supply from the place of consumption may be an insignificant factor), the nation must go on turning its coal into exchangeable forms of wealth as fast as the demand requires. That the British people will consent to commit commercial suicide now, for fear of what may happen to their descendants a century or two hence, is a very remote possibility.

The necessity for economy in the use of coal is quite another, and a most important, question. It is one thing to advise a man to circulate, and thereby increase, his wealth, rather than to bury it in the ground; another not to tell him that he is foolish to throw some of his money into the sea, because he has plenty more. The man's posterity would thank you for giving the first, but curse you for not giving the second piece of advice. Is it then foolish to turn coal into that which will increase by use.

TECHNICAL RECORD.

THE INCANDESCENT GAS-MANTLE AND ITS USE.

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Great as has been the advance in incandescent gas lighting in England during the past eight years, we are still much behind Continental practice; and whereas in many towns in Germany from 80 to 90 per cent. of the gas-burners are of the incandescent type, in London the percentage would hardly reach 20. This, of course, is largely due to the ability with which the English Welsbach Company have hedged around their great monopoly, and have kept up the price of burners and mantles; so that, though in Germany you can buy an incandescent burner and mantle for a mark (1s.), it costs the English consumer 4s. The fact that a union-jet nipple can be obtained for 1d. compensates with a very large class of consumers for the fact that they obtain only one-tenth the amount of light from their gas that the larger outlay would render possible.

All burners owe their light-giving powers to incandescence; and the gas-flame which emits light because of the glowing particles of carbon within the envelope of the flame, has just as good a claim to the name "incandescent" as the mantles which the term always now conjures up in our minds, the principle of which consists of consuming the coal gas in an atmospheric burner with a non-luminous flame, so as to obtain the maximum amount of heat, and replacing the carbon particles by finely-divided rods or threads of non-combustible oxides with a greater power of emitting light when heated to a given temperature than the original carbon particles possessed.

Producing light by heating refractory bodies to incandescence is entirely an outcome of the nineteenth century, and dates from 1826, when Drummond first showed that a piece of dense lime could be raised to intense incandescence by the heat of the oxy-hydrogen blowpipe-flame; the lime at later dates being replaced by buttons or discs of magnesia, and also by zirconia. When using a comparatively large mass of material, as was done in these earlier experiments, the temperature needed to secure incandescence was above that which could be obtained by the use of air as the supporter of combustion; and it was a considerable step forward when it was realized that, by attenuating the body to be heated, and choosing a highly refractory material of low conductivity, an ordinary flame would give the temperature which, with the larger mass, had required the use of such costly appliances as the oxy-hydrogen blowpipe.

Even before the middle of the nineteenth century, the general principles upon which the incandescent mantle of to-day is based were known; for we find that Talbot, in an article on "The Nature of Light," published in the "Philosophical Magazine" in 1835, stated that "paper soaked in a solution of chloride of calcium, and burnt in the flame of a spirit lamp, leaves a white network of ashes, which, when held in the feeblest alcohol flame, emits a brilliant light." This experiment contains the germ of incandescent gas lighting, and embodies the principles adopted at the present day—namely, the saturation of a natural combustible fibre with the salt of a metal, burning off the organic matter, and leaving a skeleton of the oxide of the salt of the metal used, in so finely divided a condition that, on being subjected to the heat of any ordinary non-luminous flame, it becomes incandescent.

Four years afterwards, Cruickshank took out a patent for a cage or mantle of fine platinum threads woven together, and of such a shape and size as to thoroughly envelop the outer portion of the flame which caused its incandescence. Cruickshank, however, noticed that the luminosity of the wire was not so great as that emitted by heating the oxides of certain metals. He therefore attempted to increase the light-emissivity by coating the platinum wires with a paste of such oxides, but without much success, as it was found impossible to make the paste adhere to the surface of the wires for any length of time.

In 1848, Gillard first put the manufacture of water gas on a comparatively successful footing, by introducing the principle of raising carbonaceous material to incandescence in a cupola furnace by an air-blast, and then injecting steam to form the water gas until the temperature fell, when the steam was cut off and the fuel again "blown" up to the necessary temperature to make water gas once more—a process which is the basis of all modern water-gas practice. Water gas—consisting of nearly equal volumes of hydrogen and carbon monoxide—burns with a non-luminous flame; and desiring to utilize it for lighting purposes, Gillard devised a cap or mantle of fine platinum wire, which was suspended in the flame and heated to incandescence. For some months, this method of lighting was in use at Passy and Narbonne. But the trouble which has wrecked all attempts to utilize mantles of platinum soon showed itself; and the light emitted by the metal filaments rapidly grew less and less under the influence of the burning carbon monoxide, and finally the mantles became so brittle that they fell to pieces.

In 1849, Frankenstein introduced a lamp in which the flame from oil or spirit was caused to heat to incandescence a netted

fabric coated with a thin paste of magnesia and lime, mixed with gum arabic. Owing, however, to the materials being merely pasted upon the fabric, and not soaked into it, these mantles were very fragile, and had no durability. Indeed, it is an impossibility to make a mantle exactly according to the instructions given by Frankenstein, who, as afterwards explained by Werner, really mixed with his ingredients a little common salt, whereby some of the oxides were converted into soluble chlorides, which soaked into the fabric, and so rendered the manufacture of the mantle possible.

So far, the work done had been to establish the form of the mantle and the principle of obtaining the material in a sufficiently fine state of division to become highly incandescent at the temperatures given by an ordinary flame; while Talbot had clearly indicated the way in which this might be done. The only non-luminous flames available up to this period were those of the spirit lamp and water gas. But at this epoch Bunsen, the greatest of Heidelberg's great men, was planning and fitting up those laboratories which have since then given so rich a harvest to the scientific world; and while considering the methods of heating which should be adopted on the working benches, his attention was called by one of his assistants—now Sir Henry Roscoe—to the then novel contrivance of a non-luminous gas-burner. Seeing at once the enormous convenience of such a source of heat, Bunsen brought his marvellous manipulative skill to bear upon the subject, and in a few weeks gave the world its "bunsen burner"—a burner which has done more for the gas industry than almost any discovery or invention connected with it, which has made coal gas possible and successful for fuel purposes, and has enabled it, in conjunction with the incandescent mantle, to hold its own against the threatened rivalry of the electric light.

The next step of importance in the history of the incandescent mantle was the replacing of lime and magnesia, which up to this time had alone figured as the constituents of the attempted mantles, by oxides of a more refractory character, and having the property of emitting a more intense light at the available temperatures. In 1852, Bergemann noticed that oxide of thorium, when heated to incandescence, emitted a beautiful light; while in 1863, Bahr, when heating nitrate of erbium upon a platinum wire, observed that it swelled up and left a residue of oxide, which emitted a brilliant greenish light. Having communicated this result to Bunsen, they made a joint investigation of the subject, the results of which were published in "Liebig's Annalen" for 1864, where they point out that the oxides of the yttrium group of metals, when heated to incandescence, emit a beautiful light of great intensity.

In 1878, Edison patented the idea of coating platinum wires with oxides of such metals as zirconium and cerium; the materials being applied as soluble salts, acetates, oxalates, or nitrates, which were then burnt off, giving a more coherent structure than was obtained by Cruickshank—the coated wires being afterwards heated by the passing of an electric current. It is evident, therefore, that by 1878 not only had the principles upon which the mantles of to-day are constructed been published, but the oxides of the rare earth metals had been recognized as incandescents.

In England, the first practical attempts at incandescent lighting were in the early eighties, when the Lewis incandescent platinum mantle and the Clamond incandescent light were for the first time brought to the notice of the public. The Lewis mantle consisted of a cylinder or cone of fine platinum wire gauze, fixed to the end of a bunsen burner; the gas being supplied at ordinary pressure, while a current of air was forced at considerable pressure up a central inner-pipe, the injecting action of which also caused an additional supply of air through lateral supply pipes. These mantles were never a great success. The necessity of using air under pressure was a serious drawback; but the most important objection to them was that the surface of the platinum was slowly corroded by the burning gas, and though the mantles yielded a very good light at first, their luminosity rapidly decreased to a very low point.

In the Clamond mantle, a conical basket of threads of calcined magnesia was employed; being supported in a small platinum cage, point downwards. The flame was driven into it from an inverted burner above. These baskets were formed by moulding a paste of the hydrate and acetate of magnesia, mixed with water, into threads, which were then woven into basket-form and ignited. In this system, the gas and air were at first used under pressure; but in the later forms, the basket was converted into a mantle by supporting it with its apex upwards, and an ordinary burner of the bunsen type was used to heat it.

The above mentioned processes and researches really represent everything of importance that was done prior to Dr. Auer von Welsbach's great adaptation; the various attempts to improve the Drummond light, the efforts of Bourbouze, Wiesnegg, Popp, and Sellon to render the platinum mantle a success, and such publications as the much-quoted patent of Stokes Williams, having no real bearing on the subsequent introduction of the incandescent mantle.

Bunsen's laboratory at Heidelberg, which was the birthplace of the bunsen burner, also supplied the idea of the mantle in the form which has revolutionized our systems of lighting; as it was here that Welsbach pursued his studies and researches on the rare metals and their salts, which afterwards stood him in such good stead. The most generally credited story of his discovery is that, while boiling a solution containing salts of some of the rare metals, the liquid boiled over, and evaporating on the fibres at the ragged edge of a piece of asbestos card (which served to support the beaker, and round which the flame was lapping), endowed them with such luminosity as to attract Welsbach's attention, and that he then devised a method of preparing a mantle of the oxides of these metals that should fit the bunsen flame, and should be made up of sufficiently attenuated filaments to allow of the flame raising it to the necessary degree of incandescence. It is more likely, however, that, as the high power of incandescing possessed by the oxides covered in his first patent of 1885 were traditions in the laboratory from the work of Bahr and Bunsen, the application of the principle underlying Talbot's and Frankenstein's experiments to the formation of a practicable mantle from these salts, was in reality the great initial step in this matter.

Be this as it may, it is impossible to give Dr. Auer von Welsbach too much credit for having brought into a practical form odds and ends of knowledge which up to this period had been practically useless, and which after another seven years of work and experience have resulted in one of the most remarkable successes of modern times. In his 1885 patent, Welsbach protected the idea of making a mantle by saturating the cotton fabric and then burning off, using mixtures of the salts which he gives as 60 per cent. of zirconia or oxide of zirconium, 20 per cent. of oxide of lanthanum, and 20 per cent. of oxide of yttrium. The oxide of yttrium may be dispensed with, the composition being then 50 per cent. of oxide of zirconium and 50 per cent. of oxide of lanthanum. Instead of using the oxide of yttrium, ytterite earth, and instead of the oxide of lanthanum, cerite earth, containing no didymium and but little cerium, may be employed. The mantles made under this patent served the purpose of accustoming the public to the idea. But commercially they were a total failure, as the light they emitted hardly exceeded that which the Clamond basket has given, while they were far more fragile. A number of tests made between 1886 and 1889 showed the light emitted to vary from 3 to 6 candles per cubic foot of gas consumed, the higher value being rarely reached; while on making mantles with the purer materials obtainable at the present time, according to the prescriptions given in the 1885 patent, the results obtained are—

	Composition of Mantle. Per Cent.	Gas Consumed. Cubic Feet.	Illuminating Power. Candles.	Candles per Cubic Foot.
1.—Zirconia	60	.. 5·4	.. 12·9	.. 2·4
Lanthana	20			
Yttria	20			
2.—Zirconia	50	.. 5·5	.. ·4	.. 1·7
Lanthana	50			

This shows that a good deal of the candle power of the earlier mantles was due to impurities present in the salts used, and also to the fact that the prescriptions were continually being varied in hope of improving the results, and that when obtainable thoria was used to replace the zirconia.

In 1886, Welsbach took out his second patent, which covered the use of thoria, either when used alone or mixed with zirconia, magnesia, yttria, erbia, neodidymia, lanthana, alumina, &c. It is evident from the text of the foreign patents which correspond with the English 1886 patent, that Welsbach had the impression that a pure thoria mantle had a very high power of emitting light; and that it was for this purpose that he patented it. In point of fact, however, if the thoria be pure it emits practically no light at all; but later experience showed that it had properties which rendered it the most important of the oxides used in mantle making, as its refractory nature gives a stability to the feeble structure that cannot be obtained by any other known body.

The thoria mantles made under the 1886 patent gave a service of 6 candles per cubic foot of gas consumed; but when now made with pure thoria as specified in the patent, they give a duty of less than 1 candle per cubic foot of gas, while the other mixtures specified in the patents give results which hardly come within the range of practical utility.

		Gas Consumed.	Light Emitted.	Candles per Cubic Foot.
1.—Thoria	3 parts	.. 4·4	.. 9·0	.. 2·0
Magnesia	2 ,,			
2.—Thoria	1 part	.. 4·5	.. 15·0	.. 3·3
Zirconia	1 ,,			
Yttria	1 ,,			
3.—Thoria	30 p. ct.	.. 4·7	.. 12·2	.. 2·5
Zirconia	30 ,,			
Lanthana	40 ,,			
4.—Thoria	2 parts	.. 4·5	.. 12·2	.. 2·7
Magnesia	1 ,,			
Lanthana	2 ,,			
5.—Thoria	3 ,,	.. 4·0	.. 3·6	.. 0·9
Magnesia	1 ,,			
Alumina	1 ,,			

The use of ceria together with thoria, is mentioned in some of Welsbach's early foreign patents; but the exact date at which it was first realized that traces of ceria had the marvellous effect on the light-emissivity of the thoria mantle that we find in the mantles of to-day is not very clear. It is evident, however, that the advantage of the presence of small quantities of ceria was beginning to be realized in 1891, when Mr. W. Mackean, the Chemist of the English Welsbach Company, read a very interesting paper before the Society of Chemical Industry, and pointed out that ceria was by no means a disadvantage in small

quantities, as it added to the constancy of the illuminating power. He gave a table showing the influence of the presence of ceria in the lighting fluid; and also the influence upon the light which increasing quantities of ceria have. Thus, for instance, the ordinary lighting fluid contains 0·25 per cent. of ceria, and gives 25 candles for a consumption of 2·5 cubic feet of gas, or 10 candles per foot; but an increase in the percentage of ceria to 0·5, reduces this to 18 candles for 2·5 cubic feet. When 1 per cent. of ceria is added, a further reduction to 13·5 candles for 2·5 cubic feet is found; but while the candle power lost 43·2 per cent. in 1000 hours with the 0·25 per cent. of ceria, it only lost 12·6 per cent. in one experiment and 28 per cent. in another with 1 per cent. of ceria present in the original fluid. He also, in the same paper, gave the composition for a mantle furnishing a yellowish light—lanthana 40 per cent, thoria 28 per cent., zirconia 30 per cent., and ceria 2 per cent. This shows that at that period the use of small quantities of ceria in mantles containing thoria was by no means unknown.

About this date, also, mantles on the Continent began to show a marked improvement; and in 1891-92 it was reported that Welsbach had produced new mantles yielding as much as 16 and 17 candles per cubic foot of gas consumed. The same great improvement manifested itself in the English mantles; the cause of the great advance being made clear the following year by Mr. Moeller taking out the patent of 1893, in which he sought protection for thoria in combination with very small traces (not exceeding 1 or 2 per cent.) of the oxides of certain other rare metals—such as uranium, cerium, terbium, neodidymium, samarium, praxeodymium, yttrium, and lanthanum. The mantles of to-day nearly all consist of 99 per cent. of thoria and 1 per cent. of ceria, as, although several of the oxides mentioned in minute traces endow a non-luminous thoria mantle with the power of emitting light, yet ceria so far transcends the others in its capacity of not only exciting luminosity but of keeping up the illuminating power over a long period, that as far as present knowledge goes it is needless to look beyond it.

From this brief description of the growth of Welsbach's great discovery, it is clear that our present mantles are the outcome of three distinct stages of invention—

1.—The method of making the mantle and the use of the oxides of the rare earths.
2.—Using thoria instead of zirconia as the basis of the mantle.
3.—The effect of traces of other oxides on the light-emissivity of thoria.

At the period when Welsbach commenced his classical piece of technology, the rare earths had been studied by but few; and though there were several illustrious chemists—first and foremost among whom stood Bunsen—who had made a special study of them, and knew how to prepare them in a condition of absolute purity, it was with the commercial, and not the purely scientific, side of the question that Welsbach had to deal. The price of most of the constituents being almost prohibitive, the processes for purification, which necessitated a considerable loss of material, were not pushed to the point that can be done at the present time, with the enormously cheapened earths at our disposal; the result being that the candle power of the earlier mantles was often more influenced by the impurities present in the materials used than by the actual composition of the mantle. This was undoubtedly the case with the nitrate of thorium used in the manufacture of the mantles in the early nineties, which was made from thorite and orangite, and which contained besides thorium salts, cerium, lanthanum, yttrium, and neodidymium compounds in large traces.

The light given by these mantles having attracted attention, careful analyses were made; and it was found that the pure thoria gave practically no light, while directly the traces were added to it the high illuminating value of the mantle returned. Having found this, Welsbach applied for a German patent to protect mantles made with thoria containing 1 to 2 per cent. of ceria; but the patent was not granted.

Many experiments have been made in order to determine the effect of the percentage of ceria when added to thoria on the light-emissivity of the mantle; and the results vary in putting the highest light-emissivity at from 0·9 to 3 per cent. of ceria, the reason of this discrepancy being due to a number of small causes acting together. In order to get the maximum result, exact air adjustment is necessary, and traces of impurities must be very carefully eliminated. Under these conditions, the point of maximum emissivity may be stated as 99 per cent. thoria and 1 per cent. ceria. At this highest point, however, the mantle is peculiarly sensitive to air adjustment; and if this is not attended to in the most careful way, the results may vary between the limits indicated. Moreover, it is necessary that the mantle should have been most carefully treated—first with dilute alkali, then with dilute acid, and finally thoroughly washed with distilled water and dried under conditions which preclude the possibility of their being contaminated with dust.

If these conditions are observed, it is found that, starting with a pure thoria mantle giving practically no light, the candle power rapidly rises as traces of ceria are added to it, until the maximum is reached, when it again rapidly falls away with further increments of ceria. The colour of the light undergoes at the same time a very marked change, and acquires a yellowish tint which, with increasing quantities, becomes gradually of a reddish character. The narrow limit over which the highest light-emissivity exists, renders a careful proportioning of the liquid for soaking the mantle of the greatest importance.

Experiments have also been made in order to try the effect which additions of various proportions of ceria have upon the life of useful light emission which the mantle possesses; and these show that, with a Welsbach mantle made under the ordinary conditions of impregnating the cotton fabric with a solution of the nitrates of thorium and cerium, the higher the initial illuminating value, the more marked is the loss in light over a given space of time. In the ordinary burning of a commercial Welsbach mantle, it is generally found that the light increases for a certain period, and that then a steady fall in illuminating power takes place; the initial period of gain in light-emissivity most probably being due to the mantle shaping itself to the flame, while the gradual fall in power which takes place after that period has been completed is chiefly due to dust particles containing silica, which are drawn in over the surface of the mantle by the chimney draught, and which, fusing on the outside of the fine filaments, form silicates having a lower power of light-emissivity than the original oxides. This point will again be reverted to in the following lecture, where I shall have to show the important bearing which the form of the filaments composing the mantle has upon this power of keeping up its illuminating value. In the Welsbach mantles made during the past few months, the preliminary rise in illuminating power which used to take place in the first 100 to 120 hours has disappeared, and the fall seems to start at once; this being probably due to the mantle being seasoned—*i.e.*, shaped and heated for some time before being sent out.

Since the facts which I have brought before you with regard to the thoria-ceria mantle have been fully ascertained, innumerable attempts have been made to evade the patent under which the Welsbach mantle is manufactured; but so far these efforts have not been of much profit to any but the legal profession and the experts. Indeed, it may be stated that the only mantle which in England has had its position placed upon the same legal footing as the Welsbach, is the Sunlight, in which advantage was taken of the power which oxides of chromium have of exciting luminosity when superimposed on a structure of alumina. In some of the mantles which have been proposed, small quantities of acidulous bodies are added—such as silicic acid or the oxides of arsenic and antimony—with the view of converting a portion of the thoria into silicate, arseniate, &c.; but in no case that I have tested does the alteration improve the mantle either in life or light-emissivity.

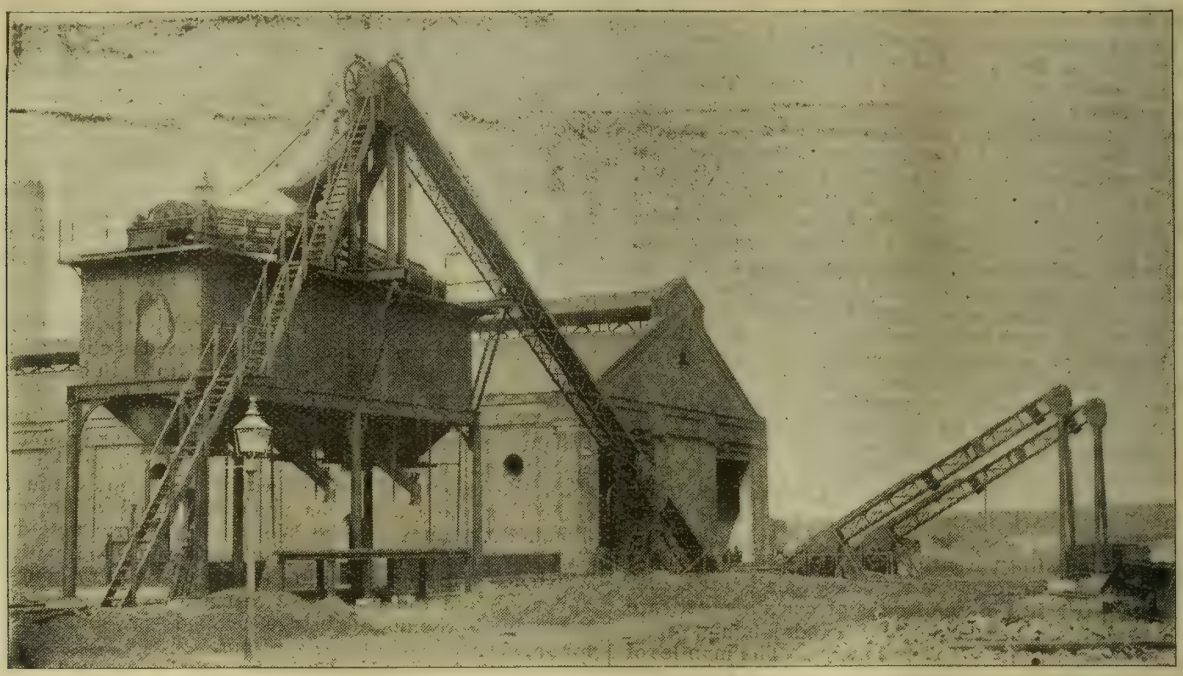
Another very popular method of making an alteration in the way of obtaining the mantle is to first produce a basis of thoria, and having got the fabric in thorium oxide, to coat it with a mixture of 99 per cent. thoria and 1 per cent. ceria. This modification of the process certainly seems to give an improvement in the mantle. In the Voelker mantle, a basis of thoria is produced which is then coated by dipping in a substance termed by the patentee "Voelkerite." This latter is made by fusing together a number of oxides in the electric furnace. The fused mass so obtained is then dissolved in the strongest nitric acid, and diluted with absolute alcohol to the necessary degree; and a very good mantle, having great lasting power, is thus produced. It is claimed that the process of fusing the material together in the electric furnace in some unexplained way alters the composition; but the true explanation is probably that all water of hydration is eliminated.

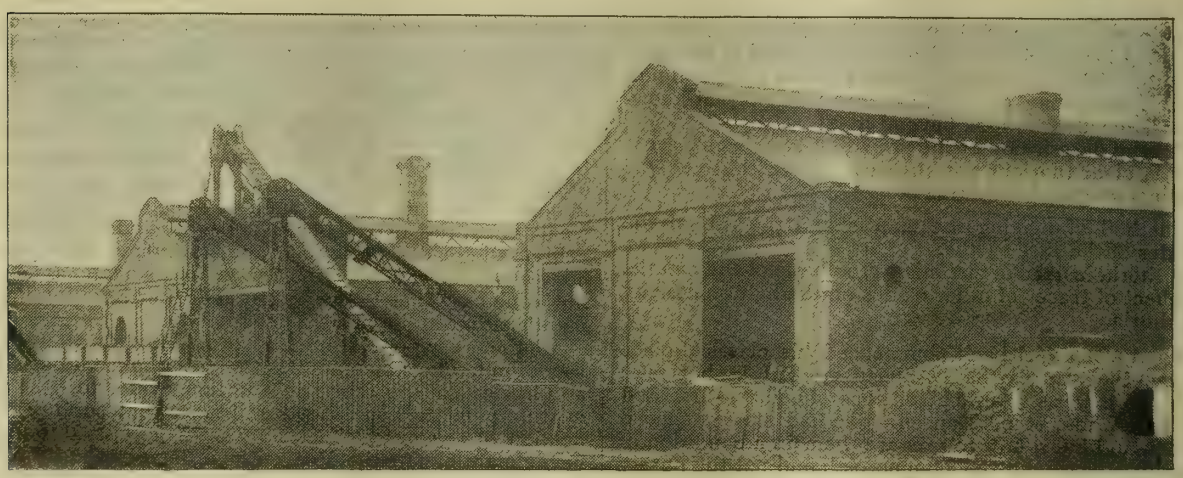
The Daylight mantle consists of a basis of thoria or thoria mixed with zirconia, which is then dipped in collodion containing a salt of cerium in solution; and on burning off the collodion, the ceria is left in a finely-divided condition on the surface of the thoria. There is no doubt that, in this way, a very high initial illuminating power is obtained; and I have seen mantles made on this principle which within a few hours of their ignition have given a total illuminating value of 100 candles, with a service of 24 to 25 candles per cubic foot. The Crown mantle, which is very largely adopted in Berlin, is of this description, and is produced by making a mantle of pure thoria from a fabric of ramie saturated with the nitrate, and then dipping the thoria basis in a mixture of 99 per cent. thoria and 1 per cent. ceria; the mantle so produced being of very considerable strength, and retaining its power of light-emissivity for a much longer period than the ordinary Welsbach mantle.

On the whole, the Welsbach monopoly has been of considerable advantage, as in the ingenuity exercised in attempting to circumvent the patent many experiments have been tried, and results obtained, which would not have been arrived at had the ordinary mixture and process been open to all users.

A careful observation of the Welsbach mantles in use shows that the light emitted by them is not of a constant quality, and that there are occasionally batches of mantles which give a distinctly greener light than others. This variation in the colour of the light emitted is, however, very often found to be a function of the temperature to which the mantle is heated; and where the temperature and light-emissivity are highest, one often finds a greenish tint appearing which, with a less well-arranged burner, appears as a white light of a lower quality.

Many attempts have been made to compare the amount of light belonging to the different portions of the spectrum in the light emitted by the mantle; and in the following table, published by Munsterberg, the proportion of rays of different colours emitted by the Welsbach incandescent mantle is compared with





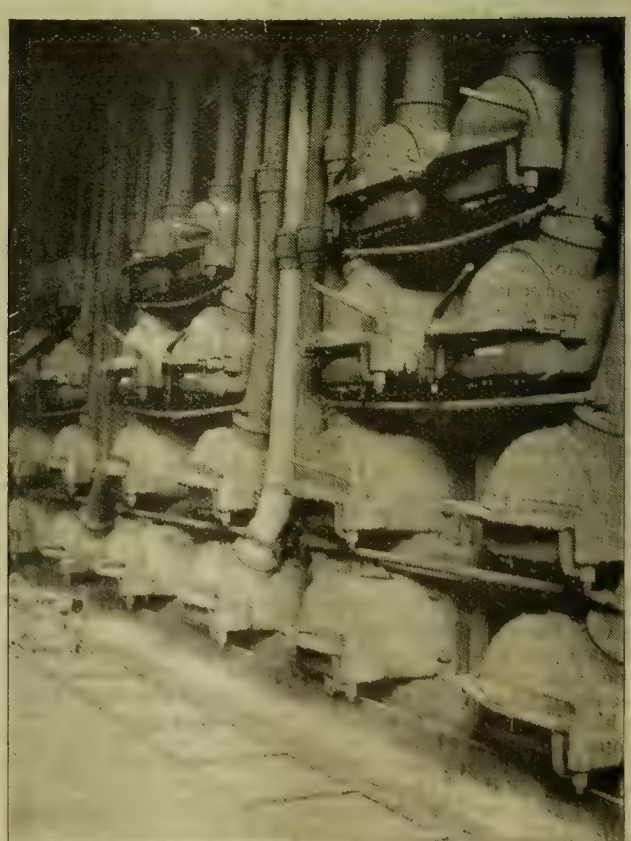
the number of the same rays in sunlight (taken as unity) and with other illuminants:—

Colour in Spectrum.	Electricity.		Coal Gas.		Acetylene.	
	Arc.	Incandescent.	Ordinary.	Welsbach.	Alone.	With Air.
Red . .	2·09	1·48	4·07	0·37	1·83	1·03
Yellow .	1·00	1·00	1·00	0·90	1·02	1·02
Green . .	0·99	0·62	0·47	4·30	0·76	0·71
Blue . . .	0·87	0·91	1·27	0·74	1·94	1·46
Violet . .	1·03	0·17	0·15	0·83	1·07	1·07

The value of the table is, however, a good deal discounted by the conditions under which the experiments were made not being stated.

THE DE BROUWER COKE CONVEYING AND ELEVATING PLANT AT THE CRYSTAL PALACE GAS-WORKS.

The description which we published on Jan. 23 last of the De Brouwer coke conveying and elevating plant at the Crystal Palace District Gas Company's works has aroused considerable interest in the gas profession. Being the first installation of the system in the country, there is a natural desire to know something as to the experience of its working; and as far as it is possible after only about three months' active service, we will endeavour to gratify our readers. Before doing so, however, reference may be made to the three photographic views of portions of the plant which we have pleasure in reproducing. One of them shows a section of the conveyor in the floor of the retort-house. It clearly depicts the simplicity of its construction—consisting as it does merely of a trough and a transmitting chain, the two lines of which are kept apart as shown by round iron stay-bars. In the other two illustrations, we have general views of the plant which deals with the coke outside the house. The larger one gives a very clear view of the elevating and screening plant, storage hopper, and loading arrangements; while the smaller one is chiefly interesting for the view it gives of the surface of the elevator up which the coke ascends to the storage hopper. The two smaller elevators, or sloping continuations of the conveyors in the retort-house, will only be used for the



purpose of dealing with any surplus coke there may be; but so far as can be seen, their duties will be very light. The minute description of the plant already published renders unnecessary any further allusion to the photographs.

By the courtesy of Mr. Sydney Y. Shoubridge, the Gas Company's Engineer, we last week had the privilege of seeing the plant in operation under normal working conditions. It was

brought into use almost immediately after the publication of our previous article; and it has since been performing its duty in a manner that has given every satisfaction. Its operation at the time of our visit was proceeding with a perfectness that was pleasant to behold; and therefore we have the best of reasons for believing that the credit it has earned for itself up to the present will be enhanced as time goes on. The plant has been found to effect a considerable saving in labour as compared with the old system of wheeling the coke out in barrows. To do the work by hand in this one house, 31 men were required in twenty-four hours; while now the same work is accomplished, by the aid of the machinery, with only six men. There is, in fact, so far a saving of about 5d. per ton of coal carbonized under the altered conditions, after making due allowance for interest, sinking fund, and wear and tear.

On one point only, it is impossible, owing to the shortness of time the plant has been in use, to speak with strict certainty, and that is as to its durability. But, as stated in the previous article, the manufacturers, Messrs. Jenkins and Co., have made certain important improvements on the original method of construction to secure a good character for the plant in this regard; and from what we saw last week of its easy and smooth operations, together with the inquiries made, we think we may say there is every assurance that time will prove that the confidence of Mr. Shoubridge in this respect has not been misplaced. In an examination of the whole of the plant, we failed to detect rattling, friction, or strain in any part; the whole was running with the regularity and smoothness of clockwork, and with exceedingly little noise. This all gives promise of long life. As to the other claims which Messrs. Jenkins and Co. put forward in commendation of this type of plant, as set forth in the descriptive article, our observations convince us that they are fully substantiated. Beyond this it is unnecessary to say more.

THE MANUFACTURE AND APPLICATION OF WATER GAS.

By Carl Dellwik.

At last week's Meeting of the Iron and Steel Institute, Mr. Carl Dellwik read a paper bearing the above title; and in view of the specific references to the Dellwik plant made by Professor Lewes in his lecture the previous week before the Institution of Gas Engineers, some considerable extracts from Mr. Dellwik's paper will be of interest.

After a few introductory remarks, the author said: My present object is to explain the theory on which the Dellwik-Fleischer process is based, and the results obtained in practice, as well as to give a short account of some of the applications which have been made for manufacturing purposes.

The value of a gas for industrial purposes depends mainly on two considerations: (1) Its adaptability for each specific purpose; and (2) its price as compared to other fuels capable of being used, though perhaps less advantageous from a purely technical point of view.

Speaking in general terms, there can be little doubt that the higher the quality of a gas is, the more readily it may be adapted for the great variety of purposes for which gaseous fuel is used in modern manufacturing. So, for instance, ordinary producer gas, of which 55 to 60 per cent. consists of incombustible elements, is quite useless for certain purposes where coal gas and water gas have proved to be excellent sources of heat. On the other hand, coal gas, by reason of its high price, the complicated and costly appliances required for its production, and other disadvantages, is practically excluded from use on a large scale for manufacturing purposes. As regards price, the same objection, though in a less degree, until recently held good against water gas, except, as has already been mentioned, in special cases where the economy of its application was so great as to counterbalance the waste of energy in its production.

For general manufacturing on a large scale, producer or Siemens gas has, therefore, remained unrivalled, as offering the cheapest means of heating large furnaces. It is, however, evident that, given the possibility of converting fuel with the same degree of economy into a gas of a higher calorific power than producer gas, such gas cannot fail to obtain a vast sphere of utility. Water gas being all combustible, having a very high flame temperature, and per volume more than twice the calorific power of producer gas, in all respects fulfils the technical requirements as regards quality.

Before proceeding to an account of practical results, I will enter into a short theoretical comparison between producer gas, water gas manufactured by what I will call the "old" processes, and water gas manufactured by the Dellwik-Fleischer process.

When 1 lb. of carbon is burnt to carbon dioxide, it develops 8080 thermal units (°C.); and when burnt to carbon monoxide, it gives off only 2400 thermal units. As the Siemens process consists in burning the carbon to carbon monoxide, it follows that the gas produced from 1 lb. of carbon contains 8080—2400 = 5680 thermal units, corresponding to a utilization of about 70 per cent. of the heating value of the solid carbon. This figure, therefore, roughly represents the maximum theoretically possible utilization in the cooled gas of the heating value of the fuel, when losses from radiation and other sources are not taken into account.

The process of water-gas manufacture consists in the alternate heating of a bed of fuel to incandescence by means of an air-blast, and the subsequent decomposition of steam in contact with the fuel thus heated, until the decrease in temperature necessitates a new period of heating. In all processes hitherto in use, both of these periods (of water-gas making and of blowing) have yielded combustible products—each containing a portion of the heating value of the fuel. The generators may have varied in form, using an air-blast, or a forced draught, or a down draught for the periods of heating or blows; but the chemical reaction has always been the same—viz., a combustion to carbon monoxide—so that the gas leaving the bed of fuel in the generator has consisted principally of carbon monoxide and nitrogen. The most important problem in the construction of a water-gas plant on a large scale on this principle has, therefore, been to find suitable employment for this producer gas, which contained the greater portion of the heat of the fuel. The difficulty of doing this, and especially the difficulty of utilizing it in the same proportion as it was generated, has, in fact, formed one of the most serious obstacles against the introduction of water gas. Various devices have been resorted to for the purpose of utilizing the producer gas for increasing the yield of the more valuable product, water gas—such as preheating of the air or steam, or both, for the water-gas generator. All such arrangements have, however, proved more or less ineffective, besides complicating the apparatus; and the ordinary practice in the production of "blue" water gas has, therefore, been simply to use the producer gas to generate the steam for the water-gas manufacture. But even this has by no means always been done; and the insufficient utilization of the fuel has been such as to effectually prevent the general introduction of water gas.

As the chemical reaction in the generation of the water gas is always the same, it is evident that the condition for an economical production of water gas is to effect the greatest possible utilization during the blows of the heat contained in the fuel, and the means to accomplish this is to produce a complete combustion in the generator. Practical results have proved that it is possible by very simple means to establish such conditions in the generator that, during the blows, a practically complete combustion to carbon dioxide is obtained within the bed of fuel to be heated, while at the same time conditions favourable to the water-gas making are maintained.

This, then, is the radical difference between the "old" processes and the one which I have originated—that, while in the former the gas leaving the generator during the "blow" contains principally carbon monoxide in addition to the inevitable nitrogen, in the latter it consists principally of carbon dioxide and nitrogen. Given this difference in principle, we will now proceed to inquire into the effect of these different methods.

If we look at the chemical reaction in the formation of water gas, we find that 18 lbs. of steam, consisting of 2 lbs. of hydrogen and 16 lbs. of oxygen, require for their decomposition $2 \times 28{,}780 = 57{,}560$ thermal units. The 16 lbs. of oxygen combine with 12 lbs. of carbon to form 28 lbs. of carbon monoxide, which mixed with the 2 lbs. of hydrogen forms 30 lbs. = 753·4 cubic feet of water gas. The heat developed by the formation of the carbon monoxide is $12 \times 2400 = 28{,}800$ thermal units; thus leaving a balance of $57{,}560 - 28{,}800 = 28{,}760$ thermal units, which must be replaced by combustion of carbon during the blows. Assuming, then, as is approximately the case in practice, that the blow-gas leaves the generator at a temperature of 700° C., we find—

	"Old" Methods.	Dellwik Method.
1 lb. of carbon requires for combustion	to CO $-\frac{16}{12}$ lbs. O.	to $CO_2-\frac{32}{12}$ lbs. O.
This oxygen is accompanied by	4·32 lbs. N.	8·64 lbs. N.
And the products of combustion carry with them at 700° C.	1136 thermal units.	2092 thermal units.
The heat of combustion of 1 lb. of carbon is	2400 thermal units.	8080 thermal units.
The balance available for heating the fuel is therefore	2400 − 1136 = 1264 thermal units	8080 − 2092 = 5988 thermal units.
To fill the before-mentioned balance of 28,760 thermal units at the production of 30 lbs. of gas, there must then be burnt	$\frac{28{,}760}{1264}$ = 22·75 lbs. C.	$\frac{28{,}760}{5988}$ = 4·83 lbs. C.
Not counting the heat lost by radiation and other causes, there are then required for the production of 30 lbs. = 753 cubic feet of water gas	12 + 22·75 = 34·75 lbs. C.	12 + 4·83 = 16·83 lbs. C.
Or per 1 lb. of carbon are obtained	21·7 cubic feet water gas.	44·7 cubic feet water gas.
As water gas of theoretical composition contains 167 thermal units per cubic foot, there are utilized in the water gas from 1 lb. of carbon	3627 thermal units = 44·8 per cent. of the heating value of the C.	7465 thermal units = 92·5 per cent. of the heating value of the C.

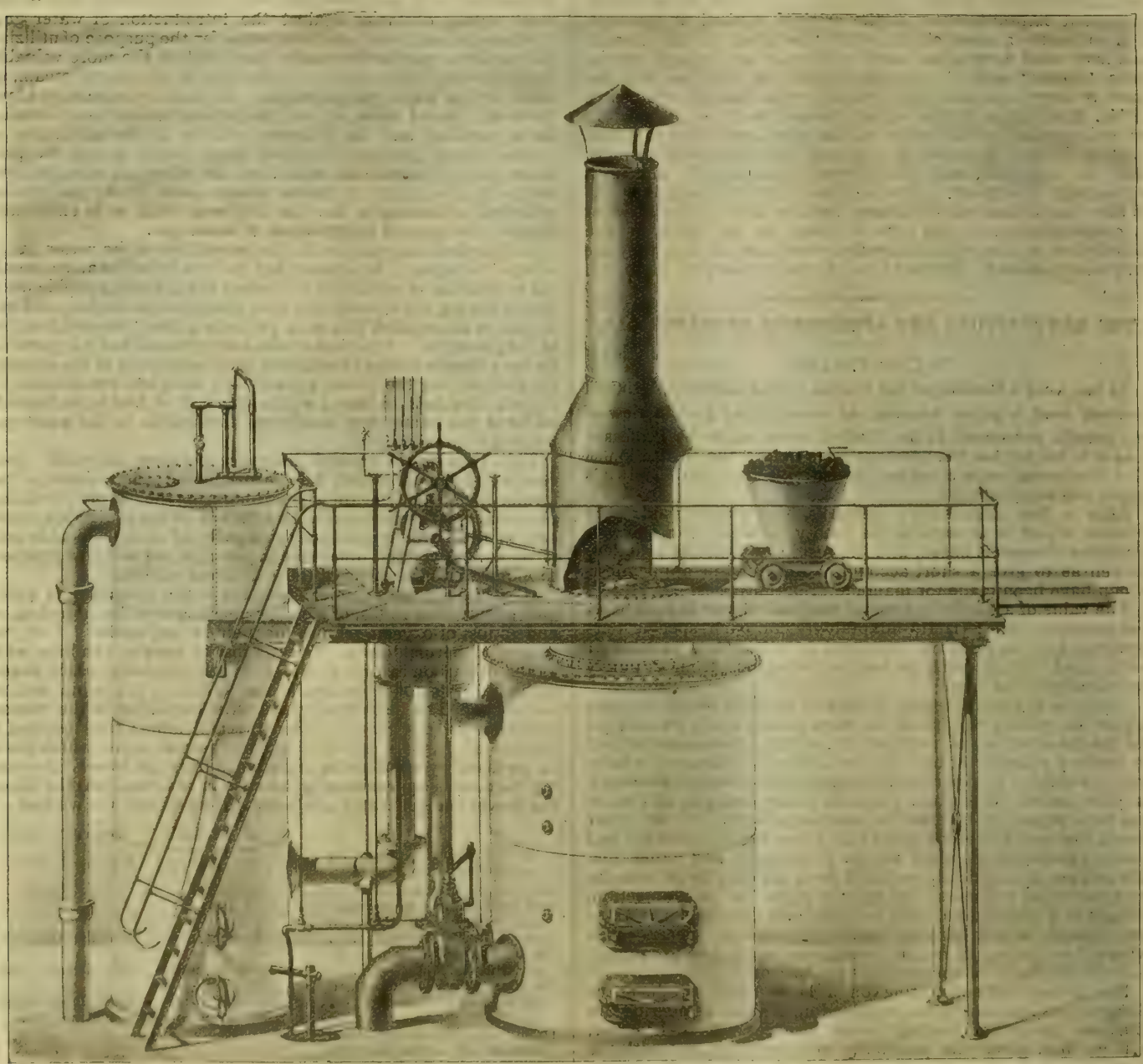
The practical working of these three different processes—for Siemens gas and water gas—is, of course, somewhat at variance with the theoretical calculations. In all of them there are

losses from radiation, &c.; and in all of them there is formed a certain amount of carbon dioxide, which is, however, to some extent compensated for by an equivalent development of hydrogen, which also tends to increase the volume. On the other hand, there is a gain from dry distillation when bituminous fuel is used. In the Siemens process, there is a further gain by the decomposition of steam in the generator at the expense of the heat developed in burning the fuel to carbon monoxide, so that its practical efficiency may be estimated at from 60 to 72 per cent.

In the old water-gas processes the producer gas formed during the "blows" is amply sufficient for generating the steam needed for the process, though, as before mentioned, it has by no means always been so used. When a combustion to carbon dioxide is effected in the generator, this advantage is, of course, lost; the waste heat being only sufficient for preheating the feed-water for the boiler. It is, therefore, necessary in this case to add for boiler fuel 12 to 15 per cent. to the fuel used in the generator. This reduces the theoretical quantity of gas obtainable from 12 lbs. of carbon to 656 cubic feet; and the possible utilization of the heating value of the fuel to about 80 per cent.

The water gas obtained in practice is of somewhat different composition from that theoretically calculated; and its calorific power is about 158 thermal units per cubic foot. If the coke averages 7000 thermal units per pound, then the utilization of the heat by these processes is 28 to 36 per cent. It then remains to ascertain how nearly the Dellwik-Fleischer process in practice approaches the theoretical computation. It is now nearly three years ago since the preliminary experiments were completed; and some of the recognized authorities of the gas industry were invited to examine into the results obtained. The first to accept such an invitation was Professor Vivian B. Lewes, of London. He has summed up the result of his test as follows:—

One thousand cubic feet of water gas, containing 15 lbs. of carbon, are obtained by a total expenditure of 29 lbs. of carbon; so that over 51 per cent. of the carbon is obtained in the gaseous form, while the expenditure of the other 49 per cent. results in the hydrogen of the water gas. The coke used in the experiments made contained 57·56 per cent. of carbon, or 1961·3 lbs. per ton, equal to 15,876,307 thermal units (° C.); and this amount yielded 77,241 cubic feet of water gas. The specific gravity, as taken by the Lux balance, was ·5365; and its gross calorific value, as determined in Junkers calorimeter, was 4089 thermal units. Hence the calorific value of the water gas from a ton of coke was 13,033,059·8 thermal units, or over 82 per cent. of the heating value of the total coke used in both generator and boiler. From this calculation 20 per cent. of the coke has been taken as used for raising steam; but in a large installation this figure could be reduced, and the percentage of the total heating value of the coke obtained in the gas slightly raised. The labour needed will be less than with the ordinary process, as less fuel has to be handled.



Other tests, made by Professor Bunte, of Karlsruhe, Professor Lunge, of Zurich, Dr. Leybold, of Hamburg, and others, have given similar results. The most trustworthy figures for continued work have been obtained from an installation at the Corporation Gas-Works at Königsberg, in Prussia, where an average yield of 38·44 to 39·72 cubic feet of water gas are obtained per pound of carbon contained in the coke charged into the generator. This corresponds to a utilization of 75·2 to 77·7 per cent. of the calorific value of the fuel. At another gas plant the tests showed a yield of 41·6 cubic feet per pound of carbon, or an efficiency of 81·3 per cent.

The method of working the generators illustrates the difference from the old methods. In the latter, the duration of the blow was from 10 to 15 minutes; while the water gas was made during the following 4 to 5 minutes. In the Dellwik generators the blow lasts only 1¼ to 2 minutes, while water gas is subsequently generated for 8 to 12 minutes. During the blow, the combustion continues throughout the entire depth of the fuel; and the whole bed of fuel is thus raised to an even high temperature—enabling the periods of water-gas production to be considerably lengthened without any deteriorating effect on the quality of the water gas.

The illustration shows the appearance of a generator. The surrounding sheet-iron shell is lined with fire-brick. On a level with the clinkering-doors is a grate supporting the fuel; and below are ash-doors for removal of the ashes. The air enters through the blast-valve; and the blow-gas leaves the generator through the central stack-valve, through which the fuel is also charged by means of a small coke-waggon. There is one water-gas outlet at the top of the generator, and one below the grate—both connected with a three-way valve, through which the gas passes on its way to the scrubber. The gas-pipe is sealed with water in the bottom of the scrubber, where the gas is cooled, and

all dust washed out by the water running through the coke with which the scrubber is filled. From the scrubber, the gas passes on to a small holder, which equalizes the flow of gas to the place of consumption. There is a steam-pipe leading into the bottom, and one to the top of the generator.

The method of working is as follows: A fire having been built on the grate, and the generator filled to the proper level with coke, the blast-valve is opened; and the fuel is raised to a high degree of incandescence in a few minutes. Then one of the gas-outlets (the upper one, for instance) is opened; the blast and stack valves being simultaneously closed by the gearing on the working stage. Steam is then admitted to the bottom of the generator; and, passing up through the bed of incandescent coke, it is decomposed—forming water gas. A set of water-gauges and a test-flame indicate the condition of the apparatus and the quality of the gas. When the temperature of the fuel has sunk below the suitable point, so that carbon dioxide begins to form in a larger proportion, the steam is shut off and the stack valve opened—the gas-valve being simultaneously closed. The blast-valve is then opened for another blow of 1½ to 2 minutes. For the next period of gas making, the lower gas-outlet is opened, and steam admitted above the fuel. By thus reversing the direction of the gas making, the temperature of the fuel is equalized—causing less wear on the brick-lining at any one point. The greater part of the coke being consumed by the action of the steam, the incombustible portions of the coke to a large extent disintegrate, and fall through the grate as ash; while the clinkers on the grate are brittle and easily removed.

From the results which I have already quoted, it is evident that by this process there is no difficulty in obtaining an efficiency rather higher than that usual in the Siemens process, and twice as high as that of the older water-gas processes. It is unnecessary to make any comparison with the latter as to price. But in regard to the former, the thermal efficiency is so nearly equal that the advantage of using one or the other of the two gases must almost entirely depend on the relative advantages they offer for practical use. The question thus becomes one of quality of the product obtained.

Siemens gas, even of the best quality, contains at least 56 to 60 per cent. of incombustible gas (CO_2 and N). The gas will, therefore, scarcely burn when cold; and it is necessary to pre-heat both the gas and the air for combustion to obtain a high temperature. For this reason Siemens gas cannot advantageously be used for small furnaces, and is impossible for any purpose where an open flame is required—as, for instance, for welding, brazing, or soldering. On account of its great volume and low calorific value, it is also not adapted for storage in gas-holders, or for being conducted to any considerable distance from the generator. Another important disadvantage is that it cannot easily be purified from the sulphur contained in it. Its utility is, in fact, limited to large furnaces with regenerative firing. But it must be remembered that, though any required temperature may be obtained, this must necessarily be done at a considerable loss of heat; for the reason that all the non-combustible portions of the gas must be raised to the temperature of the flame, and a high heat can be reached only after protracted firing.

Water gas possesses quite different properties. Its composition averages—

	Per Cent.
Hydrogen	51·0
Carbonic oxide	42·0
Marsh gas	0·5
Carbonic dioxide	4·0
Nitrogen	2·5
Total	100·0

Practically, it is therefore all combustible. Its flame temperature is such that a wire of commercial platinum melts in the flame from an ordinary gas-burner. Its heating power is, per volume, two-and-a-half times that of producer gas; and it can, therefore, be stored in a holder and conducted to any required distance with the same facility as coal gas. It can be used for all purposes, being equally efficient for the small glass-blowing lamps for the manufacture of electric glow-lamps as for the melting of steel in an open-hearth furnace. It is applicable for all heating stoves and furnaces now so extensively used for coal gas, and for many other purposes for which coal gas is too high priced to be used. Water gas can further be obtained absolutely pure, as the sulphur is contained in the form of sulphuretted hydrogen, which can easily be eliminated by passing the gas through purifiers filled with hydrate of iron; and it then consists almost entirely of hydrogen and carbonic oxide.

Leaving the method of manufacture, and the properties of water gas, the author turned to the results obtained by its application for practical purposes, in open-hearth steel melting, crucible steel melting, the welding of iron plates, &c. He then proceeded: The conversion of all the fuel into gaseous form at one place, and the distribution from this central station of the gas to the different furnaces and other places of consumption, is a principle which ought to recommend itself in all industrial establishments where large quantities of fuel are used, which will otherwise have to be carted around to a number of different places—involving labour and waste. Such a central gas-producing plant would also supply the cheapest means of generating power. For one-horse power are required 30 to 35 cubic feet of water gas per hour; and, as has already been shown, this quantity of gas is produced from less than 1 lb. of coke. The efficiency of gas-engines of small size is very nearly the same as that of large ones, which is not the case with steam-engines; and a system of water-gas plant and gas-engines, therefore, allows of a distribution of power far cheaper than is possible with steam-engines, and elaborate transmissions with shafts and belts. In addition, lighting by incandescent water-gas burners is the cheapest illuminant obtainable, and offers also other advantages over the same kind of lighting with coal gas, as the flames burn more steadily, and the mantles can be made stronger. Some installations of "blue" water gas for general distribution have been made on the Continent; and the results have proved very satisfactory.

I have earlier referred to the introduction of carburetted water gas for general distribution as an admixture with coal gas. This system has met with a great deal of favour during some years past; but it lately labours under the drawback of advanced prices of oil. On the Continent, a high duty on petroleum has practically prohibited water gas enriched with this material. But at the present time the price of benzol has gone down in such manner as to make it a very cheap enricher; and a number of plants on the Dellwik-Fleischer system with benzol enrichment have been built, or are being built, as auxiliary to coal-gas works.

These examples of the general utility of water gas, when made by the present economical process, might easily be multiplied; but doing so would, to a great extent, mean repeating the qualities which make it so desirable in the instances I have specially mentioned.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Mr. Carpenter's Paper on Inclined Retorts.

Sir,—I send you herewith my reply to the discussion on my paper, on inclined retorts at Bankside. It only deals with the kernel of the matter; and, as regards mechanical details, my reply would simply be a reiteration of the wording of the paper.

C. C. Carpenter.

May 14, 1900.

[Enclosure.]

A well-known engineer who had wholly adopted this method of carbonizing said to me significantly some time afterwards: "Well! you burn your boats when you put up inclined retorts." My paper was not written for those who have burnt their boats, but for others who, hesitating to follow suit, are anxious not to burn their fingers as well. With the Bankside plant, I do not claim to have a perfect solution of the labour-saving part of the problem. But what I do claim to have done is to have worked inclined retorts under, from the gas-making point of view, the most favourable circumstances—viz., light, thin, and regular charges, burnt off with regular and constant heats, and to have proved conclusively that success or failure of the system depends first and foremost upon the suitability of the coal. Other reasons have been given for the want of success stated—viz., retorts too small, and the charging arrangements imperfect. As regards the first, if a retort 13 inches high, 24 inches wide, and 20 feet long is not suitable for burning off 6 cwt. of coal, I should like to know why. With respect to the second reason, the Salford arrangement is in use at the Old Kent Road works, and with no greater success; selected coal having to be used there also. As regards mixing the coal, if gas making is to depend upon this operation, then I pity the gas maker, unless his supply is on a very different footing to that of London. We are told that perfection does not exist in Nature. Some installations of inclined retorts, however, appear to approach very nearly thereto. Under such circumstances, it is a little disappointing to have to confess that the future extensions of the South Metropolitan Gas Company will be with stoking machinery and "horizontals."

The Paris Exhibition.

Sir,—There are few people who have not, in the course of their childhood, had the advantages of early rising impressed upon them by the striking example of the matutinal bird and the worm. However useful the habit of being astir betimes may have been found by the bird, in enabling it to secure its first meal, it is certainly not valuable to the technician in helping him to obtain mental *pabulum* by paying an early visit to the Paris Exhibition. It was acknowledged that on the opening day the Exhibition was very far from being complete; and though a great deal has been done in the month which has since elapsed, much still remains to be accomplished. However, by the time the members of the Gas Institute arrive in the City of Light, there will be something better for them to see than there is at present—that is to say, in their special department. For the moment, packing-cases are much in evidence, scaffolding is still up, and workmen are busily engaged in putting the finishing touches to buildings, and in evolving order out of chaos. While dust and dirt are about, exhibitors naturally decline to show their goods. A large number of those which are in position are consequently covered, and others are still reposing in the wood. Now, although one is able, according to the classic writer, to judge of Hercules by the size of his foot, and although the late Professor Owen could, from a very small piece of bone, construct an entire animal of the antediluvian period, it would have puzzled both classic and naturalist, even with the aid of the Röntgen rays, to get an idea of what an exhibit would be when on view by a glimpse at its constituent parts in a package.

Even now, however, there is much to be seen, though it is somewhat

difficult to get at. The pedestrian encounters heaps of builders' rubbish, workmen with an excess of plaster of paris about them are apt to come in too close proximity to the visitor's coat, carts delivering goods obstruct the way, the flooring is up, and there is consequently much impediment to comfortable locomotion. This condition of things obtains, for the most part, in the portion of the Exhibition devoted to the heavy goods. Where the lighter ones—those more easily handled—are on view, something like order prevails. Here it is that one sees the most visitors. And even now they come in fairly good numbers—about 82,000 having entered the Exhibition between ten in the morning and closing-time on Thursday. The work of completion is being pushed on with vigour; and to-day the Norwegian and United States Palaces in the Rue des Nations have been formally inaugurated. The finishing touch may probably not have been everywhere put on by the time the members of the Institute arrive; but they will nevertheless see plenty to well repay them for their visit. Apart from the exhibits with which they are specially concerned, there is at present upon the banks of the Seine such a show as has never before been witnessed; and it should certainly be seen by all who can do so. Those who find a sameness in great exhibitions will discover that this one presents some highly attractive features; and, moreover, the city itself has its almost irresistible charms. Gas managers are called upon, in the discharge of their daily duties, to "live laborious days," especially when they are reduced to the last ton of coal, or when a tank-waggon of oil has been left for days on a siding when it was urgently needed. This is no reason, however, why they should "scorn delights." On the contrary, it should be a justification for their occasionally tasting them. Let them, therefore, visit Paris, and see what she has to offer.

If for no other reason, they should come over to see the marvellous display of lighting which the Paris Gas Company have carried out on the Champ de Mars. The area covered extends from the Trocadero Palace to the Cascade in front of the Palace of Electricity—a good three-quarters of a mile, and about 150 yards broad in the narrowest part. On this and some of the adjacent avenues, the Company have put up from 1000 to 1100 lamps, fitted with Auer and Denayrouze burners, supplied with compressed gas. By the use of from 4000 to 4500 mantles with burners consuming from 9 to 12½ cubic feet of gas per hour—a total of from 43,000 to 60,000 cubic feet—the vast space is lighted up with the brightness of day. The lamps, which are of elegant pattern, are on single columns, and also mounted in groups of three and five. The last-named are on short pillars, rising from a solid stone base. Some of the large globe-shaped lamps on single columns are fitted with clusters of ten or twelve burners; and the volume of light emitted is perfectly dazzling in brilliancy. Standing at the foot of the steps of the Trocadero, and looking across the Seine in the direction of the Eiffel Tower, there is presented to the beholder a perfect sea of light, which makes the electric lamps on the Tower "pale their ineffectual fires." The Paris Gas Company scored a point by securing this area for a display of their powers; and they have not failed to make good use of their opportunity. It is a superb piece of lighting, which will delight the heart of every gas manager who witnesses it.

AN EARLY VISITOR.

Paris, May 12, 1900.

Progress in Gas Matters.

SIR,—The interesting paper read by Dr. Colman at the meeting of the Institution of Gas Engineers marks further progress towards a knowledge of the value of coal gases of different illuminating powers. The fact brought out in Table 1B in the appendix to his paper—viz., that the gases lowest in illuminating power give the highest heating values—appeared to impress the majority of those present at the meeting as a startling refutation of views which they had previously entertained. No attempt, however, was made, either by Dr. Colman or by those who took part in the discussion, to explain what, apparently, was considered a phenomenon bordering on the mysterious. The explanation is not far to seek. In my opinion, it is to be found in the fact that the actinic or chemical rays of the flame are in greater proportion than the heat rays in the higher illuminating power gases than they are in the lower. It is this same fact that accounts for the lower diffusive quality of the electric light as compared with gas. It also goes a long way towards accounting for the difference which is now generally admitted to exist between the illuminating power of the laboratory testing-flame and the illuminating effect of the same gas in practice.

In this connection, it is interesting to see (by the report of a recent meeting), that even the Scotch gas managers are coming round to the view that 25-candle gas is a mistake, and that a much lower illuminating power gas—even as low as 16 candles—is more desirable in every way. Really, our friends in the North must take care. A long drop is good under some circumstances; but it is apt to have a neck-breaking effect, and we should be very sorry to see any of our Scotch friends come to grief.

The lecture by Professor Lewes at the Institution meeting should bear fruit in the near future. The subject last dealt with by him in the lecture—viz., the mixing of water gas with coal gas in the retort, and the removal of the gases therefrom at an accelerated speed—is of great interest. I fear, however, that the means he suggests for accomplishing the object proposed (the insertion of a pipe within the retort for the conveyance of the water gas) is impracticable. The temperature of the retort offers a bar to the use of any less refractory metal than platinum, and the cost of that is prohibitive. A channel might possibly be moulded in the crown of the retort to answer the purpose. Professor Lewes's method could be applied without difficulty to single retort-stacks where the back-ends of the retorts are closed by a lid; the water gas being driven in at that end. With inclined retorts, also, the water gas could be supplied at the charging mouthpiece. So with horizontal through retorts, all that is necessary is to dispense with one of the ascension-pipes, and force the water gas in at the blank end.

THOMAS NEWBIGGING.

Manchester, May 9, 1900.

The Directors of the West Middlesex Water Company recommend a dividend, for the half year to March 31, at the rate of 5 per cent. on the consolidated stock.

PARLIAMENTARY INTELLIGENCE.

Gleanings from the Committee Rooms.

As last week's "JOURNAL" was going to press, we were able to insert the bare announcement that the portable photometer section of the London County Council Bill had been rejected by Mr. Oldroyd's Committee; and the intelligence, we know, has been received with gratification far beyond the limits of the area which would have been affected by the Bill. In the Committee room there was quite a manifestation of relief on the side of the Companies when the Chairman made it known that the suggested imposition of what would have been an unfair, additional burden did not commend itself to him and his colleagues; while the radiance of the countenances of those who had been backing up the Bill showed a sudden diminution of several points in candle power—tested optically, and not by the portable photometer. To them the decision came as a great surprise. They had been very confident of success from the first; and really the sensational evidence which they were able to produce at the outset was of the character which might have weighed the scales down in favour of the promoters had the Committee been composed of men who had no care to dip beneath the surface of what was laid before them. But fortunately the members of Mr. Oldroyd's Committee are not of that order. They took a deep and intelligent interest in the smallest details of this essentially highly technical subject, and mastered them with a delightful promptitude and adroitness. This was conspicuously noticeable even during the first hours of the hearing of the promoters' case; and it gave hope to those who were called upon to defend themselves and their customers' interests and pockets. It was a keenly fought contest; but strength and reason were on the side of the defenders. Victory, however, has only been secured at great expense, which the gas consumers and the ratepayers, who had not had a voice in the matter, will have to bear directly or indirectly. No evidence was submitted to show that the consumers were dissatisfied with the quality of the gas, or that there was any demand outside Spring Gardens for a more critical testing. The County Council stood entirely alone, and were not supported in the Committee room by any other Metropolitan authority. The proposals had their origin entirely in the brain of one chemist; and he succeeded in bringing a few others of his own profession to see virtue in them. Outside this limited circle, only a single practical Gas Engineer (though he was not the only one whose services were sought) came forward to speak in favour. The proposals unfortunately were just of that oppressive type which the preponderating section of the County Council in their rabid antagonism to vested interests take delight in; and so they fostered them. They have had their fling at the Gas Companies, but others have to pay.

The last day's proceedings on the Bill were not by any means the least productive of influential evidence. That given on previous days in opposition was good; but in some respects this was even better. Much of it was composed of such incontestable matter that even Mr. Worsley Taylor, with all his keen-wittedness and power of dissection, could not make any appreciable impression on it. The case of the South Metropolitan Gas Company was continued by the examination of three witnesses; Mr. C. C. Carpenter, the Company's Chief Engineer, being the first. He was perfectly frank and decisive in his statements. Dealing with the period covered by Mr. Dibdin's tests—1884-97—in which the gas was alleged to have steadily depreciated in quality, he showed how in those years improvements had been effected in the system of carbonizing, by which the production of gas was more regular and uniform than formerly. But even now, he admitted, gas could not be manufactured of absolutely uniform quality. He put in a table showing for the fourteen years the gas sold per ton of coal, and the illuminating power returned by the official tests, and by the portable photometer. It will be seen that the figures disclose an almost perfect equality in the gas sold per ton and in the official returns as to illuminating power over that long period; but there is a gradual, consistent depreciation in the returns of the portable photometer, which can only be taken as indicating a growing feebleness during that period in one of three directions—in the gas, the portable photometer, or the operator. That is was not in the gas, the official tests clearly prove. Mr. R. O. Paterson followed; and what he had to say regarding his investigations into the effects of temperature and moisture on the examination of gas may be read with profit. Then there was quite a little flutter of excitement among those who were "in the know" when Mr. Henry Woodall went into the box to rub a little of the gloss off the evidence of Mr. Isaac Carr, who was the only Gas Engineer who had appeared to support the Bill. Mr. Woodall related how, with two other gentlemen, he had been down to Widnes armed with the infallible portable photometer, and how for four days they had made a series of tests suggested by Mr. Carr's assertion that he was able, and had for the past five years, supplied a gas of 18½-candle power, without substantial diminution, throughout his district. Mr. Woodall's tests with the portable photometer showed results varying between 15·96 and 12·79 candles. Mr. Worsley Taylor's only explanation was that Mr. Carr during that time was "knocking his gas about" for experimental purposes, which Mr. Balfour Browne characterized as merely "a suggestion" on the learned Counsel's part.

While speaking of Mr. Carr's evidence, there is a little discrepancy in other figures to which we do not think attention has been called. He stated that his average production of gas was 10,000 cubic feet per ton of coal, that he uses 24,000 tons, and that his make of gas is 225 millions. According to those figures, he is astray to the extent of either 15 million cubic feet of gas or 1500 tons of coal, or his make is not 10,000 cubic feet per ton. Which is it? Evidence before a Parliamentary Committee should certainly be a little more precise than this.

The South Metropolitan Company's case was concluded by Mr. Balfour Browne in a neatly pointed address; and it was followed by an appeal to the Committee by Mr. Littler for a due recognition of the rights of the City Corporation in the event of the Bill being passed. Then the opposition of the Commercial Gas Company was proceeded with; Mr. H. E. Jones, the Engineer, repudiating emphatically the sinister inferences and suggestions underlying the case put forward by the promoters. "Impracticable, unreliable, and unjust" were the epithets used by Dr. Odling in

describing the proposals of the Bill; and Mr. William Sugg, than whom few can speak with more mature experience, showed that the terms used by the learned Doctor were none too harsh. With Mr. Sugg the evidence concluded; and Mr. Littler thereupon addressed the Committee for the Commercial Company. In replying on the cases of the opponents, Mr. Worsley Taylor spoke with his accustomed vigour, and urged as significant that the fall in illuminating power had only taken place since 1884 when cannel was displaced by the more "ephemeral" petroleum spirit; but he did not explain how it was the change in enrichment had not affected the official testings. A very few minutes' private conference sufficed for the Committee to determine—as they had no doubt individually concluded in their minds long before—that the preamble of the Bill had not been proved so far as it related to the testing of gas.

There was a day's interval between the defeat of Part II. of the County Council measure and the commencement of the consideration of the second item on the heavy programme drawn up for Mr. Oldroyd's Committee. This was the resuscitated Bill of the Gaslight and Coke Company; and it has been brought forward practically in the form in which it was when thrown out by the Lords Committee on June 30 last. It may be remembered that, in the Bill as introduced last year, the Company asked for power to create and issue £3,500,000 of 3 per cent. debenture stock; and that the Commons Committee (to whom the measure was first referred) cut the amount down by a round million. This session the Company limited themselves to the reduced amount; and very wisely, as, if there were not other questions to be taken into consideration on this occasion, a Committee would be hardly likely to quash a favourable decision of another Committee of its own House on a matter of this kind, in which no question of principle is involved, and upon which there is really very little room for controversy. But the Instruction to the Committee to keep in view the recommendations of the Select Committee on the Powers of Charge of the Metropolitan Gas Companies now raises more momentous issues. The proceedings on the Bill covered two days. Mr. Pope opened the case; and the witnesses examined in support were the Secretary and General Manager, Mr. J. W. Field; the Governor, Colonel Makins; the chief officials in the various departments (Mr. G. C. Trewby, Mr. G. F. L. Foulger, and Mr. Thomas Wilton); and, unlike last year, an outside Engineer was brought in in the person of Mr. W. R. Herring, the Chief Gas Engineer of the Edinburgh and Leith Corporations, to uphold the figures of the Company's Engineers as to their requirements. Naturally, to a very large extent, the case advanced by the promoters followed on much the same lines as that of last year; the figures having been merely revised to Dec. 31 last. The necessity for additional capital was again proved; and the proposed method of raising the money by the issue of 3 per cent. debenture stock was shown to be the cheapest plan. The now well-worn reasons for the capital being higher in proportion than that of the other Companies, and for the working expenditure being heavier, were also spread before the Committee. As to the recommendations of Sir John Rankin's Committee, it was not thought an economical proceeding that the Company should be limited in their capital powers to five years; nor was it considered wise that there should be an alteration of the sliding-scale with respect to existing capital. It was confessed, however, that, in regard to the issue of new ordinary share capital, there would not be the same objection to a change in the conditions; although, it was pointed out, the Company would not be able to issue it under the suggested new sliding-scale except at a discount. But the proposals, it was urged, had no bearing upon the present Bill, seeing that power was only sought to raise debenture stock. An explanation was also made to the Committee as to the position of affairs between the promoters and the South Metropolitan Company in regard to the suggested transfer to the latter of the area of the former south of the Thames.

The Bill was opposed by the London County Council, and the Corporations of London and West Ham. The principal desires of these bodies were to ensure that nothing was done in connection with the Bill to prejudice the gas consumers, and to urge the application to the measure of the recommendations of the Select Committee. Mr. Littler, for the City Corporation, went the farthest, and asked the Committee to say the preamble of the Bill was not proved. No witnesses were called by the opposition. For very laudable reasons, the Committee resolved to postpone their decision on the Bill until to-morrow.

The Committee varied the order of their proceedings on Friday by taking up the part of the London County Council Bill relating to the control of the prepayment gas-supply system in the Metropolis. The purposes of the Bill, to put them shortly, are threefold. First, the Council seek to bring under the regulation of the Board of Trade the supply of coin-meters, the fittings, and the charges—that is to say, the Board are, after inquiry, to fix a standard pattern or patterns of meters and fittings, and the charges in payment therefor. Secondly, the Companies are to be compelled to inform users of the meters and fittings of the amount of the charges. This a consumer who can add two and two together can easily find out for himself now. Thirdly, the Companies are to be required to keep and publish separate accounts of their receipts and expenditure in respect of these meters and fittings. Whether intentional or not, the whole proposal is nothing but a gross insult to the Companies, suggesting as it does the possibility, without control, of dishonourable action in their business relations with their poorer customers. The only motive one can find for the County Council taking up the matter at all is the wild desire which seems to possess them to pursue to the extreme their old policy of officiously interfering with public trading concerns whenever there is the slightest excuse or opportunity for doing so. There has been no general complaint on the part of the prepayment consumers with the fittings or the charges; and the fact that the system has grown to such colossal proportions in so remarkably brief a space of time is in itself proof of the consumers' satisfaction, and of fair treatment on the part of the Companies. As traders, the Companies would naturally adopt those methods which would bring them the largest business; and the methods which would do this are not those which are in any way unfair or unjust to the customer. There is no compulsion on consumers to take gas by the prepayment system; and if the British working man, after adopting it, feels there is any robbery or jobbery about it, he will quickly settle his business relations with the Company by ceasing to drop his pennies into the slot. It is true, as pointed out by Mr. Worsley Taylor in opening the case for the Council, that the Select Committee on the Powers of Charge of the Metropolitan Gas Companies last year suggested that the prices for slot meters and fittings should be regulated; but surely that is a question that can be settled by Parliament directly with the Companies, without the intrusion of outside parties. There is no doubt the difference existing at that time in the charges of the Gaslight and Coke Company for the slot meters and fittings on the north and south sides of the Thames greatly influenced the Committee in making this recommendation; but since then the charges have been equalized. It is suggested by the South Metropolitan Company that the extra charge for meters and fittings should be fixed at 9d. per 1000 cubic feet; but the County Council prefer the more elastic method of reference to the Board of Trade.

After the opening by Mr. Worsley Taylor, only two witnesses were called for the promoters—Mr. H. E. Haward, the Controller of the Council, and Mr. W. J. Dibdin. The evidence of the former was directed to a very large extent against the Gaslight and Coke Company; but generally, he considered the prepayment consumers were at present at the mercy of the Companies in regard to their fittings. The remainder of the day's sitting was occupied by the evidence of Mr. J. W. Field, for the Gaslight and Coke Company. He thought that what the Select Committee of last year had in their minds in making their recommendation was not dictation, but regulation by the application to the supply of prepayment meters and fittings of something analagous to the sliding-scale. Generally the contention of the Companies is that the proposals of the Council are unnecessary, impracticable, and unworkable, and would entail great and needless expenditure.

The gas portion of the Walsall Corporation Bill came before a Committee of the House of Lords on Friday. An extension of the gas-works has become absolutely necessary; and for this purpose it is proposed to acquire and use 6 acres of land adjoining the existing works. Owners of shops and houses in the vicinity petitioned against this part of the Bill on the ground that they would be injuriously affected by the extensions; but controverting evidence was laid before their Lordships, who allowed the Bill to proceed.

HOUSE OF COMMONS COMMITTEE.

Monday, May 7.

(*Before Mr.* Oldroyd, *Chairman, Mr.* Emmott, *Mr.* Nicol, *and Mr.* Stanley Leighton.)

THE GASLIGHT AND COKE, COMMERCIAL GAS, AND SOUTH METROPOLITAN GAS COMPANIES BILL.

The Bill promoted by the London County Council to make further provision with regard to testing the illuminating power of the gas supplied in the Metropolis, and to confer power on the Board of Trade to regulate the charge for, and the supply of, prepayment meters and fittings, was further considered to-day.

Mr. Worsley Taylor, Q.C., Mr. Talbot, and Mr. B. Wilkinson, appeared for the County Council. The other Counsel engaged were: Mr. Littler, Q.C., and Mr. H. A. Rigg, for the Corporation of the City of London; Mr. Pope, Q.C., Mr. Claude Baggallay, Q.C., Mr. Danckwerts, Q,C., and Mr. R. J. Neville, for the Gaslight and Coke Company; Mr. Littler, Q.C., Mr. Baggallay, Q.C., and Mr. Snagge, for the Commercial Gas Company; and Mr. Balfour Browne, Q.C., Lord Robert Cecil, Q.C., and Mr. L. W. S. Rostron, for the South Metropolitan Gas Company.

Mr. *C. C. Carpenter*, examined by Lord R. Cecil.

Witness said he was Chief Engineer to the South Metropolitan Gas Company. Since 1884, he had given considerable attention to the carbonizing plant used in the manufacture of gas; and as a result of improvements effected, the production of gas was more regular and uniform than it used to be. But even now gas could not be manufactured of absolutely uniform quality. From 1884 to 1896, the period covered by Mr. Dibdin's tests, the coal used by the South Metropolitan Company was practically the same; and it was now carbonized with much more care than it used to be in 1884. It was during those years that, according to the portable photometer, the gas was alleged to have steadily depreciated in quality. He could only account for this by the portable photometer being an inaccurate instrument. Witness handed in the following table, relating to his Company:—

Year.	Gas Sold Per Ton of Coal.	Illuminating Power.	
		Official Tests.	Portable Photometer.
	Cubic Feet.	Candles.	Candles.
1884	9252	16·6	16·3
1885	9190	16·6	15·7
1886	9487	16·5	15·7
1887	9518	16·4	15·7
1888	9499	16·3	15·6
1889	9386	16·3	15·3
1890	9335	16·3	15·4
1891	9421	16·4	15·4
1892	9420	16·3	15·2
1893	9306	16·4	14·3
1894	9400	16·4	14·6
1895	9341	16·4	15·0
1896	9535	16·5	14·9
1897	9555	16·5	14·6

Lord R. Cecil: What is the conclusion you draw from the table?

Witness: Take 1892 and 1893. In 1893, we sold 9306 cubic feet of gas per ton of coal carbonized. According to the returns of the portable photometer, the illuminating power was only 14·3 candles. In the preceding year, we sold 114 cubic feet per ton more; and the illuminating power was 0·9 candle higher. There was no change made in the process of manufacture. The figures given as to the results of the portable photometer

were from Mr. Dibdin's report. The other two columns were from "Field's Analysis."

In a fortnight's testing, Mr. Dibdin's results show 1 candle less illuminating power than the official tests?—Yes.

There was no possibility of error, so far as the gas was concerned?—No possibility, except in the tests themselves. There can be no question of instability of the enrichment of the gas, or as to the enrichment being partial, because there was no enrichment used. This difference of 1-candle power shows that one or other of the tests was incorrect.

You quote one particular instance, on May 3, when the official return was 15·7 candles at Burridge Road, and when the return at the board-school given by the portable photometer was 13·9 candles, or a difference of nearly 2 candles?—Yes. The tests were made with the same gas, obtained from the same works. Of course, in the month of May the discrepancy would not be so great as it would be in colder weather. The suggestion in the evidence given on behalf of the County Council is that we alter the gas at the official testing-stations.

Is there any truth in that?—Absolutely none.

I believe the orders of the Directors are to supply 16-candle gas?—Yes.

And their instructions are carried out?—They are.

Witness went on to say that three readings were taken at each photometrical test. The first reading mostly gave results lower than the succeeding ones, owing to the gas lying in the pipes not having been exhausted. Mr. Dibdin only took two readings, and, moreover, most of Mr. Dibdin's tests were made in daylight. In the opinion of Professor Vernon Harcourt, the eyes of the operator were not fitted to take tests in daylight. The eyes were at their best when the operator had been for some time in the darkened room.

Mr. Worsley Taylor (in cross-examination): You hold that the discrepancies to which you have spoken are due to the fact that the portable photometer tests are all wrong?—Yes; that is so.

Then in the thousands of tests Mr. Dibdin has made, you think he has been quite wrong?—Yes; because the conditions under which he made his tests were unsuitable for the proper working of the photometer.

Could you arrange suitable conditions for working the portable photometer, if you set your mind to it?—Certainly.

Having the ability to do that, if there were errors in the tests, it would only be through wilfully laying yourself out to produce them?—No; it would be through neglecting to take the proper precautions to provide against them.

Could you, with the portable photometer, take the precautions which are adopted in the case of the photometer at an official testing-station?—It could be done.

Then if it can be done, and is not, what other explanation can there be for failure than that of wilfully shutting your eyes to the conditions that are necessary?—I should suggest that those who made the tests did not realize the importance of the conditions under which they should work.

That is incapacity?—Yes. Mr. Dibdin realized the importance of the conditions in regard to the board-school tests.

Was the portable photometer wrong in 1884, when it gave 16·3 candles, as against 16·6 candles of the official tests?—I should say it was as wrong then as now.

Witness went on to say that the maximum daily manufacture of gas by the South Metropolitan Company was 50 million cubic feet. The three London Gas Companies had, altogether, nineteen manufacturing stations; and the greatest care was taken at each of the stations to see that the gas was turned out of the right quality.

Mr. Worsley Taylor remarked that he had elicited the facts just spoken to by witness to show the magnitude of the operations that were the subject of the inquiry.

In further cross-examination, witness said the amount of cannel used for enrichment by his Company had been a gradually decreasing quantity; carburine and benzol being employed instead. The photometer used was the same instrument throughout.

Re-examined by Mr. Balfour Browne: The conditions of gas testing had been very guarded; and the tests with the portable photometer ought to be as carefully guarded. If so, he would have no objection to the instrument; but this would be tantamount to having new testing-stations. If every foot of gas was taken out of coal, the quantity obtained was more, but the illuminating power less. Mr. Dibdin years ago made an investigation into the standard of light, and in his report to the Metropolitan Board of Works showed that he was very much alive to the precautions which the Companies now said were necessary for proper tests to be made.

By Mr. Nicol: Benzol and carburine were more liable to condensation than enrichment by cannel.

Mr. Nicol: Do you attribute the large discrepancy between your official tests and the tests since 1890 to that effect?

Witness: Yes; that may be so.

If it be so, is this not an indication of the irregularity of the gas arising from the distance from the manufacturing station rather than from errors in the working of the portable photometer?—There is no doubt the use of it is not so permanent; and this we provide for, to some extent, by enriching now more than we used to do with cannel. We enrich up to 17½ candles, and sometimes more.

As a practical man, are you prepared to affirm that the gas you supply now, at a considerable distance from the works, ought to give the same illuminating power as in 1884?—I should not say absolutely, but very nearly.

Mr. *R. O. Paterson*, examined by Mr. Rostron.

Witness said he was Engineer and Manager of the Cheltenham Gas Company; and he had had considerable experience in the photometrical testing of gas. He had recently made experiments as to the effect of variations of temperature on the photometrical examination of gas; and he produced the following table, showing that variations in temperature were accountable for very large changes on the illuminating power of gas. Witness pointed out that, on Sample A, there was a difference between the two experiments of 2·13 candles; and on Sample B, of 1·34 candles. The room was in all cases prepared and perfectly suitable for testing; and the readings were corrected to the standard temperature and pressure. The inference he drew from these experiments was that the variations of temperature affected the reading of the photometer, and that the corrections did not remedy this. Corrections for temperature were made upon the gas only; and no allowance was made for the effect of the moisture in the air upon the flame of the gas—that was a very perceptible depreciation. The more moisture there was in the air, the greater diminution there was in the flame. The alteration in the temperature did not account for all the variation. The tests were made with the bar photometer and candles. Afterwards the 10-candle pentane lamp, now prescribed as the standard, was substituted for the candles on the bar photometer, and similar divergent results were obtained. The experiments showed that the pentane-lamp flame was shortened, as well as the gas-flame, when the room was cooled down; and following the instructions of the Referees, the flow of pentane had therefore to be increased, so as to raise the flame to the prescribed height. The practical effect of increasing the flow of pentane was to restore the standard to its original 10 candles. The quantity of light-giving pentane flowing to the burner had been increased; but the amount of light emitted was still 10 candles, as shown by the height of the flame. What had happened was that the lower temperature and excess of moisture were not permitted to exert their damping effect upon the pentane standard, because, when the damping effect was observed, more pentane was turned on to counteract it. It was different with the gas. With the new form of photometer prescribed, and the 10-candle pentane standard, the gas to be tested was consumed in an argand burner at such a rate as would yield a light of 16 candles. The lower temperature and excess of moisture in the atmosphere damped down the gas, as they did the pentane; and therefore to get the light of 16 candles, more gas had to be turned on. But the consumption of gas had to be corrected to the statutory rate of 5 cubic feet per hour, so that if, to overcome the damping effect of temperature and moisture, it required 5½ cubic feet per hour to give a light of 16 candles, the illuminating power of gas was reduced to 14·54 candles when corrected to the statutory rate of 5 cubic feet. A further correction was made for volume, if the temperature of the gas and the barometer were higher or lower than the normal. With the gas, volume and intensity were both under observation; but in the case of the pentane standard both were disregarded, and height of flame alone was taken into account, to the exclusion of everything else. This introduced another disturbing factor into photometry, the full effect of which was not yet known. There were no means of correcting the effect upon the pentane standard of a high or low barometer.

Illuminating Power of Stored Samples of Gas Tested under Varying Conditions of Photometer-Room.

Conditions Varied as Stated.	Corrected Illuminating Power.	Temp. of Room. Dry Bulb.	Temp. of Room. Wet Bulb.	Barometrical Pressure.
Sample A.		Deg. F.	Deg. F.	Inches.
Stored and tested during evening	16·22	63	57	29·60
Same gas tested next morning, windows open during night.	14·09	53	50	29·60
Sample B.				
Stored and tested during morning	15·24	55	50	29·70
Same gas tested in evening, after warming photometer-room	16·58	67	60	29·70
Sample C.				
Stored and tested in early evening	16·75	67	60	29·25
Same gas tested two hours afterwards, windows opened and room cooled.	15·23	58	53	29·25
Same gas tested next morning, windows open during night.	14·42	56	52	29·70
Same gas tested following evening, after warming photometer-room	16·65	66	60	29·50

Cross-examined by Mr. Worsley Taylor: Under proper conditions, the table photometer was all right. It was not alone the temperature that made the difference, but also the vapour in the atmosphere.

Mr. Worsley Taylor: If you have a temperature of 53° and a temperature of 66°, the flame would behave differently—in other words, you have to adjust it differently?

Witness: Yes.

But you always do that. You bring your flame to the same standard height, no matter what the temperature may be?—If you are speaking of the table photometer, of course, you have to regulate the flame of the gas to the 16 candles, irrespective of the quantity of gas required to do it.

The pentane flame is always brought to a standard height?—Yes.

Mr. Leighton: Do you think that observations can be properly taken by daylight?

Witness: Yes; if you have a room in which the ceiling and the walls are darkened, and if the operator has accustomed his eye to the darkness. I myself sit in the photometer-room for five minutes looking under the table, to get my eyes accustomed to the darkness, before making an observation. You must not have merely a screen here and a screen there; you must have an absolutely darkened room.

The Chairman: How long did it take to make your ten readings?

Witness: We make an observation per minute.

I take it that humidity of the atmosphere is equally unprovided for at a test with the portable photometer and with a fixed photometer?—Yes.

Mr. *Henry Woodall*, examined by Lord R. Cecil.

Witness said the evidence of Mr. Isaac Carr had been brought to his knowledge; and he had received instructions from the South Metropolitan Gas Company to go to Widnes to check that gentleman's statements. Mr. Carr had said that the portable photometer in Widnes had showed substantially the same result as the photometer at the testing-station, and that the tests proved that he had kept the gas up to 18½-candle power. On April 26 he (witness) had gone down to Widnes with a portable photometer, and everything necessary for the making of tests with it. He had set up the photometer in a disused office opposite his hotel, and near two railway stations, at a point 950 yards from the gas-works. He had made a series of tests ranging over four days; having been assisted in

the work by the tester of the Liverpool Gas Company, and the tester of the Crystal Palace Gas Company. On April 27, he made four tests; and the average results shown was 14·7 candles. On April 28, the results he obtained averaged 13·10 candles; and on the 29th they averaged 14·84 candles. On May 2, he made six tests, which averaged 14·64 candles. At the first test, the water got into the instrument, and caused some inconvenience and annoyance. After this, however, the conditions improved. The results obtained varied from 15·96 to 12·79 candles. Even the highest of the tests was fully 2 candles below what Mr. Carr said he was able to obtain by his tests.

Cross-examined by Mr. Worsley Taylor: The legal standard at Widnes was 14 candles; and all the tests were all above that. He tested with candles; and the instrument used was the Dibdin portable photometer. The gas was obtained through a meter.

Mr. Worsley Taylor: You are satisfied with these tests?

Witness: Yes; so far as they go.

And ready to stand on them?—Yes.

Did you ask Mr. Carr anything about the gas at that time?—No.

Were you aware that, at that very time, Mr. Dibdin was making various experiments; and that Mr. Carr was "knocking his gas about," and producing various qualities for experimental purposes?—No.

Mr. Balfour Browne then briefly addressed the Committee for the South Metropolitan Gas Company. He said that he had other witnesses, including Mr. Sugg, whose name was very well known in connection with gas-lighting appliances; but he would not trouble the Committee with them. The South Metropolitan Company felt that the only practical Gas Engineer called against them was Mr. Carr, of Widnes, though the promoters had tried to get others. As to the statement that when Mr. Woodall was making his experiments at Widnes, Mr. Carr was "knocking his gas about," this was only a suggestion on the part of learned Counsel.

Mr. Worsley Taylor: You should not say that. I was told it by Mr. Carr.

Mr. Balfour Browne said that Mr. Carr had stated that the gas at Widnes was of 18-candle power as recorded by the portable photometer. According to the evidence since given, this was not the case; therefore, the tests showed that the photometer could not be relied upon. Parliament, it was true, had never distinctly said that the consumer was to have 16-candle gas; but it said that the Gas Companies were to have 16-candle gas in their mains, and that the manner in which the Companies were doing their duty was to be tested in a specific manner. He submitted that the County Council, in this case, were seeking to increase the responsibility of the Gas Company. The latter undertook to supply gas in their mains of a certain illuminating power; and the question was, Were the Committee satisfied that the Company had done this? He contended that they had. Parliament was wrong in imposing on the Company the obligation to supply 16-candle gas in their mains. It was a silly thing, and of no use; but the Company had no right to take upon themselves the supply of gas of less than 16 candles. The promoters asked that the standard, as laid down by Act of Parliament, should be altered, and that the Company should be forced to give all consumers 16-candle gas. This meant that the Company must supply gas at so many candles more than at present as would overcome the whole of the difficulty existing between their mains and the premises of the consumers. He protested against penalizing the Gas Company by records taken by the portable photometer, which might be made under varying conditions. If, for instance, they were made in a school-room newly washed, a different result would be obtained to that yielded by a test in a dry room. Then the conditions as to light must be satisfactory; and altogether he submitted that the requirements were such as could only be complied with at an establishment arranged and fitted like the existing official testing-stations. He urged the Committee not to leave it to the Gas Referees to say what kind of place the test should be made in, because they had already decided the point. They had selected the existing testing-stations, and had prescribed, after years of experience, the conditions under which the tests should be carried out. He had absolutely nothing to say about the portable photometer; but as regarded the obligation which it was sought to impose on the Gas Company to supply 16-candle gas at every place in their district, he protested against it. It meant that the Company would have to supply gas of 1 or 2 candles higher illuminating power; and who was to pay for this? Not the County Council, and not the Gas Company. Even if the consumers obtained the gas of higher illuminating power, what would they do with it? Quite 50 per cent. of the gas burnt in London—certainly during eight months of the year—was used for heating purposes; and in respect of this 50 per cent., the higher illuminating power was useless to the consumers, though they would have to pay for it. What the consumers really wanted was cheap gas; and the effect of the Bill would be to make them pay something like 2d. per 1000 cubic feet more. Even Professor Vernon Harcourt had said that what was wanted by the London consumers was cheap gas of a lower illuminating power. There could not be the slightest doubt that at the testing-stations the various Companies had supplied the gas required. He did not say they had done it all over the district. They were not bound to do that; but if they were compelled to do so, the additional cost to the consumers would be something like £126,000 a year. They would have to pay this amount for a thing which they really did not want. He asked the Committee to say that there was no case made out for the portable photometer. He hoped when the Committee heard the Bill of the South Metropolitan Company, they would come to the conclusion that high illuminating power was a mistake; that petroleum spirit enrichment of gas was a mistake; and that water-gas enrichment was not only a mistake, but was dangerous. There ought to be no enrichment. The Gas Company ought to be able to supply the gas simply as it came from the coal as it was brought from Durham. When he came to the Bill of the South Metropolitan Company, he should ask for 14-candle gas instead of 16-candle; but he did not propose to ask for that for nothing. If the supply of gas of a lower illuminating power was assented to, the Company would reduce the price to the public. He urged the Committee not to put the proposed new obligation on the Company.

Mr. Littler, for the Corporation of London, said that his clients were not, like the County Council, so absolutely convinced of the advantages of the proposal contained in the Bill. He did not himself propose to say anything for or against it. He would leave it to the Committee to form their judgment on the matter, from the information they had got from the County Council and from the different Gas Companies. But what he did say was that, if the Committee should come to the conclusion that the jurisdiction asked for in the Bill was one that should be given, the Corporation did not think they would be doing justice for their constituents if they did not ask that they should have the same rights as the citizens within the County Council area. They wanted it made clear that in the City the matter should be in their jurisdiction—that the gas testing should be done by them, and not by somebody else for them. Clause 3 commenced as follows: "Any two examiners may, at any time make, at any place within the district supplied by any of the Companies, tests for ascertaining whether the illuminating power of the gas supplied by such Company at such place is that required by law." He would propose that these words should be preceded by the words: "Within the respective jurisdictions of the County Council or the Corporation any duly appointed."

The Chairman thought the learned Counsel might well leave the matter in the hands of the Committee, who would see that the position of the Corporation was duly protected.

Mr. Wilkinson did not think it right that the Committee should have to consider the form of the words.

Mr. Worsley Taylor said the County Council would accept the principle of the amendment, but would ask for time to consider the exact wording of the proposal.

Mr. Littler then proceeded to place the case for the Commercial Gas Company before the Committee.

Mr. *H. E. Jones*, examined by Mr. Littler.

Witness said he had been Chief Engineer to the Commercial Gas Company for the past 31 years. He was also Consulting Engineer to a number of important gas companies. Up to fifteen years ago, he constantly used photometers, and occasionally still took tests. In 1889, along with Professor Vernon Harcourt, he acted as Joint Arbitrator for settling the question of the photometers to be used and of the testing-rooms in Dublin; and, by agreement with the Corporation and the Company, they had to certify the suitability and propriety of the photometer and the conditions of the testing-rooms for that purpose. Thus the points in question were not fresh to him. Strangely enough, in that case there were vague imputations of manipulation—as in the present instance—which fell through during the investigation. At the outset, he desired to repudiate emphatically the sinister inferences and suggestions underlying the case which had been put forward by the promoters of the Bill. The supply of gas to the testing stations was common to the whole districts, and the gas was made and delivered uniformly throughout the 24 hours. No enrichment had ever been employed, other than that at the purifying plant at the gas works, so that it would be uniform and general. The Company never knew when the tests were going to be made, and were not represented at, nor interfered with, the testing. There had been rare interviews between the Company's Chemist and the Examiner, chiefly as to verifying some point of purity tests. With regard to the places of testing, those fixed by the Referees in the Commercial Gas Company's district were such as furnished very poor conditions for the Company. They were both very near the extreme margins of the Company's area; and they were neither of them fixed in places where a supply could be taken from any large arterial main.

Mr. Littler: Is it the fact that when first put into action the photometers had to be changed as they admitted reflected light?

Witness: Yes. One of the Examiners said they were unsatisfactory; and they were submitted to a practical photometer maker.

With regard to the condition of the photometers at the testing-stations, the new portable photometer is a copy of an entirely novel instrument, is it not?—Yes; and the notification to fit up such instruments by the Referees is not yet two years old. The Company have not yet had much experience of them. With regard to the condition of the room, the Referees had some trouble with the ventilation at the Parnell Road testing-station, and had the heating apparatus altered so as to improve the action of the photometer. The inference and aim of the evidence for the Bill suggest that the Referees have not sufficiently studied the question. The matter is one requiring careful study and investigation, which the Committee will see when I tell them that at the end of 3 hours' testing only 2½ cubic feet of gas are used out of a daily supply of 14 million cubic feet.

Each of the works of the Commercial Gas Company has only one large delivery main, which branches off outside the works?—Yes. Only by stopping the supply entirely (which is not practicable) from one works, could gas from another works reach the respective allotted testing-station. Each is naturally supplied by the works nearest to it.

In your view, the testing-stations would be still better placed if they were upon the main outlet of the Company's works?—Yes; but inasmuch as the Referees have always been at liberty to fix the testing-stations where they thought fit, they could have satisfied themselves that they tested the gas in the most reasonable and fair manner for the consumer. The Company would not consider a reasonable and fair manner the testing of stale damaged gas, or an attenuated stream of gas through too large and remote fittings—especially in very cold weather—or the testing of any gas in a room where the temperature was much below 60°, or such comfortable temperature as the consumers would employ in their own living-rooms.

In further examination, witness said, if a less accurate or less efficient mode than the present were adopted, it would upset the whole conditions under which the Companies worked. The portable photometer with the pentane standard would not be so simple, nor work so well, under a rough and hasty installation as the old candle photometers. This might explain the greater difference in later tests. At the time the Company accepted the Act of 1875, they only knew of one method of testing—namely, by enclosed photometers, and in fixed testing-places; and this was the foundation of the parliamentary settlement. If testing was allowed, in improper places and in too hasty a manner, of gas which might be damaged, to avoid penalties it would be necessary to provide an excess of illuminating power beyond the ½-candle which even the present limit necessitated; and as all additional illuminating power over that prescribed by ordinary Durham coal was less

permanent, the increased cost would be out of all proportion to its relative value. Referring to the cases in which it was said the tests showed gas of 12 and 13 candle power, his records proved that he could not, unless he had deliberately poisoned his own gas, have made such gas. His figures gave an average of 17-candle power; so that the tests applied to the Commercial Company were preposterous. The legislation proposed would handicap the Company in competing, by causing an increase of price. The shareholder would pay only about one-seventh of the burden thrown on the Companies. If it was important to ascertain the deterioration in the quality of gas consequent on its passing through small dead mains or consumers' fittings, it was of equal interest to the whole of Great Britain; because any legislation would ultimately concern, by precedent, the entire country. Before legislation of this kind, there should be an inquiry as to the whole conditions of gas manufacture, at which gas companies as well as local authorities should be represented. Much of the trouble the consumers had had was due to stoppage in the pipes caused by crystals of naphthalene, which was a chief illuminant. One of the greatest advantages of water gas was that it did not deposit naphthalene.

Witness was not cross-examined.

By Mr. LEIGHTON: The best remedy for the present state of affairs would be a lowering of the statutory standard.

Dr. *Odling*, examined by Mr. LITTLER.

Witness said he agreed in the main with Professor Dewar's evidence. The method proposed in the Bill was substantially impracticable, unreliable, and unjust to the Companies. Therefore it was unreasonable in the interest both of the consumers and the Companies. The Bill, if passed, would force the Companies to increase the candle power of their gas very considerably; and this meant a higher price to the consumers, without corresponding advantage.

Mr. *W. Sugg*, examined by Mr. LITTLER.

Witness said since 1858 he had been engaged in the manufacture of photometers, and in making photometrical experiments with all kinds of burners. He was the inventor of the London argand burner—the standard mentioned in Acts of Parliament. Under the direction of the Referees, he had fitted up the 23 testing-stations in London, and made the photometrical apparatus for them. Witness gave evidence as to the necessity of the tests being conducted under proper conditions, and said the present testing-places were the right and only places in every respect for the tests to be made. They had been carefully selected so as to give a fair test of the gas supplied. It would not be fair to make a test at any house—indeed, testing-stations had had to be removed, because for various reasons they did not give fair results. The Bill would force the Companies to increase the quality of the gas they sent out, which was unreasonable, and would add to the cost to the consumer. The Bill was absolutely impracticable.

This concluded the evidence.

Mr. LITTLER then addressed the Committee for the Commercial Gas Company. He said the Bill was promoted by people who, with the sole exception of appointing the Gas Examiners, had no interest in gas. So far from that, it was extremely likely that some of the large ratepayers would go before the Auditor to see whether they had any right or power to introduce the present Bill at all. The Referees made no complaint; and although the Gas Examiners did, he had to remark that they were appointed by the County Council, which was a serious matter for the Companies, because the Council having a strong view on this matter, they would only appoint such Examiners as would take the same view. The whole matter was one of burners, for with the best type of burners plenty of light could be obtained, whether the gas was ½ candle above or below the standard. Even now the London Companies were penalized to the extent of 1 candle; because, whereas in the country generally the Board of Trade standard was 15 candles, in the Metropolis it was 16. The County Council sought the right of going wherever they pleased to make an investigation, under whatever conditions they thought fit; and then if they found a result, according to their judgment, contrary to the Act, the Companies were to be penalized. There was to be an examination at which the Companies were not to be present, and of which they were not to have notice, because the County Council insinuated that if they were given notice they would manipulate the gas—which was one of the most ludicrous things which could be suggested. The result was to be, first, a penalty, and then (which was far worse than all penalties), a bad character among their customers. This was most unreasonable. Was this the time to introduce a new and serious element of cost and anxiety into the affairs of gas companies, when they were feeling—though not to the full, because it had not yet been perfectly developed—the competition of electricity; and when, as they learnt from the papers that morning, there was an increase of 5s. per ton in the price of coals? There was absolutely no case of public advantage, because it was only when improper burners were used that this high standard was wanted at all. The City were not consulted by the promoters before the Bill was introduced, because they knew very well the City would have told them not to interfere with what was going on very well. There was no one asking for this system of testing over the enormous area of supply. Were the Committee satisfied that it would be just? Were they satisfied that the County Council ought to be allowed to set up this system of testing, with no one to supervise them, and with no one to check them? The present position was a tolerably tyrannous one; the Companies being under the thumb of the Gas Referees, and there being no appeal against them. It was now proposed that they should be under the tyranny of the Gas Examiners. They were to be tried by the County Council, who were to be the prosecuting counsel and judges. If the Companies were right in their view as to the result of this Bill, was it not remarkable that the measure was brought forward at a time when the County Council were talking about purchasing the gas undertakings? If the Council could reduce the profit of the Companies, down would go the price to be paid for the concerns. This was a reasonable explanation, not of why the Council should expect to pass their Bill, but of their reason for trying it on. In conclusion, he submitted that no public case had been made out; no complaint had been established. Was the gas under the present legal test shown to be deficient? If it was, it was the duty of the County Council to have compelled the Companies, under the Act, to improve the supply. There had been no case made out before the proper authority. A number of vague charges were made; and he would ask the Committee to reject a Bill which would simply increase the responsibility of the Gas Companies and increase their expenses and the price of gas, without a corresponding advantage to the public.

Mr. WORSLEY TAYLOR, replying on the cases of the three Gas Companies, declared that the question before them was a practical one; and he could not deal with it like his learned friends in a general way. He had to prove his Bill, and was, therefore, compelled to go into detail. His clients were there asking Parliament to alter existing legislation, which was important in itself, and had been carefully settled; and he accepted on behalf of the County Council the full responsibility which attached to anyone seeking to alter existing legislation. The object of the legislation had been to get 16-candle gas.

Mr. NICOL: Where?

Mr. WORSLEY TAYLOR: At the fixed places, under conditions laid down by the Referees.

Mr. NICOL: Testing in a private room would be fair?

Mr. WORSLEY TAYLOR: No; it would not be according to existing conditions. Continuing, he said the County Council contended that it should be 16-candle gas taken from the main in front of the house of the consumer. He contended that the existing legislation had not effected the object with which it was passed—viz., of securing 16-candle gas to the consumers. According to Mr. Dibdin, there had been a steady decrease in the quality of the gas supplied in London from 1889 to 1896; and he (Mr. Worsley Taylor) failed to see how Mr. Dibdin's evidence had been shaken. The only way they could get over it, was by saying that Mr. Dibdin's portable photometer was not a reliable instrument. The learned Counsel then referred in detail to the evidence of Dr. Clowes and Dr. Hehner, which proved absolutely, in his opinion, that the present system of testing had failed. But beyond the witnesses in question, there was the evidence of a witness called by the Committee, Professor Vernon Harcourt, who was beyond suspicion as to ability or bias, and who did not think the gas was tested so as to ensure that 16-candle gas was supplied in the mains all over the London districts; and he had added that the present system of testing was unsatisfactory. It was clear, therefore, that the existing method had failed to effect the object originally intended. There was a solution of the problem which was free from any offensive suggestion. The Companies each had varying works, and varying qualities of coal and methods of enrichment. Here were causes of error without end; and it was absolutely necessary that extreme vigilance should be exercised in testing the gas. It was shown that, in the case of the South Metropolitan Gas Company, according to the portable photometer, the illuminating power of the gas had fallen from 16·3 candles to 15·7, 15·6, 15·3, 15·2, and 14·3 candles; and that it now stood at 14·6 candles. It was significant that this fall in illuminating power had taken place since 1884, when cannel coal for enrichment had been changed for the more ephemeral petroleum spirit. If he had satisfied the Committee that the existing system had failed, how was it to be altered? It was suggested by an extension of the testing-stations; but Professor Vernon Harcourt's evidence negatived this. He said he did not think it desirable there should be any multiplication of stations on the present lines, but that some testings from place to place would give useful information which the present system did not afford. Therefore the answer of the Official Referee disposed absolutely, and for ever, of the question of multiplication of testing-places. The only thing which would give the desired result was the present Bill. All conditions as to testing, except three, were left in the hands of the Gas Referees; and by the Bill, no alteration was made as to two—viz., the burning of the gas at the rate of 5 cubic feet per hour, and the employment of the argand burner. The only alteration was in the third point—as to fixed stations. It was not suggested that the testers should go to any place, but that the Referees should prescribe the class of place; and this it was thought would be covered by the substitution of the following for what was contained in the Bill:

> The Gas Referees shall also make, from time to time, regulations prescribing the conditions to which any place at which tests under this Act may be made shall conform; and a penalty shall not be recoverable in respect of deficiency of illuminating power ascertained by a test made at any place not conforming to the conditions so prescribed.

No one disputed that the Gas Referees were to be trusted. They could be left, therefore, to prescribe how the tests should be made. If the Bill was a just Bill, it should be passed without regard to penalties; and, moreover, if there were penalties, the case would have to be proved up to the hilt, so that there was a safeguard in this for the Companies. The result of the Bill would not be the infliction of penalties, but a more rigorous regard by the Companies to the production of the gas, with the result that the consumers would get that to which they were entitled—viz., 16-candle gas. The Bill was just to the Companies, and just to the public; and he therefore asked the Committee to pass it.

The room was then cleared. On the re-admission of the public after a few minutes' interval,

The CHAIRMAN said: The Committee have considered the preamble of this Bill so far as it relates to Part II., called Testing; and they find the preamble is not proved.

The Committee then adjourned until Wednesday; the remainder of the County Council Bill being postponed till a later period.

Friday, May 11.

To-day the Committee proceeded to consider Part III. of the Bill.

Mr. NEVILLE said the Gaslight and Coke Company had no petition against the South Metropolitan Bill; and as that measure was to be considered with the second part of the Bill of the London County Council, against which they had petitioned, he wished to know what his position would be.

Mr. WORSLEY TAYLOR pointed out what Mr. Neville's position would be according to the etiquette of the Bar.

Lord R. CECIL said that the learned gentleman wished to define before the Committee the attitude the Company took, and that ample opportunity would be afforded to him for doing so.

The Chairman remarked that the Gaslight and Coke Company would scarcely have *locus standi* against the South Metropolitan Bill.

Mr. Worsley Taylor then addressed the Committee in explanation of the second part of the Bill of the London County Council. He said that he should rely for the strength and his case very largely on the report of Sir J. Rankin's Committee of last session. The preamble of the present Bill contained the following:—

And whereas the price which the said Companies may charge for gas is regulated under the provisions of divers Acts of Parliament: And whereas under, and by virtue of, section 19 of "The Metropolis Gas Act, 1860," the said Companies are entitled (amongst other things) to enter into any contract with any owner or occupier for supplying him with pipes, burners, meters, lamps, and other apparatus, in such manner, and on such terms and conditions, as the parties agree: And whereas since the passing of the last-mentioned Act a system has been widely adopted by the said Companies by which prepayment meters and other fittings are supplied by the Companies to consumers, and the consumers so supplied pay from time to time to the Companies sums which include both the price of gas and a charge in respect of the supply of such meters and other fittings, but the mode in which such sums are made up is not stated to the consumers: And whereas the statutory provisions regulating the price of gas are thus in danger of being defeated: And whereas it is expedient that the supply of such meters and fittings and the charges therefor should be regulated by the Board of Trade, and the amount of such charges stated to the persons who pay them, and that the said Companies should keep and publish separate accounts of their receipts and expenditure in respect of such meters and fittings.

This showed the object of the Bill. There had been certain legislation fixing the price of gas to be charged to the consumers by all three Companies. Each of them had power to enter into contracts for the purposes then known to Parliament, and contemplated by Parliament and by the probable consumers and the Companies. But since this legislation an entirely new business had grown up, owing to force of circumstances, to the advantage of the Companies and the public. This new business not having been contemplated when the legislation was passed, had not been dealt with by Parliament; and it was to the interest of the consumers that it should be dealt with in a manner just to them and to the Companies. That it was a new and very extensive business no one would dispute. Last night he had looked over the evidence given before Sir J. Rankin's Committee, though he had not had time to examine it very exhaustively. He had observed one or two facts; and an expression of Mr. Livesey's had caught his eye—it being a very suggestive one. Mr. Livesey had stated how the prepayment system was started by some one in Liverpool; and, to use his graphic expression, "the idea went like wild fire." The business had only been eight or nine years in existence—ten at the outside. In 1898, the Gaslight and Coke Company had something like 100,000 of the slot-meters in use; and the South Metropolitan had about 80,000. He had been unable to find the number of the Commercial Gas Company's meters; but seeing that at that time the two Companies he had mentioned had 180,000, he should be well within the mark probably if he said that there were now in London 250,000 of these meters. If this were so, it was desirable, in the interest of the consumers, that the charge made for the fittings should be known, and should be regulated in a proper manner. It was an important question now; and seeing that there had been a wonderful development of the system in a few years, and knowing as they did that the plea raised by company after company all over England for a large increase of capital was the expenditure necessary in consequence of the probable rapid future extension of the slot-meter system, they could not but admit that at the present time the matter was one claiming the attention of Parliament. This was all he need say as to the importance of the question the Committee were asked to decide. At the present time, it was clear that there was regulation of the charge for gas; but there was no regulation with regard to the price at which the fittings should be supplied. They were all furnished by the Companies. It was profitable to supply them. The Companies sold their gas, as they would not otherwise do; and, of course, they got their profit on the fittings. The case they made out themselves was that, by the use of the prepayment meter, they encouraged the consumption of gas, and in this way brought in a class of people as customers who could not afford to take gas in the ordinary way. Therefore, the Companies were only too glad to provide these fittings. They had found it to be to their interest to do so. The price of gas was fixed; but the Companies made an all-round charge of 1d. per 25 cubic feet, or whatever it might be—the charge being a certain fixed proportion to the price of gas. Whatever was over and above that, was clearly profit, and went to pay them for the original cost and annual charge in respect of fittings, and everything in connection with the working of fittings—checking them, keeping them in order, the cost of collection, and so on. Therefore, as there were only regulations fixed as to the price of gas, it followed that the Companies were at liberty to charge any sum that the consumers might agree to pay for the cost of fittings, including working expenses. Manifestly it was absolutely impossible for the consumers—especially those of the class for whose benefit the slot-meter system had been introduced—to go into anything like satisfactory detail with the Companies as to how much they had individually to pay for the fittings over and above the price of the gas. This, clearly, must be left to the Company. It was of great advantage to the public to have the slot system; and the Companies, on their part, had admitted that it was to their interest to supply the meters. It thus appeared to the County Council to be only fair and just that there should be some means of regulating the charge. In the case of the three London Gas Companies, different charges were made. Why? The gas supplied by them was charged for at the same rate. Why should not the same charge be made for the fittings? And, further than this, they had the extraordinary fact that, in the case of one Company—the Gaslight and Coke Company—a different charge was made on the north side of the Thames for the fittings to that levied on the south side. There was also a difference in the charge for gas. If a deduction were made so as to eliminate the charge for gas, and get what was represented by the charge for fittings on the north side, they would see that a charge of 9½d——

Mr. Neville: The charges are the same now.

Mr. Worsley Taylor said he was much obliged to his learned friend for the correction. This was an illustration of what it was open for the Companies to do. Last year the charge was 9½d. on the north, while on the south side it was 1s. 2½d. for practically the same fittings. The charges were the same now; but they might be altered to-morrow. This was the sort of thing which ought to be prevented. The Committee of last year said: "The Committee desire to draw attention to the differential charge made by the Gaslight Company for automatic meters in the northern area, as compared with the southern area. It appears, from evidence given by Mr. Field, that, although compelled by law to charge the same price for gas to their slot-meter consumers in the two areas as is charged to other private consumers—namely, at the present time, 3s. in the north and 2s. 2d. in the south—the Gaslight Company make a different charge to slot-meter consumers in these two areas for the use of their fittings. That is to say, they charge the slot or automatic gas-meter consumer in the north 3s. 9½d. per 1000 cubic feet, and in the south 3s. 4½d.; and as gas must be sold at 3s. in the north and at 2s. 2d. in the south, it is obvious that the charge for fittings is 9½d. in the north and 1s. 2½d. in the south. As the fittings appear to be the same in both areas, your Committee consider that the higher price charged for them in the south is altogether unjustifiable; and they are of opinion that a clear statement of the rates charged for gas, meters, &c., should be furnished to each consumer." On this, their recommendation was: "That the charge made by the Gaslight and Coke Company for the rents of automatic meters and stoves should be the same to consumers north and south of the Thames for fittings of the same quality and capacity; and that the prices charged by all the Companies for these slot-meters and fittings require regulation, having regard to the fact that the business is a new one and has extended with extraordinary rapidity throughout the Metropolis." He asked the Committee to act on this recommendation. It was one which commended itself, especially as the South Metropolitan Company had introduced in their Bill power to regulate their charges. The real question was, What was the best method of carrying out the recommendation? The price ought to be such as would be just to the consumer and fair to the Company, having regard to their charges and their title to a fair profit on the capital employed. The County Council said: "Leave the whole matter to the Board of Trade;" the South Metropolitan Company, who alone proposed to deal with the question, said: "Stereotype now a fixed price"—the price suggested being 9d. per 1000 cubic feet. All the consumer ought to pay was a fair return to the Company. The more elastic method of reference to the Board of Trade must be the fairer. The Bill provided that: "As soon as may be after the passing of this Act, the Board of Trade shall, after holding an inquiry, approve a standard pattern or standard patterns of prepayment meters and fittings for use in connection therewith." At the inquiry, all the Companies would be represented; and the Board of Trade would decide between the rival sets of meters. Then the Board of Trade "shall fix for the use of such meters and fittings by the consumers such charges per 1000 cubic feet of gas supplied by means thereof as they may think reasonable, having regard to the fair and proper cost of supplying such meters and fittings." This recognized payment in the way familiar to the Companies—namely, the price per 1000 cubic feet—so that they would still be able to charge a penny per so many feet, as they did now. Then the Board of Trade were to inform the Companies and authorities of the standards and charges, and the Companies to give information to the consumers. The next clause said: "Any person who is entitled in respect of the ownership or occupation of any premises to be supplied with gas by any of the Companies, may, by notice in writing specifying such premises, require such Company to supply thereon standard fittings; and they shall within a reasonable time supply the same accordingly, and shall keep in repair and renew the same when necessary." This was putting on the Companies the obligation to keep a supply of standard fittings, and to furnish them when required; but it was no new hardship, because it had been proved repeatedly that this was one of the most profitable parts of the business. The clause proceeded: "If such person requires such Company to supply standard fittings on any premises on which there are in working order and repair similar fittings already supplied by such Company, the Company shall not be bound to supply standard fittings on such premises until such person shall have paid to them the reasonable expenses of replacing, either by substitution or alteration as the case may be, the fittings already on the premises by standard fittings. Any question as to the amount of such payment shall be decided by a Court of Summary Jurisdiction." This was a matter of precaution, and was clearly right. Clause 12 provided that each of the Companies should keep, in a form to be approved by the Board of Trade, a separate account showing all expenditure and receipts in respect of prepayment meters and fittings, and should furnish to the Council and the Corporation copies of such account with their annual statement of accounts. Clearly there was no difficulty in doing this; it being a new business, separate and distinct from the rest. Clause 13 proposed that if at any time after the expiration of five years from the date of an inquiry under this Act, any of the Companies or the Council, or the City Corporation, requested the Board of Trade to revise the patterns or the charges, such an inquiry should be held, and an alteration might be made. The petition of the South Metropolitan Company dealt with the County Council Bill very shortly: "Your petitioners respectfully submit that the provisions of the Bill [the one promoted by themselves] are quite sufficient, and thoroughly practicable, for the regulation of the supply of gas by means of slot-meters; while the proposals in the Bill of the London County Council are, your petitioners respectfully submit, and are prepared to prove, unnecessary and unworkable." They did not dispute that the recommendation of the Committee of last year should be given effect to; it was really a matter of clauses. Let the Committee contrast this with the position of the Gaslight and Coke Company. They said: "Your petitioners wholly controvert, and strongly challenge and object to, each and every allegation and statement contained in the preamble, so far as the same relates to your petitioners' prepayment meters and fittings; and they strenuously deny that the existing statutory provisions regulating the price of gas are in any danger whatever of being defeated; and they strongly controvert and challenge the necessity or expediency of regulating the charges to be made for the supply of prepayment meters and fittings; and they strongly object to each and every clause of Part III. of the Bill on the ground that the provisions thereof are offensive, unfair, and unjust to your petitioners"—this was in face of the recommendations of the Committee of last year—"and in violation of the previous legislation upon the faith of which a large portion of your petitioners' capital has been subscribed, and are impracticable and unworkable and wholly

unnecessary in the interests of the consumer; and they respectfully submit that none of the provisions of Part III. of the Bill are justified by the acts or conduct of your petitioners in relation to the supply of prepayment meters and fittings, and that such provisions are and can be only justifiable on the preconceived assumption that your petitioners have acted, or intend to act, fraudulently, or that they have abused the powers entrusted to them by Parliament in regard to the same." The Bill was based absolutely on the recommendations of the Committee of last year; and it was to be regretted that people should put allegations of that kind on the face of a petition. Then they drew attention to the fact that the initial cost of prepayment meters and fittings and installation was exceedingly heavy in proportion to the consumption, so that they must entail a proportionately heavy capital outlay, while the cost of keeping them in repair was very considerable; and owing to the shifting nature of the population using gas in this way, the fittings were extremely liable to remain idle. The allegation, therefore, that their capital expenditure was unduly high was unjust. All these things might be true; but they were matters which the Board of Trade would consider. The Company further pointed out that the circumstances under which the installations of prepayment meters and fittings were made necessarily varied in almost every case. Again, this was a matter for the Board of Trade. Then the Company objected to the inquiries proposed by the Bill as wholly unnecessary, and as causing great and needless expenditure to them; but the County Council, and presumably the Companies also, would not ask for a revision unless there was good reason. The Company also took exception to clause 12; holding that the separate accounts thereby directed to be kept would be misleading and useless for all practical purposes, besides which it would be misleading and useless to treat the business of supplying gas by prepayment meters and fittings as separate. Then they said it was impossible and impracticable. Surely this was a matter of evidence; and he should be surprised if the Company attempted to show that the idea was impracticable. There could be no question that the proposal was right; for without accounts of this kind, how were the Board of Trade to go into the matter for the purpose of revision? Further, the Company challenged the right of the County Council to promote the Bill. This meant, if anything, that nobody was to deal with the matter. The points, he added, in conclusion, in the petition of the Commercial Company were practically covered by the other petitions.

Mr. *H. E. Haward*, examined by Mr. WILKINSON.

Witness said he was Controller of the London County Council. Before the Select Committee of last year, he drew attention to the fact that the charges made by the Companies for gas supplied through automatic meters were not the subject of regulation. In 1898, the automatic meters in the districts of the Companies were as follows: Gaslight and Coke Company, 99,607 meters, and the gas consumed through them 1,634,750,000 cubic feet; South Metropolitan Company, 80,115 meters, and the gas consumed through them 1,281,840,000 cubic feet; Commercial Company, 9551 meters, and the gas consumed through them 114,612,000 cubic feet. Altogether, there were upwards of 190,000 consumers in the districts of the three Companies taking gas in this way; the amount so supplied being 3000 million cubic feet; and the income derived £523,000. Since then, the number of meters had increased rapidly. In the South Metropolitan area, the price was lower than that of the Gaslight and Coke Company; and the former Company had a much larger proportion of this business than the latter. Fittings of this sort were chiefly supplied to the poorer classes; and consequently they would not be in a position perhaps to discover how much they were paying for fittings, and how much for gas. Up till March last, the Gaslight and Coke Company were charging to ordinary consumers north of the Thames 2s. 11d. per 1000 cubic feet, and to the automatic consumer 3s. 8·45d.; so that the actual charge for automatic fittings was 9·45d. The charge to ordinary consumers south of the Thames was 2s. 1d., and to automatic consumers 3s. 4d.; so that the charge for fittings was 1s. 3d. In the South Metropolitan area, the charge to ordinary consumers was 2s. 1d., and to automatic consumers 2s. 10d.; so that the charge for fittings was 9d. In the Commercial Company's area, the charge to ordinary consumers was 2s. 6d., and to the automatic consumers 3s. 4d.; so that the extra charge for fittings was 10d. Since March last, the Gaslight and Coke Company had altered their price for gas south of the Thames to 2s. 1d. per 1000 cubic feet; so that the charge for fittings was now only 9d., instead of 1s. 3d. It looked very much as if they had overcharged for fittings before last March; and the overcharge appeared to have been 6d. There were 12,000 consumers south of the Thames; and they consumed on an average 16,000 cubic feet of gas per annum. On this basis the extra charge of 6d. worked out to about £5000; so that the Company were really drawing from the poor people about £5000 more than they stated to have done. Witness went on to quote in detail the evidence given by the various Companies last year regarding the prices charged for automatic fittings. Mr. Field, he said, did not account for the difference of charge for fittings in the case of the Gaslight and Coke Company north and south of the river; and this was a point which struck the Committee very much. It was admitted that the fittings of this Company north and south of the Thames were the same, though the price was different. The consumer was now absolutely at the mercy of the Companies as regarded fittings. The Gaslight and Coke Company's price in 1898 to ordinary consumers was 2s. 10d. per 1000 cubic feet, and to automatic consumers 3s. 4d.; so that 2s. 10d. was for the gas and 6d. for the fittings. When they raised the price to their ordinary consumers by 2d., prepayment consumers received 22 cubic feet instead of 25 for a penny. The result was that the price of gas to automatic consumers north of the Thames was increased 5½d. per 1000 cubic feet, whereas the price to ordinary consumers was only increased by 2d. All this showed that the whole system of automatic supply required regulation. Witness, with other officers of the County Council, saw Sir Courtenay Boyle at the Board of Trade; and the suggestion that these points should be embodied in the Bill with regard to photometer tests came from Sir Courtenay Boyle himself. He was impressed with the necessity for regulation.

Cross-examined by Mr. DANCKWERTS: You propose to put one particular competitor of the trade under directions to supply a specific kind of fitting only, at a special price only, and compulsorily. That is so, is it not?

Witness: Yes. He agreed that the charges for fittings were not regulated in provincial towns; but they should be. He denied that the present proposal was practically to dictate how the Companies should carry on their business.

Counsel handed in a form, which showed that the charge for automatic fittings had become equalized on both sides of the Thames.

Asked whether this did not show a desire on the part of the Company to comply with the recommendations of the Committee, witness said it was very tardy compliance. In further cross-examination, he agreed that the Company might supply a man with automatic fittings; and, unless the man consumed gas, they would receive nothing. Or he might move away next day; and if his successor did not choose to adopt the automatic method of supply, there would be a great loss to the Company. But these things were provided for in the charge.

Cross-examined by Mr. BAGGALLAY: The Commercial Company, under their Act of 1875, were expressly authorized to make meters. He had heard of no complaint from this Company with respect to the supply of fittings. He should not have thought this was a class of fittings which was constantly changing, though he was prepared to learn that there was variety.

Mr. BAGGALLAY; Do you not think it would be a great mistake to standardize these fittings?

Witness: I do not think so. I think the Board of Trade could exercise proper discretion in the matter. They would not standardize every single pipe that is used.

Can you give me any idea as to the nature of the complaint, if any, that has been made as to the fittings which have been supplied?—We have not had any complaint as to the nature of the fittings; but it appeared to the County Council that the fixing of a price involved the settling of a fitting, because you fix the price for the supply of a certain article. The complaints would necessarily go to the Company, not to the County Council.

Does it not strike you that it would be a serious thing, unless there was good reason for it, that you should standardize the fittings?—No.

That the very standardizing would tend to hamper the development of this business, the past development of which has shown that it is a very useful business for the purposes of the consumers?—I do not think so.

Cross-examined by Mr. ROSTRON: He had no reason to think that consumers through these meters in the South Metropolitan district were not satisfied. The Council supposed the South Metropolitan Company understood their business; and they did not wish to interfere with them more than they could help.

Mr. ROSTRON: All these provisions in the Bill as to the Board of Trade stereotyping certain classes of fittings, sending round notices, and making restrictions on agreements between Companies and consumers, are simply put in to enable a price to be arrived at?

Witness: The Council thought it would be best to leave this to be settled by the Board of Trade, rather than stereotype a price in the Bill. It is a question, not only of a proper price now, but in future.

Therefore, if we can arrive at this price without all these provisions, you would have no objection to our Bill?—If you can arrive at a fair price applying to all the Companies, not only now, but in the future, that would be satisfactory.

Can you tell me what protection your Bill provides for the consumers who do not adopt standard fittings?—They can still enter into an agreement with the Company, under clause 10.

The Bill contains no regulation as to the price to be charged such a consumer?—No.

By the CHAIRMAN: If there were new inventions, or fresh mechanical appliances, the Board of Trade would have power to standardize them.

Mr. *W. J. Dibdin*, examined by Mr. WILKINSON.

Witness said he had read those portions of the Bills of the County Council and the South Metropolitan Company dealing with fittings. The South Metropolitan Company fixed a definite sum of 9d. per 1000 cubic feet to be charged for the fittings; whereas the County Council left the price to be settled by the Board of Trade after inquiry, and then, as a corollary, they would have to standardize the fittings. His conclusion was that it would be a better system that the Board of Trade should be empowered to fix the price to be charged for the fittings. It ought to be made clear that this was not a minor point, but a very serious matter. If the illuminating power was down to 14 candles, the extra quantity of gas required to give the same light as 16-candle gas in the argand burner would be 40 to 50 per cent. more, which would be equivalent to raising the price from 9d. to 1s. 1d. per 1000 cubic feet. If the quality was down to 12 candles, the quantity of gas to do the same amount of work in the burner would be no less than 100 per cent. more, so that the 9d. would be 1s. 6d. It was right that the Board of Trade should settle the price of the fittings, and also have power to revise the same.

Cross-examined by Mr. ROSTRON: Effective supervision of the charges by the Board of Trade would meet his view as well as the Bill.

This concluded the case for the County Council.

Evidence was then called on behalf of the Gaslight and Coke Company.

Mr. *J. W. Field*, examined by Mr. DANCKWERTS.

Witness said section 6 of the Bill compelled, without leaving any discretion to, the Board of Trade to fix for the use of meters and fittings such charge per 1000 cubic feet as they might think reasonable. It appeared that they had no alternative but to fix a definite price. He was advised that it would not be competent for the Board to say the price should not exceed so much. The Board of Trade, in 1876, arrived at the conclusion that to fix the price of a commodity in which there was no monopoly, by means of Public Commissioners, was an impossibility. Then in their report, the Select Committee of last year expressed the opinion that but little benefit would accrue to the public were they to attempt to dictate to the managers of the Gas Companies how they were to carry on their business; and further, that the principle of the sliding-scale, coupled with the auction clauses, was an excellent one, and should be maintained; and, lastly, that the prices charged by all the Companies for slot meters required regulation. Putting these together, the proper conclusion to come to was that the Committee thought that, on the whole, the price to be charged should not be fixed, but that some

sort of thing analagous to the sliding-scale should be applied—in short, regulation, not dictation. It would be quite feasible to devise a sliding-scale applicable to the capital embarked in the automatic fittings part of the Company's business. This part of the business, so far as the price was concerned, was already regulated by law; and indirectly, having regard to the limitation on the Company's dividends, it was regulated to some extent already under the sliding-scale. There was also regulation in the fact that if too high a price were charged, consumers would not adopt the system. The Acts which gave the Company a monopoly, fixed the top prices to be charged for that which was a monopoly; but in regard to the part of the business which was not a monopoly, the Companies had always had a free hand. Thus the rent for stoves was a matter of bargain between the Company and the consumer. At Liverpool and Portsmouth, there were Companies who not only let out stoves, but let out automatic fittings. These Companies were wholly unattached to the Gas Companies, who had declined to take up the business. It was quite competent for any Company to supply these things in London, in opppsition to the Gas Companies. If the Board of Trade, under the proposed new powers, were to fix too high a price for stoves and fittings, the Companies would be unable to compete with outside traders.

By the CHAIRMAN: At present, the Companies were forced to supply gas, if required, through a slot-meter, even if that meter were not furnished by the Company, provided it had been tested. The Companies were not under an obligation to supply a slot-meter.

Mr. DANCKWERTS: They are bound to supply ordinary meters.

The CHAIRMAN: Suppose a man says: "I want an ordinary meter." He knows, by Act of Parliament, what price he would have to pay per 1000 cubic feet. I say that where he prefers the slot-meter, he has no protection as to price. He can have a slot-meter on demand, but loses the parliamentary protection.

Mr. DANCKWERTS said that was not the case.

The CHAIRMAN: I put it to witness: If a consumer prefers a slot-meter what charge do you make?

Witness: I do not think we have such a case; but we should charge 9d. extra.

Mr. DANCKWERTS said the law was that a man must be supplied with gas at the market price. All the Company could do in the case of the slot-meters was to charge the ordinary price, *plus* 10 per cent. for the use of the meter.

The CHAIRMAN: Witness has answered me very satisfactorily. Up to March 27, the Company were getting 1s. 3d. for that for which they now obtain 9d. This means that they were securing before March 27 6d. more for the gas than they do now.

Witness: No; 6d. more for the fittings.

The CHAIRMAN: I say for the gas. Call it what you like.

Mr. DANCKWERTS (to witness): Though you are limited in your charge as to gas, you are entirely free as to the charge for fittings?

Witness: Yes; we are perfectly free to charge what we like. The matter is similar to the supply of gas-stoves.

The CHAIRMAN: No; it is quite different. It is not the same thing at all.

Mr. DANCKWERTS: In what way?

The CHAIRMAN: I have indicated that already. You are, practically, entering into a fresh contract which contains two elements, one of which is common to the old contract, and the other of which is new. In the liberty you possess to charge what you like for that new element (It is no use your shaking your head, Mr. Danckwerts, for you demonstrated the state of affairs on March 27), you can gain an advantage, and practically increase the price of gas.

Mr. DANCKWERTS: I am not entitled to argue with you; but may I be allowed to say this—that we compete with the ordinary tradesmen in the supply of fittings. If the consumer finds that he can hire fittings cheaper from us than elsewhere, he comes to us. If not, he would go to the tradesman.

Witness said that if a consumer were to dispute the charge, the Magistrate who would try the case would allow the ordinary market price for gas and the other part of the charge for fittings.

The CHAIRMAN: Have you a single case you can point to in which the slot fittings have been supplied by an ordinary tradesman?

Witness: No.

It could not be done?—With all submission to you, it is done in Liverpool. If the Company were compelled to supply every applicant with slot-meter gas, it would involve enormous outlay, and be very unfair to the ordinary consumer. The capital of the Company is already very heavy; and it would be a serious extra burden to have the obligation contained in this Bill imposed on us.

If the Bill passed, would the effect be to send up the price of gas?—I think it would have that tendency. Our capital would not return us the same amount of profit that it does now. The Company are not obliged to sell gas by means of the slot-meter.

Do you mean that, or is it a slip of the tongue? Do you state that a consumer cannot say to you: "I want your gas, but I wish it supplied through an automatic meter"?—No.

Therefore the whole of this new business is contingent and dependent on a separate contract made outside the parliamentary contract for an initial price of gas?—Not *qud* gas.

Outside *gas*?—Yes.

You make your charge for these things outside your parliamentary duty. You charge 9d. *plus* 2s. 11d., which is the ordinary price of the gas?—Yes.

What I wish to get out is that you can, in your discretion, say: "Our price will be 3d. more or 6d. less for the fittings?"—Yes.

You could say that capriciously?—Yes; we could. But we are a trading Company.

And would not make fools of yourselves?—That is so.

You, in your discretion, say: "We will charge so much—1s. per 1000 cubic feet—for the apparatus; and now we will bring it down to 6d." In reality, it might amount to a differential charge for the gas itself?—It is open to that construction.

Mr. DANCKWERTS: Competition would prevent that.

Cross-examined by Mr. WILKINSON: The Gaslight and Coke Company had no competition in their district in the supply of fittings; but the working classes of London were as keen buyers as anyone. The Bill would put up the price of gas, because the obligation would be placed upon them to supply rich and poor under this costly system. He agreed, however, that the system was profitable.

By Mr. LEIGHTON: The automatic stoves and fittings were chiefly of the same pattern; so that when the system was once settled, it could be easily applied in a district. The £5000 loss consequent on the reduction in price, which followed the reduction in the South Metropolitan price, would have to be borne over the whole area of the Company.

By Mr. EMMOTT: He knew of no case in which there was competition with a Gas Company (beyond Liverpool and Portsmouth) in the supply of fittings. As to the extra charge made for automatic fittings, there were no parliamentary figures; but there was a return in the "JOURNAL OF GAS LIGHTING" a short time ago. It was, he believed, from 6d. to 1s.

The Committee then adjourned till yesterday (Monday).

HOUSE OF COMMONS COMMITTEE.

Wednesday, May 9.

(*Before Mr.* OLDROYD, *Chairman*, *Mr.* EMMOTT, *Mr.* STANLEY LEIGHTON, *and Mr.* NICOL.)

THE GASLIGHT AND COKE COMPANY BILL.

This Bill, the object of which is to enable the Company to raise additional capital by the issue of debenture stock, and to purchase and hold lands, came to-day before the above-named Committee.

Mr. POPE, Q.C., Mr. BALFOUR BROWNE, Q.C., Mr. BAGGALLAY, Q.C., Mr. DANCKWERTS, Q.C., and Mr. NEVILLE appeared for the promoters. The petitioners against the Bill were represented as follows: West Ham Corporation, by Mr. E. MORTEN; London County Council, by Mr. WORSLEY TAYLOR, Q.C., Mr. G. J. TALBOT, and Mr. BERNARD WILKINSON; the Corporation of London, by Mr. LITTLER, Q.C., and Mr. RIGG.

Mr. POPE, in opening the case for the Bill, said the measure was a very simple one which, under ordinary circumstances, would require very little explanation. But it came before the Committee under unusual conditions; and therefore he should have to go to some extent into detail. The Bill was promoted for the purpose of raising a sufficient amount of capital to enable the Company to discharge their statutory obligation to the public. It was an ordinary measure for raising additional capital, except that it proposed to raise the capital in a shape and form that was most beneficial to the consumers, and least advantageous to the shareholders. It was a proposal to raise £2,500,000 by means of debenture stock at 3 per cent., which stock was to be submitted to the public under the auction clauses, so that it could only be raised at the price which the market put upon it. The sole question before the Committee would be the requirements of the Company; for in no case would Parliament authorize the raising of an unreasonable amount of capital. The promoters were before Parliament last year with the same Bill, with the exception that when in the House of Commons they had asked for £3,500,000. They were there met by the London County Council, who said—and not without some show of reason—that this was a larger amount of capital than would be required to enable them for a reasonable period to carry out their obligations to the public; and the County Council had induced the House of Commons to reduce the capital in the Bill to £2,500,000. The Bill was now introduced as it left the House of Commons last year; the capital powers it contained being sufficient to enable the Company to carry on their undertaking for from six to seven years. Sir John Rankin's Committee, who had sat to consider the price of gas, had recommended that the reasonable period which new capital should cover would be five years; but he thought the Committee would see that there would be economy in dealing with the capital powers in respect of a slightly longer time. Parliament had always acted on the principle of giving capital powers for a period long enough for practical purposes, but not long enough to release the Company from parliamentary control; and this Parliament had done irrespective of any Special Committee's report. The Bill had been held back last year in the House of Lords until Sir J. Rankin's Committee reported as to the conditions under which further capital should be granted. But the House of Lords had then thrown out the Bill. Well, he submitted that it would not be fair to propose a variation of the standard price in connection with the sliding-scale, in respect of an application for capital which was not to be raised under the sliding-scale, but as debentures under the auction clauses. If the Committee altered the standard price of the sliding-scale, they would interfere with the conditions of the agreement between the public and the shareholders of the Company upon which between £12,000,000 and £13,000,000 had been raised. The learned Counsel described the sliding-scale arrangement; declaring that it was in the nature of a compromise, and had assumed the form of a most solemn contract. It would be quite contrary to parliamentary practice, and to justice, to disturb a solemn bargain simply because there was a requisition for more capital, which was not to be raised under the terms of the old bargain at all. Unless Parliament was actuated by a spirit of confiscation—which he could not believe was the case—they would not disturb the arrangement on which the capital of the Company had been contributed. In all instances in which new capital was to be authorized on terms which would involve a share in the parliamentary bargain, Parliament would be right in saying: "We will not sanction it on the old terms." But this was not the case here.

The CHAIRMAN asked what was the present standard price.

Mr. POPE said it was 3s. 9d. per 1000 cubic feet with a 10 per cent. dividend, and with ¼ per cent. addition or diminution of the dividend as the price rose or fell 1d. per 1000 cubic feet above or below the standard price. If once he satisfied the Committee that the Company wanted the money they asked for, and that they proposed to raise it in the most economical way in the interest of the consumers, and in a way which would not give those who supplied it the benefit of the old arrangement, it would not be fair for the Committee to put their hand to that old arrangement for the mere sake of gratifying the economic considerations which the County Council, on behalf of the consumers, had put forward. The questions for the Committee to consider were: Did the Company want the money? Were they going to raise it in an economical manner? And, in raising it, was it desirable that there should be

any interference with the terms on which the old capital of the Company had been raised? Another point was the recommendation in the report of the Select Committee, that the area south of the Thames, at present part of the district of the Gaslight and Coke Company, should be transferred from them to the South Metropolitan Gas Company; a fair and reasonable price being paid. The Company were quite willing that this area should be transferred to the South Metropolitan Company; but there was nothing, and there could be nothing, in the Bill about that, because the South Metropolitan Company were not buyers.

The CHAIRMAN: Could such a transfer take place without parliamentary authority?

Mr. POPE: I do not think so.

Mr. BAGGALLAY said the third paragraph of the recommendations of the Select Committee (referred to in the Instruction) about automatic meters, would more properly arise when the Committee were considering the second part of the London County Council Bill, which had been postponed, and was to be taken at the same time as the South Metropolitan Bill, which dealt with automatic meters, &c.

Mr. TALBOT said the view of the Council was that the way proposed for dealing with this question was in direct opposition to the recommendations of the Select Committee. He understood the Committee were asked to give the Bill, and then go on to the recommendations of the Select Committee. The Council held that the only method which would secure effect being given to the recommendations of the Select Committee was to take action when the Companies came for capital powers. The Committee of last year suggested that, when the Companies came for additional powers, their recommendations should be imposed as conditions precedent.

Mr. RIGG supported Mr. Talbot's contention.

Mr. POPE said Mr. Rigg misunderstood. He did not ask the Committee to pass the Bill irrespective of any question of conditions; but he did say this was not a convenient time to discuss the conditions. He was quite content that the Committee should keep hold of the Bill, and put upon the Company statutory obligations to carry out such conditions as they thought fit to fix.

The CHAIRMAN said the recommendations of the Select Committee seemed to hang one upon the other; and the Committee felt that they had better take the whole Bill before giving a decision as to capital powers.

Mr. POPE: I quite agree.

Mr. RIGG remarked that there was nothing in the Bill relating to the recommendations of Sir James Rankin's Committee; and his clients felt that, as the Company had deliberately set these recommendations at defiance, the Bill should not go forward in its present shape.

The CHAIRMAN said the Committee had in view the three recommendations of the Select Committee of last year, and would consider whether these were desirable before giving their decision.

Mr. *J. W. Field*, examined by Mr. BAGGALLAY.

Witness said he was Secretary and Manager of the Gaslight and Coke Company, the share capital of which, prior to the conversion authorized two years ago, was £9,204,000, and the borrowing power £2,539,000—a total of £11,743,000. The amount of ordinary capital to which the auction clauses applied was £1,000,000 of "A" ordinary stock; and in respect of this, they received as premium £1,078,700. Owing to the amalgamations which were carried out, there were eight or nine different classes of stock bearing different rates of interest. In 1898, the whole of the preferences were converted into one 4 per cent. consolidated preference stock, and the ordinary stock was converted from 10 per cent. standard stock to 4 per cent. stock; the amount of the new stock, in this case, being two-and-a-half times the former amount. All the stocks were dealt with under the conversion, except a sum of £130,000, the undivided profits of one of the Companies which had been amalgamated. This they were advised they could not deal with according to the terms of the bond. The conversion did not alter the amount of interest or dividend payable. The sliding-scale and standard was also altered to produce the same results in regard to the new 4 per cent. stock as they had in respect of the 10 per cent. stock. The preference, maximum, and ordinary stocks now amounted to £21,642,990, and the loan capital to £4,323,975; the former being 83½ per cent., and the latter 16½ per cent. of the whole. The unissued capital at the present moment was £250,000 ordinary stock and £200,000 loan. Practically, the Company's stock stood at no premium in the market. The proportion of loan capital to share capital was unusually low; the addition to the borrowing powers proposed in regard to the £2,500,000 would raise the percentage to 24 per cent. on the whole capital as fixed since the conversion. In addition to the actual sums raised by share and loan capital, the Company had received as premium on the ordinary stock £1,078,700, on preference stock £214,150, and on debenture stocks (to which the Company voluntarily applied the auction clauses) £310,200. The total amount actually raised by the issue of capital had been £13,463,550. The premiums had been used as capital, but bore neither interest nor dividend. The sums expended before the sliding scale came into operation had been: On works £5,670,823, on mains and service-pipes £2,165,885, on meters £210,299, and on sundries £102,132—making a total of £8,149,139. The expenditure from 1876 until 1899 had been: Works £2,842,653, products works and lands £261,867, mains and service-pipes £913,392, meters £363,208, stoves £320,576, and sundry accounts £25,980—showing a net expenditure during this period of £4,675,716. These two items, with £638,695 of floating capital, made a total of £13,463,550. The Company, on Dec. 31 last, had also borrowed from their bankers £125,000, and there was £193,000 undivided profit, which they had been using as working capital. The £125,000 was borrowed at 5·14 per cent., a high rate of interest, which showed the danger of a company having insufficient working capital. To secure the Company and obviate the necessity for borrowing, money beyond that referred to was needed, so as to prevent the coal store getting low. The Company's coal store in the past nine months, owing to the great stringency of the coal market, had been from 100,000 to 150,000 tons short. All things considered, a floating capital of £1,000,000 was needed at the present time. The capital expenditure which would be required for the present year was estimated at £257,000, which would leave, if they raised the whole of the uncalled capital, a small cash balance of £83,000. Witness proceeded to give the totals of the items for which the new capital was required, which his knowledge of the business enabled him to say were reasonable and fair, taken in connection with the expected increase in business. For gas-works, they wanted £1,720,000, mains and service-pipes £210,000, automatic meter supplies £375,000, ordinary meters £100,000, stoves £165,000, and products works £62,000—a total of £2,632,000. As regarded the item of automatic supplies, the gross expenditure would be £665,000; but from this a certain proportion was deducted which would eventually have to be borne by revenue. Therefore, in making the estimate for capital expenditure, a deduction of £290,000 to be spread over a number of years was made. Although the details were worked out by the heads of the departments, he had no reason to believe the figures were otherwise than correct. The item for automatic supplies was £375,000; and this was made up by taking £665,000, and deducting £290,000 from revenue in respect of house-fittings over which the Company had no control. They expected the whole of the sum would be written off in five years. During the last few years the progress of the Company had been very slow indeed; but in the past year there had been a large increase in business. If this increase was maintained, he thought the money asked for would last eight years.

Mr. BAGGALLAY: As to the proposal to raise the money by debenture stock, instead of by capital, was it discussed before you promoted your Bill last year?

Witness: Yes. The capital of the Company is very heavy, as compared with our business. Our capital is higher, I think, than that of any other Metropolitan Gas Company; and for this reason the Directors have proposed the present method of raising the new capital. We can get capital cheaper by 3 per cent. debentures than in any other way.

What is the saving that will be effected by this proposal, when the whole of the stock is issued?—As compared with the issue of ordinary stock, it will be £18,750 a year.

What is your capital in proportion to your annual million cubic feet output?—Before 1875 it was £870. It is now £650; showing a large reduction in 24 years. The corresponding figures for the South Metropolitan Company are: In 1875, £250; at present, £425. With the Commercial Company the figures are much the same.

What makes your capital higher than that of the other Metropolitan Companies?—In the first place, in 1868 we were compelled to transfer several of our works from London to Beckton—that is to say, we had to remove our manufacturing stations from London, and Beckton was the only place available. The extra cost of that has been £1,500,000. Then we are the only Company in London who have suffered materially by the introduction of the electric light. We have nearly all the clubs and theatres in our district, and we have the City and the large West-end shops. At all these places the electric light is used. But besides that, we have to maintain pipes capable of taking up the supply of gas at any moment.

Witness went on to specify other items of expenditure which fell more heavily on the Gaslight and Coke Company than on the other Companies. In consequence of the amount of their capital, they had to pay 3·46d. more; and they had to pay more in respect of the carriage of coal. Beyond this, they had been involved in large additional expenditure in consequence of the amalgamation of some eight or nine other Companies with them. Another item that had to be taken into consideration was the revenue from coke. Here they had one of the disadvantages of going to Beckton, which was a very isolated place, without a neighbourhood for the disposal of coke. As a result, his Company lost, as compared with the other Companies having town stations, 1·66d.; and they lost 1·4d. through their large consumption of carburetted water gas. Wages were higher under his Company by 0·63d., and rates by 1·16d. Then there were stove-rents and better prices for residuals to be considered; and the net result was a difference as against his Company of 3·54d. per 1000 cubic feet of gas, which had to be added to the 3·46d. in respect of capital. The gas supplied by the Company was of a uniformly higher quality than that furnished by the South Metropolitan Company. His Company used more enrichment than the South Metropolitan Company. In 1875, when the standard price was fixed, his Company were charging 3s. 9d. per 1000 cubic feet for gas, *plus* meter-rent; and the South Metropolitan Company were charging 3s., with no meter-rent. Then the standard of the South Metropolitan was fixed at 3s. 6d., or 6d. above the actual charge; and the standard of the Gaslight and Coke Company was 3s. 9d., or the amount of their actual charge. The Commercial Company were practically in the same position as the Gaslight and Coke Company. The present charge of his Company north of the Thames was 2s. 11d. per 1000 cubic feet, with no meter-rent; while that of the South Metropolitan Company last year was 2s. 1d., *plus* meter-rent. Thus the difference to-day was 9½d. per 1000 cubic feet—that was to say, the Companies had drifted together in the approximation of price during the whole period since 1875, to the extent of ½d. Witness went on to point out that the consumption of gas in the district of the South Metropolitan Company had increased at a much larger ratio than with the Gaslight and Coke Company. The increase in the number of consumers, in the case of his Company, had been 78 per cent., while with the South Metropolitan Company it had been 210 per cent., and with the Commercial Company 55 per cent. While the amount of the increase in the consumption of the South Metropolitan Company had doubled that of the Gaslight and Coke Company, the amount of the reduction in price of the one had rather less than doubled that of the other. In 1898, the number of Board of Trade units of electricity consumed in the Company's district was 35 million, the equivalent of which was 3500 million cubic feet of gas. The competition of the electric light in their district was absolutely different from what existed on the other side of the Thames. If his Company had had the consumption of gas which the consumption of electricity represented, their increase since 1883, instead of being 46 per cent., would have been 70 per cent. Taking the whole period from 1875, the increase, instead of being 117 per cent., would have been 153 per cent. He had considered the effects of the sliding-scale, as to the proportion which it gave to the consumer and the proportion which it gave to the shareholder, when any reduction in price was made. Taking the period 1881-1899, the value of the reductions in the price of gas made to the consumers amounted, in the aggregate, to £14,562,347. The earlier years before 1881 were affected by so many amalgamations that he could suggest no reliable figures in regard to them. In addition to this sum, the Company had abolished meter-rents, with a further benefit to the consumers of £300,000—making a total of £14,862,000. The extent to which the shareholders had benefited in the same period in

respect of reductions in price amounted to only £2,562,685. Therefore the predominant partner in the bargain had had nearly five times as much benefit from the operation of the sliding-scale as the shareholder. For every pound by which the consumer had benefited, the shareholder had received only 3s. 5d. The Company had inserted nothing in the Bill with reference to the recommendation of the Select Committee regarding the reduction of the standard price to 3s. 3d. per 1000 cubic feet carrying 10 per cent. dividend, with an increase or decrease of ¼ per cent. as the price was raised or lowered 3d. This was not a Bill in which it would be right to give effect to any such recommendation, which the Company read as applying simply to ordinary share capital subject to the sliding scale clauses, and as having no relation to a Bill for the issue of debenture stock subject to the auction clauses. Further, the Company inferred that the recommendation was not to disturb the existing bargain in relation to the sliding-scale. Paragraph 4 of the recommendation (which was not mentioned in the Instruction to the present Committee), that capital powers should not be granted to any company for more that five years, and that Parliament should revise the sliding-scale arrangement when such application was made, was held by the Company to apply to new capital, to which a new sliding-scale might be applicable. The determination of the Company to ask for debenture stock was made before the Select Committee of the House of Commons were appointed last year. With reference to the recommendation that the area south of the Thames which was at present part of the district of the Gaslight and Coke Company should be transferred to the South Metropolitan Company—a fair and reasonable price being paid for it—witness said that shortly after October last the two Companies entered into negotiations with respect to the transfer of that area and the Nine Elms works—basing their calculation on the amount of gross profit earned in the district and the value of the works. His Company made a definite offer to the South Metropolitan Company, who submitted an alternative proposal, which his Directors could not consider. As the South Metropolitan Company refused to refer the difference to arbitration, the whole question was allowed to drop. The third recommendation of the Committee, referred to in the Instruction, was that the charge made by the Gaslight and Coke Company for the rent of automatic meters and stoves should be the same to the consumers north and south of the Thames for fittings of the same quality and capacity. The Company were now charging the same; having taken the opportunity afforded a few months ago by an advance in the price of gas in the district of the South Metropolitan Company, to revise their charges. At present, the percentage of automatic consumers was 7·8 for the whole district. The Company's Bill as introduced this year was identical with the one of last year as it passed Sir W. Coddington's Committee, except a little alteration in the land scheduled. Also it was now proposed that the debenture stock to be issued should rank as a second debenture stock, immediately after the existing 3 per cent. debentures. Originally, it was proposed to make it rank *pari passu*; but the House of Commons authorities required it to be made a second debenture stock. The Bill further proposed to authorize the Company to hold certain lands which had been acquired by trustees for the Company; it being doubtful if the Company had power to hold them when they were acquired.

Cross-examined by Mr. Morten: The standard price of his Company was 3s. 9d. per 1000 cubic feet, and of the South Metropolitan Company 3s. 6d. He was aware that the South Metropolitan Company, by their Bill this year, proposed to reduce the standard price to 3s. 3d. per 1000 cubic feet, according to the recommendation of the Committee. If this proposal was accepted, the difference between the standard prices of the two Companies would be increased by 3d. This, however, had nothing whatever to do with the price charged. The present application to Parliament by the Gaslight and Coke Company was for additional capital. He did not know whether this was such a case as the Select Committee contemplated in their recommendation as to the Companies applying for an extension or alteration of capital powers.

Mr. Morten: The more gas you sell, the higher, you say, would be your total loss?

Witness: No; I do not say that. I referred in my evidence last year to reduction after the full statutory dividend had been paid.

Cross-examination continued: He did not recollect that in 1888 the Bromley Corporation, in their Improvement Bill, wanted to acquire some of the Company's land. It would have been most imprudent for the Company to have sold a foot of their land. The gas made at Silvertown was tested at the works. The gas supplied was of 17-candle power.

Cross-examined by Mr. Rigg, witness said Sir J. Rankin's Committee recommended that they should sell the part of their undertaking south of the Thames. If they did, no doubt that would throw fresh capital into the concern. The recommendation of Sir J. Rankin's Committee with regard to capital did not, in his opinion, apply to the raising of capital by debenture stock. The proportion of loan to debenture capital was not the usual one; but the disproportion was not a result of the stock-splitting which had taken place. The works for which the capital was needed must be put in hand almost immediately. The time the capital sought would last depended entirely on the rate of increase in the district. The Company had known an extension of works was necessary for a long time past; but the reason they did not come to Parliament before last year was that it was quite useless to do so when they had anything in their pocket. The only explanation he could give why the recommendation of the Select Committee with regard to capital was not included in the Bill, was that he did not think the recommendation applied to the issue of debenture stock.

Cross-examined by Mr. Talbot: The difference between the prices of the two Companies in 1876 and now was only about a farthing. He should be very much surprised to hear that the difference was 3¾d. in 1876, and was now about 9d. The sliding-scale in 1876 was imposed upon the capital created and to be created. It formed the subject of a parliamentary bargain. The price charged had never been up to the standard, or within 3d. of it, since 1876; and never since 1879 within 6d. of it. The last time the Company were in Parliament for capital powers was in 1876. The increase in the gas sold for the last ten years had been 19·6 per cent.; but any figures based on that as to what would be the increase for the next five years, would be fallacious, because the percentage had relation to years when, owing to various circumstances, the increase was low. He really anticipated that in the next ten years there would be a greater rate of increase than in the last; but that was purely a matter of opinion. The Company had about £450,000 of unexhausted capital power.

Re-examined by Mr. Balfour Browne: The Company had a public duty to perform—viz., to supply gas to every consumer in the district under penalty—and they could not continue to do this after the next year or two, unless they got the additional capital which the Bill proposed to raise at the cheapest rate possible, and therefore in the most advantageous way to the consumer.

Mr. Balfour Browne: The competition of electricity has curbed your development, at any rate?

Witness: Yes.

Is it a fact that your price has for twenty years been 6d. under the standard?—Yes.

During that time you have had to raise capital under the auction clauses?—Yes.

So the 6d. under the standard price induced people to come in and give higher premiums than they otherwise would?—Yes.

Would it be fair to touch the standard price and the capital subscribed on the strength of it?—It would be most disastrous to do so.

As I take it, the Committee who made the recommendations that have been referred to never intended anything of the sort?—They never said it. Witness added that the interest of the shareholders was to spend as little as they possibly could of this new debenture capital. It would all come before the stock on which the shareholders received the higher dividend. Their Silvertown works were now practically only used for the testing of coal.

Mr. Nicol: Mr. Pope has said that if the Committee think it desirable to confine the amount of capital to five years, the Company would, of course, bow to the decision. Suppose the capital is so limited, what amount of money would you require?

Witness: We should need from £1,500,000 to £2,000,000.

Mr. Balfour Browne, in reply to the Chairman, said that a fund for depreciation was only allowed by law in the case of gas-works on leasehold land.

The Chairman (to witness): Have you a reserve fund for the purpose of equalizing dividend?

Witness: We have not. In bad years, when coal has reached an abnormal price, we have postponed the making of a reduction in the price of gas.

Thursday, May 10.

Colonel *Makins*, examined by Mr. Baggallay.

Witness said he had been Governor of the Gaslight and Coke Company since 1872. He had been a party to the parliamentary settlement of 1876, under which the sliding-scale was laid down. Before the Act was passed, there had been one or two Committees to consider the matter, under Lord Cardwell and Mr. W. E. Forster; there having previously been a system in vogue under which, on the complaint of the representatives of the consumers or the request of the Gas Companies, a Committee was appointed to go into the question of the cost of the production of gas, and, having taken evidence, to fix such a price for gas for the ensuing year as would, provided due care and economy were exercised, yield 10 per cent. dividend. This resulted, practically, in a guarantee of 10 per cent.; but that guarantee was swept away in 1876, and the sliding-scale was substituted. The Act of 1876 was drawn up by agreement between the Metropolitan Board of Works (the predecessors of the London County Council), the Corporation of the City, and the Gas Companies, in the presence of the Board of Trade. A copy of the Bill was sealed by the Local Authorities and the Gas Companies. Power was reserved to the Board of Trade to call on the Gaslight and Coke Company to withdraw the Bill, if alterations were inserted without the consent of the Board of Trade. And, conversely, the Gas Company were to support—or rather, not to oppose—any Government Bill brought in by the Board of Trade to carry out the arrangement, in the event of the Company's measure not being carried. Not only did the Board of Trade initiate the Bill, so to speak, but they were the authority for carrying it out. The Metropolitan Board of Works, representing the consumers, were parties to the arrangement of 1876.

Mr. Baggallay: I will ask you whether the present proposals of the County Council and the Corporation of London, that new provision should be made with regard to the sliding-scale, and so forth (that is to say, if it is applied to any existing capital), is or is not in your opinion a request that the bargain made in 1876 should be altered as against one of the parties to it?

Witness: That all depends upon the reading of the first recommendation of Sir. J. Rankin's Committee. I do not know what the proposals of the Corporation and the County Council are. As far as I can see, they simply complain that we have not adopted the recommendations of the Select Committee of last year. I suppose they do not suggest we should have put into our Bill a new sliding-scale having a retrospective effect on the capital already existing. I do not see how we could be possibly supposed to do that, when we had issued, under the agreement of 1876, several millions of stock; for we set out in our invitations to tender, or when submitting stock to auction, the conditions which form the title-deeds of the shareholder. If we were to apply the new sliding-scale retrospectively, it would have the effect of at once knocking off 10s. per cent. The net result would be that the shareholders would have 10s. of their dividend taken from them, and carried to a fund for the purpose of reducing the price of gas. This would have the effect of reducing the dividend of the shareholder, to which he is entitled under the legislation of the present time; and he would get no compensation at all for that. He could not have his money back. He would simply lose the 10s. for ever; and he would also lose on the capital value of his stock from £12 to £15, which would mean a fine on the Company of £1,500,000 or £2,000,000. With regard to its being applied to new share capital, we have no objection to that. The new shareholder who came in would be perfectly aware of the terms on which he tendered or bought his stock at auction; and he would give a corresponding price. If we had brought in our Bill for share capital, we still should have asked the Committee to have fixed the same sliding-scale. It would have avoided two classes of stock, and the issuing of stock at a discount, which we should have had to have done had we applied for

share capital instead of debenture capital, and attached the proposed sliding-scale. Whatever the loss was, it would have to be borne by the undertaking as a whole—five-sixths by the consumers and one-sixth by the shareholders. Under the 1876 legislation, there is absolute identity of interest between the Company and the consumers. We cannot do anything which injures them, without injuring ourselves within the proportions; nor can any of our successes be more beneficial to us than they are to them. Continuing, witness said one of the conditions of the agreement of 1876 was the surrender by the Company of their right under the Companies Clauses Act to issue to themselves new capital, and the entering into an undertaking to sell it in the market—the premium (if any) to go into the undertaking. Now, if retrospective effect were to be given to any alteration of the sliding-scale, this would alter, as against one of the parties only, the terms of the settlement of 1876. It would be to place a penalty on the Company. It would transfer from one to the other a part of the profits which belonged to the shareholders. It was suggested by a member of Sir J. Rankin's Committee that the Company should at once reduce their price to the level of the South Metropolitan Company; and witness had to point out that this practically meant wiping out the Gaslight and Coke Company's dividend. One penny per 1000 cubic feet in the Company's district meant £82,000, of which the shareholders took £16,000, and the consumers, in the reduction of the price of gas, the remainder.

With regard to new capital, an alteration of the sliding-scale would be no interference with any bargain at all?—Not at all.

It would be merely a question of their issuing at auction the new capital on the basis of the new conditions, which would constitute a new partnership?—It would be merely a question of expediency.

The policy throughout has been to connect directly the interests of the consumer and the Company, with regard to the issue of the capital and the carrying on of the business of the Company?—Yes.

It must be so, because whatever money is earned by the Company, when it comes to be divided out, a large proportion has to go to the consumer and a small proportion to the Company?—Yes.

Before the shareholders can get a penny, they must have given five times as great an advantage to the consumers?—Yes. It would have been financial suicide if we had done anything but endeavour to carry on our undertaking in the most economical manner. We took the risk of dear coal and labour, but could not have contemplated the risk of having the terms of the old arrangement altered.

It is suggested that, in the preparation of their Bill, the Company have ignored the recommendations of the Committee of last year. Now, as to this, it is true, is it not, that you do not give effect to those recommendations?—Yes.

The Bill is the same measure as that you had prepared last year, before Sir James Rankin's Committee sat?—Yes.

Was there anything in your Bill, that you could see, by which you would have given effect to the recommendations?—No. They were referred to by the Committee as suggestions to enable the Gaslight and Coke Company to reduce the price of gas. We considered these suggestions, and could find in none of them any means of reducing the price of gas except by confiscation of property.

You think the new sliding-scale should not be applied to the existing capital. Your proposal is to raise all your new capital by means of debenture stock, in which case no new sliding-scale could be adopted. Can you explain why you decided on debenture stock, and think it the most economical way of raising capital?—The feeling of the Directors was that the cheapest capital we could get was what we ought to apply for. The difference between 3 per cent. debenture stock and 4¾ or 5 per cent. ordinary stock, would be from £15,000 to £17,000 a year on the amount asked for; and this would be practically lost. I support the statement of Mr. Field in this matter. As to the working of the sliding-scale, the value of it to the consumer in reductions in the price of gas since 1881 has been £15,000,000; and the amount of extra dividend secured by the shareholders has been £2,500,000.

The Chairman: These figures represent the result that has been obtained under the sliding-scale?

Witness: Yes.

The principles that have produced it are not in the sliding-scale itself, but in the conditions of the trade—the price of coal, and so on?—Yes.

And the sliding-scale shows to whom the benefit should go?—Yes.

Cross-examined by Mr. Rigg, witness said that his Company had considered very carefully the recommendations of Sir J. Rankin's Committee; and there were two interpretations to be placed on them.

Mr. Rigg: Who places two interpretations on them?

Witness: The man in the street.

What are they?—One that the proposed scale should be applied to existing capital; and the other, that when fresh capital is raised the new scale should apply to that.

Who is the author of the first interpretation?—Well, you crystallize it in your Bill. As to the other, it is obvious that the Committee could not have intended an act of injustice.

You contend that it would be unfair for the present Committee to interfere with the arrangement of 1876 in the interest of the consumer?—It would not be in the interest of the consumer, except *pro tanto* as an amount of penalty.

The bargain of 1876 was the result of a good deal of action on the part of the public, was it not?—It was the wish of the Board of Works to get rid of the yearly revision, which they found worked unsatisfactorily; and they wanted a system which would operate automatically.

The City Corporation brought in a Bill to buy you up, did they not?—Yes.

Then came the Act of 1870, which appointed the Revision Committee?—Yes.

The appointment of the Revision Committee was a bargain, was it not?—Yes; and it was a very valuable one to the Company, securing them 10 per cent. dividend.

And under it, you worked the price of gas up to 5*s.* per 1000 cubic feet?—We did not work it up.

But the Revision Committee put it up to that?—Yes.

And so dissatisfied were the public, that they brought in a Bill in order to enter into competition with you?—Yes.

And the existing "solemn bargain," as you call it, was put on you as the result of getting rid of these Bills?—The Board of Trade stepped in, and said: "Do not have this strife, but try and settle something;" and we did so.

The settlement of 1870 was interfered with?—At the request of all parties.

If Parliament could review the arrangement of 1870, which was between the consumers and the Company, why not review the bargain of 1876?—Parliament, of course, can do what it pleases. Mr. Kruger may blow up the Johannesburg mines, and stagger humanity. I think it would stagger humanity were a parliamentary agreement torn up.

Questioned as to whether, in the event of the sale to the South Metropolitan Company of the portion of the Gaslight and Coke Company's district on the south side of the Thames, he was prepared to maintain the Company's present obligations in regard to the public lighting on the north side, and accept a clause to that effect, witness said he thought he should not be asked that as it was purely hypothetical. The matter had not come before the Directors in any shape or form. The Company were prepared, as they ever had been, to treat the public authorities with the utmost consideration.

Cross-examined by Mr. Talbot: Sir J. Rankin's Committee were an *ex parte* Committee in the sense of not being a judicial tribunal. They were appointed at the instance of the dissatisfied consumers among the public, who thought that the difference of price between North and South London ought not to exist. He did not use the term in any offensive sense. He objected to the procedure of that Committee, if the findings were to be considered as judicial, and to involve penalties. The Company had endeavoured to carry out the bargain made in 1876, in every jot and tittle. He did not think they had broken it in a single instance. The Company were proposing to carry out part of Recommendation 3 of the Select Committee (referred to in the Instruction to the present Committee), but not to give effect to suggestions that the prices charged for slot-meters required regulation. This they could not do. Consumers north of the Thames had never had gas at the same price as those on the south, and never, he thought, would have. He did not believe the agitation with regard to the Gas Companies was quiescent pending the results of the Committee of last year. This agitation always took place in the slack season; but it was baseless. It was absolutely impossible for the Gaslight and Coke Company, owing to their conditions, to produce gas at the same price as the South Metropolitan Company. There was a difference between the two Companies in 1876; and there was a similar difference at the present time.

Re-examined by Mr. Baggallay: The recommendations made by the Select Committee with reference to the standardizing of the fittings of the automatic supplies, was a matter which was being brought directly before Parliament in Part III. of the Bill of the London County Council; and if dealt with at all, it ought to be dealt with in connection with all three Companies, so as to produce uniformity of standards and charges among them. This was the only way of dealing with the matter, because the Gaslight and Coke Company could not have introduced a provision in their Bill which would affect the other Companies. The Company's feeling was that this recommendation really was a Board of Trade matter. They felt that the House of Commons did not make these recommendations mandatory, because the Company never had the slightest opportunity of being heard upon them. They were made after the evidence had been taken; and the Company had no opportunity of pointing out how they were undesirable.

Mr. Baggallay said the procedure in the House of Commons showed there was nothing wrong in the Companies thinking that the recommendations of the Committee of last year were open to consideration.

Further re-examined by Mr. Baggallay, witness said if the confidence of investors were in any way shaken in the maintenance of the figures of the sliding-scale, it would affect the power of the Company to place capital at a premium; and this injury would be felt even more by the consumers than by the shareholders. The Company would not be able to issue share capital with the proposed sliding-scale, except at a considerable discount.

By the Chairman: In recent years, there had been considerable improvement in the manufacture of gas—as to the retorts, furnaces, use of carburetted water gas, &c. His Company had been somewhat dilatory in the adoption of these improvements, having been a little hard up. If they had been in easy capital circumstances, they could have considerably improved their machinery. The Company charged all replacements to revenue, and all extensions to capital.

Mr. *G. C. Trewby*, examined by Mr. Neville.

Witness said he was Constructing Engineer to the Company, and had planned the whole of the extensions and alterations of the works during the last sixteen years. Out of the sum of £2,500,000 asked for, his department required £1,735,830. The previous expenditure of the Company on manufacturing and storage works had been economical and properly carried out. He had founded his estimates for the future upon an increase of 3 per cent. per annum compound, which, in view of past experience, he considered fair and reasonable. It would not be fair to estimate it at less than this. The money asked for would last for about nine years, on the basis of 3 per cent. increase. On the basis of increase for last year, it would be very much shorter. There was no reason why the increase of last year should not be maintained; and if it were, the money would not last more than seven or eight years. The sale of the Company for the year 1899 was 21,657 million cubic feet; and, taking the increase at 3 per cent. per annum for nine years, there would be an addition to the sale of 6601 million cubic feet—making a total of 28,258 million cubic feet. To this had to be added an allowance for unaccounted for gas and gas used on works, making a final total, at the end of nine years, of 7005 million cubic feet, which would require manufacturing plant of 35 million cubic feet daily capacity. One of the chief difficulties in the enormous district of London, was to estimate what was the maximum quantity the Company might be called on to supply, as they had to provide at all times for what the public required. The largest amount sent out in one day last year was on Dec. 15, 130,829,000 cubic feet; and the largest amount sent out in any one week was 769,761,000 cubic feet. The largest provision of work available during last year to meet the demands was equal to the make of 830,000,000 cubic feet in a week, which left a margin of only about 8 per cent. The works it was proposed to erect were near the Royal Albert Docks Basin, and consisted of purifying houses, retort-houses, a new dock,

and so forth. They would put up works at first to make 35 million cubic feet of gas per day. Storage works would also be erected. There would be two gasholders constructed, 3 miles from the Bromley works, to hold 12 million cubic feet of gas each; and there would be another holder constructed at Fulham—at the extreme end of the district—to hold 8 million cubic feet. It was proposed to adopt additional mechanical stokers at the Beckton works and elsewhere, and also to buy new pieces of land.

Cross-examined by Mr. RIGG: There were 14 retort-houses at Beckton now, one of which was a double one. The total manufacturing power at Beckton was 56 million cubic feet a day. They must take up the whole of the increase for London at Beckton; and this during the next nine years, at 3 per cent. increase, they estimated would necessitate a manufacturing capacity of about 35 million cubic feet per day.

Cross-examined by Mr. MORTEN, witness said the testing-station at Silvertown was at the Company's works. The other gas supplied to West Ham was not tested in the borough. It was tested in the City; but the City Corporation had no control over the matter.

By the CHAIRMAN: What terms are you under?

Mr. MORTEN: The Act of 1857, which provides for 12-candle gas. We wish to be placed under the Gas-Works Clauses Acts.

Mr. BAGGALLAY asked if the learned Counsel wanted something different to the conditions already existing in the Company's district.

Mr. MORTEN said he did not ask for exceptional conditions. The Company's Act of 1876 only applied to the Metropolis.

The CHAIRMAN supposed the Company did not propose to treat West Ham differently to the rest of the district.

Mr. BAGGALLAY said they did not. He should be glad if Mr. Morten would prepare a clause embodying the claim of West Ham.

Mr. MORTEN intimated that he would act upon the suggestion.

Mr. *G. F. L. Foulger*, examined by Mr. NEVILLE.

Witness said he was Distributing Engineer to the Company. They had eleven manufacturing stations and nine distributing stations, together with a number of governor-houses where the pressure was regulated. The amount of the estimate for new works in his department was £1,140,000, which would last eight years. The district was continually increasing in the suburbs; and this increase compensated for the loss of business owing to the use of electricity. The details of his estimate were as follows: High-pressure and trunk mains, £100,000; smaller or service mains, £55,000; new and additional wrought-iron service-pipes, £55,000; new meters, £100,000; gas-stoves, £165,000. Automatic supply: Meters, £320,000; cooking-stoves, £165,000; service-pipes, £180,000. This made a total of £1,140,000.

Mr. *Thomas Wilton* examined by Mr. NEVILLE.

Witness said he was Superintendent of the Chemical Department of the Company. The amount estimated for his department under the Bill was £61,000. This would last between eight and nine years.

Mr. *W. R. Herring*, examined by Mr. WILKINSON.

Witness said he was Chief Gas Engineer to the Edinburgh and Leith Corporations, and was at present engaged in rebuilding gas-works at Edinburgh. He was providing for the future wants of the district for 42½ years, taking the average increase on the demand at 3½ per cent. per annum. They were immediately spending £750,000; and they expected to supply 50 million cubic feet of gas per day when the scheme was ultimately completed. He could confirm the figures put forward by Mr. Trewby, which he thought very fair. In his opinion, an 8 per cent. margin of gas in reserve was not sufficient, as it might be absorbed in one winter. A safe margin would be 20 per cent. reserve. So far as economy was concerned in these matters, it was desirable to look some distance ahead. It was useless patching together small pieces for a large undertaking. Proceeding in this way was costly and inconvenient.

Mr. WILKINSON: In Edinburgh, I believe, the competition between gas and electric light is very fierce?

Witness: That is so. The competition is not only in the shops and in the clubs, but in the tenements of the middle class. The charge for electricity is 3d. per unit. For gas, it was 3s. per 1000 cubic feet.

What is your experience of the increase in the supply of gas in a district where there is this keen competition?—We find that the average supply per consumer is greater now than it was before the introduction of the electric light. Generally speaking, electricity is bringing about an increased consumption of gas for lighting purposes alone, apart from the gas required for cooking and heating appliances. The public now seem to demand more light. We have not done much in the way of supplying gas for heating and cooking.

The CHAIRMAN: You think the consumers get used to a certain brilliancy, and want more light.

Witness: Yes.

Mr. WILKINSON: What is the increase in the gas supplied by you?

Witness: It is now nearly 6 per cent. per annum, in spite of the electric light. I think it would be unwise for gas engineers to estimate for a falling off in the consumption of gas; and I believe that this applies generally throughout the country.

This closed the case for the Bill.

Mr. MORTEN said the situation was perfectly plain; and the only question was how the Committee would say the Bill ought to be dealt with on behalf of the consumers. The facts were not in dispute; and the recommendations of the Select Committee put the Company in this position: After a long inquiry, certain findings and certain recommendations had been made by the Committee; and it had been an Instruction to the present Committee, in dealing with this Bill, to say how far effect was to be given to certain of these recommendations. The Company were in the position of people having to show cause; and the only way he knew in which they could have shown cause why effect should not be given to the recommendations, was to bring facts and figures pointing to different conclusions than those of the Select Committee. But beyond certain argumentative reasons, there was nothing fresh adduced to show why effect should not be given to the recommendations. The Select Committee found that the difference between the prices on the north and south of the river arose mainly, on the part of the Gaslight and Coke Company, from excessive capital charges, excessive working expenses, and the loss which the consumer north of the Thames had to bear owing to the gas being supplied to the consumer on the other side at a less price than it cost. The Company had not attempted to show that the findings were not justified. These being the reasons which led to the increased charge, the question arose whether it was to exist in perpetuity. The Company contended that this application to Parliament was not within the recommendation of the Committee; but the answer of Mr. Field, that this was an extension of capital powers, brought it within the very words of the recommendation, and made it an application which they said should lead to an alteration of the sliding-scale and standard price. There was no reason why the recommendation should not be given effect to. It was said the capital was to be issued in such a way as to benefit the consumer; and this was an observation which, as far as it went, was entitled to consideration. But how far did it go? The recommendation was that the standard price and sliding-scale should be altered with regard to the whole of the capital of the Company; and it was no reason why the recommendation should not be given effect to with regard to the whole of the capital, to say that the consumer would benefit by the issue of the new capital. It was suggested that the recommendation would do great injustice to the shareholders. If this were a private Company, there might be something in that; but they were dealing with a Company who had obtained a monopoly, and this made a great difference. The idea that the public should go on suffering from the difference in price, in order that the shareholders might continue to reap the advantage of it, ought not to prevail. Those who were responsible, by their past conduct and bad management, ought to be made to suffer. On behalf of the consumers of West Ham, he contended that the whole of the deliberations of the Select Committee would be thrown away unless effect was given to them; the main point being to secure a reduction in the standard price of gas. He did not want to deprive the Company of the capital necessary for the purposes of their undertaking; but if the Company were clearly told that Parliament would not give them further capital except upon the conditions in the recommendations, they would have to fall in with those recommendations, which were such as ought to be incorporated in the Bill.

Mr. LITTLER said the whole object of the City Corporation was to protect the gas consumer from annoying conditions of any kind, and to take care that whatever was done should not be done to the prejudice of the consumer. The Corporation had always felt that, in consequence of the amalgamations which took place, there would be economies and reductions of price effected. But this had not been the case; and the Gaslight and Coke Company were now charging a price higher than many small provincial companies. So far from a reduction being likely, with all this extra capital, it looked as if there would be an increase. Advisedly, and in the interest of the consumer, he asked the Committee not to allow this imperfect Bill to pass. He absolutely demurred to the proposition that the opponents should produce conditions; it being no part of their business to prepare a scheme for the Company. The promoters should have presented a workable scheme. Last year, in the Lea Bridge case, Lord Camperdown cut down the standard price by a third; so that all the sacredness of the standard price had been destroyed.

The CHAIRMAN: Was that in connection with an application for an increase of capital?

Mr. LITTLER: For an increase of capital, chiefly.

Mr. NEVILLE: The circumstances of that Bill were quite different from this.

The CHAIRMAN: What was the alteration in the sliding-scale?

Mr. NEVILLE: From 5s. to 4s. 6d. per 1000 cubic feet; and the Company had never once paid a standard dividend, or anything near it.

Mr. LITTLER: My point is that the sliding-scale has been touched.

Mr. NICOL: Does the sliding-scale, as carried out under the provisions of the Board of Trade, apply to other gas companies besides the three Metropolitan Companies.

Mr. LITTLER said the sliding-scale was invented for the Metropolitan Companies; and it had since been adopted in the four outside counties. The Company had not condescended to take the slightest notice of any of the recommendations of last year's Committee; and all the labours of that Committee would be wasted if the Bill were allowed to proceed without effect being given to the recommendations. The whole object of such an inquiry as that of last session was to get a basis for legislation. Parliament was absolutely free, especially since the decision of Lord Camperdown's Committee, to impose such conditions as they liked on the issue of new capital; the Companies being equally free, if Parliament imposed conditions which they could not accept, to go away without the capital, and do the best they could with their existing powers.

The CHAIRMAN: Seeing you are not going to call witnesses, and are relying on your speech, I should like to ask you if you can reconcile the first recommendation of Sir J. Rankin's Committee with the fourth. The first seems to be a precise and definite recommendation to attack the existing sliding-scale. The fourth appears to point in the same direction, but coupled with it is "either by way of increase or decrease;" and I call your attention also to the last line, "if the circumstances of the time or the conditions of the Company appear to require it." I should like to know your clients' views on these recommendations.

Mr. LITTLER: What we think is that, although every recommendation which is in favour of the consumer makes the matter more satisfactory than it otherwise would have been, and those recommendations are recommendations which we accept, they should have brought before you these proposals as part of their Bill, with the reasonable and necessary modifications. Notwithstanding all the recommendations, the Company came forward as if nothing had happened; and, under these circumstances, I ask the Committee to say the preamble is not proved.

Mr. TALBOT said he did not intend to call any witnesses, because, in the view of the London County Council, the subject had been very fully dealt with by the Select Committee. The County Council had been pressed to take action by practically all the Local Authorities within their district; these Authorities thinking they were not fairly treated by the Company, and that they were charged a price for gas for which there was no justification. The Council resisted the Bill of the Company before the House of Lords, because the Company sought by it to escape from parliamentary control for a long time and they were successful

in so doing, though their case had always been treated with contempt by Counsel for the promoters. The South Metropolitan Gas Company, on the other hand, had applied their minds to the recommendations of Sir J. Rankin's Committee, and had endeavoured to give effect to them in a Bill which would come before the present Committee later on.

Mr. NICOL: Mr. Field has given us the reasons why the Gaslight and Coke Company have not endeavoured to carry out the recommendations of Sir J. Rankin's Committee.

Mr. TALBOT said that was true; and if the Committee were satisfied with those reasons, well and good. Not only had the Company failed to carry out the recommendations of the Committee of last year; but in preparing their Bill, they had not even obeyed the injunction as to the length of time for which the capital ought to be provided. The Company had already been away from Parliament for 24 years; and it was difficult to believe that Parliament, when they gave the Company their capital powers in 1876, could have anticipated such a condition of things. As to the "parliamentary bargain," Parliament had undoubtedly reversed it in 1876; the sliding-scale having been hammered out as the result of a long contest between the Metropolitan Board of Works and the London Gas Companies. The Companies had agreed to the sliding-scale, for fear some worse arrangement should be imposed on them.

The CHAIRMAN: It was an arrangement arrived at outside Parliament; and as it was thought to be reasonable and fair, it was afterwards confirmed by Parliament.

Mr. TALBOT said that was the case; but Parliament had never anticipated that the sliding-scale was to be regarded as a part of the internal constitution of the Universe. He pointed out that, in the cases of the Lea Bridge and West Ham Gas Companies, the sliding-scale prices had been revised; so that the proposal of the County Council was not unprecedented. The Council had not thought it necessary to re-argue the case dealt with by Sir J. Rankin's Committee, though they had been prepared with evidence on the matter if it had been attempted to throw any new light on the decision of that Committee.

Mr. NICOL: You shelter yourself under Sir J. Rankin's Committee.

Mr. TALBOT: Yes.

Mr. BALFOUR BROWNE said that he had received a written statement from Mr. Littler, in which he said that he did not think the Lea Bridge case was an exact precedent.

The CHAIRMAN said it appeared to him that the fourth recommendation of Sir J. Rankin's Committee contemplated the revision of the sliding-scale in the case of every gas company.

Mr. BALFOUR BROWNE: I think that meant in the case of every Gas Company who were before the Committee.

The room was then cleared, while the Committee deliberated in private. On the re-admission of the public,

The CHAIRMAN said the Committee had decided to postpone the announcement of their decision upon the Bill until next Wednesday. He added that these Bills being so mixed, and the Committee being anxious to give a decision in each case in unison with the decisions in the other cases, was the reason they reserved their judgment. It was not that they wanted one Bill to influence their judgment in regard to another, but that they should not by their decision give rise to a conflict of interests, or stultify themselves, or give decisions which might seem inconsistent.

The Committee then adjourned.

LEGAL INTELLIGENCE.

THE FINAL STAGE IN THE SUTTON, SOUTHCOATES, AND DRYPOOL GASHOLDER CASE.

In the House of Lords on Monday last week, the appeal in the case of *Sutton, Southcoates, and Drypool Gas Company v. Jordeson* came up for the ratification of the arrangement arrived at between the parties and Lord James, to whom the matter was referred after the case had been debated in the House of Lords for a couple of days (see "JOURNAL" for Feb. 27, p. 545). It will be remembered that Mr. Jordeson is the owner of twenty-four dwelling-houses in Clyde Terrace, Hull; and he alleged that—in consequence of the operations carried out by Messrs. Holme and King, contractors in Liverpool, who were employed by the Gas Company to make excavations in preparation for the erection of a large gasholder on land adjoining his property—a subsidence had taken place, which had rendered his houses practically useless. Under a large portion of the town of Hull, there is a bed of what is known as running silt. This silt was encountered at a depth of about 16 feet, and it contained such a large percentage of water that the contractors found it impossible to prevent its oozing out from the land under the defendant's houses, which they were preparing for the reception of the gasholder. It was contended for the Company that they were acting within their statutory rights in erecting the gasholder, which had become necessary to meet the growing requirements of the town; and that they ought not to be held responsible for the damage, because they had not removed any of the soil under the defendant's property, and they were not liable for the escape of water. There was also a question as to the gasholder shutting out the light from Mr. Jordeson's houses.

The following is the text of the agreement arrived at, as ratified by the House of Lords (it applies both to the appeal of the Company *v.* Jordeson as well as to the appeal of Holme and King *v.* Jordeson): "The defendant Company having paid to the plaintiff sums together amounting to £3477, and the plaintiff having conveyed to the defendant Company the land and 24 dwelling-houses and other buildings thereon particularly referred to in the pleadings in this action, and known as Clyde Terrace, Sitwell Street, in the City of Kingston upon-Hull: By consent let the Judgment of the High Court of Justice dated the 4th of August, 1898, and the Order of the Court of Appeal dated the 16th of May, 1899, and the injunction granted by such judgment be discharged, and let each party bear and pay their own costs of this action and of the appeals, including the costs of carrying out this order, and let all further proceedings in the action and appeals be stayed. And this order is to dispose of all claims between George Stephenson Jordeson, the Sutton, Southcoates, and Drypool Gas Company and Holme and King *inter se*, and being the parties to this action, whether for injunction, damages, costs, indemnity, or otherwise, arising out of the pending litigation or incidental thereto. And any of the parties are to be at liberty to apply to the Chancery Division of the High Court of Justice for the purpose of carrying this order into effect."

CENTRAL CRIMINAL COURT.

Monday, Tuesday, and Wednesday, May 7, 8, and 9.

(*Before Sir* FORREST FULTON, *Recorder.*)

Regina v. Norris—Serious Charge of Falsification of Accounts.

Frank Fairfield Norris (32) was indicted "for that he, whilst being a clerk, officer, and servant of the Frank Wright Prepayment Gas-Meter Corporation, Limited, did unlawfully, wilfully, and with intent to defraud, omit from the cash-book belonging to his employers certain material particulars." Other counts charged him with making certain false entries in the books and otherwise falsifying them.

Mr. MATHEWS, in opening the case, said that the prosecution alleged that on a number of dates between April, 1897, and June, 1899, the prisoner fraudulently falsified certain books of account the property of a limited Company called the Frank Wright Prepayment Gas-Meter Corporation, Limited; the prisoner during those years having been in the service of the Company and having had the duty devolved upon him of making true entries in the books. A great many figures would be presented; but, apart from the figures, he was justified in saying that the case was not without its interest. The broad issue as between the accusers and the accused was: On the part of the accusers it was said: "We being your masters and you our paid servant for the discharge of duties clearly defined, and perfectly known to you, you took our money for your own purposes, and used it, well knowing that it was our money you were using." On the other side, the answer given by the accused was: "No; nothing of the kind. I took no money belonging to you. It is true I did use the money which belonged to you, but I did not use it dishonestly. I paid it away on your behalf in regard to a number of secret service commissions of which you were perfectly cognizant at the time when I made the payments." This grave issue involved a strict examination into the truth of the answer given by the accused at the date of discovery; and for the purpose of showing, not only that the accusation was true, but that this answer was false, it was necessary to lay before the Jury what was the prisoner's conduct in the years 1897, 1898, and 1899, so that they might be able to gauge which side was speaking the truth—the accusing voice, which said of the prisoner: "You were engaged in a course of dishonesty, and you knew that the course upon which you were engaged was dishonest," or, the answering voice, which said: "Dishonesty! I was guilty of none. What I did was at your request, and for your service, because you will not confess that your money was devoted to purposes which will not bear the light of day, when once that light is thrown upon the matter."

The case was necessarily a very involved one; and a considerable part of the time of the Court on the second and third days of the hearing was occupied by the examination and cross-examination of the prisoner himself. The Directors of the Company stated emphatically that they never gave any authority for the payment of secret commissions, and had no knowledge whatever of any such commissions having been paid.

In the result, the Jury brought in a verdict of "Guilty;" and the RECORDER, in passing sentence, said he considered the line of defence adopted by the prisoner—making serious and grave allegations against everybody whose evidence was necessary to secure his conviction—aggravated his offence. It was rather a series of offences, extending over a period of years; and the prisoner had resorted to every kind of ingenious artifice for the purpose of evading the particular charges. The evidence was overwhelming; and the Jury could come to no other conclusion than they had done. He sentenced the prisoner to five years' penal servitude.

Unprotected Trenches.

In the Lord Chief Justice's Court last Thursday and Friday, a case was heard in which Mr. George Harrison, of Woking, claimed damages from the local Water Company in respect of injuries sustained by cycling into a trench on Oct. 14 last. It was stated that the trench extended some 10 ft. 6 in. into the road; and there was no protection of any sort, and no warning was given. The point of the defence was as to whether the plaintiff, who knew of the existence of the trench, and ran into it in broad daylight, admittedly without looking where he was going, was entitled to recover. The Jury awarded plaintiff £25. It was arranged that notice of appeal, if that step were decided upon, should be given within fourteen days.

Embezzlement by a Sheffield Gas Collector.

At the Sheffield Police Court, on the 2nd inst., James Edward Williams, until recently one of the collectors of the Sheffield Gas Company, appeared in the dock charged, on remand, with embezzling three sums of money from the Company. The prisoner admitted his guilt. Mr. E. W. Clegg, who prosecuted, said that the prisoner had furnished a list of defalcations during the past three months amounting to £386. His methods had been as follows: In order to get blank receipt forms into his possession, he had been in the habit of giving receipts for three distinct accounts on one form, and thus obtained two spare forms which he used for his own purposes. He had also collected large amounts from customers, of which he only paid a small part in to the Company. In one case, he received £19 1s., but only handed £2 to the cashier, and pocketed the balance. Williams had been for 27 years in the service of the Company, and had been a collector for 12 years at a salary of £175. He confessed to the Chief Accountant that he had been gambling very heavily. The Stipendiary committed prisoner for four months, with hard labour.

MISCELLANEOUS NEWS.

INTENSIFIED GAS LIGHTING IN LEEDS.

A substantial installation of intensified gas-lights (on the Somzée-Greyson system) has been made in the Town Hall Square at Leeds; and last Wednesday witnessed its inauguration. In all 21 lamps have been erected; and a very brilliant display indeed is made by them. Each lantern contains three burners, giving together a light equal to at least 750 candles; so that the light from the 21 lamps is equivalent to not less than 15,750 candles. The light from the old lamps previously in use round the Town Hall, only equalled 80-candle power for three ordinary burners; being one-ninth of the light obtained under the high-pressure system. The consumption of gas for each of the new lamps equals 30 cubic feet per hour, being 10 cubic feet for each burner; and taking the cost of gas at 2s. 6d. per 1000 cubic feet, the light of 750 candles per lamp only costs ¾d. per hour. Therefore the whole cost of the 21 lamps per hour will only equal 1s. 6¼d. From these figures, it will be seen that for the expenditure of a penny, a light equal to 860-candle power can be obtained under the intensified system; while for the same expenditure under the old method of lighting previously in use for the Town Hall lamps, only 160-candle power was given. The cost under the latter for an illuminating power of 80 candles was ½d. per hour. The installation was carried out by the Yorkshire Intensified Gas Lighting Syndicate. Being the first instance of the adoption by a municipal authority of high-pressure lighting on a large scale, it is worthy of special notice; and no doubt the Town Hall Square of Leeds will be a centre of attraction for Yorkshire gas managers for some time to come.

BOMBAY GAS COMPANY, LIMITED.

The Ordinary Meeting of this Company was held on Thursday, at the London Offices, No. 6, Drapers' Gardens, Throgmorton Avenue, E.C.—Mr. Robert Davidson in the chair.

The Secretary (Mr. J. Hill Perrins) having read the notice convening the meeting, the report and accounts for 1899 were submitted.

The Chairman said he thought, considering the circumstances that had existed in Bombay during the year, the accounts could not be regarded otherwise than very satisfactory. As the shareholders were aware, there had been in the city of Bombay a very severe plague, and in the Presidency a serious famine. In fact, he believed it was the most severe they had had; and the result had been that latterly many of the principal articles on which Bombay relied for exportation had been very much diminished in quantity. However, on the revenue side of their accounts, the receipts for private lighting were £3046 more, equal to an increase of 10½ per cent. upon the previous year's consumption, and which was the largest increase they had ever had. He was glad to say that for the first two months of the current year, the increase had been very well maintained. The revenue from the public lamps advanced by £700; and the return from the residual products was also satisfactory. At the last meeting, the Directors promised to separate the receipts for residuals and fittings; but he was sorry to say the matter had been overlooked in the preparation of the accounts. The total as per account was £15,801, which was a decrease of £777. The receipts for residuals amounted to £15,266; and for fittings to £520. On the expenditure side of the account, coal had cost more by £1500. An additional 277 tons had been carbonized; and, like everybody else, they had had to pay higher rates both for coal and freights. Hitherto they had shipped nearly the whole of their supplies from this side. But lately they had been enabled to use Indian and Japanese coal very largely; and this had resulted in considerable saving. If on further experience they were able to continue the free use of these coals it would be a great advantage to the Company. Among other things, they would be able to do with a much smaller stock; and thereby the risk of fire, from which they had suffered in past years, would be very much reduced. The item of wages was £120 more. A considerable number of retort-settings had had to be renewed during the last twelve months; hence there had been a large increase in the item "maintenance of retorts." There had also been an increase in trade and general charges, chiefly due to two or three special items—such as renewing retort-house roof, altering scrubber and washer connections, allowances in connection with the famine and plague, scraping lamp columns, &c. Salaries were £434 less; and passages and law charges also showed a decrease. Bad debts were only £14 more, notwithstanding the very anxious times through which they had been passing and the increased business. Exchange exhibited a loss of no less a sum than £15,089; each rupee remitted from India having produced 1s. 4⅛d., as against 1s. 4 3/32d. in 1898. During the year there had been more sickness among the staff, both European and native; and one of the sufferers had been their excellent Assistant-Manager, who had been attacked by small-pox. This illness among the employees must have caused their Engineer and Manager very much anxiety and extra work; and, under the circumstances, the results of the year's working must be considered most creditable to him. The available balance enabled the Directors to recommend a dividend of 3 per cent. for the half year (making, with the interim distribution in December, 6 per cent. for the year), and to carry forward, after placing a small sum to reserve, a balance of £400. He concluded by moving the adoption of the report and accounts; and the declaration of the proposed dividend.

Major W. F. Gordon seconded the motion, which was unanimously carried.

On the proposition of Mr. Charles Gandon, seconded by Mr. H. E. Jones, Major Gordon was re-elected a Director; and a similar motion by Mr. F. Lane Lingino, seconded by the Chairman, returned Mr. Jones to his seat at the Board.

The Auditors (Messrs. E. A. Flinders and Magnus Ohren) were re-appointed on the motion of Mr. Gavine, seconded by Mr. F. R. Smith.

Mr. Whitley, in moving a vote of thanks to the Chairman and Directors, ascertained that the last information as to the illness among the employees was that there was a considerable improvement. He also commented upon the investment of the reserve fund in the works, and urged that, the greater the sum invested in liquid assets, the better it was for the shareholders. He saw they held £3330 in fixed deposits; and at the bankers, on deposit, and in hand, they had £9600, out of which about £7000 was going for dividends. So that, in round figures, they had only about £5000 invested in liquid securities. In regard to his motion, he was sure the Directors had the best interests of the Company at heart.

Mr. Gavine seconded the motion, which was passed unanimously.

The Chairman having responded,

A similar compliment was paid to the chief officials and staff; and an acknowledgment by the Secretary concluded the proceedings.

DUKINFIELD GAS DEPARTMENT.

The Past Year's Working.

The Engineer and Secretary of the Gas Department of the Dukinfield Corporation (Mr. Harrison Veevers) has presented his report on the past year's working. He states that the result is even more satisfactory than that of the year 1898 9; the profit being £1506, against £1074. The most striking points in the statement of accounts of the department are the large increase in the quantity of gas made, amounting to 6,787,800 cubic feet, or at the rate of 8½ per cent. over the previous year; the diminished yield of gas per ton of coal; the extra cost of coal; and the increased income from residuals, particularly coke and sulphate of ammonia. The decreased yield is due to the use of slack, through the scarcity of round coal. The difference between the gas made and that accounted for amounts to over 9 million cubic feet, or 10·8 per cent. Three years ago, before the commencement of the sewerage operations, the leakage was 3 per cent. less. The total loss of gas in that period will not be less than 7 million cubic feet. The works, mains, meters, &c., have been kept in thorough repair during the year. The use of prepayment meters is extending; the number now employed being 650, and the income from the gas supplied £849 7s. 11d., or equal to 7¼ per cent. on the total sales. The distribution of the gas made has been as follows: By ordinary meters, 69,306,016 cubic feet, or 81·3 per cent.; by prepayment meters, 5,485,750 cubic feet, or 6·4 per cent.; used at the works, &c., 1,312,834 cubic feet, or 1·5 per cent.; and unaccounted for, 9,197,200 cubic feet, or 10·8 per cent.—total, 85,301,800 cubic feet. The quantity of gas sold and used on the works was 76,104,600 cubic feet, as compared with 67,711,500 cubic feet in 1898-9; being an increase of 8,393,100 cubic feet, or at the rate of 12·4 per cent. The gross cost of production was 2s. 5·23d., and the net cost (exclusive of capital charges) 1s. 7·38d. per 1000 cubic feet of gas sold. The capital charges, amounting to 9·31d., bring the figure up to 2s. 4·69d. The average price of gas being 2s. 9·44d., the profit shown is 4·75d., as compared with 3·63d. in the preceding year.

BURSLEM CORPORATION GAS SUPPLY.

An Increase of 10d. per 1000 Cubic Feet.

At the Meeting of the Burslem Town Council yesterday week, Mr. Leigh, the Chairman of the Gas Committee, moved the adoption of the annual report and accounts. He said that the net amount received (to March last) for gas rentals, after deducting discounts, was £20,810, as against £18,575 the previous year; for meter-rents they had received £525, as against £525; for fittings £979, against £573; and for residuals (including stock in hand), £6584, as against £4557—showing a very considerable increase. The gross receipts had been £28,910, against £24,232. So far as expenditure was concerned, the amount that coals cost last year was £8256, as against £6566 in the previous year—showing an increase for the year of £1689. These figures showed that the increase from residuals more than balanced the increased cost of coals. For carbonization they had expended £2198 last year, as against £1871, an increase of £327. For maintenance their expenditure was £3105, against £2304, or an increase of £801. For meters and mains the expenditure last year was £5098, compared with £3687 the previous year, showing an increase of £1410. The only other item of serious importance was the expenditure for interest. In the past year the charges for interest and repayments were £5036, against £4478, showing an increased charge of £558. In the previous year they charged themselves with the payment of £1028, being the completion of the purchase of the land with which the Council was familiar; while in the past year they charged themselves with the sum of £600 for the purchase of a building in the town, which the Council sanctioned some months ago, and the Committee thought it desirable to include this item in the past year's accounts. The figures he had quoted brought the actual expenditure for the past year to £28,999, as against £24,179 in the previous year; and the receipts for the past year being £28,910, a deficit was shown on the year's working of £89. But as last year, he observed again that they had excluded from their accounts the whole of the charges for public lighting, amounting to £2000, or rather more, inasmuch as they had during the past year had some increase in the number of lamps which had been put up. If they added to this sum the amount they had actually provided towards the purchase of the property he had referred to, the profits for the year amounted to nearly £2600, which, under the circumstances, he did not consider unsatisfactory. At any rate, it was an emphatic confirmation of the statement he made at a meeting recently, that it was altogether a misstatement to say that the profits of the gas-works were only £1000 a year. Mr. Leigh then proceeded to move what he described as a very important resolution, which he regretted it had not been possible to bring before the Council in the form of a minute, because the difficulty of arriving at a satisfactory recommendation had been rather greater than the Committee had supposed. The Committee's recommendations were: "That the price of gas be 3s. 6d. per 1000 cubic feet, less 2d. discount on accounts paid within a month; that 4d. discount be allowed in cases where gas-engines are used; that the rents of ordinary meters and gas cooking-stoves be abolished; that the charge for gas supplied through slot-meters be 3s. 4d.; and that the previous allowance of a penny in the shilling be discontinued." These recommendations represented an increase in the price of gas of 10d. per 1000 cubic feet net; and he was bound to point out that during the coming year they had to meet an

increase in the price of coals amounting to no less than £7000. It would have been more than this, but for the fact that during the past few weeks they had been able to obtain a small concession which represented a value of some £700 or £800 a year to the Council. He pointed out that the price of coal had actually gone up in three years nearly 150 per cent.; and it could not be considered dealing unfairly with consumers if, after such an increase in coal, they asked them to pay 33⅓ per cent. increase on the price of gas. Moreover, if the proposal was accepted it would put the Council in the same position as other public bodies owning gas-works in the district. The Burslem Council had rather prided themselves for some years past on the fact that they had supplied gas at a less rate than neighbouring bodies; but he might frankly state now what they had not been anxious to make public before—that they were really buying their coal at something like 1s. 3d. per ton less than even those who were purchasing on the most favourable terms. He did not quite know how this had happened; but he thought they might put it down to the business smartness mainly of their Manager. For the present, however, the situation was very materially altered. The gentlemen who controlled the association governing the price of coals in the district had determined that all consumers of gas coal must be placed on an equal footing. It would be seen that they proposed to surrender meter-rents; this being an important concession—more important perhaps in the sense that it removed what had been a more or less irritating charge in certain quarters. But they had gone a little farther than this; for the Committee had decided not only to discontinue the rents for the ordinary meters, but also to discontinue the charge for cooking-stoves. This would probably have the result of inducing an increased demand for such stoves. This concession represented an amount of £525 per year, or about 1d. per 1000 cubic feet of gas sold in the year. With regard to the automatic meters, they were simply reverting to what was the charge on their introduction—as a matter of fact, in future all gas consumers would be practically placed on the same level. There would be an additional discount of 2d. per 1000 cubic feet where gas was used for gas-engines. This was not at present a serious matter; but the Committee felt that it was desirable to induce the use of gas for this purpose as much as possible. One advantage was that gas for gas-engines was generally taken in the daytime; and if a large consumption for this purpose were brought about, it would be an advantage to the gas-works. The actual amount paid for principal and interest last year was £5036. If to this were added the £2500 he had already mentioned, they got the actual figure of £7500 as the gross profits on the gas-works trading during the twelve months. In conclusion, referring to one of the clauses in the Committee's report in which they undertook to follow the same course as that adopted last year—namely, to make no charge for street lighting in the borough—Mr. Leigh pointed out that if the town benefited by £2100 in this respect in the year just closed, if 33⅓ per cent. were the increased price of gas, if the Committee's recommendations were adopted, it must be clear that the town would benefit by an additional £700 out of the gas undertaking in the year to come.

After a few questions had been asked by members, and duly answered, Mr. Leigh supplemented his statement by giving the actual make of gas for the past year. This was, he stated, 199,147,000 cubic feet, against 177,329,000 cubic feet in the previous year, or an increase of nearly 22 millions. The gas delivered had been practically the same. The gas sold per ton of coal, was almost the same last year as in the previous year—being 9589 cubic feet per ton, against 9664 in 1899. The amount sent out through automatic meters was 25½ million feet in the past year, compared with a little over 20 millions for the previous year—showing that the automatic consumer was now a very important customer. For public lighting, confirming exactly what he (Mr. Leigh) had stated as to the individual charge placed upon them, they had taken 600,000 feet more for public lighting in the past year than was the case in the previous year, for which the town had not paid. The leakage last year was about the same figure as in the previous year—it stood at 9·1 per cent. as against 8·9 per cent.—the small increase being accounted for by the fact that they had had some serious breakages of mains owing to the disturbance of various parts of the district. Mr. Leigh, in answer to another question, said that the Committee recognized in the term "cooker" any kind of gas-cooker as distinguished from a gas-fire, for which they had previously charged a rental.

The recommendations and report of the Committee were then carried unanimously.

ELECTRIC LIGHTING NOTES.

A report recently presented to the Exeter City Council stated that the profit on the electric lighting undertaking last year was £1061. It was recommended that £550 should be placed to the reserve fund, and the balance carried forward; and this was agreed to.

On Tuesday last, a Local Government Board inquiry was held at Stockport in regard to an application by the Corporation for permission to borrow £23,468 for the purposes of electric lighting. The money is required for new feeders to supply important parts of the town.

The electric lighting works of the Barrow Corporation have now been working for twelve months. The revenue amounted to £2630; and a gross profit of £758 remains. Of this, £735 has been absorbed in interest; leaving only £22 towards redemption of loans. On the whole, the report is regarded as a very favourable one.

Bridgwater is promised a municipal electric lighting scheme which is to cost £15,000. A bare majority of the Town Council approved of the undertaking; but its opponents called a meeting of the ratepayers, and carried a resolution urging the Corporation not to proceed further with the scheme. The meeting was largely attended, and a deputation from it is to wait on the Council at the next meeting of that body.

In a report by Messrs. Medhurst and Kitchin to the Reigate Corporation on the question of lighting the streets by electricity, it is stated that the use of arc lamps as proposed would cost about £500 a year more than is now being paid for lighting the streets by incandescent gas-lamps; but that the effective light would be about six times as good. The Corporation have decided that "four" arc lamps shall be erected in the thoroughfares of the borough.

A good deal has been made of a statement by the Town Clerk of Canter-

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1294.

Issue.	Share	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 11	10½	Alliance & Dublin 10 p. c.	20—21	..	5 0 0
100,000	10	,,	7½	Do. 7 p. c.	13½—14½	..	5 3 5
800,000	100	Jan. 2	5	Australian 5 p. c. Deb.	102—104	..	4 16 2
200,000	5	Nov. 15	6	Bombay, Ltd.	6¼—6¾	..	4 8 11
40,000	5	,,	6	Do. New, £4 paid	4¼—4¾	..	5 1 1
380,000	Stk.	Feb. 23	12	Brentford Consolidated	250—260	..	4 12 4
270,000	,,	,,	9	Do. New	190—195	−5	4 12 4
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb.	118—123	..	3 5 1
220,000	Stk.	Mar. 14	11½	Brighton & Hove Orig.	237—242	..	4 15 0
226,320	,,	,,	8½	Do. A. Ord. Stk.	177—182	..	4 18 5
999,500	Stk.	Feb. 23	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Mar. 29	10	British	39—41	−1½	4 17 7
50,000	10	Feb. 23	12	Bromley, Ord. 10 p. c.	24—26	..	4 12 4
79,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd.	9½—10	..	3 19 3
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	99—101	..	3 19 3
150,000	20	Mar. 14	8½	Cagliari, Ltd.	24—26	..	6 6 11
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	14—15	..	5 6 8
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	55—57*	..	5 5 3
550,000	Stk.	Apl. 11	13½	Commercial Old Stock	275—285	..	4 14 9
236,425	,,	,,	10½	Do. New do.	210—220	..	4 15 5
288,237	,,	Dec. 14	4½	Do. 4½ p. c. Deb.	142—145	..	3 2 1
800,000	Stk.	Dec. 14	9	Continental Union, Ltd.	160—170	..	5 5 11
200,000	,,	,,	7	Do. 7 p. c. Pref.	175—180	..	3 17 9
51,600	Stk.	Feb. 23	14	Croydon A 10 p. c.	335—340	..	4 2 4
175,400	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
555,000	Stk.	Feb. 23	5½	Crystal Palace Ord. 5 p. c.	116—120	−1½	4 7 6
60,000	,,	,,	6	Do. 5 p. c. Pref.	130—135	..	3 14 1
486,090	10	Jan. 26	11	European, Ltd.	19½—20½	..	5 7 4
854,060	10	,,	11	Do. £7 10s. paid	14½—15½	..	5 6 5
14,993,075	Stk.	Feb. 9	4%	Gas-light and Coke	4 p. c. Ord.	99—101	−2	4 17 0
2,660,000	,,	,,	3½		3½ p. c. max.	96—98	−1	3 11 5
3,799,735	,,	,,	4		4 p. c. Con. Pref.	118—120	..	3 6 8
3,993,975	,,	Dec. 14	3		3 p. c. Con. Deb.	97—99	−1	3 0 7
70,000	10	Nov. 15	8	Hongkong & China, Ltd.	13½—14½	..	5 10 4
3,800,000	Stk.	Nov. 15	10	Imperial Continental	208—211	−2	4 14 9
473,600	Stk.	Feb. 9	3½	Do. 3½ p. c. Deb. Red.	100—103	..	3 8 0
75,000	5	Dec. 14	6	Malta & Medn., Ltd.	4½—5⅛	..	5 9 1
560,000	100	Apl. 2	5	Met. of Melbourne	5 p. c. Deb.	105—109	..	4 11 9
250,000	100	,,	4½		4½ p. c. Deb.	105—107	..	4 4 1
641,920	20	Nov. 15	3	Monte Video, Ltd.		10½—11½	..	5 4 4
667,946	Stk.	Feb. 23	9½	Newc'tle & Gatesh'd Con.		215—220	..	4 4 1
299,856	Stk.	Dec. 29	3½	Do. 3½ p. c. Deb.		104—107	..	3 5 5
160,000	5	Nov. 30	8	Oriental, Ltd.		7—7⅛	..	5 6 8
135,000	5	,,	8	Do. New, £4 10s. pd.		6¼—6¾	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.		1¼—1½	..	4 11 5
60,000	5	Feb. 23	7	Ottoman, Ltd.		5—5½	..	6 7 3
500,000	100	Dec. 1	6	People's Gas of Chicago	2nd Mtg. Bonds	102—106	..	5 13 2
851,070	10	Apl. 27	7	River Plate Ord.		10½—11*	−¼	6 7 3
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.		100—102	..	3 18 5
250,000	10	Apl. 11	8	San Paulo, Ltd.		11½—12½	..	6 8 0
135,000	Stk.	Mar. 14	10	Sheffield A.		245—247	..	4 1 5
209,053	,,	,,	10	Do. B.		244—246	..	4 1 4
447,427	,,	,,	10	Do. C.		244—246	..	4 1 4
5,600,000	Stk.	Feb. 23	5⅓	South Metrop., 4 p.c. Ord.		122—124	−5½	4 5 11
1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb.		99—101	..	2 19 5
380,940	Stk.	Nov. 30	5	Southampton Ord.		117—122	..	4 2 0
70,825	,,	Dec. 29	4	Do. 4 p.c. Deb.		120—125	..	3 4 0
120,000	Stk.	Mar. 14	6	Tottenham and Edmonton	A. 5 p.c.	139—141	..	4 5 1
250,520	,,	,,	4½		B. 3½ p.c.	100—102	..	4 8 3
55,100	,,	Dec. 14	4		4 p. c. Deb.	113—117	..	3 8 5
182,380	10	Jan. 12	5	Tuscan, Ltd.		7—8	−½	6 5 0
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.		101—104	..	4 16 2
				WATER COMPANIES.			
780,399	Stk.	Dec. 29	11	Chelsea, Ord.		305—310	..	3 11 0
150,000	,,	,,	5	Do. 5 p. c. Pref.		157—162	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75		145—150	..	3 0 0
175,785	,,	Mar. 29	4½	Do. 4½ p. c. Deb.		145—150	..	3 0 0
1,720,560	Stk.	Apl. 11	7	East London, Ord.		193—198	−2	3 10 8
654,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb.		145—150	..	3 0 0
390,000	,,	,,	3	Do. 3 p. c. Deb.		99—101	..	2 19 5
700,000	50	Dec. 14	7½	Grand Junction	10 p. c. max.	104—106	−2	3 10 9
810,000	Stk.	Mar. 29	4		4 p. c. Deb.	130—135	..	2 19 3
708,000	Stk.	Feb. 23	14	Kent		307—312	..	4 9 9
160,000	,,	,,	7	Do. New, 7 p. c. max.		200—210	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.		292—297	−2	3 10 8
406,200	100	,,	8	Do. 7½ p. c. max.		208—213	−4	3 15 1
350,000	Stk.	Mar. 29	4	Do. 4 p. c. Deb.		130—138	..	3 0 2
500,000	100	Feb. 23	13½	New River, New Shares		417—422	−1	3 4 0
1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb.		132—137	..	2 18 5
902,300	Stk.	Dec. 14	7½	South-wark and Vauxhall	Ord.	198—203	−2	3 13 11
126,500	100	,,	7½		7½ p. c. max.	187—192	−3	3 18 2
489,200	Stk.	,,	5		5 p. c. Pref.	160—165	..	3 0 7
1,019,585	,,	Apl. 11	4		4 p. c. A Deb.	129—134	..	2 19 9
1,156,060	Stk.	Dec. 14	10	West Middlesex		285—290	−2	3 9 0
200,000	,,	,,	4½	Do. 4½ p. c. Deb.		147—152	..	2 19 3
200,000	,,	Mar. 14	8	Do. 3 p. c. Deb.		99—101	..	2 19 5

*Ex div.

bury, in the course of his report on the first year's working of the electric light undertaking of the Corporation, to the effect that there is a gross surplus for the year of £1913, on which "splendid result" he has congratulated the Council and the citizens. A correspondent to a local paper points out that after the interest and the sinking-fund charge, amounting together to £1507, have been met, there is left only £406. This is quite another story.

The Local Government Board have administered a snub to the Southampton Corporation. Sanction was recently asked to a loan of £55,000 for electric lighting purposes; but the Board have only complied with the application to the extent of £50,655. They have eliminated nearly the whole of the sum estimated for contingencies, and also £230 17s. 6d. described as the "amount paid as interest on stock previous to receipt of loan," as they do not consider this can be properly paid out of borrowed money. The Board also draw the attention of the Corporation to the fact that, while the works for which the previous loan was sanctioned have cost £7069 in excess of the estimated amount, a further sum of £34,088 has been expended upon large extensions of those works in anticipation of the Board's sanction, and without submitting to the Board any particulars of these extensions, until they were actually completed. The Board regard the action of the Town Council in this matter as most unsatisfactory, and trust it will not be repeated.

The "Leeds Mercury" does not always see things from the same point of view as the Gas Committee of the Corporation; but it must be credited with having rendered a service to the department by publishing the following: The Yorkshire House-to-House Electricity Company, when bought out by the Leeds Corporation some eighteen months ago, were supplying about 75,000 electric lights in the city. The Corporation are now supplying 110,000 lights, an increase of something like 50 per cent. Of the 1500 customers, the majority use electricity for business premises. Between 300 and 400 houses in the Headingley and Chapeltown districts, however, have now an installation of electric light; and the demand in this respect is growing month by month. The celebrated electrician, Sir Wm. Preece, as a result of very careful investigation of this question, has come to the conclusion that 1000 cubic feet of gas is equivalent to about eight units of electricity. Accepting this calculation as accurate, then, the electric-light consumer of Leeds is paying as much as if he was burning gas at 3s. 4d. per 1000 cubic feet. As in Leeds the gas consumer is only charged 2s. per 1000 cubic feet, to get the same illuminating power from electricity he would have to pay 3s. 4d.

Our readers may remember that a Special Committee of the Salford Corporation have been investigating certain matters relating to the Borough Electrical Engineer (Mr. C. L. Turner). The Committee presented their report at the meeting of the Town Council on Monday last week. The principal charges against Mr. Turner were that he applied for a patent for work done by him on behalf and at the expense of the Corporation, and that there had been an unfortunate coincidence in the time of his securing a patent for pipework with the time when plans were being produced for contractors with the Corporation in his own department to tender for such work. The conclusion arrived at by the Committee was that Mr. Turner had endeavoured to mislead them and members of the Electric Light Committee on important matters of fact involved in the inquiry, with the result that he had lost their confidence. The report having been adopted, the Mayor (Alderman Rudman) moved a resolution to the effect that Mr. Turner be required to resign his position, and that three months' salary be paid to him in lieu of notice. Alderman Mandley moved, as an amendment—"That the Electrical Engineer be forthwith dismissed." On a division, the amendment was lost by 28 votes to 12, and the motion agreed to. It is reported that the Chairman of the Electric Light Committee (Mr. A. Haworth) has been threatened with legal proceedings; and the Council passed a resolution undertaking his defence in that event. Mr. Turner has written to the Town Clerk to the effect that, in justice to himself, he cannot resign.

A Local Government Board inquiry was held at Hull last Tuesday, by Colonel W. R. Slacke, R.E., in regard to an application of the City Council for sanction to the borrowing of £42,000 for electric lighting purposes. The Town Clerk (Mr. E. Laverack) stated that in 1891 the population of the city was returned at 200,044; while the present estimated population was 238,763. The annual value of the general district rate, to which the proposed loan would be charged, amounted to £775,192; while the borough rate was £951,000. The outstanding loans of the Corporation amounted to £904,083; and the period for which they now asked to borrow the money was 25 years—the same as before. They required the loan for extending the electric lighting works of the city. They secured their Order in 1890, and the first loan was obtained on Dec. 15, 1892, for £25,000. This was for the installation of electric lighting in what was called the Old Town. The works were opened on Jan. 16, 1893. They commenced with 33 consumers, and they applied for a second loan of £10,000 in respect of the same works on June 14, 1893. A further loan of £2800 was obtained on May 13, 1895; and another of £8000 on Nov. 17, 1895. This brought up to £45,800 the amount borrowed in respect of the original works. The 33 customers in the Old Town had increased to 488 in that area. They then found it would be necessary to erect additional works upon a much larger scale for the city generally—a new station, and a new system for an extended area on the high-tension principle, from which they could supply the rest of the town. For this larger work, they commenced with a loan of £40,690 on July 20, 1897; a second loan of £26,000 for extension was obtained on Jan. 2, 1899; and a further loan of £15,500 was obtained on March 13, 1899. Then came the £500 loan for a sub-station on June 24, 1899. This brought the amount borrowed up to the present to a total of £128,490. Now they were applying for an additional £42,000, which was necessary because of the increasing demand the Corporation had for light. This was a productive undertaking. Last year they had a balance, which might be termed absolutely clear profit, of £1924, and they proposed to carry it to the reserve fund. Up to the 31st of March last this fund amounted to £10,092. Already the sinking fund on the undertaking amounted to £11,546. They charged 5d. per unit for the ordinary supply of electricity, and 2½d. for motive power. Large consumers—viz., those upon whose premises there were more than 100 lamps of 16-candle power each—were charged 5½d. for the first hour and 2½d. afterwards. The total number of consumers now was 1326.

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TUBES
AND FITTINGS
GAS, STEAM, WATER GALVANIZED-TUBES, &c.
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NOTES FROM SCOTLAND.

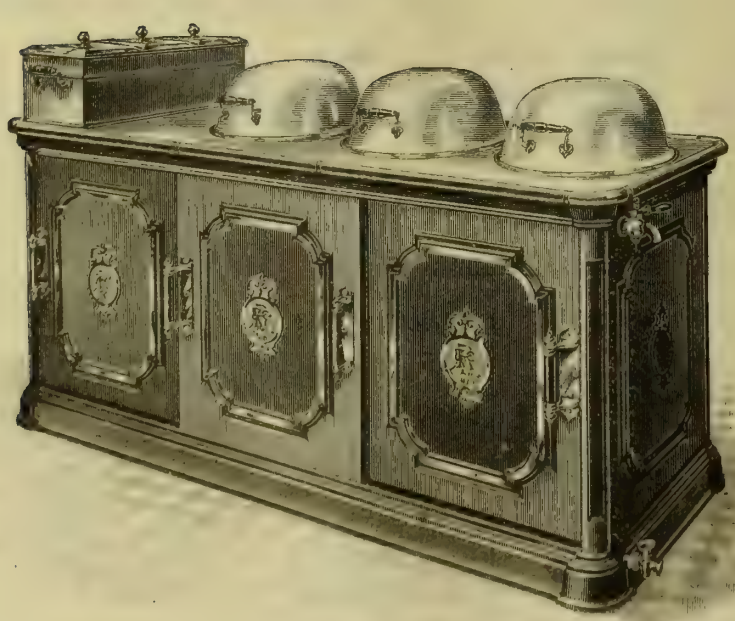
From Our Own Correspondent.

Saturday.

The "Dunfermline Journal" of to-day gives a table showing the price of gas in fifteen towns in Scotland. In Dunfermline itself, which is not in the list, the price is 3s. 9d. The comment made upon the list is that "Dundee leads the way with an easy first; then Kirkcaldy breasts the tape with a good second; while Edinburgh and Aberdeen run a dead-heat for third place. On the other hand, Glasgow and Hamilton gas consumers are to be congratulated on being supplied with an article at the lowest price possible." This is simply nonsense. I observe that the list comes down to a town in which the consumption of gas is 42 million cubic feet a year. But there are others, in which the consumption is more than 42 millions, where the price is higher than in Dundee. I do not know upon what principle the selection has been made; but, inasmuch as it is not complete, it is of no value. Even if it had been complete, in respect of the correct towns to select, there is no utility in stringing together a number of places and saying that the charge in them is so much, or so little, without taking into account antecedent and surrounding circumstances. No attempt of that sort is made in this case. Perhaps the publication may serve its purpose better without explanation than with it—this purpose being to lead the people of Dunfermline into the belief that they pay more for their gas than anybody else. It is not correct to say so, or even that of towns with a gas consumption of over 42 million cubic feet yearly, Dundee at 3s. 4d. per 1000 cubic feet, or even Dunfermline at 3s. 9d., are the highest. The whole thing is so unjustly invidious, and so useless to boot, that I refrain from giving the names of the places.

The annual meeting of the Lochore and Capledrae Cannel Coal Company, Limited, was held yesterday. The dividend declared for the year was at the rate of 10 per cent.; and the sum carried forward was £1595. This is not evidence, by any means, of exorbitant earnings; but it has to be remembered that the high profits will only begin now to be realized. Coalowners who were working out contracts have not, in many instances, reaped much benefit from the rise in the market. Now when they enter upon new contracts, they will. The question which is in the mind of everyone outside coal circles is whether the rise in price has not been more than commensurate with the situation. I think I am safe in saying that the universal answer to the question is that it has been. The idea that coalowners had formed themselves into a ring to inflate prices, which was at one time widely held, has now been given up, as it is seen that outside circumstances have been such as to warrant the rise. I would be inclined to believe them were they to say that it was the public themselves who raised the price of coal, by offering the higher rates. To owners of mines the high prices mean fortunes, if they keep up; but it must not be forgotten that to those who are merely dealers in coal, they mean something else. They, too, may be coining money, if they can buy and sell skilfully; but if they cannot do that, ruin will soon be their portion. Doubtless the high quotations which are now being received by purchasers are being made by sellers with a view to cover any mistakes which may be encountered in the course of the season. This almost may be assumed right off; but, taking these considerations into account, it is the case that the public, including gas producers, are paying more for coal than they need to, if only they could help themselves. Miners are now paid for their labour on an arrangement of the nature of a sliding-scale. I have said before that there is nothing, in my opinion, to prevent large purchasers of coal from endeavouring to secure that their contract prices should be fixed on somewhat the same lines. The difficulties in the way of such an arrangement are the foreign demand, and the competition among home consumers. The former cannot be dealt with, but can only be reckoned with; the latter could be overcome by combination. There is no such thing at present; and meanwhile large contracts are being entered upon by purchasers in a state of helplessness. The great contract for the Glasgow Corporation Gas Department is at present under consideration; and the public are being reminded, with a frequency which points to the great interest that is taken in the matter by journalists more or less irresponsible, that the prices will be up, on an average, by 5s. per ton. I will be cautious, and will express no preliminary opinion on the subject, because it would do no good. I have spoken of skill in purchasing, which is an attribute that I cannot eliminate from my mind when I think of Mr. Foulis's knowledge of the ins and outs of the business, and reflect upon the capabilities that are in his hands, in the magnitude of the orders he has it in his power to place and the many sources which he may draw from. But if gas managers and other large purchasers of coal have no combination, it is otherwise with the coalmasters. In the matter of looking after their interests, they have the faculty of, at any time, becoming a unit. They have already appeared, by deputation, before the Board of Trade in London. Yesterday they had a meeting in Glasgow upon the same subject—the increased charges by the Railway Companies for the conveyance of coal. It is reported that, as no settlement had been arrived at, it was resolved to proceed with a case before the Railway and Canal Commissioners. By no "settlement," of course, is meant that the Railway Companies have not agreed to withdraw the increase upon their charges. It appears to me that the coalmasters are too voracious. The increase upon the railway rates is only about 3d. per ton, and the miner does not get more of an increase upon his wages; and when the rise in price is several shillings per ton, I think it will occur to most people that the public, and not the coalmasters, are paying the increased rate.

It may be well to look to the future for a little, and particularly to take note of an element which, no doubt, is already being anticipated by coalmasters as a probable source of trouble. At present they and the miners are working hand in hand; but how long can such a state of matters be looked for? When the representatives of the miners come next to audit the books of the collieries, and find out how great the profits have been, is it to be expected that a demand for a very large increase of wages will not be made? Should such arise, any increase which might be given would have to come out of the pockets of the coalmasters, because any attempt to further raise the price of coal to the public would lead to the importation of coal on the one hand, and a lessened consumption on the other. The possibilities, in this view of the situation, are, therefore, the



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alternative ones of a severe struggle with the miners or working at a loss. To many of the coalowners it would, in either event, happen that the hay which they are making in this period of sunshine would be all consumed. The present arrangements with the miners terminate in the autumn. When that time arrives, new conditions will come into play; and, so far as appears, the conditions will not be so favourable to the coalmaster as are the present ones. Will the public fare any better then than now? They cannot well fare much worse. The circumstances would seem to point to a certain number retiring from business to live upon the proceeds of the large prices, rather than lose them in fighting, and to there being a rush to take their places, followed by reckless speculation, broken contracts, litigation, bankruptcy proceedings, and the like, in the course of which untoward events the market would be cleared of the unfittest. But before then, these would have made a bold bid for existence by cutting prices; and thus it is open to entertain the belief that the public will, in a short while, again have coal at a reasonable rate.

At a meeting of the Fife Lunacy Board this week, it was stated that a Sub-Committee had met a deputation from the Cupar Gas Company regarding the supply of gas to the Lunatic Asylum. At present, it is attempted to light the place by means of a main which runs direct; but, as may be supposed, the service is unsatisfactory. The Gas Company have, however, offered to erect a small gasholder at the Asylum, which could be filled during the day, and from which a plentiful supply could be drawn at night. The charge for the gas would be 6d. per 1000 cubic feet higher than to consumers in the town. The Chairman of the Board admitted that the Gas Company had gone a long way to meet them; but as that was the last meeting of the present Board, he was in favour of the subject being left to the new Board. As to the proposal to erect a gasholder at the Asylum, I may say that I know a place where a similar arrangement exists—for the supply of an asylum, too—and it does not give entire satisfaction. The reason is that it must be left to someone at the asylum to admit the gas into the holder; and it is found, in practice, that this person does so irregularly. He may let his holder almost run down, and then suddenly, at about the time of lighting up, begin to fill it. The drain upon the town holders is thus often too much—necessitating an anxious time to keep up the town supply. If a plan could be found by which it should be possible to charge the distant gasholder at will, the method of supply would work with entire satisfaction; but I am led to understand that such an arrangement does not exist.

The "North British Daily Mail's" man on 'Change calculates that it will cost the Glasgow Corporation Gas Department £120,000 to £130,000 more for coal next year than this; and he considers that a rise in the price of gas will be necessary.

It is reported that there are up to date twelve applications for the post of Engineer and Manager to the Perth Gas Commission. The time for lodging applications expired on Thursday.

The undertaking of the Dunoon Gas Company is to become the property of the Municipality of the town on the 15th inst. Negotiations have been in progress in the usual way, under the Burghs Gas Supply Acts, for the fixing of the price. These have now been completed; and the price is £31,051. The capital of the Company is given as £18,000.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 12.

Sulphate of Ammonia.—The market has again been quiet; and the closing quotations are £11 3s. 9d. to £11 7s. 6d. per ton, delivered f.o.b. at the ports. Considerable quantities being in course of shipment at the Scotch ports, and available supplies being consequently limited, full prices have been obtainable at these points. Elsewhere supplies have been sufficient, and values have scarcely been maintained. In the forward position, inquiry is mainly for delivery over the summer months; but the firmness of makers hinders business. London (Beckton terms) is quoted £11 5s. per ton. But there is speculative offering abroad at below the equivalent of this price; and Continental producers are also selling at a discount.

Nitrate of Soda is steady at 8s. 4½d. per cwt. for ordinary, and 8s. 7½d. for fine, quality on spot.

LONDON, *May* 12.

Tar Products.—There is a better inquiry for benzols, particularly for 50's quality, and slightly better prices are obtainable. The production of benzol has fallen off rapidly during the past few weeks, which has doubtless helped the position materially. Carbolic acid is quoted higher. Buyers seem anxious to book business for forward delivery. Solvent and heavy naphthas still show a dull market. Pitch is firm; and naphthalene, either in the form of creosote salts pressed or dried, is quotable somewhat firmer.

The following prices mark the average business of the week: Tar, 17s. 6d. to 27s. 6d. Pitch, east coast, 38s.; west coast, 35s. Benzol, 90's, 6d.; special qualities for gas, 8d.; 50's, 8½d. Toluol, 90's, 1s. 1d. Solvent naphtha, 1s. 1d. Crude naphtha, 3½d. Heavy naphtha, 1s. Creosote, 2½d. Heavy oils, 3¼d. Carbolic acid, 50's, 2s. 6d.; 60's, 3s. Naphthalene, 55s. to 75s. Anthracene, "A," 4d.; "B," 3d.

Sulphate of Ammonia.—The position has not materially changed for the better; but there are indications that the slump in value has been arrested. Some rather important business is noted; and there are many buyers who would pay above £11 per ton for prompt or immediate forward delivery. Makers, however, will not sell under £11 5s., less 3½ per cent.; but the average value at the various ports might be taken at £11 3s. 9d.

The Wath and District Gas Company's Provisional Order.—At the meeting of the Wath Urban District Council last Wednesday, a letter was read from the Board of Trade with reference to the application of the Wath and District Gas Company for a Provisional Order, in reply to one from the Clerk, pointing out that the maximum price mentioned in the Draft Order was 5s. instead of 4s. 2d. per 1000 cubic feet, the amount recommended by the Commissioner at the recent inquiry. The Board of Trade letter stated that 5s. had been inadvertently inserted for 4s. 2d.; and that they were taking the necessary steps to have the clause altered accordingly.

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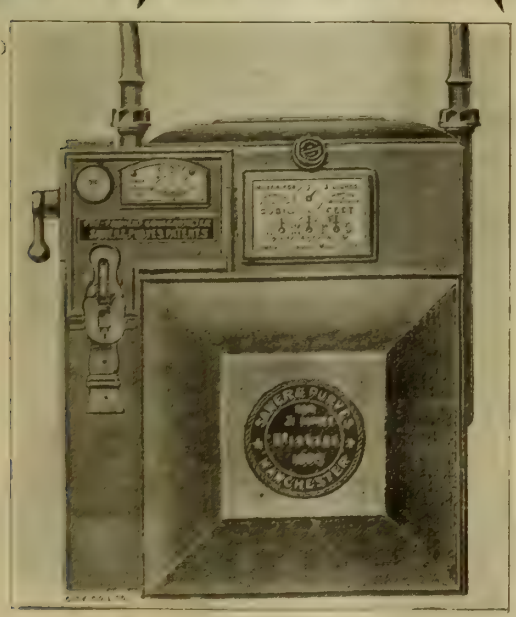
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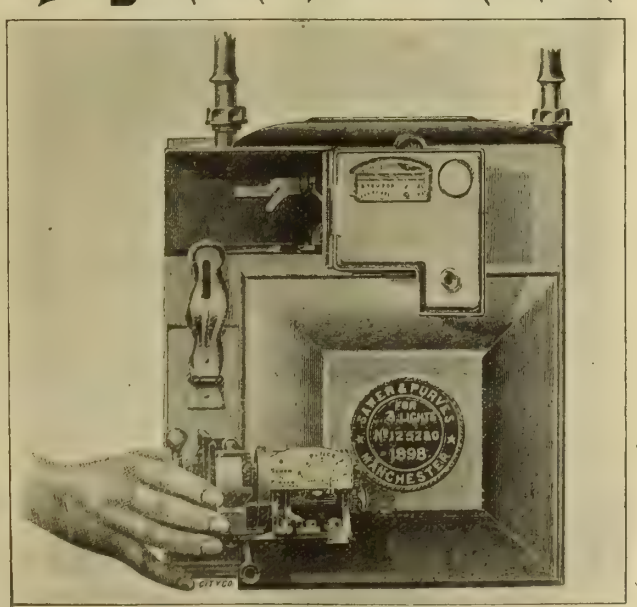
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COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—If there is any change to report in connection with the coal trade of this district, it is that the position is perhaps not quite so strong as it has been of late. The house-fire demand is now unmistakably falling off, with the result that the better qualities of round coal are becoming more plentiful on the market, and helping to relieve some of the pressure on the lower qualities for steam, forge, and general manufacturing requirements; while deliveries to gas-works are dropping down to about their minimum quantities. Although it cannot be said that this generally easier position as regards supplies has any appreciable effect upon prices, it is somewhat significant that the Lancashire coal-owners have not considered it advisable to enforce the decision of three weeks back to hold out for a minimum advance of 6s. per ton over last year's rates on the ensuing twelve months' railway contracts for locomotive fuel. Almost immediately after the resolution had been passed, it became known that several collieries outside the Lancashire Coal Sales Association were either in negotiation for, or prepared to accept, contracts at an advance of 5s. per ton over last year. This has since been accepted as the basis by the Lancashire Coal Sales Association; and tenders have been sent in to the railway companies at an average of 13s. per ton at the pit, which is 5s. over the 8s. contract basis of last year. This puts the advance on locomotive fuel and gas coal on the same level, and may be taken as representing the minimum basis that will be firmly held to on both the above classes of fuel. In fact, the railway companies have already signified their intention of closing their contracts at 13s. per ton; and the gas coal contracts that have so far been settled have also been on the basis of 5s. per ton over last year's prices. For steam and forge coals, the demand generally is fully maintained; and much the same applies to engine fuel, which, notwithstanding extra supplies just now coming in from Staffordshire, continues scarce at most of the Lancashire collieries. Pit prices are practically without quotable change; ranging from 12s. 6d. and 13s. 6d. per ton for the lower descriptions to 14s. 6d. and 15s. 6d. for the best qualities of round coal, with engine fuel 10s. 6d. to 11s. 6d. according to quality. The shipping demand is moderate; but the official minimum basis of 16s. per ton for steam coal at the Mersey ports is now scarcely more than nominal; 15s. 6d. to 15s. 9d. representing about the full average figures. The pressure for coke continues, and no difficulty is experienced in getting the recent advance. Ordinary furnace cokes readily sell at 24s., and the best foundry cokes at 32s. per ton at the ovens.

Northern Coal Trade.—There is an increased demand for coals, both for steam and for Durham kinds, except where the non-arrival of steamers temporarily interferes with the shipment. The opening out of the Baltic means a very large increase in the demand for steam coal. Best Northumbrians are firm at about 19s. per ton f.o.b.; while steam smalls are still rather scarce, and command about 13s. For gas coals, the prices are well adhered to. For occasional cargoes of best Durham gas coals, rates quoted vary from 17s. to 17s. 6d. per ton f.o.b.; and in one or two instances a higher price has been paid for special kinds and for prompt delivery. Most of the large contracts for gas coals that have long been pending are now decided on; and it is believed that the average range of prices to be paid will be about 16s. per ton f.o.b. Coke is still very firm, both for export and for home consumption; best Durham coke being 35s. per ton f.o.b. There is no change of moment in the price of gas coke this week; but the output is rather less, and stocks are limited. It is anticipated that higher prices will be asked for gas coke, to meet the advanced rates that must be paid for coal.

Scotch Coal Trade.—There is no change in the market, but the effects of the great rise in the price of coal are beginning to be felt, and the public are disposed to grumble. The high prices are still maintained, and are likely to be for some time. The quotations are: Main, 14s. to 14s. 3d. per ton f.o.b. Glasgow, ell 15s. 3d. to 15s. 6d., and splint 14s. 9d. to 15s. The shipments for the week were 216,952 tons—an increase of 3216 tons upon the previous week, and of 21,712 tons upon the corresponding week of last year. For the year to date, the total shipments have been 3,425,001 tons—an increase of 775,504 tons upon the same period of last year.

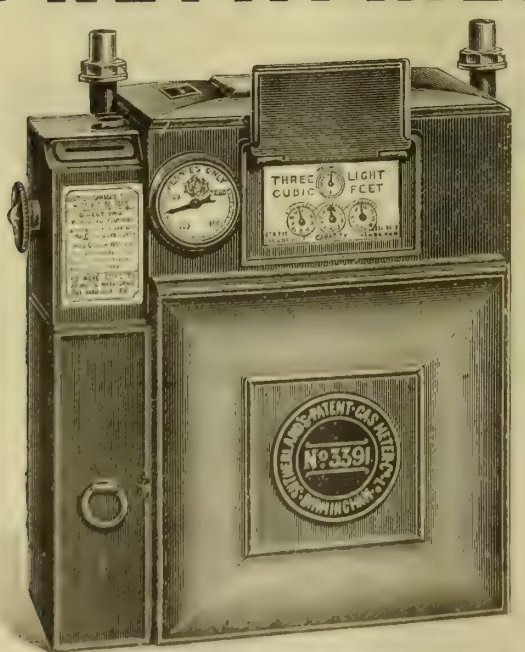
The Gas and Water Finances of Loughborough.—The Loughborough Town Council have decided to adopt a suggestion by the Local Government Board to raise the amounts required for their undertakings during the next twelve months by mortgages at short terms; and the Town Clerk has been instructed to borrow £103,000 for the purposes of the gas undertaking, and £34,000 for the water-works.

Local Authorities and Incandescent Gas Lighting.—Gas continues to compete very successfully for the purposes of street lighting, particularly in those towns where electricity is in the hands of the Municipality. The Bradford Corporation, for instance, who supply electricity at as cheap a rate per unit as almost any town in the country, have just fixed several thousand Welsbach burners in their street-lamps, having had practical experience of the economy resulting from upwards of 1000 burners already in use. The Huddersfield Corporation, who also possess their own electric lighting works, are now largely extending the Welsbach light. The Tunbridge Wells Town Council have decided to fix 350 incandescent burners in the street-lamps, instead of extending the electric lighting, which is a municipal supply. Therefore they find it more economical and efficient to purchase gas from a Company than to sell themselves their own electricity. One of the best installations of incandescent gas lighting in the country will be that on the sea-front at Hove. Hove, as everyone knows, has the best of the sea-front as compared with Brighton; but, up to now, its parades and promenades have been very inadequately lighted, while Brighton boasted of a row of arc lamps. Hove is now installing Welsbach burners; and its sea-front will soon be better lighted than its rival. Among the many other towns which have recently adopted the system are Maidenhead, Dukinfield, and Hemel Hempsted. Small towns, as a rule, are very badly lighted, as the local authorities grudge the cost. They, however, find the incandescent gas system is less expensive than deficient lighting with antiquated lamps and ordinary burners.

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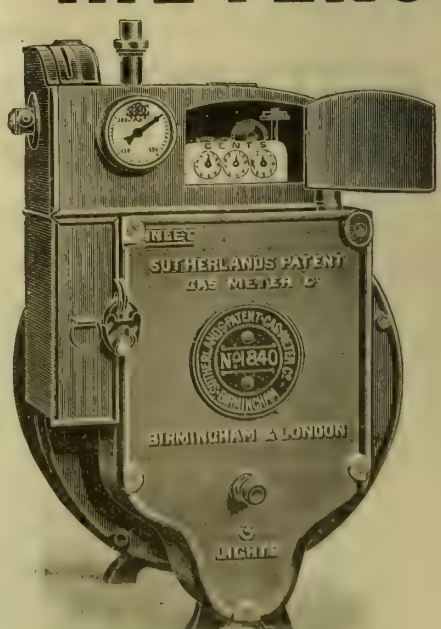
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Suggested Advance in Price at Manchester.—A recommendation is to be put before the Manchester City Council by the Gas Committee, that the price of gas be advanced from 2s. 3d. to 2s. 6d. per 1000 cubic feet to consumers within the city, and from 2s. 6d. to 2s. 9d. to consumers outside the city, from June 24 next. This will alter the Committee's estimates, enabling them to pay in relief of the rates £51,900 on the present annual rate of consumption, instead of £20,000 as had been proposed, and this without drawing from the reserve fund, which was to have supplied £10,000 towards the £20,000. The completion of the past year's accounts has proved that the trading was successful by about £10,000 beyond the estimate. The consumers outside the city will pay £8500 towards the amount raised by the proposed advance, if it is approved by the Council. It is only eighteen months since the price of gas was brought down to its present figure; and the advance recommended will put it back to a point at which it remained for many years. If the Council adopt the recommendation, the City rate can be reduced 3d.

Gas Consumers' Complaints at Birmingham.—During the past week or two, the correspondence column of the "Birmingham Post" has contained several complaints on the part of gas consumers, who state that, though they have been using the customary number of burners under ordinary conditions, their accounts for the past quarter show increases, which in some cases amount to as much as 40 per cent. Our contemporary has done a service to the Corporation Gas Department by informing its readers of the conditions under which their meters may be tested. In concluding the information, it is mentioned that an effort is made by the department to identify the writers of letters to newspapers, so that inquiry may be made. Such a case happened only a week or so ago; and here is the result: A correspondent wrote complaining of an increase of 80s. on the quarter's account; and an investigation took place. It was found that for the March quarter of 1899, the meter was read on Dec. 15, 1898, and on March 16, 1899, giving the consumption for 91 days. For the past quarter the readings were taken on Dec. 14, 1899, and on April 3; and the consumption recorded was, therefore, for 110 days. The explanation given for the longer period which was allowed to elapse this year is that the meter inspector was unable to gain admission to the premises on the usual day. The difference in the dates amounts to rather more than a 20 per cent. increase in the period during which consumption took place. As the correspondent does not mention the fact in his letter, he has evidently overlooked it; and, though it does not explain the whole of the increase, it shows the necessity for care when making comparisons. Another inquiry has been made as bearing on the complaint. The occupiers of the premises on either side of the firm were found to have reduced their consumption, in one case to the extent of 25 per cent., and in the other by 20 per cent., compared with the corresponding quarter of last year. In each case the consumption is smaller than that of the complaining firm; but it is obvious that anything affecting the gas supply so far as it is under the control of the Corporation would, in proportion, equally affect three consumers whose premises are side by side. The officials of the department have no way of singling out the middle one, and forcing up his figures.

Gas-Works in the Market.—The little gas-works at Sawston, Cambridgeshire (of which particulars have recently been advertised), were submitted for sale by auction by Mr. Alfred Richards last Tuesday. The bidding, however, did not reach the reserve fixed by the vendor; so that the works have not yet changed hands. We believe the reserve was somewhere between £500 and £600; and this is considered as very moderate, even having regard to the present outlook. A somewhat larger property —the Crawley Gas-Works—will come under Mr. Richards's hammer on June 12; and we learn that Sussex gas managers are evincing a lively interest in the fate of the concern, which has an output of between 5 and 6 million cubic feet.

The Price of Gas at Totnes.—In the course of their annual report, the Directors of the Totnes Gas Company refer to the increase of the price of gas which was the subject of much adverse comment in the town when it was announced. During the past year, gas has been supplied at the previous rate of 3s. 6d. per 1000 cubic feet; but the Directors say that, owing to the unprecedented rise in the price of gas coal (amounting to over 100 per cent. at the collieries, on the Company's last contract), they thought it necessary to raise the price to 4s. 6d. from Lady Day. Early in February they proposed to increase the price to 4s. from Christmas last; but, as strong opposition was shown by the consumers, the proposal was withdrawn, and the larger increase from Lady Day was substituted. The contract for public lighting, which has six months more to run, is now being worked at a loss. When the price of coal is reduced and other circumstances permit, the Directors hope to lower the price of gas to the original figure.

Sales of Shares.—At the Mart, Tokenhouse Yard, last Tuesday, Mr. Alfred Richards sold by auction 1000 £10 new ordinary shares in the Southend Water-Works Company, at prices varying between £11 5s. and £11 15s., or an average of £11 8s. 2d.; and 15 £10 additional ordinary shares at from £13 15s. to £15, or an average of £14 14s. 3d. On the same occasion, £3900 of ordinary "C" stock in the Ilford Gas Company was sold out of a new issue of £10,000, at from £110 to £112 per cent., or an average of £110 4s. 1d. About two months ago an issue of this stock (£7000) realized an average price of £125; but since then the investing public have become more fully alive to the coal question. At North Shields, on Monday last week, Mr. R. M. Tate sold stock of the South Shields Gas Company at the rate of £192 per £100 of stock, and stock of the Tynemouth Gas Company at £125 per cent. A few £10 "A" shares in the Deal and Walmer Gas Company have been disposed of at £21 15s. per share. At Dudley last Tuesday, £2700 of new ordinary stock in the local gas company realized by auction £152 to £153 per cent. At Gloucester on Friday, Mr. H. Knowles sold £5000 of the Gas Company's consolidated ordinary (new) 5 per cent. stock; and it produced prices ranging between £124 and £126. The total amount realized was £6249 15s. Through a printer's oversight, the name of the Tonbridge Gas Company was omitted from the sales of shares paragraph in last week's "Journal," in connection with the sale of £1500 "E" stock, which realized prices at the rate of £190 per £100 nominal. The dividend under the sliding-scale is 8½ per cent. per annum.

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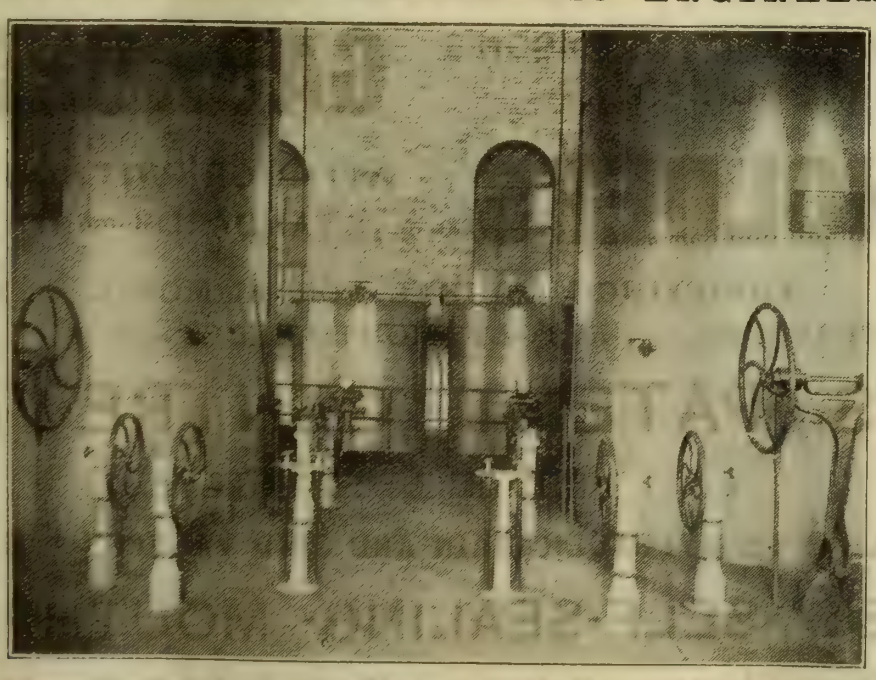
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Carburetted Water-Gas Plant for Oldham.—The Oldham Corporation have decided to manufacture carburetted water gas at their Hollinwood station, and have placed an order with Messrs. S. Cutler and Sons, of Millwall, for a plant to produce a million cubic feet per diem.

Liverpool Gas-Fittings Company, Limited.—The annual meeting of this Company was held last Wednesday, when a dividend of 5 per cent. per annum was declared. The Chairman (Mr. James Lister), in moving the adoption of the report, said that the Directors could have declared a higher dividend only that they felt bound to place the Company in the strongest possible position. The shareholders must not forget that the Company was originally started as a sort of "buffer" between the Liverpool Gas Company and the public, for any accidents that might happen in working for the public. When the Landing Stage was destroyed in 1874, the Gas Company had to pay over £100,000 for the fire; and, in order to protect themselves, the Directors inaugurated this Company, which had since, with one or two exceptions, worked with great success.

Bathurst (N.S.W.) Gas Supply.—On the occasion of the election of the new Mayor of Bathurst, a short time ago, Alderman Kenny, who had held the office for two years, gave the Borough Council some particulars in regard to the progress of the gas undertaking. He stated that in February, 1898, there was a debit balance of £2221; and the expenditure for the year was £4847. This brought the total up to £7068, against which they had receipts from gas, tar, coke, lighting, &c., amounting to £6561; leaving a debit balance of £506 due to the general fund. In the one year, therefore, they had reduced the debt from £2221 to the small sum of £506. Turning to the figures for the year 1899-1900, they started with the balance of £506, and the expenditure for the year was £4852; making a total of £5358. Against this there were receipts amounting to £6360, which left them with a credit balance of £1002. He remarked that, having started two years ago with a debit balance of £2221, the present was a state of affairs upon which they could congratulate themselves; and it appeared to him to be a complete and satisfactory answer to those who said the gas-works did not pay, and were carried out on an improper basis. He did not know from memory what was the exact cost of the works; but he thought it was something like £27,400. They now owed £12,000 on debentures and had £1000 to their credit; so that, if this was not a satisfactory state of affairs, especially when it was considered that they sold, he believed, the cheapest gas in Australia (3s. per 1000 cubic feet), he did not know what was. Within a few years they had a magnificent asset from which it would be possible to derive revenue which could be utilized for many purposes, and especially for beautifying the city. As a contrast to this pleasant story, we have to record that on the morning of the 21st of March Bathurst was visited by a violent storm which flooded the gas-works—the water rushing through them like a river, and being in some places 2 ft. 6 in. deep. Fortunately the Manager (Mr. G. Stone) was able to keep up the supply of gas, but at a reduced pressure. Regenerator firing is employed, and the brickwork of the furnaces sustained considerable damage; there being about 6 feet of water in them.

Stratford-on-Avon Gas Committee and the Rates.—The Gas Committee reported to the Stratford-on-Avon Town Council last Tuesday that, in consequence of the great increase in the price of coal, it was felt that for the current year the net receipts would only be sufficient to pay the interest on annuities and sinking fund; and consequently nothing would be available in reduction of the rates. Alderman Hawkes mentioned that about 5000 tons of coal were used during the year; and the increased cost had been estimated at 5s. per ton.

Water-Works Extensions Required at Harrogate.—Colonel W. R. Slacke, R.E., held an inquiry, on behalf of the Local Government Board, at Harrogate last Wednesday, into the application of the Corporation for sanction to a loan of £35,000 for purposes connected with the water-works. Alderman Fortune explained that the amount was needed for the purpose of putting in proper repair and covering in a disused reservoir which it was intended to use as a service reservoir. A new tank was also required to supply a population of about 600 on the high level, which could not be supplied by the present reservoirs. Three additional filter-beds and several extensions of mains were urgently necessary. There was no opposition to the proposal.

A New Gasholder for Maidstone.—The Maidstone Gas Company are increasing their storage by erecting a new gasholder adjacent to the works in St. Peter Street. It will be a two-lift holder, with a capacity of about 1¼ million cubic feet; and provision will be made for adding a third lift when necessity demands. The diameter of the holder will be 150 feet; and in height it will be 70 feet with two lifts, and 105 feet with three lifts. The present holders combined have a capacity of about 600,000 cubic feet; so that the new erection will be considerably larger than both. The tank is being constructed by Messrs. John Aird and Sons; while the holder will be erected by Messrs. Clayton, Son, and Co., Limited. The tank will probably be completed by the end of the present year; but the holder and the work in connection therewith will not be entirely finished till the autumn of 1901.

Ipswich Corporation Water Department.—The Manager of the Ipswich Corporation Water Department (Mr. Hamlet Roberts), in his annual report, as submitted to a meeting of the Council on Wednesday, stated that the total quantity of water pumped into the reservoirs during the past year was 345,391,946 gallons, which was an increase of 59,377,199 gallons over the previous year. The large increase was to be attributed to the additional number of water-closets now supplied, and to the increased waste from defective fittings. Mr. Roberts mentioned that, if his calculation as to probable weekly increase proved correct, in 1904 the requirements of the borough would exceed the present yield of the wells by about 500,000 gallons. Notwithstanding the increase of nearly 60 million gallons pumped, the cost per million gallons had shown a decrease from £1 15s. 2d. to £1 13s. 10¾d. Mr. W. O. White, in presenting the report, said that on last year's working, after payment of all expenses, £1119 had been saved; and the balance on revenue account from the taking over of the works, amounted to £4919. They had already given £2000 in aid of the rates, though the works had not been carried on in a niggardly fashion. The report was adopted.

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The Purchase of the Gainsborough Gas-Works.—Immediately after the public meeting authorizing the acquisition of the Gainsborough gas undertaking by the town, the District Council appointed a Committee to enter into negotiations with the Company. In February the Company made an offer to dispose of the works for £101,811, exclusive of compensation and stock. They have now offered to sell the undertaking for £82,500, which will include debentures and compensation to the Secretary. At the meeting of the Council yesterday week, a recommendation of the Special Committee was adopted, by which the offer was accepted on certain minor conditions. The amount is some £20,000 more than was estimated at the town's meeting. There is now little prospect of arbitration proceedings.

The Profits of the Heywood Gas Department.—Reporting on the past year's working of the Gas Department at the meeting of the Heywood Town Council last Thursday, Mr. Sutcliffe Firth said the profits amounted to £1767; and the Committee had decided to hand over £1000 in relief of the rates, and to carry the balance of £767 to the credit of the reserve fund. He thought the result was very satisfactory. The amount transferred to the relief of the rates was not so large as last year; but it must be remembered that the price of coal had been higher, and in the coming year would be still greater. The Committee did not wish to raise the price of gas if it could be avoided. For the past year the consumption had been very satisfactory. The total quantity manufactured was 125,724,000 cubic feet, or an increase of 7,079,000 cubic feet; the total amount of coal and cannel used being 12,451 tons. The report was adopted.

Retrospective Increases in Price.—The Bognor Gas Company have had to fall into line with many other similar bodies and raise their price, from the cause which has operated in all the other instances of an advance—the high cost of coal. The Urban District Council do not like this, and some very hard things were said against the Company at the meeting of the former body on the 4th inst. The Chairman (Mr. H. Lovett), who is a Director, pointed out that the Company would not have altered the price had it not been for the increased cost of coal; the contract they were entering into being just about 30s. per ton. Moreover, other companies had had to do likewise. The Chairman's attention was called to the fact that the Company proposed to make the increase retrospective; and he replied that the Directors thought it was better to go back a month or two, and make the increase 6d., than to go in for a rise of 9d. or 1s. Some reference having been made to the Company's dividends, the Chairman reminded the Council that, owing to the rise of 6d., the dividend would have to be reduced to 8½ per cent. The question of the power of the Company to make the increase retrospective was referred to the Clerk, who stated that, before he sent in his report, he would peruse the Company's Order, so as to see whether consumers could be legally called upon, by a notice dated the 1st of May, to pay extra for gas supplied from the 31st of March, without being informed in advance that the price was to be raised. A member expressed the opinion that this would be a "ticklish point." In the result, the whole question was left with the Lighting Committee for further consideration.

Mid-Sussex Water Supply.—In connection with the water undertaking of the Cuckfield Rural District Council, a duplicate set of pumping machinery was started last Wednesday, and the foundation-stone of a new water-tower laid. The machinery consists of a new 20-horse power engine, and a set of three-throw 10-inch pumps.

The Geltsdale Water-Works for Carlisle.—At the meeting of the Carlisle Town Council last Tuesday, the Geltsdale Water Committee reported that Mr. E. M. Eaton had approved the plans submitted by Mr. C. B. Newton of the water-works between the proposed reservoir at Castle Carrock, Geltsdale, and the service reservior at Carlisle. Mr. Corbett, Chairman of the Committee, in moving the confirmation of the minutes, said the plans had been completed, with the exception of those of the reservoir. The work of examining the foundations and strata and doing other things necessary for the large reservoir at Castle Carrock was proceeding satisfactorily. The trial holes sunk to ascertain the nature of the foundation had so far given satisfactory results. The minutes were confirmed.

Incandescent Street-Lighting at Plymouth.—The Electricity and Street Lighting Committee of the Plymouth Corporation have accepted a tender of the Welsbach Company for the supply of burners, mantles, lanterns, &c., for the application of incandescent lighting to those of the public lamps in the town to which the system has not hitherto been applied. The Company's tender for burners, mantles, stopcocks, &c., was £1160 12s. 6d., and was the lowest of four tenders received. For the supply of lanterns and frogs, there were ten tenders; and the one accepted amounts to £1635. While incandescent lighting is being extended in Plymouth, it is also to be applied in the neighbouring district of East Stonehouse; so that, with the exception of those lit with electric arc lamps, all the streets in the district supplied by the Plymouth and Stonehouse Gas Company will be lighted on this system. In East Stonehouse, the conversion of the lamps and the maintenance of the mantles will be undertaken by the Gas Company, who have entered into a new contract with the District Council.

The "Builder" Condemns the London County Council Testing Bill.—In a short paragraph dealing with the proceedings before the Select Committee of the House of Commons on the London County Council Gas-Testing Bill, the "Builder" last week pointed out that the evidence against the Bill consisted mainly in showing that the photometrical value ascribed to gas depends entirely upon the conditions under which it is tested, and that therefore it should in fairness only be examined under reasonable conditions, such as those hitherto recognized by the Gas Referees; also, in pointing out that by compelling the Gas Companies to send out richer gas, they would not benefit the consumer, for the Gas Companies would have to raise the price of gas to cover the extra cost of enrichment, while the consumer would not be able to detect any appreciable difference between the more highly enriched gas and that which he now receives. In a note to the paragraph, our contemporary says: "London gas consumers will learn with satisfaction that the Select Committee have thrown out the portion of the Bill which deals with the portable photometer."

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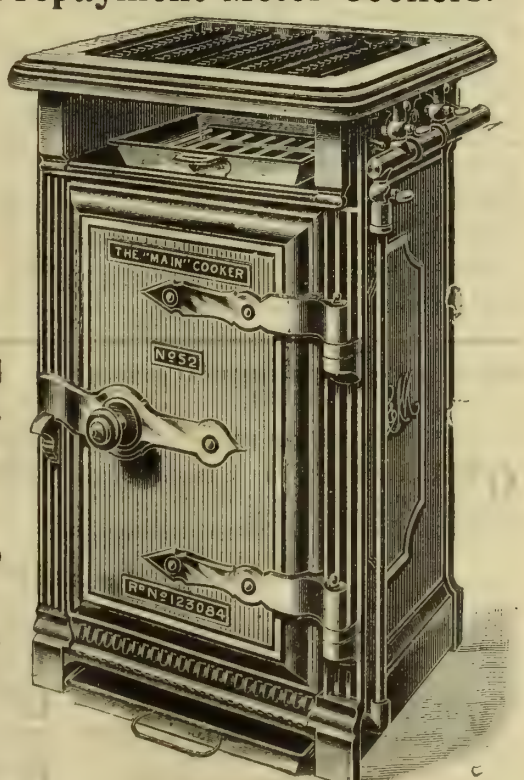


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The Bolton Corporation Water-Works undertaking shows a profit for the past year of £16,806, of which £16,000 is to go in aid of the rates.

The Cape Town District Water-Works Company and the Municipalities.—The Arbitrators appointed to decide the amount to be paid by the Municipal Councils of Claremont and Woodstock for the undertaking of the Cape Town District Water-Works Company have published their award There was a wide difference between the price asked by the Company and that offered by the Corporations. The former claimed £519,750; and the sum offered was £150,000. The latter is the equivalent of the Company's capital account, which is made up of 16,000 shares at £5 each, £80,000; and money borrowed, £70,000. The amount awarded was £219,350. Payment is to be considered due as from Jan 1, 1899. The date of the taking over of the concern is to be mutually agreed upon. Interest at the rate of 4 per cent. on the amount of the award is to be paid by the Municipalities until they complete the purchase; and, on the other hand, the Company are to account for the net earnings from Jan. 1, 1899. The Municipal Councils will pay the Company the value of the stores shown in the books on Jan. 1, 1899, together with interest on this sum at 4 per cent.; and they will take over all existing servitudes and contracts of the Company. The parties will pay their own costs, and half the costs of the arbitration.

The Honley District Council and the Gas-Works.—At the last ordinary meeting of the Honley District Council, the question of the purchase of the undertaking of the Honley Gas Company was considered in private. Mr. E. A. Harman, of Huddersfield, had been consulted on the matter; and he strongly recommended the Council to acquire the works. The price asked (£18,500) was, he said, a reasonable one; and the plant and buildings were in a substantial condition and would not require extension for a considerable time. It would be a very profitable undertaking. The Clerk (Mr. J. Sykes) remarked that he had communicated with the Local Government Board, asking for their sanction to the purchase; and in their reply they pointed out that the Company, by their Provisional Order, were under obligation to supply a certain district outside the area of the Council, and they were not prepared to sanction the scheme under these circumstances, according to section 162 of the Public Works Loans Act. The Clerk added that he thought that, having failed to secure the sanction of the Local Government Board under the existing conditions, it would be necessary to obtain an Act of Parliament, which would involve an outlay of about £500. Mr. Harman (who was present) was asked if he would still recommend the purchase of the works; and he replied that he thought the difficulty with the Local Government Board might be reduced to a minimum. Some authorities supplied outside districts in bulk, by meter; and in this way special parliamentary facilities had been avoided. But even if the Council had to apply for an Act of Parliament, the acquisition of the undertaking would, he thought, be worth the expense and trouble. After some discussion, it was resolved to endeavour to obtain the sanction of the Local Government Board to the purchase, without the necessity for obtaining a separate Act of Parliament.

Water under Cost Price to Large Consumers at Bradford.—This question was again raised at the meeting of the Bradford City Council last Tuesday, on the presentation, by Alderman Holdsworth, of the minutes of the Water Committee. These showed that the Committee had disapproved of a resolution of the Contracts and Works Sub-Committee, to the effect that charges for water for manufacturing purposes through meters be continued at the same rate as at present up to 400,000 gallons, but above that quantity the rate be 8d. per 1000 gallons. Mr. Hartley, who was told that he would have another opportunity of expressing his opinion on the question, preferred to do so at once. He asserted that there was one large firm who entailed a loss of £800 a year on the city for the water supplied to them; whereas the total amount which the firm paid in rates was only £900 a year. Two other firms who paid jointly £1100 in rates obtained their water £2500 under cost price. Thus they were carrying on business rate free, and were receiving a subsidy of £1400 per annum from the city. While the Water Committee were paying these subsidies to a few rich ratepayers, they were unable to make their accounts balance, and had occasionally to make a heavy draft on the rates and the gas profits in order to pay their way. He believed that a public service should be for the public good; but here was a public service being used for furthering private interests against the public good. Mr. Thomas Whiteley explained that the matter had been put back with a view to obtaining further information. It must be remembered that the large consumers paid 9d. per 1000 gallons for the first 400,000 gallons, which was more than the cost price; so that the quantity which had to be used before any firm obtained water under cost price must be very large. Something would be done by the Committee; but it was undesirable to make Bradford water dear just when they were on the point of receiving an inflow of abundant water. It should be their policy rather to encourage people to use the water.

Bridgnorth Gas Supply and Electric Lighting.—The consumption of gas has increased so rapidly at Bridgnorth that a considerable sum will have to be expended on the gas-works if they are to be in a position to meet requirements. At the meeting of the Council last Tuesday, Alderman Whitefoot stated that the consumption when the Corporation took over the works was 15 million cubic feet per annum; and now it was 26 millions. He asked the Council whether the time had not arrived when they should undertake the supply of electricity. Other speakers were favourable to the suggestion; and, although no formal vote was taken, the opinion of the members appeared to be unanimous on the point.

Evesham Corporation Gas Supply.—At last Wednesday's meeting of the Evesham Town Council, it was resolved to authorize the Gas Committee to make inquiries and report on the question of electric lighting for the borough. The Chairman of the Committee said that the advanced price of coal would mean an additional cost of about 8d. per 1000 cubic feet of gas made; and within the next few years it would be necessary to spend a considerable sum on the gas-works to provide for the continuous increase of business. The borrowing powers of the Gas Committee under their Provisional Order were within £1000 or £1100 of being exhausted; and for further expenditure it would be necessary to obtain another Provisional Order. They thought it wise therefore to ascertain whether it would not be possible to obtain another form of lighting to run side by side with the gas undertaking.

Wallasey Water Supply.—At the last monthly meeting of the Wallasey District Council, the Engineer submitted proposals for increasing, by means of the air lift or compressed air process, the yield of water from the No. 1 bore at Poulton from 150,000 to 700,000 gallons per day, and so for the present to dispense with No. 2 well, from which from 400,000 to 500,000 gallons of hard water are now obtained daily. The Committee instructed the Engineer to visit places where the process is in operation, and report. They recommended the Council to apply for power to borrow £18,500 for the construction of a second reservoir at Gorse Hill, New Brighton, to contain about 4 million gallons (the existing storage accommodation being only adequate for one day's supply), £3750 for a new tower and tank for 7000 gallons at Gorse Hill to improve the pressure, and three sums amounting to £1475 for new and enlarged mains, &c. The recommendation was approved.

North Warwickshire Water Supply.—The Sanitary Committee of the Warwickshire County Council have reported that, under the powers delegated to them by the Council, and acting in conjunction with the agents representing the Meriden, Solihull, and Rugby Rural District Councils, they negotiated with the promoters of the North Warwickshire Water Bill, and obtained modifications of the clauses to provide that the exclusive powers should expire in three instead of five years; that the wells should be lined for 40 feet at least from the surface, so as to exclude the percolation of surface water into the wells; that the power to take and divert springs, streams, &c., should be curtailed; that the power to take additional land by agreement should be omitted; that the power to supply water in bulk beyond the Company's limits of supply should be omitted; that a maximum rate for the supply of water for public purposes should be fixed; and that, after the expiration of a period of 25 years from the passing of the Act, the District Councils should have power to purchase. Thereupon the petition on behalf of the Council was withdrawn. The Bill was subsequently opposed by the Meriden and Solihull District Councils, when the period after which the District Councils should have power to purchase was reduced from 25 to 10 years.

The Directors of the High Wycombe Gas Company have unanimously resolved to increase the salary of their Engineer and Secretary, Mr. J. Fred. Wicks, to the extent of £100, "in recognition of his ability and additional duties entailed by the new departures previously reported and inaugurated by him."

The Thornaby Corporation will shortly have a report presented to them in regard to the position they would be in should they decide to erect gas-works for the purpose of providing for their own public lighting, instead of taking a supply from Stockton. A litttle delay in the presentation of the report has been caused by the consultation of experts.

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WANTED, a young married Man as GAS-FITTER, MAIN and SERVICE LAYER, and to have charge of all Outdoor Work, Lamps, &c.
State Age and Wages, with *copies* of three Employers' Testimonials.
Apply, by letter, to No. 3495, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, one or two additional REPRESENTATIVES calling on Gas Companies in Districts where Eveson's (Coal and Cannel) are not represented. Must have had good experience, and be well known to Gas Managers.
Replies, marked "Private," to be addressed to the EVESON COAL AND COKE COMPANY, LIMITED, BIRMINGHAM.

HIGH WYCOMBE GASLIGHT AND COKE COMPANY, LIMITED.
WANTED, by the above Company, a FITTER accustomed to Iron and Compo-work. Wages £1 8s. per week (54 hours).
Applications and Testimonials to the undersigned.
J. FRED. WICKS, C.E.,
Engineer and Secretary.

CLERK of Works required to superin-tend construction of a Brick in Cement Gasholder Tank, about 30 miles from London. Must have had similar experience, and be prepared to keep full Working Hours. Remuneration, £2 10s. to £3 per week, according to experience.
Apply, by letter only, with *copies* of two recent Testimonials (which cannot be returned), to No. 3498, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for a Gas-Works in the Mid-lands making 50 millions, a WORKING FOREMAN. Must understand Regenerative Furnaces, the manufacture of Sulphate of Ammonia, and capable of taking charge of the Works in the absence of the Manager. To an active Young Man desirous of improving his position, the above offers a good opportunity. A total Abstainer preferred. Wages to commence at 35s. per week.
Apply, by letter, stating Age and Experience, and enclosing recent Testimonial, to No. 3496, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

BOROUGH OF SMETHWICK.
(GAS DEPARTMENT.)
THE Corporation of Smethwick require the services of a competent and experienced man as MANAGER of the Gas-Works.
Salary £350 per annum.
Applications, stating Age, Training, and Experience, and accompanied by not more than three Testimonials (*copies*), endorsed "Manager," addressed to the Chairman of the Gas Committee, to be sent in not later than the 17th of May inst.
By order,
W. J. STURGES,
Secretary.
Gas Offices, Town Hall, Smethwick.

MERTHYR TYDFIL GAS COMPANY.
RENTAL CLERK.
WANTED, a Young Man as Rental CLERK. Must be experienced in the Accounts and General Routine Work of a Gas Office.
Applications, in own Writing, stating Age, Experience, and Particulars, of last employment, and enclosing *copies only* of two recent Testimonials, to be endorsed, "Rental Clerk," and addressed to the undersigned not later than Saturday, the 26th inst.
Salary £78 per annum.
JOHN L. COCKER,
General Manager and Secretary.
Gas Offices, Gas-Works, Merthyr Tydfil, Glamorganshire, May 2, 1900.

WANTED, 200 Retort Mouthpieces, with Self-Sealing Lids. 22 in. by 15 in. oval, c.l.f.
Hamburg.
AUG. KLÖNNE, Dortmund, GERMANY.

ENGINES and Exhausters combined
"Waller," to pass 30,000 cubic feet per hour. DITTO to pass 7000 feet per hour, overhauled and complete. Cheap to clear. Also BOILERS.
J. FIRTH BLAKELEY AND CO., Thornhill, DEWSBURY.

FOR SALE—Two Lancashire Boilers, each 6 ft. diameter by 20 ft. long, with Mountings. Been in use only a short time. Made by the Yorkshire Engine Company, Limited, Sheffield.
Apply to NEWTON, CHAMBERS, & Co., LIMITED, Thorncliffe Iron-Works, near SHEFFIELD, where the Boilers may be seen.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

CONDENSERS, Washer-Scrubbers,
"Cutler" patent CONDENSERS (14) 6 in. to 12 in. PIPE CONDENSERS, Patent WASHERS by "Livesey," "Holmes," and "Cockey," EXHAUSTERS up to 60,000 Cubic Feet per hour. ENGINES, BOILERS, &c. Several TOWER SCRUBBERS, PURIFIERS, METERS, GOVERNORS, PUMPS, TANKS, VALVES, &c.
J. FIRTH BLAKELEY AND CO., Gas Engineers, DEWSBURY.

THE Bromsgrove Gaslight and Coke Company, owing to Extensions, have FOR DISPOSAL—
One WASHER-SCRUBBER (by Laycock and Clapham), with 10-inch Connections, made to pass 100,000 cubic feet per diem.
One TOWER-SCRUBBER, 3 feet diameter and 20 feet high, with 10-inch Connections.
The above can be seen at work, and any other Information obtained, on application to the MANAGER.

THE Calne Gas and Coke Company, Limited, have FOR SALE the following APPARATUS. Offers to be sent to the Secretary at Church Street, Calne, Wilts.
All necessary CONNECTIONS for three Purifiers by Cockey and Sons, comprising:—
One Lift for 8-feet Purifier,
Four 6-inch Rack and Pinion Valves,
One 6-inch Centre-Valve with Column,
One 6-inch Bye-Pass Valve with Column,
Nineteen 6-inch Bends and Springs,
One 6-inch T-Piece.
Thirteen Caps and Clips.

THE Dawley Gas Company are prepared to receive TENDERS for the supply of a SINGLE-LIFT GASHOLDER, to replace one now in. Size required 40 ft. 3 in. diameter by 12 ft. deep. Present Columns and Pulleys only to remain.
Tenders to be sent in on or before May 21.
Any further Particulars may be had from the SECRETARY.

FOR SALE.
BY ORDER OF THE DIRECTORS OF THE SUTTON (SURREY) GAS COMPANY.
A CONDENSER, by Morris and Cutler, 15 ft. by 5 ft. by 6 ft., with 12-inch Valves, Connections, and Bye-Pass complete, for 500,000 cubic feet per day.
A WASHER, Livesey, 5 ft. 6 in. by 4 ft. by 2 ft. 9 in. deep, with 12-inch Connections, Valves, and Bye-Pass complete, for 500,000 cubic feet per day. Also
A SCRUBBER, "Standard" Washer-Scrubber by Kirkham, Hulett, and Chandler, 12 ft. by 5 ft. 9 in. by 6 ft high, with 12 inch Connections and Valve, for 500,000 cubic feet per day.
The above Plant is in perfect condition, and can be seen working. It is about to be removed to be replaced by Plant of greater capacity.
For further Particulars, apply to GEO. MEAD ROBINS, Secretary and Engineer, Sutton, SURREY.

RUSHDEN AND HIGHAM FERRERS DISTRICT GAS COMPANY.
THE Directors of the above Company invite TENDERS for the supply of 8000 Tons of good GAS COAL or NUTS during the Twelve Months ending the 30th of June, 1901.
The Coal to be delivered on the Gas Company's Sidings Midland Railway.
Sealed Tenders, endorsed "Tender for Coal," and addressed to the Secretary, Gas Company's Offices, Rushden, to be sent in on or before Monday, the 28th of May inst.
Full Particulars may be obtained from the undersigned.
THOMAS WATSON,
Engineer and Manager.
Gas-Works, Rushden,
May 12, 1900.

BOROUGH OF DUKINFIELD.

(Gas Department.)

TENDERS for Tar produced at the Dukinfield Gas-Works in the Year commencing the 1st of July are required by the 26th inst.

Quantity about 500 Tons, delivered free on boat.

Tenders to be sealed and endorsed "Tar."

Harrison Veevers, C.E.,
Engineer and Secretary.

Dukinfield,
May 12, 1900.

CITY OF CARLISLE.

THE Carlisle Gas Committee are prepared to receive TENDERS for the supply of COAL and CANNEL required at their Works during One Year from the 1st of July next.

Tenders to be delivered to the undersigned not later than June 2, 1900.

Forms of Tender and other Particulars on application.

C. B. Newton,
Engineer and General Manager.

Gas-Works, Carlisle,
May 12, 1900.

CITY OF CARLISLE.

THE Carlisle Gas Committee are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Works for a period of One Year from the 1st of July next.

Tenders to be delivered to the undersigned not later than June 2, 1900.

Further Particulars can be obtained on application.

C. B. Newton,
Engineer and General Manager.

Gas-Works, Carlisle,
May 12, 1900.

TO COAL MERCHANTS, SHIP OWNERS, AND OTHERS.

THE Directors of the Torquay Gas Company are prepared to receive TENDERS for the supply of about 10,000 Tons (or such other quantity as may be agreed on) of best approved GAS COALS.

Tenders to state the price of the Coals, and the freight to Dartmouth or Torquay, separately and together, and also for delivery into the Company's Works, adjoining the Great Western Railway, free of all charges.

Further Particulars and Forms of Tender to be obtained from Mr. Beynon, the Manager of the Company, Hollacombe, Paignton; and Tenders to be sent to the undersigned before the 23rd of May inst.

John Kitson,
Secretary.

Torquay, May 7, 1900.

SOWERBY BRIDGE URBAN DISTRICT COUNCIL.

TENDERS FOR COAL AND CANNEL.

THE Gas Committee are desirous of receiving TENDERS for 14,900 Tons of COAL or less, and 1200 Tons of CANNEL, as may be required, for the Gas-Works at Sowerby Bridge and Luddenden Foot for the Year ending May 31, 1901.

Specifications and Forms of Tender can be obtained by applying to Mr. John Marsland, Engineer and Manager, Gas-Works, Sowerby Bridge.

The Gas Committee do not bind themselves to accept the lowest or any Tender.

Tenders must be sent in not later than Saturday, the 26th of May, 1900, endorsed "Tender for Coal," or "Cannel," respectively, and addressed to

Godfrey Rhodes and Evans,
Clerks to the Council.

Commercial Bank Chambers,
Halifax, May 8, 1900.

RHONDDA URBAN DISTRICT COUNCIL.

(Gas and Water Department.)

TENDERS FOR GAS PLANT, &c.

THE Gas and Water Committee of the above Council invite TENDERS for the following:—

Contract No. 7—Installation of Mr. W. R. CHESTER'S REGENERATOR FURNACES, with all the necessary Ironwork at the Porth Gas-Works.

Contract No. 8—One STEEL CORNISH BOILER, 16 ft. 6 in. long, and 4 ft. 6 in. diameter, with all necessary Fittings, &c., at the Porth Gas-Works.

Contract No. 9—STATION METER, in Rectangular Case, to pass 20,000 cubic feet of Gas per hour at the Ystrad Gas-Works.

Contract No. 10—One 20-Ton WAGGON WEIGHING-MACHINE at the Porth Gas-Works.

Contract No. 11—One TWO-LIFT GASHOLDER, 40 feet high, and of an average diameter of 108 feet; also a STEEL GASHOLDER TANK for same, 20 feet deep by 112 feet diameter, at Tonypandy.

Contract No. 12—LAYING and JOINTING about 3200 yards of 4 inch and 3 inch GAS-MAINS at Tonypandy, Treorky, and Blaencwm.

The Drawings and Specifications may be seen, and Forms of Tender obtained, upon application to Mr. Octavius Thomas, Engineer and Manager, Gas and Water Offices, Pentre, R.S.O., Glam.

Contractors will be required to pay the Standard Rate of Wages recognized in the District.

Tenders, endorsed "Contract No. 7, 8, &c.," as the case may be, addressed to the Chairman of the Gas and Water Committee, to be sent to the undersigned on or before Ten a.m. Friday, the 25th of May, 1900.

The Committee do not bind themselves to accept the lowest or any Tender.

Walter H. Morgan,
Clerk.

Council Offices, Pentre, R.S.O.,
Glam., May 12, 1900.

COUNTY BOROUGH OF BLACKBURN.

(Gas Department.)

THE Gas Committee invite Tenders for the Surplus TAR made at their Works during the Year ending the 30th of June, 1901.

The estimated Quantity is 2600 Tons; and Tenders are to state a price for same delivered into Tank-Waggons at the new Gas-Works Sidings, Greenbank.

Forms of Tender may be obtained from the undersigned, and to be delivered in sealed envelopes, endorsed "Tar," before Saturday, the 26th of May, 1900.

S. R. Ogden,
Engineer and Manager.

Gas Department,
Municipal Offices, Blackburn,
May 15, 1900.

TENTERDEN GAS COMPANY.

COAL.

TENDERS invited for supply of 500 Tons of best GAS COAL, delivered at the following Stations, Tenterden (Rother Valley Railway), Headcorn and Appledore (S.E.R.), 400 Tons to be delivered in June, July, and August next, and the remainder as and when required.

Tenders, with Analysis and full Particulars of the Coal offered, to be sent to me on or before Saturday, the 19th inst.

The lowest or any Tender not necessarily accepted.

Geo. F. Varty,
Secretary.

Tenterden,
May 8, 1900.

RHYL URBAN DISTRICT COUNCIL.

(Gas Department.)

THE Gas Committee are prepared to receive TENDERS for the supply of about 4600 Tons of screened GAS COAL, to be delivered at Rhyl Station in such quantities as may be required from the 1st of June, 1900, to the 30th of June, 1901.

Forms of Tender may be obtained on application to Mr. Leonard G. Hall, Gas Engineer.

Tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Coal," to be delivered on or before Monday, the 21st of May, 1900.

The Council do not bind themselves to accept the lowest or any Tender.

Arthur Rowlands,
Clerk to the Council.

Council Offices, Rhyl,
May 11, 1900.

THE Corporation of Middleton are prepared to receive TENDERS for the supply of 10,000 Tons of COAL (Screened and Nuts) and 3000 Tons of CANNEL, delivered at the Middleton Railway Station.

Further Particulars and Form of Tender may be obtained from Mr. T. Duxbury, Gas Engineer. One-half of the quantity of Coal and Cannel will be taken during the Summer Months.

Tenders, addressed to the Chairman of the Gas, &c., Committee, and endorsed "Tender for Coal or Cannel," to be delivered at my Office not later than Monday, the 21st of May, 1900.

The Corporation do not bind themselves to accept the lowest or any Tender.

Frederick Entwistle,
Town Clerk.

Town Hall, Middleton,
May 10, 1900.

SHEPPY GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of about 8000 Tons of the best DURHAM GAS COAL for Twelve Months ending June 30, 1901, in such quantities as may be required, to be delivered free alongside their Wharf at West Minster, near Sheerness.

Tenders should be accompanied by an Analysis, together with full Particulars of the Coal offered.

The Firm whose Tender is accepted will be required to enter into an Agreement with the Company for the due carrying out of their Contract.

Tenders to be sent to the undersigned by Wednesday, the 23rd of May, 1900.

The Directors do not bind themselves to accept the lowest or any Tender.

By order,
H. Barber,
Secretary.

Gas Offices, 2, Trinity Road,
Sheerness-on-Sea.

CITY OF BRADFORD.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Gas Committee of the Bradford Corporation are prepared to receive TENDERS for the supply of Best GAS COAL, COBBLES, NUTS, and CANNEL, all to be well-screened, dressed, and free from Shale and Pyrites, to be delivered at the several works of the Corporation in the City during the period of One Year or of Two Years, commencing on the 1st day of July next, as may be agreed upon.

Form of Tender, with any further Information required, may be had on application to Mr. Wood, Gas Engineer, Town Hall.

Sealed Tenders, endorsed "Tender for Coal," to be sent to me on or before Wednesday, the 23rd of May inst.

Persons tendering must give an assurance that they have paid to their Workmen for the three months preceding date of Tender not less than the minimum Standard Rate of Wages, and undertake to continue to pay during the contract the same Rate of Wages.

The lowest or any Tender will not necessarily be accepted.

Frederick Stevens,
Town Clerk.

Town Hall, Bradford,
May 11, 1900.

MALTON GAS COMPANY.

TENDERS FOR COALS.

THE Directors invite Tenders for the supply of about 5000 Tons of GAS COALS, COBBLES, or NUTS, delivered at the North-Eastern Railway Company's Depôt, Malton, during the Year ending the 30th of June, 1901.

Payments will be made monthly.

Tenders to be sent in on or before Saturday, the 26th of May inst.

The Directors do not bind themselves to accept the lowest or any Tender.

Henry Torey,
Secretary.

Malton, Yorks.

BOROUGH OF DARWEN.

TENDERS FOR GAS COAL.

THE Corporation are prepared to receive TENDERS for the supply of GAS COAL, for One, Two, or Three Years, to be delivered at the Gas-Works Siding in the Corporation Waggons.

Forms of Tender and all Information as to quantities may be obtained on application to Mr. A. H. Smith, Gas Engineer, Darwen.

Sealed Tenders, endorsed "Gas Coal," must be delivered to the undersigned at or before noon, Saturday, May 26, 1900.

No Tender necessarily accepted.

By order,
Chas. Costeker,
Town Clerk.

Town Clerk's Office, Darwen.
May 2, 1900.

BOROUGH OF DARWEN.

THE Corporation are prepared to receive TENDERS for all the surplus GAS TAR produced at their Gas-Works for One Year.

Also for the supply of the following Goods for One Year:—

(1) OILS and PAINTS.
(2) VITRIOL.
(3) WROUGHT-IRON TUBES and FITTINGS.
(4) CAST-IRON MAINS and SPECIALS.
(5) LEAD PIPE.

Particulars as to Quantities may be obtained on application to Mr. A. H. Smith, Gas Engineer, Darwen.

Sealed and endorsed Tenders must be delivered to the undersigned at or before noon, Saturday, May 26, 1900.

No Tender necessarily accepted.

By order,
Chas. Costeker,
Town Clerk.

Town Clerk's Office, Darwen,
May 2, 1900.

BOROUGH OF CHORLEY.

TO COLLIERY OWNERS AND OTHERS.

THE Chorley Corporation invite TENDERS for the supply of GAS COAL, CANNEL, and CANNEL CHIPPINGS required at their Gas-Works during a period of Twelve Months commencing the 1st of July next.

Forms of Tender and any further Information may be obtained on application to Mr. John M'Cubbin, Gas Manager, Chorley.

Tenders, endorsed "Coal," to be sent to me on or before Tuesday, the 22nd inst.

The Corporation do not bind themselves to accept any Tender.

By order,
Jno. Mills,
Town Clerk.

Town Hall, Chorley,
May 4, 1900.

SHREWSBURY GASLIGHT COMPANY.

TENDER FOR COAL.

THE Directors of the Shrewsbury Gaslight Company, invite TENDERS for the supply of about 15,500 Tons of screened GAS COALS, to be delivered free at the Great Western or London and North-Western Goods Yard, Shrewsbury, during the Year commencing July 1, 1900, and ending June 30, 1901.

The Directors reserve to themselves the right to divide the quantity into two or more Contracts, and do not bind themselves to accept the lowest or any Tender.

Tenders must be made on Forms (containing further Particulars), which may be obtained on application at the Company's Works, or by post, and must be sent to the undersigned, on or before the 24th day of May, 1900.

By order,
Wm. Belton, Assoc.M.Inst.C.E.,
Secretary and Manager.

Gas-Works, Shrewsbury,
April 28, 1900.

SCARBOROUGH GAS COMPANY.

AMMONIACAL LIQUOR.

THE Directors of the Scarborough Gas Company invite TENDERS for the whole of the AMMONIACAL LIQUOR, to be produced at their Works for One or more Years from the 1st day of July next.

Tenders may be submitted either at a fixed Price per Ton or on a Sliding-Scale, regulated by the price of Sulphate. Preference will, however, be given to the latter.

Further Particulars may be obtained on application to the undersigned.

Tenders (duly endorsed) must be delivered, addressed to the Chairman of the Company, not later than Noon, on Saturday, the 9th of June next.

The Directors do not bind themselves to accept the highest or any Tender.

By order,
J. Holliday,
Engineer and Secretary.

Gas Offices: 32, Westborough,
Scarborough, May 16, 1900.

CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE.
The Decision of the House of Commons Committee on the London Gas Bills . . . 1351
The Conversion of Alderman Gibson, of Manchester 1352
The Cost of Fussiness 1352
A Shady Side of Municipalism 1353
The Spirit of Sweet Reasonableness in a Trade Union. . . . 1353
WATER AND SANITARY AFFAIRS—
The East London Company's Bill Passed by the Commons . . 1354
Rejection of the South Essex Water Bills 1354
The Meeting of the West Middlesex Water Company 1355
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market 1355
Electric Lighting Memoranda 1355
The Paris International Exhibition—The Gas Pavilion; The Lighting 1356
Predictions—General and Gaseous 1358
The Housing Question and Municipalism 1358
Stock Conversions and Stamp Duties 1359
The Competition of American with British Coal. 1359
TECHNICAL RECORD:—
The Incandescent Gas-Mantle and Its Use. By Vivian B. Lewes, F.I.C., F.C.S. 1360
REGISTER OF PATENTS:—
Gas-Scrubbers—Stevenson (Executrix of the late), G. E. . . . 1363
Gas and Air Compressors and Pumps—Keith, J. 1363
Obtaining Intense Heat from Gas—Delin, G. 1364
Cleaning the Interior of Ascension-Pipes—Elliott, C., Damp, G., and M'Dade, J. 1364
Patent Notices 1364
CORRESPONDENCE:—
Mr. Carpenter's Paper on Inclined Retorts 1365
Concerning Coal Exports and Political Economy 1365
The Calorimetry of Coal Gas 1365
Sunday Labour in Gas-Works 1365
Local Authorities and the Price of Gas. 1365
LEGAL INTELLIGENCE:—
Supreme Court of Judicature—Court of Appeal—
The Welsbach Incandescent Gas-Light Company, Limited, *v.* The New Sunlight Incandescent Company, Limited . . . 1366
Llanelly Police Court—Unlawfully Connecting a Gas-Meter; The Publication of Notices of Penalties to be Sued For 1366
Embezzlement by a Water-Rate Collector 1366
Intimidating Gas Stokers at Newport (Mon.). 1366
PARLIAMENTARY INTELLIGENCE:—
Gleanings from the Committee Rooms. 1367
House of Lords—Progress of Bills 1369
House of Commons—Progress of Bills. 1369
Metropolis Gas Supply—The Decision of the Committee on the London Gas Bills 1369
House of Commons Committees—
The Gaslight and Coke, Commercial Gas, and South Metropolitan Gas Companies Bill 1370
South Metropolitan Gas Company Bill 1372
Margate Corporation and Westgate and Birchington Water Bills 1386
Electric Tramways and Gas Mains—The Question of Electrolysis 1386
MISCELLANEOUS:—
Edinburgh and Leith Gas Commission—Visit of Inspection to the Granton Works 1387
Manchester Corporation Gas and Electricity Supplies—Increase in the Price of Gas; Criticism of the Electricity Committee . 1387
Birmingham Corporation Gas Supply—Railway Rates; New Water-Gas Plant; Annual Accounts. 1389
Gas Profits and Prices at Huddersfield 1389
Hull Corporation Gas and Water Supply—The Annual Accounts; The Sale of the Old Gas-Works 1390
Heywood Corporation Gas Supply—The Past Year's Working . 1390
The Leamington Priors Corporation and the Gas-Works—An Offer to Purchase 1390
Electric Lighting Notes 1391
Meeting of the West Middlesex Water-Works Company . . . 1392
Gas and Water Companies' Stock and Share List 1392
Harwich Water Supply 1393
The Tees Valley Water Board 1394
Notes from Scotland 1394
Current Sales of Gas Products 1396
Coal Trade Reports 1396
PARAGRAPHS:—
PERSONAL: Mr. E. Windsor Richards; Mr. Sidney E. Stevenson; Mr. E. P. Reilly; Mr. William J. Hollingsworth, Assoc.M.Inst. C.E.; Mr. E. Sandeman; Sir William Crookes, F.R.S. . . . 1359
OBITUARY: Mr. J. Bowman; Mr. Edward Pritchard, M.Inst. C.E.; Mr. Tom Hay Wilson 1359
The Committee on Municipal Trading—Patents in the Past Year—A Century of Chemistry at the Royal Institution 1354
Masons and the Gas Institute Meeting. 1356
The Coal Production of the United States in 1899—Excursion Meetings of District Gas Association 1362
The Inquiry Circular Nuisance Again. 1366
Bolton Gas Profits and the Rates—Helston Corporation and the Gas Company. 1369
The London County Council and their Wasteful Parliamentary Expenditure 1372
Reduction in the Price of Gas at Preston 1385
Lambeth Water-Works Company—Scarcity of Water at Ashton . 1386
Wilmslow and Alderley Edge Gas Company 1392
New Joint-Stock Companies 1394
Tiverton Gas Supply—The St. Marychurch Gas Undertaking—Messrs. Richmond and Co.'s Profit-Sharing Scheme—Increase in Price at Bradford—The Water Scheme of Shrewsbury—South African Lighting Association, Limited—Monte Video Gas Company, Limited 1397
Sales of Shares—The Torquay Watershed. 1398

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

EDITORIAL NOTES.

The Decision of the House of Commons Committee on the London Gas Bills.

THE South Metropolitan Gas Bill was before Mr. Oldroyd's Committee the whole of last week; and on Friday, the decision of the Committee was given on the three London Gas Bills which they have had under consideration, one after another. This decision can only be characterized in popular phraseology as "sensational." The remaining part of the Bill of the London County Council bearing the names of the three London Gas Companies, relating to the regulation of prepayment meter supplies, was cancelled in favour of an agreed clause enacting that the amount of the Companies' charges for gas and fittings shall be distinctly stated to the consumers, and that the maximum charge for meter and fittings is not to exceed 10d. per 1000 cubic feet of gas consumed, subject to revision by the Board of Trade in seven years. The acceptance of this reasonable and harmless clause, in substitution for the harsh and crude proposals originally contained in the Bill, is to be regarded merely as "saving the face" of the London County Council. The Parliamentary Committee of this body will not have the mortification of reporting the complete discomfiture of their gratuitous legislative attack upon the Gas Companies. Better an Act of one clause than no Act at all, even though the one clause bears no sort of resemblance to the scheme which it displaces! Actually, the Committee only saved the Bill because it afforded the sole parliamentary means of applying to all three Companies whatever reasonable regulation of prepayment meter charges might be agreed upon. The only London Gas Company with a Bill in Parliament this session to raise the question on their own account, was the South Metropolitan. Their Bill offered to take a maximum surcharge of 9d. per 1000 cubic feet; though this admittedly would not pay. As it has been settled, therefore, the South Metropolitan Company get a penny more than they asked for; and the other Companies are equally well satisfied. Whether the London County Council will think, with Dickens's charity schoolboy, that "it was hardly worth while going through so much to get "so little," remains to be seen.

The Bill of the Gaslight and Coke Company was thrown out. The gravity of this second failure of the Company to obtain the sanction of Parliament to the raising of the additional capital they declare to be necessary to enable them to fulfil their statutory obligations, cannot be overrated. The effect produced upon those interested in the matter who heard the announcement of the rejection of the preamble, was nothing short of blank consternation. Habitual frequenters of the corridor, who knew the circumstances, could only "stand at gaze," and ask one another what the Company are to do next. Such drastic chastisement of a Gas Company is scarcely precedented in parliamentary annals. The Bill was opposed, it is true; but no evidence was offered to show that the Company did not want the money, or at least a substantial part of it, or that the method by which the Company proposed to obtain it is not the cheapest possible. But, unfortunately for the promoters, the Bill did not contain a line in recognition of the labours of the Powers of Charge Committee of last session; and the House of Commons had passed an instruction to this Committee to the purpose that the fruit of that inquiry should not be thrown away. Counsel for the Company said in effect: "Give us our money; "and then we will talk about those recommendations." But, as a matter of fact, it was difficult to see where the recommendations were to be let into the Company's scheme. It was contended that so much of them as applied to capital did not affect debenture stock; and there were other objections to the remaining recommendations. All this was perfectly rational, of course, as advanced for the promoters; but it was open to the fatal retort that it simmered down into the general conclusion that, so long as the Company had recourse to mortgaging their undertaking at 3 per cent., they could hold Sir James Rankin's Committee at arm's length. There was also the further general weakness of the Company's proposal, that it tended more and more to make the ordinary shareholders mere annuitants on the pledged undertaking. It sounds very well to say that the benefit of all economies effected by a sliding-scale company goes, five-sixths to the consumers and one-sixth to the shareholders. There is

another side to this statement. It is, however, unnecessary to discuss the matter any further at the present crisis in the Company's affairs. The people of West Ham decline to resign themselves to going on paying so much more for gas than they think is fair, merely because Colonel Makins holds that the price on the north of the Thames has always been more than that charged on the south, and always will be. The Corporation of the City of London are disappointed at the net result of the Chartered amalgamations. The London County Council could show—what they could not do for their own Bill—that in opposing the Company's Bill they were acting on the instigation of practically all the Local Authorities within the district. It is an unfortunate business for the proprietors; but it cannot be pleaded that the Horseferry Road has not been warned that its ways did not command the approbation of Parliament.

With regard to the South Metropolitan Bill, which may be shortly described as a measure for enabling the Company to discontinue the artificial enrichment of their gas to the legal 16-candle standard, the astonishing thing happened that the Committee accepted the proofs offered as to the expediency of the alteration with more heartiness than the Company themselves desired. The Bill started with the supreme advantage of being a practical embodiment of the best of the recommendations of the Powers of Charge Committee. It was no flash project, suddenly sprung upon Parliament, like the Portable Photometer Bill of the London County Council. In reality, the facts about enriched gas have been understood by the South Metropolitan and other Companies, and by experts, for years; but the most ardent reformer would have had small hopes of convincing Parliament of the truth, in the absence of such a favourable opening as the present circumstances combined to offer for a sweeping reconsideration of the convention of statutory illuminating power. The coincidence of favouring conditions for this reform is particularly striking and extraordinary. First came the report of the Powers of Charge Committee, which gave a lead to the South Metropolitan administration that, as men of business and of their Age, they could not refuse. Was ever before a Gas Company actually offered an increase of dividend without asking? But, of course, there were conditions; and the Gas Company wisely gave their own turn to these. They also prudently "bettered the instruction," by offering to give the sliding-scale a fresh start in the downward direction. It does not appear to have been remarked in the course of these deeply interesting Committee proceedings, that the sliding-scale necessarily tends to arrest itself when the irreducible minimum of compressibility of the working expenses has been reached. The South Metropolitan selling price at the beginning of the year was down to 2s. 1d. per 1000 cubic feet; and this was probably the anchorage for the downward range. Since then there has been a change in the upward direction. A fresh minimum can only be realized, under ordinary conditions, by altering some datum, which is obviously the statutory illuminating power, in the case of an undertaking not already possessed of the utmost liberty in this respect. The London standard of illuminating power—16 candles—is an artificial one. Mr. Livesey saw in the relaxation of the obligation on the Company supplying this gas to enrich the bulk of the make, a means of cutting down the initial price. His Bill, therefore, offered to do this, in addition to accepting the recommendation of the Powers of Charge Committee on the same subject, at the rate of a penny per candle power actual reduction on the average of the output.

The Committee went with him willingly—nay, eagerly. They saw the inutility of enrichment, their eyes having been opened in the course of the proceedings on the Portable Photometer Bill, which had with them an effect wholly different from that designed by its promoters. In point of fact, the Bill established the advantages of the South Metropolitan proposal, which was certainly not intended by the London County Council. There could not have been a better introduction to the South Metropolitan Bill; and if the latter had stood alone, it would have been necessary to invoke in support of its proposals very much the same kind of evidence as that by which the London County Council fondly sought to bind the London gas industry tighter than ever in the bonds of red-tape photometry. The only fault of the South Metropolitan case was that the Company offered too much. The necessity for raising the price of gas, to meet the increased cost of coal, has arisen since the decision to promote the Bill was taken; and it gravely affects the financial prospects of the Company for the year For how long this disturbance may last, is another consideration altogether. At present, the Committee have placed a difficulty in the way of the Company, by suggesting that they should take a fixed standard of 14-candle power, and a correspondingly fixed initial price of 3s. 1d.; all provisions of testing and penalties remaining as of yore. This is not the same thing as Mr. Livesey's proposal of an adjustable initial price based on the average illuminating power found at the official testing-stations. It repeats the rigidity of the existing system of gas-testing, which it was partly Mr. Livesey's object to relieve. This portion of the Company's case was evidently insufficiently proved. At any rate, the finding of the Committee is a great triumph for the Company, and even as it stands is a huge measure of emancipation for the gas consumer. Generally speaking, also, it is another victory of intelligence and progress over the forces of obscurantism and officialism.

The Conversion of Alderman Gibson, of Manchester.

"Still it moves," said Galileo, speaking of the earth in its orbit; and the observation is recalled by an interesting report, in another column, of the conversion of Alderman Gibson, the Chairman of the Manchester Corporation Gas Committee, to the true faith in matters of municipal gas administration. Granted, the worthy Alderman is in a minority as yet; but seeing that he has only lately raised his banner, it is too much to expect that his cause should immediately prevail against all the forces of use and wont ranged on the other side. The conversion happened in this way: Manchester, like other places, has to face a largely increased coal bill, the natural effect of which would be to diminish the amount of the usual subsidy allocated out of the gas profits to the city fund. The electric lighting business, for other reasons, would not be in a position to hand over any surplus profit at all. In these circumstances, the City Council directed the Committees to revise their estimates, and as a result the Gas Committee proposed to increase the price of gas over the district by 3d. per 1000 cubic feet. The object of this was simply and solely to make up the amount of the usual subsidy of £52,000 a year to the city funds. The resolution to so tax the gas consumer for the benefit of the ratepayer, was arrived at by the Gas Committee in the enforced absence of their Chairman (Alderman Gibson); and the moment he had a chance of doing so, he opposed the increase of price in the City Council. The speech in which Alderman Gibson delivered his soul on this point of policy is worth reading by all municipalizers. So long as the matter of gas consumer *versus* ratepayer was as broad as it was long—while the cause of the gas consumer was, roughly speaking, that of the ratepayer—Alderman Gibson hardly thought it worth while to make a fuss about the robbing of Peter to pay Paul. For years, however, the position of the two interests has been slowly changing. Nowadays the large ratepayers are not the largest gas consumers, as they were a few years back—they mostly use electric light. In addition, the prepayment meter consumer has arisen; and he does not pay rates directly at all. The gas consumer, large or small, is to be taxed for the benefit of the ratepayer, who in each of these leading classes is a different person. Well might Alderman Gibson say that when Parliament heard of what Manchester was doing in this regard, it would be good-bye to municipal trading. This proceeding, indeed, "lets the cat out of "the bag." Why do Local Authorities want to trade? For the benefit of the consumer or the purchaser of their commodities? Not a bit of it. It is because they want to give their rates an illusory appearance of being low, to their own honour and glory. The proposal to increase the price of municipal gas or electricity, in order to make ends meet, is a perfectly legitimate one; but that of charging all consumers of Manchester gas 3d. per 1000 cubic feet more, in order that the Gas Committee may subsidize the rates of the city to the amount of £52,000 a year, is a monstrous abuse.

The Cost of Fussiness.

The plea uttered by Sir Michael Hicks-Beach at Bristol on Wednesday last, for a greater national regard to the ancient virtue of economy, followed, with special appropriateness, the announcement made the previous day by Mr. Wallace Bruce, at the weekly meeting of the London County Council, that the Metropolitan ratepayer's bill for

his proportion of that authority's expenditure during the current financial year will be calculated at 1s. 2¾d. in the pound of assessment, compared with 1s. 1½d. for the past twelve months. The ratepayer is asked to find consolation in the fact that even now he will not be paying so high a rate as he did in 1895-6, when it was 1s. 3d. in the pound. But as the apparent difference in his favour is solely due to the large increase in the assessment of London in the interim, and he is told, moreover, that he must anticipate still heavier rates in the future—the source of increased income referred to (higher assessments) being "for the "present exhausted"—the comparison with the earlier and higher rates (not payments) is little likely to be reckoned as adequate compensation. It is to be hoped, by the way, that the Local Authorities, when revaluing the gas undertakings of the Metropolis this year, will agree with the view of Mr. Bruce as to the possibility of increase being exhausted. The higher rates will be a sufficiently serious matter for them.

The growth of the total rates levied in the Metropolis during the past few years has, indeed, been a matter of no small consideration to an industry whose property is assessed at something like a million and a quarter. Taking three rates only—all outside those levied to meet local expenditure—and comparing them now with the same rates five years ago, we find the County Council requiring 1s. 2¾d., the School Board 1s. 2d., and the Asylums Board 5d. for the current year—a total of 2s. 9¾d., as compared with a County Council rate of 1s. 3d., a School Board precept of 11½d., and an Asylums expenditure of 3d. for 1895-6—a total of 2s. 5½d. The difference of 4¼d. represents between £20,000 and £25,000 a year increase in the rates paid by the Metropolitan Gas Companies.

Much of this increase is doubtless due to needed and justifiable expenditure. Some of it at any rate we know is not. The amount of money wasted annually by the London County Council upon pet parliamentary projects—their ambition to have a finger in everybody else's pie besides the very big one set before them, with its resultant Water Schemes, Portable Photometer Bill, and what not—is, in particular, a perfect scandal. Ordinary mortals would be quite (or more than) content to have on their hands the every-day working of this vast city of ours, involving incidentally such jobs as the Holborn-Strand thoroughfare, to mention one of the many urgently-needed improvements which the Council have on their hands. But the special type of Progressive with which we are blessed has a soul above merely parochial affairs, and would like to be a municipal Universal Provider. He is, however, likely to have his wings clipped at the polls so soon as his ambitions begin to take their full effect upon the rates; and it is obviously impossible to continue increasing the municipal indebtedness without eventually sending up the rate in the pound. The more foreseeing of the councillors are beginning to feel some misgivings on this score. Mr. Wallace Bruce laid stress upon the fact that, taking into consideration the schemes already arranged for, the debt-charge was certain to be an increasing one; and he warned the Council that all work not actually urgent should be postponed. We would suggest, for a commencement, that much of the parliamentary work on which the Council annually spends some thousands of pounds falls within this category of "not actually urgent." And in that opinion the House of Commons certainly appears to share.

A Shady Side of Municipalism.

A curious illustration of the way in which questions of practical politics of the most diverse natures jostle one another in the minds of public men, occurred in the course of last Friday's proceedings of Mr. Oldroyd's Committee. The night before, the House of Commons had passed the Government Bill to compel—or rather to empower—local authorities to better provide for the housing of the working classes of towns, by enabling such authorities to buy land for the purpose outside their own districts. This measure was much criticized on all sides, mainly on the ground that it was not big enough, did not go far enough, was piecemeal legislation, and so forth. The Government defended their Bill on the broad ground that all real progress in these matters must be by steps; and that there can be no more mischievous fallacy for a Legislature to adopt than the notion that what are called "comprehen-"sive" schemes of reform are the only or the best way of attacking the ills of the body politic. The very same argument, in a slightly altered shape, was used by Lord Robert Cecil—who owned that he had not followed the previous night's debate—on behalf of the proposal to allow one of the London Gas Companies to make an innovation upon the established practice of all the Companies in regard to one particular. It had been objected to the South Metropolitan project that it would disturb what was declared to be a precious uniformity in the London Gas Supply, which was tantamount to saying that nothing must ever get out of its statutory rut. Lord Robert Cecil, however, completely pulverized this contention; conclusively showing once more that there can be no progress without difference, and that all real advance must be by steps. When one remembers how strongly the influence of statutory protection and regulation of an interest or an industry acts to lull its official caretakers into a "Sleepy "Hollow" existence, how fatuous appears the inevitable bureaucratic opposition with which every single indication of enterprise on the part of such undertakings is met! To show no sign of bustling life; to go on the jog-trot of statutory duty; to satisfy all official tests and keep all officials in countenance—that is the way to please the bureaucracy of every clime and age.

The canker of *fonctionnairisme*, as it is happily styled in the language of the people who suffer so much from this disease of civilization, has infected British municipal administration more deeply, in places, than the public suspect. Some localities exhibit it more than others. Where there is a quick and lively flow of the best business blood of a town through the municipal offices, it does not appear at all. It would be invidious to single out examples of this clean and healthy Municipalism, which happily exists among us in many towns, irrespective of their size. Here the Town Clerk and all the other important officers of the local commonwealth are the stewards and servants of the community, so that there is no distinction possible between the interests of the Town Hall and those of the townspeople. The members of the Common Council are truly representative men, and are themselves inspired with the spirit and in accord with the desires of the various classes of citizens to which they belong. Very different, unfortunately, is the case of many places that could be named. Here the Town Hall has its own policy; and those councillors who do not belong to the inner ring are very much "out of it" in everything else as well. The most prominent figures of the Municipality are mountebanks, at the mention of whose names the ordinary man of business either swears or smiles, according to his temperament. Nobody in the town either knows or cares what the local magnates will do next. The best men of all classes keep out of public office in sheer disgust. The self-appointed "Labour leaders" in the Council are men who never did a day's hard work in their lives. The aldermen are either fossils or absentees. The picture is not a pleasant one; but it is true. Nor is it the worst that could be drawn. The advent into this country of electric tramway companies is already introducing into English and Irish municipal life some of the worst features of American town politics. It is said that in the United States the street railway companies own the towns; and this is what they are trying to repeat over here. Already the tramway companies "run" their candidates for election on the district and town councils. They are accomplished electioneerers, whatever they may be as electricians. Then when they go to Parliament, the voice of the local authority they have helped to constitute is accepted as that of the inhabitants of the locality. The future of British Municipalism is anything but cloudless.

The Spirit of Sweet Reasonableness in a Trade Union.

The annual report of the United Society of Boiler Makers and Iron Shipbuilders, recently issued, deserves passing notice on account of the spirit of reasonableness and the real common sense which characterize its general observations—a reasonableness and sensibility which, if they could only be generally diffused among Trade Unionists, would do much to lessen the occasions of friction between masters and men. The report comments upon the fact that, owing to the glut of shipbuilding orders in the past year, and the consequent inability of builders to undertake to complete proffered orders within the time allowed, not a few of them left our shores and were placed abroad; and it then calls attention to the possible future effect of such a diversion of business upon the shipbuilding industry of this country

when the trade returns—as it is rapidly returning—to normal conditions, and points a wholesome moral for the members of the Society. "Work once lost is hard to re-"cover again, and [the transfer of orders abroad] should "prove to all workmen, the Society's members included, "the necessity of keeping good time, and thereby doing "their part towards helping ship producers to retain their "position." How true, and how generally forgotten by the Trade Union agitator and his dupes!

The report proceeds to refer with much satisfaction to the fact that the past year has been singularly free from any labour difficulties involving great issues; and it then makes some very sensible observations upon a frequent source of irritation between engineering employers and their men—namely, questions of demarcation. Difficulties arising therefrom have, the report points out, caused, from time to time during the past year, a little uneasiness; but "although such questions are vexatious, yet there is not "the slightest reason why they should not, as time rolls "on, be even more readily adjusted than hitherto, espe-"cially if those concerned will give just consideration to "the class of material used, the class of work to which "the disputed job is more closely allied, and, most im-"portant of all, allow reason and common sense the right "to decide, not allowing obstinacy and unreasoning dogged-"ness to prevail." If only that "most important of all" clause could be printed in large letters, framed and hung up in every workshop in the kingdom, and allowed to influence the conduct of the men, what a different country ours would be.

We must be allowed one more quotation from this report—which we should like to feel we could hail as a sign of better times, but are lamentably pessimistic thereupon—and that quotation is from the concluding remarks of the General Secretary, who, after expressing the hope that the future may witness a great desire on the part of the members to educate themselves, and to do the best work they can, says:

> I know it may be said that, in these days of machine labour and competition, it is difficult to put one's personality into one's daily work, and that man becomes daily more and more but a piece of machinery; yet I make bold to say that, machinery and competition notwithstanding, all true men feel a glow of pride when they have accomplished any excellent piece of work, from the best and highest art to the very humblest piece of labour it is possible to perform.

It has so often been our duty to comment adversely upon the unenlightened and mischievous utterances of Trade Union officials—blind, often wilfully blind, leaders of the blind—that it is a pleasure to put on record the courageously sane declarations of the Boiler Makers' Executive. May their influence grow and prevail.

The Committee on Municipal Trading.—The Joint Committee of the Lords and Commons on the subject of Municipal Trading is constituted as follows: Earl Crewe, Viscounts Hampden and Peel, Lords Windsor and Rothschild, Sir Walter Foster, Sir Leonard Lyell, Mr. Lewis Fry, Mr. Hobhouse, and Mr. Grant Lawson. The Committee met for the first time on Thursday to select a Chairman and arrange the order of business.

Patents in the Past Year.—The report of the Comptroller-General of the Patent Office for 1899 shows that there were 25,786 applications for patents, and 20,015 provisional and 14,005 complete specifications submitted, while the number sealed was 14,160. The number of applications for designs was 19,495, and the number registered 18,470. Trade-mark applications numbered 8927. The receipts from patent fees amounted to £202,977, as compared with £200,418 in the previous year. The increase in acetylene lamp patents has been accompanied by a considerable decrease in those for oil and incandescent lamps.

A Century of Chemistry at the Royal Institution.—Professor Dewar delivered the second of his lectures on the above subject on the 3rd inst. Continuing his examination of the work of Davy, he showed how the electro-chemical theory had originated and been developed. He attributed to Davy the first clear and philosophic conception of an element as simply a body which cannot be decomposed by any methods at our command. The lecturer emphasized the fact that it was the invention of the safety-lamp which gave Davy a place in popular estimation which his abstract researches would hardly have won for him. He repeated Davy's experiments on flame; pointing out how steadily he moved onward by well-ordered stages to a complete understanding of the fundamental problem involved in providing a safe light for miners. Showing the enormous pressures developed by an explosive wave travelling in long galleries, Professor Dewar noted that in some conditions occurring in modern mines the Davy lamp might not afford absolute protection. This, however, did not detract from the value either of the practical invention or of the admirable scientific work which made it possible.

WATER AND SANITARY AFFAIRS.

The East London Water-Works Company are to be congratulated on having piloted safely through the House of Commons Committee of which Colonel Gunter is Chairman, the Bill by which they are seeking the powers denied to them by the Upper House last session. The Company wish to build two reservoirs which will give them additional storage to the extent of 5300 million gallons, and bring their total up to 7500 million gallons. They also desire to be in a position to draw from the Thames, with the consent of the Local Government Board and the Conservators, an extra supply of water in cases of emergency—the quantity to be taken not to exceed 30 million gallons in one day, or in one half year more than such quantity as would be equal to a daily average of 10 million gallons. For the purposes specified in the Bill, and others on which capital may legitimately be expended, the promoters asked for authority to raise £1,800,000. The proposals of the Company were objected to mainly by the County Councils of London, Middlesex, and Hertfordshire. Mr. W. H. Dickinson, now the Chairman of the first-named Council, and for some time Chairman of its Water Committee, gave expression to the views of a certain section of that body by characterizing the proposed works as unnecessary, in view of the existence of the intercommunication scheme, and, moreover, as an extravagant way of providing water for East London, seeing that the whole supply would in the future be in the hands of a Central Authority. Sir Alexander Binnie naturally supported his Chairman. He pointed out that last year—a time of drought—the Company, with half their authorized storage, were able, by the aid of other Companies, to supply their district; and the inference to be drawn from his evidence was that no additional powers were needed. Sir Alexander did not tell the Committee how far the County Council were instrumental in securing the passing of the measure which rendered this assistance possible. But although this help is available, it would be manifestly better for the Company to resort to their neighbours only in cases of emergency. Sir Frederick Bramwell took a different view of the matter. He said the proposed scheme would do for the Lea just what the Staines scheme will shortly do for the Thames—relieve the river when it is full, and store the water for use in times of drought. The weighty engineering evidence given to the Committee for the promoters satisfied them. The opposition of the Hertfordshire County Council was based upon a fear that the Company were going to use some of their new capital for sinking additional wells in the county; but on being satisfied on this and other points, they withdrew. Their neighbours in Middlesex submitted that no case of real necessity for the Bill had been proved, and that therefore it should be rejected. The Committee did not agree with them, for they passed the preamble and subsequently settled the clauses, including the now familiar "sterilization" clause. There appears, therefore, to be every prospect of the measure going safely through the other House.

A less satisfactory result, from the promoters' point of view, attended the inquiry by a Committee of the House of Lords, presided over by the Earl of Lauderdale, into the Bills promoted by the Local Authorities of South Essex to obtain parliamentary sanction for the constitution of a Water Board to acquire the undertaking of the South Essex Water Company and construct additional works for the supply of the district, and by the Company for an extension of their works and limits of supply and for additional capital. The combined authorities were before Parliament in virtue of a pledge given to a Committee last session that they would formulate a scheme for the water supply of their district; and on this understanding the Committee threw out the Bill promoted by the Company. The associated authorities entrusted the engineering part of their case to Messrs. Rofe and Mansergh; and their Bill appears to have had the almost unanimous support of the inhabitants. At the same time it encountered strong opposition from various quarters, on the ground that the carrying out of the project would have a very deleterious effect upon the water supply in the Cam Valley. The East London Water Company condemned the scheme as one likely to result in financial failure, and one, moreover, for which there was no necessity; and the Company more immediately concerned protested against being ousted from a position in which they believe they have done their duty.

They characterized the scheme as the worst which had ever been presented to Parliament. Hertfordshire was alarmed at the effect which the sinking of the proposed wells would have upon the county; and Cambridgeshire contemplated the draining of the Cam to the point of exhaustion as the result of carrying out the suggested works. A good deal of evidence had been prepared on these lines; but the Committee were evidently satisfied that there was no justification for constituting the proposed Board. With regard to the Company's application, an increased supply of water was acknowledged to be needed for their district; and it was proposed to construct works to augment the present 2¼ million gallons to 5½ millions, which would, it was stated, suffice for the next fifteen years, and supply double the existing population. Though evidence in support of the Company's Bill was given by two such competent experts as Mr. E. K. Burstal and Mr. Baldwin Latham, the Committee rejected it as well as the other. We are rather surprised at their decision. The creation of a new body may not have been necessary; but if, as the Committee were assured, the population of the district is increasing by "leaps and bounds," the Company entrusted by Parliament with the duty of providing it with a necessary of life were surely justified in asking for such additional powers as would enable them to discharge that duty more efficiently.

There was a certain air of placidity at the half-yearly meeting of the West Middlesex Water-Works Company on Tuesday, resulting doubtless from the temporary relief from agitation brought about by the *quietus* given for the present session to the projects of those arch-enemies of the London Water Companies, the Progressives of the London County Council, and by the announcement by the Directors that they were in a position to recommend a dividend at the rate of 10 per cent. per annum. Their report was mainly a review of recent events connected with the water supply of the Metropolis; and the speech of the Chairman (Mr. Edmund Boulnois, M.P.) was little more than an amplification of that document. It was nevertheless interesting from the fact that Mr. Boulnois occupies a seat both at Spring Gardens and at St. Stephen's, and thus he is in a position to give the shareholders his personal opinions as to what goes on in both assemblies. He spoke in highly appreciative terms of the manner in which Lord Llandaff conducted the important inquiry entrusted to him and his colleagues, and expressed his individual belief that not a single thing that could be examined, whether for one side or the other, was left untried. That the Water Companies came out of the trial as well as they did was due to the fact that their opponents were unable to prove their case—in truth, they had no case. Though Mr. Boulnois does not think there is any probability of the County Council attacking the Companies in the immediate future, he confessed that he would not be surprised—knowing the parties as he does—at their making some attempt to spend a little more of the ratepayers' money in harassing the Companies. In fact, signs are not wanting of a movement in this direction. How much has already been squandered in this way we shall know when the return on this subject which is understood to be in preparation by the Council is issued. However, for the present there is peace, and the Company are pushing on with works to help them to meet their increasing business. They have a large district in the neighbourhood of Willesden, which is being rapidly covered with houses; and the new services laid on during the past half year brought up the total to 85,356, of which 80,875 are under constant supply. While the requirements of the consumers are thus being fully met, their pecuniary interests are not left out of consideration by the Directors; the rebate of 10 per cent. from the statutory water-rates—amounting now to about £28,000 per annum—having been continued to all the Company's customers. This is a by no means inconsiderable concession, which is jeopardized by every hostile action on the part of the Progressives at Spring Gardens.

By the will of the late Mr. G. J. Symons, F.R.S., a valuable bequest is made to the Royal Meteorological Society. Mr. Symons was a great lover of old books, and succeeded in getting together an extensive meteorological library. He bequeathed to the Society all his books, pamphlets, maps, and photographs a copy of which is not already in the library; also his Cross of the Legion of Honour, his Albert medal and other decorations, the testimonial album presented to him by the Fellows of the Society in 1879, and the sum of £200.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1392.)

The Stock Exchange has had a much brighter week. Thanks to the pronounced relaxation of stringency in the Money Market, and to the continuance of good news from the seat of war (culminating on Saturday in the relief of Mafeking), there was a steady improvement all round; and prices of almost all descriptions have advanced. But still business was always somewhat restricted to the inside circle; and the public did not rush in. Consequently, towards the close there was the usual profit-snatching, which administered a slight check to the advance. The settlement was got through without any difficulty of importance. The supply of money continued very abundant, amply sufficient to cope with all demands in addition to the requirements of the Stock Exchange; and discount rates have declined materially. The Gas Market naturally offers an exception to the general advance in values; the process of reduction of quotations to harmonize with the altered conditions of the coal supply being still in progress. There are a good many changes to note; and all downward, with one significant exception. The chief interest in regard to the Metropolitan Companies has lain in the Parliamentary Committee Room, where the unworthy attempt to legalize rough-and-ready haphazard photometry was defeated, and the ill-conceived scheme for fettering free trade in fittings resulted in the local authority practically accepting what the Companies have voluntarily been doing without demanding to be harassed. The Gaslight Company have not carried their Bill; and the ordinary stock was flat. It opened at par; but the final mark was no better than 96½. Very little was done in the secured issues; but the preference fell a point. South Metropolitan scored an advance early in the week; but the Company's later success with their Bill did not seem to catch the market's eye. Commercials, old and new, were steady; but the debenture lost a point. More or less considerable amendments were made in the Suburban and Provincial quotations, affecting Brentford, Brighton, and Tottenham. Business was very limited in the Continental Companies; and prices fell for Imperial, Union, and European. Nothing occurred among the remoter Companies, beyond a slight fall in River Plate. In the Water Companies, there was again a general set-back of prices, but not severe.

The daily operations were: Business was very quiet on Monday; but changes were numerous. Brentford new fell 5, Union 2½, both Brightons 2, Gaslight ordinary and preference 1 each, Imperial 1, River Plate ¼, South Metropolitan debenture 1; but the ordinary rose ½. In Water, East London and Southwark fell 3, ditto "D" 2, New River 2, and West Middlesex 1. Tuesday was a busier day; and South Metropolitan rose 1. Wednesday fell quite quiet; and prices did not move. Thursday's transactions were also very limited; and Gaslight ordinary relapsed 1. In Water, West Middlesex was set back 1, Lambeth 2, ditto 7½ per cent. 1, and Grand Junction ½. On Friday there was considerable dealing in Gaslight ordinary; but nothing moved, except Commercial debenture, which was 1 lower. Saturday was a quiet day; but a number of changes were made. Gaslight ordinary fell 1½, both Europeans ½, Tottenham "A" 17½, and ditto "B" 3½.

ELECTRIC LIGHTING MEMORANDA.

Electrical Schemes at Westminster—The Electrical Business of the Brighton Corporation—Touting in the Midlands—The "Electrician" Replies.

The consulting electrical engineers and their natural allies—or opponents, as occasion serves—the mechanical engineers, have been very much in evidence in the Westminster corridors during the past week. Several Committees have been painfully wrestling with phases, and volts, and ampères, and the other fearful wildfowl of the electrical field; and the local atmosphere, usually poisonous enough with other exhalations, has had to bear an extraordinary load of magnetic force. The fortunes of the remarkable proposal to unite Manchester with Liverpool by means of an express electric railway, have been trembling in the balance; and much progress has been made with those particularly "stodgy" Bills which relate to schemes for generating electricity in bulk. Meanwhile, a ray of practicality has been shed over the endless hypothetical discussions on electric traction, by the announcement that the experimental electric trains of the Metropolitan and District Railways are to shortly begin working in the ordinary course at Earl's Court. There is much comfort in the "accomplished fact," in every branch of engineering; and the success of this important venture will have results which it is impossible to foretell.

Great interest naturally attaches to the affairs of the Brighton Corporation Electric Lighting Committee, by reason of the praiseworthy enterprise shown by the Corporation in endeavouring to adapt their system of business to the needs of the smaller householders. The Wright system of charging not only originated at Brighton, but it has been more thoroughly carried out there, under the supervision of the inventor, than anywhere else. The character of the district seems to be peculiarly suitable to the plan. Indeed, the "Electrical Review," in discussing the accounts of the undertaking for the past and previous years,

admits that it is only here that the arrangement has been carried to its logical conclusion, whatever that may be. The charge per unit starts at 7d., and drops to 1d.; the average working out to less than 3d. per unit. Surely, if electric lighting is available for the poor man anywhere, it might be supposed to be so in Brighton. Yet the business does not really pay even here. The capital expenditure is already £291,000, on which there was earned a gross profit of £16,794. Out of this has to be paid interest £7146, and redemption £8099, which leaves what is called a net profit, "carried to reserve fund and credit of rates," of £1549. Not a penny for depreciation! Is this a solvent business? The "Electrical Review" admits that the smallness of the profit balance is not only due to the legitimate influences of reduced price and rising working expenses, but is also referable to the "liability towards special or exceptional outlays for heavy repairs." This evil Brighton shares with Manchester and most other places where the bloom has faded from the generating and distributing plant. In the circumstances, it is high time these prematurely aged municipal electric lighting undertakings were put upon a sounder financial basis. Their secret cannot be kept from the ratepayers for ever.

The Government Inspectors must be sick and weary of listening over and over again to the fables of the usual run of electrical advisers of the small Local Authorities whom their blandishments have assisted to entrap into electric lighting schemes, always warranted to pay handsomely towards the relief of the rates. News of some kinds travels fast enough in these days; but useful information concerning the disappointments of some Municipalities who have trusted these gay deceivers not wisely, but too thoroughly, does not appear to circulate as freely as Divorce Court reports. And when the plunge has been made, with what whole-souled devotion do these Local Authorities commend their new shop to the patronage of possible customers! Even where there is a gas undertaking under the same ownership, the new love is scandalously favoured in preference to the useful old public service. A gas consumer of a Midland town forwards for our inspection a copy of a very creditable "puffing" circular which the town clerk of the enterprising municipality has sent out with the object of ascertaining the volume of trade which the new electrical department of the corporation may expect to have to deal with at the start. This circular sets out the "advantages of the electric light" in due form, among which it is recited that the proposed price of 4d. per unit is equivalent to gas at "about" 2s. per 1000 cubic feet. The local price of gas is from 2s. 8d. to 2s. 5d. per 1000 cubic feet. The good people of the town are further assured that the electric light is "far healthier" than their own gas, and prevents "the injury caused by the moisture, sulphur, and soot given off by gas"—their own gas! It would serve the corporation right if, after they had frightened the people off gas, the dearness and unreliability of their electric light were to drive them to use petroleum for choice.

The "Electrician" has deigned to notice our challenge to establish its claim to the superior accuracy of electricity-meters as compared with gas-meters. This is the way of it: The altogether unwarranted assumption is first made that we supposed our contemporary to have originated the misstatement complained of. Reference to our observations on the subject will completely dispose of this allegation. What we complained of was that the misstatement was repeated by our contemporary, as if it adopted it, without adequate support from the original text. Now we get the additional matter, which turns out to be a purely general statement in extenuation of the inaccuracy of electrical meters. It is here: "It is to be noticed, in addition, that in gas-meters also great accuracy cannot be attained. Owing to the influence of the pressure of the gas, temperature, and the chemical composition of the gas, which primarily determine the heat energy conveyed by the gas, the gas-meter is burdened with so many sources of error as a work-measurer that, as compared with it, the electricity-meter in its present form must be designated as quite an accurate apparatus, even at small loads." What does this amount to? We asked our contemporary to put into figures the reputed accuracy of electrical meters, and gave a statement of the same character referring to gas-meters. Now the "Electrician" calls our challenge a "ridiculous" one. Is it? This is no small matter. We willingly absolve our contemporary from any blame for not having supported the original German statement with figures which, as a matter of fact, were not in the context. But what are the cold facts of the question? We have shown what the gas-meter does, pressure, temperature, &c., notwithstanding. Does the electricity-meter do better? If so, let justice be done. We engage to pillory the gas-meter makers, if it is proved that they are outclassed.

Masons and the Gas Institute Meeting.—A Committee of the Evening Star Lodge has been formed to make arrangements for an Emergency Meeting during Gas Institute week—on somewhat the same lines as in recent years when the Institute has met in London. Monday, June 11, has been the day selected; and invitations (with full particulars) will be forwarded to Masons desiring to attend, on application to the Secretary of the Lodge, Bro. Walter T. Dunn, at No. 47, Fentiman Road, Clapham, S.W.

THE PARIS INTERNATIONAL EXHIBITION.

The Gas Pavilion—The Lighting.

Of the thousand-and-one objects of interest which have been brought together on the banks of the Seine to attract visitors from all parts of the world to the City of Light, those which should first claim the attention of the gas engineer or manager will necessarily be the objects connected with the industry with which he is associated. These will be found in Classes 20, 74, 75, and 87 in the Exhibition, where manufacturers of motors, lighting and heating apparatus, and material used in the construction of gas-works have placed on view a good representative collection of their specialities. But, as readers of the "Journal" are aware, a building has been specially erected to contain a collective exhibit of gas appliances, in order that visitors may have an opportunity of witnessing under one roof the various uses to which gas may be put, whether for lighting or for culinary, heating, or industrial purposes, and the methods and instruments employed for measuring its consumption and testing its quality. The project, it will doubtless be remembered, is in the hands of an Executive Committee, of which M. Eugène Lebon is President. The Gas Pavilion, which was described and illustrated in the "Journal" for the 16th of January last, is a light and graceful structure, erected to the designs of M. Georges Roussi; and, although the arrangement of the contents has been somewhat delayed, this is now being rapidly proceeded with, and it is expected to be completed before the end of the present month. Those members of the Gas Institute who purpose joining the excursion to Paris after the next meeting will consequently have a good opportunity of inspecting the results of the Committee's labours. In having a special building for a collective gas exhibit, they have followed the plan adopted on the occasion of the Exhibition of 1889; and, as on that occasion, the necessary funds have been raised by an appeal to the parties specially interested. The Company with which the names of MM. E. & A. Lebon are associated head the list with 30,000 frs.; the Paris Gas Company follow with 20,000 frs.; and other companies and firms connected with the gas industry contribute sums ranging from 17,000 frs. downwards.

So much for the preliminaries under which the Pavilion has been erected. Before describing its arrangements, regret may be expressed that, in view of its architectural features, a better site than the one allotted could not have been secured for it. As compared with the Pavilion at the 1889 Exhibition, it is practically hidden away. It stands at the very edge of the block of buildings on the eastern side of the Champ de Mars, behind the section devoted to Mines and Metallurgy; the space between the two buildings being rather narrow. At the back of it run the electric railway and the moving platform which make the circuit of the inner sides of the Exhibition buildings on the left bank of the river, a station of the former being immediately adjacent to the north end; it abuts on the Avenue de la Bourdonnais; and it is about 100 yards from one of the main entrances to the Exhibition—that of the Porte Rapp, opposite the end of the avenue of that name. It can therefore be easily reached from this point, to which several lines of omnibuses run; and it can be found with little difficulty from the Eiffel Tower—the usual *rendezvous* of small parties. From the Tower the visitor has only to enter the Palace of Mines and Metallurgy on the left, and go through it in a diagonal direction till he reaches the Swedish Court, when a turn to the left, passing the British exhibits, will bring him out opposite the Pavilion. Or from the Eiffel Tower he may walk for about 200 yards in the direction of the cascade, enter the above-named Palace by the door under the staircase, and pass straight through to the Swedish Court already mentioned.

Having arrived at the Pavilion and passed its gilded gates, the visitor will ascend to the principal floor by a broad flight of ten steps. As he does so, he will notice upon the walls on either hand the names, in letters of gold, of those by the aid of whose subscriptions the building has been erected and its varied and instructive contents brought together. Turning to the left, the first object to meet the eye is a large statue, 10 feet in height, of Philippe Le Bon—whose name stands out so conspicuously in connection with the introduction of gas lighting—occupying the centre of a spacious well-lighted hall. On either side are apartments decorated in effective styles, and fitted up in different ways to show the applicability of gas as a lighting and heating agent. On the left-hand side, the first room will be arranged as an office; the next as a bedroom; and the next will be ornamented with a beautiful Louis XV. lustre. Then will come a bathroom, with its bath-heater, and a statue of Psyche for lighting; and a workroom, lighted by a Wenham lamp. In the next room will be found a collection of meters and stoves, &c.; and in the succeeding one, lighted by a metal hanging lamp and wall brackets, the visitor will witness the method of using gas for glass blowers' and jewellers' work. Then comes an apartment with some more bath-heaters and other appliances, and the visitor passes out of the main hall into a large room in which heating and lighting apparatus will be shown. Two large gas cooking-stoves, each about 6 ft. 6 in. wide, occupy the space against the end wall; that on the east side (next the electric railway) being devoted to chemical, laboratory, and other apparatus. In this hall an excellent example will be afforded, by means of five lustres, of lighting an area by reflection. Returning to the main hall, the

first apartment on the east side will be another bath-room, containing a handsome chandelier composed of nine burners placed above cut-glass almond-shaped saucers. The fitting up of the next apartment has not yet been determined upon; but the succeeding one will be a dining-room, lighted by a Bengel chandelier in which figures the imitation candle, with the gas-jet for the flame, which was at one time a familiar object in connection with gas lighting. Passing the dining-room, the visitor comes to an apartment fitted up as a kitchen; a large cooking-stove, by Drouet, with a plate-warmer above, being already in position. Ordinary culinary appliances occupy the next apartment; and then the visitor reaches an elegantly-furnished dining-room, lighted by a Henri II. pendant. The last apartment is a drawing-room elaborately furnished in the Louis XVI. style.

Ascending the staircase—on the walls of which will be found framed drawings of M. Chevalet's scrubber and tar condenser, and of his apparatus for making alkali and sulphate of ammonia, as well as two coloured drawings of regenerator settings by MM. Frère et Hovine (one by the latter gentleman showing his system of heating a setting by a furnace located apart therefrom)—the visitor reaches the landing leading to the reception-room and to the galleries over the apartments in the large hall. In going up, he will not fail to notice the two massive brass stair-lamps, with large glass globes cut in the lower and opaque in the upper portion, projecting from the walls at the half landing; nor will the elegant metal-work lamp suspended from the ceiling escape his attention. Passing on to the galleries, he will find on the left-hand side of the building three large windows opening on to balconies, with book-cases between them, and tables and recesses for the exhibition of photographs, &c. In the case between the first and second windows are bound volumes of the Transactions of the Société Technique du Gaz en France and of publications connected with the gas industry. The other case contains various samples of burners. From the centre of the cross gallery, the lecture-hall under the dome of the Pavilion is entered. Here the visitor finds himself in a spacious room, lighted in the daytime by two windows—a large one looking over the Avenue de la Bourdonnais, already mentioned, and the other on to the Exhibition buildings—and at night by a large chandelier and wall lights in brass and crystal. Returning to the hall, and passing along the gallery on the east side, the visitor will find upon the walls photographs of French and other gas-works (sixteen views of those at St. Etienne), and a plan of the gas-mains in Paris as they existed in the year 1843. This plan will doubtless be studied with much interest; and it is to be regretted that no intimation is given of a companion one, showing the present extent of the canalization of the city, being placed upon the walls. As the gas consumption of Paris in 1855—twelve years after the above-named date—was about 1440 million cubic feet, while last year it was nearly 11,504 millions, the extent to which the subsoil of the streets is now occupied by the Gas Company's pipes, as compared with rather more than half a century ago, would be something astonishing. Exceedingly interesting historical documents will be found on the walls at this part of the gallery. Photographs will be exhibited of Le Bon's house, as seen from the street and from the garden; and they will be accompanied by a biographical notice and a copy of the specification of his patent. Le Bon was born at Brachay, near Joinville (Haute Marne) on May 29, 1767; and it was at about the age of twenty-two that he carried out the experiments which led to the discovery of the method of producing combustible gas from wood. According to a *brochure* published by his nephew—M. Gaudry—Le Bon continued his experiments at the suggestion of Fourcroy, and in the Year VIII. of the Republic he read at the Institute a remarkable paper giving the results of his labours. But it was not until the following year (1799) that he took out his patent, which bore the date of the 28th of September. Murdoch, however, had been using gas for lighting his house in Cornwall—the house which was shown in the "JOURNAL" for the 1st inst.—from 1792. But there appears to be a still earlier claimant than either Murdoch or Le Bon to the honour of the discovery of coal gas—one Minckelers, a Dutchman, in 1784. The text of the document in which he sets forth his claims will be shown in its original language accompanied by a translation in French.

We have lingered in the gallery of the Pavilion, and must now descend to the basement, the floor of which is a few feet below the ground level. It is reached from the landing facing the entrance to the building, as well as by a staircase at the end of the group of apartments on the east side of the large hall. Various will be the appliances shown here. Commencing on the left-hand side, two conspicuous objects will be a big meter and the Paris Gas Company's large tyre-heater. The apparatus used in the application of gas to pottery work and to other industrial operations, including confectionery making, are next seen. Then come meters, pressure-registers, &c., by the Companies with which the names of MM. Thiercelin, Chamon, and Brunt are associated; and M. Chevalet's washer, condenser, and scrubber are on view here. At the end of the basement is the door leading to the dark-room in which photometrical observations will be conducted. On the east side of the basement, the visitor will be able to inspect the apparatus for the production of aërogen gas, and witness the application of coal gas as a motive power. Machines for ironing, printing, and burning off yarns are located here; also gas-engines by Niel, Charon, Dehaître, Panhard, Fritscher, Nouvelet, and by the Paris Gas Company, as well as one of the Otto type.

In taking leave of the Gas Pavilion, it only remains to say that the Executive Committee have secured the co-operation of upwards of thirty French firms in making the collection of exhibits shown therein as thoroughly representative as possible. Only a general indication of their character can be given at the existing stage of the arrangements; but for the particulars we are now able to present we are indebted to the courtesy of M. Leclerc, the Engineer of the Compagnie Centrale, who has been very zealous in his endeavours to make the historical part of the collective exhibit as complete as practicable. Unfortunately, England has not responded so promptly as could have been desired in support of the claims of Murdoch as the inventor of gas lighting. Space would, however, readily be found for any photographs, prints, or copies of documents, specifications, &c., bearing upon the early history of gas lighting.

We now come to another matter in which gas engineers will certainly be interested—the lighting of the Exhibition. This, in the main, is done by electricity; and such is the prominence given to this illuminant, that a Palace has been specially devoted to it. Not only is electricity employed for lighting, but it is also used for motive power; the current being generated at a central station in the Exhibition, and conveyed to the spot where it is required. Unfortunately, much difficulty has been experienced in getting the heavy exhibits into position; and consequently some of the machinery which is to generate current is not yet in operation. Sufficient is at work, however, for lighting restaurants, promenades, &c. The arc and incandescent systems are both extensively employed. The great show-piece of electric lighting is, very appropriately, the *façade* of the Palace of Electricity, in front of which stands the Château d'Eau, or water cascade, which, so to speak, forms its lower portion. The roof takes the form of an immense arc of a trefoil circle, formed by the junction of several smaller arcs, and it rises to a central point at a height of 230 feet. Here is an allegorical figure representing Electricity standing in her chariot brandishing the torch of Progress, and having behind her a great glass sun which, when lighted up, sends forth brilliant rays. This beautiful piece of work, which is called by many the *clou* of the Exhibition, is illuminated by something like 5000 incandescent electric lamps, eight arc lamps with projectors of various coloured glasses, and four similar lamps furnished with reflectors. When these are all in operation, the spectacle presented is certainly unique. Unfortunately, a fire broke out in the Château d'Eau last Tuesday, which, although rapidly and without difficulty extinguished, so damaged the switch-board connections as to seriously interfere with their use for a few weeks. Some effective electric lighting by incandescent lamps is to be found in the vicinity of the Eiffel Tower; and this structure itself has its outlines illuminated on Sundays. A pretty piece of lighting, though somewhat of a theatrical character, is to be seen at the Luminous Palace, constructed entirely of glass, and lighted by incandescent electric lamps. Close by, the Costume Palace and its restaurant will not fail to attract notice for their lighting arrangements. On the other side of the Tower is the Optical Palace, the restaurant attached to which is highly effectively lighted. These are the most striking features of the electric lighting arrangements as far as they have been carried out; and the accident above alluded to will cause further delay in their completion. This backwardness—the exhibition having been open more than five weeks—is much to be regretted; and it is giving rise to complaint. To make matters worse, the current which can be generated is not, it appears, always to be relied upon; for a few evenings ago the restaurant just referred to had to close on account of failure of the supply.

We have left till the last a description of the lighting of the Parks of the Champ de Mars by the Paris Gas Company. Reference has been already made in the "JOURNAL" to this very striking piece of work, which has been carried out by the Company in conjunction with the French Incandescent Gas Company and the Denayrouze Company. The gas is supplied at ordinary as well as at high pressure (8 inches); the compressing-station being close to the Optical Palace above referred to. The area covered extends from the Palace of the Trocadéro, on the right (or north) bank of the Seine, to the Château d'Eau already mentioned, with the exception of the bridge by which the river is crossed. This is a distance, according to the official plan of the Exhibition, of 1166 yards, as the crow flies; and the portion of the area extending from the south of the Tower to the Château d'Eau is from 165 to 175 yards wide. In the neighbourhood of the Trocadéro, the lamps extend into the side walks. The entire area allotted to the Companies is lighted by 4750 burners—3000 supplied by the Incandescent Gas Company and the remainder by the Denayrouze Company. The first-named Company have 260 lanterns, each fitted with a single burner consuming 10·6 cubic feet of gas per hour; 430 with three burners, each passing 8·8 cubic feet; and 40 with five burners, each consuming a like quantity. All these burners are supplied at the ordinary pressure. Those served with compressed gas are as follows: 90 lamps with two burners, 20 with three burners, 20 with five burners, and 60 with ten burners—all consuming 12·3 cubic feet of gas per hour. The total light yielded by the entire quantity of gas consumed with this Company's burners is estimated at nearly 620,000 candles. The Denayrouze Company have gas supplied at normal pressure to 180 lamps, each fitted with one burner consuming 10·6 cubic feet per hour, and to 360 lamps

with three burners passing 8·8 cubic feet each. High-pressure gas is supplied to 60 lamps with two burners, to 15 with three burners, and to 30 with ten burners—all consuming 12·3 cubic feet each per hour. The total light yielded by this Company's installation is estimated at 285,000 candles—making altogether 905,000 candles; the consumption of gas being about 60,000 cubic feet per hour. The columns employed appear to have been specially designed for the Exhibition. Some are of the ordinary height, and have the usual type of Paris lantern, while others are much taller, and carry globular lamps with the upper portion fitted with reflectors. Though the effect of this unexampled piece of illumination may be very well appreciated from the ground level, the plan adopted for the distribution of the brilliant light-centres will be best made out from the first stage of the Eiffel Tower; and an ascent thus high may be recommended. Apart from the foregoing scheme, incandescent gas lighting is to be seen at several of the restaurants; and lines of ordinary gas-jets are employed for marking the upper portions of the buildings on either side of the Champ de Mars. It will thus be seen that, notwithstanding the prominence given to electricity at the Exhibition, opportunity has been found for showing that gas is still capable of holding its own as an illuminant; and, moreover, it was ready to time and has never failed.

PREDICTIONS—GENERAL AND GASEOUS.

It has not unfrequently been a subject of reflection with us whether the prophets of old were really endowed with some supernatural power of forecasting the future, or whether they were merely men possessing more than ordinary clearness of insight into present things, which enabled them to predict what might happen in the time to come. However this may be, it is certain that persons have lived whose predictions have been verified in a remarkable manner. In connection with this subject, the mind reverts at once to the prophetic couplets of the personage popularly known as Mother Shipton, who in the time of Henry the Eighth foretold the deaths of Wolsey, Lord Percy, and others, and threw out some remarkable indications of the possession of a capacity to look into the future. If the prophecy attributed to her that "the end of the world would come in eighteen hundred and eighty-one," is not a forgery, as it is generally believed to be, she was certainly very much out in her reckoning. But her statement that people would one day travel upon the housetops and ride in horseless carriages has been verified by the appearance of the overhead railways and motor cars of our own times. And speaking of travel, we recall a passage in which Wordsworth seemed to have a prevision of the "scorcher" of the present day, flying through the country with his eyes steadfastly fixed upon the ground, bent upon making a "record" ride rather than benefiting by contemplation of the beauties of Nature so dear to the heart of the Lake Poet. A few months ago, attention was called by Mr. Hermann Vezin, in the columns of "The Times," to a remarkable prediction in regard to the Suez Canal. The formal commencement of that great work, which now plays so important a part in commerce and politics, was made by M. de Lesseps turning a spadeful of sand at Port Said rather more than forty years since—to be exact, on Nov. 17, 1859; and yet the idea of having such a canal was put forward more than 300 years ago by Christopher (more familiarly known as Kit) Marlowe, the well-known English dramatist and poet, who lived between 1564 and 1593. Before he had reached the age of twenty-three, he wrote a tragedy entitled "Tamburlaine the Great." It was divided into two parts, in the second of which will be found (Act V., sc. 3) these lines:

> "And here, not far from Alexandria,
> Whereas the Terrene and the Red Sea meet,
> Being distant less than full a hundred leagues,
> *I meant to cut a channel to them both,*
> *That men might quickly sail to India.*"

But it is to two predictions with reference to the industry with which the "Journal" is identified, rather than to those mentioned above, that we wish to call our readers' attention. In the course of an interesting article which appeared in the "Evening Standard" last week on "The Lights of London," the writer told a story about Dr. Johnson which we shall venture to repeat, because we do not think it is generally known—at all events, we do not recollect having met with it in "Boswell" or anywhere else—and, further, because the remark attributed to the great lexicographer was made within a few yards of the "Journal" office. It may be stated, by way of preliminary, that in 1684 the first public street-lamps burning oil with cotton wicks were introduced by an inventor named Heming. They were made with thick convex glasses on two or three sides, and threw out rays of light where required for the illumination of the footpaths. This system of lighting was improved and extended from time to time, and reached its highest stage of efficiency from 1744 to 1750. In 1786, a foreign writer described the lamps of London as being "all of crystal glass, each furnished with three wicks, and affixed to posts placed at the distance of a certain number of paces from each other." Oxford Street was reported to contain "more lamps than all Paris;" and they were said to have "a beautiful and noble effect." It was one of these lamps which evoked the remark recorded in the following extract from the article in our contemporary:—

> It is said that as Dr. Johnson was one evening leaning out of the window of his house in Bolt Court, he observed the parish lamplighter nimbly ascend a ladder for the purpose of lighting one of these street-lamps. The man had scarcely descended the ladder half way when he discovered that the flame had expired. Quickly returning, he lifted the cover partially, and, on his thrusting the end of his torch beneath it, the flame was instantly communicated to the wick by the thick vapour that issued from it. "Ah!" exclaimed the Doctor, much interested; "one of these days the streets of London will be lighted by smoke.

The "smoke" referred to by the Doctor was not, as the writer points out, long in coming; for Murdoch lighted his little house at Redruth with gas in 1792. Out of "smoke" he had succeeded in bringing forth "light." Another utterance which partook very much of the nature of a prediction is attributed to the French chemist Le Bon, who a few years later produced gas from wood, which material he subsequently replaced by coal. In a *brochure* which he published, he indicated how his gas could be distributed by means of pipes to the inhabitants of towns; and he pointed to a time when, by its aid, light and heat would be supplied from Brachay (his native village) to Paris.

THE HOUSING QUESTION AND MUNICIPALISM.

Some of the many unforeseen—or, if pointed out by the prudent, by the ardent Progressive disregarded—results of municipal enterprise were given prominence to in a recent issue of "The Times" in an article dealing with the Socialist and Labour conference held a week or so since at Glasgow. At that conference, much was said of the work that has been done by the Municipality of that city, some account of which was given in the "Journal" at the beginning of the year (*ante*, p. 23), in a review of Sir David Richmond's notes on the progress of Glasgow during the term of his office as Lord Provost. Especially was attention called at the labour conference to the work that has been done in Glasgow in providing houses for the working classes. One of the speakers remarked that, compared with the Glasgow lodging houses, those lately erected in West Ham are "mere mousetraps." This heroic policy for dealing with an admittedly difficult and pressing problem in our large cities has not been attended by unqualified success; it has, indeed, tended to create fresh problems.

First, we are told that in Glasgow, as elsewhere, the people for whom the houses were built do not always avail themselves of the opportunities for decent living so provided. "Even a munificent corporation must exact some rent; and a moderate charge for excellent rooms is too much for some of those who will put up with overcrowding, dirt, noise, and every inconvenience, provided the rent be small and irregularly paid." Then, it is said, the attractiveness and comparative cheapness of the municipal lodging houses is having the effect of drawing to Glasgow more and more of the poorer sections of the country districts. The over-crowding will, if that be the case, remain and flourish side by side with the Corporation debt, which is already not far short of 8 millions. Again, it is not certain that the experiment is even a paying one. "On the lodging houses of the city it is alleged that a dividend of 5 per cent. is earned; but the Corporation 'family home' has not yet proved a success, involving as it does to the town a loss of some hundreds a year." Knowing what we do of municipal book-keeping, we should not be too sure about that 5 per cent.

Moreover, as the writer in "The Times" remarks, we hear of and see chiefly the good effects of such experiments. The reverse of the coin is only seen later. "We hear praise of the comforts of the lodging houses built by pledging the rates. What are not seen are the ultimate and indirect effects on the ratepayers and the recipients of this bounty. . . . Let it be understood that every Municipality is bound to provide lodgings on easy terms, and work at fair wages; and the outlook, when work is slack, will be serious." These facts and possibilities should be carefully weighed and considered by all who wish to see the housing question dealt with practically, but who do not wish to make the remedy produce effects worse than the disease.

The programme of the "Municipal Enterprise" party is well defined as being founded on the principle that "whatever a private person may do with his own, that a Municipality should be able to do with what is not exactly its own." That is just the point. The runners of the municipal machine often have no stake of any considerable size in the efficiency and economy of its working. There is no "director's qualification" required of the municipal councillor, who does not necessarily suffer if the ratepayers'—as a director does if the shareholders'—money be wasted. It is also pointed out, with much force, that there is wide scope for municipal enterprise within its own true sphere, opportunities for municipal energy which from their prosaic and unpretentious character—affording no field for opening ceremonies and self-glorifications—are often neglected for the more showy and "popular" undertakings. "The best sanitary engineers and authorities on hygiene could point to a score of directions in which the most enlightened Municipalities might labour to the great improvement of the health of the inhabitants. Picture galleries and stately municipal buildings and libraries have their place; but a low death-rate, and a general improvement in vitality, are better still. Luxuries by all means in time; but let us first have the necessities of municipal life." That, however, is much too humdrum a programme for the Municipal Progressive.

STOCK CONVERSIONS AND STAMP DUTIES.

The judgment of the Court of Queen's Bench on the 9th inst., in the case of *The Attorney-General v. The Midland Railway Company*, is of considerable importance to all Companies contemplating a conversion of their capital, and also of those who have carried out that operation since 1891. By an Act passed in August, 1897, the Midland Railway Company were authorized to consolidate certain of their 4 per cent. preference stocks into new 2½ per cent. stock; the old stockholders receiving such a larger nominal amount of new stock as would yield the same annual return as their holdings of the old stock. The Company were also authorized to nominally double their ordinary stock. The result of these operations was to add some sixty odd millions to the nominal capital of the Company; and the Commissioners of Inland Revenue claimed that this increment was subject, under section 113 of the Stamp Act, 1891, to a duty of 2s. per cent. The Company resisted the claim; but, by the judgment referred to, the Court have upheld the contention of the Inland Revenue. Should this judgment be confirmed in the Higher Courts, to which it will doubtless be carried, the Railway Company will have to pay rather more than £60,000 duty as the cost of their stock conversion.

The section of the Stamp Act in point requires that, "in the case of any increase of the amount of the nominal capital of any Corporation or Company," a statement of such increase shall be delivered to the Commissioners of Inland Revenue, and the duty paid thereon; and the Court of Queen's Bench have decided that this provision covers all such stock conversions as that effected by the Midland Railway.

Mr. Justice Ridley, in his judgment (in which Mr. Justice Darling concurred), said that "nominal share capital meant the capital of the Company in shares, computed according to the figure value attached to the shares. An increase of the nominal share value would, therefore, take place if the figures of the shares were altered from, say, £100 to £200; and the increase of share capital so effected would be one in respect of which the additional duty provided for by section 113 would be payable. In his opinion, the alteration in the stock of the Midland Railway authorized by the Act of 1897 did amount to an increase of their nominal share capital; and the duty was payable accordingly."

This judgment appears to bear upon the various conversions effected by Gas Companies at different times since 1891, except in the cases where the authorizing Act has contained an express exemption. It is to be hoped that an appeal will be lodged, and will be successful. Otherwise all conversion schemes will—especially since the duty was, by section 7 of the Finance Act, 1899, increased to 50 per cent.—be costly luxuries.

THE COMPETITION OF AMERICAN WITH BRITISH COAL.

As has been more than once pointed out in these columns, the present exaggerated prices for coal in England and on the Continent afford an opportunity, which could not occur in normal times, for American coalowners to compete with British for the European market. That our 'cute cousin across the water is fully alive to his opportunity, now as always, is shown by the following, which is a copy of a recent circular sent out by the Commercial Department of the United States Government to all its Consuls.

The Department have recently received a number of voluntary reports from Consular Officers at different points in Europe upon the scarcity of coal suitable for manufacturing and steamship purposes; and they call attention to the fact that an opportunity offers for the increased exportation from the United States, not only of bituminous, but also of anthracite coal. Certain grades of our steam coal have been found to compare very favourably with similar coals imported from Great Britain or from mining regions on the continent of Europe. During the calendar year 1899, the export of American coal increased by more than 3 million tons over that of the previous year; and there would seem to be exceptionally favourable conditions—which should be promptly availed of—to largely increase the consumption in foreign markets. You are therefore directed to report, with as little delay as possible, upon the demand in your district for imported coal, the total consumption of coal, the kinds and qualities which are especially needed, the prices they command, and the sources from which the present coal supply is obtained. If American coal is already being used, please indicate to what extent, the origin and character of the coal, and whether it is satisfactorily supplying the place of coals previously used. Should there be coal mines in your district which supply the local demand, please state the fact; also whether coal is exported, and to what extent, and the causes and probable duration of scarcity of supply, if such scarcity exists. It is important, if objections exist to American coals, that the reasons be stated; also what tariff or other restrictions upon importations are imposed, and the character of transportation facilities from points in this country, foreign rates, &c.

Some weeks since we informed our readers that American coal had been shipped to Europe; and this fact is referred to by Mr. Vice-Consul Carmichael in his recent report upon the trade of Leghorn. He says:

The coal famine which set in last November has had the effect of attracting American coal to this market. The high price which British coal has now attained more than made up for the handicap in freight with which American exporters have hitherto had to contend. It is probable, however, that the quantity imported would have been considerably larger had the consumers here not been somewhat chary of buying a new kind of coal, of the qualities of which they knew nothing, especially as at first the difference in price as compared with British coal was slight. At present, however, American coal is about 12s. a ton cheaper f.o.b., while the freight from the United States to Leghorn is about 4s. above that from the United Kingdom; thus leaving American coal a margin of about 8s. a ton. Of course, when the British market regains its normal condition, United States coal will again be at a disadvantage, unless favoured by an exceptional condition of the American freight market. But having once gained a footing, it is conceivable that it may continue to be imported by liners which may prefer to fill up with coal at an exceptionally low rate to returning to the Mediterranean with incomplete cargoes, as sometimes happens.

Whether the possibility referred to by Mr. Carmichael in his concluding remarks becomes a fact or not, it is beyond doubt that every ton of American coal now unloaded in Europe must tend to bring about the all-desirable return of home markets to the level of reasonable prices.

PERSONAL.

Mr. Sidney E. Stevenson, who has relinquished the position of Manager of the Cape Town and District Gas Company, will sail for England on the 31st inst. He is succeeded by Mr. E. P. Reilly, lately of Guildford.

Mr. William J. Hollingsworth, Assoc.M.Inst.C.E., has been appointed London Manager of Messrs. Crossley Bros., Limited, in succession to the late Mr. Tom Hay Wilson, whose death is noticed in our "Obituary." Mr. Hollingsworth has been with the firm during the past eight years.

The Plymouth Town Council accepted last week the resignation of Mr. E. Sandeman, the Water Engineer, and confirmed a resolution of the Water Committee, congratulating him upon his appointment as Engineer to the Derwent Valley water scheme, and expressing appreciation of his services to the town during the time he has filled his present position.

The Council of the Society of Arts recently attended at Marlborough House, when His Royal Highness the Prince of Wales, K.G., President of the Society, presented the Albert medal to Sir William Crookes, F.R.S., "for his extensive and laborious researches in chemistry and in physics—researches which have, in many instances, developed into useful practical applications in the arts and manufactures."

OBITUARY.

Mr. J. Bowman, who was for thirty years Manager of the Huntly Gas Company, and who was twice Chief Magistrate of the burgh, died at his residence there last Wednesday. Mr. Bowman retired from business some years ago on account of ill-health.

Mr. Edward Pritchard, M.Inst.C.E., died last Friday week, as the result of an apoplectic fit. As an engineer, he had had a varied experience. It is worthy of note at this particular time that he was the designer of the Pretoria Water-Works; and the Warwick Water-Works were also constructed from his plans. He has taken a large part in the projection of electric tramway schemes. Mr. Pritchard, who was head of the firm of Messrs. Pritchard and Co., of Birmingham, was 62 years old.

With ourselves, a large number of readers will regret to learn of the death of Mr. Tom Hay Wilson, the London Manager of Messrs. Crossley Bros., Limited. Mr. Wilson had been ill for something like six weeks; but he expired suddenly on Thursday, the 10th inst.—death being due to an apoplectic stroke. The deceased gentleman commenced his engineering career with the firm of Robert Stephenson and Co., of Newcastle-on-Tyne; and he had been connected with Messrs. Crossley Bros. for twenty years, which is about the period that the London house has been established. He was for several years the assistant to the previous Manager, Mr. Robert Wilson (no relation), who is now a Director of the firm. The late Mr. Wilson, who was 60 years of age on the 4th inst., had been Manager for rather more than three years.

At the recent meeting of the Iron and Steel Institute, Mr. A. Greiner gave an account of the results obtained at the Cockerill Works, Belgium, with the first blowing-engine worked by blast-furnace gas ever employed in iron-works. This 600-horse power engine has been running since Nov. 20 last with unpurified gas taken from the Seraing blast-furnaces.

The United States Congress has under consideration a Bill for the conversion of the present Office of Standard Weights and Measures into a National Standardizing Bureau similar to the Reichsanstalt at Charlottenburg and the National Physical Laboratory. The clause dealing with the work of the bureau reads as follows: "The functions of the bureau shall consist in the custody of the standards; the comparison of the standards used in scientific investigations, engineering, manufacturing, commerce, and educational institutions with the standards adopted or recognized by the Government; the construction when necessary of standards, their multiples and subdivisions; the testing and calibration of standard measuring apparatus; the solution of problems which arise in connection with standards; the determination of physical constants, and the properties of materials, when such data are of great importance to scientific or manufacturing interests, and are not to be obtained of sufficient accuracy elsewhere."

TECHNICAL RECORD.

THE INCANDESCENT GAS-MANTLE AND ITS USE.

By VIVIAN B. LEWES, F.I.C., F.C.S.,

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[The Second of a Course of Three Cantor Lectures at the Society of Arts delivered May 14, 1900.]

In the last lecture, an attempt was made to trace the inception and growth of the incandescent mantle as it exists to-day; and it will be well to now tabulate the oxides which have been used in the manufacture of mantles, and see the amount of light emitted by each under the conditions existing in the mantles.

Light Emitted by Various Oxides.

Oxide.	Pure.	Commercial.
Metals—		
Zirconia	1·5	3·1
Thoria	0·5	6·0
Earth Metals—		
Cerite earths.		
Ceria	0·4	0·9
Lanthana		6·0
Ytterite earths.		
Yttria		5·2
Erbia	0·6	1·7
Common earths.		
Chromium oxide	0·4	0·4
Alumina	0·6	0·6
Alkaline Earth Metals—		
Baryta	3·3	3·3
Strontia	5·2	5·5
Magnesia	5·0	5·0

In utilizing these oxides for the manufacture of mantles, it is evident that there are many points besides the power of emitting light which must be taken into consideration.

Some salts shrink so much during the conversion by burning into oxides, that a mantle of very considerable initial size would have to be taken in order to get a skeleton of oxide of sufficient dimensions to fit the flame. Other oxides which promise well as far as their shrinkage during formation goes, are found to slowly volatilize under the influence of the bunsen flame; so that in the zone of most intense heating, the thread of oxide gets thinner and thinner and gradually disappears. Other oxides, again, are brought too near to their point of fusion, and soften to such an extent that the mantle shrinks in where most heated, and gets inside the zone of greatest heat—giving rise to a considerable loss of light; while other oxides, like yttria, give so distinctly coloured a light as to be objectionable. Careful testing, both as regards duration and strength, leads one to the conclusion that, of the oxides given, thoria, zirconia, and alumina alone can be used for forming the structure of the mantle. Alumina, however, has the drawback that the mantle is very hard, and not easily shaped in the blowpipe flame, shrinks in the zone of greatest heat, and slowly volatilizes; while zirconia mantles are liable to considerable and rapid shrinkage. So that thoria practically stands alone as the ideal basis for a mantle. It is easily shaped in the blowpipe flame, gives a comparatively small shrinkage when the fabric containing the nitrate is being converted into oxide, and, when formed, the mantle resists the action of temperature for a longer period than any other known oxide.

Perhaps the most important property is the enormous increase which takes place when thorium nitrate is converted into oxide, as if a comparatively small mass of nitrate be heated on platinum foil, it swells up in much the same way that the sulphocyanide of mercury constituting the old "Pharaoh's Serpent" does; and the small bulk of nitrate becomes an enormously larger mass of thorium oxide. So that, although in the mantles as now used there is 1 per cent. of ceria by weight, the proportion by volume is less than 0·1 per cent. Having got the basis of thoria, it is seen that in its pure condition it only emits about half-a-candle of light per cubic foot of gas consumed. The difference, however, between the lighting power of the pure thoria and the commercial at once indicates how sensitive it is to the exciting influence of small traces of impurities; and when mixed with 1 to 2 per cent. of ceria, it acquires a power of light-emissivity, combined with durability, which is unequalled by any other known mixture of the available oxides.

Many attempts have been made to explain in a satisfactory manner the marvellous power which the minute trace of ceria has of awakening to life the light-giving power of the mantle. In order that the mantle may emit its full measure of luminosity, it has to be heated in the extreme fringe of the outer zone of the bunsen flame; and here it is that the combinations take place between the products of incomplete combustion and the oxygen of the air. Such theories as credit the power which the mantle has of emitting light, as being due to any special action that the ceria may have in converting heat rays into light rays (which was the one put forward by Dr. Drossbach), are at the present time discarded in favour of the theory that both the air and gas are taking part in the actions which induce the luminosity.

Drs. Killing and Moschelles are of opinion that the ceria particles on the surface of the mantle are heated to a higher temperature than is the surrounding material, owing to the cerium being a metal which forms two oxides—the lower cerous oxide (Ce_2O_3), and the higher, or ceric oxide (CeO_2); and that at a high temperature, under the reducing action of the hydrogen and carbon monoxide, the ceric oxide becomes reduced to cerous oxide with the liberation of oxygen, which, combining on the surface of the ceria with the combustible gases in the burner, induces a far higher temperature in the ceria particles than exists in the thoria, and they suppose that the cerous oxide so formed again undergoes oxidation to the higher compound by the action of the excess of air present.

It is hard, however, to accept this theory in view of the extremely narrow range over which ceria acts as a useful excitant of the thoria basis. One would expect that, if the theory were the true one, the more ceria that was present the more particles would be heated to high incandescence; and increase in the quantity of ceria would increase rather than reduce the power of light emissivity.

The second theory—and the one now most generally accepted—is that propounded by Dr. Bunte, who ascribes the high illuminating effect produced by the trace of ceria as being due to a catalytic action of the same character as causes a piece of platinum foil, which has been heated in order to cleanse its surface, to become red hot when a current of mixed coal gas and air is allowed to impinge upon it; the action here being due to the power which platinum possesses of compressing both coal gas and air upon the surface, and rendering them so chemically active that they combine on the surface of the metal and emit sufficient heat to raise the mass to a bright red.

Dr. Bunte made a number of experiments as to the influence of thoria and ceria in bringing about the combination of hydrogen and oxygen. He found that at 1200° Fahr. (649° C.) a mixture of hydrogen and oxygen, in the ratio of 2 to 1, when passed through a heated porcelain tube, combined to form water; and that the presence of thoria in the tube had no effect in lowering the temperature at which this action took place. When, however, the oxygen and hydrogen were passed though a tube containing ceria, the action commenced at 600° Fahr. (315·5° C.); and he concludes that this catalytic action, localizing a high temperature in the small particles of ceria spread over the surface of the large mass of inert thoria, is the cause of the high light emissivity.

Had Drossbach been right in ascribing the light of the mantle to any peculiar light emissivity on the part of the oxides, proof of this ought easily to have been obtained by the way in which the rare oxides and mixtures behaved when heated out of contact with air; and Dr. Bunte found that, on trying this experiment, there was a very small difference in the noticeable light radiation from bodies of such widely different light emissivity as carbon, magnesia, thoria, or the mixtures used in the Welsbach mantle.

In order to prove this, Bunte took a thick-walled tube of retort-carbon, the walls of the middle portion of which were reduced to a thickness of 0·059 inch for a length of about 4 inches; and on passing a strong current of electricity through the retort-carbon cylinder the resistance of the thin-walled portion caused it to be heated up to whiteness—the temperature attained being estimated by him at over 3630° Fahr. (1999° C). The tube was prevented from burning away at this highly heated point by being coated with magnesia, over which an outer wrapper of asbestos paper was pressed; and in the interior of this tube small square prisms of magnesia were placed, coated with the substances to be examined—each prism being compared side by side in the hottest portion of the tube, and the conditions existing being observed through a small sight-hole at the end of the carbon tube.

By using double prisms, one of which was coated with the substance to be tested and the other with a standard substance of known composition, it was found that practically little or no difference existed between the various materials tested. This point was also confirmed by some very interesting experiments made by Mr. Swinton, in which he enclosed various mantle materials in a vacuum tube and submitted them to cathode rays, by which a very high temperature can be obtained, capable of raising finely divided carbon to incandescence and fusing platinum into glass. Using mantles made up of small squares of ceria and thoria alone, and mixed in varying proportions, he found that, although the mixture of 99 per cent. of thoria and 1 per cent. of ceria in a vacuum heated up to incandescence more rapidly than pure thoria alone, and on stopping the discharge cooled down more rapidly, its incandescence was only very slightly greater than that of the thoria alone. Both these experiments clearly show that the idea of the Welsbach mantle having any peculiar power of converting heat rays into light must be discarded; otherwise the same differences would have been noted when the materials were heated out of contact with air as when heated in the presence of air.

There are also many facts which tend to support the theory that the light is due to the particles of the oxide of ceria being heated to a higher temperature than that of the flame. My own researches on the cause of the luminosity of flame point to the splitting up of the molecule of acetylene, with the liberation of the endothermic heat contained in it, as endowing the carbon particles with a temperature far above that which exists in the flame; so that the temperature of incandescence in the hydrocarbon flame is due to the heat of the combustion *plus* the local endothermic heat of the decomposition. In the same way in the

mantle, it is probably the heat of the flame which heats the whole of the mantle *plus* the locally intensified points of excessively high temperature due to the catalytic action of the ceria on the mixture of oxygen, carbon monoxide, and hydrogen that gives the intense power of light emissivity that the mantle possesses; the theory being made more probable by the fact that other substances known to have catalytic powers when used in sufficiently small traces give similar, although not such marked, results.

An objection to this theory may be raised from the fact that the amount of ceria is so minute that it does not seem possible that it should play any important part in the light-giving power of the mantle. Dr. Bunte, however, overcomes this by pointing out that in an ordinary gas-flame the luminosity is due to the liberated carbon particles being heated to an intense degree. This carbon is obtained chiefly from the decomposition of unsaturated hydrocarbons, which together only form about 5 per cent. of the volume of the gas. Supposing that all the carbon of the unsaturated hydrocarbons be liberated and heated to incandescence, it may be calculated that about 54 milligrammes of carbon are separated from 1 litre of coal gas, or 23·6 grains from 1 cubic foot. Thus 4 per cent of ethylene and 1 per cent. of benzene give per litre of gas 60 cc. of carbon vapour from the benzene, and 40 cc. from the ethylene—in all 100 cc., which is equal to about 54 milligrammes of carbon. The volume of the luminous portion of a flame having a consumption of 5·297 cubic feet per hour and an illuminating power of 17·5 candles, is about 2 cc. at 32° Fahr. (0° C.). It therefore contains $2 \times 54 \div 1000$ milligrammes, or 0·1 milligramme (0·0015 grain) of incandescent carbon; and this small quantity of 0·0015 grain of incandescent carbon is sufficient to yield a light of 17·5 candles. In a Welsbach mantle, the amount of ceria is about 4 milligrammes, 0·06 grain, or forty times the quantity of the incandescent carbon in an ordinary flat-flame, and therefore is quite sufficient to explain why the Welsbach mantle gives a light of 80 candles when the argand burner only affords 16 candles.

The point that always seems a difficulty to me in this theory is that, if it be the true one, the only explanation of 1 per cent. of ceria being the amount that gives the maximum of light emissivity would be that in the outer envelope of the flame there was just sufficient unburnt combustible gas for this amount to act upon by its catalytic power, and that an increase of the combustible gas at this point should enable one to increase the amount of ceria present. But, so far, I know of no confirmation of this; nor does the minute trace of ceria have the same exciting effect upon a zirconia or alumina basis. We have probably much more to learn as to the true action of the trace of ceria in exciting the light emissivity of the thoria mantle; and it must be borne in mind that thorium itself has some strange, and at present unexplained, action towards light, which enables it to act in the same way as radium on a sensitive plate in the dark.

The actions which lead to the emission of light in the Sunlight mantle are of the same character as those taking place in the thoria-ceria mantle. The basis is alumina, which itself has no power of emitting light, but which is endowed with that power by the addition of chromic acid, which, when itself made into a mantle, is also void of any practical illuminating emissivity. Chromium, like cerium, forms two oxides; so that the theory of Killing and Moschelles would also apply to its light-emitting power. The light given by such a mantle is entirely dependent upon the proportion of the oxides of chromium present; and while with a small percentage only, and using a dilute solution of the alumina salt, it is possible to obtain a nearly white light, an increase in the strength of the solution and the percentage of chromium oxides gives a reddish yellow light.

It is impossible, however, in practice, to use a solution for saturating the cottons sufficiently dilute to give anything approaching a white light. If this is done, though the mantle will give a good light of about 14 to 15 candles per cubic foot of gas, the mantle shrinks so rapidly that in a comparatively short space of time it gets out of the zone of greatest intensity, and only emits a very feeble light; while if the percentage of chromium is increased, the light emitted is not so high—rarely exceeding 11 candles per cubic foot of gas—but the mantle lasts fairly well for 300 or 400 hours.

Analyses of the "Pink Sunlight Mantles" show them to be composed of—

Alumina	86·88
Chromium oxides	8·68
Zirconia	4·44
	100·00

The zirconia being added to give greater strength to certain parts of the mantle.

In these mantles, the alumina, if used alone, would volatilize slowly at the heat of the bunsen flame; so that in the zone of greatest intensity the threads rapidly become thinner and thinner until they finally disappear—this point being arrived at before the mantle has been in use 100 hours. The alumina, moreover, is near its fusion point, and is softened and rapidly shrinks. The oxides of chromium also slowly evaporate when continuously heated; so that the materials do not give much promise in making a good mantle. But when mixed together, or when the alumina mantle is sprayed with a dilute chromium solution, a far more stable compound is formed, of a pink colour, which probably dissociates slowly when heated for a long period, yielding a continuous supply of traces of oxides of chromium, which are the real source of the luminosity, and which gradually burn off.

If instead of an alumina basis a pure thoria mantle be sprayed with the chromium solution, it becomes endowed with a certain degree of luminosity. But this rapidly falls away; there being nothing to prevent the volatilization of the chromium oxides. The property which the chromium has of increasing the illuminating power and prolonging the life of such basic bodies as it can unite with, is well shown in the case of the Fahnehjelm comb. This was originally made of magnesia rods, and lasted barely 100 hours, so rapidly did the magnesia volatilize. When, however, the idea arose of dipping the magnesia rods into a solution of chromic acid, it was found that, not only was the power of emitting light nearly doubled, but that the life of the comb was increased threefold.

Many attempts have been made to improve upon, or alter, the composition of the 99 per cent. thoria and 1 per cent. ceria mantle, by mixing such bodies as zirconia with the thoria. But it is nearly always found that any attempts in this direction tend to make the mantle far more susceptible to shrinkage; while if the foreign body so introduced is present in sufficient quantity to give any practical economy on the thoria saved, the light is at once affected.

Dr. Ernst Hintz, of Wiesbaden, whose researches on the composition of incandescent mantles and the influence of various factors on their light-emitting power are perhaps the most complete ever made, found that quantities of neodidymia, lanthana, and yttria up to 2 per cent. have no influence on the light emitted by a mantle the remainder of which consists of thoria and ceria in the ratio of 99 to 1; that 2 per cent. of zirconia just began to affect the mantle; and that larger quantities of any of these bodies had a detrimental effect upon the light. His experiments and researches are of especial interest, as they show fairly conclusively the inception of the present mantle from the compositions mentioned in the 1886 (or thoria) patent.

The two minerals available for the preparation of thorium salts at the time of this patent—and, indeed, up to about 1892—were thorite and orangite, found in Norway, which are crude hydrated silicates of thorium containing from 56 to 72 per cent. of thoria together with traces of several other oxides of the rare metals, including ceria; and from these the liquid to impregnate the mantles was made without any special precautions being taken to eliminate the traces of the other rare earths—the mantles made from this fluid being looked upon as consisting of pure thoria. Dr. Hintz and others, however, found that, by employing the same methods of separation as were used for the manufacture, the composition of the oxides made from the fluids obtained from the minerals was—

	Thorite.	Orangite.
Thoria	96·606	92·416
Ceria	0·994	3·162
Neodidymia and lanthana	1·205	3·227
Yttria	1·195	1·195

These compositions agree very closely with analyses made of mantles sold during 1891-92, and which yielded an illuminating power of the same value as mantles made from liquids of this composition.

Monazite, which is the source from which the thoria now used is obtained, is mainly composed of phosphate of cerium and lanthanum, together with the phosphates of other rare earths, among which is thorium in quantities varying from a little over 1 to 16 per cent., and traces of many other bodies. This mineral, which used to be considered extremely rare, has now been found to be very widely distributed; its chief sources being the United States, Brazil, Siberia, Canada, &c., where it is found in the form of sand produced by the disintegration of primitive rocks.

Ceria being the main constituent of the monazite, and occurring in far larger proportion than the thoria, is separated with a much greater degree of completeness at the present time than was the case with the thoria made from orangite and thorite. Indeed, it was only a few observers who, prior to 1890, had stated that thorite and orangite contained ceria. Small as is the percentage of thoria in monazite, and laborious as is the separation of the thoria from it, the discovery of these large supplies of the mineral has reduced the price of thorium nitrate, according to Dr. Hintz, from £100 per kilo. at the end of 1894 to the present price of about 30s. per kilo.

Of late years, an important variation has been introduced in the manufacture of some mantles, in which, using the mixture of 99 per cent. thoria and 1 per cent. ceria, the principle under which the old Clamond basket was made has been pressed into service. As pointed out in the previous lecture, these baskets were made in the early eighties by weaving together filaments which had been produced by squeezing a paste of magnesia and magnesium acetate through a suitable orifice; and the woven mantle, when baked, could be rendered incandescent by means of an ordinary burner, owing to the threads being reduced to a sufficient degree of fineness.

On November 4, 1890, Lungren took out a patent for an improvement in the method of manufacturing the mantle, which was a great advance on Clamond's original process. In this latter method, it was found that it was a troublesome matter to get a coherent mantle, owing to the threads at the points of intersection not welding properly. The first threads laid on the mould dried before the cross-threads could be put on; so that,

when pressed together, the dried threads cut through the softer ones and did not properly unite with them. In order to overcome this, Lungren mixed his refractory earths into a paste with some combustible elastic material, and from this squeezed out the threads from which the mantle was woven, after which operation the elastic binding material was burnt out. As examples of suitable materials, Lungren instances glue mixed with glycerine, india-rubber dissolved in naphtha, &c., and states that a variety of materials may be used.

At the present day, collodion is rapidly coming to the front as a vehicle for holding the incandescent oxides. This substance has a very interesting history. In 1838, Pelouze discovered that, when paper was treated with the strongest nitric acid, it was rendered exceedingly inflammable; and in 1845, Schonbein, the Swedish Chemist, proposed the use of nitrated cotton wool as a substitute for gunpowder, and showed that its combustion gave no smoke. Several factories were soon at work making guncotton for explosive purposes; but some disastrous accidents taking place, for which no apparent reason could be found, and guncotton being found unfitted for guns, the works were stopped, and until late in the sixties that guncotton was not made on a manufacturing scale as an explosive. Meanwhile, however, it had been found that if the strength of the nitric acid was not kept up, a lower form of guncotton was produced, which was not of much use as an explosive, but which could be dissolved in a mixture of alcohol and ether, and that, when these solvents had evaporated off, a structureless semi-transparent mass was left. Many commercial adaptations were soon found for this material; and its manufacture was started on a large scale.

Among the many other applications of collodion, it has been employed for the manufacture of artificial silk; and large factories have been built in many parts of Europe for this purpose. In one process, wood pulp is converted into collodion by nitration, and this collodion is then dissolved in as little alcohol and ether as possible. In order to obtain the fibre, the thick solution is forced by enormous hydraulic pressure through capillary glass tubes, the bore of which is less than the one-hundredth of a millimetre. Ten to twelve of the expressed fibres are twisted together and wound on to a bobbin; the air of the room being kept sufficiently heated to cause the drying of the filaments a few inches from the orifice of the tube. The compound thread is next denitrated, in order to remove the extreme inflammability which it possesses at this stage; and for this purpose the skeins are dipped in a solution of ammonium sulphide, by which they are converted into ordinary cellulose.

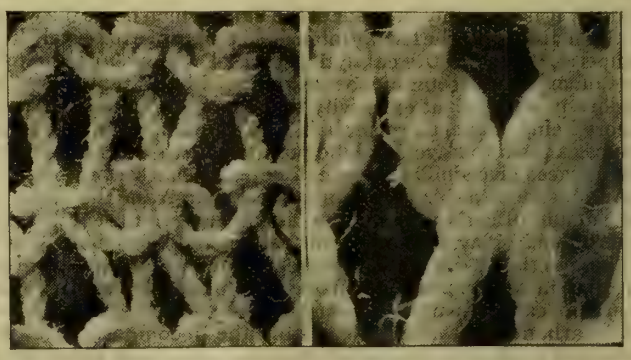
In 1894, De Mare utilized collodion for the manufacture of a mantle, adding the necessary salts to the collodion before squeezing it into thread. Following in his steps, Knofler, in 1895, and later on Plaissetty, took out patents for the manufacture of mantles by a similar process to De Mare's; the difference being that Knofler used ammonium sulphide for the denitration of his fabric, while Plaissetty employed calcium sulphide, the objection to which is the trace of lime left in the material.

Another method of the same kind for making artificial silk, which has considerable reputation, is that known as the Lehner process, which in its broad outlines somewhat resembles the Chardonnet, but differs from it in that the excessively high pressure used in the earlier method is done away with by employing a solution of a more liquid character, and hardening the thread by passing it through certain organic solutions. It is found that this form of silk lends itself perhaps better than the previous solutions to the carrying of the salts forming the incandescent oxides; and mantles made by this process, which we will speak of as Lehner mantles, show promise of being a most important development of De Mare's original idea. Mantles made by such methods as those of De Mare, Knofler, Plaissetty, and Lehner, are clearly developments of the Clamond hood, and not of the Auer mantle. In the Clamond class, the filaments are made by squeezing a homogeneous pasty material through small orifices, so as to form rods or threads; and when the vehicle holding the salts is burnt off, the oxides are left in a thread of even density.

The Auer class consists of excessively minute filaments, many hundreds of which go to form a thread; while each filament, when burnt off, after impregnation with the illuminating solution, leaves a minute rod of the oxides having a dense central portion, which was produced by the salts by capillary attraction being drawn into the small tubes in the centre of the cotton fibre—this dense central portion being surrounded by a more or less spongy coating formed by the salts on the exterior of the fibre being reduced to oxides, and being kept in a broken-up condition by the escape through them of the gases from the burning fabric.

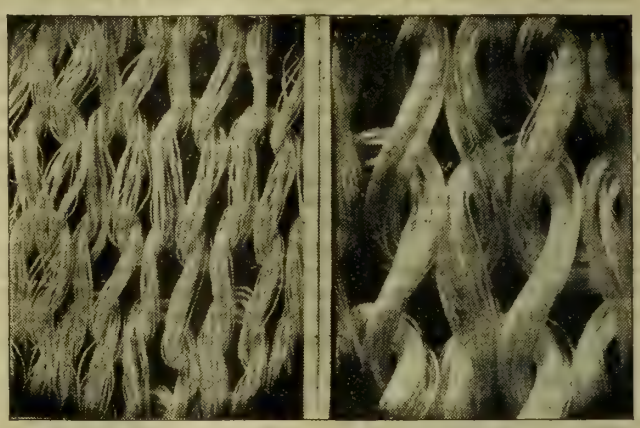
In the Welsbach mantles, this enormous mass of small filamentary matter is twisted in the thread into what, after burning, becomes practically a fluted column of oxides; while in the Clamond class of mantle each separate filament that forms the thread stands out separately by itself, so that what appears to the eye to be one solid filament reveals itself under the microscope as a loose bundle of rods, which vary in number according to the make of the mantle. Those made by the Lehner process have rather more of these separate filaments than those made by the Plaissetty and Knofler methods.

This alteration in physical structure has a most extraordinary effect upon the light-giving life of the mantle, and also upon its strength, as after burning for a few hundred hours the constant bombardment of the mantle by dust particles drawn up by the



Burnt. Unburnt.

WELSBACH "FABRIC" MANTLE.



Burnt. Unburnt.

NEW SUNLIGHT "FILAMENT" MANTLE.

rush of air in the chimney, causes the formation of silicates on the surface of the mantle, owing to the silica being present in the dust; and this seems to affect the Welsbach structure far more than it does the Clamond type, with the result that, when burnt continuously, the Welsbach mantle falls to so low a pitch of light-emissivity after 500 to 600 hours as to be a mere shadow of its former self—giving not more than one-third of its original light—while the Knofler mantle keeps up its light-emitting power to a much greater extent, and the Lehner fabric is the most remarkable of all. Two Lehner mantles, which have now been burning continuously in my laboratory for over 3000 hours, give at this moment a higher light-emissivity than most of the Welsbachs do in their prime.

I am in hopes that I have been able to trace the causes which lead to this extraordinary result, and trust at an early date to be able to give the exact reasons that determine this phenomenon. In any case, it may be stated that the trouble with regard to the length of useful light-emission is practically solved, and that the new developments of the Clamond process form as important a step in the history of incandescent gas lighting as the discoveries which gave rise to the original mantles.

The Coal Production of the United States in 1899.—According to the returns representing between 80 and 90 per cent. of the total tonnage, the production of coal in the United States in 1899 is estimated by Mr. E. W. Parker, the Statistician of the United States Geological Survey, to have amounted to 230,838,973 long tons, equivalent to 258,539,650 short tons. As compared with the production in 1898, when the output amounted to 196,405,935 long tons or 219,974,667 short tons, this indicates an increase of more than 34,000,000 long tons (over 38,000,000 short tons), or 17·5 per cent. These figures exceed by 15,000,000 short tons the estimates made on the coal tonnage for 1899.

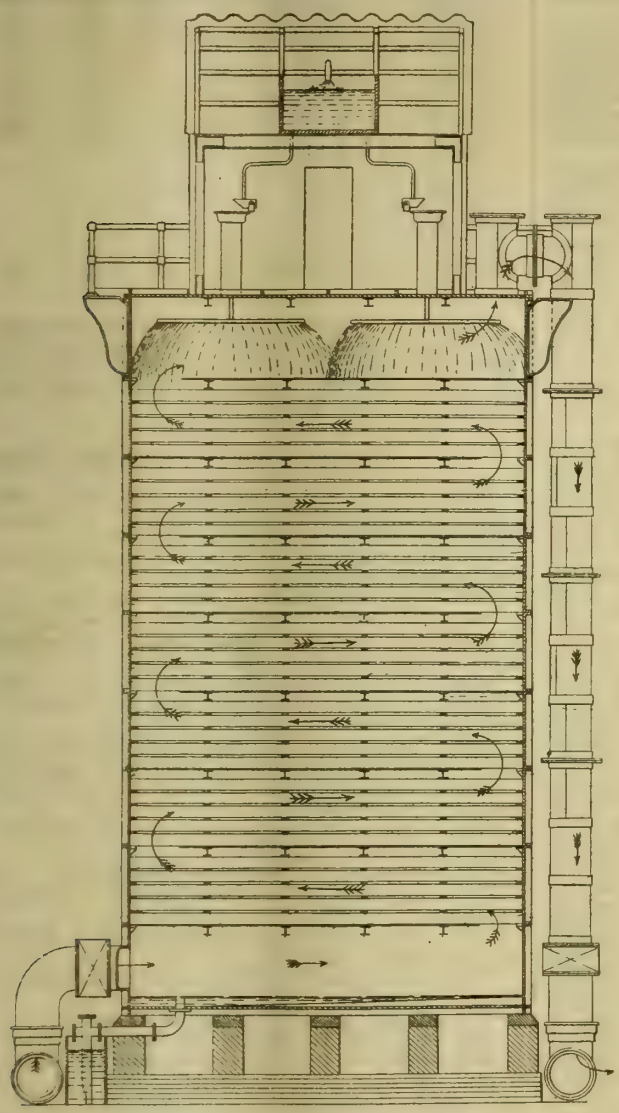
Excursion Meetings of District Gas Associations.—The dates of the Spring meetings of the Manchester, Southern District, and Midland Associations have been fixed. The members of the first-named Association will assemble at the Commercial Hotel, Kendal, of which town the President (Mr. T. N. Ritson, Assoc.M.Inst.C.E.) is Gas and Water Engineer, on Saturday next, and dispose of the few items of business on the *agenda*, which include the election of three new members. They will then drive to Windermere, and take tea together at the Royal Hotel, Bowness. The meeting of the Southern District Association will be held on the 31st inst. at Bristol, under the presidency of Mr. D. Irving. A visit will be paid to the electric power stations of the Bristol Tramways Company; a short paper, setting forth the arrangements made in the city for protecting the mains and services of the Gas and Water Companies, will be read; and there will be a drive to the Clifton Zoological Gardens, where high-tea will be served. The Midland Association will hold their meeting at Stafford, the home of the President (Mr. J. Ferguson Bell), on the 7th prox.

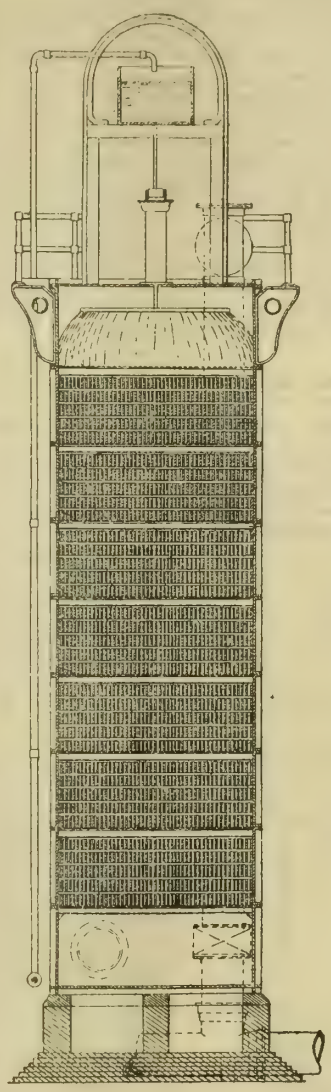
REGISTER OF PATENTS.

Gas-Scrubbers.—Stevenson, (Executrix of the late) G. E., of Manchester. No. 7474; April 10, 1899.

The patentee (whose final specification was filed by his widow, Mrs. M. S. Stevenson) proposed to employ in tower scrubbers perforated metal trays, arranged horizontally one above the other, and stopped off short of the opposite walls of the tower alternately. The trays carry boards on edge, or canvas screens, or the like, arranged in the direction in which the gas travels. A shower of liquid purifying agent falls down the tower, and through the perforations, wetting the boards or screens. The arrangement is such that the gas, in rising up the tower, travels to-and-fro over the trays, zig-zag, from side to side, and between the wetted surfaces of the boards or screens; and it is prevented rising up through the perforations in the trays by the liquid falling through the perforations.

In carrying out the invention, the patentee said he preferred to make the tower rectangular in plan, and about twice as wide from side to side as it was from back to front. In the scrubber represented, there





are eight perforated trays, made of No. 12 B.W.G. in thickness, and perforated with holes ½ inch in diameter and 2 inches from centre to centre, arranged in rows 1 inch apart. The trays are carried by end-brackets cast on the walls of the tower, and by girders arranged cross-wise of the tower from front to back. The trays are stopped short of the wall of the tower at opposite ends alternately; so that, as indicated by the arrows, the gas which enters the tower by the pipe E must pass from side to side of the tower, in a zig-zag manner, in its ascent to the outlet pipe F, down which it passes after it has left the scrubber.

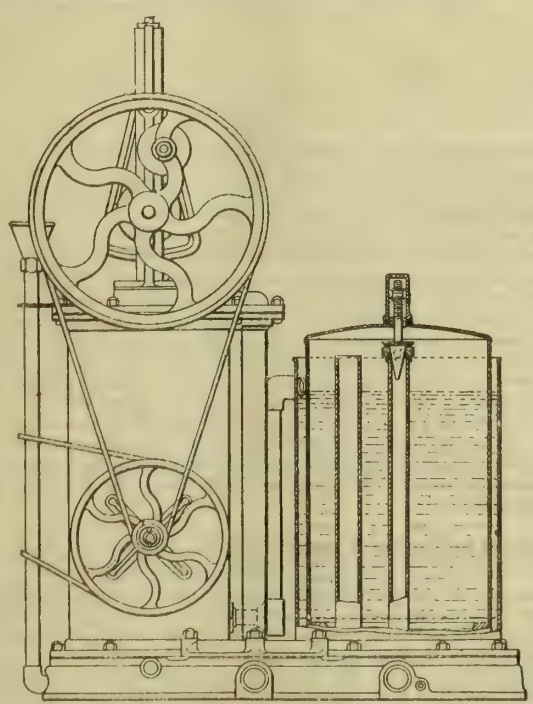
Between the trays, are rows of wood or canvas-screens, or the like, similar to those used in other tower scrubbers; but, instead of being placed one on the top of the other in a crossed position, the rows are arranged in the same direction—namely, in the direction of the greatest width of the tower—and each row is made to rest on packing boards placed on the bottom row below, so that there is a small space between each row. At the top of the tower, is an arrangement of the ordinary kind, for distributing a shower of water or ammoniacal liquor, or any other liquid purifying agent passing through the tower. The liquid in falling wets the rows of boards, and passing through the perforations in the trays, prevents the gas ascending therethrough.

The advantage claimed for the invention is that "the gas has a considerably increased length of travel in passing from the bottom to the top of the tower, and is all the while in contact with the wetted surfaces of the boards or screens, and exposed to the shower of liquid. The efficiency of the tower is, therefore, three times as great as a tower scrubber of the same size, or an equivalent efficiency may be made about one-third the height of the ordinary tower scrubber—thus saving a large proportion of the cost of the apparatus."

Gas and Air Compressors and Pumps.—Keith, J., of Farringdon Avenue, E.C. No. 11,593; June 5, 1899.

This invention relates to apparatus of the kind described in patents No. 14,057 of 1897 and No. 15,291 of 1898; and it has for its object to provide means for operating the pumping-bell from a rotary motor or running shaft, in cases in which an automatically controlled hydraulic or like motor cannot be conveniently applied.

To that end (as shown) the pumping-bell is fitted with a piston-rod which passes upwards, downwards, or outwards through a gland or water-seal in the casing of the apparatus; and there is connected thereto a crank and a rod or eccentric, or like device, on a shaft which is driven by belt or other gearing, or directly from the motor or shaft, having a rotary



motion. The result is "to obtain an easy working rectilinear motion on the compressor from the circular motion of the driving power."

The pump has inlet and discharge valves as described in the earlier

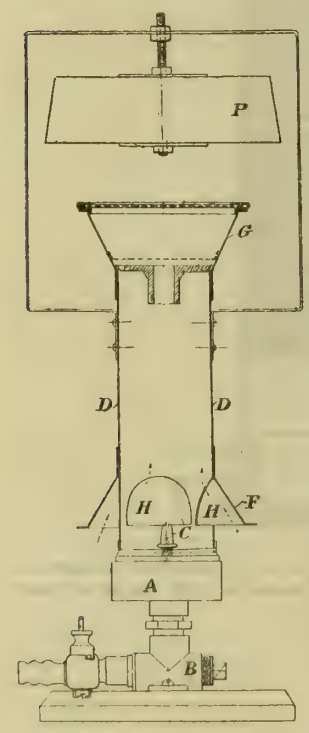
specifications; and it discharges by a stand-pipe into a holder loaded to the desired pressure. Inside (and preferably in the centre of) this holder is another stand-pipe, the lower end of which is connected to the suction side of the pump, and has a tapered valve on the top, opening upwards so as to give a gradually increasing opening over a considerable length of stroke. The valve is so arranged that, after the holder rises to a certain extent over its normal height, it engages with an adjustable tappet on the valve-rod; and the higher the holder rises, the larger the valve opening becomes. There is still another stand-pipe inside the holder, which is connected to the delivery-end of the apparatus, and through which the gas is drawn off to the burners as required.

When used for compressing gas or compressing and mixing gas and air for incandescent lighting, the pump is run at a practically constant speed—sufficient for the supply of gas to the maximum number of lights required. If then the supply of the compressed gas exceeds the demand, the holder rises, and by raising the valve allows a portion of the high-pressure gas to escape to the suction side of the pump; while, if all the burners are shut off, the gas is merely circulated through the apparatus.

In general, any regulation of the gearing or driving power is not required; but in special cases the loaded gasholder may be connected to the power supply for the motor, so that when the holder rises to its full height, it may partially cut off the supply of gas or other power for the heating of a hot-air motor, or otherwise reduce the power of the driver, and, consequently, the speed of the compressor itself. But when the holder again returns to its normal level, it in like manner turns on the supplies or power, and increases the speed of the apparatus—the whole being thus made partially self-governing.

Obtaining Intense Heat from Gas.—Delin, G., of Brussels. No. 3217; Feb. 17, 1900.

This invention—relating to apparatus "for obtaining intense and economical heating by means of gas, with a contrivance for accumulating and recuperating the heat"—is based on the principle "of creating, on the one hand, a large volume of mixed gas and air by suction, and retaining the same in a series of superposed chambers, in order to effect a more or less thorough mixture, by means of an eddying motion and general circulation; and, on the other hand, of giving a large surface to the opening in the apparatus where the flame is generated, so as to produce complete expansion, and enable the greater portion of the rays of heat which are used for horizontal radiation to be recuperated by the superposing, at a suitable distance, of an accumulating plate."



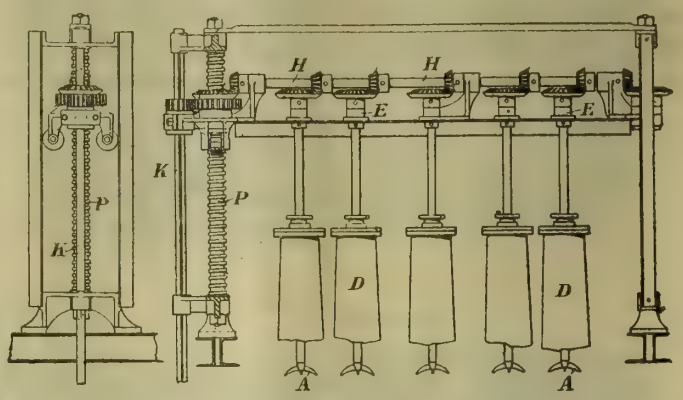
In the form of apparatus illustrated, the heating portion is composed of a box A containing a residue of petroleum, tar, or other substance, for enriching the gas, which enters the box by the pipe B, and escapes from it through the nozzle C. The box is surmounted by a mixing-chamber D, furnished at the upper and lower ends with cones F and G. Openings H are formed in the chamber D, inside the cone F, for admitting air to the mixing-chamber. The latter is closed at the top by a plug, which has an opening in the centre and smaller openings arranged around the central opening, as well as recesses formed in its circumference. Above the plug on the mixing-chamber, at a slight distance from it, a sheet of metallic gauze is arranged in the cone G; the upper part of the latter being also covered by metallic gauze. At a certain distance above the latter gauze, where the flame is generated, a plate P made of refractory substance is suspended.

When the cock is opened, the gas passes through the layer of enriching material enclosed in the box A, and issues in an enriched state through the nozzle C, rises into the pipe D, which forms the heating chamber or stove, and at the same time draws up a large volume of air through the openings H. The column of air and gas, in rising, meets with its first obstacle in the plug on the mixing-chamber. A portion of the mixture passes through the various openings, which are of such form as to maintain the draught of the fluids; while the larger portion is forced back towards the bottom, and mixes afresh with the fluid that is ascending. In this way, there is a continuous eddying and circulating motion between the gaseous fluids drawn up at the bottom of the pipe-stove D, and those forced back at the top of the latter; while in consequence of the openings, a certain portion always enters the second mixing-chamber between the plug and the metallic gauze. Here a first expansion is produced, and a portion of the fluids is again forced back through the openings—the other portion flowing through the meshes of the gauze, and entering the third chamber, which is considerably larger. There "a perfectly thorough and homogeneous mixing is effected."

Cleaning the Interior of Ascension-Pipes.—Elliott, C., Damp, G., and M'Dade, J., of Leyland. No. 12,012; June 9, 1899.

This apparatus for cleaning and scraping the interiors of retort ascension-pipes, is also applicable to cases where it is required to clean the interior of pipes without removing them from their position—such as economizer pipes of steam-generators.

The illustration shows the invention applied to a series of pipes. It consists in providing the interior of each pipe with a revolvable cutter or scraping appliance A, mounted on a shaft which passes through a packed gland in the end of the pipe D. In order to rotate the cutters and traverse them within the pipes (so that all accumulations are removed), the cutter-shafts are secured in bearings in brackets E, supported by angle-irons carried by end-brackets; and the shafts are driven by suitable gearing. The cutter-shafts are provided with bevel wheels gearing with bevel pinions secured to a horizontal shaft H, to which motion is imparted by a pinion J slidably mounted upon a vertical shaft K, which is revolved by a hand wheel or by power.



To traverse the cutters vertically, each end of the apparatus is provided with a screwed shaft P, the bevel wheels on which are formed as nuts upon the shafts. Therefore, as the bevel wheels are rotated to revolve the cutters, they and the cutter-shafts are raised vertically so as to traverse the latter within the pipes.

APPLICATIONS FOR LETTERS PATENT.

7446.—Hill, T. & M., "Generating Acetylene." April 23.

7481.—Spooner, A. F., "Carburettors." A communication from C. Bouché and F. P. de la Montluel. April 23.

7487.—Chandler, D. & S. B., "Combining known parts of gas apparatus advantageously." April 23.

7495.—Zimmer, G. F., "Conveyors." April 23.

7505.—Lacroix, P., "Burners of the bunsen type." April 23.

7528.—Allison, C. A., "Rotary pumps.' A communication from The P. H. & F. M. Roots Company. April 24.

7539.—Morin, R., "Generating acetylene gas." April 24.

7595.—Thompson, W. P., "Self-lighting gas-burners." A communication from A. Simonini. April 24.

7596.—Thompson, W. P., "Lighting devices for causing the ignition of gas." A communication from A. Simonini. April 24.

7650.—Scammell, A. E., "Gas-lamp, suitable for lighting and heating purposes." April 25.

7707.—Bibbero, M., "Regulating screw for controlling gas-pressure in elbows or burners." April 26.

7751.—Seagrave, G., "Generating acetylene gas." April 26.

7754.—Bullock, A. R., "Gas pressure reducing and regulating apparatus." April 26.

7757.—Lake, H. H., "Gas and like engines." A communication from O. J. Friedman. April 26.

7797.—Wilkinson, J., "Burners for illuminating and heating purposes." April 27.

7798.—Wilkinson, J., "Gas-engines." April 27.

7846.—Sugg, W. T., "Torches for lighting gas-lamps." April 27.

7847.—Sugg, W. T., "Supports for mantles." April 27.

7859.—Johnson, G. W., "Generating acetylene gas." A communication from La Compagnie Française de l'acétylène dissous. April 27.

7860.—Johnson, G. W., "Regulating the supply of gas under pressure." A communication from La Compagnie Française de l'acétylène dissous. April 27.

7863.—Lewes, V. B., "Manufacture of coal gas." April 27.

7933.—Pink, L., and Vulkan, Gesellschaft für Selbstzündende Glühkörper mit beschränkter Haftung, "Manufacture of substances for use in impregnating incandescent mantles." April 28.

7934.—Busch, M., "Incandescent gas-burners." April 28.

7952.—Dempster, R., and Sons, Ltd., and Broadhead, J. W., "Coal, coke, and other like conveyors and elevators." April 30.

7962.—Rowbotham, K. A. & W., "Explosion engines." April 30.

8055.—Simmance, J. F., "Lighting and extinguishing gas-flames." May 1.

8100.—Bellan, E., and Camus, G., "Carburettors." May 1.

8195.—Louis, H., "Gas and other engines." May 3.

8228.—Foulis, W., "Charging, drawing, and stirring the charge in gas-retorts." May 3.

8235.—Glover, J. G., "Street and like gas-lamps." May 3.

8278.—Thwaite, B. H., and Mensforth, H., "Effecting ignition of combustible mixtures of low calorific value in gas-engines." May 4.

8348.—Knöfler, O., "Improvements relating to the production of intense light." May 5.

8381.—Roberts, H., "Fluid meters." May 7.

8387.—Fawcett, P. W., "Fluid meters." May 7.

8436.—Biheller, S., "Lanterns for incandescent gas-lights." May 7.

8524.—Simpson, S., "Coin-freed mechanism applicable to gas, electricity, and like meters." May 8.

8625.—Hein, A., "Automatic apparatus for transmitting fluids any required distance." May 10.

8634.—Legge, J. St. C., "Renovating incandescent gas-mantles." May 10.

8635.—Legge, J. St. C., "Incandescent lighting." May 10.

8640.—Scheidt, B. von, "Gas-motors." May 10.

8655.—Moss, R. J., "Generating acetylene gas." May 10.

8666.—Menz, P., "Reducing valves." May 10.

8675.—Forbes, Sir C. S., "Bye-passes for gas." May 10.

8720.—Justice, P. M., "Automatic gas-lighters." A communication from C. W. Bernson. May 11.

8782.—Jackson, W. L., "Gas-burner." May 12.

8790.—Fairweather, W., "Incandescent burners." A communication from the Standard Incandescent Burner Company. May 12.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Mr. Carpenter's Paper on Inclined Retorts.

Sir,—Mr. Carpenter's letter and reply to the discussion on his paper, which appeared in the last issue of the "Journal," would not call for any comment were it not for the fact that they contain some statements that need qualifying, and that their tone may possibly have, in some cases, a deterrent and prejudicial effect upon an important and increasingly adopted system of the gas industry—the carbonizing of coal in inclined retorts. No one regretted more than myself that Mr. Carpenter was unable to reply personally and verbally to the discussion. It might have been expected, however, that the unavoidable absence of the author of a paper, read and discussed at a technical meeting, would have induced him to reply in the fullest possible manner to the questions and criticisms of his fellow-members, when such opportunity of doing so offered itself. It hardly seems adequate, therefore (to use no other word), for Mr. Carpenter to sweep on one side a naturally large portion of the discussion, and to remark, "as regards mechanical details, my reply would simply be a reiteration of the wording of the paper."

Mr. Carpenter quotes with approval the remark of some engineer that "you burn your boats when you put up inclined retorts." This may mean anything or nothing. One might reply that if your boats (or benches) are rotten, uneconomical, and out of date, the sooner they are burnt, the safer and better. The inclined-retort system is certainly by now sufficiently established and experimented with to put it altogether out of reach of such a simile as that of "burning your boats." And is it not passing strange that the author of "Inclined Retorts at Bankside" should have opened his reply with such an analogy, when he went for the inspiration of his Bankside installation to the Brentford Gas-Works, where all the boats have been burnt, or, in simpler language, where there are no retorts but those on the inclined system? All the horizontal retorts at these works have been replaced by inclined, because of the satisfaction given by the latter; and the same transformation is also in course at the Southall works But Mr. Carpenter's paper was written for those who "are anxious not to burn their fingers" with inclined retorts. To describe and point to a confessedly imperfect arrangement, seems a somewhat curious way of inculcating a general lesson of avoidance. Mr. Carpenter, in fact, puts himself in the position of a man, who, unaccustomed to the lighting of a fire, tries to do so, only succeeding in burning his fingers, whereupon he advises all his friends to dispense with the comfort and utility of fires, and points to his own unfortunate experience as a sufficient reason for their denying themselves.

The difference between the author's paper and his reply is striking. The former gave some the impression that the installation described was, generally speaking, a success. Mr. Carpenter himself says that "he came to the conclusion that he could equally make inclined retorts a success" at Bankside as at Brentford; and, later on, he remarks that "only one defect made itself apparent in the plant." This certainly seems to offer some contrast to the statement in the reply to the discussion that he did "not claim to have a perfect solution of the labour-saving part of the problem," and a further reference to "the want of success stated." Mr. Carpenter claims "to have proved conclusively that success or failure of the system depends, first and foremost, upon the suitability of the coal." But, in his paper, he records the fact that at Brentford "he saw various kinds of coal operated, large and small, dry and damp;" and the success of the system at Brentford is admitted.

It is really too late in the day to endeavour to limit the applicability of the inclined-retort system to certain restricted classes of coal. The extensive area (naturally necessitating the use of all kinds of coal) over which inclined retorts have been adopted during the last ten years, will refute this contention. For some of the following approximate figures, I am indebted to Herr Lenz, of the Stettiner-Chamotte Company. They give the number of lineal feet of inclined retorts already erected in Europe:—

Great Britain	96,000
Germany	40,200
Austria	23,100
Switzerland	6,700
Italy	3,300
Denmark	3,100
Sweden	2,700
Spain	2,300
France	1,400
Belgium	1,100

It would be interesting to know who has told us that "perfection does not exist in Nature." I have always been given to understand that the very reverse is the case, and that one looks to Nature for the best, most perfect, and economical adoption of means to ends. It is by employing, in some way and to some extent, Nature's laws and forces in the system of carbonizing coal by inclined retorts that some engineers have conferred benefits upon the gas-worker and the gas consumer alike. It is, therefore, "a little disappointing" to find that the Engineer of the South Metropolitan Gas Company will not, in the future, be counted among them.

C. E Brackenbury.

May 18, 1900.

Concerning Coal Exports and Political Economy.

Sir,—As you do not join issue with my contention that an export duty on British coal is not economically justifiable, I have not to further argue the general question. There are, however, one or two points in your editorial comments upon my arguments that I may, perhaps, be allowed to briefly notice, and, if I am able, to answer.

In the first place, you think I would have been more conclusive in my reasoning had I descended from the general to the particular. Well I tried to argue the point broadly, in such a way that my arguments could be applied to any specific case. Apparently not with complete success, for you put one that my arguments would, I should have thought, have met. Supposing, you say, that a five-shilling duty on British coal were to keep a possible foreign buyer out of the market just when prices were trembling in the balance, would not the coalowner come to easier terms with the home purchaser? Does not my answer to my own question apply exactly? I said: "What would be the result of a duty that would stop all exports? To reduce the price at home? 'Yes,' at the present time; but in the normal condition of the coal trade, when coal is sold at a price only sufficient to earn a bare margin of profit, 'No.'" For, as I pointed out, if the coalowner lost definitely his foreign customer—and it is surely not proposed that an export duty should only be put on every now and then just when the home consumer thought it advisable—he would reduce his production to the level of the home demand. The answer to such a particular question as you put does not, in fact, cover the whole problem.

Then you say it is difficult to understand, on the general principles of political economy, why the price of gas coal should double in two years. "Was it too cheap in 1897, or is it too dear to-day?" Well, if I ever learned anything from political economy it was this, that the price-value of any commodity is that which the buyer will give and the seller take; and it therefore depends absolutely upon the relation of the demand to the supply. The answer to your question is, I take it, that gas coal was neither too cheap in 1897, nor is it too dear to-day—the price-value being something quite distinct from the intrinsic value. Food in Mafeking during the latter days of the siege was probably twenty times the price it was eight months ago; but it was not too dear. It was worth its price to the buyer The same with coal. It is worth just what it will fetch; neither more nor less.

Political economy, you say, does not help the expert in its principles to make better bargains than the ignorant and foolish; it does not enable its votaries to foretell much within its own purview. But is that true? Has it not enabled the English nation to make better bargains with the world at large by pointing the way to Free Trade? We make a very good bargain with France when we admit her bounty-cheapened sugar duty-free. We get sugar below cost price because France is, on this point, ignorant and foolish. Do we not get the best of the bargain, and did not political economy enable us to foretell the result? Again, if the imposition of an export coal duty would be disastrous to trade, is it not the teachings of political economy that enable us to avoid the disaster? True, the study of Mill cannot be a substitute for the acquirement of accurate knowledge of the markets in which a man has to deal, nor for the exercise of intelligent judgment. But does that prove political economy to be a purely academic and futile study?

As to the hair-splitting and altogether unpractical distinction between calling Sir Isaac Newton's deduction from the coincident conduct of myriads of falling bodies the "law of gravitation," or "a brief description of observed similarities," I can only remark that it is a curious quotation for one to make who has apparently a practical man's contempt for "schools." It is logic-chopping that reminds one of the psychology class. Let Dr. Poynting, if he really doubt that it is an immutable law, throw himself over Beachy Head, and see if he be favoured with a different experience from the unlearned.

The question for which you suspect that scholastic political economy has no answer, does not, I confess, appear a difficult one. If a Frenchman will offer us more for an article than even its uniqueness and superlative goodness make it worth to us, let us by all means sell it to him. As a nation we are richer by the so much more. If the article be really priceless to the nation—as it might be argued coal suitable for the Navy is—then the nation *qua* nation must acquire it from the owner at a higher price than any foreigner will give. I do not pretend to be a political economy scholar; but there does appear to me to be an answer to your question not inconsistent with any principle of political economy.

Your Correspondent.

May 19 1900.

The Calorimetry of Coal Gas.

Sir,—Dr. Colman's admirable paper will attract attention to gas calorimetry. I wish to add the history of the system of testing which he adopted.

In 1882, the President of the British Association of Gas Managers expressed regret that no reliable method of ascertaining the heating power of coal gas existed—his remarks being elicited by a paper on the subject read by the late Mr. F. W. Hartley. In 1884, Mr. Hartley produced before the same scientific body the first practical gas calorimeter. A full description is given in the "Transactions;" but, briefly, the principle is that of absorbing the heat from a stream of gas products by a stream of water—the two being separated by thin walls of metal. Eight years after, the same principle was "introduced into England" by Herr Hugo Junkers, of Dessau.

I wish emphatically to claim for the late Mr. Hartley the inventorship of the modern gas calorimeter; and I am certain that Dr. Colman was not aware of the fact that, in referring to "Junker," instead of "Hartley" (or to "Hartley-Junker"), he was doing an injustice to the memory of a man who is not yet quite forgotten.

Jno. F. Simmance.

Ravenscourt Park, W., May 17, 1900.

Sunday Labour in Gas-Works.

Sir,—Having had many years' experience in the management of gas-works, I should like to express my conviction that Sunday labour in gas-works can be almost entirely dispensed with. My rule has been to cease work for twelve or fourteen hours in autumn, winter, and spring. In the summer months, I stop working for the whole twenty-four hours; and this would be done all the year round with ample storage or sufficient plant to easily produce seven days' maximum consumption in six days. That this can be done is a settled question; that it ought to be done should also be a settled question. The loss, if any, would be very slight; and it should be cheerfully borne by shareholders or consumers, in justice to the workmen, to whom the advantages would be very considerable.

Thomas Layton.

Redditch, May 17, 1900.

Local Authorities and the Price of Gas.

Sir,—Your correspondent of last week, in desiring to know what Local Authorities intend doing to meet the increased cost of gas manufacture,

can hardly expect to be furnished with collective information as to the prospective action of such authorities, which would, of course, be difficult to obtain by even the most experienced of those conversant with the administration of gas undertakings by local governing bodies.

Having devoted a little attention to the subject, I should like to point out to him that, from Midsummer last to the present time, of those gas authorities whose increases in price have been recorded in your columns, Local Authorities have not on the average raised their prices to such an extent as Gas Companies—thus leading one to the conclusion that they do not intend their gas consumers to bear the whole burden of the general advance in the price of coal and other materials, and continue to provide the useful surplus profit which your correspondent apparently abhors.

Permit me also to call his attention to a portion of Mr. Livesey's evidence before the Parliamentary Committee the other day, in which the Chairman of the South Metropolitan Gas Company is reported to have said that his Company were not paying as much dividend as the price of gas allowed them to do; and he further remarked "that this year they would have to lose dividend," which probably means additional reciprocity between supplier and supplied in the present condition of affairs in gas matters.

If this view be correct, his example is to be commended. As far as the municipal gas consumer is concerned, it cannot matter whether the price of gas is necessarily increased, or the rates go up; for whatever he contributes, either in the way of surplus profit or in direct taxation, is chiefly spent in his own neighbourhood; whereas, in the case of companies, the dividends provided are generally distributed over a larger area, to the detriment of local residents.

Why, then, should there be any apprehension on the part of your correspondent as to the effect on Mr. Ratepayer, who, if he neglects to consume municipally manufactured gas, and fails to participate in the accompanying advantages, has, I should think, no one but himself to blame.

G. T.

May 11, 1900.

The Inquiry Circular Nuisance Again.—A correspondent sends a copy of a circular of inquiry with which he has been "favoured" by the Town Clerk of an important borough in the Eastern Counties, dealing with the "Salary and Duties of Engineer and Manager of Water-Works." Most readers, after glancing through the following list of questions (to which a *gratis* reply is expected), will agree with our correspondent in considering the circular as "inquisitive and exceptional": 1. Name of town. 2. Population. 3. Is your water supply (*a*) by pumping from deep wells, or (*b*) by gravitation from collected sources into reservoirs? 4. If by pumping, what is the cost per million gallons? 5. What is the salary of your Water-Works Engineer or Manager? 6. What is the number and amount paid for salaries to his office staff? 7. What is the number of, and wages paid to, the out-door staff—including out-door foreman, turncocks, pipe-layers, labourers, &c.? 8. What is the number and wages of your pumping department staff—viz., engine fitters, drivers, and stokers? 9. What is the number of water-fitting and waste inspectors, and wages paid? 10. Does your Engineer or Manager design and carry out all extensions to, and alterations in, your water-works buildings, pumping plant, &c.? 11. Have you a Consulting Engineer; or do you call in expert advice on the above matters? 12. Number of meters in use; and if repaired by your staff? 13. Is your Water Engineer or Manager allowed private practice or to take pupils?

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Wednesday, May 16.

(*Before the* Master of the Rolls *and Lords Justices* Rigby *and* Collins.)

The Welsbach Incandescent Gaslight Company, Limited, v. The New Sunlight Incandescent Company, Limited.

This was an appeal by the plaintiffs from the order of Mr. Justice Byrne of April 28 (*ante*, p. 1135) directing them to make a further and better affidavit in answer to interrogatories. Plaintiffs brought their action in respect of an alleged infringement of the 1893 patent; and defendants said that, before the date of the patent, the Welsbach Company's predecessors in title made and sold mantles pursuant to the invention contained in the 1893 patent. The Secretary of the plaintiff Company had been interrogated upon the subject; and he objected to answer, except in regard to such knowledge as he possessed as an officer of the Company.

Mr. Moulton, Q.C., Mr. T. Terrell, Q.C., and Mr. Walter appeared for the appellants; Mr. Bousfield, Q.C., and Mr. Neill represented the respondents.

After a long legal argument,

Their Lordships allowed the appeal, with costs; holding that the objection taken by the Secretary was well founded.

LLANELLY POLICE COURT.—Wednesday, May 16.

(*Before Messrs.* H. Wilkins *and* T. Jones.)

Unlawfully Connecting a Gas-Meter The Publication of Notices of Penalties to be Sued For.

To-day an adjourned summons, taken out under section 18 of the Gas-Works Clauses Act, 1847, by Mr. A. R. Cawley, Manager and Secretary of the Llanelly Gas Company, against William Ewart Francis, a plumber, for connecting a gas meter at No. 59, Station Road, Llanelly, without the consent of the Company, was disposed of. There was also a summons against John Bowen Harries, a builder and ironmonger, for causing a pipe to be laid; but this was not gone into.

The facts were as follows: On the 5th of January last year the occupant of the above-named house left it, and an employee of the Company took a reading of the meter, disconnected it, and plugged the service pipe. On the 13th of February last, one of the Company's collectors visited the premises, and found that the meter had been reconnected, and that gas was being supplied without their knowledge or consent. The meter was connected on Nov. 6, 1899, by Francis, who was in the employ of Harries. It appeared that Francis was asked by the tenant if it was necessary to make any application to the Company, and he replied that it was not. Francis acknowledged to the Company's Manager that it was he who fixed the meter, and it was admitted that "a connection had been made which ought not to have been made." The matter had been before the Court a fortnight previously, when the case was adjourned on two technical objections—the one most relied upon by the defence being that it was necessary, according to section 145 of the Companies Clauses Consolidation Act, 1885, to have posted at the works and other places lists of penalties for various offences, and that this had not been done.

Mr. W. Howell appeared for the Company; Mr. T. R. Ludford represented the defendant.

Mr. Howell replied to the arguments advanced on the other side, and stated that, although there was no desire to press the case, it was important that the Bench should mark their sense of the wrong done to the Company, if only by the imposition of a small fine. On the point of law, he held that section 15 of the Gas-Works Clauses Act, 1871, did not require any such publication as that mentioned in the Companies Clauses Consolidation Act, and that therefore the Company had the right to ask for conviction without the publication of notices. However, if it were insisted by his friend that the chief objection should stand, and if he were supported by the Bench, he (Mr. Howell) would have no course left open but to apply for another summons under the section he had named.

Their Worships having deliberated in private,

The Chairman said that since the matter was before them on the previous occasion, the Clerk had gone thoroughly into the case, and had advised them most carefully and learnedly. They could not see their way at that stage to amend the summons, and they must dismiss it; being convinced that the non-publication of the notices required by the Companies Clauses Consolidation Act was fatal.

Mr. Ludford applied for costs on behalf of both Francis and Harries. He said that Mr. Howell, in his opening statement, had charged a respectable tradesman in the town with fraud.

Mr. Howell repudiated the allegation.

Mr. Ludford said the offence alleged was a criminal one. He was sorry he was unable to get Mr. Harries to the Court to give evidence, as he would tell the Bench that he knew nothing whatever of what had taken place. He was summoned after making an explanation to the Company. They had not the slightest cause for taking the proceedings, and were wrong from the outset. They had no legal grounds for their action, and therefore it would only be just on the part of the Bench to grant costs to Mr. Harries.

Mr. Howell urged that the Company were simply doing their duty to the shareholders in taking these proceedings. He said it was not essential, in a charge of this kind, that knowledge on the part of Mr. Harries should be proved. He asked the Bench not to allow costs in a case which had not been fought upon its merits, but upon "a miserable technicality."

The Chairman said the Bench refused to allow costs, and were satisfied that no imputation of fraud was intended.

The summons against Mr. Harries was withdrawn.

Embezzlement by a Water-Rate Collector.

Arthur Hill, of Rochdale, who was employed by the Corporation to collect the water-rates in the Todmorden district, has been sentenced to six months' imprisonment as a second-class misdemeanant, for embezzling money received by him on behalf of the Corporation. It was proved that the defalcations had been going on for about four years; and the amount embezzled was something like £130.

Intimidating Gas Stokers at Newport (Mon.).

At the Newport (Mon.) Borough Police Court last Wednesday, before Alderman Phillips and other Magistrates, William Green, brickyard worker, was charged on a warrant with endeavouring to induce Joseph Hall to abstain from working for the Newport Gas Company, and also with persistently following him with the view of intimidating him. Mr. T. B. R. Wilson prosecuted; Mr. Watson represented Green. Mr. Wilson explained that some of the men employed at the Crindau Gas-Works declined to work certain machines which had been introduced for stoking the retorts. Other men who were brought into the works had to be kept there. But when any of them had chanced to go outside, they had been met and threatened. On the previous Saturday night, Hall and his companions were followed for an hour-and-a-half, and were threatened. Hall stated that he had been employed by the Newport Gas Company since the 28th ult.; and he left the works for the first time on the day named. Defendant started to follow witness and his companions, and when they went into several shops and public-houses they found Green waiting for them. Witness complained to the police that he was being followed. The accused was called, and denied having either followed or threatened the prosecutor. He had been employed at the gas-works as a winter hand, and had left eight weeks before, when the winter hands were sent off. Mr. Watson contended the charge had not been made out, and that there had been neither intimidation nor persistent following within the meaning of the Act. The evidence did not show that the prisoner had done anything to "compel" the three men who had given evidence to refrain from working for the Gas Company. The Magistrates found that both cases had been proved, and fined the prisoner 50s. in each, or two months' imprisonment.

The firm of Meldrum Bros., of Manchester—whose specialities are the "Meldrum" furnace, the "Koker" stoker, and the "Simplex" destructor—are converting their business into a Limited Liability Company. Ordinary stock will be taken by the vendors; and £50,000 of 5½ per cent. preference shares are to be issued to the public. The object of the issue is, we understand, to provide additional and extensive works to meet the demands for the firm's productions.

PARLIAMENTARY INTELLIGENCE.

Gleanings from the Committee Rooms.

About midday on Friday, the protracted proceedings on the three great London Gas Bills came to an end; and all that remained was to await the decision of the Committee who have shown so much patience and judicial spirit in dealing with the many questions and complications raised. Something like two hours were spent by the four honourable members in private deliberation; and—the Chairman having thoughtfully given an indication of the time he anticipated would be required—the parties concerned were free to beguile themselves during the interval as fancy dictated. The proceedings were naturally the main topic of conversation among them; and the coolest and most level-headed could not repress a little mild excitement, and speculate as to the fates of the Bills. Shortly before four o'clock the parties were admitted into the room; and the Chairman at once proceeded to announce the decisions. It was evident to the onlooker that Mr. Oldroyd, usually so imperturbable, was keenly sensible of the great responsibility that rested upon the Committee, and of the importance of the occasion. With measured tone, and in clearly worded sentences, which left no room for doubt on any point, he delivered first the decision on the prepayment section of the County Council Bill, then on the Gaslight and Coke Company's Bill, and lastly on that of the South Metropolitan Company. What effect the decisions will have upon the future of the gas supply of the Metropolis, it is, of course, impossible to predict. But it is safe to say that to the Gaslight and Coke Company, the result of their appeal for further capital is a calamitous one. The Committee have thrown out their Bill; and so for the third time within twelve months has Parliament—first by the Select Committee, then by a Lords Committee, and again by a Commons Committee—endorsed external criticism of the Company's past administration. The principal of the considerations which influenced the Committee last Friday in declaring the preamble of the Bill not proved was the fact that the provisions had not been drafted with any intention of meeting the recommendations of the Select Committee of last year, "which recommendations were largely based on evidence relating to this Company." The course which the directorate will now take will be watched with some curiosity by outsiders, and with the gravest anxiety by the proprietors, who have had the mortification of seeing the market value of their ordinary stock depreciate until it is below par. There is no question as to the Company being badly in want of capital; and, if compliance with the recommendations of the Select Committee, or any of them, is to be a *sine quâ non* to the procuring of fresh capital powers, then one fails to see how the present rate of dividend can be maintained and the value of the stock escape further depression. Reference to the other two decisions is made in a paragraph following the notes on the proceedings on the South Metropolitan Gas Bill. It may, however, be remarked here that the price fixed as the extra charge for prepayment meters and fittings will apply to the three London Companies, and provincial undertakings may in time be called upon to fall into line. As to the decision on the South Metropolitan Bill, the conditions on which the preamble has been passed have been left for the acceptance or refusal of the Company.

"*Cum grano salis*" is a phrase that is met with in print so frequently from childhood up that, as time rolls on, one has a disposition to smile at its use. But, although a little old-fashioned, there are occasions when it comes in very conveniently, by conveying briefly and politely what, expressed in other words, would perhaps appear to be a bit harsh. This is the excuse for making use of it here; and so readers will forgive the infliction. In his evidence in support of the section of the London County Council Bill relating to the regulation of prepayment meters, fittings, and charges, Mr. Haward told Mr. Oldroyd's Committee that, with other officers of the Council, he had seen Sir Courtenay Boyle at the Board of Trade; and the suggestion that these points should be embodied in the Bill came from Sir Courtenay himself. Now that is the statement reported in the "JOURNAL" last week; and it is hoped that it was taken by readers *cum grano salis*. Given a literal interpretation, it means that the Board of Trade endorsed all the proposals in this part of the Bill, and that they had been included at the instigation of the Permanent Secretary to the Board. The statement, it is evident, was taken with a grain of salt by Mr. Oldroyd and his colleagues; for, at the commencement of last week's sittings, Sir Courtenay Boyle presented himself for examination. He did this at the instance of the Committee themselves; and this made clear a desire on their part to learn at first-hand what was the exact attitude and feeling of the Board of Trade on the question. Sir Courtenay's version of what took place at the interview with the County Council officials gives one the impression that Mr. Haward is the unhappy owner of a very capricious memory. It now appears that what really was in Sir Courtenay's mind at the interview was that, in respect of the charges, the slot-meter consumer should have the same protection as the ordinary consumer; and this seemed to him to be a matter that could be dealt with by regulation. But as to approving of standard patterns for the prepayment fittings, and fixing the prices to be paid for them by the Companies, these were duties, in his opinion, altogether beyond the functions of the Department. He made it quite plain that the utmost the Board could do would be to approve of the meter to be used; but even in doing this, he foresaw difficulties, although not insuperable ones. It will interest provincial readers to learn that Sir Courtenay Boyle hopes that, if a standard is arrived at for London, it will be applied generally throughout the country.

If the Committee had been left alone with the Bill after Sir Courtenay Boyle's evidence, it would have been safe to say that it was doomed; but Mr. Danckwerts opened fresh ground by remarking that, if the matter could be settled by some practical authority under the Board of Trade, in the direction of limiting the charge, the Gaslight and Coke Company would be pleased to accede to it. Thereupon, Mr. Balfour Browne went one better by saying that the South Metropolitan Company would forego all profit on the prepayment meters—merely charging sufficient to cover the cost; all they desired being to make a profit on the sale of the gas. The County Council representatives were clearly in a dilemma; and the only course Mr. Worsley Taylor could find out of it was to suggest the withdrawal of the Bill and the corresponding part of the South Metropolitan Bill, and a conference with the three London Companies. Then Sir Courtenay Boyle came to the rescue, and offered, if the Committee thought any advantage would accrue, to invite a conference. A lengthened discussion ended in the Chairman suspending the County Council Bill, and relying on the parties concerned to use the good offices of Sir Courtenay Boyle to arrive at a settlement. What has happened will be found detailed in a subsequent paragraph.

This arrangement cleared the stage for the contest over the most remarkable gas measure of the session—that of the South Metropolitan Gas Company, upon which the eyes of the whole gas industry have been riveted. Such proposals as the Bill contains can only have emanated from the creative brain of one man, and that man Mr. George Livesey. If the first reading of the Australian Commonwealth Bill meant the nativity of a nation, the passing of the South Metropolitan Bill through Parliament would be the nativity of cheap and common-sense gas supply. For years past, the finger-post of the gas industry has borne the words "incandescent lighting," "heating," "cooking," and "motive power;" and in all four directions one meets with the same cry for cheap gas. But cheaper gas means lower illuminating power, and lower illuminating power the casting off of all enrichment processes. A gas unenriched by foreign means is the best, the scientists of the industry tell us, for use in the four directions in which the finger-post is pointing; and it is in these directions that gas suppliers must look, and are looking for the development of their business. To give the South Metropolitan Company power to supply the best gas that can be obtained from ordinary gas coal, without exterior enrichment, and to give the consumers the greater portion of any savings effected, are the principal objects of the Bill; and therefore it is the natural outcome of the great change which time has wrought in the demands and requirements of users of gas.

It is difficult to comprehensively describe the proposals of the Bill in limited compass; but they have already been so fully explained in these columns, that the merest outline will refresh readers' memories. In the first place, it is intended to amplify the present sliding-scale arrangement by ingrafting a third consideration—viz., the illuminating power. The Bill contemplates the varying of the standard price (which, by the way, is now 3s. 6d.) according to the illuminating power of the gas in this wise: 3s. 3d. for gas having the power of 16 or more candles, 3s. 2d. for gas of 15 and under 16 candles, and 3s. 1d. for gas of 14 and under 15 candles. The rate at which the dividend is to increase or decrease with the dropping or raising of the price of gas of any specified illuminating power is put at 1s. 4d. per cent. The comparative effect of the various sliding-scales on the dividend, for every penny from 3s. 6d. to 1s. 10d. per 1000 cubic feet, is shown in the table in Mr. Livesey's evidence. As the Bill was drafted, it was proposed that, for the purpose of determining and regulating the increase or decrease of the dividend by the increase or decrease of the illuminating power, the illuminating power of every half year shall be the average of all the official testings made during the half year; but it was proposed in the course of the proceedings to adopt a monthly average. Then, as already stated in the paragraph referring to the County Council Bill, it was intended to legalize a surcharge of 9d. per 1000 cubic feet in connection with the provision of prepayment meters and fittings. The promoters also ask for power to construct a railway between the South-Eastern Railway Company's line and the East Greenwich Gas-Works; and other clauses are to enable the purchase by agreement of the portion of the undertaking of the Gaslight and Coke Company on the south of the Thames. It should be explained that this summary of the various proposals (which were set forth at much greater length in the "JOURNAL" for Dec. 19 last) was prepared before the Committee's decision was known.

The case for the Bill was opened by Mr. Balfour Browne; and, the Committee having been instructed (as upon the Gaslight and Coke Company's Bill) to consider the recommendations of the Select Committee of last year, learned Counsel dwelt on them at some length. In giving an epitome of the provisions of the Bill, he showed that the Company had adopted the recommendations of the Select Committee so far as they could do so without imperilling the interests of the Company and of the consumers. A revision of the sliding-scale and a reduction of the standard price was proposed in a manner which would not affect the shareholders; but he made it clear that the Company set their faces sternly against any interference with the sliding-scale in cases—the Gaslight and Coke Company for example—where it would affect the security upon which capital had been subscribed. To make any alteration which would reduce the dividend on the old capital would amount to confiscation; but Counsel thought the Select Committee only intended their recommendation to apply to new capital. Sinking all personal interest in the matter, he argued strongly against the proposed fixing of five years as the outside period that the Companies should absent themselves from Parliament. With reference to the sinking fund suggested by the Select Committee, he pointed out that, to redeem capital in this way, would be taking money out of the consumers of to-day to relieve consumers hereafter. He commented very freely and forcibly on the proposal of the Company that they should be relieved from the obligation to supply 16-candle gas; and on the questions of the fixing of a charge for slot-meters, the construction of the railway in connection with the East Greenwich works, and the position of the Company in respect of the Gaslight Company's works south of the Thames he also expatiated.

The evidence for the Bill was splendidly marshalled; and it is impossible to put a finger on any one spot where anything was omitted that would have been useful. The major part of the evidence was naturally directed to the great proposal for a reformation in gas supply; and the Company, it was manifest, had spared no expense in ensuring that the Committee had before them the highest scientific and practical evidence on all points bearing on the question, in order to prove that the best interests of the consumers would be served in every way, under the changed conditions of the time, by having a natural coal gas supplied to them, unenriched by any extraneous means. The witnesses for the Bill were, in the order examined, Mr. George Livesey (the Chairman of the Company), Mr. Thomas Newbigging, Professor Vivian B. Lewes, Mr. C. C. Carpenter, Mr. William Sugg, Mr. W. H. Y. Webber, Dr. S. Rideal, and Professor Dewar. Their evidence is reported at length elsewhere; but, without particularizing either the witnesses or their testimony, we will here endeavour to indicate its trend.

The Committee were appealed to to allow the Company (who, with distinguished success, have for the past thirty years pursued the policy

of trying to satisfy their consumers) to carry out their proposals if only as an experiment; but other witnesses went on higher grounds and described the movement as a reform, a splendid precedent, and a marked advance in gas legislation. Enrichment was held to be a mistake, expensive, wasteful, and unnecessary in these days when such a large quantity of gas is used for purposes other than lighting and in incandescent burners. Without enrichment, it was contended, a gas would be produced of more uniform quality, and, providing a proper burner was employed, with less variation in illuminating power. Temperature, it was also pointed out, affected natural coal gas much less than enriched gas. Mr. Webber's evidence introduced some really new information on the subject of the supply of low-grade gas. It will be seen from the report that he has been investigating the question in Germany; and what he says shows that there they are certainly more enlightened in this regard than we are in this country. All that he told the Committee regarding the supply of low-quality gas in Germany, and as to the progress of incandescent gas lighting, and the causes of that progress, should receive the earnest consideration of everyone who has the interests of the home industry at heart. But turning again to the general drift of the evidence, it was maintained that the reduction of a penny per candle was a perfectly just and generous offer on the part of the Company. It was estimated that during eight or nine months of the year 75 per cent. of the gas manufactured by the Company was used for heating and cooking purposes; and several witnesses agreed that 14-candle gas would therefore, and in the matter of lighting too, adequately meet the requirements of the consumers. The calorific value of a lower grade gas was held by Mr. Newbigging to be greater than that of a higher grade gas; and Professor Dewar maintained that the difference of a candle or two in luminosity had no substantial effect on the heating value. On the other hand, Professor Lewes, while admitting a slight fall in calorific value between gas of 16 and 15 candle power and 15 and 14 candle power, was of opinion that, comparing the fall with the reduction in price, there was a gain to the consumer.

Under the proposed altered conditions, there was some anxiety in the minds of the Committee on the question of the fitness of the consumers' burners; but Mr. Livesey, with his usual decisiveness, to a large extent disarmed opposition on that point, at an early stage of the proceedings, by offering to be bound in the Bill to supply the Company's slot meter consumers, and any consumer in fact who cared to apply for them, with special burners of a new type made by Messrs. Sugg and Co. Mr. Sugg, it appears, has been dipping into futurity, and has seen that the days of low-grade gas were fast approaching. Very wisely therefore he set about preparing for those days by perfecting a burner which should be suitable for such gas; and Professor Dewar, having experimented with it, has assured the Committee that he is convinced Mr. Sugg has succeeded in producing what is required.

On the other points of the Bill, very little evidence was tendered. Mr. Livesey, referring to the clause which fixes the maximum charge for slot-meters and fittings at 9d. per 1000 cubic feet, was of opinion that, if there was to be legislation on the subject, he thought the precedent in regard to ordinary meters ought to be taken; and the Companies allowed to charge 10 per cent. on the cost of the meters, stoves, &c.—this being distributed over the average quantity of gas used. In regard to the proposed railway siding, Mr. Livesey was not very anxious about it; but Mr. Carpenter showed that it would enable the Company to transport material to and from the East Greenwich works more cheaply than at present, and be a safeguard in the winter. Concerning the suggested transfer of the Nine Elms works, Mr. Livesey was the only witness examined. He informed the Committee that the Company were willing to take over the works, provided they could do so on terms which would not entail a loss on the shareholders and consumers; but there would be little advantage in acquiring them. The figures offered and required for the works will be found in his evidence.

Six Vestries, the County Council, and the Corporation of the City of London were the opponents; but about their opposition there was nothing striking excepting its utter feebleness. The witnesses were Mr. Haward, Mr. W. J. Dibdin, Dr. Frank Clowes, Dr. Percy Frankland, Mr. Otto Hehner, Mr. Isaac Carr, Mr. C. R. Bellamy, and Mr. Thomas Fairley—most of them men of repute in their own particular spheres, but here engaged in trying to perpetuate something in quite another sphere which a changed condition of things demands shall be altered. Their case was built up of a small portion of practical evidence and a large amount of assumption, in parts of which ran a noticeable vein of dogmatism. The new departure proposed by the Bill was variously regarded by witnesses as objectionable, complicated, and disastrous. Their previous evidence in connection with the Portable Photometer Bill proved very troublesome to them; keen-sighted Mr. Oldroyd more than once desiring to know how the consumers would be injured if a homogeneous gas of about 15-candle power which would carry to the point of consumption replaced an enriched gas which, if the portable photometer tests were to be relied upon, suffered in transit from the works, and reached the consumers with a value of only about 14·8 candles. But Mr. Oldroyd failed to obtain satisfaction on the point. Another objection to the Bill was that it would destroy uniformity of illuminating power in the Metropolis, which cannot matter, seeing that the supply would be confined to a complete district south of the river. Then it was argued that the illuminating power in the southern district would be variable; but it can hardly be more so under the new conditions than the same witnesses testified not many days since that it is at present. Burners specially made for the lower quality gas were derided; and it was anticipated that the low born gas would behave itself very badly. It would be more susceptible to draughts than a gas of a superior class; and a larger quantity would have to be consumed to get the same illumination. The poor consumers' accounts would greatly increase, notwithstanding the reduction of price that would be certain to follow; and the lowering of the standard price by 1d. per candle was not considered fair compensation to the consumers. Altogether, the new state of the consumer would be, from the County Council point of view, infinitely worse than the present. Some of the scientific witnesses appeared to have had an exceptionally poor experience of incandescent lighting; but that may be on account of their scientific training, which many successful users of the light have not had. It is a pity that Mr. Bellamy was permitted to escape from the witness chair without giving his scientific colleagues the benefit of his experience with street lighting by incandescent burners in Liverpool. It was further maintained that the calculation of the standard price on the illuminating power returns of the present testing-stations would not be fair; and no doubt Mr. Dibdin and others would like to subject the dividends of the shareholders of the Company to the tender mercies of the portable photometer.

The evidence was concluded on Thursday; and Friday morning was consumed by Counsel's addresses. During the speeches, it transpired that the Companies had agreed on the figure they felt they could adopt as a fixed extra charge for prepayment meters and fittings; but the County Council had not fallen into line. This was not very strange, seeing that practically all their cherished hopes in this matter had been knocked to the ground by the course of events before the Committee. It also appeared that, after further consideration, Sir Courtenay Boyle had taken no part in the conference, which was additional proof that the Board of Trade were not quite so solicitous in regard to the matter as Mr. Haward had tried to induce the Committee to believe. However, the Committee have practically adopted the views of the Companies; and they have done the County Council the honour of utilizing the shred which remained of their Bill in order to enact that 10d. shall be the maximum additional price to be charged for gas supplied under the prepayment system, that this is to be subject to revision in seven years, and that the Companies are to state the amount of the charges to the persons who pay them. Then as to the South Metropolitan Bill, they have declared the preamble of the Bill, as amended, proved. They consider it inexpedient that there should be a floating standard, and they therefore suggest that the new standard should be 14 candles, and the standard price 3s. 1d.—the conditions as to testing remaining exactly upon the same basis as at present. They also desire that provision shall be made for the supply of burners to consumers as offered by Mr. Livesey during the evidence; and that an undertaking shall be given by the Company that the gas produced under the new standard will be homogeneous, and not subject to the fluctuations which, in the mind of the Committee, seem to arise from enrichment. There are, of course, objections to the alteration made by the Committee in the vital part of the Bill; and whether the Company will accept or refuse it, has yet to be seen.

The Bill of the British Gaslight and Coke Company, Limited (Staffordshire Potteries), was down for the Committee stage last week; but before it was reached, the opposition was satisfied by a few inconsequential concessions, including, we believe, a little rebate in meter-rents. The Bill (which will therefore proceed as an unopposed measure) is to authorize the Company to expend for the purposes of the undertaking capital to the amount of £75,000, in addition to the sum of £197,610 already authorized by previous Acts down to 1895; and to empower the acquisition of land for the construction of extension works, the necessity for which was explained at the meeting of the Company in March last (*ante*, p. 817).

The Bill of the Grantham Gas Company, which has already passed the House of Commons, recently came before Lord Morley as an unopposed measure. The Parliamentary Agent for the promoters (Mr. Frere) submitted an addition to the clause dealing with the inspection of fittings, proposing to test gas-pipes by air pressure before the gas is turned on. The Engineer of the Company (Mr. R. G. Shadbolt) was examined in support of the proposal, and said it was intended as a safeguard against leakage, and would be of advantage both to the Company and to the consumers. The Company had already power to inspect fittings, &c.; but it was desirable that they should have the further power of testing. Lord Morley saw no special need to depart from the ordinary clause sanctioned by the House in regard to other gas undertakings. Unless some very special reason were advanced in favour of the additional powers sought by the promoters, he should decide that the clause as it left the House of Commons should stand. After some discussion, the proposal was withdrawn; and the Bill was reported for third reading.

The South Metropolitan Gas Company made another essay, when the South-Eastern Metropolitan Electric Tramways Bill was before a Commons Committee a few days ago, to secure protective clauses for their mains and pipes, and power to carry out themselves any alterations to their mains which may be necessitated by the construction of the electrical conduits. In regard to the latter point, a 2½-feet high-pressure main will be affected in this case; so that supervision by the Company's Engineer is absolutely needful from many points of view. The Committee, after hearing Mr. C. C. Carpenter and others, decided to allow the Company to do their own work, subject to an arbitration clause; but, respecting the question of electrolysis, it was considered that, as the electrical work will be executed under the Board of Trade regulations, a special clause was not required. Provided the regulations are carried out, Mr. James Swinburne says they will do much to keep down damage by electrolysis; but with earth-returns it cannot be prevented altogether. He cannot see why Gas Companies should not be compensated for damage to their pipes by electrolysis. There is justice in the proposition; but the South Metropolitan Gas Company's contentions for justice in this connection have not so far prevailed this session.

In dealing with the financial clauses of the Ilfracombe Improvement Bill, and the length of time in which a loan for water-works purposes should be repaid (the promoters proposing sixty years), the Chairman of the Police and Sanitary Regulations Committee of the House of Commons (Lord E. Fitzmaurice) raised the interesting question as to the effect of moorland and mossy water on the pipes. His Lordship knew of some districts in which such water had a destructive effect; and therefore he thought it might be necessary to curtail the time allowed for repayment. The Engineer to the scheme informed his Lordship that the water in some places acted in that way upon lead pipes; but on cast-iron pipes its corroding or oxidizing effect was very small. In this respect, the life of pipes with the Ilfracombe water was particularly good. The Borough Surveyor said that the existing mains had lasted 25 years; and in the case of the new scheme, it was proposed that the pipes should be glazed inside. The Committee subsequently allowed sixty years for repayment.

The reduction (from ten to five years) of the period allowed for the payment of costs incurred in connection with the promotion of Bills appears to be causing some little vexation among local authorities who

are promoters of Bills this session; and, as previously stated, very special reasons have to be shown to secure a relaxation of the new rule. The Chairman of Committees of the House of Lords (Earl Morley) has quite settled views on the subject. He considers the change is a very proper one; and therefore, when appealed to last Tuesday for an extension of the term by the Parliamentary Agents for the Barnsley Corporation Water-Works and Tramways Bill, he would not yield in the slightest degree.

HOUSE OF LORDS.

The following further progress has been made with Private Bills:—

Bills read the first time, and referred to the Examiners: Bedford Gas Bill, Wolverhampton Gas Bill, Woodbridge District Water Bill.

Bills read a second time: Gas Orders Confirmation Bills (Nos. 1 and 2), Water Orders Confirmation Bill.

Bills read a second time and committed: Glastonbury Corporation Gas Bill, Maidenhead Gas Bill.

Bill reported: Redhill Gas Bill.

Bills reported, with amendments: Barnsley Corporation Bill, Bristol Water Bill, Glastonbury Corporation Gas Bill, Grantham Gas Bill, Ossett Corporation Gas Bill, Rotherham Corporation Bill, Spalding Urban District Council (Water) Bill, Wetherby District Water Bill.

Bills reported [preamble not proved]: South Essex Water Bill, South Essex Water Board Bill.

Bills read the third time and passed: Bristol Water Bill, Gas and Water Orders Confirmation Bill, Grantham Gas Bill, Redhill Gas Bill, Spalding Urban District Council (Water) Bill, Wetherby District Water Bill.

The opposition to the Barnsley Corporation Bill has been withdrawn.

HOUSE OF COMMONS.

The following further progress has been made with Private Bills:—

Bills read the first time, and referred to the Examiners: Bristol Water Bill [Lords], Local Government Provisional Orders (Gas) Bill [Ilkeston and Rothwell Orders].

Bill read a second time and committed: Gas Provisional Order (No. 3) Bill.

Lords Bills read a second time and committed: Dorking Water Bill, Exmouth Urban District Water Bill, Fishguard Water and Gas Bill, Hemel Hempstead Corporation (Water) Bill, Mountain Ash Water Bill.

Bill reported [preamble not proved]: Gaslight and Coke Company Bill.

Bill reported with amendment: East London Water Bill.

Lords Bills reported, with amendments: Cleethorpes Gas Bill, Dorking Water Bill, Fishguard Water and Gas Bill, Higham Ferrers Water Bill, Kingston-upon-Thames Gas Bill, Mountain Ash Water Bill, Otley Urban District Council Water Bill.

Bills read the third time and passed: Bedford Gas Bill, Bradford Corporation Bill, Newport (Mon.) Gas Bill [Lords], Wolverhampton Gas Bill, Woodbridge District Water Bill.

Opposition withdrawn: British Gaslight Company Bill.

Petitions have been presented against the following Bills: Gas Provisional Order (No. 3) Bill [Wath-upon-Dearne and District Gas Order], Hemel Hempstead Corporation (Water) Bill [Lords].

Mr. Steadman has given notice of his intention to ask the President of the Board of Trade next Friday "whether there is any legislative regulation or restriction in regard to the use of, and supply by the London Gas Companies of, carburetted water gas; whether he is aware that in 1898 a Departmental Committee appointed by the Board of Trade recommended that the admixture of water gas with ordinary coal gas should be limited to 12 per cent., and that, by a Parliamentary Return in the same year, it was shown that some of the London Companies were even then using considerably over double that proportion; and whether, in view of the fact that there is reason to believe the amount has since been largely increased, and that water gas is four times as poisonous as coal gas and cannot be detected by its odour, he will consider the advisability of taking steps to initiate legislation on the subject, as has long been urged by medical and sanitary authorities, and by some means acquaint the public with the fact that they are being supplied with a poisonous article in the name of ordinary gas, so that due care may be taken in its general use."

Bolton Gas Profits and the Rates.—The Gas Committee of the Bolton Corporation have had before them the statement of accounts for the past financial year; and as a result they have resolved that £3294, part of the balance, be placed to the reserve fund account, and that the remainder, amounting to £20,000, be transferred in aid of the rates. Last year the amount handed over was £24,057, but in view of the enhanced price of coal the present result is considered eminently satisfactory. A draft estimate of income and expenditure for the current year has also been considered; and the Borough Treasurer has been directed to estimate for a sum equal to £10,000 as available in aid of the rates.

Helston Corporation and the Gas Company.—The dispute between the Helston Corporation and the Gas Company respecting the opening of the roads has been amicably settled. It was reported to the Council on Wednesday last that the Committee who had been conferring with the Company had arranged terms satisfactory to both parties, and without prejudice to the rights of either. The Council rescinded the resolution requiring the Company to ask permission three days before breaking the streets. Instead, it is agreed that, before opening the streets, the Company shall give three days' notice to the Surveyor of their intention to do so. A Committee was appointed to meet the Directors of the Water Company with a view to entering into a similar agreement.

THE DECISION OF THE PARLIAMENTARY COMMITTEE ON THE LONDON GAS BILLS.

The following is an account of the proceedings on Friday afternoon, when the Committee gave their decision on the three Bills—the London County Council Bill, the Gaslight and Coke Company Bill, and the South Metropolitan Gas Bill—the reports of which have occupied so much space in recent numbers of the "Journal" (see pp. 937, 1219, 1307, 1313), and are concluded to-day, pp. 1370-72, 1372-85.

On the re-admission of the public at the close of the Committee's consultation,

The Chairman said: The first Bill which the Committee considered was the County Council Bill—called the Gaslight and Coke, Commercial Gas, and South Metropolitan Gas Companies Bill. The Committee find the preamble of this Bill, as amended, proved. The Committee propose to amend it in page 3 of the preamble, line 17. They propose that this should read as follows: "And whereas it is expedient that the charges to be made by the Companies in respect of gas supplied by means of such meters and fittings should be regulated, and the amount of such charges stated to the persons who pay them"—leaving out the remainder of the clause. Further, I think I may say the Committee have decided that 10d. shall be the maximum additional price to be charged for gas so supplied, subject to a revision in seven years from this date. That is the slot-meter clause. I ought perhaps to remind you that the other part of the Bill was disposed of on a previous occasion.

Mr. Cooper said the Committee's decision affected the Commercial Gas Company; but they had not yet heard the representations of that Company with regard to the 10d.

The Chairman said the Company would have an opportunity of dealing with the matter when they reached the clauses. On the facts already before them, the Committee thought 10d. was the right figure; but they would hear anything the Commercial Company might wish to urge on the subject. Before going further, he wished, however, to say that the Committee had understood that the only point of difference was between the three Companies unitedly and the County Council, as to whether the figure should be 10d. or 11d.

Mr. H. E. Jones: I may say the Commercial Company do charge 10d. Our Agent did not know that when he was speaking just now. The Commercial Company will be satisfied with 10d.

The Chairman: Then the next Bill we had to consider, and upon which we announce our decision, is the Gaslight and Coke Company Bill. We find the preamble of this Bill not proved. Among other considerations, the Committee are led to this conclusion by the fact that the provisions of the Bill have obviously not been drafted with any intention of meeting the recommendations of the Select Committee of 1899, which recommendations were largely based on evidence relating to the Gaslight and Coke Company. Then with regard to the South Metropolitan Gas Bill, the decision of the Committee is that the preamble, as amended by the Committee, is proved. The amendment of the Committee is entirely in the clause which contains the principle and apparatus power of the Bill. It is on page 3, line 24. The Committee, after the word "the," have inserted the word "standard"—"And whereas it is expedient to alter the standard illuminating power of the gas supplied by the Company and the standard price to be charged therefor, and also to alter the variation in dividend dependent on the increase or decrease of such standard price as provided for by the Act of 1896." There we stop; the whole of the clause thereafter is thrown out. I am going to explain now the ground on which we have done it, and the end we have in view; and if we have failed in our attempt at draftsmanship, by the amendment we have just drawn up, to secure the purposes we have in mind, we shall be glad to receive any suggestions from Counsel. This is the amendment we suggest; and we suggest it on the following grounds: We think it would be very unwise and inexpedient that a floating standard—I think Counsel will know what we mean—should be adopted. We suggest, therefore, that the new standard should be 14 candles, and that the standard price should be 3s. 1d. This will obviate all question of variation of the standard according to the tests that are made; and the testing for the future will remain upon exactly the same basis, and subject to the same rules and authorities, as testing does now—the only difference being that the testers will look for 14 candles where formerly they looked for 16. The Company will be subject to penalties for deviation from the 14 candles, exactly as they are subject to penalties for deviation from 16 candles. These conditions are laid down by the Committee for the acceptance or refusal of the Company promoting the Bill; and also one or two other matters which perhaps I ought to name—*i.e.*, that provision should be made in the Bill for the gratuitous supply of gas-burners as has been suggested (the class of burners that has been named), and also the undertaking of the Company that the gas produced under the new standard will be homogeneous, and not subject to the fluctuations which, in the mind of the Committee, seem to arise by the introduction of enrichment. The Committee, on looking through the preamble of the South Metropolitan Bill, do not see any provision for slot-meter legislation. This, however, does not matter, because, seeing that we have passed the slot-meter legislation by adopting the County Council Bill, and therefore securing its application to all the three Companies in the Metropolis, it seems that the slot-meter clauses in the South Metropolitan Bill may go out. I think that is all. We have the Wandsworth Bill before us, which we propose to take on Monday. We presume that Bill will be easily disposed of on Monday and Tuesday; and that being so, we propose to meet on Wednesday morning at 11 o'clock for the settlement of clauses.

Mr. Danckwerts: Might I ask whether the preamble of the London County Council Bill, which the Committee have found to be proved, is the part to which the Chairman referred, and which the Committee have amended.

Mr. Cripps (Parliamentary Agent to the London County Council): Of course, the preamble will have to be corrected in accordance with the decision of the Committee.

The Chairman: I think, if I rightly appreciate your point, my reply will be this: The preamble of the London County Council Bill has been proved only so far as it relates to the slot-meters. The other part has been already announced as not proved. As regards the slot-meter clauses, we

shall consider any representations from Counsel for the Gaslight and Coke Company the same as by any other Company.

Lord R. Cecil: Perhaps Mr. Cripps will give us the clauses which he has submitted in respect of the slot-meters.

The Chairman: We shall be glad to receive suggestions from any of the parties with regard to the preamble. We, as laymen, have attempted to make an amendment of the preamble which we have no doubt is very faulty.

Lord R. Cecil: We will bring up the amendments to our Bill; and no doubt the other promoters will bring up the amendments to theirs.

The Chairman: I think I ought to say the County Council representatives will please not run away with the idea that their clause on the slot-meter is adopted—by no means. The wording of the clauses is quite open. We have simply approved of the preamble.

Lord R. Cecil: And said that some slot-meter clauses shall be passed as part of the County Council Bill.

Mr. Nicol: To meet the three Gas Companies.

HOUSE OF COMMONS COMMITTEE.

Monday, May 14.

(*Before Mr.* Oldroyd, *Chairman, Mr.* Emmott, *Mr.* Nicol, *and Mr.* Stanley Leighton.)

THE GASLIGHT AND COKE, COMMERCIAL GAS, AND SOUTH METROPOLITAN GAS COMPANIES BILL.

Part III. of the Bill promoted by the London County Council, which was to confer power on the Board of Trade to regulate the charge for, and the supply of, prepayment meters and fittings, was further considered to-day.

Mr. Worsley Taylor, Q.C., Mr. Talbot, and Mr. B. Wilkinson, appeared for the County Council. The other Counsel engaged were: Mr. Littler, Q.C., and Mr. H. A. Rigg, for the Corporation of the City of London; Mr. Pope, Q.C., Mr. Claude Baggallay, Q.C., Mr. Danckwerts, Q.C., and Mr. R. J. Neville, for the Gaslight and Coke Company; Mr. Littler, Q.C., Mr. Baggallay, Q.C., and Mr. Snagge, for the Commercial Gas Company; and Mr. Balfour Browne, Q.C., Lord Robert Cecil, Q.C., and Mr. L. W. S. Rostron, for the South Metropolitan Gas Company.

Sir *Courtenay Boyle*, K.C.B.

This witness, who is Permanent Secretary to the Board of Trade, was called at the instance of the Committee.

In reply to the Chairman, who asked if he could give the Committee any information as regarded the attitude of the Board of Trade towards the Bill, witness said that on Nov. 20 last a certain number of members of the London County Council called at the Board of Trade and had a conversation with regard to the first portion of the Bill. At the end of the conversation, he said he thought it was clear, from the evidence given before the Select Committee of last year, that the penny-in-the-slot consumer was paying a higher price for gas than the ordinary consumer. He said it also seemed clear that the system of charge by slot-meters was a convenient one, and expressed the opinion that it would be probably considered desirable to ensure that the statutory protection enjoyed by the ordinary consumer should also be enjoyed by penny-in-the-slot consumers; and that it seemed to him to be a matter which should be dealt with by regulation. He was asked whether it would be more desirable to proceed by Private Bill or by Public General Statute; and he said, without very much consideration of the question, that it might very well be dealt with by Private Bill in the first instance. The matter was left there, except that Mr. Haward, of the London County Council, had an interview with Mr. Hopwood, of the Board of Trade, following which a letter was written to the effect that the County Council might rely upon the benevolent attitude of the Board in any action which the Council might think fit to take to give effect to the recommendations of the Select Committee of last year with regard to automatic meters. The exact form of the proposals by which to legalize the recommendations, it was further stated in the letter, must necessarily be reserved for future consideration by the Board of Trade, until they had before them, not only the proposals of the County Council, but also any counter proposals of the Gas Companies. When the proposals of the County Council had been put into a Bill, the letter concluded, the Board would be glad of a copy. Further questioned as to the present views of the Board of Trade, witness said the proposals in Part III. of the Bill were calculated to give the Board very serious pause indeed. They proposed to enact that the Board of Trade should have the duty of approving standard patterns of prepayment meters and fittings, and fix the charges for the use of such meters and fittings. This was going a very considerable way, and a great deal in advance of any duty which had devolved upon the Board of Trade. The Board could approve a standard of meter, he thought, without very serious, or at least insuperable, difficulty; but if they were to be asked to fix the price, not only of the meters, but of the fittings by which the gas supplied by the meters was to be consumed, it was a serious thing indeed. Fittings, by the definition clause, included pipes, burners, stoves, and other fittings used in connection with the supply of gas by means of prepayment meters after it had passed the meter. This would place upon the Board of Trade the duty of approving and fixing the price of stoves, burners, and all things connected with the supply of gas. Probably the duty of the Board under the clause would be to approve, in the first instance, of the stoves of small consumers; but they might have to approve of cooking-stoves put in large houses. This seemed to be much beyond the functions of the State—certainly beyond the function of any State Department—to fix the price of a commercial commodity. By another phrase in the Bill—standard pattern—apparently the Board of Trade were to standardize the pattern of fittings. The word "standardize" was an ambiguous, doubtful word. What the State did was to standardize weights and measures; but he knew of no instance in which the State attempted to standardize a gas stove or gas-burner. The Board of Trade had power, under the Electric Lighting Acts, to approve of a supply meter; and under the Gas Supply Acts, they undertook the verification of gas measuring standards used in the sale of gas—that was a gas-measuring machine, not a machine for the use of gas after it had passed the meter. Questioned as to whether the Board objected to the extension of the powers of the Board beyond those which now obtained, he said the most the Board could do was to approve the pattern of penny-in-the-slot meters. It would be a difficult thing to do, because the Board would have to ensure that the automatic meter was right in recording, on the putting in of the coin, the amount of gas supplied; but it could be done, and the Board would have no objection to that.

The Chairman: You said just now that you, as representing the Board of Trade, were under the impression that the gas supplied by these prepayment meters was charged at a somewhat higher rate than that supplied to ordinary consumers. How did you arrive at that?

Witness: I think it is so. The evidence given before the Committee of last year tended to show that.

Do you agree with the recommendations of the Committee of last year, presided over by Sir James Rankin?—I agree that the charge by the Gaslight and Coke Company should be the same on the north side of the Thames as on the south side. But Recommendation No. 3 goes on to say that the fittings should be of the same capacity.

Do you suggest that it is possible to have an effective regulation which will not affect the fittings?—I should say "Yes," so far as regards gas up to the point of fixing the meters. The State might approve of arrangements for the passing of the gas into the meter; but as to what becomes of the gas after it passes the meter, I do not think the State could interfere.

The price charged for the gas includes rent and depreciation of the fittings, which are part and parcel of the contract?—So I understand.

Mr. Danckwerts: It was so; but it is not now.

Witness: I do not think it is necessarily so. The Company can charge the penny-in-the-slot consumer for the gas supplied by the penny-in-the-slot meter. What happens with the gas after it has passed the meter is a matter for the consumer only. He can make his own bargain.

Mr. Danckwerts: The meter is regulated in such a way that it only passes so much gas as represents so much of the penny for the gas. The rest of the charge is for the fittings.

The Chairman said he understood this position. It seemed that, so long as the price fixed for the fittings was undefined, the Company were at liberty to make an excessive charge for that part of the contract; and that therefore, as a consequence, the consumer under the system was charged more than he ought to be, which practically meant that he was charged too much for the gas.

Witness was understood to remark that it was a matter of bargain.

The Chairman went on to say that from the evidence it seemed to the Committee that the consumers consisted of a class who could scarcely be considered independent. They could not go to the outside public who sold fittings and buy what they required. Their tenancy was very often short, and they could not burden themselves with the responsibility. In fact, he did not believe that the consumers could buy the fittings they required outside. The Gaslight and Coke Company, at any rate, were not aware of any means by which the consumer could get the fittings without going directly to them.

Mr. Danckwerts: That is in London.

The Chairman: Yes; I am speaking of London.

Witness admitted the difficulty. But the fittings were not a monopoly article. They might be supplied from outside at any time.

Mr. Nicol said he gathered from Sir Courtenay Boyle that the Board of Trade considered their control should not go beyond the meter.

Witness replied that that was so. The meter was a measure of supply—like a quart-pot or yard measure.

Mr. Nicol said the contention of the Board of Trade was that the State should not interfere beyond the meter, whether it was used in the ordinary way or as a slot-meter.

Witness said that was his position.

Mr. Nicol: You do not see how the Board of Trade can take up the further position of controlling these fittings?

Witness: I do not think it would be possible to do it.

Mr. Emmott asked what witness would suggest if the Committee were desirous of carrying out the suggestion of Sir J. Rankin's Committee, that the price of the fittings should be fixed. Would he advise the Committee to lay down a maximum?

Witness said that was a difficult question to answer. What Parliament could do was to fix the price to be charged up to the meter—not beyond. If there were any fittings necessary to the user of the meter for the passage of the gas from the street main into the meter, which must affect the value or quality of the gas so passing through the meter, then he thought they would be a matter for reasonable approval. But ordinary fittings used by the consumer after the gas had passed the meter, the State, to his mind, should have nothing to do with.

Mr. Emmott remarked that the slot system had grown up during recent years; and if the consumers preferred to take gas in this way, obviously they should have some protection.

Witness replied that they must take the consequences as to charges for fittings. If the public were overcharged, they must suffer to that extent. He could not see any means of preventing the mischief which would not create greater mischief.

The Chairman asked whether witness saw a difficulty in meeting the recommendations of the Committee of last year, which involved not only the regulation of the price of gas supplied through the slot-meters, but also the regulation of the price of the fittings?

Witness replied in the affirmative—if that by fittings was meant something beyond the meter.

The Chairman: That is what is meant.

Witness: Then we should not have anything to do with it.

Mr. Nicol said he understood that, when the sliding-scale was arranged, the decision was come to with the assent of the Board of Trade.

Witness replied that this was the case; and he should think that the penny-in-the-slot system could be worked out in the same way. He himself had not thought the matter over, to see how it could be done; but he had no doubt that it could be worked.

Mr. Nicol asked whether the result would not be that, instead of charging a penny, the penny would be divided.

Witness: No; the meter might be made to vary—that is, made to

supply a larger amount of gas for a penny under one set of conditions than under another.

The CHAIRMAN: We have it in evidence that a larger or smaller amount of gas can be supplied for a penny, so that the meters can be regulated.

Witness said that would meet his view.

Mr. LEIGHTON: Were you called before Sir James Rankin's Committee?

Witness: Yes; but speaking from memory, I do not think I was examined on this point.

Mr. DANCKWERTS asked if he might put a few questions to witness.

Witness said the learned Counsel could only put questions to him through the Committee. He came to supply the Committee with any information in his power—not to give evidence either for or against the Bill.

Mr. DANCKWERTS said he would not cross-examine. He wished to know if it would be possible to fix a standard percentage of profit on the total capital embarked on the fittings business by way of reward for extra consumption.

Witness replied that it might be done. He had not thought out whether this would be a satisfactory way of doing the thing. It would be going perilously near fixing the price of the fittings. The Board of Trade had power, under certain Acts, to require gas standards to be altered and varied; and these might give them power to sanction gas measurement under the penny-in-the-slot system.

Mr. DANCKWERTS drew attention to the duty of the Official Auditor, which was to certify the accounts if correct, or require them to be modified in the manner he thought right. Dividends were not to be declared until the accounts were certified by the Auditor. He wished to know if this power was not ample to enable the Auditor to keep control over a Company.

Witness said the Auditor, in extreme cases, could certify that the accounts were incorrect in principle. This was a useful power, and operated very well; but if he were asked whether this gave the Auditor control over the accounts of a company, he should answer "No."

The CHAIRMAN said they had it in evidence that there was great difficulty in keeping the prepayment-meter accounts.

Mr. NICOL: Assuming that a standard is arrived at by Parliament, should it be one that should apply, not to London only, but to the whole of the United Kingdom?

Witness: It is to be hoped it would apply generally. If the Bill were carried, a vast amount of work would be cast on the Board of Trade which would be carried out purely for the benefit of the Metropolis.

Do you think the system, as proposed, could be adopted for the whole country?—The penny-in-the-slot system is spreading all over the country; and any principle adopted in respect of it should hereafter be adopted in the rest of the United Kingdom.

Then, do you think it desirable for Parliament to adopt the clauses contained in Part III. of this Bill, and deal with the question as a whole?—There is a good deal to be said for that; but we know that Parliament has proceeded in these matters step by step. If we could get a settlement of this question in the Metropolis, it might assist in arriving at a settlement in other parts of the country.

Have any of the London Gas Companies approached you on this subject, or are the London County Council the only authority who have approached you?—There is a clause in the South Metropolitan Company's Bill dealing with the question of the slot-meters; and on this we have had interviews and communications. That is the extent to which we have been approached.

Mr. DANCKWERTS said that, on behalf of the Gaslight and Coke Company, he wished to say that if this matter could be settled by some practical authority under the Board of Trade, in the direction of limiting the charge, the Company would be glad to accede to it.

Mr. BALFOUR BROWNE said that, on behalf of the South Metropolitan Gas Company, he would go one better. His Company did not want to make a profit out of these meters; but they did wish to make a profit on the sale of gas through the meters. They only wanted to be saved from loss on the meters—on the charge for meters and repairs and management in connection with them. They only desired to cover the cost; and no doubt Sir Courtenay Boyle would say that was only fair.

Mr. DANCKWERTS remarked that his Company were perfectly ready to see a Committee appointed at once in the matter.

Counsel representing the Corporation of West Ham said his clients would like to see provision made for the due investigation of the accounts of the Gas Companies by some authority or other.

Mr. BALFOUR BROWNE felt bound to say he thought the Committee could settle the points in dispute between the parties.

Mr. LEIGHTON asked whether he might take it that the Board of Trade did not think the preamble of the Bill was proved?

Witness replied that this was rather a question bearing on policy. He, however, did not think that the supply of fittings for the prepayment system should be regulated by the Board of Trade.

The CHAIRMAN said witness was assuming that the Board of Trade would be asked to deal directly with these questions. Would it not be possible for them to appoint some body of experts to deal with them?

Witness said they should not be asked to appoint an authority to fix the price of fittings. He did not think it was in the power of Parliament to create such an authority. If the meter was to be standardized, and a price fixed for the gas, well and good; but when the price had to be settled for the use of the fittings, he said it was impossible to do it.

Mr. NICOL remarked that he had been a member of the Committee of last year; and his view had been that the question as to the meter was important, and must be dealt with. The business was a new one, and was extending very largely over the Metropolis. His idea had been that the legislation passed should be such as would set up a common standard applicable not only to the Metropolis, but to the whole of the United Kingdom. Was this the view of witness?

Witness replied in the affirmative. He added that if Parliament in its wisdom settled the question in the Metropolis, the decision would be of considerable use to the other Companies. He did not think that Part III. of the Bill should be adopted in its present shape.

The CHAIRMAN: If the Committee were of opinion that some satisfactory charge should be found to cover the cost of fittings and maintenance and depreciation, it would be within the province of the Board of Trade, and their wish, to adopt it?

Witness: Yes; if it can be done. The open market may come; and these fittings may be procurable there.

The price fixed would be for supply by the Companies?—Of course, if the consumer could better himself, he would be at liberty to do so.

Then there could be no harm in the Committee coming in as suggested?—The consumer, of course, would be at liberty, if he wished, to make his own contract.

Mr. LEIGHTON said he took it that the Board of Trade did not approve of the first part of the recommendation of the Committee of last year. Could the witness say if the Board agreed to the other part of the recommendation?

Witness did not think he could go into that at the present moment.

Mr. DANCKWERTS said he hardly understood that anyone differed from the findings of the Committee.

Mr. LEIGHTON: But Sir Courtenay Boyle says he differs from Recommendation No. 3.

Mr. WORSLEY TAYLOR said that, on behalf of the County Council, he wished to observe that he had an opportunity of saying a word to his clients; but the matter seemed to him to have entered on a new phase. Till this morning, they had had before them the Bill of the County Council attempting to deal with the matter on uniform lines, and a measure brought forward by one of the Gas Companies in their own interest. They had heard the views of the Gaslight and Coke Company, and, for the first time, the views of the Commercial Gas Company; and there seemed to be a great deal of agreement between them and the County Council. It seemed to him that this part of the County Council Bill should satisfy everyone, because it was agreed that the prepayment system was an increasing system in the hands of all three Companies. The Bill affected a poor class, who were not able to take the necessary measures for their own protection. The practice of all the Companies was to let the meters and fittings together as a whole; and it was agreed that some regulation of the amount to be paid was desirable, in the interest of the consumer, and that there should be uniformity of charge all over the Metropolis. Under these circumstances, his learned friends had criticized the Bill; and it had been suggested that a *modus vivendi* could be arrived at if the Companies were to meet the County Council, and settle the matter. If this was the suggestion, it seemed to him that its adoption would be of great advantage. The consumer, as represented by the County Council, should meet the Companies.

Mr. NICOL: With the Board of Trade?

Mr. WORSLEY TAYLOR: Yes; if that is the proposal, the County Council would be ready to fall in with it.

Mr. NICOL: Would that mean a fresh Bill?

Mr. WORSLEY TAYLOR said he did not know that the matter could be dealt with at once. He did not say that it could not; but he was afraid that the negotiations would take so much time that the result could not be dealt with. It might involve the withdrawal of the slot powers from the County Council Bill, and the withdrawal of the South Metropolitan Bill. He put it whether it was not worth while to meet, and endeavour to arrive at some agreement.

Witness said if the Committee thought any advantage would accrue from a conference between the representatives of the County Council and the Gas Companies, he should be very glad to invite such a conference, to see if they could not arrive at a conclusion.

Mr. DANCKWERTS: I am sure that will be agreed to by everybody. What I suggest is that the Board of Trade should select some really practical man who can go into the question—I myself have a scheme ready—to settle the thing on broad, sensible lines.

Mr. NICOL: Have the County Council approached your Company with reference to the scheme they have?

Mr. DANCKWERTS: No. The County Council could have such representation on this proposed Commission as the Board of Trade think fit.

The CHAIRMAN: On the other hand, the Committee had before them, or will have before them, the Bill of the South Metropolitan Company, in which they suggest a settlement under one of their clauses.

Mr. DANCKWERTS: Mr. Livesey is here; and he tells me he is perfectly willing to stand in with all the Companies.

The CHAIRMAN: I see Mr. Livesey shaking his head.

Mr. LIVESEY: I think it can be done much more easily than that.

The CHAIRMAN: At all events, we have the goodwill of the Board of Trade. Sir Courtenay, I think you said you would convene?

Witness: I said "invite."

Mr. LEIGHTON: You do not propose, Mr. Worsley Taylor, to withdraw your Bill to have a conference?

Mr. WORSLEY TAYLOR: I said I doubted whether legislation would be possible; and in that case, the convenient course would be to withdraw this part of our Bill and the corresponding part of the South Metropolitan Bill—the matter to stand over for a conference under the auspices of the Board of Trade.

Mr. ROSTRON: We should like our Bill to be first heard.

Mr. WORSLEY TAYLOR: I only said this as a means of settling the matter on a friendly basis. Suppose, conceivably, you thought the South Metropolitan was a better proposal than the County Council Bill, you would be legislating for only one. Therefore for the other two, supposing you settled that, you could decide nothing—there would have to be fresh legislation next year.

Mr. DANCKWERTS: For once, I am in cordial agreement with what my learned friend has said. It is extremely advantageous that the legislation should be, not upon the discussion of one single proposal before the Committee, but upon all possible proposals that can be made.

Mr. WORSLEY TAYLOR: That is another advantage, it seems to me, of a conference of this kind. The Board of Trade might be able to suggest something, and so might the Commercial and the Gaslight and Coke Companies.

Mr. NICOL: What is left of your Bill? We threw out the preamble of the first part?

Mr. WORSLEY TAYLOR: This is the remaining part of the Bill.

Mr. NICOL: This conference may last till the Greek Kalends.

Mr. LEIGHTON: You propose to withdraw the Bill for this year?

Mr. WORSLEY TAYLOR: I should like to have an opportunity of considering that—to see whether legislation would be practicable this year. Uniform legislation could clearly only come about under the Bill of the County Council, because it is the only Bill which deals with all three Companies.

Mr. Danckwerts: Or by Public Bill.

Mr. Worsley Taylor; Would this be convenient—simply to suspend the further consideration of this part of these two Bills for the present, and see whether anything could be done in the meantime with a view to legislation this session?

Mr. Danckwerts: That is the precedent of 1876. Then all the parties met, and agreed upon a form of Bill; and it was settled that it should go through as an unopposed Bill. That might even be done this session, by suspending the Standing Orders, or something of that sort.

Mr. Worsley Taylor: I think if a uniform result can be arrived at by agreement, it will be better.

The Chairman: Would it be possible for the three Companies to consult, and also the promoters of the Bill now before the Committee, and arrive at some practical conclusion by (say) to-morrow?

Mr. Danckwerts: No; that is impossible. Twenty-four hours is hardly enough to think out a good scheme.

The Chairman: I—and the Committee agree—think it would be better if we could arrive at some definite conclusion which would apply to all the Companies in the Metropolis; and therefore it seems to us that the best plan would be for all the parties concerned to confer with a view to arriving at a satisfactory conclusion to be made applicable to all.

Mr. Nicol: We have dealt with a portion of the Gaslight and Coke Company's Bill; and we held over our decision on that matter until we took up the second part of the London County Council Bill—that is, the slot-meter part. Why could we not go on with the South Metropolitan Bill, hold over our decision in regard to this question, and then see how we stand when we have heard their case?

The Chairman: I think that is a very good suggestion. It is one which will not entail inactivity on the part of the Committee. We can go on with the South Metropolitan Bill. We are very anxious to get the Bill through.

Mr. Danckwerts: The Committee will remember that if a scheme is agreed upon, it will come before the Committee as an unopposed proposal; and that if, on the other hand, the Committee force us to do the thing in a short period, there may be failure to come to an agreement, and we may have the fight over again.

The Chairman said they had the suggestion that the Board of Trade would use their influence in securing a conference; and with a conference of that sort, the Committee thought a settlement could be arrived at in such time as would be covered by the hearing of the South Metropolitan Bill.

Mr. Danckwerts: I am afraid that is too sanguine.

Mr. Nicol: But we could go on with the South Metropolitan Bill.

Witness suggested to the Committee that the County Council Bill might be a more useful way of dealing with the matter than by individual Bills. If the Committee could use the machinery of the County Council Bill to get a parliamentary decision upon the proposal, it might be convenient to both parties.

Mr. Danckwerts said his observations were only in regard to the slot-meter part of the South Metropolitan Bill.

Mr. Nicol: The conference will be in reference to matters dealt with by the Bill of the County Council now before the Committee.

The Chairman: And specifically that they deal with the difficulty arising on the fittings.

Witness did not think the Board of Trade would invite such a conference, unless something in the shape of a recommendation came from the Committee. If such a recommendation came from the Committee, he was certain an attempt would be made to hold such a conference; and the terms of invitation he had in mind were to consider the method of charge for prepayment meters, and whether it is possible to arrive at any regulation.

Lord R. Cecil said his Company had a scheme which they were very anxious to submit to the Committee.

Mr. Danckwerts: Let us proceed with an open mind all round.

Mr. Baggallay: May I say the Commercial Company would be very willing to attend such a conference as Sir Courtenay Boyle has suggested, in order to see whether some uniform mode of dealing with the matter might be discovered? With regard to what Lord R. Cecil says on the part of the South Metropolitan Company, I should have thought that if his system is really a workable one, it might be adopted; but it would be a good opportunity for it to be submitted at the conference. In the meantime, the Committee could go on with the other part of the South Metropolitan Bill.

The Chairman: Then we will suspend the hearing of the Bill for the day, and take up the South Metropolitan Bill in the meantime—relying upon the parties concerned to use the good offices of Sir Courtenay Boyle to arrive at a settlement.

This terminated the proceedings for the day on the Bill of the London County Council.

The determination of the Committee was announced on Friday—see *ante*, p. 1369.

The London County Council and their Wasteful Parliamentary Expenditure.—A correspondent (signing "E") in the "Standard" last week wrote: "I am not a Parliamentary Agent, or a Parliamentary Counsel, or an expert witness. I am a ratepayer. I do not revel in the parliamentary struggles between the London County Council and the Gas and Water Companies. I only know that, whichever side wins, I have nothing to gain, I have only to pay. *Delirant reges plectuntur Achivi.* For some years past the London County Council have tilted desperately against the Water Companies; but the wisdom of Parliament has been against them. This year they have made an onslaught on the Gas Companies, with the like result. I have sometimes peeped into the parliamentary committee-rooms where these fights have been raging, and have ruefully remarked the array of prosperous-looking warriors engaged on either side. It was sport to them; but it was death to me, for the public has to pay the bill. Will some obliging member of Parliament move for a return of the expenditure in recent years of the London County Council in futile parliamentary campaigns, and of the expenditure incurred by their opponents? And may a plain man suggest that a public authority who shall fail to convince Parliament of the merits of their aspirations, should be required to obtain the sanction of the Board of Trade or Local Government Board before they may fight the same fight over again?"

HOUSE OF COMMONS COMMITTEE.

Monday, May 14.

(*Before Mr.* Mark Oldroyd, *Chairman, Mr.* Emmott, *Mr.* Nicol, *and Mr.* Stanley Leighton.)

SOUTH METROPOLITAN GAS BILL.

On the suspension of the proceedings in regard to Part III. of the London County Council Bill to-day, the Committee proceeded to consider the Bill of the South Metropolitan Gas Company.

Mr. Balfour Browne, Q.C., Lord Robert Cecil, Q.C., and Mr. Rostron were for the promoters. The other Counsel engaged were: Mr. F. R. Fitzgerald, for the Ecclesiastical Commissioners; Mr. Freeman, Q.C., and Mr. G. J. Talbot, for the Vestries of Camberwell, Rotherhithe, Battersea, Bermondsey, and Newington; Mr. Worsley Taylor, Q.C., Mr. Freeman, Q.C., and Mr. G. J. Talbot, for the London County Council; Mr. Corrie Grant, for the Vestry of St. George, Southwark; and Mr. Littler, Q.C., and Mr. Rigg, for the Corporation of the City of London.

Mr. Balfour Browne, in opening, drew attention to the Instruction to the Committee on the Bill, to consider whether it was desirable to insert such clauses as might be required to give effect to Recommendations Nos. 1 and 2 of the Select Committee of last year. The first recommendation was: "That, whenever any of the Metropolitan Gas Companies again come to Parliament for an extension or alteration of their capital powers, a revision of the sliding-scale should take place, and that the standard price should be reduced to 3s. 3d. to carry the standard dividend of 10 per cent., and that the existing scale of increase and decrease of dividend of ¼ per cent. for every penny of increase or decrease of price below or above 3s. 3d. be maintained, and that a secondary or additional scale be imposed, which should permit of an increase or decrease of dividend over and above that regulated by the present scale of ¼ per cent. for every complete 3d. of decrease or increase below or above the standard price of 3s. 3d." The Company had adopted that in their Bill. The second recommendation was that the area south of the Thames, at present part of the district of the Gaslight and Coke Company, should be transferred by them to the South Metropolitan Company at a fair and reasonable price. That, also, the South Metropolitan Company were willing to adopt; and the Bill provided for it. The first recommendation the Company could adopt without doing any harm to their shareholders; but any such recommendation as was contained in the fourth paragraph, with regard to touching the sliding-scale, so as to affect the security upon which people had subscribed their capital, they could not accept any more than the Gaslight and Coke Company. On the existing price of 2s. 1d., present regulations would allow of a dividend of 14 per cent., or on the converted capital of £5 12s. per cent. The suggested rule of a double sliding-scale would allow the Company to divide 14¼ per cent., or £5 14s. per cent. as against £5 12s. That recommendation, therefore, did not allow of the cheating of those persons who had subscribed to the capital of the Company or bought stock at a premium; it gave them a little more. In the case of the Gaslight and Coke Company, the effect would be a loss of 10s. per cent., which would be very unfair, because the premiums on the capital were obtained on the supposition that they were to get that 10s. per cent. It was true there was a lowering of the standard price in the Lea Bridge case; but under perfectly exceptional circumstances. There the sliding-scale was not one on which they had raised any money. It would be a monstrous thing if people were invited to subscribe to the capital of a Company, believing that they might get an increase of dividend to a certain amount, and then to have the chance of that increase removed. Parliament had never done such a thing. If he understood the fourth recommendation, it was to reduce the interest on the old capital. Parliament had reduced the dividend on new capital from time to time, but never on old capital. If the recommendation meant a reduction of dividend on old capital, it would be confiscation; but he did not think that was the meaning, because earlier in the report the Committee said they thought the time had come when the standard price might be reduced on the ground that the cost of gas production had been reduced, and also—and this was important—because capital could now be obtained at a much less rate of interest than formerly. That must apply to new capital. It could not refer to past capital obtained on an old rate of interest; and therefore he took it that the Committee meant that a new standard price might be put upon new, but not upon old, capital. Recommendation No. 1 was not contrary to the principles of the sliding-scale at all; it was perfectly fair and honest, and therefore the Company were prepared to adopt it.

The Chairman: Although the application of Recommendation No. 1 to your Company would be emphatically beneficial to a small degree, it would be derogatory to the interests of the present shareholders in the Gaslight and Coke Company.

Mr. Balfour Browne: Certainly.

Mr. Neville: Two millions of capital lost to us.

Mr. Balfour Browne: That is, by taking off 10s. per cent., their stock would be depreciated by two millions of money.

The Chairman: Was not that circumstance before the mind of the Committee when they signed the report?

Mr. Balfour Browne: I cannot think so. I cannot think that the Committee intended absolutely to write off two millions of the capital of a Company who had been authorized by Parliament.

Mr. Neville: I do not think there is any evidence to that effect in the report. There was only one suggestion of the kind, which was from Mr. Haward, who was not a practical man.

The Chairman asked whether there was not a suspicion in the mind of the Committee that the Gaslight and Coke Company had not been very prompt in adopting modern methods of production, and whether they had not done this in rather a primitive way.

Mr. Neville said the Company were between the devil and the deep sea, because they said the Company was over-capitalized, and therefore charged a high price, and then they inquired why the Company did not come for more capital with which to adopt labour saving appliances.

Mr. Balfour Browne said the over capitalization, as he understood, arose from amalgamation. Suppose it did. Every amalgamation was sanctioned by Parliament; and the mismanagement—if there was mis-

management—therefore was partly that of Parliament. Would anybody say shareholders were to be mulcted of two millions of stock, because there had been some want of labour-saving appliances in the making of gas?

The Chairman: As a rule shareholders suffer through those who mismanage the affairs of a company.

Mr. Balfour Browne said he thought that was so—automatically, by the reduction in dividend. The first proposal of the Select Committee, however, did not affect the South Metropolitan Company.

Mr. Emmott: If you have to raise your price to 2s. 9d., it will reduce the dividend you have to pay?

Mr. Balfour Browne: Yes.

The Chairman: The effect of this double sliding-scale is this: When gas is dear your dividend will be a little less; when it is cheap it will be a little more.

Mr. Balfour Browne: That is it exactly. Continuing, he said, with regard to the proposal as to the five years, every weight of unremunerative capital hung round the neck of a company had to be borne by the consumer; and having to come to Parliament every five years was a provision weighing down a concern like the South Metropolitan Company. He did not say it was not a right thing that Companies should come to Parliament occasionally; but he deprecated fixing so short a time as five years, because it meant very great expense. With regard to the recommendation of the Select Committee with reference to the sinking fund, he said if they did redeem capital in this way the Company would be merely taking money out of the pockets of the consumers of gas to-day to relieve consumers hereafter. As a fact, he believed there was here very little obsolete capital to be redeemed. Clause V. introduced a new principle, because it relieved the Company of the obligation to supply 16-candle power gas, and directed them to supply such gas (and unenriched) as Newcastle coal produced.

Mr. Nicol: Do you mean this 14-candle power—a reduction of 2 candles—entirely for the South Metropolitan Company?

Mr. Balfour Browne: Entirely for the South Metropolitan Company. It cannot affect any other Company. He thought he could show that the proposal would be an advantage for the consumers. The money saved would not go to the Company, but to the consumers; so that for the the Company it meant no pecuniary benefit. The Company held that the public wanted not gas of high illuminating power, but cheap gas. During eight months of the year, 50 per cent. of the Company's gas was used not for illumination, but for heating; and for heating, enrichment was mere silliness. The illuminating power of gas was entirely in the consumer's hands, because it depended on the burner used. With a Welsbach burner, for instance, he could get 20-candle illuminating power out of 14-candle gas; and for this purpose the 14-candle gas was better than the 16-candle power, because they wanted heat and not light to get the incandescence. It was proposed that the Company should have power to charge 3s. 3d. for 16-candle gas, 3s. 2d. if they supplied 15-candle gas, and 3s. 1d. if they supplied 14-candle gas. Of course, only one class of gas would be supplied. The question was whether the new principle was sound. Part III. related to the slot-meter, which had been the very greatest boon to gas companies, having induced people to take gas who never would have taken it before. Desiring to encourage people to take as many of these meters as they could, they wanted to supply them at the lowest possible price—looking for their profit, not from the meters, but from the gas passing through them. The proposition, therefore, was to charge for the meters an amount which would cover only the interest on the cost, the repairs, the depreciation or renewals, and a fair allowance for management. The railway contemplated in the Bill was to be public for goods, and the South-Eastern Company were to work it; the object being to take coal more cheaply into the works and to get coke away, thus avoiding an immense amount of cartage. The fifth part of the Bill was for the purchase of the Gaslight and Coke Company's area south of the Thames. The Companies so far had been unable to agree as to price. The South Metropolitan Company were perfectly willing to purchase the works and take over the supply of the district; but the Committee would agree, he believed, that they should not pay such a price as would put a burden upon their present district greater than that which it was at present bearing—that was to say, that the people at present being supplied should not be made to pay for people they were to supply in the future. It might be said that they could go to arbitration; but he did not like arbitration, because the price to be paid for expropriating such a Company as the Gaslight and Coke Company must be very great. If the South Metropolitan Company had to pay for prospective value, the result would be a distinct burden. He hoped the two Companies would be able to arrive at an arrangement mutually advantageous to both. With regard to the petitions against the Bill, the Ecclesiastical Commissioners referred to the proposed railway, 53 chains in length, declaring that it would intersect their property, and cut off access to the southern part of the same. In reply to that, he pointed out that the petitioners could go before the Justices and get compensation works carried out, or get severance damages. Moreover, the land would be taken under the Lands Clauses Acts, which would give the petitioners all the protection to which they were entitled.

Mr. Fitzgerald, interposing, said that an agreement was in course of preparation between the Ecclesiastical Commissioners and the promoters, so that for the present the case of the former might be held over.

Mr. Balfour Browne then dealt with the petition of the London County Council. They objected to the reduction in the illuminating power of the Company's gas, and said that if any alteration were made, it should apply to all the London Gas Companies. He pointed out that it would be impossible for his clients to direct the action of the other Gas Companies. That had never been done in any of the Bills which either of the Companies had passed. Besides, there would be no interference with uniformity, as the whole of the south of London would be under the same law. If the alteration proposed was right, it did not matter to him who invented it. It was sufficient for him that it was good; and the Committee, he hoped, would pass it. As to the petition of the Corporation, they held that the proposals of the Bill would be taken as a precedent for the Gaslight and Coke Company. In this matter, the Corporation was "a Free Stater"—not having anything to complain of itself, but fearing that the example to be set would be followed by another Company; and in the case of the purchase of the Gaslight and Coke Company's property south of the Thames, the petitioners considered that it would remove a plea they had against the Gaslight and Coke Company for reduction in the price of gas north of the Thames. No doubt it would; and in all probability that point was in the mind of Sir J. Rankin's Committee when they recommended the purchase. But he submitted that this question did not affect the South Metropolitan Company, who were not responsible for the Gaslight and Coke Company or their charges. The Vestries and District Boards south of the Thames also petitioned against the Bill, and objected to having varying charges in their districts, and to the Gas Company having power to supply gas of varying qualities. This was evidently the outcome of misapprehension. These authorities would no doubt agree with the Gas Company that the great desideratum was the supply of cheap gas to the public.

Mr. *George Livesey*, examined by Mr. Rostron.

Witness said he was Chairman of the South Metropolitan Gas Company. He was the originator of the present sliding-scale, which was founded on identity of interest between the consumer and the gas company; and it had worked well in his district. It was becoming almost inoperative, according to Mr. Haward, as the benefit to the Company of the reduction in the price of gas by a penny was so small. It gave the consumers £42,000, but the Gas Company only got £5600. This was a smaller proportion than the Company had secured originally, when the scale was fixed. This was why a revision of the scale was proposed—to bring the condition of things back to what it was originally. They desired to fall in with the recommendation of the able Committee of last year. The following table would show what would be the effect of the Company's proposal:—

Table *Showing the Effect of the Various Sliding-Scales and Initial Prices on the Company's Dividend.*

Sliding-Scales.

Price of Gas.	1876. With 3s. 6d. Initial Price.	1899. Committee 3s. 3d. Initial and Secondary Sliding-Scale.	The Company's Proposals.		
			Initial Price to be 3s. 3d. for 16-Candle Gas, and to fall One Penny for each Candle.		
			16 Candles and over. 3s. 3d.	15 and under 16 Candles. 3s. 2d.	14 and under 15 Candles. 3s. 1d.
s. d.	Per Cent. £ s. d.	Per Cent. £ s. d.	Per Cent. £ s. d.	Per Cent. £ s. d.	Per Cent. £ s. d.
3 6	4 0 0	3 12 0	3 12 0	3 9 4	3 6 8
3 5	4 2 0	3 16 0	3 14 8	3 12 0	3 9 4
3 4	4 4 0	3 18 0	3 17 4	3 14 8	3 12 0
3 3	4 6 0	4 0 0	4 0 0	3 17 4	3 14 8
3 2	4 8 0	4 2 0	4 2 8	4 0 0	3 17 4
3 1	4 10 0	4 4 0	4 5 4	4 2 8	4 0 0
3 0	4 12 0	4 8 0	4 8 0	4 5 4	4 2 8
2 11	4 14 0	4 10 0	4 10 8	4 8 0	4 5 4
2 10	4 16 0	4 12 0	4 13 4	4 10 8	4 8 0
2 9	4 18 0	4 16 0	4 16 0	4 13 4	4 10 8
2 8	5 0 0	4 18 0	4 18 8	4 16 0	4 13 4
2 7	5 2 0	5 0 0	5 1 4	4 18 8	4 16 0
2 6	5 4 0	5 4 0	5 4 0	5 1 4	4 18 8
2 5	5 6 0	5 6 0	5 6 8	5 4 0	5 1 4
2 4	5 8 0	5 8 0	5 9 4	5 6 8	5 4 0
2 3	5 10 0	5 12 0	5 12 0	5 9 4	5 6 8
2 2	5 12 0	5 14 0	5 14 8	5 12 0	5 9 4
2 1	5 14 0	5 16 0	5 17 4	5 14 8	5 12 0
2 0	5 16 0	6 0 0	6 0 0	5 17 4	5 14 8
1 11	..	..	..	6 0 0	5 17 4
1 10	..	..	..	..	6 0 0

2s. per cent. amounts to £5642 a Year on the Dividend; 2s. 8d. per cent. to £7522.

With regard to the proposal of the Company for the reduction of the illuminating power of their gas, witness pointed out that, when the original standard was fixed, the conditions were very different to those now prevailing. The illuminants in common use, besides gas, were of very low power; and cannel coal was comparatively plentiful. There was now four times as much gas used in London as in 1870. Moreover, some of the best seams of cannel coal had been worked out. The increase in the cost of this coal had forced manufacturers to search for other means of enrichment. More enrichment was required now than formerly, owing to the ordinary coal producing less illumination; and the enriching materials were less satisfactory. Petroleum spirit would not reach well over a large district; and carburetted water gas was unpopular with the public owing to its poisonous quality. His view was that it should be made possible for Gas Companies to use an inferior quality of coal. If they were compelled to go on using gas coal, its price would rise in the market, just as that of cannel coal had. Witness enumerated the methods of illumination which had come into use since 1870, including acetylene, which he considered would become more popular in the future.

The Chairman: For your information, I may tell you that I have had an installation of acetylene which has displaced gas.

Witness (continuing) said that in the district of his Company there were a large number of gas-stoves and gas-engines. He estimated that during eight or nine months in the year 75 per cent. of the gas manufactured by his Company was used for heating purposes. He pointed out that, when applied to the incandescent burner, 14-candle gas was more effective than gas of higher illuminating power. Having referred to the improved gas-burners and appliances invented in recent years, he said that it was clearly shown that what the consumer wanted was cheap gas. They said to the consumer: "We will give you 14-candle gas, and show you how to use it—show you that, by proper means of lighting it, you can get more light than you get with 16-candle gas."

The Chairman: Why do you not propose to reduce the illumination below 14 candles?

Witness: Because we think that is as much as Parliament will swallow at once. When we have educated the consumers to the use of that gas, we may propose a further reduction in the illuminating power. Witness

said he imagined that before long there would be an enormous development in the use of the incandescent gas-light—when, as in Germany, a burner could be procured for 1s., and a mantle for 2d.

How long have the patents to run?—About seven years, I think; but there is reason to believe that the light will be rendered very popular before long. The gas consumer, like the average Englishman in other things, was very conservative, and required educating in connection with these matters. Witness denied that there was any cause for alarm on the score of the Company supplying 17-candle gas in one district and 14-candle gas in another.

You are not making this proposal for 14-candle gas as a hard-and-fast rule, under which the consumer will only get 14-candle gas; but your object is rather to find the point at which you can supply the public with gas—whether 14 or 15 candle power—without enrichment?—Yes.

It is the enrichment you are trying to avoid?—Yes. I hold it to be a great mistake.

Examination continued: With regard to slot-meters, the Company would put in a clause which fixed a maximum of 9d. per 1000 cubic feet as the charge for meters, stoves, fittings, &c., which was what they had been charging. He held that the Company ought to supply the slot-meter consumer with gas at the same price as the ordinary consumer, although the slot-meter consumers burnt only about one-fourth of what the ordinary consumers did. The extra cost to the slot-meter consumer was merely to pay for the slot-meter and fittings put into the consumers' houses. The Companies were allowed, by Act of Parliament, to charge 10 per cent. as rent of meters, which 10 per cent. covered the interest on capital and cost of repair, maintenance, and renewal. If there was to be any legislation for slot-meters, the precedent in regard to ordinary meters ought to be taken, and the Companies allowed to charge 10 per cent. on the cost of the meters, stoves, &c. The proper way was to say that the Company should not charge more than 10 per cent. on the cost; that this should be distributed over the average quantity used; and then that the Official Auditor should certify that the amount was no more than sufficient to pay interest on the capital and to meet the extra cost of administration. Although the figure of 9d. was mentioned in the Bill, it would have to be settled every year. It was absurd to standardize fittings.

Mr. Leighton: Sir Courtenay Boyle thought you could only standardize the meters?

Witness: That is done now.

You propose another form of standardizing, through the Official Auditor, with regard to the cost of the fittings?—No; we should put before the Official Auditor the average cost of the fittings. Ten per cent. on that is so much; and he is to see that we have not charged more than the 10 per cent.

Sir C. Boyle said they could not deal with the fittings?—They cannot standardize them.

The payment for the fittings would be a statutory payment under the Official Auditor?—Yes.

In further examination, witness said he was not very anxious about the railway. He was not sure it would be an advantage. With regard to the purchase of the Nine Elms works of the Gaslight and Coke Company, he saw little advantage in it to the South Metropolitan Company, though there would be a gain to the consumers and to the sellers of the works. His Company were willing to take the works if they could get them on terms which would not entail a loss to their shareholders or consumers. There would be no difficulty with regard to the mains; but two-thirds of the gas made at the works supplying the area went over the river, so that the mains crossing the river would be of no use. The South Metropolitan Company had offered as high a price as, in the interests of the shareholders, they could afford. They offered £800,000; and the Gaslight Company asked £1,250,000. The South Metropolitan Company took the profit per 1000 cubic feet the Gaslight and Coke Company had been earning south of the Thames in 1898, which came to a little over 5d., or an aggregate of £21,000 a year. This would pay interest (at 3½ per cent., the rate at which they expected to raise the capital) on £600,000. Then there were the surplus works, which were capable of making a certain quantity of gas. It was found that to extend their works at East Greenwich to make an equal quantity of gas would cost £150,000, which they called £200,000—thus arriving at the £800,000.

Mr. Rostron: You are not disposed to accept an arbitration clause on this subject?

Witness: No; we are better judges of what it is worth than any Arbitrators. I think we went beyond our limits. The Company took permissive power; so that if at any time they found it to their advantage to sell the district and came to terms, they could do so.

The Chairman: Would an enabling clause like that give power to the Company to sell?

Mr. Neville: We have power to sell, under the Metropolis Gas Act. This Bill is really not required.

Witness: It is necessary for us in this sense—that we could not raise the capital.

Mr. Neville: It is not necessary for us.

Witness, in further examination, said it was also proposed to alter the form of accounts. The accounts at present were so set out that no one could tell the amount of capital on which they paid dividend or interest; and the alteration would make this clear.

Cross-examined by Mr. Littler: At present the Gaslight and Coke Company were required to supply gas for public lighting in the City at the lowest price at which they supplied any consumer; and gas was sold by that Company at a lower price south than north of the Thames. He agreed that if the Bill made no special provision, and the transfer of the area south of the Thames of the Gaslight Company took place, the City would lose the benefit of receiving gas at the lower price; but it was not fair that the public consumer should be supplied at a lower rate than the private consumer.

By Mr. Freeman: The same would apply to the whole of the Authorities north of the Thames. The result was that these Authorities were paying only 2s. 1d. per 1000 cubic feet, although the private consumer paid 3s.; but the private consumer paid too much. There was at present an absolutely uniform standard of candle power over London; but it would be a great advantage to alter it—at any rate, for the sake of experiment. In this case, it would be a most interesting experiment to try the effect of a reduction of illuminating power. It could not injure consumers north of the Thames. The Company would be quite prepared to alter the burners of the consumers, if they wished it, or if it were necessary, in consequence of the reduction in illuminating power. It would be distinctly to the advantage of the consumer to be supplied with lower quality gas; and he believed it would be shown that more light could be obtained from 14-candle gas with a change of burner than was now being obtained from 16-candle gas. The Widnes experiments, in which the quality of gas was reduced by drawing in air, were most unreliable. If Mr. Dibdin was right in suggesting that the reduction from 16 to 15 candle power was equivalent to 5d., it was absurd to talk of reducing the illuminating power. But Mr. Dibdin was not right. He was simply an experimenter, who had had nothing whatever to do with gas manufacture or distribution. The County Council knew nothing about what consumers wanted; the Company did. Moreover, the County Council did not care about them. Like Mr. Littler, who represented the City, they did not care about the consumers one snap. His Company did; they lived by them, and held it to be to their interest to do the best they could for them. He contended that his Company had been the consumers' friend. It was an impossibility that the Companies should supply varying qualities of gas in different parts of their district, or at different times. He objected to a compulsory clause for the acquisition of the portion of the Gaslight and Coke Company's area, because they did not want the district, and would not accept it on any terms which would be a disadvantage to the consumers. Questioned as to his objection to the Board of Trade having control of the fittings, witness said Sir Courtenay Boyle had told them that nothing should induce him to undertake it. The Board of Trade could not do it. How could anyone make the consumer use the fittings the Board of Trade standardized? The Companies supplied fittings with which the consumers were satisfied; and it was open to the consumers to get them elsewhere.

Tuesday, May 15.

Mr. *Livesey*, in cross-examination by Mr. Corrie Grant, said he had not the details of the winter consumption of gas in the Company's district; but he would get them.

Mr. Corrie Grant said he wanted the total consumption of gas, divided into lighting and heating.

Witness: Then you cannot have it. It is impossible to get it.

In reply to further questions, witness said that in the month of March he assumed that 50 per cent. of the gas consumed was used during the daylight hours—more than in the month of June. He assumed that this would be for purposes other than lighting. An additional 5 per cent. of the public lamps would, before long, use the incandescent mantles. It was not too much to assume that during eight months of the year at least 75 per cent. of the gas supplied was consumed for purposes other than lighting.

Mr. Corrie Grant: This is, practically, all assumption.

Witness: No.

Why do you assume that 50 per cent. of the gas used in daylight is not for purposes of lighting?—Well, I do not suppose that many people burn gas in daylight for purposes of lighting.

What I want is the actual consumption during the summer time and the winter time?—There is three times as much gas burnt in January as in June. I will get the figures you want prepared. With regard to the proposed amalgamation, some part of the money spent on gas in the St. George's parish now goes to the Gaslight and Coke Company.

If your purchase is effected, we lose competition in our parish?—The Gaslight and Coke Company are obliged to charge the same amount as the South Metropolitan charge.

Is that not a result of competition—if their price is forced down to the level of yours?—No doubt it is.

Lord R. Cecil (in re-examination): It has been suggested that you might vary the illuminating power of your gas, and supply sometimes 17 and sometimes 14 candle gas. If you supply gas without enrichment, do you suppose that there will be any great variation in the illuminating power?

Witness: No; I assume not. I take it that the consumers will get gas of the quality that the photometer showed when we did not enrich the gas—that is to say, 15-candle gas.

Is there any foundation for the suggestion that you will supply, say, 14-candle gas in January and 17-candle gas in June?—Certainly not. We shall supply gas of the same uniform quality. Probably it will be of a little less quality in January than in June, as the cold weather causes a little condensation.

Are you prepared for the tests to be taken on a monthly instead of a six-monthly average?—Yes. The Bill was drafted for a six months' average, which we take because our accounts are made up half-yearly. But that is not quite a fair way to deal with the matter, because we find that three times as much gas is used in January as in June. We therefore propose to take a monthly test in January, and multiply it by the quality, and the quantity sent out in June, and multiply that by the quality, and then take the average.

If you supply gas from the same coal without enrichment, by the same process, you get substantially the same quality all the year round, do you not?—Yes; with very little variation.

You say one of the chief reasons for passing this Bill is that it will be of great benefit to the consumer?—Yes.

In saying that, you do not pretend to pose as a pure philanthropist?—No. For thirty years we have pursued the policy of trying to satisfy our consumers, and it has answered our purpose. We have held our ground against our opponents, and have secured a much greater increase of business than they. I may say we have got so far as to offer all our stock to consumers. We have told them they can have it on application, at such and such a price.

In other words, it is to your interest to satisfy your customers?—Yes; and we have gone further than that. We have given our employees an interest in our business in the same ratio. They are paid on a scale corresponding with the price that the gas is sold for. If the price can be reduced, the men benefit.

The Chairman: As to the proposal to lower the standard of illuminating power, you propose to fix the lowest at 14 candles?

Witness: Yes.

And so on up to 16 candles?—Yes.

And you propose to supply your gas without enrichment for the future?—Yes.

You must have had large experience in dealing with supplies of gas coal—the peculiar class of coal eminently fitted for the making of gas. According to that experience, do you think you will be able to obtain a supply which will secure your ability to furnish gas at any given standard you may adopt—that is to say, of 14, 15, or 16 candle power?—We could work in that direction. We could get our coal and supply gas of the quality it produces, taking care that it does not fall below 14-candle power. We have had coal from one colliery for sixty years. I remember it when I was a boy. But it certainly is not so good now as it was. It is getting more a coking coal than a gas coal. We cannot, in fact, get the coal we want from Durham. Twelve months ago we contracted for 100,000 tons from Lord Londonderry's collieries. We have not got it yet. There is plenty of coal available that will give us 15-candle gas, but very little that will give us gas of 16-candle power.

Mr. LEIGHTON: What security will the public have that you will enrich gas that is below 14-candle power?

Witness: If the coal fails, we shall be obliged to use enrichment.

Mr. NICOL: If the gas depreciates in quality, you will have to come to Parliament again for a further reduction of illuminating power?

Witness: With a new burner.

Mr. NICOL: I do not know about that.

The CHAIRMAN: You have now a margin of ½ candle before you come under penalties?

Witness: Yes. If it were not put in that way, we should be subject to penalty even if the gas fell a tenth of a candle during the first hour of testing. Under the arrangement of 1876, the penalty for the first ½-candle deficiency is 40s. In respect of the first candle deficiency, the penalty is in proportion to the value of the gas, and so on with the succeeding candles. The penalties in respect of 14-candle gas will be the same as those which now apply to 16-candle gas.

Mr. *Thomas Newbigging*, examined by Lord R. CECIL.

Witness said that generally he agreed with Mr. Livesey's evidence. He thought there was a distinct disadvantage in a very high illuminating power to the gas consumer. The enrichment of gas not only costs the consumer more than it is worth, but it introduces an element which aggravates the irregularity of the illuminating power over the district of supply. As a rule, the burners used by the public were not capable of developing the full illuminating power of the gas; and in these circumstances, a variation in the initial quality to the extent of 2 candles would produce no appreciable difference in the illuminating effect. Consumers went on using their burners long after they ceased to give a proper result. It might be desirable; but he did not think Parliament would ever allow a gas company to compel the consumer to use a certain burner. He thought a reduction, within limits, of the initial illuminating power was a desirable thing. In his view, the provisions of the present Bill provided a scheme by which this could be properly, justly, and generously carried out. The suggestion of the South Metropolitan Company was one which it was exceedingly desirable to adopt. If the consumer used an improved incandescent burner, the lower quality gas would make no difference; and with such a burner the high illuminating power of gas was positively objectionable. There was risk under the Bill that the Company would not be sufficiently remunerated. The Company might have to pay the same price for the inferior as they had to pay for the better-class coal; so then it was the Company who was under disability, not the consumer. The Company might have to pay the same price for coal, and yet get less for the gas produced by that coal.

Lord R. CECIL: Can you tell the Committee what your experience is as to complaints of the illuminating power of gas?

Witness: My experience is that in the southern counties, where the illuminating power is fixed at 14 candles, as a rule the complaints are not nearly so numerous. In fact, there is almost an entire absence of complaints in the southern portions of the kingdom, whereas in the north, where the illuminating power ranges from 16 to 20 candles, complaints of bad gas are of daily occurrence. Even in the Metropolis, there are very few complaints by the consumers; the complaints come almost entirely from the Gas Examiners. The reason is that in burning a low-grade gas, you burn it to better advantage than you can burn a higher grade gas, using the same burner.

In other words, the ordinary burner is adapted for the low-grade gas, and not the high-grade gas?—That is so.

You are also of opinion that, where a higher-grade gas is supplied, you do not get such good street lighting?—That is my experience. The street lighting in London, for example, is, I was going to say, perfect. At least, it is very much better with its 16-candle gas, than street lighting I have seen with 18-candle gas. In Edinburgh, where the streets were lighted with gas of 25 or 26 candles, the result was exceedingly unsatisfactory. The consequence was that the Corporation resorted to electric arc lighting. I doubt very much whether they would ever have done so had not the street lighting been notoriously unsatisfactory by reason of the high illuminating power of the gas. The gas had a very high illuminating power, but a very low diffusive power. For the use of gas for purposes other than lighting, the reduction of the initial power by 1 or 2 candles would not have any appreciable effect, and certainly any such difference would be covered by the proposed reduction in price of 1d. The scientific application of gas for purposes other than lighting was in a very crude state; and improvements were being made, and would be made in the future. Low-grade gases, within a certain range, were better for heating purposes than high-grade gases.

Do you regard enrichment as a cause of deterioration in the gas?—Not exactly as a cause of deterioration. Any gas not homogeneous suffers deterioration by condensation when passing through mains—less or more. I believe simple coal gas suffers no deterioration—or but little—in passing through mains.

Generally, I may take it, you are strongly in favour of this Bill?—Yes.

Cross-examined by Mr. WORSLEY TAYLOR: Many Scotch managers who laughed at witness three years ago, when he began to advocate lower-candle power gas, were now coming round to his opinion. The proposal of the Bill was introducing no new innovation at all; it simply introduced natural conditions, and would give wider scope in the purchase of coal. He agreed that a large number of the Companies he advised had to supply gas of fixed illuminating power; the average being about 15 candles. The figure with a large number was 16 candles. The Bill was intended for the advantage of both consumers and Company. He had not heard that any consumer had asked for it; but he was not aware that any consumer objected. By the present system, the Company were not able to reduce the price as they would like, which was a hardship. The Company, further, were continually in a state of anxiety, because they were not able to supply, unenriched, the gas made from coal. If the Bill were passed, the result, in his opinion, would be that 15-candle gas would be supplied all the year. It would reduce the illuminating power as tested on the photometer, but not the illuminating effect. The result of giving the Company a margin, and not fixing a hard-and-fast limit to the illuminating power, might be that they would avoid penalties; but it was desirable there should be such a margin. In Edinburgh, he agreed, they burnt 2½ cubic feet of gas per hour in each burner, instead of 5 cubic feet as in London. It was not necessary that there should be a general inquiry before making the changes proposed in the Bill, which might lead to an alteration in standards of illuminating power in London and all over the country. In London, Durham coal was used; but in other parts there was coal which produced 16-candle gas without enrichment, and he would apply the same rule to them as to the London Companies. He would allow them to use the coal without enrichment, which would be no disadvantage to the consumer at all. No doubt, if the Bill were passed, the same proposal could not be refused the Gaslight and Coke Company and the Commercial Company. But there was no uniformity in gas legislation. Even in Lancashire, where the coal was supposed to supply gas of high quality, some Companies were only under obligation to give 12-candle gas. It would be a splendid thing if each Company were under obligation to supply gas of the quality which could be obtained from the coal of the particular district.

Mr. CORRIE GRANT: Does not your proposal come to this—to give the South Metropolitan Company freedom to go to other coalfields, and use coal of inferior quality if they choose?

Witness: Yes; it does.

Lord R. CECIL: Subject to this—that they cannot use any coal which will produce less than 14-candle gas?

Witness: Yes; that is so.

To do away with enrichment is the main object of the Bill, so far as that part of it is concerned?—Yes. The fact that this was the first Bill of the kind, was no reason why it should not pass. One Company must take the initiative in every reform; and he sincerely hoped it would pass, because it would be good for the Company and the consumers.

By Mr. NICOL: Ordinary coal without enrichment would give more uniformity of illumination than coal with enrichment, provided a proper burner was used. Gas of 14-candle power was good enough for any practical purpose. Generally, for illuminating, 14-candle gas would satisfy the consumer, and be better than gas of 16-candle power.

By Mr. EMMOTT: Gas of high candle power, as tested by the photometer, appeared to have a low diffusive power; but he had made no experiments on this point, and his opinion rested therefore on observation and not on scientific investigation. The calorific power of low-grade gas was greater than that of high-grade gas.

By the CHAIRMAN: Many years ago, the usual method of enrichment of gas was by cannel; but the supply of cannel failing, substitutes were used, which, not being homogeneous with the gas, tended to precipitate in certain unfavourable conditions of temperature and friction.

The CHAIRMAN: Therefore the smaller the service-pipe of the individual consumer, the larger the friction in the pipe, and the more precipitation and loss of what had been supplied originally?

Witness: That is so. There is no doubt about that. The skin friction is very great in proportion to the small bulk of gas.

Therefore your theory is that, in the interests of the country generally, Parliament will gradually—if it is wise, at all events—resort to adapting the standard which it imposes to the local conditions of the supply of coal?—I think that is coming.

Do you think the coal supplies now available in the Metropolis are such that the South Metropolitan Company, if the Bill passes, can safely rely upon their ability to supply 14 to 16 candle gas without enrichment?—I do. I will not say quite up to 16; but I would fix the average at about 15, and I have no doubt it would be perfectly uniform.

You do not regard the Bill as a retrograde movement from the standpoint of a gas expert, but rather as a movement of reform?—I do. If passed, it would be a splendid precedent for the country.

Therefore, although you approve of the principle of uniformity as far as the Metropolis is concerned, yet you think the passing of the Bill introducing a breach of uniformity would be a positive advantage?—Yes.

In your judgment the advantage would be such that it would be the precursor to similar steps on the part of other companies?—Yes.

Professor *Vivian B. Lewes*, examined by Mr. ROSTRON.

Witness said he was Chief Superintending Gas Examiner to the Corporation of the City of London; and he attended to give evidence on an order of the Speaker of the House of Commons. He said that in 1894, he read a paper before the Society of Arts, in which he advanced the view that in the manufacture of coal gas Gas Companies should use the coal which they could most economically obtain at their gas-works, retort it in the best possible way, and send out the gas without enrichment. He had seen no reason to alter his opinion in favour of natural as against enriched gas.

Mr. ROSTRON: You think a cheap supply of gas is more useful for the consumer than an enriched gas at a higher price?

Witness: Undoubtedly. My view on the subject of enrichment is that it is money practically thrown away. The old method of enriching with cannel had had to be practically abandoned, because the price became prohibitive; and there was great prejudice against the use of carburetted water gas, because of the increase it involved in the carbon monoxide—a highly poisonous gas. Even with the volatile hydrocarbon method used by the South Metropolitan Company, in cross-mains, dead-ends, and places where stagnation could occur, the artificial illuminating matter in the gas was deposited. This Company had been able to fulfil their parliamentary obligations, because their works were scattered over the district of supply. He approved of the proposal to reduce the standard in London to that of the gas to be obtained from Durham coal.

What are your views as to the reduction of 1d. for each fall of a candle?—I think it is a perfectly just and generous offer on the part of the

Company. Formerly, carburetting oil was at such a price as allowed enrichment to be effected for a little over ½d. per 1000 cubic feet; but now oil had risen to such a point that it costs over 1d. to get one candle of enrichment. With carburine, the figure was 1·12d. The quantity of gas by this method was increased practically nothing. The Bill would assist rather than damage the consumer. Of the gas used in London, 50 per cent. was for heating purposes, 15 per cent. for incandescent mantle lighting, and 35 per cent. for other methods of lighting. He had made experiments with regard to the calorific value of coal gas, and found that, as the candle power fell, so there was a fall in the calorific value. As between 16 and 15 candle gas, there was a loss of 2·4 per cent., and between 15 and 14 candle gas a further loss of about 2·5 per cent. on the total heating value. Comparing this with the reduction in price, there was a gain to the consumer. In connection with incandescent lighting, there was some peculiar phenomena; there being apparently an absolute gain in light by lowering the quality of the gas. The reason was that the air supply in these burners was not regulated for a rich but for a poor gas; so that in a burner where the conditions were for 15-candle gas, a better result was obtained than with 16-candle gas. This would be the case with gas down to 12 candles. Nine consumers out of ten would thus benefit by the lower quality. If a scientific man were to regulate the air supply, he would find the opposite occur.

At the consumer's burner, the quality of the pure coal gas would be almost as good as, and more uniform than, the present gas supplied?—Yes, undoubtedly. The rate of progress of incandescent lighting in this country had been much slower than in other countries. On the Continent, where an incandescent burner could be obtained for a third of the price charged in England, this method of lighting had increased in places to as much as 85 per cent. of the total. In London, it was increasing; the Welsbach burner being much the cheapest, reckoned by cubic feet. The flat-flame burner was totally unfitted for the burning of poor gas. A large number of these burners had two little holes, from which jets of gas were made to rush out and splay themselves. This drew in a large amount of air, which, while good for gas of high quality—say, 22 candles—was not good for gas of any lower quality. The Bill would be decidedly advantageous to the consumer; and it would mark a distinct advance in gas legislation. Paris was as much better illuminated with gas of 14 candles as London, with gas of 16 candles, was better illuminated than Edinburgh, with gas of above 20-candle power.

Cross-examined by Mr. TALBOT: With the best burner, and burning gas rationally, there was a difference of 7 or 8 per cent. between 16 and 15 candle gas. The scheme by which the price of gas rose and fell with the illuminating power, rested on the hypothesis that a penny was fair compensation to the consumer for the loss of a candle in power.

By Mr. NICOL: Temperature affected natural gas much less than enriched gas; so that the difficulty with regard to temperature would be avoided by using natural gas.

Mr. *C. C. Carpenter*, examined by Mr. ROSTRON.

Witness said he was Chief Engineer to the South Metropolitan Gas Company. He explained that the railway proposed in the Bill was to connect the South-Eastern Railway with the Company's East Greenwich works, where it was expected almost all the extension of works necessary to meet the increased demands on the Company would take place. It would enable manufacturing materials to be brought to the works, and coke to be sent out, more cheaply; and it would provide an alternative route to send coal to other works of the Company. The capital expenditure was estimated at £25,000.

Mr. *William Sugg*, examined by Lord R. CECIL.

Witness said 16-candle gas, as ordinarily burnt in London, gave a light, when consumed at the rate of 5 cubic feet per hour, of from 6 to 8 candles—that was, with a union-jet or flat-flame burner. He could supply a burner which, with 14-candle gas, would give as good a result as—perhaps better than—16-candle gas burnt in the present burners. He had heard the Company say they were willing to supply such a burner to their consumers.

By the CHAIRMAN: As a practical manufacturer, he could make a burner which would give the best possible results to any gas which might be supplied to him. Asked why, therefore, any advantage would arise to the consumer from the substitution of the standard of 14 candles for the present standard of 16 candles, witness said with 14-candle gas and a proper burner a brighter result would be obtained than with 16-candle gas. The best burner of all was the argand; but this, he thought, would never be adopted generally.

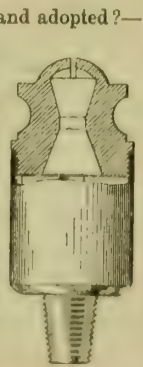
The CHAIRMAN: Your point is that, to get the best result out of 16-candle gas, you require an argand burner; whereas to get the best results from 14-candle gas, you can use a modification of the present flat-flame burner?

Witness: Yes.

Also that this modification will be readily understood and adopted?—Yes.

And that it is a modification which will prove lasting and enduring?—Yes. The burner was not fragile or easily put out of order; and therefore its adoption was within the compass of rational expectation, without overstraining the intelligence of the general public. If the Company carried out their suggestion, and supplied consumers with the burner best adapted to 14-candle gas, the consumers would see that the results were satisfactory, and equal to those obtained on the present conditions. They would have the advantage of 2d. reduction in the price of gas, and would generally adopt the burner.

Cross-examined by Mr. WORSLEY TAYLOR: The burner was an improvement on the well-known hollow-top burner, which he brought out some years ago, and was known as the cone top flat flame burner.



SUGG'S PATENT CONED-TOP FLAT-FLAME "VINCENT" GOVERNOR BURNER.

[Witness handed some samples to the Committee and Counsel, and explained their construction. The head of the burner was hollowed out in an arch over the top, and then cut out in cone form; the apex of the cone pointing to the bottom of the burner. The gas stood in the burner as it rose from the bottom, and thus there was equal pressure at the top, where it spread itself out, and gave a perfect flame of the very best form. The heat struck downwards, and so warmed the gas, causing it to give light to its full power. With 14-candle gas, it would give better results than the public were getting from 16-candle gas with their present burners. With 16-candle gas in this burner, the result would be better than with 14-candle gas.]

Mr. WORSLEY TAYLOR: Could you get as good a result with 13-candle gas?

Witness: We make burners for 13-candle gas for Paris; but we have not made them yet for this country. I do not think 13-candle gas will give as good a result as 14-candle gas.

You say you get as good a result with 14 as with 16 candle gas?—No. It is a question of the kind of burner you use. You could get a good light with 13 or with 12 candle gas. I have made experiments down to 12-candle gas; but not below it. I have nothing to do with the adoption of 14 candles as the standard. No doubt, 16-candle gas can be improved by my burners, just as 14-candle gas is improved; but, though more brilliant, it would be more smoky, and more liable to be affected by draughts.

Re-examined by Lord R. CECIL: He had turned his attention to these burners, because he had felt certain that before long there would be a reduction made in the illuminating power of the gas. He had worked out a burner which gave the best flame with 16-candle gas. His burner was reckoned to cost about 3d., and would last twenty years; whereas the cheaper burners lasted about 3000 burning hours.

Mr. *W. H. Y. Webber*, examined by Mr. ROSTRON.

Witness said he was a Gas Engineer of upwards of thirty years' experience; and during his connection for the last twenty years with the "JOURNAL," he had studied the course of development of the gas industry both at home and abroad. He had observed that the industry had been changing by stages during the past twenty years, and that it had been very much hurried up of late. Originally gas was only used for lighting by luminous-flame burners—there was nothing else; and the first departure from this was the development of the gas-engine in a commercial form by Otto, in 1876. Then came the rivalry of commercial arc electric lighting, about 1880, which inspired makers of gas apparatus to develop very high-power gas-burners—high-power clusters of flames—in order to compete with the electric arc. This made a market, which did not previously exist, for the regenerative burners of the Siemens type, which were of a high power; and about the same time the use of gas for cooking and heating was brought to comparatively speaking perfection. Finally, the crown was put upon the long course of development by the introduction, from outside, of the incandescent system of gas-burner. He agreed that the demand was now for a cheap gas without special reference to illuminating power. He looked upon the old classical school of photometry as dead. He had studied especially the progress of the gas industry in Germany, where it was necessary to go now if one wished to see the latest triumphs of applied science in the gas industry. Owing to a number of circumstances (the chief of which was the refusal of any master patent for the Welsbach system of gas lighting in the German Empire), and owing to the great industrial development of Germany during the last few years, which, of course, was common knowledge, it might be said that the incandescent system of gas lighting had come into its inheritance in Germany during the last two or three years. In the early days of gas lighting in Germany, it was done by English Companies, and English standards were followed—that was to say, there was a standard of illuminating power varying from 15 to 19 candles. As time went on, and concessions fell in, this practice was dropped. The 19-candle gas, he believed, was still supplied from one or two of the Imperial Continental Gas Association's German stations; but as a rule the statutory illuminating power, if it might be called so, fell to 13½ candles about fifteen years ago. At present, 13-candle gas was practically the German standard.

Mr. ROSTRON: Since that time, a new unit of light has been introduced in Germany?

Witness: The introduction of the Hefner-Alteneck unit of light, which is only 0·877 of an English parliamentary candle, was accepted all over Germany as a candle for photometrical purposes, so that this was a further relief to the gas companies.

The result of that has been to reduce the 13½ legal candles to 11·84 candles?—Yes, about that. From 11 to 12 candle gas where the legal convention of 13 candles is still upheld, as it is in cases where the gas is supplied by companies.

The CHAIRMAN: When the governmental standard was altered to the equivalent of 0·877 to our candle, there was no alteration *pro ratâ?*

Witness: No; none whatever.

Do you mean to imply that the German Government, with its usual enlightenment, saw that a lower standard of light was advantageous for illuminating power, and they took the opportunity of altering their standard in order to get the point without disturbing the prescribed candle power of the different authorities—different companies?—No; I do not think it was quite like that. I think the Professors at the Reichsanstalt—the Technical Institute in Germany—were seeking for a national unit of light. The French had one—the Carcel lamp—which nobody else took to. They have adhered to it for forty years, and are quite content with it now. We have played with standards of lights of all kinds; and nobody has copied us particularly there. The Germans wanted a German national standard of light, and they produced one—Hefner-Alteneck produced one in the form of a lamp burning acetate of amyl. As a matter of fact, they could not make it burn brightly. It is a kind of spirit lamp, with a very feeble red flame; and they could not make it give a higher illuminating power than ⅞ of an English candle. But as soon as it was adopted by the German Government as a German standard of light, all the municipalities took it as an equivalent to the candles with which they were familiar, the practical result of which is that 13-candle gas by English candles came down to between 11 and 12 candles. Expressed in English candles, 11½ is now the German standard.

By Mr. ROSTRON: It was not the practice of all German municipalities to work up to that standard. As soon as a German municipality get hold of the gas-works officially, photometry goes to the winds; and they make the gas from Westphalian coal, which is their natural gas coal, mined in the Ruhr basin of Westphalia. Without carburetting at all, the German coal would naturally make gas running from about 11 to

12 Hefners—that was to say, about 9½ to 10½ English candles. That meant working the coal to the best technical advantage.

Mr. Rostron: They refuse to enrich?

Witness: They do not like throwing money away in Germany. They believe in getting the utmost value for every pfennig.

I think that Magdeburg is a practical example of the state of things you have been describing?—It has a municipal gas undertaking, which has been the first to adopt the principle of sending out gas just as it comes by the ordinary way of carbonizing from the cheap Westphalian coal. They have done that now for some years. They used to buy English coal, and also to carburet; but they have given all that up.

The Chairman: Is it black coal or brown?

Witness: Black. It makes a very good coke for their purposes. It is a little soft by our standard; but it suits their closed stoves very well.

By Mr. Rostron: Magdeburg had about 250,000 inhabitants, and, like many manufacturing towns, was growing very fast. It was the centre of several industries. Krupp's people had a branch there, and they had electric trams all over the place; but electric lighting was practically obsolete. It had been given up in favour of incandescent gas. It was the most incandescent gas-lit town he ever saw; it was necessary to hunt for a flat-flame burner. The people said they could not afford to use them. This burner was practically obsolete in Germany.

Mr. Rostron: What is the relative cost of the incandescent installation in Magdeburg, as compared with London?

Witness: Not more than one-third the average cost. I can show you some burners here, bought in a retail shop in Magdeburg. Here is a Welsbach burner, which I bought over the counter retail for 1 mark. Here is another, which is a superior article, with a lava ring inside. That retails for 1s. 3d. If there is any inflammable material in a shop window, they do not allow them to burn gas in it; so they put a bar across the top of the shop, out of the line of sight, and this bar takes the gas. They will cram the bar with incandescent burners under reflectors. I have counted seventeen in a shop window; and the whole thing will cost the shopkeeper somewhere about 2s. to 2s. 6d. a point. They have a very good system for renewing the incandescent gas mantles. You never see such a thing as a bad mantle or a bad light. They send to the gas-works (there is no monopoly), or to some leading gas-fitter who does these things; and they will come and take away the old mantle and chimney, and everything above the gallery. You buy the mantles wholesale for 2d. each; and they take the whole thing away, chimney and everything else, and replace it and see that it is all right for 60 pfennigs (7½d.).

Mr. Nicol: Some make a contract for the year?

Witness: I daresay they do; but as a rule I think they have them changed by the agent. The consequence is you never see a bad light.

What is the cost of those made in Germany, as compared with ours?—I believe the Welsbach people, who hold the patent monopoly, are contemplating—at least, they have made an announcement—reducing their prices. It would not be safe to say what they will be.

The Chairman: The burners here cost 3s. 6d. or 4s. 6d.

Mr. Emmott: The mantles are 1s. or more each?

Witness: 1s. or 1s. 3d. They buy them wholesale there. The Berlin Welsbach mantles are sold by the thousand at 16 pfennigs apiece, which is about 2d. They are sent out packed like stockings; and they are put in shape at the gas-works. The result is, broadly, that you see nothing else. I can give you the figures of the German Continental Gas Company, of Dessau. They serve about a dozen towns over Germany, from Potsdam to Warsaw; and their increase is very great. I have a record of twelve days' testings of the gas supplied at Magdeburg, with results varying from 12·1 Hefners to as low as 8·5, owing to some accident at the works. The normal range was from 12·1 to 10·7. There is no complaint of bad gas in the town. With regard to securing good lighting results, they do not admit that there is any connection between the illuminating power and the question of bad gas. With ample service-pipes, sufficient pressure, a proper sized meter, suitable house connections, and a good mantle, there is no such thing as bad gas.

By Mr. Nicol: He gave this town as an illustration of the general policy all over Germany. Without the incandescent system, the same results could not be produced with the low-candle gas.

By the Chairman: There was no obligation on the consumer to adopt the incandescent burner; but he was intelligent.

The Chairman: He is intelligent enough to see his own interest. You think it would be an advantage, under this Bill, to quicken the intelligence of the British consumer?

Witness: I think that when he can get an incandescent burner complete for a matter of 1s. 6d. or 2s., and he sees very well, even as matters are now, what a splendid light it is, his intelligence will screw him up to the point that he will sooner have 40 or 50 candle power for 3 cubic feet of gas, than go on with the obsolete flat-flame, getting 9 or 10 candle power for the same quantity.

Mr. Nicol: The gas bill is less in amount each quarter?

Witness: Yes. It has put a different complexion on the gas industry in Germany, because, owing to the fact of gas having been a luxury of the rich in bygone times, it has been very dear, and the consumption comparatively small.

Have the Imperial Continental Gas Association a large interest in Germany?—Very large.

Is their policy the same as you have stated with reference to Magdeburg?—They are bound by their existing concessions to supply gas of a certain power, which involves carburetting.

Mr. Rostron: I believe you can say something as to the policy of the German Continental Gas Company when the concessions fall in?

Witness: As their concessions with the different cities fall in, they mean to represent to them the example of Magdeburg and Bremen. Of course, when they renew concessions for the lighting of a town, there is a give-and-take; and they propose to follow the example of Magdeburg, and do away with the convention of illuminating power taken by the luminous flame burner, which is obsolete, and to give the consumer as much as they possibly can in reduction of price to make up for it.

What I gather is that when their concessions expire or fall in, they will give the thing a start *de novo*, so to speak. They will take the ground-work you have represented as already adopted at Magdeburg?—Yes.

Which ground-work of a low illuminating power is, according to German scientific knowledge, found to be the best?—The best policy. Instead of charging 5s. 8d. per 1000 cubic feet, they will charge not much more than two-thirds as much and hope to make it pay, though in Magdeburg, as a matter of fact, they have not hitherto been able to make any reduction of price, because their intentions were frustrated by the sudden rise in the price of coal.

Is the rate of consumption increasing in Germany?—Very fast indeed.

The Chairman: It may do that, and still not be increasing any more than it is here?

Witness: I think relatively it is.

It depends upon the basis upon which the increase is reckoned. A few years ago, everybody used oil-lamps in Germany?—Yes; but 20 per cent. annual gas increases are not uncommon there now.

Mr. Rostron: I think you made the experiments to which the diagrams on the wall refer? [The diagrams alluded to were those which accompanied Mr. Livesey's paper read before the recent meeting of the Institution of Gas Engineers, *ante*, p. 1201.]

Witness: No; I made the inquiries about that matter. The experiments were not made for the purpose of this inquiry. They were made by direction of Herr W. von Oechelhaeuser, who is the President of the German Continental Gas Company. They took place last May, in order to ascertain whether it was safe to reduce the illuminating power of the gas—the normal illuminating power—not by putting air or anything of that kind into it, but by taking it from a so-called low-grade coal. In order to do this, they took a sample of their ordinary Dessau gas, which started at 12¾ Hefners; and then they took the calorific power also by the calorimeter. It was a little over 600 British thermal units. They passed this gas from the test holder progressively over animal wool soaked in creosote oil, which has the property of absorbing the benzol. It was originally carburetted with benzol; and they took out all the benzol which they put in, and all the benzol that they could find in the gas. Eventually, they got their illuminating power down to 2 candles—practically a non-luminous gas—and the result on the other qualities of the gas you see here. The incandescent gas-burner was a Welsbach pattern of German make, which had already been in use for 300 hours, so that it had got into its stride; and it was burnt at one uniform rate of gas consumption throughout.

Cross-examined by Mr. Worsley Taylor: The Companies in Germany supplied gas of 13 Hefners, or about 11½ English candles. When the power was 13 candles, the charge was about the same as now—5s. 8d. per 1000 cubic feet. The people now paid 5s. 8d. for 11½-candle gas.

Mr. Worsley Taylor: I do not wonder there is some leeway to make up. Shortly, it comes to this: They had a gas they could not do much good with unless they adopted a Welsbach burner. Was not that so?

Witness: I do not think they would take it from you that it was a gas they could not do much with. It is the same as Paris gas. They did a great deal with it before the Welsbach burner came out. That burner was the reason for the increase.

They had a low quality of gas, and the Welsbach burner came, which enabled them to use it?—No; that would not hold good all over Germany, because in certain places they had a very high quality of gas. At Bremen—the Liverpool of North Germany—they had 20-candle gas. The standard varied throughout Germany.

The Chairman: Do you know whether the variation in standard depended, or was based upon, the supply of coal?

Witness: No, as in England, there was no rational basis for it. The Imperial Continental Gas Association had a great deal to do with introducing gas in Germany; and they took the English standard with them, as a matter of course.

Further cross-examined: If there was to be 14-candle gas, it was desirable to use the burner before the Committee, the cost of which in Germany was about 2s. 6d., against 7s. 6d. in England.

The Chairman: The witness's suggestion is that, to get the best advantage out of the 14-candle gas, this is the thing to use, whatever it may be in the future. He does not say that he cannot get a better condition of things than now obtains in London, with the 16-candle gas, at a much less cost. We have got Mr. Sugg's burner. Perhaps he does not know about that?

Witness: I look upon the flat flame as an obsolete system.

Mr. Worsley Taylor: I do not want to go back upon that. (To witness:) What do you suggest is the right illuminating power to be fixed as a standard here in England?

Witness: I suggest—and I have held the point for twenty years—that the right and only sound economic principle is to send out the gas as it can be made to the best technical advantage from the natural coal supply, without carburetting of any kind. If the natural coal supply of London and the south coast is the Durham coal, and that coal will make 15-candle gas tested at the works, when made pure, then I say that that is the natural illuminating power; and you cannot by any possible means either increase or deteriorate it without causing very great unnecessary expense and waste. He agreed that, if the adoption of a lower standard involved the burning of more cubic feet per hour, there ought to be a corresponding reduction in price.

Cross-examined by Mr. Corrie Grant: Theoretically the natural standard would involve an alteration every time there was a change in the coalfield; but practically it did not.

Witness: Something has been said regarding burners. I brought this [producing a gas-pendant with incandescent fittings] because I thought perhaps a question might be put to me as to the point that the incandescent system was a delicate system, and a luxury. This is a fitting made in Germany, which I bought; and it was sent over to me retail at 7s. 6d., all complete. I saw a man using a steam-hammer by the light of this thing. It was hung within a foot of his hammer. He puts it to any height he likes. This is a so-called "Gem" incandescent burner, consuming 2½ cubic feet of gas per hour; and they make gas and carry on the work of the factory, and do everything, even on the works themselves, with this. I said: "Do you use these in place of flat-flame burners?" They replied, "Yes; we could not afford to use flat-flame burners." This is absolutely in use. It is not a luxury; and Germany is now where we shall be at a time which the Law Courts will shortly determine.

Lord R. Cecil (in re-examination): Under the proposals of this Bill, will there be, as you understand it, any reduction of the illuminating power in the house of the ordinary consumer?

Witness: Oh, no. He can get what illuminating power he likes.

Mr. Worsley Taylor: The same burner in each case?

Witness: If it is the same burner in each case, there will be no alteration in the illuminating power, if he uses an incandescent burner.

Lord R. CECIL: Take this case. They get a gas that gives them 8-candle power.

Mr. WORSLEY TAYLOR: With what burner?

Lord R. CECIL: With the existing burner. The Company are prepared to offer them an improved burner that will give them 12-candle power.

The CHAIRMAN: Nominally 14.

Lord R. CECIL: It will increase by the combination of their new burner and their new gas. They will increase really the illuminating power of the gas in the house of the consumer?

Witness: Yes.

In that case, is the fair measure of the reduction the amount of money that the Company save by supplying the lower-power gas?—Clearly. I take it that the Bill proposes to make an allowance.

Mr. LEIGHTON: Is there anything in the Bill about the Company providing burners in the house?

Lord R. CECIL: I think not. It was an offer made by Mr. Livesey, by which we stand.

Mr. LEIGHTON: How does it come into our consideration with regard to the Bill—that is to say, how will it be enforced. It is a great consideration, of course.

Lord R. CECIL: Of course, it is a very important matter. Speaking on the spur of the moment, I do not think there will be any difficulty in drafting a clause to the effect that the Company shall be bound to supply an improved burner to any consumer who asks them for it.

By Mr. NICOL: There were districts in Germany where they had had the electric light, and where, owing to the system of using low-candle power gas in the Welsbach burner, electricity was abandoned. It is so in Berlin.

By the CHAIRMAN: Going back some years, gas was not used as much as in England, largely because of the cost; the price of coal there being relatively much higher than here.

The CHAIRMAN: Then, owing to the excessive cost of coal gas and the development of the electric industry, electricity was largely adopted as being cheaper than gas?

Witness: I would not say that.

Mr. NICOL: Better light?

Witness: It was a better light in some respects than the old flat flame; but you see Germany was the birthplace of Siemens's regenerative gas-burner, as well as of the incandescent system, and it really came into the market contemporaneously with the electric arc lamp.

The CHAIRMAN: It was the dearness of coal, and therefore the dearness of gas, which stimulated the development of the electric light in Germany?

Witness: No doubt.

Now we come to a later stage in the development, when the German people find that they can get so much more luminosity by the Welsbach principle. They say: "Our electric light is dearer than our gas, therefore we go at once, from economical considerations, to the use of gas?"—Yes.

Therefore gas has now become popular, particularly in the form of the incandescent light?—Yes.

To the extent of about 90 per cent. of the whole amount of gas used for illumination?—Yes, certainly that.

Mr. NICOL: Is it your opinion that, so long as the standard of light of 16 candles exists, we shall make no progress on the same lines as Germany has done?

Witness: I would not like to say that, because I do not know when the Welsbach monopoly expires. Certainly 16-candle gas will do very well with the incandescent system; but the cheaper gas will do equally well, if not better.

The CHAIRMAN: I will put it in this way: There will not be as much reduction in price to the consumer of gas of 16-candle power, even with the incandescent light, as there would be with the 14-candle gas?

Witness: Certainly not. It will be as much as the Company can do to make 16-candle gas at any price.

Wednesday, May 16.

At the commencement of to-day's proceedings,

Mr. WORSLEY TAYLOR said there had been some alterations in the Bill as to burners, and giving notice of variation in the gas. He should like to see the exact terms of the alterations.

Lord R. CECIL: I should be very glad to discuss the clauses of the Bill with my learned friend at any time.

Mr. WORSLEY TAYLOR: I desire to see the Bill—the clauses it is proposed to put in.

Lord R. CECIL: I have not got them. I do not know what my learned friend's difficulty is. We have told him what we propose to do; and if he wishes to discuss the clauses now, I am ready.

Mr. WORSLEY TAYLOR: I am not going to be put off in that way. I am entitled to see the Bill as modified.

The CHAIRMAN: The sooner the clauses can be given the better.

Lord R. CECIL: Certainly. I will do what I can to get them.

Dr. *S. Rideal*, examined by Mr. ROSTRON.

Witness had for some years paid attention to the methods employed in the enrichment of gas and in determining its illuminating power. He had been for some time one of the Gas Examiners to the London County Council, and was now employed in that capacity by the Lewisham Board of Works and many other local authorities. He agreed with the views of Mr. Livesey and the other witnesses in connection with the Bill, that enrichment of gas was a very undesirable thing. He said that, in the case of foodstuffs, the Legislature had taken steps to prevent adulteration. For instance, the addition of alcohol to sherry, although it fortified the wine, was regarded as an adulteration; and in the same way the addition of butter to margarine was looked upon as adulteration. What was chiefly desired in the interest of gas consumers was cheap gas, without special regard to illuminating power.

Mr. WORSLEY TAYLOR (in cross-examination): As I understand it, you look upon enrichment as adulteration?

Witness: I do.

Professor *Dewar*, examined by Lord R. CECIL.

Witness said the proposal to get rid of the enriching of gas would be a great advantage to both the public and the Gas Companies.

Lord R. CECIL: That is to say, you fix as your illuminating power such power as you could get from Newcastle coal without enrichment?

Witness: Yes; with the present supply of coal we can get in this country, having regard to the exhaustion of cannel, it would be a great advantage to use the gas unenriched, because undoubtedly it will be more permanent. If it gives 14½ to 15 candles, that is substantially a permanent result—that is, the gas is not liable to deterioration by standing in small mains. The methods of enrichment are more liable to cause inequality.

Do you think that, with a proper burner, any illuminating power between 14 and 16 candles is enough for all ordinary purposes?—Yes; and considering the results that are obtained by the average burner, that would be a suitable illuminating power.

I think you have some records of experiments which may be of service to the Committee?—They are not a complete set; but they are enough to satisfy me of the accuracy of the statement made by Mr. Sugg. I desired to have samples of these burners. I went to Mr. Sugg and picked out two or three of the burners, and tested them with 16-candle gas, and also with 14·5-candle gas, in order to see what was the efficiency or duty of the burner—that is, how many candles per cubic foot of gas consumed you get from two different gases burned with the same or different burners. With the Sugg coned-top flat-flame burner, I found that the efficiency, with 16-candle gas, per cubic foot of gas consumed per hour, was 2·46. There were four of these, and the readings were 2·46, 2·42, 2·41, and 2·48. Then I took one of these governor-burners of Mr. Sugg; and there the result was 2·43. Next I took a Bray No. 4 fishtail; and the efficiency was 1·5. With a Bray No. 6, the efficiency was 1·66. Then I changed to 14·5-candle gas, as tested by the standard; and with the first new Sugg burner the efficiency was 2·62, with a second such burner it was 2·67, and with a third 2·67. This satisfied me that the new burner gives as great an efficiency as can be obtained by the use of 16-candle gas when employed with a consumption of something like 6 or 6½ cubic feet per hour. It proved to me that the burner could produce the same efficiency with 14½-candle gas as with 16-candle gas.

By the CHAIRMAN: The old burner deteriorated very rapidly, because of the nearness of the metal to the flame; but with the new burner there was no metal body near the heat, and consequently the length of time the burner would last was merely a question of the durability of the steatite. He saw no exaggeration in the statement that the old burner was good for 3000 burning hours, and the new one for twenty years.

Further examined by Lord R. CECIL: As regarded heating, the difference produced by a candle or two in the luminosity had no substantial effect. It might be a difference of 2 per cent.; but it was practically not material for incandescent lighting or for heating. So that all the money spent on enriching was wasted. What was wanted was a gas which was of high thermal value, but without being enriched or loaded in any way with mere luminous hydrocarbons.

Mr. WORSLEY TAYLOR (in cross-examination): With 14 or 14½ candle gas, and a better burner, you can get as good a result as now with 16-candle gas and an inferior burner?

Witness: I will not call it necessarily inferior. It depends upon the way in which you burn the gas.

The burner ordinarily in use?—I say you get much greater efficiency with the new burner than with the common burners.

The result to the man who uses the ordinary burner is that he will get the same amount of light as now?—He will get a great deal more; he will get more than 50 per cent. more light.

Do you agree that, if we had 16-candle gas, and adapted your burners to it, we could get a better illuminating result than out of 14-candle gas?—That will depend altogether upon experimental inquiry. I should doubt whether it was so until it was proved.

Assume that it is right—that at present the man who has 16-candle gas can, by using a better burner, get a better result, because he has 16-candle gas, than he can by any possibility get when he is limited to 14 candles. What is the advantage, from the consumer's point of view, of taking away the right which the law gives him?—The answer is that you must look at the average consumption of gas. You must not take the gas of a few isolated persons who use argand burners, and who get the best result. You must take the average result of the use of No. 4 and No. 6 Bray burners. With that, it will be a distinct improvement.

The CHAIRMAN: Mr. Sugg said that, to get the best result with 16-candle gas, an argand burner would be necessary.

Mr. WORSLEY TAYLOR said Mr. Sugg's view was that his 3d. burner would be used with 16-candle gas, and that the consumer could also employ an argand burner. Why should the consumer be deprived of these two advantages?

Witness said that there was no ordinary burner in existence which could be applied in that way to 16-candle gas. Mr. Sugg only said he thought he could produce such a burner—the whole thing was speculative. As to the argand burner, there was only a limited use for it. If the result of the Bill were to be that the consumer would be put to greater expense in getting the amount of illumination he required from 14-candle gas than from 16-candle gas, this would to his mind be wrong; but he could not assent to the hypothesis that this would be the result of the Bill.

For heating purposes, 16-candle gas is slightly better, I understand, than 14-candle gas?—Slightly, owing to the presence of more hydrocarbons in it.

To get the 14½-candle gas to the same heating power, what additional volume will have to be burnt?—I have not calculated it out, but I should say not more than 5 per cent. in the thermal value. Witness went on to say that a large amount of the heat from the burners went to waste up the chimney.

Re-examined by Lord R. CECIL: At present, there was no burner in existence which would give better illumination with 16 than with 14½ candle gas. The benefit given with such a burner was merely a theoretical one; whereas under the Bill, a practical benefit would be given to the consumers at once.

Mr. NICOL asked if the irregularity which existed with 16-candle gas, through the necessity for enrichment, would disappear in the event of the Sugg burner being used.

Witness said the burner would not get over the inequalities in the illuminating power of the gas. The whole question was how to get rid of the difficulties attendant upon the use of enrichment.

Is it your opinion that, as the result of reducing the standard of illumination, the public would get an equally efficient light by using Sugg's burners, and also get a reduction in the price?—Yes. I think the poor would be much better off.

You mean that it costs more to supply 16 than 14 candle gas?—Yes. The saving to the Gas Company would recoup them for supplying the burner to any person who would allow the change to be made. The poor in that way would be benefited.

So that, from a financial point of view, both the consumer and the shareholder benefit?—That is a point I am not capable of speaking on.

The CHAIRMAN: I understand you to say that enrichment at the source of supply gives no guarantee in cold weather that the gas will be of 16-candle power when it reaches the meter of the consumer?

Witness: Tested rigidly, that is undoubtedly the case.

Therefore, in your judgment, so far as regularity is concerned, a rigid adherence to a legalized standard of 14 candles would be preferable to one of 16 candles?—Undoubtedly.

So that at the same price, or more especially at the reduced price, you cannot see it possible that the consumer of 14-candle gas can be in any sense mulcted by the adoption of this as against 16-candle gas?—I cannot. The only difficulty I have in my mind is as to the time that it will take to change the burners. There will be an interval; and the question is what would be the best thing to do in the interval, and what is the interval to be.

That is a practical question for the Company?—Yes. The period it would take to effect the transition is the only time during which there would be any suffering.

You believe that the consumer would not suffer if he had 14 in place of 16 candle gas?—He would not—that is to say, the average consumer. I am not speaking of the consumer who uses the argand burner.

But that is not usually adopted?—No.

If, in process of time, and, perhaps, by the decision of the Law Courts, the incandescent light becomes cheaper and more generally adopted, do you think the consumer would suffer by having 14 rather than 16 candle gas?—Certainly not. It is better for the incandescent burner to have gas of a less illuminating power.

The consumer will not suffer under existing conditions; nor will he suffer under prospective conditions, I take it?—That is so.

You think the incandescent burner is a thing that is likely to become more popular and develop?—Yes; it must. I quite corroborate the evidence of Mr. Webber.

In reply to an inquiry by the Chairman,

Mr. LIVESEY said that the offer of the Company was only to supply burners—with a governor—to the users of slot-meters. They would want 300,000 of these governor burners; and he could not say how long it would take to make them.

Mr. SUGG: It would take about three months.

Mr. CORBIE GRANT: What would be the number required, supposing all the consumers were supplied?

Mr. LIVESEY: Over 1,000,000—perhaps 1,200,000. Of course, we should keep a stock of these burners.

After some conversation as to the production of the proposed new clauses,

Lord R. CECIL said the day before, on the subject of the supply of burners by the Company, he had said that, in reply to Mr. Leighton, "Of course, it is a very important matter. Speaking on the spur of the moment, I do not think there will be any difficulty in drafting a clause to the effect that the Gas Company shall be bound to supply an improved burner to any consumer who asks them for it." By this undertaking, Mr. Livesey instructed him that he was prepared to abide.

The CHAIRMAN: Mr. Livesey goes further, and says that he will give burners with governors in the case of the slot-meter consumers.

Mr. CORBIE GRANT then briefly addressed the Committee on behalf of the district of St. George-the-Martyr; arguing that if the Gaslight and Coke Company's district south of the Thames were purchased by the South Metropolitan Gas Company, the residents in that area would lose the benefit of competition. Competition at present had given them cheaper gas than that supplied by the Gaslight and Coke Company north of the Thames. He pointed out that the residents in the district of St. George-the-Martyr were an extremely poor class of people, who would not even be able to afford the cost of changing their gas-burners.

The CHAIRMAN: They will mostly use the slot-meter, I suppose.

Mr. CORBIE GRANT said that was no doubt the case; but the Committee should have in their minds the necessity for safeguarding the interests of these poor residents in considering the preamble of the Bill. With regard to Mr. Livesey's evidence, this gentleman was a well-known gas expert; but the learned Counsel was not familiar with him as a philanthropist. When, therefore, he came forward in that capacity, it was necessary to examine what he proposed, so as to see whether he was not giving more to the Company than to the consumers. He was escaping the obligation to enrich, which cost 1·12d. per 1000 cubic feet, and was getting in return the right to use different coal from that at present employed, and so to go to a much wider area of coalfields, and therefore to make a very much better bargain for coal than he could at present. The matter seemed to come down to this: Was the consumer to have a fair share of the benefits Mr. Livesey proposed. All that he could do, having no expert testimony, was to direct attention to the evidence, which showed, at any rate, that the change would be of very considerable benefit to the South Metropolitan Company. He invited the Committee to put aside the philanthropist view altogether, and see whether the consumers in the district of his clients had been sufficiently protected.

Evidence was then called for the London County Council,

Mr. *Haward*, examined by Mr. TALBOT.

Witness said the proposals of the Company in the Bill were a new departure, and objectionable, *primâ facie*, as introducing a new complication by destroying the uniformity which had hitherto existed with regard to the illuminating power and sliding-scale arrangements of the three Companies of the Metropolis. As a matter of fact, the provision with regard to uniformity had produced actual uniformity; the average illuminating power of gas supplied by the three Companies in 1898, according to the official tests, having been: Gaslight and Coke Company, 16·40; South Metropolitan Company, 16·40; and Commercial Company, 16·38. So far as he knew, neither of the other two great Companies had expressed themselves favourably to the change. The Gaslight and Coke Company had spent considerable sums on enriching plant, so that the policy of enrichment had not been abandoned. He also objected to the proposed system of averaging with regard to the illuminating power; but, in so far as the period had been reduced to one month, the Bill was improved. The Bill would secure the rights of the Company with reference to dividend. At present, it was perfectly easy for the public to know the rights of the Companies in the matter of dividend; but under the Bill, before these rights could be ascertained, the official testings would have to be obtained, in order to get the average illuminating power. This would be introducing another element for consideration. A very important question arose with regard to the reduction of 1d. in the initial price, as a fair equivalent for the reduction of 1 candle in the illuminating power—assuming that the illuminating power ought to be reduced. This did not seem to be sufficient compensation to the consumer. He had worked out some figures from the evidence already given before the Committee, to show the effect upon the consumer. He believed it had been admitted by Professor Lewes that the increased consumption of gas which would take place in consequence of a reduction of 1 candle would be 16 per cent.

Lord R. CECIL asked for the reference to this statement; but although an effort was made to find it, it was not produced.

Witness (continuing) said that there would be an increase in the consumer's gas bill of 16 per cent., so that the consumer would have to pay 4½d. more per 1000 cubic feet for the same result in light as at present. Instead of 2s. 4d., he would have to pay 2s. 8½d.

The CHAIRMAN: Then I should think the fines to which the Company are liable under the existing Acts are lamentably insufficient—if by reducing a single candle power you would consume 16 per cent. more gas. One candle power lower than the standard you say will entail 16 per cent. more consumption?

Witness: I do not say so; but our witnesses are prepared to support it.

By lowering the gas one candle, you inflict a certain disadvantage on the consumer, to the extent of 16 per cent. If that be the case, is not the penalty to which the Company are subject for reducing the illuminating power 1 candle monstrously insufficient? What is the penalty to which the Company are subject for going down to 15-candle power?—£20 a day, I think.

Mr. TALBOT: £100.

The CHAIRMAN: Well, what is £100!

Witness (continuing) said he had not finished the calculation. He did not say that the 4½d. was lost to the consumer; that was only the first item. It was suggested also, by Professor Lewes, that the cessation of enrichment would save the Company $\frac{5}{10}$d. per 1000 cubic feet in working expenses; and then it was stated that the increased sales of gas yielded a profit of 1⅜d. per 1000 feet (this figure being arrived at by taking 40 per cent. of the 4½d.). Then the reduction in the initial price proposed, of 1d. for each candle less illuminating power, would save the Company £7500 a year, which was equal to ⅛d. per 1000 feet. The consumer would receive seven-eighths of the three items—the 0·3d., 1⅜d., and ⅛d.—which equalled, roughly, 2d. So that, while on the one hand the consumer would pay 4½d. per 1000 feet more for his gas, he would receive in future reductions of price about 2d. He would therefore lose (say) 2½d. per 1000 cubic feet.

The CHAIRMAN: But your whole argument goes if your 16 per cent. is wrong.

Witness: Certainly.

Further examined, witness said that, with regard to the sliding-scale, the Company had not adhered to the proposal of the Select Committee, but had simply taken the benefit of the secondary sliding-scale, which rather did away with the object of the Select Committee. The effect of the sliding-scale proposed in the Bill would be to give the Company more than the Select Committee's scale gave them, and more than they were entitled to at the present time. Taking the price at 2s. 1d., for instance, the Company would be entitled to a dividend of £5 14s.; the Select Committee's proposal would give them £5 16s.; and the Company's proposal would give them £5 17s. 4d.—with gas of 16-candle power. The reduction in initial price from 3s. 6d. to 3s. 3d., would not be very serious. The Bill did not compel the transfer of the portion of the Gaslight Company's area south of the Thames; and there seemed no likelihood of the transfer taking place. The Council held that the area ought to be transferred; and that if the Companies could not agree, it should be made compulsory, on arbitration terms. The Council also objected to the proposal that the Company should have power to raise such sum as they would have to pay in connection with the transfer, *plus* 10 per cent. The more convenient form would be to state a round sum of money. With regard to the transfer of the Gaslight and Coke Company's area, if this took place it seemed that the obligation now resting on the Gaslight and Coke Company to charge north of the Thames the same price for gas for public lamps as they were charging in the southern area, would disappear, and they would be able to charge the same as they charged ordinary consumers. The difference might be £29,000 a year; it would be a large sum.

Cross-examined by Lord R. CECIL, witness said that the proposals of the Bill differed from those of the Committee of last year. For instance, if the price of gas was reduced to 2s. 1d., by the proposals of the Committee, the Company would have been able to divide £5 16s.; whereas under the Bill, the amount would be £5 17s. 4d. It was true that the Bill would afford a greater inducement to the Company to reduce the price of gas; but the increment of profit to the Company would come out of the pockets of the consumers.

The CHAIRMAN: Under the additional sliding-scale required by the Committee, the Company are to get the benefit of 2s. per cent. dividend on a reduction in price of a complete 3d. per 1000 cubic feet?

Witness: Yes.

It is an inducement or incentive to the Company to manage their business to that end?—Yes.

The difference of the proposal of the Bill is that, instead of having 2s. for a complete 3d. reduction, they should have 8d. for each 1d. reduction?—Yes. I prefer the proposal of the Bill.

If by struggling very hard, you got an advantage of 2½d. towards your reduction, and you failed in your 3d., and therefore all your efforts were nothing, would not that be rather damaging to the spirits of the Company?—I do not think so. The point is really very small, because the South Metropolitan Company are not at present dividing up to their statutory maximum. Therefore the alteration made by the Bill would not really practically affect them at the present time.

As regards the public, will it not be simpler to add 8d. dividend for every 1d. economized, than to have an interval of 3d. before any alteration comes in? Would this be more readily understood by the consumer than the dividing of 2s. for every 3d.?—Certainly; and still simpler if it were made 2s. 6d. instead—an eighth.

Further cross-examined: With regard to the district of the Gaslight Company south of the Thames, the suggestion was not that an unwilling purchaser should be compelled to buy from an unwilling seller. He understood the South Metropolitan Company were willing to purchase on fair and reasonable terms.

By Mr. Leighton: The suggestion was not that the price of gas would be raised to the consumer by 2½d., but that the consumer would have to pay 2½d. more per 1000 cubic feet for the same amount of light. The idea of the County Council with regard to the transfer of the area of the Gaslight and Coke Company, without reference to the obligation as to public lighting, was that it would enable the Company to devote at once £29,000, or whatever the figure was, to reducing the price of gas.

Mr. Emmott: I understood you to say that, if this reduction in candle power were made, the price of gas would be raised. What you meant was that so much more gas would be burnt that it would be equivalent to raising the price 2½d.?

Witness: I thought I was careful to say that the price per 1000 cubic feet would not be raised, but the consumer's gas bill would increase.

Mr. Talbot: It is the price of light, as distinguished from the price of gas.

Mr. Leighton: It would not be so, if these burners have the effect we are told.

The Chairman: It is a matter of expert evidence.

Mr. *W. J. Dibdin*, examined by Mr. Talbot.

Witness said if gas of lower illuminating power was passed through the same appliances as gas of higher illuminating power, the result was less light and greater consumption of gas. The result was very much affected by the burner used. The extra cost of the improved burners to the Company—2d. or 3d. each—was very small compared with the extra money the consumer would have to pay in consequence of being supplied with lower-quality gas. The new burners would not counterbalance that cost. Witness proceeded to refer to a large diagram giving information with regard to the amount of gas which would have to be burnt, according as the quality of the gas and the burners used varied. Thus, with a Bray No. 4 burner, with 16-candle gas, they would burn 100 per cent.—the normal volume. If the quality fell to 15·2 candles, a quantity equivalent to 135 per cent. would have to be burnt; if the gas fell to 14·2 candles, the quantity would be 180 per cent.; and so on, for each of the qualities represented, until with 11·3-candle gas this burner would require no less than about 380 volumes of gas, instead of 100, in order to obtain the same amount of light as with 16-candle gas. Going the other way, with 17·2-candle gas, the same amount of light could be maintained with 84 per cent.; and with 19·2-candle gas, with only 60 per cent.—or a little more than half the gas of 16-candle power required to give the same light. A point he wished to bring out was in regard to the comparison of the German and the English figures. Mr. Webber gave the figure of 11½ candles as the quality of the gas used in Germany; and he stated that a manufacturer there told him he could not afford to use flat-flame burners. This diagram supplied that explanation. Presuming that he was using a Bray No. 5 burner, with 11½-candle gas, to obtain the same amount of light as he would get from the normal quantity of 16-candle gas, he would have to burn about 290 volumes of gas, against 100 volumes—about three times as much. Mr. Webber told them the price of that gas was 5s. 6d. per 1000 cubic feet; so that the consumer would have to use three times 5s. 6d. worth of gas, which would give 16s. 6d. to represent the actual cost of the gas, as compared with the average here of about 2s. 6d. for the 100 volumes of London gas of 16 candles required to give the same amount of light. This explained the whole difference in the position of gas lighting in Germany as compared with England, and why there had been such tremendous development since the introduction of the Welsbach burner. Seeing that the money question was much accentuated by the extreme price, the German became more alive to his interests; but the ratio would be the same if similar economical processes were used in England, only the economy would be effected on the price in England instead of on 5s. 6d. Witness had made a series of tests with Mr. Sugg's burner on four different qualities of gas; and the result was the same as with the flat table-top No. 5. The burner gave a better intensity of light for any particular quantity; but the ratio of light remained practically the same as with the No. 5 table-top burner. Therefore any variations due to the influence of different qualities of gas, shown on the diagram in regard to the No. 5 burner, would also be shown in regard to the new burner which had been proposed. If with the lower quality the consumer had to burn a greater percentage of gas, the price would rise proportionately. The experiments shown on the diagram were made at the Widnes Gas-Works, where the "knocking about" of the gas which had been referred to took place. But, in order not to mislead the Committee, he repeated the experiments upon South Metropolitan gas taken at the testing-station of the London County Council in Southwark. The results were practically identical. As to the infusion of the atmosphere in the gas at Widnes, he was informed that whatever air was present, it was not more than would get in under the ordinary conditions of working. The results with regard to the Welsbach burner differed materially in the two sets of experiments. He was not surprised at this, because the performance of these burners always varied very largely.

Mr. Talbot: What conclusions do your facts lead you to, as to the adequacy of the proposals of the Bill?

Witness: I say that, from the point of view of illuminating power, the Bill would be disastrous to anyone using white-flame burners. I hold that 90 per cent. of the gas used for illuminating purposes is burnt in flat-flame burners. The largest quantity burnt in shops is consumed in butchers' burners.

You do not agree with Professor Lewes, who puts the incandescent light at 30 per cent. of the consumption?—He must have been under some misapprehension.

Your objection to the Bill, apparently, is based on the question of lighting. From the point of view of heating, your objection is not so great?—So far as the evidence goes, I should say that the 1d. reduction per candle would fairly meet the case for heating. But that is only one side of the question. Those who use the gas for illuminating will be hampered by a largely increased cost.

Would it be possible, as a means of dealing with this question, to have one burner for the whole of the South Metropolitan district?—You could not with advantage use one burner over the whole district for any quality of gas. Mr. Sugg's burner is a very admirable one, and does good duty as a flat-flame burner when used in a globe. But the moment there is a draught, as the flame is a very feeble one, it is blown about everywhere; and when this occurs away goes its illuminating power.

We know that a great deal of the gas burnt in London is actually consumed in the open air?—Quite so.

Lord R. Cecil (in cross-examination): Do you say that the burner produced by Mr. Sugg is not so good for general purposes as an ordinary burner?

Witness: Not so good as the union jet.

Your contention is that the fishtail burner is the one to use in a draught?—Yes; the burner to be used depends upon the different purposes for which you want it. I employ different burners on my own premises.

Is the fishtail burner the right one to burn in a draught?—There are fishtails and fishtails.

Is the union jet the same as a fishtail burner?—Yes. But certain union jets are better under pressure than other fishtail burners.

Is unenriched or enriched gas the best, from the point of view of reaching the consumer unimpaired through small pipes?—That is a question that puzzles me very much. I cannot understand the variations that take place. That is why I asked the Gaslight and Coke Company to have an investigation made; but they did not consent to it.

Do you think that, however you enrich gas, the enrichment is not of a permanent character?—That is contrary to the statements I have heard from gas companies on previous occasions. One says: "Yea," and another "Nay." Until I have proof one way or the other, I keep an open mind. I want information.

Have you carried out experiments yourself?—Only in a small way in the laboratory.

In reply to other questions, witness said he first advised the Metropolitan Board of Works in 1876, and after them the London County Council. He left the service of the County Council two-and-a-half years ago. He had never investigated the question of the permanence of enrichment, though he had been anxious to do so. The Gas Company would not give him the facilities he desired. As to heating purposes, he thought the case of the consumer might be met by a reduction in price; in that he agreed with Professor Dewar. A low-power gas went through the meter quicker than a high-power gas. It had a lower density when it was unenriched. In preparing the diagram he had submitted, he had used two Welsbach mantles; the reason being that one got broken. The mantles were so fragile that the moment they were moved, they became frayed and broken. The curves of light shown with the mantles varied very much; for although the incandescent light was good, it was variable in intensity. The behaviour of any gas in a burner depended very much upon the character of the gas—that was to say, the manner in which it was enriched. Under any of the conditions in which he had made his test, so far as the use of the burner was concerned, the interest of the consumer would suffer. Under ordinary conditions, a fishtail burner—say, a Bray No. 4—gave 8·6 candles with 4·3 cubic feet of gas—that was about 2 candles per cubic foot of gas. Table-top No. 5 burners, with 16½-candle gas, gave over 3 candles per cubic foot, or practically the same as Sugg's No. 6. With 5·5 cubic feet of gas, he got an illuminating power of 18 candles. The burner was a pretty good one. No doubt, a better light could be secured by one burner than by another; but it would be wasteful to use a burner which required a large quantity in a passage or in a draughty place, where only 2 or 3 candle power was used. There were many cases in which only a small light was required.

By the Chairman: In a small room the air would be vitiated by the use of the large burner proposed; and the light could not be turned down without altering the conditions at which the burner performed the duty claimed for it.

Further cross-examined: It was not true to say that the question of burners made so much difference that all questions of the illuminating power sank into insignificance compared with it.

Mr. Talbot (in re-examination): Do you regard it as possible, under present conditions, for the great majority of consumers now to adopt the Welsbach burner?

Witness: No; it would be most inadvisable in many instances. He had used the burner himself, and in some cases had to abandon it. The expense and annoyance connected with it simply prevented its use; it was not a light for universal application. Whatever the burner, the poorer the gas the quicker it would have to be burnt to produce the same light.

By Mr. Leighton: He could not see the advantage of unenriched gas. He could perceive a disadvantage in it, as regarded luminosity. The same objection did not apply to it with regard to cooking.

By the Chairman: He was not prepared to state that the luminosity of gas was or was not affected by enrichment being deposited. Some of the variations in the quality of gas which his tests had disclosed were due, in his opinion, to oversights or variations in the manufacture. The variations, he believed, were not due to changes of temperature, because he had kept petroleum vapour mixed with air over water for weeks without condensation taking place. Why, therefore, should the same vapour condense in gas?

The Chairman: Homogeneous coal gas will not, in your judgment, as

a scientific man, give any greater security for regular and constant illuminating power than gas enriched by these processes?

Witness: No; I do not think it would.

Therefore the scientific evidence that we have heard on that subject is such that we ought not to rely upon it?—Unfortunately, I have not been able to obtain any confirmation of it. I have been struck by the remarkable absence of precise and definite information on this point. Gas of 14 candles could be produced from coal without enrichment; and being sent out from the works at 14 candles, he should expect it to arrive at the consumer's burner, under normal conditions, of about the same quality. In London, it reached the consumer at from 11 to 17 candles, or on an average from 14 to 14½ candles.

Therefore, if the Company undertook to make gas (and charged accordingly) of 15 candles, and being homogeneous, it arrived at the consumer of the strength at which it emanated from the works, the consumer in London would, under the new Bill, have about 1-candle power more than to-day?—In some cases.

Is it your opinion that, with a homogeneous gas, there would be greater security for equality at the burner of the consumer than there is with an enriched gas which is not homogeneous?—I am sorry to say my experience does not lead me to think so.

Mr. Rostron asked if witness had had any experience in connection with the manufacture and distribution of gas.

Witness answered in the affirmative. On one occasion his services had been enlisted by the South Metropolitan Gas Company at their works; and he had not been there long before he put his hand on a fault, and showed the Company how to save £2000 a year.

Mr. Livesey: That was in connection with the chemical testing of lime.

The Chairman expressed a hope that to-morrow the promoters would put the Committee in possession of their proposed new clauses. He asked for information as to the result of the conference between the three Gas Companies, the London County Council, and the Board of Trade on the previous afternoon, in relation to the Bills of the County Council and the South Metropolitan Gas Company dealing with the subject of the prepayment-meter system.

Mr. Livesey said that the three Gas Companies had met, and had invited the County Council to join them; but Mr. Haward had been unable to comply, as he had a Council meeting to attend. The three Companies had agreed; the principle of agreement being that laid down in his (Mr. Livesey's) evidence—namely, that the charge to the consumers for fittings should be a certain percentage calculated on the price of gas.

The Chairman: I hope you will take steps as soon as possible to obtain the consent of the County Council and of the Board of Trade to the conclusions of the three Gas Companies.

Mr. Livesey: The Board of Trade will have nothing to do with it; and they want us to settle the matter ourselves.

The Committee then adjourned, and it is understood proceeded to view an apparatus illustrating the effect on illumination of substituting one description of gas for another.

Thursday, May 17.

Dr. *Clowes*, examined by Mr. Talbot.

Witness said the proposals of the Bill with regard to the sliding-scale and illuminating power, under present conditions, offered great disadvantages to the consumer. He still maintained the opinion (which had not been in any way shaken by what had transpired before the Committee) that the tests of the illuminating power of the gas, as obtained at the present fixed stations, did not at all represent the quality of the gas surrounding these stations; and if this were so, the Company would not be right in settling the charge according to the tests in the fixed stations. He would be satisfied, so far as the tests were concerned, if there were a wider method of testing. With regard to the statement that, if enrichment were done away with, the quality of the gas over the whole area of supply would be approximately uniform, he said this assumed that enrichment was the only cause of the variation in the illuminating power of gas. But there were many other causes—such as the use of coal of varying illuminating quality, and the volume of gas extracted from a given weight of coal. In all the works he had visited (which did not include those of the South Metropolitan Company), the gas was actually drawn from the retorts by an exhauster; and it was freely confessed that, according to the extent to which the exhauster was employed, the amount of air which entered the gas would vary. He submitted that the abolition of enrichment would not in any way secure the uniform quality of the gas, so far as illuminating power was concerned. Moreover, if the proposal was to be fair, the testing-station should in every case represent areas of equal consumption, which was emphatically not the case at present. If the price were to be based on the average results of the stations, very poor gas might conceivably be supplied to a district of large consumption, and richer gas to one of smaller consumption; and this would be palpably unjust. Assuming that those in charge of the works had the most honourable intentions towards the consumers, with the South Metropolitan Company the workmen were largely shareholders; and although this was a very satisfactory arrangement in other respects, it was not so to the consumer, because evidently a workman with not much conscience might say: "If I supply gas of an inferior quality, it will be for the benefit of the shareholders, of whom I am one." This should be remembered. Witness was sure the lowering of the candle power from 16 to 14 candles would not be adequately compensated by a reduction of 2d. per 1000 cubic feet in the price. The assumption was made that the consumer would supply himself with the Welsbach burner; but this was very costly, both in the first instance and in regard to maintenance, because it required to be frequently renewed. As to the possibility of supplying unenriched gas of over 15-candle power, they had Mr. Livesey's statement that he could furnish it of an average illuminating power of 15 to 15½ candles. The figure Mr. Livesey fixed upon in the London County Council Bill was 15½ candles. It would be much more satisfactory, supposing there were to be a reduction at all, that it should be to 15 candles. As to the cost of enrichment, he was informed by practical men that the expense of obtaining higher candle powers—say, 16 or 17—was very small, and that it might be far more advantageous to the consumer for the Companies to incur this outlay and maintain the present or a higher standard, rather than the lower one. It would be a very great disadvantage that the consumers north and south of the Thames should have gas of varying quality.

Mr. Rostron (in cross-examination): It seems to be your idea that the South Metropolitan workmen, because they are shareholders, will be less likely to do their duty to the consumers?

Witness: I think there is temptation thrown in their way by their becoming shareholders.

Questioned as to the divergence in the tests of enriched gas which the portable photometer had shown over long periods, and the fact that when similar tests were made for a fortnight with unenriched gas, this variation did not appear, witness said that this did not suggest to him that the divergence was caused by the enrichment. It being suggested that the enrichment disappeared, he said gas might have deposited naphthalene or other substances in the pipes, and then other gas taken these substances up again. It was quite conceivable gas might enrich itself by passing through the mains. He did not agree that the incandescent light was the cheapest form in England.

By the Chairman: A company infusing too much air into their gas would reduce the quality; but such gas was not found at the testing-stations.

The Chairman: Do you suggest that this purposely and intentionally vitiated gas is diverted to some other channel, and does not go to the testing-station?

Witness: I do not think any other conclusion can be drawn from these results. He could not think the irregularity between the gas as tested at the stations and at consumers' premises was caused in any degree by the enrichment.

Your experience does not enable you to suggest to the Committee any other cause?—I cannot suggest any other cause.

You have no explanation to make to the Committee?—I can see no explanation. The facts are before us; and I stand by the facts. I see nothing in Mr. Dibdin's tests to show that the variations may be due to the enrichment.

Dr. *Percy Frankland*, examined by Mr. Talbot.

Witness said he considered the proposals of the Bill with regard to the sliding-scale on the basis of illuminating power, as highly disadvantageous to the consumer. It was proposed to allow a considerable amount of variation in the quality of the gas. Burners were constructed to consume a particular quality of gas to the best advantage; and any variations, therefore, would lead to disadvantageous consumption in particular burners.

Mr. Talbot: Do you think it is possible for the Company to provide against this by any system of themselves supplying burners to consumers over the whole of their district?

Witness: It obviously could not meet the point about variation in the quality of the gas. Whatever burner they supplied would be suitable for a particular quality of gas; if the quality varied, it would cease to be the best. The manner and place in which the burner was used would considerably affect the result. A 16-candle gas in a flat-flame burner which would consume it to the greatest advantage, would not be suitable for a draughty place, such as a butcher's shop. If they had a 14-candle gas, a burner which would deal with it satisfactorily in a draughty spot would do very badly elsewhere.

Mr. Nicol: The consumer has no control over the pressure of the gas.

Witness: Except in using a burner with a smaller or larger aperture. He has a right to receive gas at a sufficient pressure to enable him to use what burner he chooses.

By the Chairman: The lower the quality of the gas, the greater disadvantage would the consumer experience where there were draughts.

Mr. Talbot: I take it that, in your view, a high illuminating power is to the advantage of the consumer?

Witness: Yes; very much so.

In reply to further questions, witness said that he failed to understand how the new sliding-scale could have been brought before the public at all, as the reduction in price would depend upon the kind of burner employed. Moreover, the poorer the quality of the gas, the more would the atmosphere be vitiated in confined places. With the incandescent system, again, one was never sure of the amount of light one was going to get. It was good at first; but it gradually deteriorated, until it became bad, and it was necessary to change the mantle. Besides, the incandescent light could not be used in a draughty place.

Cross-examined by Lord R. Cecil: He considered the proposed reduction in the illuminating power of the gas in the South Metropolitan district would be a very serious matter to consumers. He had not made any experiments; but he was acquainted with those which had been carried out by Mr. Dibdin and Professor Lewes. They confirmed what had been general knowledge for the past thirty years.

Lord R. Cecil: What is the loss in the illuminating power of gas (say) with a No. 6 Bray fishtail burner?

Witness: It is 14 per cent. with 16-candle gas; and with 14-candle gas, it is 16 per cent.

Do you think there would be any difficulty in overcoming the inconvenience of draughts with the incandescent burner?—There would be difficulty, no doubt; but the obstacles are not necessarily insuperable.

Do you not think the consumer would be better off with a good burner and 14-candle gas, than with a bad burner and 16-candle gas?—That is not the question.

Whether it is the question or not, is for the Committee to decide?—The consumer with a good burner would necessarily be better off than the consumer with a bad one.

With a good burner, the advantage to him would be out of all proportion to the loss of 2 candles in the illuminating power of his gas?—That is supposing he had the worst kind of burner in use; and I do not think we have a right to assume that.

But he has a bad burner?—I do not know that all consumers have bad burners.

In re-examination, witness said he did not think the proposed basis for the sliding-scale would be satisfactory to the consumer.

Lord R. Cecil said that, on the point of the effect of draughts on low illuminating power gas, if the Committee desired he would recall Mr. Sugg.

The Chairman said the matter was of vital importance; and the Committee would like to have the fullest information on it.

By the Committee: The smoky character of a gas-flame was due to there being an insufficient admixture of air with the flame to ensure the efficient combustion of the hydrogen in the gas.

Mr. *Sugg* re-called.

The Chairman: In the matter of the table-top burner that you suggest as the most appropriate for 14 or 15 candle gas—the burner recently brought out by you—is it the fact that the flame it would give would be more subject to the influence of draughts than the flame from the ordinary fishtail burner now in common use?

Witness: In giving the same quantity of light?

Yes?—It would not be so susceptible to draughts, because the nature of it is such that it promotes a better consumption. Take two burners, the one burning 16 and the other 14 candle gas, they will give the same light; the little difference that would exist being all in favour of the 14-candle gas burning naturally. The burner is so made that it gives a better combustion. Therefore the flame is not so liable to be made smoky by draughts as the flame of 16-candle gas.

Mr. Talbot: Do you mean that 14-candle gas gives a better light than 16-candle gas?

Witness: I do not say that.

The Chairman: Let us confine ourselves to the susceptibility to draughts. (To witness:) Please explain to the Committee the grounds on which you make your statement. Is it the fact that the orifice in the new burner is larger than in the old burners.

Witness: Yes, slightly.

And is it not also the fact that the gas will come at a lower pressure to the flame?—It will.

Coming to the lower pressure, is it not the fact that this makes the flame more flickering and lambent?—Not more flickering.

How is that? We have been told that, where the orifice for the flame is larger, the pressure is reduced, and the flame is less steady. How can this be avoided in the case of these burners?—By the shape of the new burner. It brings the gas at the same pressure through the cone—that is to say, to every part of the flame.

Mr. Talbot (in cross-examination): You have in the course of your business supplied a vast number of burners to the consumers?

Witness: Yes; all over the country.

Are they suited to the gas burnt?—Yes; so far as we can make them.

Then why do you think you will introduce a great reform by adding another table-top burner to those in use?—It is not a table-top burner that I have added. It is a coned top.

What is the difference between that and the others?—As I say, the gas is brought to every part of the burner at the same pressure.

Would not the burner give a better result with 16-candle gas?—The difficulty is the same with all rich gases—viz., to get sufficient air to the burner. In the case of the new burner, I have endeavoured to produce a better combustion of gas by the shape of the top. In the flame it gives, there is less tendency to smoke.

But applying the new principle, do you not get a better result with the better gas?—You do not get a proportionately better result. The 14-candle gas shows the best result. With 16-candle gas, you cannot get perfect combustion.

The Chairman: When you say "better" you mean better in proportion?

Witness: Yes.

Lord R. Cecil: Greater efficiency?

Witness: That is so.

Mr. Talbot: Do you regard a globe as essential?

Witness: No. A globe reflects the flame down. No doubt, it steadies the flame, as in the case of the chimney of the argand burner.

A great deal of the gas is burnt in the open air, is it not?—Yes; in butchers' shops, and the like. The burner the butcher uses is, as a rule, a piece of iron with a slit cut in it.

Is your burner only adapted to use in the rooms of houses?—No; it can be employed in cellars, and so forth. If it were fixed in the open air, I think it would work a great deal better than many of the burners in use in London now.

Do you make all the burners used in London?—No.

Ninety per cent.?—No. I should say the common burners are 70 per cent. of the whole number. The ordinary working man, if he could get this new burner, would use it because with it he would be able to have the equivalent of two burners at work while paying no more for his gas than he does now. He would get 16 candles, whereas he only gets 8 with his present burner.

Mr. *Otto Hehner*, examined by Mr. Freeman.

Witness agreed that an allowance of 1d. would be inadequate for each reduction of a candle in the illuminating power. It was desirable there should be uniformity all over London. By reducing the candle power from 16 to 14, the illuminating power of the Welsbach burner would also suffer; it would go down for every diminution of a candle from 16 to 14, by at least 4 per cent. In addition, it would be necessary to alter the burners. If a Welsbach burner was adapted for 16 candle gas, it would not give the best possible result if used for 14-candle gas. He knew the development of incandescent lighting exceedingly well in England and on the Continent, of which a very glowing picture had been drawn by Mr. Webber. It was true that in Germany and Belgium, and other Continental countries, incandescent gas lighting had been adopted by the public. But there such lighting was very cheap. Here, until the patents expired, it would not be cheap. It would require ten years at least for England to reach the present position of Germany in regard to incandescent lighting; and witness suggested that the proposals of the Bill might be postponed for this period. The bulk of the gas in this country was consumed in flat-flame burners; and the illuminating power given by such burners diminished far more rapidly than with others.

The Chairman: You mean to say it goes down in greater ratio than the candle power?

Witness: Yes; far more.

In order to obtain the same amount of light with these common burners, would the consumer have to burn a far greater amount of gas?—Yes, which would not be compensated by the reduction in price.

Questioned as to the Company supplying fittings, witness said he should have thought the ordinary consumer would look with suspicion upon whatever was offered by the Gas Company.

Mr. Freeman: I see, under the clauses proposed, the Company are only to supply these new burners when requested to do so by the consumers?

Witness: Yes.

Do you think this would be a real remedy?—It would suit some people; and, with those who adopted it, it would be effective.

Cross-examined by Lord R. Cecil: The chief reason why uniformity was desirable in the Metropolis, was that the burners used should be constructed for a particular quality of gas; it was mainly a question of burners. If 14-candle in place of 16-candle gas was consumed in a Welsbach burner, instead of getting a duty of 20 candles, only 17 candles per cubic foot would be obtained. As a fact, he agreed that there would be a great deal more difference than that, in accidental variations and deterioration in the mantle. He doubted whether many consumers would take the new burners from the Company; and he did not think they cared very much about a candle or two in the quality of the gas.

Mr. *Isaac Carr*, examined by Mr. Freeman.

Witness said that for years he had sold gas of 18½-candle power within the borough of Widnes; the statutory standard being 14 candles. This was sold at a lower price than at any other works in the kingdom, and also at a lower price than gas had ever been sold at in the annals of gas lighting. The prices were 1s. 5d. per 1000 cubic feet to the small consumers, 1s. 3d. to consumers of over 3 million feet per annum, and 1s. 1d. to users for motive power. The Corporation had supplied the higher quality gas on his advice, and being of opinion that it was in the interests of the consumers. It had always been their aim to sell gas of a remunerative quality. He had heard Mr. Livesey's statement that the illuminating power within a range of 2 or 3 candles was of no importance, because it was entirely in the hands of the consumer to remedy. Witness disagreed with this statement entirely. Such a reduction would involve the consumer in considerable loss. Varying standards of illuminating power were undesirable in the best interests of the consumer, having regard to the ordinary type of burner in use. Tests showed him that, with a batswing burner, he had to burn 5 cubic feet per hour of 14-candle gas more than he would have to burn with 16-candle gas to produce the same light. The value of a diminution of 1 candle in the illuminating power on the price of the South Metropolitan Company (2s. 4d.), he estimated at 4½d. per 1000 cubic feet, which was in accord with the evidence of Professor Lewes. So that the reduction asked for, from 16 to 14 candles, would mean 9d. per 1000 cubic feet difference in the quantity of gas consumed. In incandescent burners, there was a loss of 3·1 per cent. per candle. As bearing on the question of the alleged advantage to the consumer of low-grade gas for heating purposes, witness said non-luminous gas had for years past been used for heating and motive power; but it was necessary to consume four or five times the amount of it to get the same heating power as with coal gas. He did not think enrichment was a waste of money for cooking purposes; the proposed rebate would compensate for that, but not as regards the loss of lighting power. Mr. Livesey's estimate of 2d. per candle per 1000 cubic feet as the cost of enrichment with cannel, was somewhat high; as was also his estimate of 1d. per candle per 1000 cubic feet for petroleum spirit. Two-thirds of these figures would more properly represent general experience throughout the kingdom, especially with gas of about 15½ to 16 candle power. As regarded the benzol method, it was matter of surprise that Mr. Livesey omitted to mention it. Benzol to-day cost 8d. a gallon, at which price it would enrich gas from 15½ to 16½ candles at a cost of ⅝d. The cost of the application of benzol spirit was practically *nil*. The plant for its use by a huge gas-works could be bought for a few hundred pounds only. The cost of enrichment to the Company did not bear a proportionate relation to the loss sustained by the consumer in the reduction of quality. While the Company might keep up the quality from 14 to 16 candles at an additional cost of ⅓d. to ⅝d. per candle per 1000 cubic feet, the loss to the consumer by reducing the quality from 16 to 14 candles for ordinary purposes would be 4½d. per candle per 1000 cubic feet—making 9d. on the 2 candles. Allowing for the rebate by the Company of 1d. per 1000 cubic feet, the consumer would still be at a disadvantage of 3½d. per candle. With regard to the efficiency of flat-flame burners, he understood Professor Dewar to say that he obtained, with the special burner described by Mr. Sugg, a higher efficiency with 14-candle gas than he did with gas of 16-candle power. This statement was contrary to all knowledge and experience; and no gas engineer would accept it.

The Chairman: Professor Dewar was admittedly on that occasion using a burner, according to the statement of the maker, adapted to 14-candle gas?

Witness: Yes.

Do you deny the possibility of producing, under those circumstances, a better result with 14 than with 16 candle gas, to which the burner was not adapted?—Speaking from my experience, most decidedly.

With the evidence given by Professor Dewar, why did it not occur to you that in the last two days you might have made a trial?—Mr. Dibdin made some experiments; and I asked what the results were. He told me they were as nearly as possible the same as with the table-top burner. To get the same amount of light, you require to burn about 23 per cent. more gas of 14-candle power than if it were of 16 candle power.

By Lord R. Cecil: All burners were more efficient with 16 than with 14 candle gas.

The Chairman: Then, according to your statement, it does not matter what sort of burner a man puts on?

Witness: Yes; but if you have a good or a bad burner, your result is better or worse according to the quality of the gas. A good or a bad result depends on the burner used.

That being so, I cannot understand your position when you say that one burner is as good as another?—One burner cannot be as good as another with the same quality of gas.

I can understand your saying that, with a given burner, good or bad, you will get more light with 16 than you will with 14 candle gas?—And you will get a better efficiency.

The Chairman: I cannot understand that. I cannot understand your saying that the question of efficiency, having regard to the difference in quality, does not depend upon the burner.

Witness went on to say that, with the lower-quality gas, the consumption per cubic foot increased, and therefore the efficiency of the gas must have decreased. He could not understand Professor Dewar's opinion at all. Enrichment was a very desirable thing; and enriched gas was better then unenriched gas from the consumer's point of view. Up to 16 candles, the difference in efficiency between enriched and unenriched gas was infinitesimal. As the quality increased, the liability to deposition also increased. If there was condensation, it not only took away the enrichment, but diminished the light-giving power of the original gas; but he had never found, when gas had been properly carburetted with spirit, a trace of condensation in the mains.

Lord R. Cecil: You have been extraordinarily fortunate.

Witness: No. He added that when the carburettor had not been properly attended to, there had been deposit.

By Mr. Leighton: The Widnes Corporation paid something like 4 per cent. on their capital. They made a profit out of the gas undertaking, and were able to contribute 2d. per 1000 cubic feet to the rates.

By the Chairman: Though low, their charges were not so low as those of some other authorities.

By Mr. Nicol: They were able to sell at a low price, because their cost of manufacture was low. When he took charge of the works, some eighteen years ago, the price of gas was 4s. per 1000 cubic feet; but it had gone on decreasing ever since. He bought a low-priced coal, and used an enricher.

The Chairman: I ask you, as a practical man, to say how the difference occurs between gas of the illuminating power of 16·2 candles when tested at the testing-stations and of 14·8 candles when tested at a board-school?

Witness said the Chairman had addressed the same question to him when he was last before the Committee; and he had replied that he did not know how the difference arose in London. He had added, however, that if such a result occurred in his own district, he should say that the 14·8-candle gas was differently treated in the process of manufacture to the 16·2-candle gas.

Do you mean to say that you should hold that the gas tested at the testing-station was not the same as that tested at the board-school?—I confine my remarks to my own district. I can tell you what I should do to bring the result about there.

And would the same principles apply in London as in Widnes?—Precisely.

Then I will take your answer?—I should enrich a part of my gas.

Then, in your opinion, there is no other explanation of the difference, except fraud?—I cannot say. I do not know.

You say that enrichment by benzol and carburetted water gas will carry?—Yes; they are very permanent up to 16 candles.

You would not say that the difference between 16·2-candle gas and 14·8-candle gas would be accounted for in the variation in quality of the enrichment?—Not in my own locality. I should say that there was a difference in the process of manufacture.

Would stagnation in the pipes have anything to do with it?—There is, as we have heard, a "flowing main" up to the testing-station, but not so flowing a main perhaps up to the board-school. I have gone with the portable photometer into various parts of London where there were no fixed testing-stations, and have taken testings; and I have found the gas at 16·2 candles. I should think it hardly possible to have a stagnant main in London.

If a homogeneous gas is to be made by the South Metropolitan Company of 14 or 15 candles, do you think the consumer would get gas of that quality at his burners?—In gas making, the quality of the gas is entirely at the will of the manufacturer.

Mr. Livesey is anxious to contract to supply 14-candle gas. Do you think if he sends out a homogeneous gas of that quality, it will survive until it reaches the consumer?—Yes; a 14, 15, or 16 candle gas would survive.

If, in real practice, according to the experiments of Mr. Dibdin and Dr. Clowes, the London consumer receives 14·8-candle gas, how much worse off will he be if he gets 15-candle gas under this Bill?—He will be 1·6 per cent better off.

Mr. *C. R. Bellamy*, examined by Mr. Talbot.

Witness said that the London consumer would lose in the illuminating power of the gas, under the Bill, 27 per cent. The gas at present used gave 2·44 candles per cubic foot, with a flat-flame burner; and under the Bill it would be 1·78 candles. According to "Field's Analysis," he found that in the gas of corporations the average prescribed illuminating power was 15·35 candles; but they actually supplied 18·75-candle gas, so that they gave the consumers nearly 3·5 candles in excess of their statutory requirements. If they took the case of the Provincial Gas Companies, the average prescribed was 14·94 candles; while they actually supplied 16·03-candle gas, which was an excess of 1·09 candles. Then, taking the Metropolitan Companies, the prescribed candle power being the same in each case—16—they actually supplied 16·39-candle gas. It might be urged that these tests were not altogether reliable as to the gas supplied; but, at the instance of the Corporation of Sheffield, he had checked the figures, and found that they were substantially correct.

Cross-examined by Mr. Rostron, witness said that in Glasgow the illuminating standard had been reduced from 25 to 20 candles; and the Dublin standard had also been lowered.

The Chairman: You have heard the evidence given here as to burners?

Witness: Yes.

What is your experience in Liverpool?—That every grade of gas requires a special burner. You must change your burner with a change of gas. The higher the illuminating power of the gas, the more simple the lighting becomes. Liverpool gas, with an ordinary flat-flame burner, will give better duty than London 16-candle gas. Our standard burner is the one commonly used; while that adopted in London is the argand burner, which is not available to the ordinary consumer.

Your 20-candle standard is not identical with the same form used in London?—No. The consumer gets gas of the standard value in Liverpool; but in London he does not, unless he uses the standard burner.

How will the London consumer be affected by having 14-candle gas? Will it increase his disadvantage or diminish it?—It will increase it, because he will have to use 27 per cent. more gas to get the result he has to-day.

Not with the Sugg burner?—Yes; with that. I have tested all the existing burners.

Having regard to all the facts, you think that a reduction in the price of 1d. for a diminution of 1 candle in the illuminating power of the gas is not enough?—I say it is not enough. The consumer should have 3·7d. per candle, in relation to the loss of light.

Mr. *Thomas Fairley*, examined by Mr. Talbot.

Witness said he considered it was in the interest of consumers generally to have gas of high illuminating power; and in his part of the country that was the general rule. He agreed that, to obtain a given amount of light from a gas of low quality, required the consumption of more gas than with a gas of higher quality; the result being to render a certain proportion of the air unbreathable. More carbon dioxide was prodnced to obtain the same light with low than with high grade gas. At Leeds, cannel coal was used for enrichment. They were proposing to employ benzol at the end of the present year, when the cannel contracts expired. The cost of enrichment by that means, at the present contract price of cannel, was about double that of benzol. Yorkshire coal usually produced gas of not less than 16 candles; cannel, between 16 and 28 candles. It was necessary to adapt the burner to the quality of the gas; and this had to be done within a very narrow range. If gas were reduced from 16 to 14 candle power, with the common burners the increase in consumption would be about 15 per cent. per candle.

The Chairman: Taking the best burner applicable respectively to the 16 and the 14 candle gas, what is the difference in effect?

Witness: The difference in effect I happen to know partly by accident. I have a 14-candle burner in my house. I cannot burn Leeds gas without deposit of soot; and there is a waste of light.

But you are putting 18-candle gas through it. You have a wrong burner?—I know I have.

We have in London 16-candle gas. Take that with the best burner known for 16-candle gas, and you produce a certain effective light. Now I want you to take 14-candle gas, which is to be made by this Company, and apply to it the best burner known; and you will then get another result. I want to know what is the difference between the two results.—I cannot answer that; but I think the ratio would be about the same.

Using the best burner in each case, you think the difference between the two would be exactly the difference of the gases?—Yes; I think so.

The Chairman: That rather contradicts some of the evidence we have had before.

Mr. Talbot: I think you have said, Mr. Fairley, that burners are extremely sensitive to minute variations in the quality of the gas. Therefore, the state of things that might be true if you always had gas supplied at a precisely uniform quality of 14 candles, might cease to be true if the quality varied slightly up and down?

Witness: It might, and it would.

Mr. Talbot, replying to the Chairman, said: It is suggested that you get rid of the objection to reducing the illuminating power by adapting the burner to the gas supplied. One of our objections to the Bill is that it is impossible to do this satisfactorily, because you would have to adapt a new burner to the constant variations of the gas.

The Chairman: I do not understand that under the Bill it will be varied constantly.

Mr. Talbot: The average is to be the result of a great number of tests.

The Chairman: The unintended variation will be the same whatever the standard.

Mr. Talbot: Yes.

The Chairman: Therefore, it will affect the burner, whatever is adopted, in both cases the same.

Mr. Talbot: Yes.

The Chairman (to witness): Suppose you got a burner adapted to 16-candle gas, and 16 candles is the standard, and you get in another case a burner adapted to 14-candle gas, and 14 candles is the standard, will the uncertainty of manufacture, the difficulty of approximating to the standard, influence the one gas to a greater degree than the other?

Witness: I think not.

Mr. Talbot: With regard to heating, I think it is not contested that 1d. reduction will be a fair equivalent for the loss of illuminating power?

Witness: No; as far as the heating power is concerned.

By the Chairman: The evidence that the ratio of consumption would increase in greater proportion than would be expected from the change in the nominal standard, applied, he understood, to common burners. The lower-quality gas would cost the consumer more than the higher-quality gas.

The Chairman: Focussing the whole year, do you think the position of the Metropolitan consumer under the Bill will be worse than it is at present under the existing law?

Witness: If the law were efficient, I think it would be distinctly worse. It is difficult to say what the Metropolitan consumer gets now. If he receives at present 16-candle gas uniformly, he would certainly be worse off.

You are of opinion that he does not get 16-candle gas now?—Yes.

Friday, May 18.

Mr. Balfour Browne wished to say, before the Committee proceeded to hear the speeches of Counsel, that the fear expressed was that, by the reduction of the illuminating power, people would have to burn more gas to get the same light. He was prepared with evidence—and would submit it, if the Committee desired—to show that, when the illuminating power of the gas was increased, there was no diminution in the ordinary rate of increase in the supply of gas. He thought that this, to an extent, met the point made by some of the opponents to the Bill of the South Metropolitan Company. When the illuminating power was increased, there was no diminution in the consumption; but it went on at the ordinary rate of increase.

The Chairman asked when the illuminating power of the gas was increased.

Mr. Balfour Browne replied that it was in 1876 and 1880.

The Chairman said the Committee did not think it necessary that evidence should be called on the point in question.

Mr. Littler then addressed the Committee for the City of London—declaring at the outset that he did not propose to call evidence. His point, he said, was a very small one; relating solely to the statutory powers for public lighting. By the Act of 1860, section 37 (which was somewhat historical), it was laid down that the Gas Company should not charge a higher price for gas to the Public Authority than the lowest rate charged to a private consumer. This was confirmed by the Act of 1868. Under that Act and the Act of 1871, a scheme had to be prepared and submitted to the Board of Trade; and then an Order in Council was obtained which dealt, not only with the City, but with the whole of the North of London. This became law. So long, therefore, as the Gaslight and Coke Company had a district south of the Thames in which they charged a lower rate than they did north of the Thames, they were obliged to charge for public lighting over the whole of their area the lower rate. The result of passing the Bill would be that the Gaslight and Coke Company would hand over to the South Metropolitan Gas Company the district in which they charged private consumers the lowest price; and the figure on which they would be able to base their charge for public lighting would be the rate they levied all over the north. Inasmuch as the Gaslight and Coke Company would have lost the southern district, they would not be supplying the lowest-charged consumers; and therefore they would be able to deprive the City of the advantage it had enjoyed. This was his point. The moment the Gaslight and Coke Company got rid of the south side of the Thames, up would go the rate for public lighting in the City.

The Chairman: What difference will it make?

Mr. Littler said that at present the Gaslight and Coke Company were charging for public lighting in the City the lowest price they were charging the consumers in the south of London, which was 7d. less than the charge to the consumers in the north of London. This would make a difference to the City of £29,000 a year.

The Chairman: When it settles down to the final pocket, I do not think there will be much in it.

Mr. Littler said that the private pocket would not be improved. The only pocket that would be affected, would be the public pocket—to the tune of £29,000 a year. And that which came out of the public pocket, would go into the pocket of the Gaslight and Coke Company. The City was paying 2s. 4d. per 1000 cubic feet for public lighting, because this was the price south of the Thames. If the southern district was got rid of, the City would immediately have to pay 2s. 11d.; and this would be 7d. per 1000 cubic feet going straight into the pocket of the Gaslight and Coke Company. By one stroke of the pen, the Company would be able, in this way, to repeal the whole of the enactments which the City had obtained, at the cost of great labour and expense.

Mr. Leighton: This was present to the mind of the Committee of last year, was it not?

Mr. Littler said it was not before them. There was then no opportunity of discussing it. It was only now, when the proposal was made by the South Metropolitan Company to purchase the district south of the Thames, that the City came forward to represent to Parliament the position of affairs. The aggregate quantity of the gas consumed by the public authorities was stated by Mr. Field and Mr. Livesey at 1000 million cubic feet; and taking this at 2d., it would mean £29,166 a year, which would go into the pocket of the Gaslight and Coke Company, without their doing anything for it. The result would be still worse if the price of coal went up, and there was a consequent rise in the price of gas, which was very likely to be the case. The City had spent thousands of pounds in satisfying Parliament that there ought to be the existing difference in price. And now, not through any change in the general circumstances, but because it became convenient that the Gaslight and Coke Company should hand this small district over to the South Metropolitan Company, it was proposed to mulct the Authorities in this large sum. Clearly, it was a temptation to the Gaslight and Coke Company to make this proposal. The amount the Company would gain—nearly £30,000—was 3 per cent. on £1,000,000; and this the Gas Company would receive for doing nothing.

The Chairman: Seven-eighths of it will go back to the public under the sliding-scale.

Mr. Littler said that this would depend on the economies of the Gas Company; and they had had a tolerable experience of the sliding-scale which was to be such a magnificent thing for the public. Besides, through the sliding-scale the money would not go back into the pocket of the same person. It would go to the private consumer, and not to the public. The Gas Company were offering no sort of equivalent. And why should they have even one-eighth of this £30,000 for nothing? The ratepayer had the advantage of this £30,000 at present. Why should it undergo the process of passing through the pocket of the Gaslight and Coke Company, trusting to Providence for it to come back again? It was well known what the Gas Company did. They took an amount out of their reserve fund every now and then, for the purpose of keeping up the dividends. They had spent £277,000 in this way; and the £30,000 would doubtless follow. When a bad year came—and they were very likely to have that soon, with the present price of coal—they would put the money to the reserve, and in a year or two apply it to the payment of dividend; so that the consumer would never get a halfpenny of it. He did ask the Committee not to interfere with legislation which had gone on very satisfactorily for so many years.

The Chairman: We have had no suggestion from you as to how that which you wish to prevent is to be obviated.

Mr. Littler said he would ask the Committee to keep alive the existing state of things. If they passed the preamble, he would ask them to say that they would not disturb the present position of affairs. If the Committee would concede that principle, he would bring up a form of words to carry it out.

The Chairman: You mean to say that if the Committee decide to follow the recommendations of the Select Committee of last year, they shall do so by a proviso safeguarding the interests of the City.

Mr. Littler: That is all—simply a proviso. This question could not be gone into before the Committee last year, because it was not a matter which was germane.

Mr. Leighton: All this advantage to the public consumer is to the disadvantage of the private consumer.

Mr. Littler: The private consumer will remain exactly as he is, except that if the Company reduce the price of gas under the sliding-scale, he will get some advantage; but the public consumer will pay on the higher price.

Mr. Leighton said if the advantage were taken away from the public consumer, the money would go to lower the rate of private consumers.

Mr. Littler: It might do; but I say it will not. It goes into the reserve and the other funds the Company have got. They are not bound to reduce the price.

The Chairman: When the reserve is accumulated, it is a protection to the consumer; and when it is depleted, it prevents a rise in the price of gas. The Company do not spend the reserve they accumulate in big dinners in the City; they keep it in their coffers.

Mr. Littler: But the reserve itself is a device for keeping up the price of gas. If there were no reserve, the Company would be obliged either to be content with less dividend or reduce the price of gas.

The Chairman: I take it these reserves are all regulated by Act of Parliament.

Mr. Littler: Yes; but the very Act of Parliament which dealt with them granted us this privilege.

Lord R. Cecil: Any such provision as my friend suggests would absolutely destroy our Bill on Standing Orders.

Mr. Littler: I cannot help that.

Lord R. Cecil: Because if we were required to insert any provision into the Bill putting compulsion on the Gaslight and Coke Company, we ought to have given proper notice before we introduced the measure.

Mr. Littler, in conclusion, remarked that he only wanted reserved to him that which Parliament had said in every Act since 1860 he should have.

Mr. Freeman then addressed the Committee for the London County Council, who, he said, were not opposing the Bill in any sense of hostility to the Company. Their view was that the Bill undoubtedly involved some very important, broad, and far-reaching changes—changes which were opposed to the recent tendency of legislation; and therefore it was necessary that the most careful inquiry should be made into the proposals. If the Company could establish to the satisfaction of the Committee that the changes would be for the interest of the public, and not merely of the Company, the County Council would not object; but they were extremely anxious that the consumers should not suffer. Already the Bill had been considerably modified; there having been no suggestion at first that the Company, at their own cost, would supply burners suited for the gas to be sent out. The Bill proposed to change the standard from 16 candles to a lower standard, which was not fixed, and might vary from time to time within certain limits. The County Council held that it required strong evidence of advantage to justify the alteration of the uniform standard which existed at present, practically for the whole of the Metropolis, though there were some Companies on the outskirts where the standard was different. Moreover, so far as they knew, the Gaslight and Coke Company and the Commercial Company were satisfied with the existing standard, and did not desire to alter it. If there was to be an alteration in the Metropolis, it could be much more satisfactorily done if all the parties concerned in supplying London were brought together in some such conference, under the auspices of the Board of Trade, as took place in 1876, when the matter could be thoroughly threshed out. He protested against the change being introduced in one district, and at the instance of one Company only. If it was for the public advantage that there should be reduction in one district, why was it not also to the public advantage that there should be a similar reduction in the case of the other Companies? It was doing by piecemeal legislation, what should be done by general legislation. He knew of no modern case—except that of Glasgow—where the standard of a Company had been lowered. The whole point depended on Mr. Livesey's argument as to the result of the enrichment of gas. Mr. Livesey, in effect, said "If at present at the testing-station I am giving gas of 16-candle power, but at the consumer's point of reception it has fallen to 14·8 candles, if I fix a standard which will give him the equivalent of what he receives now, he is not hurt at all." The answer to this seemed to be that there was no more reason to suppose that when Mr. Livesey had given up enrichment, and was simply producing his homogeneous gas, it would reach the point of consumption without loss, any more than would enriched gas. Counsel knew Mr. Livesey argued that enrichment was lost in the pipes, or in some other way. But they had the evidence of Dr. Clowes that the abolition of enrichment would not lead to uniformity; there being other influences, besides enrichment, tending to affect the quality. There was no equivalent given to the consumer for the drop in the candle power. If the obligation to enrich the gas were removed, there was no reason why the quality should not vary as it did at present. The whole of Mr. Livesey's case, so far as enrichment was concerned, broke down, or was subject to the very gravest doubt. It lay with the promoters to prove their case; and this they had not done. Then Mr. Livesey contended that 1d. afforded full satisfaction to the consumer; and so far as gas for heating purposes was concerned, no question was raised on this point. But as regarded gas for other purposes, the County Council had called a considerable mass of evidence which, if right at all, showed that, so far from 1d. being sufficient, it ought to be 3·7d. Even the penny involved a fallacy, because it was to be taken off the standard, not off the selling price. By the Company's own calculations, at 2s. 8d., the price to be charged in respect of the new capital, £750 per annum would be produced. So that six years would be required to reach the figure of £42,000, which would have to be reached before the reduction of 1d. could be made. In this case, instead of the reduction being 1d., it was a reduction of 1d. in six years, or ⅙d. per year. Therefore the consumer would not get anything equivalent to the reduction asked for. Mr. Livesey said the getting of a good or bad result from the gas supplied depended on the burner; and he offered to supply, whenever the gas standard was altered, at the cost of the Company, fittings best suited to the gas. So that, whenever a change took place, if the consumer was to have the burner which would give the best result, Mr. Livesey would have to supply the whole of his 200,000 consumers with new burners. Surely this could not be right. The burners were to be supplied by the Gas Company at the request of the consumers; but how many would apply? The almost inevitable result would be that the consumers would burn more gas with the inferior burners. Then Mr. Sugg had been recalled to say he had found salvation in a new burner which he had just discovered; but the new burner was found to

give a slightly worse result than the one he had previously invented. If there was to be any alteration at all, it would be very much better that the standard should be fixed, instead of allowing the Company to wander up and down the sliding-scale, and cause the re-arrangement of the burners from time to time. As regarded the public lighting, the County Council held precisely the same view as the Corporation, as to the effect of the clause for the transfer to the South Metropolitan Company of a part of the Gaslight and Coke Company's undertaking. The money which the Gaslight and Coke Company would save should the transfer take place, if it was returned by the Company, would not go back to the same pockets, because it by no means followed that every ratepayer was a consumer, and every reduction in the sliding-scale would go to the consumer only. This matter was of much greater importance to the County Council than to the Corporation, because they represented seven times the area of the City. It was quite possible to suggest a method of safeguarding the public in this matter, without in any way endangering the Bill. On behalf of the Vestries and Local Boards he represented, he went on to point out that all the districts whose consumers were chiefly affected by the Bill, protested against it being carried in the present form. The population in these districts consisted chiefly of poor persons, who were quite unable to protect themselves; and therefore the Local Authorities came forward and asked the Committee very carefully to weigh the arguments on both sides, in order to make sure that the result arrived at was in the general public interest. They viewed with very considerable alarm the clause which provided that various testings should be taken into consideration, and made up on the average of a month. They were afraid that it would be possible, by taking these averages, to supply one district at a certain standard, and another at a different standard; and then, by taking the average of the two, to give a result which would be unfair to the consumer, and unduly advantageous to the Company. Mr. Livesey said this would not be done; but if it were possible there should be safeguards. As regarded the other points, the Local Authorities were in entire accord with the County Council.

Some discussion then followed with regard to the proposals in reference to slot-meters, and the position of the Companies, in the course of which

Mr. Danckwerts informed the Committee that the three Companies had come to an agreement, but that the County Council had not yet fallen into line. The agreement was that no more should be charged per 1000 cubic feet for gas than was now the established price by law; that in regard to automatic meters and fittings, there should be an inclusive maximum charge of 11d. per 1000 cubic feet, with a revision every seven years (to which there was an alternative proposal that there should be a maximum of 10d. per 1000 cubic feet), and no compulsory sale.

Mr. Talbot said the County Council agreed in substance to the proposal, except that they suggested 10d. per 1000 cubic feet—being 1d. more than the figure in the South Metropolitan Bill—with power of revision every seven years.

The Chairman said it would be a very simple matter to decide, if the parties left it to the Committee.

Mr. Cooper, Parliamentary Agent, said he was authorized, on behalf of the Commercial Gas Company, to give an undertaking that the Company would promote a Bill or Provisional Order to carry out any arrangement which the Committee might put upon the Gaslight and Coke and South Metropolitan Companies.

The Chairman: May I ask what the Commercial Gas Company are now charging?

Mr. Livesey: They are now charging 10d. over.

Mr. Danckwerts: I am told that, with regard to the Gaslight and Coke Company's Bill, there is some Standing Order in the way. We could do it by Bill or Provisional Order next session.

Mr. Emmott: It can be done in the South Metropolitan Bill.

Mr. Danckwerts: It can come in that Bill all right.

Mr. Talbot said there was not the least difficulty, because the agreement could be put in the County Council Bill, which applied to all the parties.

The Chairman: My suggestion is that you should submit that to the Committee; setting out the whole details in clauses, and leaving the price blank for the Committee to fill in. You, Mr. Danckwerts, have no objection to these slot-meter clauses being made operative as regards your Company through the County Council Bill?

Mr. Danckwerts: No; but I should like to say something as to the proper wording of the Bill, so that he who runs may understand.

Lord R. Cecil then addressed the Committee in reply, on behalf of the South Metropolitan Bill. He need say nothing about the slot-meters, nor, he understood, about the accounts.

The Chairman said the Committee were anxious to secure that there should be no complication in case the South Metropolitan Bill became law; and they had therefore consulted with the Official Auditor, and were informed that no difficulties would arise through the operation of any of the clauses of the Bill.

Lord R. Cecil (continuing) stated that the provision for the transfer of the portion of the Gaslight and Coke Company's area which was south of the Thames to the South Metropolitan Company was inserted to carry out the recommendation of the Committee of last year. The South Metropolitan Company had no anxiety to purchase it; and he was informed that the Gaslight and Coke Company had no desire to sell. The South Metropolitan Company were prepared to take power to agree with the Gaslight and Coke Company to purchase, but not to come under compulsory obligation to do so; and, indeed, the parliamentary notices in connection with the Bill precluded them from taking any such power. The effect of the transfer on the price for public lighting north of the Thames, did not really affect the South Metropolitan Company. But it did appear surprising that the Local Authorities should be getting their gas more cheaply than the private consumers; and when Mr. Littler talked about giving £20,000 to the Company, he totally ignored the effect of the sliding-scale, under which seven-eighths of this sum would go to the consumers. The Committee of last year might have recommended the transfer as a means of relieving the Gaslight and Coke Company. If the Committee were not satisfied about the provision, he asked them to strike it out, rather than put on the Company any such provision as that suggested by Mr. Littler. Moreover, in fairness to the Gaslight and Coke Company, when discussing this question, it was only right that they should be heard, which could not be done on this Bill; and therefore the Committee had not heard any reason against the proposal which might be brought forward by the other party to the matter. As to the contention that the Bill would interfere with the uniformity prevailing in London, there was no such uniformity, except on the one point of candle power; and in regard to this, it was the fact that the Suburban Companies had not the same standard. Apart from this, it was desirable on principle that, when making a change of this kind, it should be done in respect of one Company first, and not in the case of all. It was not a sound, though attractive, proposition, that they should make a change in all at the same time. This would mean that they were so certain of the result that they would apply it all over London without any experiment on a large scale, which was the only scale which could be effective. The main question was whether the South Metropolitan Company had made out that the change would be to the advantage of the public. The first objection was obvious—viz., that the change might result in loss of light to the consumer. Assuming that the illuminating power at the testing-stations, by the abolition of enrichment, would result in the reduction of illuminating power at the consumer's burner, he submitted that, in fact, no appreciable injury would be done to the consumer, because practically the consumer now used a burner which gave him 8 or 10 candles at the very outside—more often 4 or 6 candles—whereas with the new burner proposed to be given him he would get much more. Practically, and in effect, the Bill would give a better light to the consumers. It was said there would be an addition to gas bills; but this was all theoretical. Practically, the consumer did not care whether it was 14 or 16 candle gas he burnt; and the proof of this was in the fact that consumers persisted in using burners which, however improved, did not give them half the candle power they might secure from the gas. A burner constructed for the use of 14-candle gas was only slightly less efficient for 15 or 15½ candle gas; so that the suggestion that the burner would have to be constantly changed was illusory. The real strength of the case was that the consumer would get better gas than at present—or at least as good. The contention on which the Bill was founded was that natural gas was better and more permanent in every way than enriched gas. If it was more permanent, it followed that if the Company made 15-candle gas, and it reached the consumer substantially as it was made in the works, the consumer would get a better result than at present with 16 or 16½ candle gas, which only reached the consumer at 14·8 or 14·6 candle power. Mr. Carr said that enriched gas was quite as permanent as natural gas. There might be special conditions to account for this at Widnes; but he stood alone in the opinion. Dr. Clowes said that neither with natural gas nor with enriched gas could one be secure that the product of manufacture would always be the same. This was true. But he did not say, and did not suggest, that enriched gas was as permanent, once it had been enriched, as natural gas. Then Professor Lewes said, in effect, that while carburine enrichment was as good as any other, all carburine enrichments were non-permanent; so that he was against the County Council. Mr. Dibdin, in a report on the experiments made by Mr. Livesey when gas was supplied for a fortnight without enrichment, said the effect was limited to the official testing-places and their near proximity—that when they did not enrich for a fortnight, the consumers were unable to detect any difference in the illuminating power of the gas when it reached them; or, in other words, that it was so much more permanent that it reached them in the same condition as it left the works. This was really the case for the Bill. Therefore, on the evidence, it was unquestionable that there was far greater permanence in the supply of unenriched gas, and that gas was equally good for heating purposes and for the Welsbach burner, for which 75 per cent. of the South Metropolitan supply was used. Undoubtedly, the Bill would produce a cheaper gas. This was admitted; and he thought it was clear that what the gas consumers wanted was a cheap, pure gas, sufficiently bright for ordinary purposes. The reduction in price contemplated by the Bill went wholly to the consumer, unless the penny was not a true representative of the saving caused by the abandonment of enrichment. The Bill was to legalize the supply of natural for enriched gas, which had become necessary to meet changed conditions. It was said this was a great revolution; but a very great change had taken place in the conditions since the settlement of 1876. At that time, it was possible to use cannel coal for enrichment; now this was impossible, which was an enormous change. Since then, the electric light and the Welsbach burner had been introduced. This was a matter of immense importance, because it added great competition to the Company's difficulties, and rendered it necessary for them to make changes so as to compete on more equal terms. Lastly, there was another great change in the largely increased use of gas for heating purposes. These were the reasons the Company desired the alteration, the whole advantage of which would be given to the consumers. It might be asked if the Company came forward as philanthropists. This was not so. The Company would be better off, because they would be better able to compete with the Welsbach burner and oil, and save them, also, a certain amount of worry in connection with the enrichment process. Mr. Freeman suggested that the Bill ought to be suspended for some better inquiry to take place. They had had an inquiry lasting for several weeks; and the Committee had had before them nearly everyone in England capable of throwing light on the matter. Was the whole of the money and time so expended to be thrown away? If the Committee were satisfied that the change was for the public interest, they should not hesitate to pass the Bill, even though it did to a certain extent represent a change from the tendency of modern legislation.

The Committee then deliberated in private; and their decision on the three Bills (given later in the day) will be found on p. 1369.

Reduction in the Price of Gas at Preston.—Advances in the price of gas appear now to be almost universally the order of the day; but news is to hand of at least one alteration in price in the other direction. The Directors of the Preston Gas Company, when making up the accounts to the end of last year, having coal and oil contracts that were estimated to see them over the next two to two-and-a-half years, decided to reduce the price of their gas (of a standard quality of 18 candles) from 3s. 7½d. per 1000 cubic feet to 3s. 5½d., subject to discounts varying from 15 to 20 per cent.

MARGATE CORPORATION AND WESTGATE AND BIRCHINGTON WATER BILLS.

On Monday last week, a House of Lords Committee (Lord Brougham and Vaux in the chair) had before them the application of the Margate Corporation for an extension of district, and further powers to establish a pumping-station in St. Nicholas Wade; this district being under the control of the Rural Sanitary Authorities, and adjoining the district supplied by the Westgate and Birchington Water Company. The latter Company had also a Bill before their Lordships asking for an extension of district and further powers for making works, &c. Mr. Baldwin Latham and Mr. Edward Easton appeared as the expert witnesses for the Corporation of Margate; while Mr. William A. M'Intosh Valon (Engineer to the Company), in conjunction with Mr. Charles Hawksley and Mr. Charles Gott, appeared against the Corporation scheme, and in support of the Westgate and Birchington Company's Bill.

After a prolonged hearing, extending over two days, their Lordships threw out the water clauses of the Margate Bill, and passed the preamble of the Westgate and Birchington Company's Bill. This latter Bill, among other things, asked for an extension of district to take in the parish of Acol, as also the part of the parish of Westgate-on-Sea supplied at present by the Margate Corporation. It was contended by the Westgate Company that this part of Westgate-on-Sea was not included within the present limits of the Margate supply, although they had originally purchased it from a Company who had powers over that district; the reason given being that, as the Corporation purchased from the Company under the Public Health Act, they had no power to supply outside their municipal boundary. The Margate Corporation by their Bill sought for power to extend their district so as to cover the ground originally occupied by the Margate Water Company, which would in that event have taken in the ground sought by the Westgate Company. In the decision given by their Lordships, they threw out all the water clauses of the Margate Corporation, including the extension of district, notwithstanding the fact that the Margate Corporation are at the present moment supplying water within the district they were seeking to acquire. Further, they approved the preamble of the Westgate and Birchington Water Bill, which gave them power to take over the part of Westgate-on-Sea supplied by the Margate Corporation by purchasing the pipes and mains comprised in that part of their undertaking, if any. This we think is the first time a Company has ever obtained parliamentary power to carve a piece out of a district watered by a Corporation claiming to be in possession.

The Lords Committee on Wednesday, while passing clauses, distinctly stated that their decision did not alter the status of the Margate Corporation. The interesting legal question therefore remaining to be discussed is whether they have or have not powers over this part of their district outside their municipal boundary—that is to say, whether the powers of the Public Health Act will give them statutory authority outside their district. It may be noted that the Margate Corporation had doubts as to this as, while, on the one hand, they claim the district as belonging to themselves, in their Bill they ask Parliament to confirm their statutory powers over the district. This request the Lords have refused to grant, leaving the Company exactly where they were before they went to Parliament, but the worse off by having their proposed pumping scheme refused, and further leaving them in the unenviable position of having to propose some other and more acceptable way to Parliament for increasing the supply to their district.

The examination and cross-examination of Mr. Valon lasted for some hours; and at the termination of the evidence of the expert witnesses for the Company, it was pretty clear the Lords would decide against the proposed new pumping-station of the Margate Corporation, and, as a consequence, it was anticipated that the district would be refused, seeing that the Margate Corporation had to confess their inability to supply present needs for the restricted area within their borough.

ELECTRIC TRAMWAYS AND GAS MAINS.

The Question of Electrolysis.

A Select Committee of the House of Commons, presided over by Colonel Cotton-Jodrell, recently considered the Bill of the South-Eastern Metropolitan Tramways Company, which had for its object, as it came before the Committee, the substitution of electric for horse traction on the tramway running from Greenwich to Catford. The Bill was opposed by, among others, the South Metropolitan Gas Company whose opposition was based on two grounds—the danger from electrolysis to their pipes and mains, and the desire for the insertion of a clause giving them power to make, at the expense of the Tramway Company, any alterations of their mains that might be required in the laying down of the tramway as an electric one.

Sir W. H. Preece, who gave evidence as Engineer to the scheme, said (in cross-examination on behalf of the Gas Company) that he did not think the mains would be affected by the electricity, as it was proposed to proceed under the Board of Trade regulations, which he considered would protect the Company without the insertion of any special clause. In the result, the Committee passed the preamble of the Bill.

Mr. Castle, Q.C., for the South Metropolitan Gas Company, in proposing clauses for the protection of his clients' mains and pipes, and conferring on them power to carry out all alterations themselves, said the matter was an important one for the Gas Company, who supplied some 50 square miles of London; for there was everywhere a desire to substitute, in the working of tramways, electric for horse traction. What the effect would be on a large scale, of setting these electric currents free all over the place, it was impossible to foresee. The South Metropolitan Company had had cases occurring (especially along the route of the City and South London Railway) of electrolysis, an example of which had been shown to the Committee; and fusion had also taken place between their pipes and the electric wires. Therefore they felt bound to appear before Parliament. It was suggested in one case—the London County Tramways (No. 2) Bill—that the Gas Companies were intruders along the public highways, and that they must take any risk arising from the electric tramways or the user of the public. This was an entirely wrong argument. The sub-soil of the roads belonged to the adjoining proprietors; and all that had been granted away was the user to passengers. The sub-soil was reserved for the amenities of the houses; and therefore it became a question between the user of the public and the user of the inhabitants for their gas, water, and drains. He contended that the Gas Companies were in their proper place, and that anyone interfering with them interfered with the property of the adjoining proprietors. Up to the present, in constructing these tramways it had simply been a question of taking up the surface of the roads; but electric traction involved interference with the sub-soil, and the setting free of currents which would affect the mains by electrolysis, unless they were properly safeguarded. The Board of Trade might make regulations; but they were not sufficient. Sir W. H. Preece had put his hand on what was required—it was not regulation, but supervision from time to time. Accidents would occur here and there. Electricity would escape, pass through moist ground, and turn the water into hydrogen and oxygen, which would attack the iron and change it into plumbago. The damage might amount to thousands of pounds in the case of a large undertaking like that of the South Metropolitan Gas Company, if the Bill passed without a protective clause. Sir W. H. Preece had said there would be no damage in this instance from electrolysis. But, if so, a protective clause would do no harm, but only make the Tramway Company more careful in laying down their system. The works proposed would necessitate a considerable amount of alteration of the Company's pipes and mains; and they desired to be allowed to make such alterations themselves, at the Tramway Company's expense.

Mr. C. C. Carpenter, the Chief Engineer to the South Metropolitan Gas Company, said that, under the Tramways Act of 1870, the Tramway Companies had a right to make such alterations as were necessary to gas pipes and mains; but these powers had never been put into operation, and it would be dangerous if they were. In respect to the conduits for electrical traction, they required a depth of from 2 to 3 feet, and would necessitate interference with the gas-mains. The main that would be affected in this case was a 2 ft. 6 in. high-pressure one. In the case of any alteration to it, personal supervision on his part would be absolutely necessary. Great attention had been drawn in America to the damage done by electrolysis. Mr. W. R. Cooper, an Electrical Engineer, gave evidence as to the effects of electricity on pipes and mains. Mr. James Swinburne said the Board of Trade regulations would do much to keep down damage from electrolysis, provided they were carried out; but with earth returns, it could not be stopped altogether. In America, owing to the absence of rules, electrolysis was much worse than in this country, where low-power currents were employed. Insulated returns would be a perfect protection. He could not see why Gas Companies should not be compensated for damage done to the pipes by electrolysis. A proposal had been made in the United States to substitute earthenware pipes; but it was not found to be practicable. To put insulated returns on tramways was difficult; and if Parliament insisted on it being done, it would cripple the tramway industry more than it would benefit the public. Tramways should be allowed to use earth returns; but if they spoiled other people's property, they should pay for it.

Ultimately, the Committee refused to insert the protective clause asked for by the South Metropolitan Company, but agreed to insert a proviso that the Company should be allowed to do their own work, subject to an arbitration clause.

Lambeth Water-Works Company.—The report of the Directors of this Company for the half year ended March 31 states that the revenue account shows an increase of £5679 in the water-rents, &c., and of £2535 in the expenditure, as compared with the corresponding period of 1899. The principal additions to the expenditure occur under the heads of distribution, pumping and engine charges, salaries of Engineers, &c., and rates and taxes. With the exception of the latter item, they may be attributed to a larger business and to the enhanced cost of coal and other stores. The surplus transferred from the revenue to the dividend and interest account is £85,121. There is to the credit of the latter account, after payment of interest on debenture stock, an available balance of £85,969. The Directors have decided to transfer £10,000 to the contingency fund (which will then stand at £40,000); and they recommend that a dividend of 7½ per cent. per annum be paid on the shares issued under the Company's Act of 1856, and one of 10 per cent. per annum on all the other share capital of the Company; also that a payment of 5s. per cent. (being at the rate of ½ per cent. per annum) be made on all the share capital of the Company on account of deficiencies of previous dividends. A balance of £2015 will remain to be carried forward, after making provision for the payment to be made to the Chamberlain of London in virtue of the sinking-fund clause of the Company's Act of 1886, in respect of debenture stock that has been issued under that Act.

Scarcity of Water at Ashton.—At the monthly meeting of the Ashton Joint Water-Works Committee last Thursday, it was reported that there was a deficiency of 100,298,000 gallons of water in the reservoirs as compared with this time last year. The Chairman (Alderman J. Wilson) said the Committee felt that it was desirable to enforce a restriction in the consumption of water, if they were to be able to give a supply at all in the event of there being a very dry June and July. He would propose—and he thought it would be agreeable to the members generally—that they should shut off the water from eleven o'clock at night until five o'clock in the morning. They could try this for a month, and see what the condition of the reservoirs would be then. He might tell them that until the end of July there were 75 days. If the weather kept as it had been, they would be in a very serious condition. They had altogether in their reservoirs, a week ago the previous night, a little more than 15 weeks' supply, which meant that they could not supply at all at the end of 75 days. Mr. Noel asked if notices could not be sent out to the effect that people wasting water would be prosecuted. The Chairman replied that this would have to be done; someone would have to be punished. It was useless to attempt to save water by restricting the hours of supply if people were to be allowed to let it run to waste. After the notices had been issued, people caught in the act of wasting water by swilling, &c., would be brought before the Magistrates and dealt with. Mr. Noel seconded the motion, and expressed concurrence with all the Chairman had said. The proposition was agreed to.

MISCELLANEOUS NEWS.

EDINBURGH AND LEITH GAS COMMISSION.

Visit of Inspection to the Granton Works.

On the afternoon of Monday last week, the Works Committee of the Edinburgh and Leith Gas Commission paid a visit of inspection to the new gas-works which are under erection at Granton. Mr. Kinloch Anderson, the Convener of the Committee, was in charge of the company. On their arrival at the works, they were received by Mr. W. R. Herring, the Engineer, who showed them round.

Mr. Herring furnished the information that down to April 15 last, the expenditure upon the works in process of construction amounted to £41,739. The gasholder tank, which should have been finished at the beginning of the present year, at a cost of £19,000, has only been completed to the extent of £13,631. The side-walls, however, are constructed; and the stone coping is now being placed in position. At the present rate of progress, the interior of the tank and the completion of the puddle bed over the cone will occupy another three months, at which date the erection of the steel work will commence. The deep-level drainage system, which has been laid for serving the present area being dealt with, has been finished to the point of issue—low-water mark in the Firth of Forth—the total cost being £2390. The residual products works buildings, including the chimney, are now practically completed, at a cost of £3805; and the chemical works plant is being erected therein, the contract price for which, including the boilers, is £8905. Some cast-iron tanks from the Portobello works have been removed, and re-erected upon the Granton site for this portion of the works. The railways existing upon the site are, with slight exceptions, permanently laid, and are sufficient in themselves to cover two complete sections of the works. The total cost for railways, both on the upper and lower sites, is about £5938. The levelling of the site, construction of the foundations for the main buildings and plant, including the culverting of a burn running through the ground, building of boundary walls, &c., account for about £6000. The building of the retort-house, coal-store, plant-house, &c., are well started now, but have been seriously delayed in consequence of the difficulties of getting materials. The buildings are being constructed of brick, with hard red brick facings. The 22 contracts at present in process of execution comprise the gasholder, representing a sum of £43,314, considerable portions of which are already delivered upon the site. The arge girder-roof for the retort-house, 100 feet span, portions of which are also delivered, represents a sum of £10,609. The coal-store roof, constructional steel work, &c., is also well in hand, representing a sum of £16,746, in addition to which the Commissioners have two locomotives, one steam travelling crane, excavating grabs, and steam driven stone-breaker and concrete mixer, 2-feet narrow gauge railway with iron tipping waggons, several 3-yard ballast-waggons for running on the permanent way, as well as a considerable amount of general plant and appliances on the works. A stone quarry has been opened in the Pennywell Parks; and the whole of the materials removed therefrom have been used in connection with the construction of various parts of the works. There appears to be some very good stone in the quarry, although the upper strata have only at the present been quarried. In consequence, however, of the nature of the works in process, all qualities of stone being removed are available for the works—the softer portions being used for the making of concrete; the rougher and harder portions, for rubble work and for ballasting under the roads, railways, and floors; and the larger pieces are being dressed and worked into the structures. There appears to be an abundance of stone beneath these parks, which will no doubt prove of very considerable value to the Commissioners. Mr. Herring pointed out the site of a passenger railway station which it is proposed to erect, for the convenience of the workmen travelling to and from the works. Then the retort-house and coal-store were looked at, after which the gasholder tank, being further advanced, received more attention. The Belgian stone used for the construction of the coping is being received in satisfactory quantities. It is a very tough stone, and most suitable for such work. The tank is being constructed by Mr. W. Wilson, of Hillhead, Glasgow; and the holder will be erected by Messrs. Clayton, Sons, and Co., Limited, of Leeds. The only other portion of the works in existence is the chemical works, situated about 50 yards from the shores of the Firth of Forth. The building is all but completed; slaters being engaged on the roof—in which, by the way, there is no wood, the slates being wired on to iron ribs. Two ammonia stills are in course of construction within the building; and in an annexe are two Lancashire boilers, which are to be fired with producer gas. Outside the building is a tar-tank, nearly completed, and a specially constructed plant for the recovery of sulphur. The chemical works are expected to be in full operation in about three months. It is intended to start them at once, conveying the raw materials by rail, as they are at present and have been for years, to Falkirk. Mr. Kinloch Anderson stated that it had been expected that they would have been able to make gas at Granton in the autumn of 1901; but on account of the delays which had taken place, by reason of want of labour and the non-delivery of materials, they were satisfied that it would be the spring of 1902 before the new works could be started. There was no doubt they would be in a tight place by then; but Mr. Herring's ingenuity had been such in the past, that they need have no fear but that he would be able to cope with it. When once this section of the works was started, the works at Leith and Portobello would be closed and sold; and when a second section of the new works was erected, the Edinburgh works would also be disposed of.

The weather was fine; and a very enjoyable, as well as profitable, afternoon was spent. The visit tended to confirm the view that a more ideal site for a gas-works could not be found. Mr. Herring has taken possession of Granton House, which has just been vacated by Mr. Reginald Macleod, the new Registrar-General for England.

The Llandudno District Council have, on the recommendation of the Gas Committee, resolved to make application to the Local Government Board for sanction to the borrowing of the money required for the provision of a carburetter at the gas-works.

MANCHESTER CORPORATION GAS AND ELECTRICITY SUPPLIES.

Increase in the Price of Gas—Criticism of the Electricity Committee.

At an Adjourned Meeting of the Manchester City Council, held on Wednesday last—the Lord Mayor (Mr. T. Briggs) presiding—the estimates for the current year prepared by the various Committees (*ante*, p. 1238) were considered.

Alderman King, Chairman of the Finance Committee, in introducing the estimates, observed that, in accordance with a resolution of the Council passed on May 2, certain of the Committees had found it possible to revise their estimates, in order to relieve the city rate. The Gas and Electricity Committees now proposed to hand over £51,900, instead of £20,000 as originally estimated. This alteration would, however, involve an alteration in the price of gas.

The Lord Mayor (Deputy-Chairman of the Gas Committee) moved the adoption of the revised gas estimates. These involved an increase in the price of gas to consumers by ordinary meters (including public lamps) of 3d. per 1000 cubic feet, to take effect from June 24 next. This would enable the Committee to hand over £51,900 to the city fund, instead of £20,000, as originally estimated.

Alderman Rushworth seconded the motion. It was, he observed, only right to say that the decision to advance the price of gas was arrived at by the Committee in the absence of the Chairman (Alderman Gibson), whom they were glad to see present that day. He would like to give a few reasons for the necessity of the increase in the price of gas. Some criticism had been passed on the Committee on account of what was termed its "hand-to-mouth" policy; but he could tell them that the Committee had secured every ounce of coal and cannel obtainable. One of the causes of the increase in the price of gas was the extra cost of coal and cannel. Judging from the information supplied to him, it was a matter of grave doubt whether the increase of 3d. per 1000 cubic feet would meet the case; but that was only his own view. He would remind them that the gas-works were the property, not of the consumers, but of the ratepayers of the city. He had, however, every possible sympathy with the supply of gas at the lowest possible price, and the encouragement of its use for cooking, motive power, and other purposes; and when the time arrived, he would be the first to advocate a reduction. But at present, the only course they could pursue was to increase the price.

Alderman Gibson said he occupied a somewhat painful position, in that he had to oppose a resolution passed by his own Committee. He only placed himself in this position from a keen sense of public duty, and a firm belief that if the course recommended were adopted, it would prove quite an unnecessary and serious drawback to the best interests of the undertaking. The resolution was passed by the Committee when he was away from home, and, he thought, under a misapprehension. He believed that if his colleagues had known that he could not possibly be at the meeting, they would have adjourned their consideration of the matter for a few days. He would then have been able to give them the explanation he now had to furnish to the Council. In the first place, he might say that he was, and always had been, of the opinion that they had no right to tax one class of the community for the benefit of another. They had been doing this for years in the gas undertaking. He was quite aware that, in making this statement, he laid himself open to the taunt: "If that is your opinion, how is it that you have so long quietly acquiesced in the position which you now so thoroughly condemn?" He would tell them the reason. When 1d. per 1000 cubic feet of gas was about equal to 1d. per pound on the rates, and when the large ratepayers were also the large gas consumers, he thought it was nearly as broad as it was long—or at any rate, that the small difference involved would not be enough to make any trouble about. But the position was to-day a totally different one. The large ratepayers were not now the large gas consumers, as they were four years ago. They were at present the large electric light consumers; and what was proposed was, unquestionably, to tax the gas consumers by making them pay 3d. per 1000 cubic feet more than they should pay, in order to take 3d. per pound off the rates of these rich men who did not burn gas. For these rich men he was not concerned to legislate. He wanted to legislate for the poor; and he said that, in raising the price of gas to-day, without any necessity—if there had been any necessity, it would have been quite another thing—they were taxing the poor shopkeeper, who was already overburdened with what he had to pay. What, too, about the penny-in-the-slot customers? They had 30,000 last year. They spent a great deal of money in altering the slot-meters to give 30 cubic feet for a penny, instead of 25 feet. What were they going to do now? (A Voice: Leave them as they are.) He wanted someone to tell him that; and he now knew they were going to do something worse than all. These people, to all intents and purposes, were not ratepayers. (A Voice: Yes.) Well, they might be, indirectly, but not in the sense that shopkeepers were; and they would not be affected in the same way. They were going to continue giving them the advantage of 30 cubic feet for a penny; and they were also giving the rich people an advantage, who did not burn gas. The whole weight would be placed on the middle-class—the shopkeepers, &c. Then, again, what about gas for power purposes? In 1896, when the price of gas was reduced 3d., he told them that the business would go up by leaps and bounds. In that year, there were 962 engines using their gas. To-day there were 1662, or nearly twice the number. The people who had these gas-engines were mostly in a small way of business; and they had no right to relieve those who did not want relief, at the expense of such men as these. With regard to cookers, he might mention that in 1896, when the price of gas was reduced, there were 3781 cookers and heaters; to-day there were 9560. It had been said that if they did not raise the price of gas this year, they would have to do so next. Let every tub stand on its own bottom. They would know how to deal with the question when the time came. If they could not produce gas at the price, the price would have to be raised; but that was not so to-day. They could make gas just the same as before, with £10,000 profit. They had no justification for raising the price; and he strongly urged the members to agree to his amendment, which was that the estimates submitted to the Council on May 2 should be adopted. Then there was another point that had escaped the attention of his colleagues when they passed the resolution. A Municipal Trading Committee had been formed in the House of Commons,

with the consent, he believed, of Mr. Balfour. Why had it been formed? Because there were a number of members of the House who said that municipal trading was not pursued for the benefit of those who were served, and that the profits were used for bolstering up the rates of the city. They further said that the tramway, gas, and other undertakings were all vying with each other as to which could gain the most popularity, not by the way in which they served their customers, or by charging them the lowest price, but by making the most profit out of the undertaking, in order to pay it over to the rates. They said this was wrong; and he held the same opinion. They had no right to pay anything at all out of profits towards reducing the rates. The Committee was formed to prevent, as much as possible, municipalities from becoming trading committees. The argument was that the fact of their paying these sums to the rates went to prove that private competition could do better for the people than municipalities. Supposing he were called before the Committee, and were asked if the Manchester Corporation had raised the price of gas because they could not supply it at less, he would have to answer: "No. We could do it, and make £10,000 profit." "Why then have you raised the price?" He would have to reply that they had done it simply in order to be able to hand over so much to the rates. This would settle the whole business. They would not want another witness after that. If, therefore, they passed the resolution, they would do great injury to the undertaking and to the community, and to a number of other local administrations, because they would show that it was not for the consumers' benefit they wanted to work the departments, but in order to pay money over to the rates. The little benefit they might bestow on the rich people who did not burn their gas, would be more than counterbalanced by the great injury they would inflict on the poorer classes of the people who did burn gas.

Councillor LAMBERT seconded the amendment. His first reason was that he did not think the matter should have been decided in Committee in the absence of the Chairman. The Committee arrived at the decision under a misapprehension. They had since learnt that the Chairman, who had been in London, only received notice of Friday's meeting late on Thursday night; so that it was impossible for him to attend. He therefore thought the Chairman and other members should have an opportunity of considering the matter together. In the second place, there was a good deal in what Alderman Gibson had set forth. He contended that the principle the Chairman had advocated was a sound one—that consumers were entitled to be supplied with gas at a price as near as possible to the cost of production, having due regard, of course, to the interest, sinking fund, and reserve fund; and that it was not fair or justifiable to charge a high price for gas in order to contribute a substantial amount to the city fund in reduction of rates. The most important point touched upon by the Chairman was the last. At the present time, there was sitting in London a Committee who had under consideration the Lancashire Electric Power Bill, which was promoted by private individuals in London for the purpose of supplying electricity to the whole county of Lancaster south of the Ribble, in competition with the municipal authorities. Their strongest argument was that they could supply the article cheaper than municipalities could do, because the latter were not furnishing it at cost price, *plus* a fair margin of profit, but at a price which would enable them to pay so many thousand pounds annually in reduction of the city rates. This argument might be applied to other departments of enterprise; and for this reason he thought they should hesitate before raising the price of gas.

Alderman THOMSON, who opposed the amendment, said they ought to look for a moment at the history of the gas-works. When real property devolved on a man, certain moral and perhaps legal obligations rested upon him. He was bound to keep it in repair, and develop it to the best of his ability. Many years ago the Council inherited a very valuable property—the gas-works. These were established before Manchester was incorporated; and when that occurred, they took over the responsibilities of the undertaking that had been carried out by the ratepayers under the Lord of the Manor. It was for the use of the ratepayers; and they were bound to develop the property to the best of their ability. When the property was handed over to the Manchester township, it was considered right and lawful that the town should receive a profit of 10 per cent.; and they had that right now. Of course, if a new town went to the Government, and asked for powers to make gas to-day, they would probably be told the conditions were different, and that only a profit of 5 per cent. would be allowed. Still the right to make a profit was recognized. He did not like to hear Alderman Gibson dividing class against class. He would also say that if they were doing wrong by getting a profit on the gas, because it was bad for the shopkeeper, they ought also to increase the rate for electric lighting. He would be sorry to say a word that would pain the shopkeepers, or any other class of the people; but this was a matter of ordinary economy. If a man in business was passing through times when everything else was raised in price, he must try to increase the price of his own goods as well. This was precisely the position of the Gas Committee. He had looked with alarm at the last reduction. He thought it dangerous, and that the time would soon come when they would have to raise the price again. He supported the Gas Committee's recommendation, which he considered a sound one.

Councillor PLUMMER observed that the position of the Chairman reminded him of "Athanasius contra mundum." He was not only against his own Committee, but against the Council, and, what was more, the outside public. They all had the highest respect for Alderman Gibson; and generally he found himself on the same side. But he had never heard him present a weaker case than that which he had put before them that morning. With regard to the effects of the increase, those who paid the highest rates would find a distinct relief, and not any imposition. It was impossible to adopt a measure of this kind without pressing on a few individuals; but they must take the general sense of the community. The number adversely affected would be small, compared with the general advantage. With regard to the Committee on Municipal Trading, he thought the House of Commons, or any other sensible Committee, ought to take the instance mentioned by Alderman Gibson as favourable to municipal trading. They were proud of the Manchester gas undertaking; and he gladly recognized the good work Alderman Gibson had done as Chairman. Time after time, the Chairman had pointed out, with pardonable pride, the splendid financial basis on which it rested. Were not the ratepayers, then, entitled to interest on the money invested in it, at least at the rate of 5 per cent? The Chairman came before them to protest against this interest being given, on the ground that they should work as near as possible to the cost price. What about the £50,000 last year? They were simply seeking to contribute an equal sum to-day, and were asking for 3d. per 1000 cubic feet more to cover the cost of material. If there was anything in the argument about working to cost price, they ought never to have had the £50,000 before. Looking at it from a business point of view, they were, in the first place, entitled to interest on the investment; and, in the second place, they were not seeking to make any more surplus than before. It was purely a defensive measure; and he thought the Council would, with practical unanimity, support the action of the Committee.

Sir BOSDIN LEECH remarked that, when the last reduction was proposed, he was in opposition, on the ground that, though times were then favourable, coal being at a low price, they should not hurry matters, as coal would go up, and they would then want to raise the price of gas. There was a good deal to be said on the principle of everyone bearing his own burden. The gas consumer might think it an injustice that he should have to pay something which was a burden that ought to be borne by the ratepayers as a whole. In many ways, however, the rich man was taxed when the poor man was absolved. They could not lay down an absolute rule. Alderman Gibson said it would be a hardship to users of cookers and engines; but was it not a greater hardship that, while the man who had a gas-engine was getting his power at a price which was an absolute loss to the seller, his neighbour using steam, had to pay a big price for his coal? The same remark applied to users of gas for cooking, and those who employed coal-fires. It was only fair that they should meet the circumstances of the day, and put on again what he held at the time was wrongly taken off. The citizens stood all the loss and risk, so far as the gas-works were concerned; and they would have to bear the burden in the case of any accident, like that at Rochdale Road. The Gas Committee were taking a wise step. He knew the Chairman worked very hard in the Committee; but he was entirely wrong in this matter.

Councillor WAINWRIGHT suggested that the Electricity Committee should be asked to increase the price of current; but the proposal was ruled out of order.

The revised gas estimates were eventually adopted; only 4 votes being recorded in favour of the amendment proposed by the Chairman.

Considerable discussion took place on the motion to adopt the revised estimates of the Electricity Committee. In the original estimates, no contribution to the city rates was anticipated by the Committee; but in the revised estimates, provision was made for handing over £4000 in relief of the rates.

Councillor LAMBERT moved, as an amendment, that the original estimate be adhered to. If the Chairman of the Committee, who was attending to his duties in London, were present, he was sure he would object to the proposed payment of £4000 from the reserve account. The Committee at present had a ridiculously small reserve. They were entitled to a reserve of £66,000. This time last year it was about £32,000. During the twelve months, it had been drawn on to the extent of £20,000, which reduced it to £12,000. If they drew on it for a further £4000, the remainder would be quite inadequate to meet any sudden emergency. If they had any serious breakdown to make good, the whole of the reserve would be swallowed up.

Dr. BISHOP, in seconding the amendment, described the proposal of the Committee as due to what might be called "panic legislation." This £4000 profit had been arrived at by increasing the estimated increase in consumption during the twelve months. But the original estimate had been made on the widest possible basis; and to go and increase it so as to produce on paper £4000 extra, was to put the matter on a false basis altogether. It meant that they would have to dip into the reserve fund. They had now £10,000 reserve; and the deduction of £4000 would leave them with only £6000. If they had another breakdown such as they had had during the past twelve months, where would the reserve fund be? He thought the Chairman (Alderman Higginbottom) should have been at the meeting of the Committee. [The LORD MAYOR: He is in London on municipal business.] Well, they had adjourned the meeting to the Saturday, to suit his convenience. He (the Chairman) was not before the House of Commons on Saturday. He was sorry the Chairman was not present that day. These estimates were the most important business of the year, and he thought when the Chairman did not attend he should be called on to explain. What prevented them paying over anything was the increased interest and sinking fund, amounting to £39,880. It would be interesting to know how much of this should be allotted to work carried out or about to be carried out in out-districts, and to that carried out in the city itself. From figures he had before him, he might state that in three districts alone—Moss Side, Levenshulme, and Withington—they had spent £33,926, and only received £285 in return.

The LORD MAYOR: Things are not fully developed in the department. They are in a state of transition.

Dr. BISHOP asked how long they were going to be in a state of transition. Last year they paid £10,000; now they were able to pay nothing. Was this the kind of transition they liked to see in any Committee?

The LORD MAYOR: Please adhere to the estimates.

Dr. BISHOP said that, as a member of the Committee, he ought to know whether they were in a state of transition. Even allowing for that, they should be able, after spending £650,000 on the undertaking, to hand over £4000 without trenching on the reserve fund. The financial condition of the department was such as to require strict investigation. It was not on a sound financial basis; and he did not think the Council should give their consent to the course proposed. There was a lack of administrative ability in the Committee. There was far too much of the "station" element. There was too much done that the department knew nothing about. The Deputy Chairman himself did not know one-half of what went on. There was a requisition book used at the station; that book was never presented to the Committee. Money was squandered in a ridiculous manner.

Councillor HARRISON also thought there was either great incompetency in the management or bad administration; and there ought to be an end to it. When they looked at the large amount spent on the undertaking, and then at the lack of profit, there appeared to be something wrong. The current had been carried a great distance in some

directions, with only a very small result; whereas if it had been taken to other districts that were neglected, the return would have been many times as great. At the last meeting of the Council, the Chairman had told them the Committee had since 1893 paid £68,000 to the city fund, and built up a reserve of £40,000 out of the profits of the undertaking. Now he had been looking up the figures, and found the actual amounts were £48,963 and £23,206 respectively.

Alderman Richards said he had thought at the time that the Chairman's statement was not accurate. He hardly knew how to vote. A sum of £4000 would not help the rates much. He hoped they would set their house in order. What they made in the city, they lost in the out-districts.

Alderman Southern said Alderman Higginbottom was absent on very onerous duties in the interests, not only of Manchester, but some thirty other towns in Lancashire. He thought it wrong to attack an absent colleague, as Dr. Bishop had done. When that absence was caused by devotion to their interests, it was not only wrong but despicable.

Dr. Bishop: I ask for that word to be withdrawn. Alderman Southern has forgotten himself.

Alderman Southern: Oh, dear, no. It is despicable.

Dr. Bishop asked for the ruling of the Lord Mayor, who observed that the expression was rather strong.

Alderman Southern: Well, then, it is very much to be regretted. Alderman Higginbottom was acting in opposition to measures by which the interests of municipalities would be seriously injured; and some amount of thanks was due to him, rather than animadversions. If it were desired to criticize the administration, the proper course would be to put a resolution on the notice paper, and have it discussed in a formal manner, in the presence of those whose conduct was animadverted upon. It was also hardly fair to ignore the explanation given by the Chairman at the last Council meeting, with regard to the out-districts. The Chairman had said that the Committee could find £10,000, but did not want to. He (the speaker) thought they might very fairly accept the present proposal.

Councillor Wainwright observed that the financial department and the works were not in touch, as they should be.

Councillor Bax supported the resolution. He was not satisfied with the work of the Committee; but he did not think the present occasion was opportune for discussing it.

Councillor Bowes, Deputy-Chairman of the Committee, regretted that personal topics had been introduced. The Chairman had fully explained the matter of the large expenditure on the out-districts, which had so far produced no return. Perhaps this time next year they would be in a better financial position, and there would be good results from the work of the Committee.

The estimates were ultimately adopted.

BIRMINGHAM CORPORATION GAS DEPARTMENT.

Railway Rates—New Water-Gas Plant—Annual Accounts.

Several matters of interest are dealt with in the Gas Committee's annual report to the Birmingham City Council.

There is first a long reference to the question of railway rates. The Committee, it appears, have for some time been anxious to secure a reduction of the rates charged for the carriage of coal to their various gas-works; but as the most oppressive of the increased rates were not paid directly by the Committee, but by the coalowners from whom they purchased, the power of appeal to the Board of Trade or the Railway Commission was considerably limited. The Committee endeavoured to obtain the co-operation of the coalowners, but without general success, as the owners were already in association for the purpose of obtaining relief, and were unable to engage in further proceedings. Their efforts were, however, mainly directed to the indirect increase of rates by the alteration of the weight carried from 21 cwt. to 20 cwt. per ton. The Committee were thus debarred from raising the more serious question to them of the withdrawal of the rebates. It has, they add, recently appeared in proceedings before the Railway Commissioners that rebates on coal delivered in large quantities are still in force in other districts. Two firms consented to join the Committee in an appeal to the Railway Commissioners on the question of deductions from rates in respect of coal dealt with on the private sidings of the department. Applications were thereupon filed against the London and North-Western and the North Staffordshire Companies jointly for a uniform allowance of 3d. per ton on all coal dealt with on the Windsor Street siding, and against the Midland Railway Company for a similar allowance on coal dealt with on the Saltley siding. The grounds of the application were that the rates to the public wharves at Lawley Street and Windsor Street, which must include a charge for terminals, and to the private sidings of the department were the same. The London and North-Western Railway Company assented to the reduction as regarded Windsor Street, and the application was accordingly withdrawn. The Midland Company, however, not only opposed the application, but also obtained the appointment of the Railway Commissioners as arbitrators to determine what allowance was due to them for special services rendered in connection with the transfer of the coal to the Corporation siding. On the case being heard, Mr. Justice Collins decided that it was incumbent upon the Corporation to show that there was a station charge included in the Saltley rate; and that inasmuch as they were unable to adduce this evidence, the application failed. In this decision, the Committee say, the learned Judge does not seem to have been in agreement with his colleagues; but the members of the Court were unanimous in deciding that the special services rendered by the Company were equal in value to the amount of any rebate to which the Corporation were entitled in respect of their private siding, and that consequently the application must be dismissed. Subsequently it was found that in the case of coal carried from the Derbyshire district to Windsor Street by the Midland Company, no siding allowance was being made, though the Company did not render any services in connection with the siding. In conjunction with the coalowners who had paid the charge, an application was made for an allowance of 3d. per ton, and also for damages in regard to excessive charges on coal already delivered. The Company, after a delay of some months, reduced the rates, but declined to admit that it was in respect of siding allowance or to make it retrospective. An appeal to the Railway Commission for damages was accordingly lodged, and also for a revised through rate. The latter application was made because it was ascertained that the reduced charge was 4s. per ton to Windsor Street, a distance of 74¼ miles, against 3s. 9d. from the same pits to Lawley Street—a distance of 77¾ miles. The Commissioners upheld the application for damages. The second application, however, failed; the Court holding that as in the one case the coal travelled over three different railway systems, and in the other over two, the difference was justified. With regard to coke the Committee petitioned the Board of Trade against the rates on that sold for fuel for cement ovens, and the Assistant-Secretary of the Board of Trade, who heard the evidence, intimated that it was a case of compromise. The Companies therefore offered a reduction of 3d. per ton, and agreed that the question of further allowances should rest on the decision of the coalowners' application concerning the reduction of weight allowed from 21 cwt. to 20 cwt. per ton. As the decision was in favour of the coalowners, further relief was gained; and subsequently reductions followed in most of the other rates for coke. The financial result to the Corporation has been that £1818 has been received in respect of over-payments. Of this amount £349 has been paid to customers who bought coke under contracts subject to rebate if the reduction were obtained, and £695 was absorbed by law costs—leaving a net gain to the Corporation of £774. In addition, customers who have paid their own rates have recovered various amounts. The annual gain to the department, the Committee say, will vary. On the annual traffic since the charges have been made, it has probably varied between £3500 and £4000 a year. This, however, is not more than one-third of the estimated annual burden placed on the undertaking by the increased rates and the withdrawal of rebates.

Dealing with other matters, the Committee state that they had very great difficulty in maintaining the gas supply, especially at the Saltley and Swan Village works, during the winter months, owing to the inability of the Midland Railway Company to deliver in December the coal which had been purchased. When the difficulties of the railway had been overcome, the Committee were, fortunately, able to rely on the assistance of most of the colliery proprietors with whom they had contracts for the prompt delivery of the coal in arrear. There were, however, a few exceptions; and the Committee, in order to secure supplies in January and February, had to make additional contracts for periods extending to June 30, and under which upwards of 4000 tons of coal have been bought, at a price considerably in advance of the contract price for the financial year. It has become apparent that, with a liability to a sudden breakdown on the part of the railway companies in the darkest portion of the year, the punctual delivery of the coal purchased for the year's supply can no longer be relied on, and that, in order to prevent a recurrence of the serious circumstances under which the Committee have been placed in the past winter, it is advisable to provide carburetted water-gas plant at the Swan Village works, which can be resorted to in a time of emergency, in aid of the coal-gas supply. It has been decided to take immediate steps for the provision of this plant, in order that it may be ready for use next winter if it should be required; and the Committee have authorized an expenditure of £15,000 at the works on generating and storage plant, capable of producing 1½ million cubic feet per day. They have accepted the following tenders in connection with this expenditure: Messrs. Humphreys and Glasgow, generating plant, £7896; Messrs. Clayton, Sons, and Co., oil storage tank, £1279; Messrs. Whitehouse and Sons, buildings, £4125. The Committee have had under consideration the increasing trouble which has been experienced during the last few years, in the summer months, from the presence of naphthalene in the mains and service-pipes. Mr. Hunt is of opinion that the difficulty may be overcome by the more effective condensation of the gas at the works in those months; and the Committee have authorized an expenditure of £2170 in additional condensing plant at Windsor Street, and have accepted the following tenders for the work: Condensing plant, £1135; and pumps and engines, £525.

Among miscellaneous matters, the Committee state that they have purchased an additional quantity of coal for delivery to the Windsor Street works in the summer months, to replace stocks which have been heavily drawn on in the winter, owing to an unusually large increase in the output. They also report that 56 army reserve men have been called up to service from the employment of the department. In order to preserve their status under Part 2 of the Superannuation Scheme, leave of absence has been granted to these men. Six of them have since returned to work, three on furlough, and three rejected as unfit for service. Assistance is being given to the families of twenty-four men who have been permanently employed by the department, and whose families are in need of assistance. The Committee recommend that the salary of Dr. Colman, Chemist at the Saltley works, be increased as from the 1st ult. to £400 per annum. He was appointed in September, 1892, at a salary of £300 per annum, which was increased to £350 in 1897. Since that time very large additions have been made to the chemical duties he is called upon to perform, and additional manufacturing operations requiring his attention and knowledge have been introduced.

The Committee also submit their balance-sheet and statement of accounts for the year ended March 31 last, showing a profit amounting to £29,821. They recommend that this amount shall be appropriated to the improvement rate of 1900. If this recommendation is approved, the contribution for public purposes from the gas undertaking for the year ended March 31, 1900, will be as follows: In aid of the improvement rate of 1900, from profits, £29,821; in aid of the improvement rate of 1900, interest on reserve fund, £4000; in aid of public lighting within the city, £10,579; in aid of lighting of courts within the city, £2388—total £46,588; and in aid of public and court lighting outside the city, £3490 16s. The cost of repairs to meters for the year has been £6084, and the number repaired 8925.

GAS PROFITS AND PRICES AT HUDDERSFIELD.

At last Wednesday's Meeting of the Huddersfield Town Council, the Gas Committee reported that the surplus balance from the gas-works for the past year was £10,072. The sum of £3433 had been devoted to the relief of the borough rate (equal to a rate of 2d. in the pound), and £6639 to the reduction of the reconstruction account. Alderman Stocks,

in moving the confirmation of the recommendation, said these figures did not by any means show the whole of the profits made by the works. The gross profit was £20,710; and out of this £10,640 had been paid for various purposes. Referring to the great advance in the price of coal, he observed that they consumed somewhere about 63,000 tons of coal a year. So far as they could infer, they would have to pay something like 5s. a ton more for the coal; or a total of between £15,000 or £16,000 in excess of the past year. He did not wish to raise the price of gas generally if he could help it; but he saw no other chance for supplies for heating and motive power. The gas for these purposes might be advanced by 3d. or 4d.; and with this increase and the higher price of residuals, he hoped they would be able to do without a rate-in-aid. Mr. Beaumont suggested to Alderman Stocks the advisability of the Committee conferring with other corporations as to the desirability of corporations acquiring collieries of their own. Alderman Stocks, in reply, said the Committee were quite alive to this question; but it was not fitting that they should show their hand. The Committee's recommendation was adopted.

HULL CORPORATION GAS AND WATER SUPPLY.

The Annual Accounts—The Sale of the Old Gas-Works.

At the Meeting of the Water and Gas Committee of the Hull Corporation yesterday week, the City Treasurer and Accountant submitted the revenue accounts of the water and gas undertakings for the year ended March 31. The former showed (after meeting working expenses, city fund annuity, interest and sinking fund charges) a net credit balance of £11,809. The gas undertaking (after providing for the expenditure on cookers and prepayment meters and fittings) showed a gross profit of £4902, out of which interest and sinking fund charges (£3738) had been met; leaving a net credit balance of £1164, and making, with £2510 from the previous year, £3674. The Chairman (Alderman Massey), in moving that the amounts be applied to the reduction of capital, observed with regard to the water-works that last year the Council commandeered £6000, and in the coming year they would take £7000. Somebody had kindly proposed that they should have a reserve fund of £5000; and this would take all they had got. The resolution was adopted.

A Middlesbrough firm have purchased from the Hull Corporation the remaining plant at the old Kingston-upon-Hull Gas-Works; the price paid by them being £1825. The money has already been handed over; and the work of dismantling is proceeding. The purchasers have three months in which to remove the plant and buildings. Sales previously effected included purchases by the Mirfield and Maidenhead Gas Companies and a firm at Hull. Above £420 was received from these sources.

HEYWOOD CORPORATION GAS SUPPLY.

The Past Year's Working.

The Engineer and Manager of the Heywood Corporation Gas-Works (Mr. W. Whatmough) has presented his report on the working of the undertaking in the year ending March 31 last. It shows that the gross revenue amounted to £20,681; and the gross expenditure (less interest and sinking fund), to £14,209—leaving a profit of £6472. The net profit amounted to £1767, which the Gas Committee have decided to dispose of as follows: To the profit and loss account, £767; contribution in aid of the rates, £1000. The receipts for gas sold for all purposes amounted to £15,982; being an increase of £473. This amount would, he says, have been considerably larger but for the reduced price of gas (which was in force for the whole of the twelve months, as against six months of the previous year), and for the earlier taking of the indices of meters in consequence of the alteration of the discount day. The total amount received for residuals was £4445, or £1030 more than in the year 1898-9, due to the increased amount realized from the sale of coke, tar, and sulphate of ammonia. For coal and cannel there was an increased expenditure of £989 14s. 6d., consequent upon the additional quantity used and the higher price which had to be paid. During the year, 1320 tons of cannel and 11,131 tons of coal were carbonized; the gas made per ton of coal being 10,097 cubic feet. The percentage of cannel used was considerably higher than in the previous year, due to the decision of the Committee to improve the quality of the gas. The total bulk of gas manufactured was 125,724,000 cubic feet; being an increase of 7,079,000 cubic feet, or 5·97 per cent. The total quantity sold was 114,685,017 cubic feet—an increase over the year 1898-9 of 5,197,406 cubic feet, or 4·75 per cent. The gas consumed by prepayment meters again showed a considerable increase; the total amount collected being £339 14s. The quantity of gas not accounted for was 10,232,383 cubic feet, against 7,735,789 cubic feet in the previous year; representing a leakage of 8·13 per cent., as compared with 6·52 per cent. for 1899, or an increase of 1·61 per cent., due to the indices of the meters being taken earlier this year in consequence of the alteration of the time for the payment of accounts. The maximum quantity of gas delivered in 24 hours was on Dec. 16, being 922,000 cubic feet, as compared with 832,000 cubic feet in the preceding year; showing an increase of 90,000 cubic feet. The minimum quantity delivered was on May 29; being 88,000 cubic feet, as compared with 86,000 cubic feet in the year before, or an increase of 2000 cubic feet. Mr. Whatmough states that during the past year the policy of selling a good reliable burner at the small charge of 1d. each answered very well; the total number disposed of being 5596. In most cases, as is well known, the cause of complaint arises either from defective fittings or bad burners; and the large number of burners sold shows that the action of the Committee has been appreciated. The sale of Welsbach incandescent burners was also adopted during the year; the total number disposed of amounting to 73. It is satisfactory to find that the demand for grillers continues to grow; the total number of stoves and grillers in use being now 2504, or an increase for the year of 271. Gas smoothing irons became very popular in the past year; the number employed having increased by 323. During the dark weather of last winter, portions of the plant were utilized to their utmost capacity; but Mr. Whatmough was able to keep up a satisfactory supply of gas. He informs his Committee, however, that if the consumption continues to increase at the same rate as in the past year, it will be necessary at no distant date to make further extensions, in order to meet the requirements of the consumers.

LEAMINGTON PRIORS CORPORATION AND THE GAS-WORKS.

An Offer to Purchase.

At the Meeting of the Leamington Town Council on Monday last week—the Mayor (Mr. J. M. Molesworth) in the chair—the General Purposes Committee presented a report in which it was stated that the Gas-Works Purchase Sub-Committee had reported on the matter submitted to them, and had recommended that an offer should be made to the Leamington Priors Gas Company to purchase their undertaking for the sum of £140,000, and that Mr. Thomas Newbigging should be appointed Arbitrator. The recommendation had been adopted by the Committee with one dissentient.

The Mayor having moved the adoption of the report,

Alderman Bright said he had to move an amendment, which he did with considerable regret and with some anxiety. He was the one dissentient who voted in Committee against the adoption of the report; and he desired to give his reasons for dissenting. The Sub-Committee recommended that the sum of £140,000 be offered to the Gas Company for their undertaking. This was staggering. A great portion of his income was derived from freehold properties in Leamington; and the Sub-Committee proposed to mortgage this at market value for the purpose of buying the concern, which, in his opinion, did not offer the slightest chance of profit. When Mr. Newbigging was recently at Leamington, he (Alderman Bright) asked him whether, with the price of coal going up as it was, he still held out a hope of profit; and he replied very guardedly to the question, and added that he felt that the Council must at once advance the price of gas 6d. per 1000 cubic feet. Why should they go into this business? If the Council gave £140,000 for the concern, the inhabitants would not only have the price of gas raised immediately, but very likely their rates also. If the charge for gas was increased, the result would be that people would take the electric light. Where would the Council be then with their expenditure of £140,000 of public money? He did not think the price of coal would improve—in fact, he believed it was going to be worse. He was of opinion that it would be better to let the Gas Company go on.

The Mayor (interposing) said it was not in order for Alderman Bright to discuss the general question of the purchase of the gas-works after the Council had passed a resolution upon it.

Alderman Bright (continuing) said he thought that £140,000 was infinitely too large a sum to pay. If the concern were purchased at this figure, the Council would greatly regret it; and when the necessary rise in the price of gas took place, the ratepayers of Leamington would repent it. He would move as an amendment, that the confirmation of the clause in the report relating to the purchase of the gas-works be deferred, and that the Committee be requested to confer with the Gas Company with a view to the withdrawal of the Council's notice to purchase. He said he believed the shareholders would be very glad if the Council would do this. He should strongly urge them not to be rushed into an expenditure which would cripple their funds for years to come, and possibly increase the rates, which were growing fast enough now.

Mr. Heath Stubbs seconded the amendment.

Alderman Wackrill pointed out that if the Council were going to adopt the second portion of the amendment, it was altogether out of order.

The Town Clerk, on being appealed to on the point, said that, having passed a resolution to purchase the gas-works, the Council could not get rid of it without the sanction of the Gas Company. As he understood the amendment, it had nothing to do with the purchase, but was a proposition to put back, at all events, the offer of £140,000 for the gas undertaking.

The Mayor ruled the second part of the amendment out of order.

Mr. Heath Stubbs expressed regret at the course the Mayor had found it necessary to take, but said he would second the portion of the amendment which was in order. It appeared to him that the Council should proceed very carefully in the matter, and hesitate before they made an offer to the Gas Company which would place the town in some financial difficulty. In October, when the matter was before the Council, Alderman Wackrill said that if they purchased the gas-works they would be able to make some thousands of pounds of profits, and carry them to the credit of the rates. Would Alderman Wackrill repeat that statement? Would any man on the Council say that if they acquired this concern they would have the remotest chance of carrying a penny profit to the rates? They all knew what had happened. There had been an extraordinary rise in the price of coal; and they did not know what would be the end of it. Surely, prudent men would pause if they found they might be drifted into a bad bargain. The Council would be bound to purchase if the Gas Company held them to the contract; and they were bound to go to arbitration if they could not agree as to terms. They were told that the rise in the price of coal would necessitate an increase of 6d. per 1000 cubic feet in the charge for gas. If they added to this whatever they might have to pay as an instalment off the loan, it would be a very heavy sum. They would have to pay at least £2000 or £3000 a year in excess of the profit which the Company now made. He should strongly advise that the Sub-Committee should ascertain the feeling of the Company as to allowing the Council to withdraw their notice of purchase.

Mr. Yates appealed to the Council not to be frightened. He reminded them that Birmingham made £20,000 a year out of their gas supply, and that Manchester and many other towns owned the gas-works.

Mr. Fell said Alderman Bright cut the ground from under his own feet when he said the shareholders were not anxious to sell. This was the more reason why the Council should buy. He hoped, therefore, they would endorse their own act.

Alderman Wackrill said if they did not make an offer they would have to go to arbitration. He pointed out that the property was capable of great development, as not half Leamington used gas.

Alderman Bland said he felt very frightened about this purchase, and he thought, if they could, the best thing would be to honourably back out of it.

Mr. Norris considered it was too late in the day to buy the gas-works. It was unlikely, he said, that the Gas Company would accept the Council's offer; their price being very much greater. If the difference was split, and it cost the Corporation between £150,000 and £160,000, they could not make the thing pay.

Mr. Overell remarked that the Council spent half their time in coming to one conclusion, and the other half in reversing their decision. They had come to a conclusion on the matter of the gas-works purchase; let them go on with it.

On the amendment being put, it was lost by 10 votes to 12. On the result being announced,

Alderman Bright remarked that it was the worst day's work the Council had done for some time.

ELECTRIC LIGHTING NOTES.

After very mature consideration, the Cardiff Corporation have decided to erect an electricity generating station for tramway traction as a distinct undertaking from the lighting department.

The Lewes Town Council last Tuesday affixed the corporate seal to a deed of transfer of the "powers, duties, liabilities, and works" under their Electric Lighting Order, to the County of Sussex Electrical Power Distribution Company, Limited.

As the result of the working of the Shrewsbury electric lighting undertaking during the past fifteen months, a "profit" of £680 has been earned; but the amount required for the sinking fund is £1448. The sanguine Chairman of the Lighting Committee expects to be able to make sufficient profit during the present year to meet this sum.

The abortive attempt of the Oswestry Town Council to acquire the electric light undertaking has cost the town £251. One or two cheerful councillors look upon this as money well spent, seeing that it has (so they think) had the effect of stirring up the Gas Company. The ratepayers, however, may not regard the matter in the same light.

A Local Government Board inquiry was held at Accrington on Tuesday respecting an application by the Corporation for power to borrow £26,250 for electricity purposes. The scheme, upon which £11,736 has already been spent, is a combination one for the production of electric light and power and a refuse destructor. The sum so far borrowed is £18,000; so that the estimated cost will be above £44,000.

The Sunderland Corporation are proposing to build a new electric lighting station; and they have applied to the Local Government Board to sanction the borrowing of the money required for the purchase of the necessary land—viz., £4500. The estimated net profit on the undertaking this year is £500, after paying £3000 for interest and sinking fund. There was no opposition at the inquiry held last Tuesday.

Mr. F. H. Tulloch sat at Ilkeston last Friday to hear evidence with regard to an application by the Corporation to borrow £18,271 for electric lighting purposes. As usual, estimates were laid before the Inspector to show that, in a very short time, the whole of the lamps for which provision could be made would be taken up, and that, at the proposed low charge of 4d. per unit, a profit of £941 would be earned. By this time, the Inspectors of the Board must be tired of hearing these hypothetical and fancy figures in connection with small electric lighting ventures.

Accounts presented to the Plymouth Town Council yesterday week show that the first six months' operation of the municipal electricity works has resulted in a loss of £1374. The undertaking is a combination of lighting and traction; but the accounts do not distinguish between the income for current supplied for the working of the tramways and that supplied for lighting, and do not separate the receipts from public and private lighting. The total revenue for the six months was £3278, of which £3122 was for current supplied. The working expenses were £3167; and the interest and sinking fund on loans account, and various establishment charges, amounted to £1485.

The Middleton Corporation are going in for an electric light scheme; and they have applied to the Local Government Board for power to borrow £20,000 for the purpose. An inquiry has been held into the matter by Mr. R. H. Bicknell. He was informed that 200 post-cards had been sent to people whom it was thought would use electricity; and most of them had stated their willingness to become consumers. The Inspector displayed an unpleasant curiosity as to what was meant by "most of them;" and then it appeared that seven hotels, 88 dwelling-houses and shops, a few works, one bank, and one livery stable comprised the total, which is a long way from the 200. There was a little opposition to the scheme.

Electric lighting at Heckmondwike bids fair to be an expensive matter for the ratepayers. Tenders for the works and buildings have been under the consideration of the District Council; and they amount to £14,842—being an increase of £1500 on the original estimate of Mr. Hawtayne. The advance is attributed to the higher prices of materials. The cost in sinking fund, at 3¾ per cent. for 25 years, is estimated at £853 per annum; and there is now a consensus of opinion in the Council that the scheme will involve an annual rate-in-aid of 3d. or 4d. in the pound for many years. Land and other property in connection with the scheme was acquired several months ago; but since then the electric lighting fever has abated to a very considerable extent.

At the Lincoln Guildhall last Thursday, Mr. F. H. Tulloch conducted an inquiry on behalf of the Local Government Board into the Corporation's application for power to borrow £6000 for the extension of electric lighting in the city. Mr. W. T. Page (Deputy Town Clerk) explained that a loan was sanctioned in 1897 for £20,650, and in 1899 there was another loan of £19,000 for extensions. Of the last-mentioned amount £4500 was still unexpended; and the loan now asked for was to provide and lay down cables in the southern part of the city, where there was every probability of the demand for the current increasing. Replying to the Inspector, Mr. Page said the capacity of the present plant was 18,000 8-candle lamps, and with the proposed extension the capacity would be 25,000 lamps. There was no opposition.

At the meeting last Tuesday of the Kingston Town Council, Alderman Collings moved that the Council authorize application to be made to the Local Government Board for their sanction to the borrowing of £15,000 for further extensions in regard to the electric light works. Referring to the annual report of the Borough Electrical Engineer (Mr. J. E. Edgcome), he pointed out the very satisfactory results of the past year's working. The gross profit before paying interest and the instalment of capital was £2737; but after paying the interest, there still remained a sum of £1298 applicable to the redemption of capital. As the amount required was £1346, there was an adverse balance of £48, as against an adverse balance of £1112 in 1898. This showed that the electric lighting was an enterprise which had become a decided financial success; and so small a deficiency as £48 led him to hope that next year there would be a balance in hand in relief of the rates. The motion was carried unanimously.

The governing bodies of small and moderate sized towns who are aspiring to become their own suppliers of electric lighting should pause and consider the woeful plight of Hanley, in connection with its electric lighting undertaking, as pictured in a recent issue of the "Staffordshire Sentinel." Our contemporary states that, at the last meeting of the Council, it was announced that £1200 would have to be included in the rates for the ensuing year; being the loss on the electric lighting concern. But "considerable sensation" has been caused by a statement published in a previous issue of the "Sentinel" that the actual loss on the undertaking during 1899 was £2269, and that this loss had apparently been continuing at the rate of over £40 per week. The actual revenue last year amounted to £8809, and the expenditure to £7632; leaving a balance of £1177, which was all that could be shown towards the interest and sinking fund, amounting to £3446. If things go on as they are doing at present, the total loss promises to stand at £4538 at the end of this year, which the confiding ratepayers will have the pleasure of making up in extra rates. This year they are providing £1200, which still leaves £1069 loss to be made good.

At the meeting of the Salford Town Council last Friday, a letter was read from Mr. C. L. Turner, the Borough Electrical Engineer, in answer to the resolution of the Council asking him to resign his position (*ante*, p. 1321). The letter stated: "I cannot admit any reason why I should resign. I know that the charges brought against me were without foundation, and I consider the evidence I produced to your Committee was sufficient to disprove them. If your Council think otherwise they must act accordingly. With the consciousness of my own *bona fides* and of my faithful service to the Corporation, I cannot adopt the course required of me, and admit what I strongly deny." The Mayor (Alderman Rudman) moved—"That, in view of the refusal of Mr. C. L. Turner to comply with the resolution of the Council of the 7th inst. requiring him to resign forthwith, the Council hereby determine his appointment, and instruct the Borough Treasurer to pay him three months' salary in lieu of notice." He said it was extremely painful that the action of the Electrical Engineer should have necessitated such a resolution. Mr. Turner had been ill-advised in the matter. Alderman Phillips seconded the motion, and it was carried with three dissentients.

The members of the Yeadon District Council evidently all belong to the leisured class to whom time is of little object. They have had several discussions on the electric lighting question; and they again applied themselves to its consideration last Tuesday for three-and-a-half hours. But even then no decision was arrived at; and another meeting is to be held next week. The meeting last Tuesday was chiefly interesting on account of the communications received from two sources as to the comparative cost of gas and electric lighting. Mr. A. H. Preece wrote that it was impossible to make a comparison until it was known at what price each illuminant was supplied; but it was usually taken that electricity at 6d. per unit was practically equivalent to gas at 3s. per 1000 cubic feet. It is too bad of the son to ignore the opinion of his eminent father, that eight units of electricity are about equivalent to 1000 cubic feet of gas. Then Messrs. Hopkinson and Tabot wrote that 15-candle power gas at 2s. 8½d. per 1000 feet (the net price at Yeadon) was about equivalent, so far as its illuminating power was concerned, to electricity at 4½d. per unit. It was not likely, they also said, that electricity supply could be made to pay at Yeadon unless there was a substantial demand for power for manufacturing purposes. Even the "doctors" of the electrical industry differ, and differ widely.

The Chesterfield Corporation obtained an Electric Lighting Order in 1894; but the purchase of the gas and water undertakings caused the question to be shelved. But the threatened intrusion of Companies has roused the Corporation to activity again; and they have settled on a scheme for which they require to borrow £25,000. Consequently, last Tuesday, Mr. F. H. Tulloch held an inquiry on behalf of the Local Government Board. Interesting evidence was given by the Chairman of the Electrical Committee (Mr. C. P. Robinson). He said that, by direction of the Board, the town had been canvassed; and the result had been remarkable. For the purpose of the canvass, the town had been divided into four divisions. The central portion had applied for 4912 lights, and 11 motors equivalent to 58-horse power. He had put 50 per cent. on the lights in order to bring them to the 8-candle power. Most of those supplied would be 16-candle. This brought the number of lights up to 7368 of 8-candle power. Reducing the motor power applied for to its lighting equivalent of 1160 lights, they had a total demand by the central, or business portion of the town for 8528 lights. The second district, comprising four streets, had applied for 1117 lights, and one motor—or 1680 8-candle lights. The third district applied for 628 8-candle lights; and the fourth district for 1407 lights. Then the Council had sanctioned 20 arc lamps for the public street lighting. The total demand was for 12,242 8-candle lights. The question had arisen in the town as to whether or not the adoption of electricity would injure the gas undertaking, which, as had been stated, was two-thirds the property of the town; but the evidence gathered from other towns where the experiment had been tried went to show that the gas undertaking would not be injured. In four years, the consumption of gas had increased by 75 per cent. The gas-works had already been enlarged; and if a further demand came upon them, the Engineer had advised them to put down a new holder of a million cubic feet capacity, at a cost of from £18,000 to £20,000. The Corporation had considered it best to spend money in electric lighting, instead of enlarging the gas-works.

The Corporation of Sudbury having applied to the Local Government Board for sanction to the borrowing of £13,150 for various purposes connected with the improvement of the town (including £650 for electrically lighting the Wents Estate), the matter was the subject of an inquiry by Major-General H. D. Crozier, R.E., at the Town Hall last Wednesday. Mr. W. C. C. Hawtayne, the Consulting Electrical Engineer to the Corporation, gave details of the scheme. He said the Wents Estate had an area of 15 acres; and the total expense of lighting it would be £650. The charge would be 2d. per unit, and there would be some twenty

60-watt incandescent lamps. About 1500 units a year would be the consumption. The cost of lighting would be £12 10s. per annum; but including repairs, interest, &c., the total expense to the Corporation would be about £47, until the estate was brought into the general scheme for the town, which would cost £16,300. Mr. F. Shewell Cooper, who represented the Gas Company, the Lessee (Mr. C. W. Grimwood), and several ratepayers, pointed out that the Company had offered to light the estate with 20 lamps for £35 a year—£1 each for lighting and 15s. for upkeep—supplying standards, paying all expenses of laying mains, and so forth. Witness remarked that this did not bear the same proportion to the other charges of the Company. The Borough Surveyor (Mr. Hayward) said that at present there were four gas-lamps on the estate. For the year 1899-1900 the cost of lighting the lamps of the town was £336, which, for 189 lamps, was about 35s. 6d. per lamp. Mr. Cooper contended that the proposal to expend £650 to light a small part (15 acres) of the town by electricity was ridiculous. Was it not more reasonable, he asked, to light the estate with gas, in the same way that the other portions were lighted? It was clear from the figures—cost of gas £35, and of electricity £47 10s. per annum—that by the adoption of the latter scheme a considerable burden would be thrown upon the ratepayers, without any corresponding advantage. He submitted that the provision of lamps such as those already in use would be ample. If they accepted the offer of the Gas Company, there would be no initial outlay on the part of the Corporation. As a separate scheme, the proposal was chimerical; but as part of a general scheme, there might be something to be said in favour of it. There had been no serious demand for electric lighting—no ratepayers' meeting in support of it, though possibly a few private persons might have applied for it; but the Corporation were trying to thrust the scheme upon the ratepayers, and he should ask the Inspector to report unfavourably upon it. The Town Clerk (Mr. W. B. Ransom), in reply, said the Council had been advised that electricity would be cheaper than gas; and although there would be extra expense during the first few years, the works would become the property of the Corporation. He therefore trusted that the Inspector would report favourably on the scheme.

Wilmslow and Alderley Edge Gas Company.—The annual meeting of this Company was held last Tuesday, at the offices, in Manchester. In their report, the Directors recommended a dividend of 10 per cent. on the old, and 7 per cent. on the new shares (less income-tax). The profits for the year ending March 31 amounted to £2400; and the balance, after payment of the dividends, is £251. The Directors regarded this as satisfactory, in view of the reduction of 3d. per 1000 cubic feet in the price of gas. During the period covered by the report, 45,202,300 cubic feet of gas were made, of which 43,530,700 cubic feet were sold. There was an increase of 50 in the number of consumers; the total on the books being now 959. The report was adopted; and votes of thanks were accorded to the Chairman (Mr. R. L. Bourne) and Directors, the Secretary (Mr. W. H. Welsh), and the Engineer and Manager (Mr. W. Severs).

WEST MIDDLESEX WATER-WORKS COMPANY.

The Half-Yearly General Meeting was held at the Company's Office, No. 19, Marylebone Road, on the 15th inst., under the presidency of Mr. Edmund Boulnois, M.P.

The Secretary (Mr. F. H. Wybroo) read the advertisement calling the meeting, and subsequently the report of the Company's Auditors, who stated that the total expenditure on works amounted on March 31 last to £1,759,003, including £53,534 expended during the past half year; the outlay being £15,341 in excess of the amount received. The gross rental for the half year to Ladyday last was £144,003, showing an increase on that of the corresponding period of 1899 of £3579. The balance to the credit of the dividend and interest account was £66,108.

The Chairman, in moving the adoption of the report and accounts, observed that the progress and prosperity of the Company continued. During the half year no fewer than 560 new supplies had been laid on. They were constantly getting an accession of new consumers in the districts that were being developed; and further outlay was, therefore, continually required to be made. The Engineer reported that all the works had been maintained in a thoroughly efficient condition; and it was one of the features of the Company that the Board had always endeavoured to keep the property at the highest point of efficiency. The Directors' report contained a paragraph alluding to the final report of the Royal Commission on London Water Supply, and he felt sure that the proprietors would agree with him that this report was highly satisfactory. The Commission were appointed in May, 1897; and the inquiry had been a most exhaustive and searching one. The legal acumen and ability of the Chairman, Lord Llandaff, was brought to bear on every point in a manner which was quite surprising. His Lordship made himself thorough master of the whole subject; and he (the speaker) did not believe that there was a single thing that could be examined, either for the case of the London County Council or for that of the Metropolitan Water Companies, which was left untried. Of course, the County Council left no device unemployed to damage the case of the Companies; but, as on many previous occasions, they were not successful in this. Indeed, the Commissioners stated explicitly that on the whole the Companies had performed their duties efficiently and to the public satisfaction; and he did not know that they could have any higher praise than this, because the public were somewhat exacting in their requirements from the Water Companies. Notwithstanding the unanimous report of the Royal Commission, that in their opinion the London County Council were not the body who ought to acquire the undertakings of the eight Companies, the County Council deliberately asked Parliament to affirm that they were the body to do this; and, in spite of advice which was given to them by the large minority of the Moderates on the Council, the majority courted defeat on the second reading of their Purchase Bill, which was thrown out by the considerable majority of 83. The Bill introduced by the County Council to expend over £18,000,000 in constructing reservoirs and works in Wales, and aqueducts, &c., for the supply of water to London was thereupon withdrawn. It had always surprised

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1393.

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 11	10½	Alliance & Dublin 10 p. c.	20—21	..	5 0 0
100,000	10	,,	7½	Do. 7 p. c.	13½—14½	..	5 3 5
800,000	100	Jan. 2	5	Australian 5 p. c. Deb.	102—104	..	4 16 2
200,000	5	May 16	6	Bombay, Ltd.	6—6¼*	..	4 12 4
40,000	5	,,	6	Do. New, £4 paid	4—4¼*	..	5 6 8
880,000	Stk.	Feb. 23	12	Brentford Consolidated	250—260	..	4 12 4
270,000	,,	,,	9	Do. New	185—190	−5	4 14 9
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb.	118—123	..	3 5 1
220,000	Stk.	Mar. 14	11½	Brighton & Hove Orig.	235—240	−2	4 15 10
226,320	,,	,,	8½	Do. A. Ord. Stk.	175—180	−2	4 14 5
999,500	Stk.	Feb. 23	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Mar. 29	10	British	39—41	..	4 17 7
50,000	10	Feb. 23	12	Bromley, Ord. 10 p. c.	24—26	..	4 12 4
79,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	May 16	6	Buenos Ayres (New) Ltd.	9—9¼*	..	6 6 4
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	99—101	..	3 19 3
150,000	20	Mar. 14	8½	Cagliari, Ltd.	24—26	..	6 6 11
100,000	10	Sept. 29	5	Cape Town & Dis., Ltd.	14—15	..	5 6 8
50,000	50	May 3	6	Do. 6 p. c. 1st Mort.	55—57	..	5 5 8
550,000	Stk.	Apl. 11	13½	Commercial Old Stock	275—285	..	4 14 9
236,425	,,	,,	10½	Do. New do.	210—220	..	4 15 5
288,237	,,	Dec. 14	4½	Do. 4½ p. c. Deb.	141—144	−1	3 2 6
800,000	Stk.	Dec. 14	9	Continental Union, Ltd.	160—165	−2½	5 9 1
200,000	,,	,,	7	Do. 7 p. c. Pref.	175—180	..	3 17 9
51,600	Stk.	Feb. 23	14	Croydon A 10 p. c.	335—340	..	4 2 4
173,400	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
555,000	Stk.	Feb. 23	5½	Crystal Palace Ord. 5 p. c.	116—120	..	4 7 6
60,000	,,	,,	5	Do. 5 p. c. Pref.	130—135	..	3 14 1
486,090	10	Jan. 26	11	European, Ltd.	19—20	−½	5 10 0
354,960	10	,,	11	Do. £7 10s. paid	14—15	−½	5 10 0
14,993,075	Stk.	Feb. 9	4⅞	Gas-light and Coke	4 p. c. Ord.	95—98	−3½	5 0 0
2,600,000	,,	,,	8½		8½ p. c. max.	96—98	..	3 11 5
3,799,785	,,	,,	4		4 p. c. Con. Pref.	117—119	−1	3 7 3
3,993,975	,,	Dec. 14	3		3 p. c. Con. Deb.	97—99	..	3 0 7
70,000	10	Nov. 15	8	Hongkong & China, Ltd.		13½—14½	..	5 10 4
3,900,000	Stk.	May 16	10	Imperial Continental		202—205*	−1	4 17 7
473,600	Stk.	Feb. 9	8½	Do. 8½ p. c. Deb. Red.		100—103	..	3 8 0
75,000	5	Dec. 14	6	Malta & Medn., Ltd.		4½—5½	..	5 14 3
560,000	100	Apl. 2	5	Met. of	5 p. c. Deb.	105—109	..	4 11 9
250,000	100	,,	4½	Melbourne	4½ p. c. Deb.	105—107	..	4 4 1
641,920	20	Nov. 15	6	Monte Video, Ltd.		10½—11½	..	5 4 4
997,946	Stk.	Feb. 23	9½	Newc'tle & Gateah'd Con.		218—220	..	4 4 1
299,855	Stk.	Dec. 29	8½	Do. 8½ p. c. Deb.		104—107	..	3 5 5
150,000	5	May 16	8	Oriental, Ltd.		7—7¼*	+¼	5 6 8
195,000	5	,,	8	Do. New, £4 10s. pd.		6¼—6½*	+¼	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.		1½—1¾*	+¼	4 11 5

* Ex. div.

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
60,000	5	Feb. 23	7	Ottoman, Ltd.	5—5½	..	6 7 3
500,000	100	Dec. 1	6	People's Gas of Chicago	2nd Mtg. Bonds	102—106	..	5 13 2
851,070	10	Apl. 27	7	River Plate Ord.		10½—10⅝	−¼	6 10 3
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.		100—102	..	3 18 5
250,000	10	Apl. 11	8	San Paulo, Ltd.		11½—12½	..	6 8 0
135,000	Stk.	Mar. 14	10	Sheffield A.		245—247	..	4 1 0
209,053	,,	,,	10	Do. B.		244—246	..	4 1 4
447,427	,,	,,	10	Do. C.		244—246	..	4 1 4
5,600,000	Stk.	Feb. 23	5⅓	South Metrop., 4 p.c. Ord.		123—126	+1⅓	4 4 7
1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb.		98—100	−1	3 0 0
380,940	Stk.	May 16	5	Southampton Ord.		115—120*	..	4 3 4
70,825	,,	Dec. 29	4	Do. 4 p.c. Deb.		120—125	..	3 4 0
120,000	Stk.	Mar. 14	6	Tottenham and	A. 5 p.c.	120—125	−17½	4 16 0
250,520	,,	,,	4½		B. 3½ p.c.	95—100	−3½	4 10 0
55,100	,,	Dec. 14	4	Edmonton	4 p. c. Deb.	113—117	..	3 8 5
182,380	10	Jan. 12	5	Tuscan, Ltd.		7—8	..	6 5 0
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.		101—104	..	4 16 2
				WATER COMPANIES.			
780,399	Stk.	Dec. 29	11	Chelsea, Ord.		305—310	..	3 11 0
150,000	,,	,,	5	Do. 5 p. c. Pref.		157—162	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75		145—150	..	3 0 0
175,785	,,	Mar. 29	4½	Do. 4½ p. c. Deb.		145—150	..	3 0 0
1,720,560	Stk.	Apl. 11	7	East London, Ord.		190—195	−3	3 11 10
654,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb.		145—150	..	3 0 0
800,000	,,	,,	3	Do. 3 p. c. Deb.		99—101	..	2 19 5
700,000	50	Dec. 14	7½	Grand Junction	10 p. c. max.	103—106	−½	3 10 9
810,000	Stk.	Mar. 29	4		4 p. c. Deb.	130—135	..	2 19 3
708,000	Stk.	Feb. 23	14	Kent		307—312	..	4 9 9
160,000	,,	,,	7	Do. New, 7 p. c. max.		200—210	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.		290—295	−2	3 11 2
406,200	100	,,	8	Do. 7½ p. c. max.		207—212	−1	3 16 6
850,000	Stk.	Mar. 29	4	Do. 4 p. c. Deb.		130—133	..	3 0 2
500,000	100	Feb. 23	13½	New River, New Shares		415—420	−2	3 4 3
1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb.		132—137	..	2 18 5
902,300	Stk.	Dec. 14	7½	South-wark and	Ord.	195—200	−3	3 15 0
126,500	100	,,	7½		7½ p. c. max.	185—190	−2	3 18 11
489,200	Stk.	,,	5		5 p. c. Pref.	160—165	..	3 0 7
1,019,585	,,	Apl. 11	4	Vauxhall	4 p. c. A Deb.	129—134	..	2 19 9
1,155,066	Stk.	Dec. 14	10	West Middlesex		283—288	−2	3 9 5
200,000	,,	,,	4½	Do. 4½ p. c. Deb.		147—152	..	2 19 3
200,000	,,	Mar. 14	8	Do. 8 p. c. Deb.		99—101	..	2 19 5

* Ex div.

him that the County Council should have kept the Bill on the notice paper of the House of Commons—the Royal Commission having stated so explicitly that there was no necessity whatever for the public money to be wasted in going to Wales for water. He should like to say with confidence on this that there was no probability that the County Council would renew their attacks on the Water Companies in the immediate future. But having been a member of that body himself for over eleven years, he had naturally somewhat gauged their character; and he might tell the proprietors—what, indeed, they had probably already learned for themselves—that the London County Council were a body who never knew when they were beaten. He should therefore not be the least surprised if by-and-bye, for next session, plausible reasons were not forthcoming which would induce the Progressive majority of the County Council to dip a little deeper into the pockets of the unfortunate ratepayers, and incur a further useless expenditure in promoting a Bill or Bills against the Water Companies. For his own part, however, he sincerely hoped that this would not be the case. Hardly a session had passed since the County Council were established in which the Water Companies had not had to defend themselves against the attacks of that body; and in the case of this Company, the fact was peculiarly hard upon their consumers, because the County Council not only paid out of the rates the expenses of promoting their Bills, and of their attempts to defeat the Bills of this Company, but the latter were compelled to defend themselves in these attacks and to promote Bills for the advantage of their consumers—he would not say out of the rates, but practically out of the same thing, because the money must come out of the pockets of the consumers in the rebate which the Company allowed them. The joint Bill introduced this session on behalf of a majority of the Metropolitan Water Companies was withdrawn after a pronouncement by the Speaker of the House of Commons that the measure was one which, in his judgment, was not suitable for promotion as a Private Bill, as it conferred large powers upon a State Department, and so should be introduced as a Public Bill. The rebate of 10 per cent. from the statutory water-rates, amounting now to about £28,000 per annum, had been continued to be made to all the consumers in the Company's district. It was impossible to say how long this very handsome discount could be continued. Parliament had imposed such very heavy burdens upon the Company that it was clear that the consumer would ultimately be deprived—although he could not say how soon—of the advantages which he reaped from the careful management and conduct of the Company's affairs. The payments to the City Chamberlain, which were ordered by Parliament to be made under circumstances which he thought he might safely say no longer existed, had already begun to be made by this Company. He might point out, incidentally, that the accounts which had been presented to the proprietors on this occasion were signed only by the Company's Auditors—the name of the Official Auditor not appearing. The latter had not signed the accounts because a difference of opinion had arisen between the Secretary and Mr. Stoneham with reference to the amount which the Company were compelled to pay under their Act of 1894 to the City Chamberlain. The Directors had very carefully considered this question; and they unanimously supported the view held by the Secretary as to the amount which the Company were compelled to pay this half year. The question was complicated to some extent by the Company's connection with the Staines Reservoirs Joint Committee; but the whole matter would be settled by arbitration, which was the course prescribed by Parliament in these matters. Their Company and the other Companies were also affected by certain other small questions in connection with which arbitration would be resorted to in the usual way; but he might tell the proprietors that whatever was happening between the Company and the Official Auditor could not in any way endanger their dividend. The Board greatly regretted to announce the death of their old and esteemed colleague, Mr. W. P. Bodkin, who took an active interest in all the affairs of the Company, and who laboured among them to the last. He could not conclude without again expressing the satisfaction of the Board at the manner in which the whole staff of the Company, from the Secretary and the Engineer downwards, had discharged their duties.

The Deputy Chairman (Mr. Jackson Hunt) seconded the resolution.

Mr. Werry asked whether it was possible, considering the large reserve fund the Company had, that the dividend could not be paid without deducting income-tax.

The Chairman, in reply, said he feared that it would not be legal to pay the dividend free of income-tax, as in that case the distribution would be more than 10 per cent.

The motion was carried unanimously.

Resolutions were afterwards passed declaring a dividend for the half year ended March 31 at the rate of 10 per cent. per annum, payable, less income-tax, on and after July 5 next, and re-electing the retiring Directors and Auditors.

The meeting was afterwards made special, when, on the motion of Mr. F. E. Bodkin, seconded by Mr. Howson, the Hon. Charles, Baron Dimsdale was appointed a Director of the Company, to fill the vacancy caused by the death of Mr. W. P. Bodkin.

The usual complimentary votes terminated the proceedings.

HARWICH WATER SUPPLY.

At the recent Quarterly Meeting of the Harwich Town Council, the Public Health Committee reported, with reference to the defective supply of water to which the attention of the Corporation was drawn at the previous meeting, that the opinion of Counsel (Mr. Tindal Atkinson) had been taken, and as his advice entirely coincided with that given by the Town Clerk, the Committee recommended—"That proceedings be at once instituted by the Corporation against the Tendring Hundred Water-Works Company for a mandamus to compel them to obtain and provide for the Borough of Harwich a sufficient and permanent supply of pure and wholesome fresh water, constantly laid under pressure, in accordance with the provisions of the Tendring Hundred Water-Works Act, 1884 and 1886, and of the Order of the Local Government Board, dated the 28th of July, 1892." The Town Clerk having read the communication received from Mr. Tindal Atkinson, Alderman

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Tar-Distilling Plants. Claus' Sulphur-Recovery Plants.

SULPHATE OF AMMONIA PLANTS.

Nalborough, in strong terms, moved that the mandamus be applied for. He said that it was quite time the Council spoke in very plain terms to the Company about the supply, as for years past the ratepayers had been greatly inconvenienced. When the question of the insufficient water supply was first brought to the notice of the Company, they replied that a constant supply would be given, as they were erecting a new reservoir at Dovercourt. This had been done, but the reservoir proved unsatisfactory. He further moved—"That an injunction be applied for against the Water Company, to prevent them from supplying water to any person or persons in such a manner as to prejudice the giving of a proper and sufficient supply for domestic purposes within the limits of the above-mentioned Acts, and contrary to the provisions thereof." Both propositions were carried *nem. con.*

THE TEES VALLEY WATER BOARD.

The half-yearly report of the Tees Valley Water Board to the Corporations of Stockton, Middlesbrough, and Thornaby was considered at the meeting of the Board on Monday last week. It showed that the capital expenditure for the half year had been £15,418; bringing up the total cost of the undertaking to £1,895,555. The sum of £24,391 was received on capital account during the half year; the total to date being £1,889,194, or £6360 less than the amount expended. But a precept was issued (payable on March 13) for £11,887 on account of mains extensions. The revenue account showed an income of £46,248; being an increase of £3222 as compared with the preceding half year. The expenditure on revenue account was £8362; being an increase of £246. The balance carried to net revenue account was £37,887, as against £34,909. The net revenue account was debited with several payments for interest, and was credited with the interest allowed by the bank. After being dealt with in this manner, there remained a balance of £71,988, including £34,502 brought forward from the previous half year. Of this amount £53,800 was paid to the Corporations during the half year; leaving £18,188, of which £18,000 has since been paid to the Corporations. The report was approved.

New Joint-Stock Companies.—The Compressed Fuel Syndicate, Limited, with a capital of £15,000, in £1 shares, will acquire any inventions relating to the manufacture of artificial fuel and machinery used in connection therewith, and carry on the business of engineers, coke and fuel manufacturers, colliery proprietors, coal merchants, &c. The Ingleton Water Power Company, Limited, with a capital of £7000, in £1 shares, has been formed to acquire the business carried on by the Ingleton Carbide Company at Ingleton Mill, Yorkshire, and to carry on the business of calcium carbide manufacturers and merchants. The Cookstown Gas and Light Company has been registered with a capital of £10,000, in £1 shares, to acquire and carry on the business of the Cookstown Gas Company.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

With the fixing of the gas coal contracts for Glasgow and Paisley, the purchases of coal for the coming year are practically over; and the worst is now known. A rise of 50 per cent. in one year, is an experience not to be sought, and one which, when it comes unsought, as now, is not likely to be forgotten. The gas manager who is able to escape a rise of at least 3d. per 1000 cubic feet in the price of gas, will be fortunate. The Glasgow contract is for about 500,000 tons; and the tenders accepted are for quantities of from 10,000 up to 40,000 tons. First-class cannel was tendered for at such a prohibitive price that very little of it has been purchased. It is explained that, on account of the price of oil, consequent upon Russian dealing, having risen by about 100 per cent., the demand for cannel for enriching purposes has become stronger than it has been for years. Second-class cannels are suitable for the manufacture of gas in Glasgow; and these have been bought largely, from Lanarkshire and Ayrshire coalmasters, at an increased price of from 5s. to 7s. 6d. per ton. Splint has also been purchased heavily, at from 14s. 6d. to 15s. a ton—the bulk at 14s. 9d.—which is fully 5s. advance upon the current year's prices. The balance is made up of shale—from Fifeshire chiefly—which is also up from 4s. to 5s. per ton. Last year the prices were advanced about 1s. per ton. The Corporation are evidently pleased with their oil process, because they are about to extend it by the erection of six additional cast-iron retorts at Dawsholm, the contract for which has been let to Messrs. R. Laidlaw and Son. With the two processes of coal and oil at command, there is a better chance of good results being obtained than where there is only one.

The Paisley Corporation contracts are for about 27,000 tons of coal, which is about 10,000 tons less than the current year's contracts. The price for splints is up about 5s., and shales about 4s. 6d. per ton.

The plans for the new Provan gas-works for the Corporation of Glasgow were before the Town Council on Thursday. Mr. R. M. Mitchell, the Convener of the Gas Committee, said that the plans had been before the Committee and had been unanimously approved. The section which it was proposed to construct at present was about one-fourth of the works when completed; and it would have a producing power of 12 million cubic feet per day. The ground was very well suited for the erection of a gas-works—in fact, better ground for the purpose could not be found in the neighbourhood of Glasgow. Everything in connection with the works would be constructed in the most modern way, and with a view of obtaining a maximum production of gas per area of ground at a minimum cost for labour as compared with any other system of carbonizing in practical use. Ample provision was being made for the utilization of residual products, which formed a very large part of their production. They could either use the works themselves or let them out to other people, under such arrangement as might be thought best. Another important matter in connection with the manufacture of gas was the fact that the highest qualities of cannel coal were becoming very scarce in Scotland, and Mr. Foulis had provided in the erection of the works for

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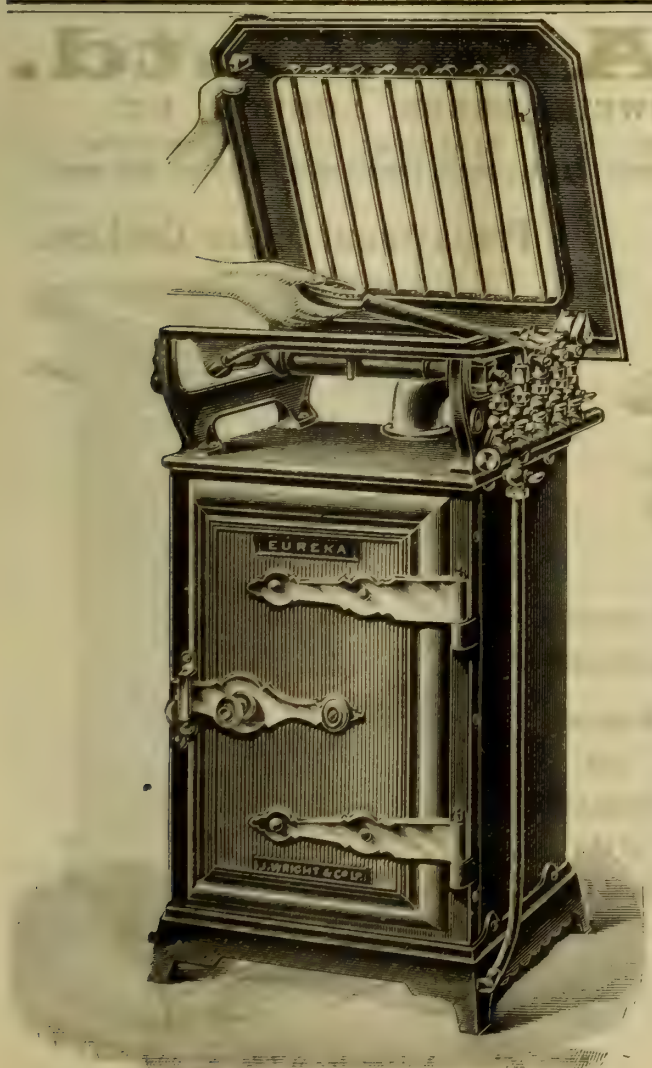
the production of oil gas. It was proposed to erect two gasholders. These would store considerably more than the works would yield for some time at least. But with the present rate of increase in the annual demand for gas, notwithstanding the progress that had been made, it would only be a very short time before the whole of the storage capacity would be required; and in order to have a constant supply of gas, Mr. Foulis thought it better that the two holders should be proceeded with at once. The cost of the section of the works which it was proposed to go on with at present would probably be something like £300,000. This did not mean that the cost of the four sections would be four times that amount, because in connection with the first section there was the cost of levelling and preparing the ground, which to a large extent might reduce the outlay on the other sections. The works might cost upwards of a million pounds, and they would give ample security for a long time to come that the citizens of Glasgow would be able to count on a certain supply of gas. The minute was approved.

The Council then considered a report by Mr. Foulis upon the subject of the alleged capricious dismissal of men who had been employed in one of the gas-works, and which the Gas Committee had adopted by a majority of 12 to 5. Mr. Foulis's report was to the effect that during the past six weeks nearly 400 men had been discharged from the works, for the reason that there was no work for them, and several more had still to be paid off. No men had been taken on for several months. The men are taken on and discharged by the Works Manager. After full investigation, he was satisfied that there had been no undue preference shown towards any particular workman, and that no workman had been discharged because he was or was not a member of any Union. The submission of this report gave rise to a long discussion, nearly all of which was on the one side—that of the men. The occasion was probably seized upon as appropriate for "making the Council Chamber ring" with the cause of the men, until the Town Council agree to recognize the men's Union. The motion on behalf of the men was that the report be taken back by the Committee and reconsidered; the suggestion being thrown out that a Sub-Committee might be appointed to meet with the men. Apparently very little recognition would satisfy them—that is, until they may chance to get that little, and then Glasgow would be added to the list of towns where recognition had been accorded, and the fact would be well rubbed in upon other less acquiescent corporations. The Corporation will commit a mistake if they give up their right to manage the works in their own way. If there be any truth in the remark of Bailie Willoch, to the effect that "the men had been influenced in what they had done by a man who stood behind a public-house counter," it was sufficiently startling to make everyone pause and reflect. What sort of balance-sheet could be expected if the employees in a municipal gas-works were to take their orders from a publican? I mean the corporation balance-sheet; the publican's would be all right. There was only one other item of consequence in the discussion. It was elicited that a change in the treatment of the men had been introduced since the Union started business in Glasgow. Till then, it had been the custom of the Works Managers to select the men who were to be retained, when the summer season arrived. But great offence was given by the system; and now the men working at a particular bench are dismissed *en bloc*, irrespective of every consideration. In the working of this method, it turned out that three men out of the 400 or so who were dismissed chose to say that they had been aggrieved; and the present agitation was entirely on account of the dismissal of these three men. Whichever way the Corporation may act, the Union will be able to manufacture a grievance out of it, which is a sufficient reason why the Union should be discouraged by all legitimate means. In the end, the Council were half persuaded that reconsideration was advisable; this course having been resolved upon by the casting vote of the Chairman (Bailie Fife). Now, as to this, the only reconsideration which will be acceptable to the men will be reinstatement; and if three men are to be reinstated because of length of service, it would soon be impossible to dismiss any men in summer. That is the goal to which the Corporation are travelling, if they give way in this matter.

A communication has been received from the Parliamentary Agent for the city of Perth, to the effect that, instead of granting borrowing powers to the Corporation to the amount of £100,000, whereof one-half was to be for electric lighting purposes, and the other half to defray the cost of the new gas-works, the Secretary for Scotland had decided to allow only £25,000 for the gas-works, and this, too, upon condition that £1000 be placed annually to a sinking fund for paying off the loan, and that £1000 be set aside annually for the paying off of annuities. The Gas Commissioners met this week to consider the communication. They were of opinion that the annuities should be redeemed out of the sinking fund, and directed that the sanction of the Secretary for Scotland should be asked to this arrangement. Misfortune seems to dog the footsteps of the Commissioners. How are they to proceed with the erection of new gas-works if they have not the capital?

The Dunfermline Gas Commissioners, on Monday, agreed to defer consideration of the report by Mr. H. Pooley, their Engineer, upon proposed additions to the carbonizing plant until June, when they will have before them the estimates of revenue and expenditure for the year. Upon the recommendation of Mr. Pooley, the Commissioners contracted for 9000 tons of coal at an average cost of 15s. 3·6d. per ton—an increase of 4s. 0·69d. per ton upon the price which is being paid under last year's contracts. A communication was received from nine Trades Unions, containing a resolution to the effect that the employment of one of the retort-men to do slater and other work outside of his working day of eight hours was an irregularity, and was prejudicial to the interests of other workmen. Mr. Pooley reported that the man was still being employed to do slater work, but not outside his working hours. This explanation seemed to satisfy the majority of the members; and the matter was allowed to drop. It was a trifling subject, and, at the same time, an impertinent one.

The Gas Committee of the Peterhead Town Council reported this week that the offers for coal showed an increase of 4s. 4d. per ton over those of last year. The Manager (Mr. George Keiller, junr.) was instructed to accept the offers. It was resolved to renew gas loans to the amount of £5000, at 3½ per cent.; and authority was given to negotiate a loan to meet the cost of extensions at the gas-works which are now in progress.



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CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 19.

Sulphate of Ammonia.—The week opened with a quiet, though steady, market. But later a firmer tone supervened; and, at the close, an advance upon the lowest points touched was realized—the quotations being £11 5s. to £11 7s. 6d. per ton, delivered f.o.b. at the ports. For some time the Continent has been very quiet. But considerable Colonial and Spanish orders have somewhat reduced the limited supplies; and both consumers and middlemen having begun to realize the situation, a much better inquiry has set in. In the forward position, there has also been more interest; and business is reported to have been done in Scotland at £11 7s. 6d. But the firmness of makers generally has rather discouraged buying. At the close, Beckton is quoted £11 10s. per ton.

Nitrate of Soda remains quiet at 8s. 4½d. per cwt. for ordinary, and 8s. 7½d. for fine quality.

LONDON, *May* 19.

Tar Products.—Lower prices are being taken for creosote and other tar oils; the season so far having been against consumption and in other respects disappointing. Pitch continues fairly steady; but the much higher freights now being asked have undoubtedly affected its value, and checked a possible advance. Benzols are steadier with more business being done, though the reported increased output does not tend to any important improvement in prices. Solvent and other naphthas are in slightly better demand. Carbolic acid is strong with much inquiry for forward delivery. Anthracene is steadier, with considerable business doing.

Prices are as follows: Tar, 17s. 6d. to 27s. 6d. Pitch, east coast, 38s.; west coast, 35s. Benzol, 90's, 6d.; special qualities for gas, 8d.; 50's, 8½d. Toluol, 90's, 1s. 1d. Solvent naphtha, 1s. 1d. Crude naphtha, 3½d. Heavy naphtha, 1s. Creosote, 2½d. Heavy oils, 3½d. Carbolic acid, 50's, 2s. 6d.; 60's, 3s. Naphthalene, 55s. to 75s. Anthracene, "A," 4d.; "B," 3d.

Sulphate of Ammonia.—The week has witnessed a distinct improvement in this market; and it looks very much as if dealers have had important orders up their sleeves. Urgent buying is going on; and the outlook is stronger. The average price may be taken as £11 5s. to £11 10s. per ton, less 3½ per cent., according to port of shipment.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Now that the important locomotive fuel contracts of the London and North-Western Railway Company in this district have been definitely concluded on the basis of a 5s. per ton advance on last year's rates, representing 13s. per ton at the pit mouth, this may be taken to settle the position generally, both as regards the railway and the gas companies. So far as gas coals are concerned, there has been no difficulty in obtaining contracts for next year's supplies at an advance of quite 5s. over 1899 prices; the general basis on which business has so far been done being about 13s. 6d. to 14s. per ton for the medium sorts of gas coal—such as Wigan four-feet—and 14s. 6d. up to 15s. for the best screened Wigan Arley gas coals. A fair number of contracts have already been put through at something like these figures; and there seems now to be no question whatever that these will represent the minimum prices, at any rate, for the ensuing season's supplies. As to the general trade of the district, perhaps the position in some directions is not quite so strong. For house-fire requirements, the demand is naturally falling off as the season advances; but it is still exceptionally good for the time of the year, and no stocks of any weight are as yet being put down. At many of the leading collieries the output continues short to meet the full requirements of their customers. All the present output of common round coal moves off freely for steam and forge purposes, and readily fetches recent full prices. At the pit, quotations range from about 12s. 6d. up to 13s. 6d. per ton for the lower qualities of round coal to 14s. 6d. and 15s. 6d. for the best descriptions. Although at most of the Lancashire collieries the output of slack is still insufficient to meet the demand, more plentiful supplies have been coming in during the last two or three weeks from the Midlands; the strike in the Potteries throwing a good deal of Staffordshire slack on the market, which has met with a ready sale here—especially as surplus lots have in many cases been offered at quite 1s. per ton below Lancashire prices. This has tended to ease the position somewhat; and although Lancashire collieries have not given way at all in their quotations, the competition from other quarters has temporarily a weakening effect on the market. For Lancashire slack, prices remain at from 10s. 6d. per ton for common to 11s. 6d. for best descriptions at the pit. The shipping demand is not more than moderate; and the minimum Association basis price has been reduced to 15s. 3d. for steam coals, delivered at the ports on the Mersey. For coke, the demand continues quite as strong as ever; and on forward contracts makers in some cases are getting advances on current rates. At the ovens, ordinary furnace cokes are quoted at about 24s. to 24s. 6d., and best foundry cokes up to 32s. per ton.

Northern Coal Trade.—The trade is very active, and there is an increased demand for coal; but the want of ready steamships is lessening the shipments for the time, and causing some irregularity, both in price and in the extent of the inquiry. Best Northumbrian steam coals are quieter at from 18s. 9d. to 19s. per ton f.o.b. Steam smalls are about 13s. to 13s. 3d. per ton, and are still very scarce; but it may be noted that much of the latter kind of coal is being delivered on contracts that average about 7s. per ton. In the gas coal trade, the production is still full, and is readily taken up. Though the local consumption is naturally less, the export season to the Baltic makes up in part for the deficiency. Some slight sales of gas coal are noticed at about 17s. per ton f.o.b.; but the bulk of the deliveries are on contracts at lower rates—about 16s. per ton f.o.b. being the average price of the best of these, while a few contracts run on at moderate prices for three or four months yet. Manufacturing coals are steady, and in good demand. Coke is very firm both

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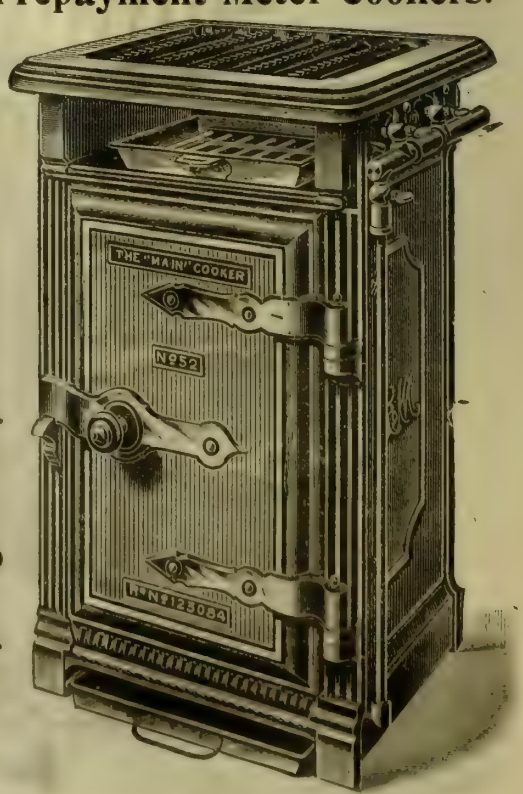


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for export and for home use. For the latter, about 29s. per ton free at the blast furnaces is the quotation. There is no change to report in the price of gas coke this week. Deliveries are at 16s. per ton, or thereabouts, on the average; but the output is limited, and with dearer coals it is expected we shall soon hear of higher prices for gas coke.

Scotch Coal Trade.—Prices remain high. This season there has been a recovery, to a very considerable extent, of the foreign contracts which were lost several years ago, on account of the strike of the miners. This circumstance will have the effect of making coal scarce on the market, and will thus help to keep up rates. Any hope there may be of prices coming down, may arise from the fact that nearly all the great coal contracts have now been entered into, and consequently there will be less inquiry. The prices quoted are: Main 14s. to 14s. 3d. per ton f.o.b. Glasgow, ell 15s. 6d. to 16s. 8d., and splints 15s. to 15s. 6d. The shipments for the week amounted to 234,423 tons—an increase of 17,471 tons upon the preceding week, and of 33,188 tons upon the corresponding week of last year. For the year to date, the total shipments have been 3,653,516 tons—an increase of 800,316 tons upon the same period of last year.

Tiverton Gas Supply.—The accounts of the gas undertaking for the year ended the 31st of March were presented to the Tiverton Town Council yesterday week. They show that the total receipts were £7960, and that the expenditure was £6226; leaving a balance of £1734. As interest and sinking fund absorbed £1478, there was a balance of £256 to be carried to the reserve. Alderman Thorne, Chairman of the Gas Committee, said the accounts were satisfactory; but, owing to the rise in the price of coal, they could not expect so good a result next year.

The St. Mary Church Gas Undertaking.—Terms have been agreed upon for the amalgamation of the district of St. Mary Church with the borough of Torquay. Among the assets to be taken over by the Corporation are the gas-works of the St. Mary Church District Council; but the Provisional Order provides that this and other properties are to be held "in respect exclusively of the added part of St. Mary Church." The works are to be held in trust by the Corporation for St. Mary Church, and any balance of revenue is to be applied "in relief of the rates levied in such area," while any deficiency is to be made good by the ratepayers of that district.

Messrs. Richmond and Co.'s Profit-Sharing Scheme.—The third annual distribution of profits to the employees at the Warrington branch of Messrs. Richmond and Co., Limited, took place last Saturday. Mr. E. W. T. Richmond, the Chairman and Managing-Director of the Company, to whose exertions the men owe the introduction of the scheme, presented the share certificates and interest. This is the first time that the whole of the bonuses have been distributed in shares. Employees who have participated in the two previous distributions have now a substantial amount invested in the 6 per cent. preference shares of the Company. Nearly 450 men took part in the distribution; and the bonuses amounted to upwards of £1500.

Increase in Price at Bradford.—The Bradford Corporation last Wednesday resolved to increase the price of gas from 2s. 3d. to 2s. 6d. per 1000 cubic feet.

The Water Scheme of Shrewsbury.—The everlasting question of an auxiliary water supply for Shrewsbury appears as far from settlement now as it was at the beginning; and it is a pity the Corporation do not take the matter boldly in hand, and adopt a comprehensive scheme that will satisfy the requirements of the Local Government Board. Their last proposal is that, instead of providing an entirely new supply, the present dual supply from springs near the town and the river should be improved. The Local Government Board have declined to sanction this, and recommend the adoption of the Batchcott scheme, the cost of which the Council consider prohibitive.

South African Lighting Association, Limited.—The report of this Company for the past year states that the unsettled state of affairs in South Africa during 1899, and the war now being carried on, have disturbed the course of business, and have had a prejudicial effect on the undertaking. The consumption of gas at Port Elizabeth for the entire year shows a small increase; but at Grahamstown, where the effect of the war has been more marked, there has been a slight decrease. In July last, a further reduction in the charge for gas at Port Elizabeth came into effect; and the increase in the price of gas coal has, in addition, militated against the year's working. The profits amount to £9208, or £855 less than in 1898. The available balance, including the amount brought forward, and after payment of debenture interest and income-tax, is £11,708. The Directors have transferred £1500 to the reserve account; and they recommend a dividend of 10 per cent., free of tax (less the interim dividend of 4 per cent. already paid). The sum of £1000 is added to the plant depreciation account, and the balance of £3958 is carried forward.

Monte Video Gas Company, Limited.—In the report which the Directors of this Company will present to the shareholders at the ordinary general meeting next Tuesday, they state the profit on the working of the past year, as shown by the revenue account, is £21,945, which has been passed to the credit of the profit and loss. Adding interest and discount (£1029) and profit on exchange (£132), the total is £23,106. After providing for interest on debentures, bad and doubtful debts, and for depreciation, the balance available for distribution is £19,154. An interim dividend was paid on Nov. 25 last, in respect of the half year ended the 30th of June, of 6s. per share, less income-tax, and the Board recommend the payment on the 1st prox., of a further amount of 8s. per share; making 3½ per cent. for the year. This will absorb £18,967, and leave a balance of £187 to be carried forward. The Company's operations throughout the year were carried on under more settled conditions than have prevailed in Monte Video of late years—there having been no important political disturbance; and the position of the Company has improved as follows: The number of meters in use increased by 10·15 per cent.; of consumers, by 13·93 per cent.; the sales of gas, by 4·50 per cent.; and the net profit by £2602.

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SWINDON (New Swindon Gas Co.)	120,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000
WINDSOR ST., BIRMINGHAM (Second Cont.)	2,000,000
HALIFAX	1,000,000
TORONTO	250,000
OTTAWA	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
TORONTO (Second Contract; Remodelled)	2,000,000
BELLEVILLE	250,000
OTTAWA (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000

	Cubic Feet Daily.
BUFFALO, N.Y.	2,000,000
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.,	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
LEICESTER	2,000,000
ENSCHEDE (HOLLAND)	150,000
BUENOS AYRES (RIVER PLATE CO.)	700,000
BURNLEY	1,500,000
KINGSTON-ON-THAMES	1,750,000
ACCRINGTON	500,000
TONBRIDGE	300,000
STRETFORD	500,000
OLDBURY	300,000
TODMORDEN	500,000
SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
YORK (Second Contract)	750,000

Sales of Shares.—Last week, Messrs. Herbert Morris and Son sold by auction 600 new ordinary £10 shares, part of the additional capital of the Newhaven and Seaford Water Company. They were put up in £100 lots; and 40 were disposed of—39 at par, and the remaining one at 10s. premium. Mr. W. E. R. Randall also held, at Chatham, a sale of shares in the Brompton, Chatham, &c., Water Company. Some original "A" shares in the Company, yielding 10 per cent. dividend, fetched £14 12s. per share, while a few "B" shares, producing 7 per cent., were disposed of at £10 per share.

The Torquay Watershed.—Some controversy is taking place at Torquay with regard to the ultimate use of the land in the vicinity of the reservoirs which the Corporation have purchased during the past few years. Altogether, the estate consisted of 583 acres of moorland, 801 acres of arable land, 761 acres of pasture, and 74 acres of wood. At present there are only 231 acres of arable land, and this will be gradually converted into pasture. Last week, 850 acres were let for grazing at an average of 11s. per acre, or 1s. per acre less than was realized last year. The lower price is regarded as an indication of deterioration in the average value of the land; and it is assumed that it will continue to decline until it becomes moorland. As this would mean considerable falling off in revenue, the Corporation are being urged not to allow the land to go entirely out of cultivation. A belt of from 100 to 200 feet wide round the reservoirs is fenced off and uncultivated; and it is contended that the remainder may be safely dealt with by methods which will bring a larger return to the borough treasury. On the other hand, it has to be recognized that the only reason the Corporation had for purchasing the land was to ensure the water against risk of contamination from houses on the watershed or the manuring of the ground.

The York United Gas Company have placed an order with Messrs. R. Dempster and Sons, of Elland, for four 25-feet square purifiers.

The Spalding District Council have granted a licence to the Vicar of Surfleet for the storage of carbide of calcium for the production of acetylene gas, with which the Parish Church is now lighted.

Exhibitions of gas appliances have lately been held by the following firms: Messrs. Fletcher, Russell, and Co., at Wallingford; Messrs. R. & A. Main, at Bristol; and Messrs. Wilsons and Mathiesons, at Chester. Lectures and demonstrations for the various firms were given by Mrs. Collins, Mrs. Pilcher, and Miss Wilkinson.

As will be seen by an announcement which appears elsewhere, the East London Water-Works Company are inviting tenders for an issue of £198,788 of 3 per cent. debenture stock; being the balance of the capital created under the Company's statutory powers. The stock will be redeemable at par after the expiration of 25 years from the date of issue, subject to six months' notice being given by the Company.

At the Mart, Tokenhouse Yard, to-morrow, Mr. Alfred Richards will conduct an important sale of gas and water stocks and shares, comprising new issues by order of the Directors of the Plymouth and Maidstone Gas Companies, and property placed upon the market by order of the Executors of the late Mr. W. H. H. Broadberry and others. The Companies concerned, in addition to those named above, are the Barnet, Buntingford, Colney Hatch, Harrow and Stanmore, Horley, Romford, St. Margaret's, Southend, Tottenham and Edmonton, Waltham Abbey and Cheshunt, Walton-on-Thames and Weybridge, West Surrey, and Woking. On the same occasion, he will offer for sale a few fully-paid £10 shares in the South African Lighting Association, Limited.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

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TO GAS AND WATER OFFICIALS.

HIGH-CLASS Cycles at reasonable and low Prices. Guaranteed for Twelve Months. Sent on approval. For Cash or Gradual Payment System. Send for Catalogue, Post Free.

Melrose Cycle Company, Coventry.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
Telegrams: "Enamel." National Telephone 1759.

PRACTICAL RETORT SETTERS.

GEORGE NUTTALL & CO., 32, Havelock Road, Saltley, Birmingham.

Regenerator or other Furnaces erected to Engineers' own Designs. Best Work Guaranteed. Please write for Estimates.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, Oldham; and 45 & 47, Westminster Bridge Road, London, S.E.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Addresses:
"Braddock, Oldham." "Metrique, London."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited,
Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

GAS TAR wanted.

Brotherton and Co., Tar Distillers. Works: Birmingham, Leeds, and Wakefield.

BENZOL, specially made for the Enrichment of Gas.

Ellison and Mitchell, Limited, Kilnhurst, near Rotherham.

ENRICH your Gas with cheap Benzol.

Specially prepared, free from sulphur. At to-day's Price of Benzol, ILLUMINATING POWER costs less than ONE-THIRD OF A PENNY PER CANDLE.

Apply to Sadler And Co., Middlesbrough.

SULPHURIC ACID for Sale.

Brotherton and Co., Chemical Manufacturers. Works: Birmingham, Leeds, and Wakefield.

PORTER & CO., Gowts Bridge Works,
LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.

Telegraphic Address: "Porter, Lincoln."
[For Illustrated Advertisement, See May 8, p. 1178.

CANNEL, COAL, ETC.

JOHN ROMANS & SON, EDINBURGH,
Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.

Prices, &c., will be forwarded on application
No. 30, St. Andrew Square, Edinburgh,
Newton Grange, Newbattle, Dalkeith, } Scotland.

DRAUGHTSMAN, experienced in the design and construction of all kinds of Gas Plant and Buildings, is open to engagement.

Address G. W., care of Street's Agency, 30, Cornhill, E.C.

TO GAS COMPANIES.

ADVERTISER desires to obtain employment in connection with the Fittings and Prepayment departments of a Gas Company. Has had 19 Years' Experience with a first-class London Firm. Can give excellent References.

Address No. 3491, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, a Gas-Fitter.

Apply, stating Age and Experience, with Testimonials, to W. Cowles, Manager and Secretary, Gas-Works, Bitterne Moor.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality.
SPECIAL FIRE CEMENT, OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, Newgate Street, London, E.C.
Telegrams: "Bogore, London."

SADLER & CO., Ltd., Middlesbrough,
Tar Distillers and Tar Colour Manufacturers, BENZOL specially prepared for Gas Enrichment free from Sulphur. Pure Hydrated OXIDE OF IRON for Purifying Gas either for Sale or Lent on Hire. Always Buyers of GAS TAR and AMMONIACAL LIQUOR.

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical
Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c., Central Plumbing Works, Town Hall Square, Bolton. Special attention to Repairs.
Before placing Orders, please write for Estimate.
Telegraphic Address: "Saturators, Bolton."

AGENTS wanted, already calling on Gas-Works, for the sale of Oxide of Iron. Good Terms.

Full Particulars, by letter, stating District worked, to No. 3494, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

DRAUGHTSMAN wanted. Permanency
for one experienced in the construction of Furnaces, Destructors, &c. Also two JUNIORS.

Apply, by letter only, stating Qualifications and Requirements, to Meldrum Bros., Limited, Atlantic Works, Manchester, S.W.

WANTED, for a Gas-Works in the Midlands making 50 millions, a WORKING FOREMAN. Must understand Regenerative Furnaces, the manufacture of Sulphate of Ammonia, and capable of taking charge of the Works in the absence of the Manager. To an active Young Man desirous of improving his position, the above offers a good opportunity. A total Abstainer preferred. Wages to commence at 35s. per week.

Apply, by letter, stating Age and Experience, and enclosing recent Testimonial, to No. 3496, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

THE Corporation of Halifax are prepared
to receive Applications for the post of CHEMIST at their Gas-Works.

Applicants are to state in full their Training, Experience, present Position, and Salary required, accompanied by recent Testimonials as to Character, Industry, and Ability.

Applications, to be endorsed "Chemist," and addressed to the undersigned not later than May 31, 1900.

Thos. Holgate, M.Inst.C.E.,
Engineer and Manager.
Corporation Gas-Works, Halifax.

THE Corporation of Halifax are prepared
to receive Applications for the post of DRAUGHTSMAN at their Gas-Works.

Applicants are to state in full their Training, Experience, present Position, and Salary required, accompanied by recent Testimonials as to Character, Industry, and Ability.

Applications, to be endorsed "Draughtsman," and addressed to the undersigned not later than May 31, 1900.

Thos. Holgate, M.Inst.C.E.,
Engineer and Manager.
Corporation Gas-Works, Halifax.

WANTED, Erectors accustomed to Gasholders and Structural Ironwork.
Apply, with Testimonials, to CLAYTON, SON, AND CO., LTD., Hunslet, LEEDS.

WANTED, as Head Fitter or Outdoor INSPECTOR, an energetic Man, who has a thorough grasp of Main and Service Laying and Fitting, and well able to control Workmen. Wages 35s. to 40s. per week to commence.
Apply to G. HELPS, Gas-Works, NUNEATON.

WANTED, a level-headed and practical Man to LAY OUT new Foundry and SUPERINTEND and take charge of CASTINGS for Gas Cooking-Stoves on up-to-date and economical System. Good and permanent position for suitable person.
Apply, by letter, to No. 3492, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO GAS MANAGERS.

WANTED, a thoroughly qualified MANAGER for Gas-Works, within 25 miles of London. Make about 45 Million Cubic feet per annum.
Apply, by letter, before the 25th inst., stating Age, Salary, and full Record of Experience, to No. 3493, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Port Erin and Port St. Mary Gas Company, Limited, a WORKING MANAGER. Wages, 25s. per week, with free House, Coal, Gas, Water, and Kitchen Garden. Duties to commence on the 3rd of June.
Applications, stating Age and Experience, with *copies* of Testimonials, to JOHN MOORE, jun., Secretary, Athol Street, PORT ST. MARY.

WANTED, a Steady, Reliable Stoker, for Small Gas-Works, accustomed to Shovel Charging and attending to Engine and Exhauster, and to make himself generally useful. Would be required to do from Two to Three Months' Night Work in Summer. Wages 28s. for Seven Months and 26s. for Five Months. None but steady Men need apply.
Apply, by letter, with Testimonials, to No. 3500, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CARLISLE GAS-WORKS.

WANTED, a thoroughly reliable Man as ASSISTANT FOREMAN. Must have good knowledge of Gas Manufacture and the usual routine of a Gas-Works.
Wages 35s. per week.
Applications to be sent to the undersigned not later than May 31.

C. B. NEWTON,
Engineer and Manager.

MERTHYR TYDFIL GAS COMPANY.

RENTAL CLERK.

WANTED, a Young Man as Rental CLERK. Must be experienced in the Accounts and General Routine Work of a Gas Office.
Applications, in own Writing, stating Age, Experience, and Particulars, of last employment, and enclosing *copies only* of two recent Testimonials, to be endorsed, "Rental Clerk," and addressed to the undersigned not later than Saturday, the 26th inst.
Salary £78 per annum.

JOHN L. COCKER,
General Manager and Secretary.
Gas Offices, Gas-Works, Merthyr Tydfil, Glamorganshire, May 2, 1900.

CORPORATION OF ST. IVES (CORNWALL).

APPOINTMENT OF GAS MANAGER AND COLLECTOR.

THE Gas-Works Committee of the above Corporation require a thoroughly qualified WORKING MANAGER and COLLECTOR for their Works (present annual make about 7¼ millions). Must thoroughly understand Modern Plant and Apparatus; including Gas-Engine and Exhauster, Laying and Repairs of Mains and Services, Fixing and Reading of Meters, and the Keeping of the Books and Accounts of the Department.
Applications, in Candidates' own Handwriting, stating Age and Salary required, accompanied by two recent Testimonials (*copies* only, which will not be returned), to be sent to the undersigned not later than Saturday, the 26th inst., endorsed "Gas Manager." Canvassing direct or indirect will be a disqualification.

EDWARD BOASE,
Town Clerk.
May 14, 1900.

WANTED, a good second-hand SCRUBBER, 6 feet in diameter, and about 40 feet high.
Position, Price, and Particulars to R. S. CHURCH, Engineer, Gas-Works, CHICHESTER.

GASOLINE.

WANTED, Offers for the supply of 1000 Gallons per month of GASOLINE (·650 sp. gr.), delivered at Grant in Edinburgh.
Offers to be addressed to the SECRETARY, Notkin Syndicate, Limited, 22, Queen Street, EDINBURGH.

DRY GAS-METER (80-Light) for Sale. Second-hand. By Thomas Glover and Co., Limited.
Apply, by letter, to No. 3499, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ENGINES and Exhausters combined Worker," to pass 30,000 cubic feet per hour. DITTO to pass 7000 feet per hour, overhauled and complete. Cheap to clear. Also BOILERS.
J. FIRTH BLAKELEY AND CO., Thornhill, DEWSBURY.

FOR SALE—Two Lancashire Boilers, each 6 ft. diameter by 20 ft. long, with Mountings. Been in use only a short time. Made by the Yorkshire Engine Company, Limited, Sheffield.
Apply to NEWTON, CHAMBERS, & Co., LIMITED, Thorncliffe Iron-Works, near SHEFFIELD, where the Boilers may be seen.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

CONDENSERS, Washer-Scrubbers, "Cutler" patent CONDENSERS (14) 6 in. to 12 in. PIPE CONDENSERS, Patent WASHERS by "Livesey," "Holmes," and "Cockey," EXHAUSTERS up to 60,000 Cubic Feet per hour. ENGINES, BOILERS, &c. Several TOWER SCRUBBERS, PURIFIERS, METERS, GOVERNORS, PUMPS, TANKS, VALVES, &c.
J. FIRTH BLAKELEY AND CO., Gas Engineers, DEWSBURY.

ISLE OF THANET GASLIGHT AND COKE COMPANY, MARGATE.

THE Directors of the above Company have FOR SALE, consequent upon the Extensions they have made to their Works, the following Second-Hand Plant:—
One EXHAUSTER, capacity per hour, 30,000 Cubic Feet of Gas.
Two EXHAUSTERS, capacity per hour, 25,000 Cubic Feet of Gas each.
Two 6-Horse Power Table STEAM-ENGINES, with Overhead Shafting, Driving-Pulleys, &c., also all Connections, Bye-Pass Valves, Inlet and Outlet Valves, &c., complete.
The whole will be sold as they stand in the Engine-House.
For further Particulars, apply to the Engineer, Mr. James Dougall.
Tenders, addressed to the Chairman, and endorsed "Tender for Engines and Exhausters," to be delivered at these Offices not later than the 31st inst.

By order of the Board,
THOS. C. FULLER,
Secretary.
Offices, The Dane, Margate, May 19, 1900.

CITY OF RIPON GAS-WORKS.

THE Corporation of Ripon are desirous of purchasing the necessary PLANT for the manufacture of SULPHATE of AMMONIA and TAR DISTILLING.
For further Particulars, apply to Mr. Anderson, M.Inst.M.E., Engineer and Manager, Gas-Works, Ripon.
Tenders must be sent in to me on or before Monday, the 28th day of May inst.

M. KIRKLEY,
Town Clerk.
Town Hall, Ripon, May 15, 1900.

TENDERS FOR COAL AND CANNEL.

THE Gas Department of the Penrith Urban District Council are prepared to receive TENDERS for the supply of COAL and CANNEL during the Year ending June 30, 1901.
Tenders to be delivered to Mr. Geo. Wainwright, Public Offices, Penrith, not later than Tuesday, the 29th inst.
Forms of Tender may be obtained on application.

E. SHAUL,
Manager.
Gas-Works, Penrith, May 17, 1900.

BUXTON URBAN DISTRICT COUNCIL.

TENDERS FOR TAR AND LIQUOR.

THE Gas Committee invite Tenders for the purchase of the surplus TAR and LIQUOR produced at their Works in Ashwood Dale, for One Year commencing from the 30th of June next.
Further Particulars and Forms of Tender may be obtained of Mr. H. Barker, Engineer, Town Hall, Buxton.
Tenders, endorsed "Tender for Tar and Liquor," to be addressed to the Chairman of the Gas Committee, and delivered not later than noon on the 2nd day of June.
The Council do not bind themselves to accept the highest or any Tender.

By order,
JOSIAH TAYLOR,
Clerk.

BUXTON URBAN DISTRICT COUNCIL.

TENDERS FOR COAL AND CANNEL.

THE Gas Committee invite Tenders for the supply of 6000 Tons of best screened GAS COAL and 4000 Tons of CANNEL, to be delivered at their Siding (on the Midland Railway) in Ashwood Dale, Buxton, at such times and in such quantities as may be required during the Year from the 1st of July, 1900, to the 30th of June, 1901.
Tenders, endorsed "Tender for Coal and Cannel," addressed to the Chairman of the Gas Committee, to be delivered at the Town Hall, Buxton, not later than noon on the 2nd day of June.
Forms of Tender and other Particulars may be obtained of Mr. H. Barker, Engineer, Town Hall, Buxton.
The Council do not bind themselves to accept the lowest or any Tender.

By order,
JOSIAH TAYLOR,
Clerk.

TODMORDEN CORPORATION.

TO COLLIERY PROPRIETORS AND OTHERS.
TENDERS FOR COAL.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the supply of 14,000 Tons of GAS COAL required at their Works, Todmorden, during a period of Twelve Months, commencing on the 1st day of July next.
Forms of Tender and any further Information may be obtained on application to the Engineer and Manager, Mr. Hy. Hawkins.
Sealed Tenders, endorsed "Gas Coal," addressed to the Chairman, Gas Committee, and delivered at the Town Clerk's Office, Town Hall, Todmorden, not later than Three p.m., on the 29th inst.

By order,
HY. HAWKINS,
Engineer and Manager.
Millwood, Todmorden.

LURGAN GASLIGHT AND CHEMICAL COMPANY, LIMITED.

COAL WANTED.

THE Directors invite Tenders for the supply of 3300 Tons of best quality screened GAS COAL, and 100 Tons of STEAM COAL, delivered into the Works at Lurgan, or placed on Lighters, or on Rail, at Belfast.
Eight Hundred Tons of the required quantity should be Scotch Coal, suitable for use in Hislop's Patent Regenerative Furnaces.
The Coal must be delivered in such quantities and at such times as the Directors may fix; but a large proportion can be taken before the 1st of November.
Each Cargo to be accompanied by a Certificate as to place of origin.
Tenders (in sealed envelope), accompanied by reference to Gas-Works using the Coal offered, should reach me not later than Saturday, the 2nd of June, 1900.
The Directors do not bind themselves to accept the lowest or any Tender.

FRED. W. MAGAHAN,
Secretary.
Gas-Works, Lurgan, May 7, 1900.

TO TAR DISTILLERS AND OTHERS.

THE Corporation of Birkenhead invite OFFERS for the purchase and removal of the surplus TAR produced at their Gas-Works during a period of One, Three, or Five Years commencing on the 1st of July, 1900.
Deliveries will be made at the Gas-Works either into Contractor's Tanks on the Gas-Works Railway Siding, or into Tanks for conveyance by road to boats.
The Contractor whose Tender is accepted will be required to enter into a formal Contract or Agreement with the Corporation, upon the specific Terms and Conditions contained in the Draft Contract, which has been prepared by the Town Clerk, and deposited in his Office for inspection.
Forms of Tender and further Particulars may be obtained from the Gas Engineer, Mr. T. O. Paterson, C.E., Gas-Works, Thomas Street.
Tenders, which must be on the printed Form supplied, sealed and endorsed "Tender for Tar," to be sent in to me not later than Five p.m. on Thursday, the 31st of May, 1900.
The Corporation do not bind themselves to accept the highest or any Tender.

By order,
ALFRED GILL,
Town Clerk.
Town Hall, Birkenhead, May 16, 1900.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Corporation of Birkenhead are prepared to receive TENDERS for the supply of COAL, COAL NUTS, THROUGH and THROUGH CANNEL, and CANNEL NUTS for Gas-Making purposes, for a period of One, Two, or Three Years commencing from the 1st of July, 1900.
Forms of Tender, together with any further Information, may be obtained from Mr. T. O. Paterson, C.E., Gas Engineer, Gas-Works, Birkenhead.
Tenders (accompanied by copy of recent Analysis), stating the Price per ton delivered on to the Gas-Works Railway Siding, must be sent in to me sealed, and endorsed "Tender for Gas-Works Coal," not later than Five o'clock in the Afternoon of Thursday, the 31st of May, 1900.
Also for a supply of STEAM COAL and SLACK to be delivered at the Pumping-Stations of the Spring Hill, Playbrick Hill, Borough Road, Mount Road, and The Ford Water-Works for a period of One, Two, or Three Years commencing from the 1st of July, 1900.
Forms of Tender, together with any further Information may be obtained from Mr. W. A. Richardson, C.E., Water Engineer, Town Hall, Birkenhead.
Tenders, stating the price per Ton delivered at the various Pumping-Stations, must be sent in to me sealed and endorsed, "Tender for Water-Works Coal," not later than Five o'clock in the afternoon of Thursday, the 31st of May, 1900.
Also for a supply of WASHED SLACK, to be delivered at the Electrical Generating Station, Bentinck Street, for a period of One, Two, or Three Years commencing from the 1st of July, 1900.
Forms of Tender, together with any further Information may be obtained from Mr. W. Bates, Electrical Engineer, Bentinck Street, Birkenhead.
Tenders, stating the price per ton delivered, must be sent in to me, sealed and endorsed "Tender for Washed Slack," not later than Five o'clock in the afternoon of Thursday, the 31st of May, 1900.
All deliveries to be made from time to time according to the requirements of the respective Engineers.
The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
ALFRED GILL,
Town Clerk.
Town Hall, Birkenhead, May 16, 1900.

[For continuation of Contract Advertisements, see p. 1402.

APPLICATIONS FROM CUSTOMERS WILL BE PREFERENTIALLY CONSIDERED ON ALLOTMENT.

No part of this Issue has been or will be Underwritten or Guaranteed.

The List of Applications will open at 10 a.m. on Wednesday, 30th May, 1900, and will close for both Town and Country on Saturday, 2nd June, 1900.

The Davis Gas Stove Company,

LIMITED.

(INCORPORATED UNDER THE COMPANIES ACTS, 1862 TO 1899.)

CAPITAL - - - £150,000,

DIVIDED INTO

15,000 Cumulative 5½ per cent. Preference Shares of £5 each - -	£75,000
15,000 Ordinary Shares of £5 each - - - -	75,000
	£150,000

Of which 2500 Preference and 2500 Ordinary Shares are reserved for future issue.

PRESENT ISSUE

12,500 Preference Shares and 12,500 Ordinary Shares,

Of which Shares 7466 of each class go to the Vendors in part payment of their purchase money, leaving for subscription 5034 Preference Shares and 5034 Ordinary Shares, which are hereby offered, payable as follows:—

£2 per Share on Application.
£1 per Share on Allotment.
£2 per Share at one Month after Allotment.

The Preference Shareholders are entitled to one vote for each Share held by them.

No Debenture to rank in priority to this issue can be created without the consent of the holders of at least three-fourths of the Preference Shares present or represented at a meeting specially convened for the purpose.

Dividends on the Preference Shares are payable half-yearly, on June 30th and December 30th. The first will be payable on December 30th, 1900, and Dividends on both classes of Shares will be calculated from the dates of payment of the instalments.

Directors.

HENRY JOHN DAVIS, Camberwell, Gas Engineer.
CHARLES WILLIAM DAVIS, Camberwell, Gas Engineer.
HENRY ADDIS PRICE, Camberwell, Gas Engineer.
HAROLD NEWSOM DAVIS, Luton, Iron Founder.
CHARLES SILBURN BARBER, Camberwell, *Secretary.*
} *Managing Directors.*

Messrs. H. J. & C. W. Davis and Mr. H. Addis Price are Directors, and Mr. C. S. Barber is Secretary of the Vendor Company, and Mr. H. N. Davis is Manager of the Langley Foundry Company, Limited, of Luton, Beds.

Bankers.

LONDON & SOUTH-WESTERN BANK (Camberwell Green Branch).

Solicitors.

ALLEN & TENNANT, 16, Philpot Lane, E.C.

Brokers.

E. W. MEYERSTEIN & CO., 1, Drapers' Gardens, E.C., and Stock Exchange, E.C.

Auditors.

A. DANGERFIELD & CO., 56, Cannon Street, E.C.

Secretary.

C. S. BARBER.

Registered Offices.

200, CAMBERWELL ROAD, S.E.

PROSPECTUS.

THIS Company is formed to acquire and extend the business of The Davis Gas Stove Company, Limited, of Camberwell, S.E. (herein referred to as the "Vendor Co."), and also to acquire, and amalgamate with it, the business and assets of the Langley Foundry Co., Ltd., of Luton, Beds, and the Foundry and Works known as the Springfield Foundry, Falkirk, Scotland.

The business of the Vendor Co. was established in 1875, as Gas Engineers and Stove Makers, and in 1891 consisted of 200, Camberwell Road, only. It was in 1891 formed into a private limited Company, and has continued to steadily develop and require a constant extension of plant and premises. The Vendor Co. has but recently been obliged to buy the three freehold shops adjoining their extensive frontage in the Camberwell Road, and the shops are now being altered and rearranged and warehouse built at the rear, with a view to extending warehouse room and frontage.

So continuously has the business increased, that the premises now consist of the following:

Freehold Factory and Offices, known as 196, 198, and 200, Camberwell Road, and Nos. 21 and 23, Mansion Street.

Freehold Shops, known as 202, 204, and 206, Camberwell Road, now being dealt with as mentioned above.

Leasehold Factory, known as 16a, Wyndham Road, and consisting of 16a, Wyndham Road, and Arches 303 and 304.

Railway Arches, Nos. 305, 306, 307, 308, 309, 310, 311, 312, 313, and 314, at the rear of the Factory, and connected with it by underground passage, and held under lease and agreement.

Leasehold Shop, 13a, Wyndham Road.

There is also a large Show Room, 59, Queen Victoria Street, E.C., specially fitted for the purpose of the business, and held on a yearly tenancy.

The works are very fully equipped with all necessary machinery and plant, and all the work (other than the casting) is done in the numerous workshops on the premises.

With a view to ensuring a supply of castings, the Directors of the Vendor Co. in 1895 acquired a large interest in (and registered as a private Company) the freehold premises, plant, and business of a foundry in Langley Street, Luton, Beds. In addition to Gas Stove Castings the Foundry has a large connection in the general trade for Ranges, Ornamental Railings, Sanitary Castings, &c., &c., and is equipped with every modern appliance, and can turn out 60 tons of light castings per week. The moulding shop covers 25,680 square feet, and the total Buildings cover an area of more than an acre, the large dwelling-house belonging to the Foundry letting at £60 per annum.

The growth of the Vendor Company's business and the general casting trade of the Langley Foundry, make it necessary to increase the working capital and the factory and foundry accommodation. The first want will be met by the £20,000 additional working capital provided by the shares now offered for subscription, and to meet the second want the Vendor Co. has contracted to purchase a large and well equipped foundry at Falkirk, N.B., known as the Springfield Foundry, close to Grahamstown Station on the Stirlingshire Midland Junction Railway, in connection with which the foundry has its own Siding. This foundry has, since the commencement of the business in 1875, supplied to the Vendor Company nearly all the castings for the Metropolitan Stove, and is at present capable of turning out between 80 and 90 tons of light castings per week, and there is room for additional moulding accommodation. There is in connection with the foundry a dwelling-house let at a rental of £38 per annum. The lands on which the foundry stands and its adjacent grounds are held in feu (which is a perpetuity holding) at a total annual rent of £74 9s. 3d., and covers in all an area of over 2 acres. Possession of this foundry is to be given on July 14th, and the purchase money for the buildings, plant, and machinery, and also the legal expenses and stamps, will be borne by the Vendor Co.; this Company taking the benefit of the existing contract for sale.

The businesses of The Langley Foundry Company, Limited, and the Vendor Co. are taken over as going concerns, with the benefit of the trading as to the first

named from 1st October, 1899, and as to the last named from 1st January, 1900, this Company taking over the assets as mentioned below:—

	£	s.	d.
The assets to be acquired by this Company consist of—			
The Freehold, Leasehold and Feu Land and Buildings in London, Luton, and Falkirk, together with the Vendor Co.'s interest in the Leasehold Railway Arches in London, the whole valued by Messrs. Fuller, Horsey, Sons, and Cassell at	36,720	0	0
Fixed and loose plant, machinery, and tools in London, Luton, and Falkirk, together with fixtures and fittings at 59, Queen Victoria Street, E.C., valued by Messrs. Fuller, Horsey, Sons, and Cassell at	12,470	0	0
Patterns and drawings at London, Luton, and Falkirk, including patterns at other Foundries, valued by Messrs. Fuller, Horsey, Sons, and Cassell at	5,000	0	0
	54,190	0	0
Stock in trade, including finished and partly finished goods, and all materials and stores at London and Luton, taken at cost price	22,469	10	3
	76,659	10	3
Book debts owing and cash in hand and at Bankers 17,352 0 7			
Less trade liabilities 14,174 1 4			
	3,177	19	3
	79,837	9	3
To which must be added the balance of cash from this issue	20,000	0	0
Making the total net assets exclusive of Goodwill ..	£99,837	9	6

To pay the Dividend on the present issue of Preference Shares will require £3437 10s. per annum, and in view of the £20,000 additional working capital, and after careful consideration of their past trade, and from their intimate knowledge of the same, the Directors are satisfied that the annual profits of the works and foundries when amalgamated will be sufficient to pay the Preference Dividend four times over.

The following is Messrs. Fuller, Horsey, Sons, and Cassell's valuation before referred to:—

11, *Billiter Square, London, E.C., May 3rd*, 1900.

To the Directors of THE DAVIS GAS STOVE COMPANY, LIMITED.

GENTLEMEN,—

In accordance with your instructions, we have attended at **The Metropolitan Engineering Works, Camberwell Road, S.E.; The Langley Foundry, Luton, Beds.**; and **The Springfield Iron Foundry, Falkirk, Scotland,** and have made a careful survey and valuation of same.

The London and Luton Properties are all Freehold and subject to neither Tithe Rate nor Land Tax, with the exception of the railway arches adjoining the Camberwell Works, which are held on Leases and other tenancies. The Works at Falkirk are held in perpetuity, subject to a Feu Duty of £74 9s. 3d. per annum.

We are of opinion that the present fair value as a going concern of the above-mentioned **Freehold Engineering Works** and **Iron Foundries,** together with the whole of the **Fixed** and **Loose Plant** and **Machinery, Patterns and Drawings,** is the sum of **Fifty-four thousand one hundred and ninety pounds (£54,190).**

These figures are inclusive of the fixtures and fittings at Queen Victoria Street, but exclusive of any value for stock, stores, work in progress, book debts, patents, or goodwill.

We are, Gentlemen,

Yours faithfully,

FULLER, HORSEY, SONS, & CASSELL.

The businesses of the Vendor Company and of the Langley Foundry Company Limited, have been managed from the commencement by the Directors of this Company, and it is owing to their efforts that the businesses have reached their present dimensions. The Directors will continue the management as heretofore, and for their joint managing and secretarial services will receive a fixed salary of £2000 per annum, *plus* 10 per cent. of the net profits earned over and above the sum required to pay the Preference Dividend and a 10 per cent. dividend on the Ordinary Shares.

The total price to be paid for the purchase of the Springfield Foundry and plant, for the business, assets, and goodwill of the Vendor Company, and of The Langley Foundry Company, Limited, has been fixed by the Vendor Company at £105,000 to be satisfied, as to £30,340 part thereof in cash, and as to £74,660 the balance thereof, by the allotment to the Vendor Company of 7466 fully paid-up Preference Shares, and 7466 fully paid-up Ordinary Shares. The Vendor Company will pay all the costs, stamps, and expenses of, and incidental to, the formation and registration of the Company and the issuing of the Prospectus, and will receive interest at 5 per cent. per annum on their purchase-money from the dates the businesses are taken over.

The following contracts have been, or will be, entered into, viz:—

(1) A contract for sale, made between The Davis Gas Stove Company Limited (thereafter called "the old Company"), and Charles Silburn Barber, the liquidator thereof of the one part, and The Davis Gas Stove Company, Limited (thereinafter called "the new Company"), of the other part, the draft whereof has for the purpose of identification been subscribed by Francis Allen, a Solicitor of the Supreme Court.

(2) A Contract for sale dated 21st May, 1900, and made between The Langley Foundry Company, Limited, of the one part, the persons mentioned in the Schedule thereto of the second part, and Herbert Henry Dashwood of the third part.

(3) A Contract for sale dated 8th and 10th March, 1900, between Malcolm Cockburn, of Springfield Foundry, Falkirk, N.B., of the one part, and The Davis Gas Stove Company, Limited (being the old Company), of the other part.

The respective businesses are taken over subject to all existing contracts and engagements. These fall technically within Section 38 of the Companies Act, 1867, but have reference only to the ordinary business of the respective Companies, and cannot in the interests of this Company be specified here. Applicants for shares will be deemed to have had notice of all these contracts, to have waived their rights, if any, to further particulars thereof, and to have agreed with the Company, as trustee for the Directors and other persons liable, not to make any claim whatever, or to take any proceedings under the said section in respect of any non-compliance therewith.

The Contracts specified above, the Memorandum and Articles of Association of the Company, and Messrs. Fuller, Horsey, Sons, & Cassell's valuation, can be seen at the offices of Messrs. Allen & Tennant, 16, Philpot Lane, London, E.C.

Application will be made in due course to the Stock Exchange for a settlement for both classes of shares.

Applications for Shares should be made on the form below, and be forwarded **to the Bankers** with the amount payable on application.

If no allotment is made the deposit will be returned in full, and where the number of shares allotted is less than the number applied for, the balance will be applied towards the payment due on allotment, and final call.

Failure to pay any instalments on the shares will render the previous payments liable to forfeiture.

Copies of the Prospectus, with Forms of Application for Shares, can be obtained at the Registered Offices of the Company, and from the Bankers, Brokers, Accountants, and Solicitors of the Company.

200, CAMBERWELL ROAD, S.E.,
18th May, 1900.

THE DAVIS GAS STOVE COMPANY, LIMITED.

(*Incorporated under the Companies Acts*, 1862 *to* 1898.)

FORM OF APPLICATION FOR PREFERENCE SHARES.

To the Directors of THE DAVIS GAS STOVE COMPANY, LIMITED.

GENTLEMEN,

Having paid to the Company's Bankers the sum of £_____ being a deposit of £2 per Share on _____ 5½ per cent. Cumulative Preference Shares of £5 each in the above Company, I request you to allot me that number of such Preference Shares, and agree to accept the same, or any smaller number that may be allotted to me upon the terms of the Company's Prospectus, dated 18th May, 1900, and to pay £1 per Share on allotment and the balance of £2 per Share one month after allotment, as provided by the said Prospectus, and I authorize you to register me as the holder of the said Preference Shares, and I waive any fuller compliance with Section 38 of the Companies Act, 1867, or otherwise, than that contained in such Prospectus.

Name (in full) _____

Address _____

Description _____

Date 1900.

Kindly make Cheque payable to the Bankers.

This Form must be sent entire with remittance to the Company's Bankers, the London & South-Western Bank, Limited, CAMBERWELL GREEN BRANCH.

THE DAVIS GAS STOVE COMPANY, LIMITED.

RECEIPT FOR DEPOSIT

(To be returned to the Applicant).

Received *the* _____ *day of* _____ 1900,

from _____

the sum of £ : : , *being a deposit of £2 per Share upon* _____ *Preference Shares in the above-named Company.*

For the LONDON & SOUTH-WESTERN BANK, LIMITED,

STAMP

£ : :

THE DAVIS GAS STOVE COMPANY, LIMITED.

(*Incorporated under the Companies Acts*, 1862 *to* 1898.)

FORM OF APPLICATION FOR ORDINARY SHARES.

To the Directors of THE DAVIS GAS STOVE COMPANY, LIMITED.

GENTLEMEN,

Having paid to the Company's Bankers the sum of £_____ being a deposit of £2 per Share on _____ Ordinary Shares of £5 each in the above Company, I request you to allot me that number of such Ordinary Shares, and agree to accept the same, or any smaller number that may be allotted to me upon the terms of the Company's Prospectus, dated 18th May, 1900, and to pay £1 per Share on allotment and the balance of £2 per Share one month after allotment, as provided by the said Prospectus, and I authorize you to register me as the holder of the said Ordinary Shares, and I waive any fuller compliance with Section 38 of the Companies Act, 1867, or otherwise, than that contained in such Prospectus.

Name (in full) _____

Address _____

Description _____

Date 1900.

Kindly make Cheque payable to the Bankers.

This Form must be sent entire with remittance to the Company's Bankers, the London & South-Western Bank, Limited, CAMBERWELL GREEN BRANCH.

THE DAVIS GAS STOVE COMPANY, LIMITED.

RECEIPT FOR DEPOSIT

(To be returned to the Applicant).

Received *the* _____ *day of* _____ 1900,

from _____

the sum of £ : : , *being a deposit of £2 per Share upon* _____ *Ordinary Shares in the above-named Company.*

For the LONDON & SOUTH-WESTERN BANK, LIMITED,

STAMP

£ : :

THE Directors of the Camborne Gas Company, Limited, invite TENDERS for the supply of 1000 Tons of GAS COAL, f.o.b. to their order at any period within the next Twelve Months from the 1st prox.

Tenders should be addressed to the undersigned on or before the 29th inst.

The lowest or any Tender not necessarily accepted.

W. BAILEY,
Secretary.

Dated Gas-Works, Camborne,
May 19, 1900.

CITY OF CARLISLE.

THE Carlisle Gas Committee are prepared to receive TENDERS for the supply of COAL and CANNEL required at their Works during One Year from the 1st of July next.

Tenders to be delivered to the undersigned not later than June 2, 1900.

Forms of Tender and other Particulars on application.

C. B. NEWTON,
Engineer and General Manager.

Gas-Works, Carlisle,
May 12, 1900.

CITY OF CARLISLE.

THE Carlisle Gas Committee are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Works for a period of One Year from the 1st of July next.

Tenders to be delivered to the undersigned not later than June 2, 1900.

Further Particulars can be obtained on application.

C. B. NEWTON,
Engineer and General Manager.

Gas-Works, Carlisle,
May 12, 1900.

COUNTY BOROUGH OF BLACKBURN.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the Surplus TAR made at their Works during the Year ending the 30th of June, 1901.

The estimated Quantity is 2600 Tons; and Tenders are to state a price for same delivered into Tank-Waggons at the new Gas-Works Sidings, Greenbank.

Forms of Tender may be obtained from the undersigned, and to be delivered in sealed envelopes, endorsed "Tar," before Saturday, the 26th of May, 1900.

S. R. OGDEN,
Engineer and Manager.

Gas Department,
Municipal Offices, Blackburn,
May 15, 1900.

BRIERLEY HILL DISTRICT GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors are prepared to receive TENDERS for the supply of 7000 Tons of GAS COAL, delivered to Brettell Lane or Round Oak Siding (G.W.R.), in such quantities as may be required from the 1st of July next to the 30th of June, 1901.

Tenders, stating Price per ton (20 cwt.), delivered to the above-mentioned Stations, with latest Analytical Test, to be sent, addressed to the Chairman of the Company, and marked "Tender for Coal," not later than the 26th inst.

The Directors reserve the right to accept Tenders for the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any Tender.

No Tender Forms issued.

By order,
HENRY M. JACKSON,
Secretary.

Board-Room, Gas-Works,
Brierley Hill, May 14, 1900.

TENDERS FOR TAR.

THE Directors of the Clayton, Allerton, and Thornton Gas Company are prepared to receive TENDERS for the purchase of the COAL TAR produced at these Works during a period of Twelve Months from the 1st day of July, 1900, to the 30th of June, 1901.

Quantity, about 400 Tons.

The Tar will have to be removed daily from the 1st of October to the end of April.

Sealed Tenders, endorsed "Tender for Tar," addressed to the Chairman at the Gas-Works, to be delivered at or before Noon, on Monday, the 11th of June, 1900.

The Directors do not pledge themselves to accept the highest or any Tender.

By order,
JOHN NIVEN,
Secretary and Manager.

Gas-Works, Clayton, near
Bradford, May 8, 1900.

TENDERS FOR GAS COAL.

THE Directors of the Clayton, Allerton, and Thornton Gas Company invite TENDERS for the supply of 8000 Tons of GAS COAL, screened and unscreened, and 1600 Tons of CANNEL COAL. The Coal to be free from Scale, Sulphurous Pyrites, or other objectionable matter, and to be delivered at the Gas Works, Low Lane, Clayton, or at the Great Northern Railway Station, Clayton, in such quantities weekly as may be ordered by the Company's Manager, during the next Twelve Months. The said Tenders to state the Seam and the Pit from which the Coal is intended to be sent.

Sealed Tenders, endorsed "Tender for Gas Coal," addressed to the Chairman at the Gas Works, to be delivered at or before Noon on Monday, the 11th day of June, 1900.

The Directors do not pledge themselves to accept the lowest or any Tender, reserving to themselves the right to divide the contracts as they may think proper.

By order,
JOHN NIVEN,
Secretary and Manager.

Gas Offices, Clayton, near
Bradford, May 8, 1900.

RADCLIFFE AND PILKINGTON GAS COMPANY.

TENDERS FOR COAL AND CANNEL.

THE Directors of the Radcliffe and Pilkington Gas Company invite TENDERS for about 14 000 Tons of GAS COAL and CANNEL.

Particulars may be obtained from the undersigned, to whom Tenders, properly endorsed, must be delivered on or before Friday, the 1st of June.

JAMES BRADDOCK,
Manager and Secretary.

Gas Offices, Radcliffe,
May 17, 1900.

GOOLE URBAN DISTRICT COUNCIL.

TENDERS are invited for the supply of 5000 to 6000 Tons of best screened GAS COAL.

Full Particulars and copy of Conditions may be had on application to the undersigned.

Sealed and endorsed Tenders, to be sent to Mr. George England, Clerk to the Goole Urban District Council, Chapel Street Offices, Goole, on or before Twelve o'clock noon, Monday, May 28, 1900.

By order,
MATT. DUNN, M.Inst.M.E.,
Engineer.

Engineer's Office, Doyle Street, Goole.

KING'S LYNN GAS COMPANY.

THE Directors of the King's Lynn Gas Company invite TENDERS for the supply of about 7000 Tons of GAS COAL or NUTS, for delivery from July 1, 1900, to June 30, 1901.

Tenders, endorsed "Coal," stating Price f.o.b. the Company's Steamboats in Tyne or elsewhere, or f.o.r. Harbour Siding, King's Lynn, to be sent to the undersigned not later than June 2, 1900.

EDMUND G. SMITHARD,
Engineer.

Gas-Works, King's Lynn,
May 19, 1900.

CORPORATION OF WOKINGHAM.

TENDERS FOR GAS COAL.

THE Gas Committee invite Tenders for the supply and delivery at Wokingham of 1000 Tons of GAS COAL, screened or unscreened, during the Year ending the 31st of May, 1901, in quantities to be arranged.

Tenders to be sent in by the 29th of May next.

The Committee do not bind themselves to accept the lowest or any Tender.

A. G. BATES,
Secretary and Manager.

Gas Offices, Wokingham,
May 16, 1900.

BOROUGH OF NEWBURY.
(GAS DEPARTMENT.)

THE Gas Committee of the Newbury Corporation invite TENDERS for the supply of about 3600 Tons of Best GAS COAL and 250 Tons of a good class CANNEL during the period ending June 30, 1901, to be delivered free to Newbury Station on the G. W. Railway in such quantities as may be agreed.

Tenders to state full Particulars of the Coal and Cannel offered, to be endorsed "Tender for Coal," and addressed to the Chairman of the Gas Committee, Gas Offices, Newbury, and delivered not later than the 1st day of June next.

The Committee do not bind themselves to accept the lowest or any Tender.

No particular form issued.

WM. R. DAVEY,
Manager.

Gas-Works, Newbury,
May 15, 1900.

PAIGNTON GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the Paignton Gas Company are prepared to receive TENDERS for the supply of about 2000 Tons (or such other quantity as may be agreed on) of best approved GAS COALS, in such monthly quantities as may be required by the Company.

Tenders to state the Price of the Coal, delivered at Paignton Station, Great Western Railway, free of all charges.

The Directors do not bind themselves to accept the lowest or any Tender.

Further Particulars may be obtained on application to Mr. C. G. Dawson, the Company's Manager.

Sealed Tenders, endorsed "Tender for Coal," specifying the description and quality of Coal, to be sent on or before the 9th of June addressed to the undersigned, Gas Offices, 5, Victoria Street, Paignton.

F. W. PUDDICOMBE,
Secretary.

Paignton, May 19, 1900.

COUNTY BOROUGH OF HUDDERSFIELD.

TENDERS FOR GAS COAL AND NUTS.

THE Gas Committee are prepared to receive TENDERS, from Colliery Proprietors only, for the supply and delivery of about 60,000 Tons of unscreened GAS COAL and screened NUTS for a period of Twelve Months, commencing the 1st of January, 1901.

Full Particulars and Form of Tender may be obtained on application to the Gas Engineer and Manager (Mr. E. A. Harman, M.Inst.C.E.), Leeds Road, Huddersfield.

Sealed Tenders, endorsed "Tender for Gas Coal," must be delivered, free of charge, addressed, in the handwriting of the Tenderer or his Agent, to the Town Clerk, Town Hall, Huddersfield, not later than Tuesday, the 12th of June, 1900.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
F. C. LLOYD,
Town Clerk.

Town Hall, Huddersfield,
May 18, 1900.

TO COAL CONTRACTORS.

THE Kineton Gaslight, Coal, and Coke Company, Limited, invite TENDERS for not less than 400 Tons of well-screened SILKSTONE GAS COAL, delivered at their Works as required during Twelve Months, from July 1, 1900.

Tenders, to be addressed to the SECRETARY of the Company, Kineton, WARWICK, by May 28.

OSWALDTWISTLE URBAN DISTRICT COUNCIL.

TENDERS FOR GAS COAL.

THE Council invite Tenders for the supply of 4000 Tons of screened GAS COAL during the Twelve Months ending June 30, 1901.

Further Particulars may be obtained from the undersigned.

Sealed Tenders, endorsed "Tender for Gas Coal," to be sent to the undersigned, not later than the 30th of May inst.

BENJN. T. WESTWELL,
Clerk.

Town Hall, Oswaldtwistle,
(Lancs.), May 10, 1900.

COUNTY BOROUGH OF BOLTON.
(GAS DEPARTMENT.)

TENDERS FOR COAL AND CANNEL.

THE Gas and Lighting Committee invite TENDERS for the supply of Screened GAS COAL, COBBLES, and CANNEL required during the Year ending the 30th of June, 1901.

Specification and Form of Tender may be obtained on application to Mr. William Walch, Office Superintendent, Gas Offices, Bolton.

Sealed Tenders, endorsed "Tender for Coal," to be addressed to Alderman John Miles, Chairman, and to be delivered at the Gas Offices, Bolton, not later than Thursday, the 31st of May inst.

The Committee do not bind themselves to accept the lowest or any Tender.

R. G. HUMELL,
Town Clerk.

Town Hall, Bolton,
May 17, 1900.

SCARBOROUGH GAS COMPANY.

AMMONIACAL LIQUOR.

THE Directors of the Scarborough Gas Company invite TENDERS for the whole of the AMMONIACAL LIQUOR, to be produced at their Works for One or more Years from the 1st day of July next.

Tenders may be submitted either at a fixed Price per Ton or on a Sliding-Scale, regulated by the price of Sulphate. Preference will, however, be given to the latter.

Further Particulars may be obtained on application to the underigned.

Tenders (duly endorsed) must be delivered, addressed to the Chairman of the Company, not later than Noon, on Saturday, the 9th of June next.

The Directors do not bind themselves to accept the highest or any Tender.

By order,
J. HOLLIDAY,
Engineer and Secretary.

Gas Offices: 32, Westborough.
Scarborough, May 16, 1900.

EXMOUTH GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the Exmouth Gas Company invite TENDERS for 3000 Tons of clean unscreened (through and through) first-class DURHAM or ANY OTHER GOOD GAS COAL, to be shipped in such quantities (by Sailing Vessels only), and at such times as may be required, commencing from the 1st of August next.

Tenders to be accompanied by practical Working Analysis, and Prices may be quoted c.i.f. or f.o.b. at Exmouth Docks.

Sealed Tenders to be sent to the undersigned, addressed to the Chairman of the Company, and endorsed "Tender for Coal," not later than Thursday, the 31st day of May.

The Directors reserve to themselves the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any Tender (no special Form of Tender issued).

By order,
JAMES T. FOSTER,
Secretary and Manager.

Gas-Works, Exmouth,
May 8, 1900.

GLOUCESTER GASLIGHT COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of about 30,000 Tons of GAS COAL for One Year from the 1st day of July next, in such monthly quantities as may be required by the Company.

Tenders to state the price delivered at the Midland Railway Wharf, High Orchard, or the Great Western Railway Wharf, Llanthony, Gloucester; or if sent (as preferred) by Water, the price f.o.b., and also the price delivered at the Gas Company's Wharf on the Gloucester and Berkeley Canal.

Further Particulars and Forms of Tender may be obtained of the undersigned.

Sealed Tenders, endorsed "Tender for Coal," specifying the description and quality of the Coal, to be addressed to the Chairman, Gas Offices, Eastgate Street, Gloucester, and delivered not later than the 4th day of June next.

The Directors reserve to themselves the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any Tender.

By order,
WILLIAM E. VINSON,
Secretary.

Gas Offices, Gloucester,
May 3, 1900.

CONTENTS.

EDITORIAL NOTES:—

GAS, LIGHTING, &c.— PAGE.

The South Metropolitan Gas Bill—A Great Triumph 1423
The Wandsworth and Putney Gas Bill. 1424
The Coal Market 1424
The Programme of the Gas Institute Meeting 1425
The Committee on Municipal Trading. 1425
The Bank-Rate and the Price of Gas Stocks 1425
Another Outrage on Political Economy 1426
For the Preservation of the Picturesque 1426

WATER AND SANITARY AFFAIRS—

The London County Council and the Water Companies . . . 1427
Birmingham Water Supply—Progress of the Welsh Scheme . . 1427

ESSAYS, COMMENTARIES, AND REVIEWS:—

Gas and Water Companies in the Stock Market 1428
Electric Lighting Memoranda 1428
American Engineering Competition 1428
The Paris International Exhibition—A Walk Through. . . . 1430
The Path of Patent Office Reform 1432
The Chemistry of Tars and Mineral Oils 1433

NOTES:—

A Criterion for Pipe-Discharge Formulæ 1434
The Action of Water on Asphalte 1434
Tough Coal-Tar Paving 1434

TECHNICAL RECORD:—

The Incorporated Gas Institute—The Programme for the Forthcoming Meeting—The Annual Report and Accounts 1435
Manchester District Institution of Gas Engineers—Excursion Meeting to Kendal and Windermere 1435
Manchester and District Junior Gas Association. 1435
The Incandescent Gas-Mantle and Its Use. By Vivian B. Lewes, F.I.C., F.C.S. 1436
Determination of Benzene and Ethylene in Coal Gas 1439
Water Hammer in Pipes 1440

REGISTER OF PATENTS:—

Anti-Vibratory Incandescent Burners—Frith, G. H., Bentham, F. H., and Stott, J. H. 1441
Gas-Engine Exhaust Silencers—New, A. G. 1441
Street-Lanterns for Incandescent Gas-Burners—Talbot, H. . . 1441
Low-Pressure Incandescent Lighting Apparatus—Sugg, W. . . 1441
Lighting Gas from a Distance—Anspach, J. 1442
Gas-Engines—Dougill, A. 1442
Patent Notices 1442

CORRESPONDENCE:—

Mr. Carpenter's Paper on Inclined Retorts 1443
The Calorimetry of Coal Gas 1443

PARLIAMENTARY INTELLIGENCE:—

Gleanings from the Committee Rooms. 1443
House of Lords—Progress of Bills 1444
House of Commons—The Supply of Carburetted Water Gas—Progress of Bills 1444
House of Commons Committee—
The Gaslight and Coke, Commercial Gas, and South Metropolitan Gas Companies Bill 1445
South Metropolitan Gas Company Bill 1446
Wandsworth and Putney Gas Bill. 1449

LEGAL INTELLIGENCE:—

The Intimidation of Gas Stokers at Newport (Mon.). 1454

MISCELLANEOUS:—

West Riding Coalowners and Gas Coal Contracts 1454
Manchester Corporation Gas Supply—Settlement of the Coal Contracts 1454
Birmingham Corporation Gas Supply—The Annual Report of the Committee 1454
The Price of Gas at Leeds 1455
Stafford Corporation Gas and Electricity Supply—The Past Year's Working; The Bonus Scheme 1455
Sales of Stocks and Shares 1456
The Gas Supply of New York 1456
Electric Lighting Notes 1456
Metropolis Water Supply—The Carrying Out of the Intercommunication Scheme 1457
The London County Council and the Water Question—An Explanatory Report by the Parliamentary Committee 1457
Gas and Water Companies' Stock and Share List 1457
The Water Supply of Birmingham—Annual Report; The Elan Valley Works 1458
The Tonbridge Local Authorities and the Water Company's Order—Consents Dispensed With 1459
Kimberley Water-Works Company. 1459
Notes from Scotland 1460
Current Sales of Gas Products 1461
Coal Trade Reports 1462

PARAGRAPHS:—

PERSONAL: Mr. J. Ferguson Bell 1434
OBITUARY: Mr. G. Earl; Mr. Joseph Stanford; Mr. Charles Hooker. 1434
Society of Engineers—The Work of the City and Guilds of London Institute—A Committee on Patents 1427
Preventing the Pollution of the Leeds Water Supply—Bingley Gas Affairs 1442
Fatality at the Ashton Gas-Works 1444
Increase in the Price of Gas at Newcastle—Gas Poisoning at Bingley 1454
Wages of Leeds Gas Workers—Malta and Mediterranean Gas Company, Limited 1462
Heywood and Middleton Water Undertaking—The Present Condition of the Coal Market—The Coal Production of the World—A Second Main from Thirlmere to Manchester—The Winsford District Council Propose to Purchase the Gas-Works—Additional Storage for the Lytham Gas-Works—Barnoldswick Gas and Water Supply 1463
Birmingham's New Reservoir at Frankley—Coventry Corporation Water-Works—Newbury Corporation Gas Supply—Bradford Gas Discounts and Accounts—Portsmouth Water-Works Company—The Salary of the Plymouth Water Engineer 1464
Water Charges to Bradford Manufacturers—Formation of a Reservoir Rating Association. 1465

EDITORIAL NOTES.

The South Metropolitan Gas Bill—A Great Triumph.

OUR notes on the proceedings of Mr. Mark Oldroyd's Committee were perforce broken off at a most critical and interesting juncture. We were able to signalize the decision of the Committee accepting the preamble of the South Metropolitan Bill as proved; while remarking that the conditions attached to this acceptance were more stringent upon the Company than those originally submitted in the Bill. The main objects of the promoters were three in number: The first was to give effect, so far as the scope and powers of the South Metropolitan Company extend, to the recommendations of the Powers of Charge Committee of last session. The second was to give the public the advantage of cheap gas, freed from the financial and other burdens of artificial enrichment. The third was to get rid of penalty gas-testing, in favour of a substituted system of ascertaining the average illuminating power of the gas actually supplied, upon which the standard price under the sliding-scale was to be based. As we recorded last week, the Committee approved unreservedly of the first two objects, and overruled the captious and ill-advised opposition of the London County Council. We shall have something to say later as to the character of some of the so-called evidence offered in support of this opposition. The only point in regard to which the promoters failed to convince the Committee of the justice of their views was the proposal to vary the standard price with the average illuminating power.

This the Committee would have none of. Announcing the decision of the Committee, the Chairman said they thought "it would be very unwise and inexpedient that a "floating standard should be adopted." Therefore, with a view to carrying out what they considered the chief object of the Company—to cut down the standard price together with the statutory illuminating power—the Committee suggested that a new fixed standard of 3s. 1d. for 14-candle gas, the testing to remain exactly on the same basis, and to be subject to the same rules as before, would meet the requirements of the case. There the matter stood until last Wednesday. The suggested amended conditions were laid down by the Committee "for acceptance or refusal" by the Company; and when we last wrote on the subject, it was very doubtful whether the Company would be able to accept these conditions, and so save their Bill. The existence of this doubt was pretty clearly indicated in last week's "Editorial Notes."

The Company, as we surmised, were disappointed at the adherence of the Committee to the old system of penalty testing, albeit, as the Chairman of the Committee observed there would be the great change that the examiners would look for 14-candle instead of 16-candle gas. This means a downward range to 13½ candles without penalty, and to 13 candles for a penalty of 40s. This was undoubtedly an enormous gain for the consumers, who would at the same time receive every farthing of whatever economy in the cost of manufacture the change might bring about; but it was not what the Company wanted, especially for the immediate future. No London Gas Company, under existing conditions, can know anything about the manufacture of 14-candle gas—or, to put it more broadly, of unenriched gas of any quality indicated by the photometer. What the Company sought to obtain was complete liberty of action in this regard; and for this they offered to pay, on the ascertained results. The advantages of such liberty to all parties are obvious. The Committee, however, while not oblivious of them, could not bring themselves to allow a statutory Gas Company so much rope. It meant breaking with the whole of our national system of statutory gas examination; and they were unable to create so momentous a precedent on the evidence before them. Far be it from us to dispute the deliberate judgment of a tribunal of such conspicuous competency as this exceptional Committee has proved itself to be; and therefore we will content ourselves with an expression of regret that the cardinal importance attached by the Committee to this point of the fixed data of standard price and illuminating power was not appreciated earlier, when it might have been possible for the Company to have strengthened their case for a change of system.

It almost appeared, for a time, as if the hard-and-fast

prescription of a 3s. 1d. standard price and 14-candle power would wreck the Bill. As a matter of fact, the Company not only do not know how to make 14-candle gas to the best advantage, but they cannot do so even if they would. The artless suggestion of the opposition that gas of 14-candle power and under can always be made at will by the simple expedient of overrunning the exhauster, does not commend itself to gas engineers worthy of the name, who have no fancy for dealing in those expensive gases, nitrogen and carbonic acid. The South Metropolitan Company have a stock of coal bought for the purpose of making 16-candle gas, and the worst of it only needs enrichment by one candle to pass the actual standard. By stopping enrichment altogether, the Company might send out 15½-candle gas from their Durham coal; and, as it happens, they have made a considerable purchase of Yorkshire coal, which will yield 16-candle gas without enrichment. Thus, if the Company had been compelled to take the Bill as it appeared to stand amended at the adjournment on Friday week, they would have been in the awkward predicament of having sacrificed their old initial price while being still compelled, by circumstances beyond their own control, to go on sending out gas of the illuminating power to which the lost standard price properly corresponded.

By Wednesday, however, as everybody hoped, a middle course was found out of what would have been a most regrettable deadlock. The Chairman of the Committee, in the handsomest way, declared that after rising the previous Friday he and his colleagues had been struck with the reflection that their decision seemed to make no allowance for any transition period such as all practical men must allow to be inevitable in the case of a great gas undertaking called upon to readjust itself to new working conditions. Therefore, while adhering to the principle of their decision, the Committee were anxious to hear the promoters on the question of how the adjustment might be made without injury to the Company's interests. Mr. Livesey was accordingly called to the witness-chair again; a feeble protest from the opposition to what Counsel tried to call this reopening of the preamble being effectually quelled by the Chairman. Mr. Livesey had no difficulty in showing the Committee, already in full sympathy with him on the point, that some time must perforce elapse before the Company could adapt themselves to the new conditions. Naturally, the Committee wanted to fix a date, or dates, for the successive drops to 15 and 14 candle power; but Mr. Livesey showed the greatest reluctance to be pinned down to dates. He was willing to engage, in order to get rid of the objection to what had been called the "floating" standard, that the reduction, whenever made, should not be reversed; but the Committee were not to be shaken. Then Mr. Livesey pleaded the cause of the shareholders, many of whom have bought South Metropolitan 4 per cent. stock at 142 or thereabouts, and would undeservedly suffer if the proposed change were made while coal remains so dear. To this line of contention the Chairman was obdurate; and again the prospects of the Bill seemed to be clouded over. The able diplomacy with which this very serious and momentous discussion of the fundamental lines of the most important Gas Bill since 1876 was conducted on both sides of the Committee-room table, was very noteworthy. Mr. Livesey and the Chairman were perfectly matched; and although the issue was for some time doubtful, the evident desire of both to save the Bill eventually composed all differences. Mr. Livesey, having thoroughly sounded the Committee's intentions, took the opportunity of the adjournment for luncheon to consult his colleagues of the Board, who were just then sitting at the Old Kent Road; and his final communication to the Committee on his return was to the effect that the Company would consent to come down to the 15-candle standard as from July 1, 1901, and to the 14-candle standard within four years later. He gave reasons for this delay which satisfied the Committee, who instantly accepted the proposal; and, after a parting shot at the London County Council, which will make it very difficult even for this Bill-loving body to reintroduce their portable photometer scheme, Mr. Livesey carried off his Bill amid the heartiest congratulations of most of those who had been interested in the proceedings, not excepting the members of the Committee. The promotion of the Bill all through was a fine performance, although it may be safely opined that only the personality of Mr. Livesey could have carried to a triumphal issue so sweeping a scheme of reform of the statutory settlement of a London gas undertaking of the first order of magnitude.

The Wandsworth and Putney Gas Bill.

The tale of legislative work done by Mr. Oldroyd's Committee was completed by the passing, with amendments offered by the promoters, of the Wandsworth and Putney Gas Company's Bill. This is a very simple and ordinary measure for the conversion of the Company's share capital; its increase by £300,000; and power to acquire additional gas lands. The exceptionally good public record of the Company practically disarmed the perfunctory opposition offered by the London County Council and the Local Authorities of the district. Again, the Committee showed by their dealing with the Bill that economical administration and cheap gas are certain passports to the delectable land of parliamentary favour and protection. The opposition had only the hackneyed old claims to prefer; and these they would not abandon in conference with the promoters, although an opportunity was afforded for the amicable adjustment of real differences. In the event, the Company offered a new testing-station at the Wandsworth District Council Offices; and this concession to photometry was deemed by the Committee to be sufficient. The decision of the Committee to accept the preamble as drafted was a high testimonial to the character of the Company's past and present management. The repulse of the attempt to force the Company into the inner group of London Gas Companies was noteworthy as a confirmation of the precedent of the Crystal Palace District Company's Act; and the successful defence of the Company's standard price for gas was of the utmost significance and value, in all the circumstances of the case.

The Coal Market.

It is as yet too early to say what the prospects are as to the probable state of the coal market next winter; but the immediate outlook may be summed up in the remark made a few days since by a dealer on the London Coal Exchange: "There will be no 'summer prices' this year." Reports from the principal centres of the trade all point in the same direction; for although almost every colliery is busily turning out good tonnage, no stocks are accumulating, while there is little coal put on the market for sale except when merchants are disappointed of the requisite shipping for getting their contract deliveries made. Those buyers who are in immediate need of coal, and who have been holding back in the hope of a decline in prices, are consequently obliged to buy at practically whatever price is asked, with the result of hardening the market. The trade with the Baltic is just now in full swing, and the demand from that quarter is unusually heavy; the shortness of fuel in Russia, where industrial activity is very great, being a source of much trouble and anxiety to the Government, who own and run the rapidly developing railway system of the Empire both in Europe and Asia.

So long, therefore, as there is such a ready market for coal abroad, prices at home are little likely to fall, in spite of the decided check to business that is resulting from the dearness of both fuel and metals. It is, then, of interest to note the report that (according to the "Philadelphia "Public Ledger") the Russian Imperial Government have been making overtures to the Berwind-White Coal Mining Company of America for the purchase of nearly half-a-million tons of coal for shipment to the Baltic. No definite sale has been arranged up to the present. But the fact that such negotiations are "in the air" is significant; and their termination in actual business would have no small effect upon the English market. Note may also be taken of the fact reported from Berlin, that in Germany "it is recognized more and more generally that the great "rush of business in the iron industry has passed its "climax." There, as in this country, the manufacturers of finished goods report a decided slackening in orders; and this—unless, as does not seem likely, the check be only temporary—will sooner or later react upon the coal demand. The Glasgow Correspondent of "The Times" especially refers to the fact that new orders are not being received in the iron trade at all equal to old orders as they are completed; the reason given being that "the prices "asked for fuel are practically prohibitive, as consumers "cannot command a proportionate advance in the price "of the manufactured article." The correspondent also reports that several mills have already been stopped owing

to the diversion of orders to the United States. It may then truly be said that the heavens are no longer as brass. The cloud "no bigger than a man's hand" is discernible on the horizon; and though relief to the coal and iron consumer may come tardily, it is even now on the way.

One point in the political economy of the present situation does not appear to have received anything like adequate attention in the Press; and that is—as we have often remarked—that for the existing state of the iron, and consequently of the coal, trade we have in no small degree to thank the constant endeavour of the nations to outvie one another in the magnitude of their navies. So many good people hug themselves with the fallacious idea that the employment of thousands of men in building and manning our vast Navy is "good for trade." So it is—good for the shipbuilding, metal, and coal trades; but for the trade of the country as a whole, emphatically not. It cannot be too plainly stated that every pound so spent is non-productive—being an absolute charge on the wealth of the nation for the protection (not production) of its property. If, in an undue and disproportionate anxiety for his own safety or that of his property, a £40 householder were to employ half-a-dozen men to walk up and down outside his house every day and night, it would be good for those men to be earning their living, but it would be a very expensive luxury for him who employed them; and by the cost of every man with whose services that person was able to bring himself to dispense, he would be so much the richer. We are not, of course, contending (or suggesting) that we can dispense with a ship or even a man from our Navy—it may be that more of both are needed—so long as other countries maintain or increase their sea armaments. The point is that the taxpayers in all countries should realize the price that has to be paid for this apparently unlimited competition in navy-building. The present cost of coal is certainly part of that price. A shilling income-tax is also not without its share therein.

The Programme of the Gas Institute Meeting.

The programme of the forthcoming meeting of the Incorporated Gas Institute has been issued, and the full particulars of the official announcement will be found in another column. It will be only a two days' meeting, as regards technical business, commencing at 10.30 a.m. on the 12th prox. at the Royal United Service Institution, Whitehall. The chair will be taken by the President of the Institute, Mr. E. Herbert Stevenson; and immediately after the delivery of the Inaugural Address, resolutions relating to the proposed amalgamation of the Institute with the Institution of Gas Engineers, to form a new national organization, will be dealt with. The papers and communications are much less numerous than usual, as is dictated by the special circumstances of the meeting; but they are all of very fair promise. Mr. W. R. Chester, of Nottingham, will read a paper on "Automatic Stoking "and Inclined Retorts"—a subject on which the last word has certainly still to be said. Mr. A. T. Walmisley, of London, will discourse with authority on "Roofs for "Retort-Houses." Mr. J. Wilkinson, of Drighlington, will expound "Some Disputed Points amongst Gas and "Water Experts;" and Mr. William Young, of Peebles, will treat of "Naphthalene from the Retort to the Point of "Deposition." In addition to these papers, there is to be a lecture on the Wednesday morning by Mr. W. H. Y. Webber, with the enigmatical title, "The New Gas." This technical *pabulum* will be amply sufficient for the short day-and-a-half available for its production and assimilation. On the Wednesday night, the Institute excursion to Paris will begin; and a full programme of travel and Parisian sight-seeing will occupy the rest of the week. A reception at the Gas Pavilion in the Exhibition, upon the invitation of M. Th. Vautier, President of the International Gas Congress, will signalize the last day of the brief trip. All the arrangements have been made with the thoroughness and careful attention to detail for which the Secretary of the Institute—Mr. Walter T. Dunn—is so honourably distinguished; and there need be no fear that the members of the Institute who trust themselves to his guidance will have the smallest reason to regret their confidence. It is to be hoped that the gathering, both in London and in Paris, will be a full one. Subscribers to the Benevolent Fund are reminded that the annual general meeting will be held on Tuesday, the 12th prox., immediately following the morning sitting, at about 1 p.m. This fixture is an improvement on the practice hitherto followed of putting off the Benevolent Fund meeting until late in the afternoon; and a good attendance of the contributors is particularly desired on the present occasion.

The Committee on "Municipal Trading."

It is somewhat incomprehensible to those who do not know the little ways of the Municipal Progressive, that the appointment of a Parliamentary Committee to inquire into the subject of trading by municipalities should have been received with much clamour of deprecation from those who profess themselves most fully persuaded as to the expediency of the practice. It might be thought that if the system is all that Progressive fancy paints it, there could be no valid objection to the fact being established to the satisfaction of a Joint Committee, and the confounding of all cavillers outside Parliament. However, it was otherwise; and even when the Committee began their work, one of the choice new journalistic flowers of Progressivism judged it fitting to try to be sarcastically funny, in the style of the halfpenny "comic" newspaper, over the whole business. The matter is nevertheless serious enough—far too weighty, indeed, to be disposed of by an exercise in criticism of the quality that might possibly suffice for the discussion of a personal squabble at a vestry meeting. Sir Henry Fowler, as President of the Royal Statistical Society, chose the subject of "Municipal Finance and "Municipal Enterprise" for his Inaugural Address; and he gave striking figures showing the growth and present extent of the local national debt, which is practically the creation of the century. This important address forms a complete justification of, as well as the best introduction to, the investigation now being conducted by Lord Crewe's Committee. Sir Henry Fowler stated the amount of the local national debt at upwards of 262 millions sterling, of which more than one-half is for absolutely necessary and compulsory purposes. He holds that the local taxation which pays for this burden is "most unfairly levied;" but, inasmuch as this part of the question is now under consideration of a Royal Commission, it must stand over until the Commission has duly reported. So-called "trading" and similar enterprises stand British Local Authorities in 87½ millions of capital, and just pay for themselves.

We shall take another opportunity for discussing what Sir H. Fowler has been able to advance respecting the rights of consumers under municipalization; and for the present we may confine our notice to the Committee proceedings. Sir Courtenay Boyle, for the Board of Trade, was naturally the first witness. He expounded the Parliamentary and Departmental attitude in regard to the supply of gas, water, and tramways, as based on recognition of the undesirability of competing services; while, as regards electricity supply, the rule of limited competition prevails. In speaking of gas supply as an enterprise falling well within the competence of local authorities to undertake, Sir Courtenay Boyle was careful to point out that the gas industry has an important industrial branch in the residuals department, which cannot well be separated from the main business. As regards what is often held to be another branch of a gas undertaking—the dealing in gas consumers' necessaries and accessories—Sir Courtenay Boyle declares that the Board of Trade feel it desirable to draw the line somewhere, in the case of municipalities. The Department does not greatly favour the sale of gas-fittings by municipal gas committees, and is dead against their manufacture. "The Board of Trade had always objected "to corporations being allowed to make or sell fittings. "If the supply of these things was necessarily incidental "to the supply of electricity, it might be permitted; but "not otherwise. For instance, the provision of a good "supply meter (*when one was found*) might well be entrusted to "corporations." The words italicized may be commended to the notice of the "Electrician," which has only recently repeated some disparaging observations, originally made in Germany, on the gas-meter as compared with the ordinary trade electricity meter.

The Bank-Rate and the Price of Gas Stocks.

The period of dear money that has lasted from the autumn until recently has now come to an end, though the present easier condition of the market is not, we think, likely to subsist for long. The climax of the period was reached in November; and from the last day of that month until the second Thursday in January—that is to say, for six

weeks—the bank-rate was at the altogether abnormal figure of 6 per cent. It then fell to 5; and on the succeeding Thursdays to 4½ and 4 per cent., at which latter figure it remained until last week. The Directors then reduced the rate still further to 3½, preliminary, in all probability, to a fall to 3 per cent., to which figure the Bank of France have already lowered their rate. This cheapening of money should steady the price of gas stocks; though, so far as the financing of the Companies themselves is concerned, the fall in the rate happens somewhat unfortunately—this being a time when (the money coming in hand over hand for the second winter quarter's consumption, while payments for wages and, as a rule, coals are at the summer level) Gas Companies are more likely to be depositors with, than to be borrowers from, their bankers. Taken as a whole, however, the industry will possibly not, during the next twelve months or so, have much superfluous cash at its disposal; for the high price of coal will necessarily lock up in the coal stores a very much larger amount of floating capital than is utilized in normal times, provided always that the Companies are able to build up such stocks as prudent managers, with last winter's experience fresh in their memory, must wish to have in their hands before facing the always somewhat uncertain demands of the winter season.

To take a normal year, the coal stocks of the three Metropolitan Companies at the end of 1898 totalled up to 375,000 tons. To provide for these stocks on Dec. 31 next, at the prices now ruling, would necessitate the employment of somewhere about £150,000 of additional floating capital. Moreover, as the increases in the price of gas in London—both those announced and those inevitable but not yet determined—will not bring anything near the amount of cash into the coffers of the Companies by the end of the year that will have to be paid away for coal at the higher contract rates, the Companies are likely to be heavy debtors to their bankers when the books are closed on Dec. 31. It is, of course, unnecessary to point out that for issuing fresh stock no time could be more unpropitious than the present; and, under the special circumstances, the bankers of any gas undertaking having a fair margin of unexhausted capital powers should be only too pleased to afford the accommodation necessary to carry the concern through to a more convenient season. It follows therefore that, although undertakings of such credit as Gas Companies should rarely have to pay the full bank-rate on their loans, the price of money during the next year or so will be of more than ordinary importance to gas managers.

Unfortunately, in view of the condition of the Money Market in Germany and Russia, and considering the heavy disbursements of our own Government on the war account, we do not think that the present easement of the Money Market is more than temporary; the probabilities being all in favour of dear money again in the course of three or four months—involving, of course, a tendency to further depression in gas stocks. Meanwhile, to those holders of gas securities who are agitated by the present low price thereof, an article on the subject which appeared in last Saturday's "Economist" may be commended for perusal, especially the concluding remark that, "on the whole, the "gas industry, whether carried on in the United Kingdom "or abroad, has proved a very remunerative form of enter- "prise for investors, and has survived many threats of "partial or total extinction. And it is for investors to "consider whether, in view of the steadily remunerative "character of the industry, a period of temporary depression "may not be their opportunity."

Another Outrage on Political Economy.

Poor Political Economy—scholastic, not actual—received another staggering blow in the house of its ancient friends, the Liberal Party of this country, last Wednesday. In the "Daily News" of that date may be read a lament that the House of Lords so summarily rejected the Shops (Early Closing) Bill at the instigation of that modern representative of the stern, unbending Individualists, Lord Salisbury! This is really a very interesting sign of the times. We all know the leading points of the Cobdenite philosophy, and how strenuously those who professed to understand and tried to follow it protested against even the Factory Acts as an unwarrantable legislative interference with the principle of the liberty of even women and children to sell their labour as they chose. The world has travelled a long way since that time. Still, it comes with something of a shock when the leading newspaper of the so-called Liberal Party, which professes to hold in direct descent from the great economists of the middle of the century, attacks a Conservative Statesman for demurring to the proposal that the early closing of shops in any district may be imposed on all shopkeepers by a majority vote. Where are we? The "Daily News" says that the Bill with this remarkable object, "whether right or wrong in principle, "is desired by a large class of shop assistants as the only "means of ensuring them a reduction in their excessive "hours of labour"—wherefore it should be passed as a matter of course. Once more, one may well ask, where is that shade of Cobden which is occasionally heard of, in flights of rhetoric, as still frequenting the precincts of the House? It is more to the point, however, to inquire of those who would yoke every amelioration of the lot of working people to an Act of Parliament, to look at the matter all round, and before and after. We are all for humanitarian reforms nowadays. The public taste and the public morality are gradually, but, as we hope and believe, certainly, rising. Is it either expedient or right that, as soon as those things which used to be done or suffered as a matter of course by everybody fall to be considered as the backwardness of a minority, an Act of Parliament must be passed to put them down by sheer force of law? It is the early beginnings of reform which need helping by the Legislature, if possible. When the Saturday half-holiday was being fought for by the British workman; and the early closing movement was being welcomed by a few public-spirited shopkeepers, where was Parliament? With regard to invoking the strong arm of the law to bend to a sanitary or other true reformation some few hopelessly ignorant or reactionary citizens who will not otherwise participate in it, there is something to be said; but many causes are best left outside the direct action of the Legislature. The force of public opinion is the only motive power that makes any law operative; and it can do an infinity of good or evil, as the case may be, without reference to any form of law at all.

For the Preservation of the Picturesque.

It has already been said of the latest of the trunk line railway extensions to London, now called the "Great "Central," that, whatever their quality as engineering, the bridges, viaducts, and all other structures of this line which might be generally classified as public works, are characterized by the most unmitigated ugliness. They are not merely ugly—they are meanly, crudely, aggressively, and unnecessarily hideous. This soft impeachment of the Great Central railway engineering arouses in thoughtful minds an uncomfortable suspicion that it might be enlarged to embrace most of the latest appliances and appurtenances of modern civilization. How is it that all the newest triumphs of material progress in the adaptation of the forces of Nature to the service of mankind are so undeniably ugly? Not to more than mention the new Charing Cross street arc lamp-posts—the glaring arc light itself, or the thin red line of the incandescent electric lamp in its hard glass integument, is not beautiful as a living flame is beautiful. We would not say that an incandescent gas-mantle is any improvement, as regards looks, on a cheerful flat-flame, even of the much-maligned butcher's "flare." And is the motor car a thing of beauty? Not more so than is the electric tramcar with its overhead strings and the horrible bent pole that connects them. It is well that the newest electric railroads are being put underground; for there they do not offend the eye. So urgent is the need for doing anything and everything that it is possible to do to prevent the unnecessary spoiling of towns in the process of making them more convenient to live in, that it should be strongly recommended to every young engineer and mechanic to keep alive and strengthen in himself the sense of, and natural love for, beauty. We English are not an artistic people; but we need not all sink to the æsthetic level of the Great Central engineers and the St. Martin's Vestry. Every engineer should know something of the principles of architectural design, and learn a little music. Every mechanician should have an appreciation of the treasures of the South Kensington Museum; and keep a soft place in his affections for some branch of natural history. Young engineers have a tendency to get absorbed in the practical side of construction; so that, unless this preoccupation is corrected, they will go and

build a thing like the Lambeth Bridge when they get the chance. Electrical engineers get so obsessed with the charms of the trolley-wire, that they would run it along the Victoria Embankment; and we are only too familiar with the lamp-post, unredeemed by the simplest Art. If life is to be endurable in the cities of the future, this must be altered. Otherwise, as the natural fauna of a country possessing no economical value are preserved as specimens in National Parks, so it will be needful to set aside an English cathedral city and a few prettily-situated villages, and forbid any more civilization of the material kind to touch them. It will soon be too late even for this.

WATER AND SANITARY AFFAIRS.

The attitude of the representatives of the London County Council at the inquiry held by Mr. Charles Perrin, on behalf of the Local Government Board, on Monday last week, on the subject of the intercommunication scheme of the associated Water Companies, seemed to indicate a return to something like reasonableness on the part of the Council in regard to the Metropolitan Water Question. For a round dozen of years that body has persistently depreciated the present supply, and inveighed against those who have been entrusted by Parliament with the duty of furnishing it. Yet, with what seems to us to be singular inconsistency, whenever steps have been taken to improve it, they have met with strenuous opposition. When at length, by the intervention of a higher power than that at Spring Gardens, an Act was passed authorizing the coupling-up of the Companies' systems, and the Local Government Board are applied to for sanction to the raising of the necessary money and to the scheme generally, the Council feel that they must needs play the part of the watch-dog. However, it was refreshing to hear their Counsel state that they were not present in any hostile spirit, and that if the Local Government Board were satisfied with the estimates put before them, well and good. Why have they not always acted thus?

Very different was the feeling displayed at the meeting of the Council the following day, when a long report by the Parliamentary Committee recording the fate of the Water Bills, and explaining the various steps taken in the course of the proceedings which led to this result, was formally brought up. It had been on the *agenda* for some few weeks, to allow time for its consideration. It is never an agreeable duty to report defeat, or even reverse, as those who are conducting the present campaign in South Africa have unfortunately had to admit; and consequently the Committee had to make out the best case they could. They claimed for the Council the credit of having used every effort, "in the interests of the ratepayers and water "consumers of London," to obtain a settlement of the water question—going even so far as to offer to modify the proposals contained in their Bills—but with no other result than that of meeting opposition from the Government. We fail to see how they could have expected anything else, in view of the unequivocal terms of the report of the last Royal Commission. Mr. Cornwall, the Chairman of the Committee, declared that the way in which the Council's Water Bills had been treated was "gross "injustice" to London; Sir Arthur Arnold characterized the report of the Commission as a failure; and Mr. John Burns, M.P., favoured his colleagues with one of his vituperative speeches, which had about as much effect upon the parties against whom it was directed as did the "terrible curse" pronounced by a certain celebrated dignitary of the Romish Church against the purloiner of his ring. One member of the Council candidly confessed that he was "sick of the whole business"—a feeling which is doubtless shared by many of the ratepayers, seeing that about £56,000 of their money has, according to Mr. Westacott, been squandered in the fruitless prosecution of Water Bills. But the merry game is by no means ended; for the Water Committee wish to have the Standing Orders suspended, so far as they would affect proposals for legislation next session dealing with the Metropolitan Water Supply, and to be authorized, if they deem it advisable, to recommend applications to Parliament on this subject at any time up to the 13th of November.

About a month ago, we referred to the caution which the Water Committee of the Birmingham Corporation had considered it necessary to give to the consumers against extravagant use of water; and further evidence of anxiety as to maintaining the supply to the city during the coming summer is afforded by the Committee's annual report, the principal portions of which appear in another column. In spite of the restrictive measures adopted last year, by which the consumption of water was reduced, the quantity distributed showed an increase of 6 per cent. on the previous year. As the attempts to find temporary sources of supply have been unsuccessful, and the steps taken to increase the yield of those now available have been productive of only disappointing results, the Committee intimate that further measures of compulsory curtailment of the supply will be imperative if the experience of the last two years is repeated this summer. As an intermittent supply will only be resorted to at the last moment, they appeal to consumers to exercise the most rigid economy in times of drought. In this serious condition of affairs, the progress of the great undertaking which is to bring to the city a supply of water from Wales is watched with keener interest than usual. Unfortunately, the weather during last winter was not favourable for carrying out the works in the Elan Valley; and consequently comparatively little was done in connection with the building of the various dams. During the year ending the 31st of March, a sum of £170,219 was expended on these works, bringing the total outlay up to £829,132. The portion of the aqueduct from Elan to Dolau, which was entrusted to Messrs. John Aird and Sons, is practically finished; and progress is being made with the other sections, though it is not quite so fast as could be desired. As no relief can be afforded by any intercommunication system in Birmingham, everybody concerned—Water Committee and consumers alike—will rejoice at the speedy completion of this important scheme of water supply. But unforeseen difficulties have arisen, and they have only been overcome by skilful engineering and an additional expenditure of about £30,000. It is to be hoped the work will now go on steadily until the end.

Society of Engineers.—We have received from the Secretary of the Society (Mr. Perry F. Nursey) the volume of Transactions for the past year. It is a book of 258 pages, with a goodly number of folding plates. Of the seven papers read during the session, only one—"Water Supply to Country Mansions and Estates," by Mr. Gordon Harris—was on a subject in which our readers are directly interested. Among the obituary notices, reference is made to the career of the late Mr. W. H. H. Broadberry, who was elected a member of the Society in 1881. At the end of the volume is the general index to the Transactions from 1857 to 1899. The book has been produced under the editorship of Mr. Nursey.

The Work of the City and Guilds of London Institute.—We learn from the annual report of the above-named Institute that at the Central Technical College there were at the last winter term 272 students, of whom 115 took the civil and mechanical engineering course, 94 the electrical engineering course, 24 the chemical course, and 39 the special course. At the close of the session, the diploma of the Institute was awarded to 39 matriculated third-year students. The gross amount of fees received from the students during the year was £6797, of which £467 was remitted in the form of studentships. The cost of the College in excess of the amount received from students' fees was £5813. At the Finsbury Technical College last session there were 180 day students, against 185 in the previous year; and the evening classes were attended by 649, against 760. The report was adopted at the annual meeting of the Institute, held at the Mercers' Hall, Cheapside, last Wednesday, under the presidency of the Lord Chancellor.

A Committee on Patents.—The Board of Trade have appointed a Departmental Committee on Patents, to consist of Sir E. Fry (Chairman), Sir R. Webster (Master of the Rolls), Sir E. Carson (Solicitor-General), Sir W. H. Houldsworth, Bart., M.P., Mr. F. J. S. Hopwood, C.B., C.M.G., Mr. S. E. Spring Rice, C.B., Mr. J. Fletcher Moulton, Q.C., M.P., Colonel T. W. Harding, Mr. E. Carpmael, and Mr. H. Hughes. The Committee are to inquire into the working of the Patents Acts with reference to the following questions: (1) Whether any, and, if so, what, additional powers should be given to the Patent Office to control, impose conditions on, or otherwise limit the issue of letters patent in respect of inventions which are obviously old, or which the information recorded in the Office shows to have been previously protected by letters patent in this country. (2) Whether any, and, if so, what, amendments are necessary in the provisions of section 22 of the Patents, &c., Act, 1883. (3) Whether the period of seven months' priority allowed by section 103 of that Act to applicants for letters patent under the International Convention may properly be extended; and, if so, on what conditions. Mr. Arthur Paget has been appointed to act as Secretary to the Committee.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1457.)

THE state of affairs in the Stock Exchange last week was most disappointing. Everything was quite listless and inanimate; and dulness prevailed in every department. For weeks people have been saying, "Wait till Roberts makes genuine progress, and the end of the war is in sight," and, "Wait till we get money a bit cheaper, then we shall have our good times back again." And now that both conditions have been satisfied, it is provoking to find that the public will not move, as if rusted into immobility. Indeed, new factors of disturbance arose last week to impede enterprise; and Politics and the Plague were held up as bogies to frighten the timid investor. Of course, prices all round have had a further drop; and only here and there can any special exemption be found. In the Money Market, the most important item was the reduction of the Bank of England rate to 3½ per cent. from the 4 per cent. rate, which had reigned for exactly four months. The sudden and unexpected influx of gold rendered it inevitable, though there had been nothing to indicate the approaching change. Business in the Gas Market showed a very fair degree of activity, especially as compared with the general run of the markets; but transactions were to a considerable extent restricted to a few of the leading issues. Changes in quotation were few in number, and slight in degree; and though they were (again with one conspicuous exception) in the downward direction, there seems to be an approaching tendency to steadiness, as if the lowering of quotations in agreement with announced advances in the price of gas had gone far enough. In Gaslights, there was a further fall, as might be expected; but nothing much to speak of. The ordinary opened at 97, and was done once specially as low as 95; but this figure did not recur. Moderate business was done in the secured issues at lower prices. South Metropolitan was fairly active, and advanced another point. The triumphant passage of the Company's Bill—the first nail in the coffin of that costly extravagance, artificially enriched gas—is not yet generally understood. Commercials were quiet and unchanged. Very little was done in the Suburban and Provincial group; and movements were confined to a fall in British and Tottenham "B." Business in the Continental Companies was very quiet. Imperial gained a point, but lost it again; and Union was a little easier. Nothing occurred among the remoter undertakings. The Water Companies were almost devoid of incident; and the only changes were slight reductions in East London and Grand Junction.

The daily operations were: Business on Monday was almost all in Gaslight and South Metropolitan. The latter advanced 1; but Gaslight preference fell 1. Tuesday's transactions were much the same. Gaslight ordinary and debenture relapsed ½ each, and Continental Union 2½; but Imperial rose 1. Business continued fairly brisk on Wednesday. Tottenham "B" fell 2. In Water, Grand Junction dropped 1. Thursday was a little quieter; and the only change was a fall of ½ in British. Friday was the quietest day of the week; and nothing moved at all. On Saturday, there was considerable dealing in Gaslights at unchanged figures. Imperial lost the point it had been advanced. In Water, East London fell 2.

ELECTRIC LIGHTING MEMORANDA.

Rejection of the Manchester-Liverpool Express Electric Railway Bill—The Electric Lighting of Dublin by a New Company—The Estimates of Cost of Electricity Generation in Bulk.

ANOTHER salutary lesson to promoters of "wild-cat" schemes, electrical or otherwise, has been given by the rejection of the Bill for the "monorail" express electric railway between Manchester and Liverpool. It is satisfactory to know that the Committee threw out the Bill strictly on the merits, and not as a concession to municipal or any other kind of obstruction. It is very remarkable how open-minded most Parliamentary Committees are becoming. They are no longer slaves to precedent, and give proof that the average member of Parliament is better able to do good work on Select Committees now that he is not required to dance attendance on the rhetoricians of the House far into the small hours of the morning. This by the way. On the so-called "monorail" express line, the Committee decided that the idea is probably a good one; but the particular scheme before them was seriously incomplete in several most important respects. For one thing nobody could say convincingly what was likely to happen if an attempt was made to quickly bring to a standstill a train running at the high rate of speed proposed. It sounds odd that so obvious a consideration was not thoroughly gone into before the matter was brought into Parliament. Another objection lay in the nature of the proposed line of communication, as an overhead affair throughout. It has been plainly shown, as the Committee justly observe, that the principle of underground penetration to the heart of great cities is the least objectionable, and therefore it is to be preferred wherever practicable. The combined weaknesses of the overhead arrangement, and the uncertainty about the brake power, were too much for the scheme to live through; and, accordingly, it has collapsed, not much regretted by anybody.

A curious three-cornered fight has been going on over the future of electric lighting for Dublin. A Company, composed of some well-known local people, some of whom are also interested in the Dublin United Tramways Company, seek incorporation for the purpose of supplying the city with electricity for lighting purposes. This service is actually being performed by the Corporation, in a small and not very successful way; but, as we have had occasion to mention in this column, there is in contemplation a large scheme of extension of the Corporation undertaking under the direction of Mr. Robert Hammond. Mr. Balfour Browne, Q.C., had a pretty tale of this enterprise to tell the Committee. It was objected to the Company that they were really an off-shoot of the Tramways Company, whose attempt to get possession of the Dublin electric lighting failed. Consequently, it was easy to argue that what the Tramways Company had been prevented from doing themselves, directly, they were seeking to attain indirectly by the formation of this Company. The occurrence of certain prominent names on the Boards of both Companies lent colour to this contention. The Committee therefore found themselves confronted by at least three different interests. Here again, however, the Committee exhibited a notable desire to do what is best for the public, regardless of political considerations, or municipal "principles." Several important persons were called to inform the Committee that they preferred to see electric lighting in the hands of corporations rather than of private companies; but, astonishing to relate, the Committee declared the preamble of the Bill proved! It was probably the masterly evidence of Mr. H. F. Parshall in support of the Company's scheme that won over the Committee. This is for a direct-current service at 440 volts, vouched for by Mr. Parshall as being more efficient and serviceable, both for lighting and power purposes, than the alternating system as favoured by the Corporation. Against this ably-put evidence, the rival Corporation proposal made a very weak showing, although supported by Mr. Robert Hammond and Professor Silvanus P. Thompson. Of course, the Lord Mayor of Dublin declared that the Corporation meant to keep the electric lighting in their hands, and would still go on with their proposed extension scheme at the estimated cost of £254,000; but the Committee were not frightened. If the Corporation are stubborn enough to spend the money of the ratepayers on a competing scheme, and if the ratepayers are willing to let this be done, Dublin ought at least to be well off for cheap electricity. In view of the fact that the Committee inserted a purchase clause in the Bill, for the benefit of the Corporation, the waste of competition may after all be avoided. The chief interest of this decision for outsiders lies in the wholesome set-back it administers to the "principle" of Municipalism where merit is absent.

The Committee on the electricity-in-bulk schemes is laboriously working through these Bills. The Chairman has already got to the point of announcing that the value of electrical energy as a form of power for use in the national industries has been amply demonstrated; so that the parties need not pile up any more scientific evidence on this head. The Committee wants to get at the merits of electricity generation in bulk; but a vast accumulation of incidental considerations has first to be cleared away. In this matter, it is more than usually difficult to see the wood for the trees. Mr. F. E. Gripper, of Edmundson's Electricity Corporation, has been able to state that, with the exception of Niagara, electricity on a large scale can nowhere be generated more cheaply than in Lancashire. The statement probably applies equally to all coalfields. In Lancashire, at any rate, assuming a load factor of 25 per cent., Mr. Gripper estimates that a station with a capacity of 12,500 kilowatts will be able to generate and distribute electricity at a cost of 0·7d. per unit. Mr. Ferranti's estimate for the same thing in Durham is 0·65d. per unit, with nothing said about the load-factor. Mr. Swinburne advocates for the Tyneside, electricity generation in units of 4000 or 5000 horse power as a convenient commencement for a supply "in bulk;" but he does not appear to have stated the approximate cost per unit. If any of these schemes are realized, the result of correcting promise by performance will certainly be instructive.

AMERICAN ENGINEERING COMPETITION.

PASSING reference has already been made in the "JOURNAL" to a very interesting series of articles which have been appearing of late in "The Times" under the above title—articles written by a Special Correspondent of that paper who has recently visited the United States—and we now propose to consider some of the facts adduced and inferences drawn by the writer, as the subject is one of considerable importance to the gas industry from more points of view than one. In the first place, gas companies, as very considerable buyers of iron and steel goods, are, at the present moment, suffering severely from the high prices ruling for plant, machinery, and iron, steel, and tin goods of every kind. Those high prices being due to the excess of demand over supply, the question of the possibility of imports from America redressing the balance of the market, and thereby reducing prices to normal levels, is of no small importance. In the second place, the condition of the iron and steel market, not only here but also on the Continent and in America, being largely responsible for the abnormal price of coal, the future of that market in the States—which exercises

daily more and more influence on the English and European trade—is a matter of great interest to coal consumers. Finally, the process of gas manufacture involving much engineering skill, it is essential that those concerned in the industry should consider whether they have anything to learn, in regard especially to enterprise, fertility of resource, and originality, from that most astute of men, the American Engineer.

In regard to the probability of American manufacturers entering to a material extent into active competition with English iron and steel goods makers, not only in foreign markets but in our own, "The Times" correspondent is firmly of opinion that such an event is only a question of time. As the result of his observations, he says:

> As soon as supply overtakes demand in the United States, it is the fixed determination of American manufacturers to attack us vigorously in the neutral markets of the world, and even in our own home market. A prominent American steel maker—the head of one of the most important corporations in the country—recently declared in public that he would supply rails for abroad at cost price, simply to retain a hold on the market for use in duller times. In following out this policy, the Americans will rely largely on their protective tariff. It is their intention, when the reaction in trade comes, to keep up values in America by stinting the supply to the home market, and to force the export trade by cutting prices for foreign countries. That is the avowed intention of manufacturers with whom I have conversed; and the systems of combines, trusts, consolidations—or whatever name may be given to these recent wholesale amalgamations of factories—will render such tactics possible.

That is to say, the English consumer will benefit at the expense of the American. It will be of great interest in the years to come to see for how long the American consumer will allow himself to be fleeced at the will of the manufacturing trust, and to watch the growth—inevitable, though it may be long delayed—of Free Trade principles in the States. For the present, the question is: When will "the reaction in trade" over there make itself evident? Writing apparently at the beginning of the year, "The Times" correspondent did not anticipate any reaction in the near future. He said:

> At the present moment, American manufacturers of all classes have more than they can do to keep pace with the home demand; and this is more especially true of iron and steel makers. During a tour through the chief manufacturing States of the Union . . . I found everywhere the same tale of blooming prosperity, works of all kinds full of orders for a year or more ahead; old works being enlarged and new works being started. Never anywhere has there been such a period of commercial expansion since the factory system was established. Naturally in this way supply and demand act and react on each other, so that the ball may be kept merrily rolling for a long time yet. But some day . . . America will awake to the fact that she has more blast-furnaces, more steel-mills, more factories of all kinds, than the country demands for its existing need.

In spite of this apparent promise of full occupation for the whole of this year, our impression, strengthened by reading the articles before us, is that the Americans are so strenuously active, and design, erect, and set going new works and plant with such astonishing rapidity, that production is fast overhauling consumption, and that an overflow of surplus manufactures may pour into foreign, if not into our home, markets before many months are out. One of the causes of the great activity in the iron trade in the United States during the past two or three years, leading to the tremendous and rapid increase of factories and plant which "The Times" correspondent records, is to be found in the enormous amount of railway construction that has been in progress, no less than 3000 miles of new railway having been laid in the United States in 1898, and as many if not more in 1899. This extension of the railway systems in that country cannot, however, proceed indefinitely; and a falling away from the present phenomenal demand must inevitably result in the owners of the surplus plant turning their attention more and more to the export trade.

As to the question of whether Britain or the United States is commercially supreme, it is pointed out that the volume of business done is not a fair basis of comparison, unless the relative populations be taken into account; and that, looked at from this point of view, the still existing industrial supremacy of Britain is apparent. The imports per head of the population in 1898 were £1 13s. in America, compared with £11 14s. 1d. in Great Britain; and the exports, £3 7s. 9d. per head, as against our £5 16s. 2d. We are warned, however, in the following remarks, to look rather at the future than at the past:

> Those who rely wholly on statistics lean too much on the past. They think that when their tables do not supply instances, instances cannot exist. Such an attitude ignores change and the possibility of change; it is as if Adam had forecast the coming birth-rate upon data collected before the Fall. That is an attitude the British mind is a little too apt to take. British manufacturers and merchants ought not, therefore, to trust overmuch to "returns." They should visit other countries, more especially America, to see what facilities there are for production in this new land, and what sort of people it is with whom they will have to cope.

We are far from thinking that the American manufacturer is going to cut the Englishman out in his own market—at any rate, not for more than a short time. But it will be necessary for the competition to be smartly felt before our manufacturers will really stir themselves to meet it. We have had the markets of the world too much at our disposal in the past—business has fallen into our lap, so to speak, too constantly—for the English merchant to need to exert the whole of his capacity, or to sufficiently study the needs of his consumers. Just as the competition of electric lighting has aroused the gas industry from its lethargy and its *laissez faire* attitude—to the great benefit of both shareholder and consumer—while the pessimistic prognostications of those who, twenty years ago, would have us believe that the end of the business of gas supply was at hand, have been completely falsified, so the competition of American producers with English will, we believe, infuse new life into our own engineering and manufacturing centres, giving birth to improved processes, and therefore cheapened products, with advantages all round.

Apart, however, from the question of the benefit that consumers of iron and steel goods, and moreover the users of coal, must derive from the competition of American manufactures with our own, there are many points worth noting from the articles before us as to the differences observed by the writer between American methods, both in the production of their goods and in the selling of them. One most striking characteristic of the American producer—constantly emphasized in the accounts given by "The Times" correspondent of his visits to the various principal works in the States—is his readiness to immediately abandon good methods of production for new and better; preferring to sacrifice the capital spent on the discarded plant at once, rather than lose his customers eventually. Another secret of his success—one noted now not for the first time—is his constant, unceasing study, and attempted anticipation, of his customers' requirements. Speaking of the Tonawanda Iron-Works at Buffalo, the correspondent says:

> They teach that it is only by liberal if judicious expenditure of capital in maintaining plant in most efficient condition, and by studying the special needs of purchasers, that we can keep our hold on any trade. In spite of distance, and in spite of ancient prestige, we shall be beaten unless some of us wake up to the fact that obsolete appliances, old, slow methods, and the old carelessness of customers' needs, must give place to something more businesslike and more intelligent.

There are still not a few gas undertakings that might with great advantage realize the need of this substitution of new for antiquated methods alike of manufacture and of business. As an instance of the American method of meeting new custom more than half way may be mentioned the fact that the world-famed Carnegie Company, who employ over a hundred draughtsmen at their Pittsburg office, "will furnish designs for a building containing thousands of tons of steel, and make no charge for the design if they get the contract for the material." It is truly observed that "this is a marked contrast to our usual procedure with heavy architects' fees."

One of the most noticeable features of American works is the substitution, at every possible point, of machinery for manual labour. Again and again our contemporary's correspondent notes the marked absence of hands from the buildings where thousands of tons of material are being dealt with. He writes:

> Nothing seemed to me more notable at the Duquesne works than their *loneliness*. Had it not been for the subdued hum, characteristic of a furnace in blast, and the rush of waste water from the tuyeres, one might have thought the works were shut down. This is seen, more or less, throughout the United States, where great effort is made in all productive industries towards the replacement of human labour by mechanical appliances. From the humblest kitchen to the mammoth factory—from peeling apples or washing plates to heaping tons of coke and ore into a blast-furnace—the American always strives to do what he can by machinery; and the inevitable consequences are that labour is better paid, and that there is more demand for it, than in any other country. "For anything that can be done without thinking, we want to use a machine, so that men can be set free to work the best part of them—their brains." That is the position taken by the American. It is this that chiefly accounts for the apparent anomaly of high wages and cheap labour—that is, cheap in terms of the product.

It is obvious that, in some respects at least, Trade Unionists in the States must have much more enlightened views as to their own best interests than have their British brethren.

In illustration of the pitch of perfection to which methods of unloading ships have been brought, may be cited the ore-landing plant at Lorain, where 6000 tons of ore have been taken out of one ship and deposited on the stock heaps in twelve hours, at a cost of between ¼d. and ½d. per ton. Again, at the Illinois Steel Company's works, a vessel of 7000 tons is generally unloaded in from 11 to 12 hours:

> A vessel would be filled in about four hours; but the work had been performed in two hours. . . . It will be seen by those acquainted with the mineral industries of Europe that the methods of handling material adopted in the United States differ essentially from those in vogue on this side of the Atlantic. To a large extent the Americans have been forced by circumstances into new departures and improved methods, by geographical considerations, and the exigencies of their position. None the less, credit is due to them; and it is credit that no fair-minded Englishman will withhold. The ingenuity they have displayed and the courage they have shown in tackling difficulties during the uphill fight in putting their steel industry on a footing to compete with our own in neutral markets is worthy of all praise and admiration.

We agree; but would add that we have every faith that eventually, when the pinch of American competition is really felt, the English manufacturer will display equal ingenuity and courage, and will hold his own against his shrewd and intrepid competitor. But he will have a rough awakening, and will pass through a very bad time, before he can make up the lee-way he is at present more and more quickly making.

Before leaving, at any rate for the present, these very interesting articles—which we should like to see reproduced in book form, when they would be much more likely to be widely read—we will make one quotation for the benefit of Great George Street and elsewhere:

> Although we have in England a larger and more influential class of Engineers who sell only advice, I think on the whole, very much more advice is sought in America. The broad difference is that British advice is manufactured largely in offices unconnected with works; in America it is chiefly the product of the workshop.

We need not enlarge upon the point.

THE PARIS INTERNATIONAL EXHIBITION.

A Walk Through.

THE visitor to Paris who purposes devoting only one day to the Exhibition will find he has before him a task for the accomplishment of which a considerable amount of physical and mental endurance will be needed. The area to be covered is so vast, and the objects to be looked at so multifarious, that the powers of locomotion and the visual and perceptive faculties are alike taxed to their fullest capacity. For, without the slightest intention of perpetrating a very bad pun, there is unquestionably a considerable "eye-full" to take in on the banks of the Seine, as the present Exhibition covers a very much larger space than that occupied by any of those previously held in Paris. It is rather curious that, although we are in the habit of regarding the latter half of this century as what might be called the Exhibition Period in the history of nations—the impetus being given to the movement by the great show which was held in Hyde Park in 1851—the idea did not originate in this country, nor were we the first to carry it out. In point of fact, industrial exhibitions began with the French; the earliest recorded being held in Paris in 1798. Ten others followed at various periods down to 1849; the last exceeding all its predecessors in extent and brilliancy. It must have presented a striking contrast to the scenes witnessed the previous year, when the city was in a state of siege! The next Exhibition was the one which followed closely upon the World's Fair in Hyde Park—namely, that held in the Palais de l'Industrie, in the Champs Elysées, in 1855. This building, which has been removed to make way for the two beautiful palaces devoted to the Fine Arts which form part of the present Exhibition, was rectangular in form—270 yards long, 118 yards wide, and 114 feet high; the handsomest portion being the pavilion in front, towards the Avenue des Champs Elysées, which occupied nearly one-third of the length. The entire superficial area was about 202,000 square yards, or 42 acres, of which 144,000 square yards were covered. This structure sufficed to contain the exhibits in Paris five-and-forty years ago.

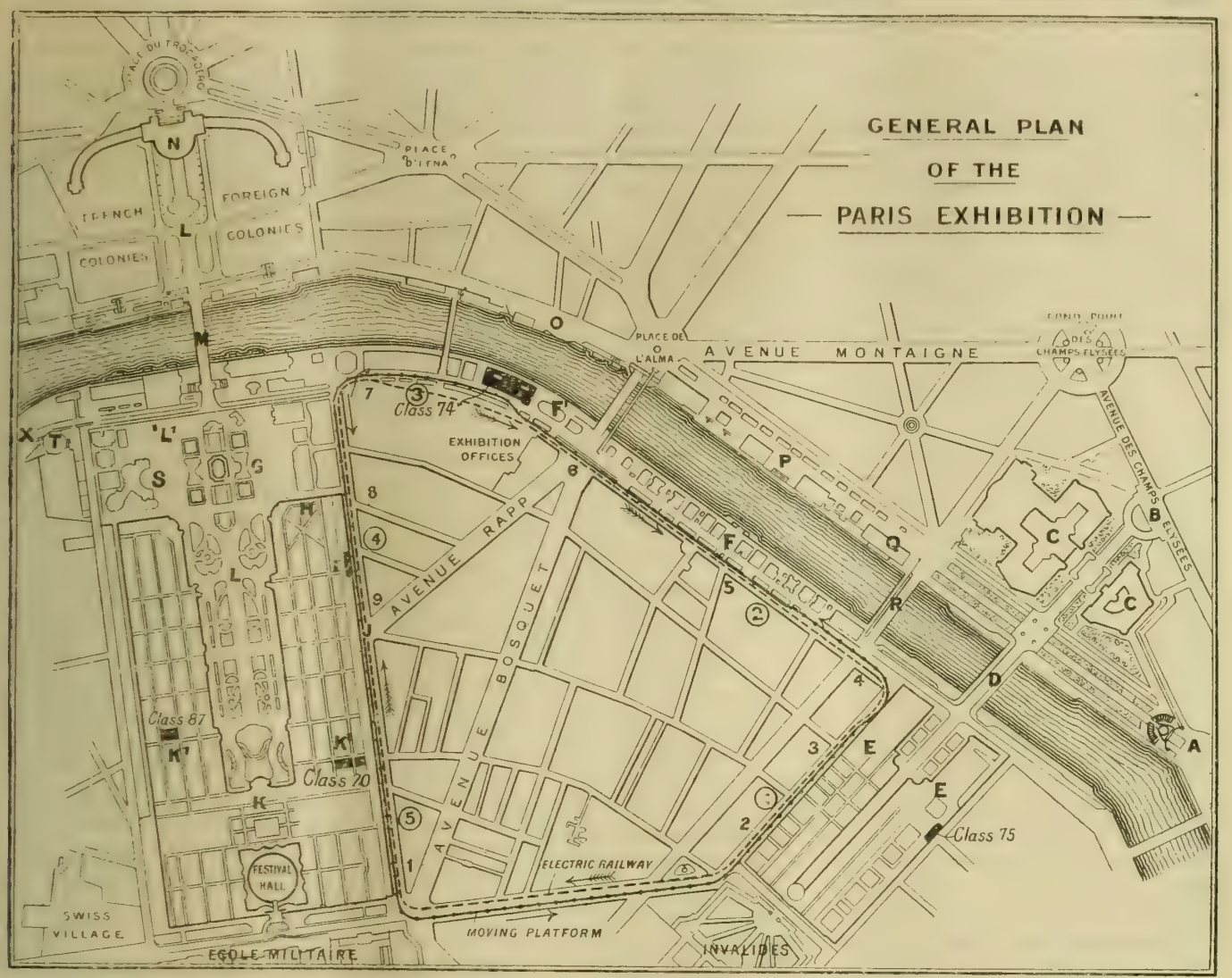
Nothing more was done until 1867, when the large space in front of the Military School, appropriately named the Champ de Mars, and the scene of so many brilliant displays to the glorification of War, was utilized in the more beneficent cause of Peace. This exhibition occupied a superficial area of 825,000 square yards, or about 170 acres. Eleven years later—viz., in 1878—another was held on the same spot, with an extension across the river to the Trocadéro Palace; the total area occupied being 900,000 square yards, or about 187 acres. After the lapse of a similar period, Paris, in 1889, invited the world to another Exhibition—this one upon a still larger scale; the Esplanade in front of the Invalides and a portion of the quays on the left bank of the Seine being requisitioned in addition to the ground occupied in 1878. The superficial area of this Exhibition was 207 acres. The present Exhibition comprises not only the area occupied in 1889, but also parts of the Champs Elysées and the right bank of the river, covering 277 acres, together with an annex in the Park at Vincennes, covering 272 acres; making a total of 549 acres. The strip of land, on either side of the river, devoted to the Exhibition extends for a distance of $1\frac{1}{3}$ miles; and on the entire site about 175 foreign pavilions and detached buildings have been erected, without reckoning the 36 official pavilions of nations participating in the Exhibition, constructed in a double row on the Quai d'Orsay, on the left bank. The "lie" of the several buildings in regard to the entire collection, and of the Exhibition as a whole in regard to the city, will be readily seen from the accompanying plan.

Having given an indication of the extent of the Exhibition, a few remarks may be made as to the arrangement of the exhibits. These have been classified into 18 groups, subdivided into 121 classes. In their arrangement, the method adopted appears to have been to show visitors on one site all the products of a similar nature, whatever their origin. Instead, therefore, of there being one British Section, with one or several buildings exclusively devoted to all the products of British industry, visitors will find the latter competing side by side with similar products of other nations in various parts of the Exhibition. Another feature is the attempt to represent together on one site, as far as possible, the raw material, processes of manufacture, and finished products of an industry. It has therefore been necessary to show machinery in conjunction with the finished article, so as to illustrate the method of producing it. Moving machinery will consequently be found all over the Exhibition—an advantage which has been capable of realization only by the use of electricity as the motive power, which has permitted of a large quantity of shafting being dispensed with. The groups in which readers of the "JOURNAL" are more or less interested are the following: Group IV., Mechanical Engineering (Classes 19—22); Group V., Electricity (Classes 23—27); Group VI., Civil Engineering (Classes 28—34); Group XI., Mining and Metallurgy (Classes 63—65); Group XII., Decoration and Furniture (Classes 66—75); and Group XIV., Chemical Industries (Classes 87—91). Their special attention will probably be given to the exhibits in the following classes: Class 20, gas engines; Class 74, gas heating appliances; Class 75, gas-fittings and other lighting apparatus; and Class 87, materials employed in the manufacture of gas. In addition to the exhibits in the respective groups, separate buildings for making special displays have been erected in various parts of the grounds; and the one which contains the collective gas exhibit was described in the "JOURNAL" last week (p. 1356). It will be manifest, from the foregoing brief indication of the extent of the Exhibition, that two or even three days should be given to visiting it, if it is desired to obtain a good general idea of the contents. If, however, interest centres in certain sections only, of course two days, or even a single day, would suffice. We will assume, for the present, that the visitor wishes to see the entire Exhibition, and will endeavour to show how this may be done without going over the same ground several times.

There are upwards of fifty entrances to the Exhibition; the principal one—called the Monumental Gate—being on the Place de la Concorde. It consists of three arches forming a triangle, and supporting a dome, 100 feet high, which will shelter 2000 people waiting for admission. Above the central arch, on either side of which is a tall minaret, is a figure by M. Paul Moreau-Vauthier, which is stated, in the grandiloquent language of a French writer, to represent Paris welcoming her guests. In the niches on either side are fountains surmounted by colossal statues of Electricity. As no money is taken at the entrances, the visitor will have to purchase a ticket outside, for which, although marked "1 franc," he must be careful not to pay more than 60 c., unless he wishes to incur the derision of his friends. Armed with this little billet, he arrives by one of the numerous railed-off avenues, arranged fan-shaped before him, at the wicket, where two officials are seated in separate boxes. One takes the ticket, perforates it, and hands it back to the visitor, who gives it up to the official in the second box. Before ten in the morning and after six in the evening, two tickets are required. Having fairly entered the Exhibition, the visitor passes through the prettily laid-out gardens on the river side until he reaches the open space at the bottom of the Avenue Nicolas II., in which stand the two beautiful buildings, already referred to, devoted to the Fine Arts. Turning to the left, crossing the river by the new Alexander III. Bridge, the visitor has before him the buildings containing exhibits relating to national manufactures, furniture and decoration, and various industries. Taking first those on the left-hand side, and passing down the centre, he soon comes upon Class 75, in which will be found an assortment of lamps, chandeliers, and gas-fittings, a show of Welsbach burners, and several sizes of acetylene gas apparatus. Continuing to the end of the building, he should cross to those on the opposite side, and return to the foot of the new bridge. He can now walk through the Street of the Nations—one of the most attractive features of the Exhibition. It consists of a double row of pavilions constructed in a style characteristic of the nations to whom they severally belong. The pavilion built by the British Royal Commission, which was not formally inaugurated till last Thursday, stands between the Belgian and Hungarian Pavilions. It was designed by Mr. E. Lutyens to represent an old English manor house—in fact, the river front is a copy of Kingston House, Bradford-on-Avon—and was erected by Messrs. John Aird and Sons. The framework, constructed entirely of steel, was designed by Sir B. Baker.* Leaving this remarkable street, the visitor passes by a footbridge to the section of the Exhibition devoted to Hygiene and Arms. Just beyond the Mexican Pavilion will be found a building containing exhibits in Class 74—gas heating appliances—which, with its annex close by, will claim attention. Interest will doubtless be felt in the very fine show of implements of warfare made by Messrs. Vickers, Sons, and Maxim, in their pavilion, as well as by Belgium and other countries. Passing the conspicuous Creusot exhibit, the visitor very shortly reaches the Eiffel Tower, in the neighbourhood of which a pause may be made.

Continuing his walk, the visitor should enter the Palace of Mines and Metallurgy, where he will find much to engage his attention. A striking exhibit is an arch of castings from the Forges de Douai; another is the group of pipes sent by the Société Anonyme des Hauts Fourneaux et Fonderies of Pont-à-Mousson. There is a remarkable show of heavy and light castings here; and the group of courts down to the Swedish will bear careful examination. Just outside the building, as explained last week, stands the Gas Pavilion. After inspecting this, the Textile Fabrics, Clothing, &c., Section may be rapidly passed through, in order to reach the Mechanical Engineering Section, which comprises Class 20 (gas-engines). Motors by Niel, Charon, Brenhot, Delahaye, Ravel, the Duplex Company, Tangyes, and Crossleys are on view here—the exhibits of the last-named firms not being particularly well placed. A little farther on is the boiler-house, with its adjacent monumental chimney, 263 feet high. A similar chimney will be found on the other side of the building. While here, it will be well to look into the Festival Hall, having an area of 7560 square yards, and capable of holding 25,000 persons, in which the official inauguration of the Exhibition took place on the 14th ult. It is lighted by 4500 incandescent electric lamps. Neglecting the agricultural exhibits, and returning to the Machinery Section, the visitor enters the Palace of Electricity to which reference was made last week. Its aisles are 132 yards long and 44 yards wide, and they contain the machinery furnishing the electricity required for the Exhibition. The display of electrical appliances, when complete, will be something to make engineers open their eyes. Unfortunately, the arrangement of the exhibits was still in progress on the occasion of our visit; the gigantic crane of Carl Flohr, of Berlin, reaching

* Readers specially interested in this building will find a description of its contents in "The Times" of last Thursday.



A. Main Entrance. B. Entrance from the Champs Elysées. C. Fine Arts Palaces. D. Pont Alexandre III. E. Manufactures Furniture, Decoration, &c. (comprising Class 75). F. Street of Nations. F¹. Hygiene (comprising Class 74). G. Eiffel Tower. H. Mines and Metallurgy. I. Gas Pavilion. J. Porte Rapp Entrance. K, K¹. Electrical and other Machinery and Mechanical Appliances (comprising Classes 20 and 87). L. Areas lighted by the Paris Gas Company. L¹. Gas-compressing Station. M. Pont d'Iéna. N. Trocadéro. O. Old Paris. P. Paris Street. Q. Pavilion of the City of Paris. R. Pont des Invalides. S. Optical Palace. T. Celestial Globe. X. Exhibition Hotel. (The figures in the central portion of the plan—part of the city not comprised in the area of the Exhibition—show the points of access to the moving platform and the stations of the electrical railway; the latter being indicated by the encircled figures.)

to the roof of the building, being requisitioned for lowering into position a 25-ton armature at the stand of Siemens Bros., Limited. Germany, however, had a good show, and so had Switzerland. Leaving this important section of the Exhibition, and proceeding northward, the visitor passes on the left the building containing the exhibits connected with the chemical industries, and then comes upon Class 87—materials used in the manufacture of gas. A stand which cannot fail to attract notice is that of the Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz, of Paris. The collection comprises a Pelouze and Audouin condenser, photometers, an engine and exhauster, pressure registers, and a large meter. Proceeding farther on his way, the visitor reaches the Civil Engineering, Education, and Science and Arts Groups, in the last of which the Metropolitan Gas Referees show a pentance photometer, and Professor Thorpe, the Water Examiner to the Local Government Board, the apparatus used in the Government Laboratories, of which he is chief. The visitor now reaches the piano room, and passes out into the grounds near the south-west pillar of the Eiffel Tower. Ascending to the first stage of that ugly but highly remunerative structure, which is designated upon the official plan, for reasons into which we need not inquire, the "Tour de 300 Mètres," the visitor may pause again for rest and refreshment, and contemplate the remarkable scene lying below him on all sides.

Descending to *terra firma*, he might cast a glance at the buildings in the immediate vicinity of the Tower (including that containing the Worthington Company's exhibit), and then proceed on his journey. Crossing the Pont d'Iéna, he reaches the Trocadéro Palace, in the gardens of which have been erected the pavilions to contain the colonial exhibits. They cover an area of 40 acres. Immediately in front stands the Algerian Section, in which an attempt has been made to reproduce a street in Algiers. Here will be found, in a somewhat less obtrusive form, some of the features which proved so attractive in the Rue du Caire of the 1889 Exhibition. The Tunisian Section—with its interesting collection of mosques, shops, and cafés—is immediately adjacent. French colonies and the countries under the protection of France occupy the left-hand portion of this area; those of foreign countries the other side. There is much to tempt a visitor to linger here. Retracing his steps to the bank of the river, he turns to the left, and passing through the building containing the exhibits of the Chambers of Commerce, soon finds himself—that is, assuming he has paid his franc at the gate—in Paris of the Middle Ages! This highly interesting series of reproductions of historical buildings covers an area of 7200 square yards; its river front being 286 yards long. In passing through it, and rubbing shoulders with strange creatures, speaking "the French of Paris" of to-day, but clad in the garb and armed with the weapons of the sixteenth and seventeenth centuries, one's mind naturally reverts to the times depicted with such marvellous skill in the captivating romances of Dumas and Victor Hugo. But we must hasten on. Leaving Old Paris, and crossing the footbridge at the Pont de l'Alma, the visitor passes the Congress Hall, the Museum of Social Economy, and that truly extraordinary freak of fancy, "The Wonderful Tower"—in other words, the topsy-turvy tower—in which, by the use of reflectors, the visitor is made to believe he is walking on the ceiling. This forms a fitting introduction, from this end, to what may be called the frivolities of the Exhibition—the dancing and singing palaces, the theatre, aquarium, *tableaux vivants*, &c. They are all grouped together in the Rue de Paris; and they may be left severely alone or taken for just what they are worth, as the visitor feels disposed.

We are now drawing to the close of our long walk. Leaving the Rue de Paris, and the immense conservatory devoted to the horticultural exhibits, the visitor enters the pavilion of the City of Paris. This building stands parallel with the Seine; its *façade* being about 110 yards long, with a portion measuring 58 feet in length projecting about 9 feet towards the river. On the exterior are medallions showing the arms of the city since the year 1200. The structure is elegant and well lighted, and it contains exhibits relating to the general management and improvement of the city. Interesting to water engineers and those engaged in carrying out sewerage operations will be the plans of the sewage-disposal works, and the lengths of various-sized pipes

used in the supply of water, samples of which, drawn from the Varne, the Avre, the Ourcq, the Vanne, and the Seine, are shown in a large divided glass tank above and a stoneware one beneath. Some good draughtmanship is to be seen here. Taking the footbridge which passes over the Avenue d'Antin, and strolling through the gardens, the visitor comes to the larger of the two palaces devoted to the Fine Arts—the principal entrance to which is in the Avenue Nicolas II. The French works are on the right; the foreign ones on the left. On the opposite side of the avenue is the smaller palace, containing the retrospective collection of French objects of art. These two very fine structures are to be permanent. Returning into the avenue, we pass down it a short distance in the direction of the river, turn to the left, and reach the gate by which we entered, having completed the tour of the Exhibition. The distance covered, as the crow flies, without reckoning divergences, has been about five miles.

It will be obvious from what has been said that a one-day visit will only allow of a passing glance at the contents of the Exhibition. It will therefore be better to devote two days to it. This may be done by dividing the above itinerary in the middle—that is to say, at the entrance at the bottom of the Avenue Rapp—and taking the remainder on the following day. As an alternative, the first day's journey could commence at this point, and finish at the main entrance—thus comprising the machinery, the Colonial Sections, Old Paris, and the Fine Arts; and the second could begin at the Place de la Concorde and end at the Porte Rapp, or *vice versâ*.

Walking about the Exhibition is undoubtedly productive of fatigue. But there are fortunately three means by which the visitor can relieve himself of some of it. In the first place, he may, if so disposed, engage a *fauteuil roulant*—a wicker-work arm-chair in which he can be wheeled about just where he pleases at a cost of 2·60 frs. per hour. It may possibly be a little undignified for one of the male sex, who is not actually an invalid, to resort to the use of a kind of bath-chair; but the writer frankly acknowledges that he was glad on one occasion to avail himself of its assistance, and at the same time profit by the passing observations of its intelligent attendant. Next there is the electric railway, which takes the course shown on the plan. It is a single line, about 2½ miles long, and there are five stations upon it, their positions being indicated by the encircled figures. The trains, which consist of three covered carriages, accommodating about 200 passengers, run every 1½ minutes, their speed being about 10 miles an hour. The fare is only 25c. for any distance. The railway unquestionably facilitates rapid transition from one part of the Exhibition to another; and a fairly good view of the exteriors of the buildings may be obtained therefrom. Finally, we have a means of conveyance which is certainly unique, as far as the writer is aware, in connection with exhibitions—viz., the *plateforme mobile* or the *trottoir roulant* (for it is called by both names), a moving platform which follows the course of the electric railway, but in an opposite direction. There are nine points of access to the platform; their location being shown by the unenclosed figures. The fare is 50c. for any distance. From this elevated platform the visitor certainly obtains a better view of the Exhibition than he does from the railway; and seeing that, like the much-quoted Brook, it goes on "for ever"—or rather till seven or eight o'clock on week days and about half-past ten on Sundays—one could, if so inclined, spend a day upon it, if it were only furnished with a few garden seats. Though it is spoken of always in the singular number, there are, as a matter of fact, three platforms—one fixed and two moving, the latter being slightly higher than the other. The *trottoir* nearest the fixed platform, or quay, moves at the rate of 2½ miles an hour; the outer one going at just twice the speed. At short intervals there are fixed stout iron rods surmounted by knobs; and the would-be traveller simply takes hold of one of these, and steps on to the nearer platform, whence he passes to the farther one, and is conveyed round. The viaduct of the platform is supported by 268 timber piers about 20 feet high; and the weight of steel used in its construction was upwards of 1500 tons. As mentioned in our "Electric Lighting Memoranda" a fortnight ago, the platform is worked by electricity, the current being supplied by 17 cables; and 172 electric motors are employed. A few interruptions in the railway service have taken place; one, curiously enough, occurring simultaneously with a stoppage of the platform.

It will be convenient to give here a few particulars in regard to the lighting of the Exhibition which were inadvertently omitted from the article in the "Journal" last week. It was stated, it may be remembered, that the gas lighting in the Parc du Champ de Mars had been carried out by the Paris Gas Company in conjunction with the Auer and Denayrouze Companies. It should have been mentioned that, for the ordinary incandescent gas-lighting in the vicinity of the Trocadéro, Denayrouze burners are employed; those used in the Champ de Mars being Bandsept "D" burners. Readers are probably aware that the electric lighting of the Exhibition has been relied upon to form one of its principal attractions. Preparations on a very large scale were made; but the scheme has not even yet, we believe, been carried out in its entirety. Some idea of its extent may be gathered from the following figures: In addition to the 5000 incandescent lamps in the Electricity Palace, to which reference was made last week, there are 1000 in the adjacent Château d'Eau, about a dozen arc and something like 3700 incandescent lamps at the principal entrance to the Exhibition, and 1068 of the latter lamps in each of the palaces on the Esplanade des Invalides, the central avenue of which is illuminated by 25 arc lamps, while 35 are used for what is called the "Quincunx" lighting. On the Alexander III. Bridge there are about 500 incandescent lamps. The grounds after dark will therefore, in time, present a brilliant spectacle. Good view-points for the two kinds of lighting are the north side of the above-named bridge, the Trocadéro Gardens, and the Eiffel Tower.

Since the foregoing was written, the programme for the forthcoming meeting of the Gas Institute has reached us. As it appears therefrom that the members visiting Paris who purpose returning on the evening of the 16th prox. will have only two mornings (Thursday and Saturday) free, the following suggestions are offered for utilizing the time at their disposal: On Thursday, enter the Exhibition by the gate just beyond the Celestial Globe, marked T on the plan. (It was near this globe that the collapse of the concrete bridge, referred to in a "Note" in the "Journal" for the 15th inst., took place; and it is a conspicuous object from the Exhibition Hotel, where members will stay.) Look into the gas-compressing station of the Paris Gas Company, and then make for the Eiffel Tower. Enter the Palace of Arts and Sciences, and pass straight through to the Mechanical Appliances and Machinery Sections and the Palace of Electricity (K, K¹ on the plan). A *détour* may be made to the Swiss Village; but unless this has been connected with the Exhibition it will involve the use of a ticket for re-admission. Cross to the east side of the Machinery Section, ascend to the *plateforme mobile* at the point marked 1 (Salle des Fêtes Station), and go round to 4 (Pont des Invalides). Descend and walk through the Street of Nations, continuing past the Hygienic and Armaments Sections (getting a view of Old Paris, on the other side of the river, while doing so) to the Champ de Mars. This will probably occupy the morning till luncheon time. On Saturday, enter the Exhibition as before, cross the grounds under the Eiffel Tower, take the electric railway from station No. 4 (Parc du Champ de Mars) to No. 1 (Invalides-Université), visit the palaces on the Esplanade des Invalides, and return by rail or platform to the Champ de Mars. After luncheon, on the way to the Gas Pavilion, the Mines and Metallurgy Section, which is very interesting, may be taken. Should there be time after the inspection of the Pavilion, Old Paris and the Colonial Sections may be visited.

THE PATH OF PATENT OFFICE REFORM.

The efforts made from time to time in the "Journal" with the object of guiding readers through some of the intricacies of Patent Law and Patent Office practice appear to be much appreciated; and we have the satisfaction of feeling that most of our views of debateable matters belonging to this category are fairly in agreement with the best contemporary expert opinion. For example, our protest against the hasty accusation of some popular writers on the subject that the Patent Office takes fees without giving value for the money, and against the principle of official examination of applications, is well supported by a skilled writer in the "Ironmonger," whose opinions of "Patents: British, German, and American," are given in a letter that appeared in our contemporary on the 5th inst. This is his point: That the English Patent Office does not really profess to issue a valid monopoly grant. All it does is to stamp and date a document which is supposed to have been properly drawn for use in bringing or defending a law suit; for the authority that actually confers the monopoly in this country is a judge of the High Court. There is reason to believe that this view of patent right is new to many an inventor; the general idea being rather that a patent is a valuable piece of property in itself. When this notion is rudely dispelled, as it usually is in various ways, the disillusioned patentee commonly turns round and abuses the Patent Office; whereas his own unfounded hopes and beliefs are really being visited upon him, according to the ruthless disciplinary system of the natural order of things sublunary.

It is further remarked, with much cogency, that where the English Patent Office is to blame, perhaps, is in not making the true nature of its grants plain and obvious to all and sundry. A patentee is allowed to parade his patent before the public, as if it constituted a valid legal monopoly, "the inventor being either ignorant and the public credulous, or the former 'bluffing' and the latter indifferent." This is a view of the facts which is so conspicuously true and instructive that one wonders it is so rarely mentioned in controversies on our patent system. It is to be feared, however, that in popular discussions of the case of the typical "poor inventor," as of so many other interesting hypothetical personages, it is far easier to go astray in pursuit of the abstract than to bear in mind concrete realities. The English Patent Office certainly ought to do this for the "poor inventor," and for the equally meritorious public, with whom he hopes to deal at an artificial advantage by virtue of his patent—it should proclaim on the face of the letters patent, and require the advertisement on the patented article, wherever possible, an English equivalent to the familiar French inscription "S.G.D.G." Doubtless these cabalistic-looking capitals have excited the wonder and exercised the speculative faculty of many English purchasers of French patented articles. They

mean, simply, that the patent right is without any Government guarantee—*Sans Garantie du Gouvernement*. They proclaim that the patent is issued "without prejudice," as the lawyers say; and that the letters patent are merely a sort of birth certificate, valid only so far as it goes.

With regard to the vexed question of whether a government office could or should "assist" the inventor and would-be patentee by subjecting his application to official examination, the anonymous, but evidently well-posted, critic whom we are now following admits that to the outsider, and to the inventor working in one of the less occult branches of creative industry, it very naturally seems desirable that the German and American official practice in this respect should be introduced into the English patent system. The theory of both the countries named in this connection is that their patents are only granted after the officials have satisfied themselves as to the novelty and patentability of the subject-matter of the application. The idea is perfectly good—in theory; but as it is actually worked, it is rendered perfectly worthless by the attendant disadvantages. Those who believe in the theory argue, of course, that, if the idea is good and likely to be beneficial to the inventor, and through him to the community, we ought not to be deterred from adopting it by the failures, probably preventible, of other countries to realize its advantages. The answer is that the practical disadvantages are inherent and incurable, while the benefits remain theoretical. It is clear, to begin with, that submission to official examination into originality and patentability can only be tolerable on the assumption that the examiners are infallible. This is with regard to examination with power of rejection. There can be no appeal; for the competency and fairness of the officials must not be questioned. As to the merely advisory examination, advocated by Mr. W. Lloyd Wise and others, we have, in a previous article, shown cause for objecting to it. Secondly, an authoritative official examination must be equally efficacious over the whole range of human endeavour brought within the cognizance of the Patent Office. To state this consideration is almost to answer it. There are degrees, in this as in other branches of knowledge. If a man is thinking of patenting a new brace button, or a new card game—and these are the "poor inventors" for whose benefit, in the popular mind, the Patent Offices of the world exist—there is comparatively little difficulty in the way of an official pronouncement as to the novelty of the invention. But suppose the case of a man who wishes to protect the method of producing a new coal-tar derivative. There are possibly not half-a-dozen other men living who know as much about it as he does himself; and these are all in the business, with him or against him. Such an expert would, and in some countries does, scorn the suggestion that the Patent Office Staff are able to pass any valid judgment upon his invention. Yet the officials are there, and what are they to do?

In addition to all other objections to official examination, there is the most serious one of the delay, which has nothing to do with the merits of the examination, as such. It was recently reported that an American patent of Edison's had just been sealed, about seventeen years after the date of application. And after all, there is as much litigation over German and American patents as over English ones—rivals in trade in these countries being just as willing to fight cases out in the Courts as they are here. All these considerations should make British inventors pause before they clamour for any substantial alteration of the English Patent Law to assimilate it to the German or American system in the matter of examinations. There may be, of course, points in the English system and practice which are capable of improvement; and the object, partly, of these studies of Patent Office systems is to bring out any such suggestions. Up to the present time, however, the case for fresh material alteration of the English law and practice is very weak. At one time, Mr. Lloyd Wise strongly favoured the suppression of the "provisional"—substituting therefor a complete specification, with extended facilities for amending the latter within the lifetime of the patent. There is a good deal to be said for the latter suggestion. We hold firmly the belief that the time is ripe for an independent inquiry into the operation of the English patent system, with particular regard to its influence upon the national industries. Much more good might be expected to come of such an investigation than of any agitation against the judicial hearing of patents. The enormous cost of patent actions is often urged as a reproach to the whole system; but it is not so. Patent litigation is not more costly than libel suits, and not nearly so expensive as actions to obtain possession of real estates which happen to be in other hands. People point to the heavy cyanide gold-extraction, or the incandescent gas-light litigation, and call it scandalous and ruinous. It never occurs to these critics that the Tichborne case bulked larger in all respects than any two or three patent law suits of the century; and that the issues here were in principle the same as those of patent cases—namely, who is the rightful owner of a particular piece of property. We shall never be able to limit the natural right of property to defend itself to the utmost of its resources, or of citizens who think they have a right to property not in their possession, to get it by all lawful means.

The reform of Patent systems and Patent Office practice is, however, a matter of practical politics, which must always be of engrossing interest to all those who have anything to do with industrial property. The questions mooted in our essays on the subject in the present volume of the "JOURNAL" indicate the nature and extent of the grounds upon which a new inquiry into the whole subject is called for. Mr. Levinstein, and those who are interested both generally and particularly in patents, licences, foreign competition with British patented specialities, and other aspects of the matter, should approach the Board of Trade and prevail upon the President of the Department to enlarge the inquiry which has been promised into one suggestion for reform, so as to embrace all that is actually debateable. It does not serve any real, fruitful purpose to go by popular opinion in matters of this kind. Yet, unless there is some sort of outside pressure brought to bear upon Ministers in a constitutional government, the Departments are slow to move. Mr. Ritchie told the cyclists the other day that their best remedy against the obstructiveness of the Railway Companies lay in their power as voters to influence parliamentary candidates. Inquiry into, and if requisite reform of, the Patent Law is equally one of those matters that may legitimately be brought under the intelligent notice of members and would-be members of the legislature, when opportunity serves. The "chestnuts" of the parliamentary platform are being dropped on all hands. It begins to look as if a more practical turn is being given to national politics than was possible in the fast-receding days when rhetoric was cultivated in the high places of the senate to the suppression of almost everything else. New causes of the minor order are wanted to go with the new Imperial statesmanship which seems at last to set deeds before words. Parliamentary candidates must listen when influential constituents speak; and if, at any rate in the big industrial centres, leading men suggest Patent systems as a fit subject of senatorial study, they will be heeded.

THE CHEMISTRY OF TARS AND MINERAL OILS.

THE second volume of Mr. A. H. Allen's well-known work on "Commercial Organic Analysis" has long been a recognized authoritative book of reference in every laboratory where tars, tar-products, or mineral oils are dealt with. Unfortunately, for some time past the volume has been out of print, and it has now only re-appeared in two separate parts under new editorship, which is skilful but scarcely so successful as would probably have been revision executed wholly by the original author.* But as ill-health and multitudinous engagements have prevented Mr. Allen re-editing the work unaided, our best thanks are due to Dr. H. Leffmann for his co-operation, which was rendered doubly arduous by the paucity of opportunities which he had for consultation with his author and co-editor. Far better, however, is it that the volume should be obtainable in its present form than not at all, though we confess it does not attain to our ideal of a revised "Allen."

The information in regard to coal tar and its products is absolutely reliable; and the portions of the work which deal with petroleum and shale and their chief commercial products also are perfectly good. Russian petroleum, however, is perhaps scarcely given adequate treatment; and we find very scanty references to the "Solar" and similar distillates which are now so extensively used in the manufacture of oil gas and carburetted water gas. The chief properties of these gas oils should certainly have been described in a text-book of the scope of the one under notice. So far as any information in this work is concerned, the carburetted water gas industry might be virtually non-existent. Tars from sundry sources—some unimportant—are described; but the tar from carburetted water-gas installations is not even mentioned, though the quantity produced in America and Great Britain is now enormous. We should have expected to find full information on this tar in a work revised in the country where carburetted water gas has ousted coal gas from the predominant position. Yet to the best of our knowledge, we have still to go to English treatises on gas manufacture for such text-book information as is to be found on this interesting tar. Truly, it is in some places regarded as worthless; but in others, buyers of tar will pay as high a price for it as for coal tar. Mr. Allen's work should have indicated on what qualities the value of water-gas tar is determined. We have in this instance, we think, selected a typical case of the imperfection of the revision accorded to the book. Those to whom the earlier editions remain completely satisfactory will naturally be content with the present new edition, and will find the additional matter contained in it a welcome supplement to their previous store of data. But those who expect to find the third edition as up to date as the first and second were at the time of their issue will be very grievously disappointed.

Among the additions, we notice a rather scrappy account of acetylene, on which, we think, the information given has not been selected judiciously. The volume of research work on acetylene is now so enormous that only one who has made a special study of it is able to appreciate the relative technical importance

* "Commercial Organic Analysis." By Alfred H. Allen, F.I.C., F.C.S., Past-President of the Society of Public Analysts, Analyst for the West Riding of Yorkshire, the City of Sheffield, &c. Third edition, with revisions and additions by the author and Henry Leffmann, M.A., M.D., Professor of Chemistry and Toxicology in the Woman's Medical College of Pennsylvania, and in the Wagner Free Institute of Science, Philadelphia. Volume II.—Part II., Hydrocarbons, Petroleum and Coal-Tar Products, Asphalt, Phenols, and Creosotes. London, J. & A. Churchill; 1900.

of each contribution. We trust we are wrong in the impression which forces itself on us on reading the pages on acetylene in this edition of Allen, that the subject has been read up expressly by a busy contributor who had no previous knowledge of it. There is also much new matter on asphalt, disinfectants of the phenol class, and creosote. This appears to be quite good.

The introductory chapter, which deals with the classification of the hydrocarbons, is well compiled, and in most respects trustworthy. We see, however, that it is stated that gaseous olefines, as existing in coal gas, may be estimated from the diminution in volume of a sample of the gas when agitated with bromine. This statement is misleading; for bromine removes from the gas both the olefines and benzene and its homologues. It is true that bromine vapour re-acts very slowly indeed with benzene; but, nevertheless, benzene is completely removed from coal gas when the latter is agitated with bromine water. Probably this result is largely due to mechanical action; but it has been long familiar to gas chemists, who do not now return the hydrocarbons absorbed by bromine in their analyses as "olefines," but merely as "illuminating hydrocarbons," or "heavy hydrocarbons," or "illuminants," represented by the comprehensive formula C_mH_n. An analyst following the guidance of Messrs. Allen and Leffmann would have an error of over 25 per cent. in his estimation of olefines in coal gas. After the classification of the hydrocarbons, follow chapters on destructive distillation, tars, bitumens, and petroleum and shale products. Then come, in order, chapters on the important tar products, under the headings benzene and homologues, naphthalene and derivatives, anthracene and associates, and phenols. This list of the subjects of the chapters affords a fair conception of the scope of the volume, which, apart from the defects and limitations we have already indicated, should prove invaluable to the technical chemist.

PERSONAL.

We are sure a large number of "Journal" readers will join with us in offering congratulations to Mr. J. Ferguson Bell, the Gas and Electrical Engineer of the Stafford Corporation, on the success which has attended his application for the position of Engineer and Manager of the Derby Gas Company, in succession to Mr. Charles Taylor, who, as already announced, will shortly retire. During the sixteen years Mr. Bell has been at Stafford, the gas-works have been almost entirely rebuilt and brought up to date, and the electricity works erected. The latter have been running for more than four years; and there has never been a single failure of the light. The price of gas has been reduced 10d. per 1000 cubic feet, meter-rents have been abolished, and this year there is a surplus profit of nearly 6d. per 1000 cubic feet after paying everything. The charge for gas ranges from 2s. 3d. to 2s. 9d.; and we understand that but for the enormous increase in the cost of coal, it would have been reduced to 2s. to 2s. 6d. net. In addition to holding the appointment at Stafford, Mr. Bell has done a fair share of consulting work for Gas Companies and Local Authorities in the Midlands. Before going to Stafford, Mr. Bell was Deputy-Manager at the Birkenhead Gas-Works. As our readers are aware, Mr. Bell is President of the Midland Association of Gas Managers, an ex-member of the Council of the Institution of Gas Engineers, an Associate Member of the Institution of Civil Engineers, and a Member of the Society of Chemical Industry. We believe Mr. Bell's appointment is a popular one with his professional brethren. The town in which his future work will be carried on is well supplied with gas by a private Company, who look after the interests of the consumers as well as those of the shareholders. The Board of Directors is composed of well-known business men of high standing; the Chairman being Mr. H. Swingler, D.L., who takes a great interest in the affairs of the Company. Mr. Bell will devote the whole of his time to his new duties.

OBITUARY.

The death is announced, after a brief illness, of Mr. G. Earl, the Secretary of the Uckfield Gas Company. He was 62 years of age.

Mr. Joseph Stanford, Chairman of the Edenbridge Gas Company, died on the 14th inst.—a few days after celebrating his 77th birthday.

Mr. Charles Hooker, the Secretary of the Westerham Gas Company, died on the 15th inst., at the age of 64. The deceased had been in failing health for some time.

Among the honours which Her Majesty has been pleased to confer on the occasion of the anniversary of her birthday, is a peerage for Sir Richard Webster, on his elevation to the Bench as Master of the Rolls, in succession to Sir Nathaniel Lindley, and knighthoods for Alderman W. H. Stephenson, one of the Directors of the Newcastle and Gateshead Gas Company, and Mr. John Watney, the Chief Organizer of the City and Guilds of London Institute, and Clerk to the Mercers' Company; while Mr. A. Bonham Carter, the Referee of Private Bills of the House of Commons, and Professor T. E. Thorpe, the Director of the Government Laboratories, and Water Examiner for the Local Government Board, are appointed Companions of the Bath (Civil Division).

NOTES.

A Criterion for Pipe-Discharge Formulæ.

A somewhat mysterious article has appeared in the "Engineering Record" relating to the alleged discovery of a new criterion for determining the reliability of the results of experiments on the flow of water in pipes. It is further stated that this is a simple test which will probably indicate that some experiments long esteemed by engineers as reliable are really seriously wrong. Professor Gardner S. Williams has publicly defined the new criterion of the accuracy of experiments on pipe discharges as follows: "Assuming that the loss of head varies as the square of the velocity, the former must also vary as the first power of the velocity head. Wherefore, in any series of experiments covering more than one velocity, if the velocity heads and the corresponding losses of head be used as co-ordinates, theoretically, the points so located should fall in a straight line, which may be expected to pass through the origin, and the deviation of the points so plotted from such a line will indicate the relative merits of the several observations. It will be appreciated at once that, while some form of curve can usually be made to pass through and fit fairly well a great many observations, it is not such an easy matter to fit a straight line to them." It is stated that this test has been applied by Mr. G. H. Fenkell to most of the pipe-discharge experiments hitherto regarded as trustworthy, with the result of exhibiting a considerable number of them as hardly better than crude approximations. These results have not yet been published; and when they are, it is asserted that engineers will know more than they do at present about the flow of water in pipes. One of the great merits of the new test is said to be the readiness with which it lends itself to the detection, and to the qualification as plus or minus, of erroneous observations.

The Action of Water on Asphalte.

The value of asphalte as a lining for water reservoirs has been recognized of late years; trouble which had arisen from leakage having been effectually removed by its use. It has been assumed that the material was unaffected by contact with water; but in a paper recently presented to the Engineers' Club of Brooklyn by Messrs. G. C. Whipple and D. D. Jackson, and published in "Engineering News," the results are given of a number of experiments which seem in certain cases to prove the contrary. The tests were conducted at the Mount Prospect Laboratory of the Brooklyn Water-Works, and covered a period of about two years. Seventeen specimens of asphalte were investigated, and both distilled and surface waters were used. Throughout the course of the trials it was observed that the waters which contained the smallest amount of mineral matter produced the greatest action upon the asphaltes. Sea water gave but little action; while the most marked effect was produced by distilled water. These facts show conclusively that the action of water upon asphalte is largely one of oxidation, and is due to the oxygen dissolved in the water. As a final test, however, a sample of Trinidad asphalte was covered with water which had been boiled until free from oxygen, and then tightly sealed to prevent absorption from the air. The action that took place under these conditions was very slight. It appears, therefore, that water acts chiefly as a carrier of oxygen, and does not to any extent give up the oxygen of its own composition. A practical example of the behaviour of asphalte in actual service as a reservoir lining is given in the case of the reservoirs at Denver (Col.), one of which was lined with Trinidad asphalte and another with California asphalte in 1891-2. The condition of both has become very unsatisfactory owing to the action of the water.

Tough Coal Tar Paving.

The manufacture and laying of coal-tar macadam and tar paving for footpaths, yards, &c., has been greatly improved since the early days when it was first attempted to make pavements of this material. One of these pioneer tar pavings is now, it is reported, being broken up in a street in Brooklyn, New York, by the aid of a steam pile driver. The necessity of such treatment at least testifies to the structural soundness of the old paving. It appears that the original surface of this street was of the primeval "cobblestone" pavement finish, for which the old borough of Brooklyn was widely famed. The stones ranged in size from that of an apple to that of a pumpkin; and at some undated period the tortured people resolved to cover up the old stones with a smooth coating of tar asphalt. How many layers of the new material were laid is not recorded; but from 1868 onward successive coats were added, until the deposit attained a thickness of from 6 inches in the thinnest, to 14 inches in the deepest portions. The paving was never good, owing to the initial mistake of not removing the old cobblestones and grading the subsoil. The irregular thickness of the asphalt caused it to form ridges; and at last the cost of the incessant repairs led to the decision to remove it. This was more easily ordered than done. A steam macadam plough failed to tear up the tough asphalt; and, consequently, the contractor had recourse to a heavy guillotine chopper, worked by a pile driver. This cuts into the tar paving in lines, and hand bars do the rest. It is rather curious that such drastic measures should have been required to deal with the oldest tar paving in America; and the fact goes to show that the paving might have been good yet if the foundation had been satisfactory.

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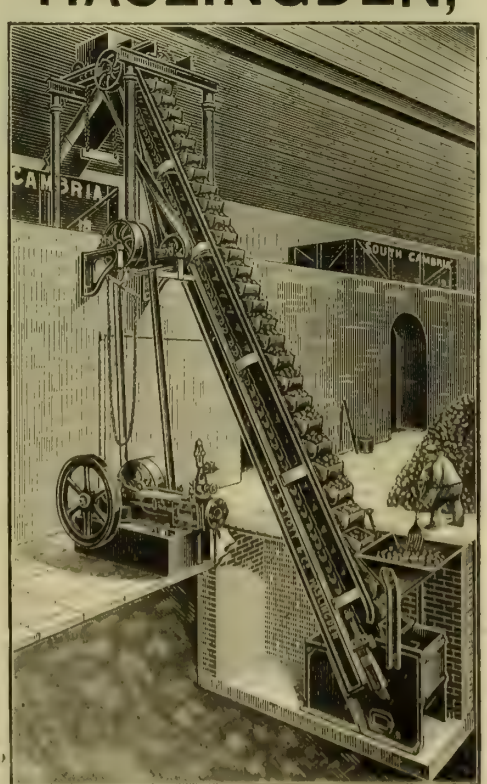
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TECHNICAL RECORD.

THE INCORPORATED GAS INSTITUTE.

The Programme for the Forthcoming Meeting—The Annual Report and Accounts.

We have received from the Secretary of the Gas Institute (Mr. Walter Dunn) the programme for the forthcoming annual meeting, which will be held at the Royal United Service Institution, Whitehall, on the 12th and 13th prox., under the presidency of Mr. E. Herbert Stevenson, M.Inst.C.E. The business on the first day will consist, as usual, of the presentation of the report and accounts (noticed below) and the premiums for papers read last year. The first (with the President's Medal) has been awarded to Mr. T. O. Paterson, for his paper on "Gas for Motor Purposes;" the second to Mr. T. Newbigging, for his paper on "Differential Rates;" and the third to Mr. John P. Leather, for his communication dealing with "Naphthalene Deposits." The President will then deliver his Inaugural Address; and immediately afterwards the following resolutions will be considered:—

(*a*) That it is desirable that the Incorporated Gas Institute and the Incorporated Institution of Gas Engineers be amalgamated.

(*b*) That it is desirable that such amalgamation be effected by the voluntary liquidation of the Incorporated Gas Institute and the Incorporated Institution of Gas Engineers, and by the transfer of all the property and assets of these two Societies to a new Society, to be registered under the 23rd section of the Companies Act, 1867, by the name of (incorporated 1900), having a Memorandum and Articles of Association in the form of the draft issued to the members, and produced to, and approved by, this meeting and identified by the signature of the President, subject to such alteration (if any) as may be approved by the Council.

If these should be approved, a resolution will forthwith be submitted to the members to sanction the voluntary winding up of the Institute. In the event of its being passed by the requisite majority, it will be submitted for confirmation as a special resolution to an extraordinary general meeting which will be subsequently convened. The reading and discussion of papers will next be taken; and the annual general meeting of the donors and subscribers to the Benevolent Fund will take place at the close of the morning sitting. The papers to be read are four in number, their titles being as follows: "Automatic Stoking and Inclined Retorts," by Mr. W. R. Chester, of Nottingham. "Roofs for Retort-Houses," by Mr. A. T. Walmisley, of London. "Some Disputed Points amongst Gas and Water Experts," by Mr. J. Wilkinson, of Drighlington. "Naphthalene, from the Retort to the Point of Deposition," by Mr. W. Young, of Peebles. In addition to the papers, a lecture will be delivered on the morning of the second day by Mr. W. H. Y. Webber, on "The New Gas." The rest of that day will be devoted to the technical matters not already disposed of, and to the transaction of the remaining routine business. In the evening, those of the members who have decided on joining the excursion to Paris will start *viâ* Dover and Calais or *viâ* Newhaven and Dieppe, according to their preference for the short or the long sea passage. On both sides of the Channel, carriages will be reserved for the party. On arriving in Paris, conveyances will be in readiness to take them to their destination—the Hôtel de l'Exposition, on the Quai de Grenelle, which is within a few minutes' walk of one of the entrances to the Exhibition (see map on p. 1431). The morning of Thursday has been considerately left open; but in the afternoon members have been invited by the authorities of the Paris Gas Company to visit one of their stations. Friday will be devoted to the sights of Paris—and a good day's work has been cut out. Saturday morning will be free; but after luncheon the party will assemble, in the Gas Pavilion in the Exhibition, on the invitation of M. Th. Vautier, the President of the International Gas Congress, and, under the guidance of the Committee, will inspect the exhibits relating to gas manufacture, distribution, &c., which will be found there. Some particulars in regard to them were given in the "JOURNAL" last week, p. 1356. After dinner, those of the members whose visit is to be short will leave for London, where they will arrive early on Sunday morning. Arrangements can, however, be made for prolonging their stay at the hotel (which is stated to contain 1000 beds), should they be desirous of doing so.

The report of the Council shows that the total number of members on the roll at the end of last year was 682, distributed as follows: Honorary, 19; ordinary, 518; extraordinary, 32; associate, 57; associates, 56—an increase of 18 on the year 1898. The ballot at the last annual general meeting resulted in the election of thirty members and eight associate members; and two of the latter class were also transferred to that of member. On the other hand, there were nine resignations and removals of names; and the Council record with sorrow the loss by death of fourteen members, whose names are given. Three—MM. Breittmayer, Jordan, and Melon—were honorary members; and two others were Mr. Peter Simpson, of Rugby, who had been one of the Trustees of the Institute since 1889, and Mr. Frederick G. Burfield, who was Secretary from 1893 to 1896. The Council review the proceedings at last year's meeting, a "notable incident" of which, they point out, was the appearance thereat of Mr. George Livesey, Mr. George Bray, and Mr. Charles Sellers, each of whom, at the request of the President (Mr. Samuel Stewart), addressed the members. The Council report on this matter as follows: "Endorsing the cogent observations made by Mr. Stewart in his Presidential Address, they spoke on the very great desirability of establishing a united Association, and expressed the earnest hope that the amalgamation of the two Societies involved might soon be effected. Their remarks were received with hearty approbation. The Council of the Institution of Gas Engineers subsequently communicated with the Council of the Gas Institute on the matter, and a Joint Committee of both Societies was appointed to consider negotiations. Their recommendations have been carefully discussed by the respective Councils, and have been adopted, with modifications." The Council inform the members that they have accepted an invitation from the Committee of the Société Technique du Gaz en France for the Institute to participate in the International Gas Congress to be held in Paris next September. The French Society make reference to pleasant remembrances of the reception extended by the Institute to them on the occasion of their visit to London in 1888, and promise a cordial welcome to those attending the congress from this side of the Channel. The accounts accompanying the report show a balance of £252 carried to the profit and loss account; bringing up the total to £1509.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

The remembrance of the pleasant excursion the members of the Institution had to Kendal twelve months ago, was evidently responsible for the large attendance at Saturday's gathering, which had been arranged for the Lake District during the presidency of Mr. T. N. Ritson; and the weather being all that could be desired for outdoor enjoyment, many were the congratulations the Secretary (Mr. S. S. Mellor) received on the success attending the day's proceedings. An early start from Manchester enabled Kendal to be reached by train shortly after mid-day, when the party drove in coaches to the Commercial Hotel for lunch.

Before separating, the only formal business of the day was transacted—the confirmation of the minutes of the last meeting, at which Mr. Ritson delivered his Presidential Address, and the election of the following three new members: Mr. H. Barker, of Buxton; Mr. J. H. Buckley, of Formby; and Mr. W. L. Donaldson, of Lymm.

A drive through the lovely country lying between Kendal and Bowness, on Lake Windermere, was the feature of the day; and the lake was reached in time for the members to enjoy a stroll of an hour and more before tea was served at the Royal Hotel. Afterwards the coaches were again requisitioned for a drive to Windermere; and the bulk of the members returned to Manchester by train, reaching the city about half-past nine.

Much interest was evinced in the presence among the party of Mr. J. W. Carr, who has just been relieved of his charge as Engineer and Manager of the Johannesburg Gas-Works. Mr. Carr was ordered by the Transvaal Government to leave Johannesburg at forty-eight hours' notice, and returned to England last Saturday week. As may be imagined, he was heartily received by the members present, and vastly interested many in the course of the day with his personal experiences in South Africa.

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

On the occasion of the Monthly Meeting of the above-named Association last Saturday, the members paid a visit to the works of the National Gas-Engine Company at Ashton-under-Lyne. The party numbered about thirty. On reaching the works, they were received, in the absence of the Manager, by Mr. Wood and Mr. Addenbrook, who gave them a hearty welcome. These gentlemen then conducted the party through the various departments, including the foundry, the fitting and erection shop, and the machine-shops, which were most ably and fully explained by Mr. Wood. Then they had the pleasure of seeing at work two very large gas-engines used for the electric lighting of the premises. Every part of the engines was dealt with; and what had previously been somewhat of a mystery to the members was made clear by the explanations furnished. After having gone through all the departments, the party retired to the office, where Mr. R. H. Garlick, the President, moved their best thanks to Mr. Wood and Mr. Addenbrook for the pleasant way in which they had received the Association as well as for the lucid manner in which the works and plant had been described—nothing having been kept secret. Mr. Butterworth, in seconding the motion, also made a few complimentary remarks; and the resolution was carried. Mr. Wood responded, and thanked the members. The party then left, after spending a most enjoyable, useful, and instructive afternoon. After the visit, they made their way to Stamford Park, where tea was provided. A short meeting was afterwards held; the remainder of the evening being devoted to games.

Paraffin is the staple source of artificial light in Palestine; neither coal gas nor electricity having as yet been introduced for illuminating purposes. Coal is almost entirely used on the railway, and in some of the flour-mills erected at Jaffa and in the neighbourhood.

THE INCANDESCENT GAS-MANTLE AND ITS USE.

By Vivian B. Lewes, F.I.C., F.C.S.,

Chief Superintending Gas Examiner to the Corporation of London, Professor of Chemistry at the Royal Naval College, Greenwich.

[The Last of a Course of Three Cantor Lectures at the Society of Arts delivered May 14, 1900.]

The history of the incandescent mantle has not been altogether devoid of attempts to introduce forms suitable for flames other than those given by the bunsen burning from a circular tube. First and foremost among these in the inception of incandescence came the Fahnebjelm comb, made of a number of thin magnesia rods set in a back of fire-clay, supported by an iron frame clamped above a small Bray burner in which water gas was consumed. The comb, however, as has been before stated, burnt away in less than 100 hours, owing to the volatility of the magnesia; while the light which it emitted, even in its prime, only amounted to 3 or 4 candles per cubic foot. It was, however, afterwards found that dipping it in a solution of chromic acid brought this up to nearly double this value, and increased its life fourfold.

When the idea of making a fabric was firmly established, and the mantles began to be a success, De Mare tried to utilize the flat flame as a source of heat in which to excite a fringe of fabric soaked in a mixture of the salts of the rare earths, and burnt off so as to give a comb of very fine oxide filaments; and the effect produced by this, when properly arranged, was extremely good. In the burner employed for this purpose, he first tried what was practically a flat-flame bunsen, which gave very good results; and later he employed a burner in which the coal gas *per se* was forced out into the air in so thin a sheet that the hydrocarbons in it became thoroughly consumed, and a non-luminous flame was produced. It was possible to do this in Paris, as the gas supplied was only 14 candles, and the pressure at which it was distributed 4 to 5 inches; so that, by using a very small Bray nipple, a thin non-luminous flame is produced, which, owing to the admixture of air being only just sufficient to give the desired effect, was hotter than the flat bunsen flame. It was attempted to introduce these De Mare plumes into England; but the rare earths employed were held to be the equivalent of the earths protected in Welsbach's 1885 patent.

Another very effective variety of incandescent is to be found in the De Lery burner and its cluster of baby mantles or tassels. Taking a bunsen burner with a dome top, in the sides of which holes were pierced at regular intervals, De Lery obtained a circle of small bunsen jets, each of which raised to incandescence a small tassel of the oxides of thorium and cerium, which were suspended from a twelve armed circular support, and hung in the corresponding number of flames issuing from the top of the burner. The effect given is most excellent, as spreading the incandescence over a considerably larger surface prevents the irritation of the eye so prevalent with the ordinary mantle; while the diffusion of light obtained in the room is distinctly superior to that furnished by the ordinary mantle.

I have already, on more than one occasion, pointed out the great difference which exists between the measurement of illuminating power as carried out on the photometer and the illuminating effect which one obtains from illuminants in practice; and the De Lery tassel burner is as good an example of this phenomenon as can be found. Although it gives less light than the ordinary incandescent mantle when tested at the horizontal in the photometer, its illuminating effect is far superior to it; and the light, being mostly cast in a downward direction, illuminates the surface below the burner, while with the ordinary mantle, the bulk of the illumination is thrown from the horizontal upwards, owing to the form of mantle being a cone. These burners with their tassels have proved very successful in America; and I am informed that they will shortly be introduced into this country, when their novelty of appearance and excellent effect will undoubtedly go a long way towards achieving success.

Attempts have also been made to strengthen and increase the amount of light obtainable from the ordinary shape of mantle, a noticeable endeavour in this direction having been made by Plaissetty, who, observing the great intensity of heat produced over the small area immediately above the burner top, and the tendency which mantles had to shrink at this spot, attempted to both strengthen the mantle and increase its light-emissivity by braiding the mantle with clocks or seams of the same incandescent material as that of which the mantle was composed. The result, however, did not give promise of any very great increase in illuminating power; and it has been, I believe, abandoned. Plaissetty also made mantles consisting of plaited bands or ropes, each perfectly distinct from the other, which were hung from a central support around the mantle head, and which could be burnt off by the consumer, as no shaping was required.

Leaving, now, the subject of the mantle which is heated to incandescence, let us pass on to the burners, which have from time to time been improved and altered in order to give the highest attainable candle power from the incandescent mantle. It was Davy who first showed that, when a jet of coal gas is allowed to pass under pressure from a small orifice and is then burnt upon the surface of a piece of wire gauze held an inch or two above the exit pipe, the flame, being kept from flashing back to the exit owing to the high conducting power of the gauze, becomes non luminous. This result he correctly ascribed to the gas mingling with the air in its upward passage, and, as he supposed, completing the combustion of the carbon so rapidly as to prevent the presence of any solid particles that could be heated to incandescence. The concreting of this idea into the burner that has done so much for the utilization of gas as a fuel and an illuminant, is due, as I have shown, to Roscoe and Bunsen; and simple as the adaptation was, it forms a link in the chain that supports the great gas industry, even more important than Welsbach's valuable discovery.

In the early form of burner made by Bunsen, the gas issued from either a flat flame or an argand burner head into a metal cylinder, open at the bottom, and closed at the top by means of a disc of fine wire gauze; so that the gas issuing from the burner head passed upwards through the air in the cylinder, mixed with it, and the mixture burnt on the top of the gauze. The difference between this class of burner and those which succeeded it was that the uprush of the gas, and its mingling with the air, was due simply to the velocity with which it left the burner and the specific gravity being less than half that of air.

Very soon, however, it was found that a more rigid flame, and one more easily under control, could be obtained by utilizing the pressure under which the gas was delivered at the burner to act as an injector; and instead of merely mingling with air in its upward flow through a surplus, to make the uprush of the gas drag in air through side holes arranged at the bottom of a vertical burner tube placed above the gas-nozzle. In order to do this, a small jet, or series of orifices, discharged the coal gas into a small chamber surmounted by the upright burner tube; and either the walls of the chamber or the lower portion of the tube were perforated with an opening or openings in connection with the air. On opening the gas-tap, the coal gas is discharged through a jet with a velocity dependent upon the pressure of the supply, and, rushing upwards and impinging upon the sides of the tube above, acts in the same way as the steam in a Giffard's injector, and, by drawing up from the chamber the air which is present there, forms in it an area of low pressure, and so sucks in more air through the lateral holes to re-establish equilibrium —this action continuing, and the formation of the mixture of gas and air in the tube going on, as long as gas continues to flow.

By adopting this arrangement, it is manifest that, by regulating the size of the hole in the gas jet and the lateral air holes, it is possible to adjust the mixture of air and gas formed in the tube with the greatest nicety, and to obtain a perfectly non-luminous and fairly rigid flame at the top of the burner. After burners have, however, been in use for some time, no matter how well they may be regulated at first, the partial stoppage of the injector tip, by dust particles and other causes acting upon the jet and air supply, frequently deranges the ratio of the two supplies; and the result is that, in a laboratory or other place where a large number of bunsen burners are used, a wide discrepancy can be noticed in the appearance of the flames given by the burners. In some, the gas is burning with a slightly luminous top and the inner zone is barely visible. In others, the normal conditions exist, and you have a well marked violet inner zone and a non-luminous lilac outer zone. In others, again, the flame is somewhat shortened, showing a distinct greenish tint in the inner zone, with a pale lilac outer zone; and it is generally found that, when this point has been reached, the flame has more or less a tendency to roar, and will frequently flash back in the burner-tube and ignite the gas as it issues from the jet.

These appearances all mark different ratios between the air and gas in the mixture passing up the tube. When one sees a slightly luminous tip, it means that the gas is mixed with less than twice its own volume of air; while, with the normal conditions obtained with ordinary 16-candle gas (one volume of gas drawing in 2·2 volumes of air), the violet inner zone begins to show a tendency to turn to green when the ratio has become 1 of gas to 2·3 of air. Another $\frac{1}{10}$ per cent. causes the green to become most marked, and the roaring to commence.

With the ordinary bunsen burner as used in the laboratory, it is not possible to push the admixture of air and gas beyond this point, as the admixture of air and gas in the tube is now explosive, and the flame is only prevented from flashing back to the jet below by the rate of propagation of the explosive wave being less than the upward rate of flow of the mixture. Any further increase in the quantity of air present increases the rate of the explosive wave, and so causes flashing back. If, however, the head of the burner tube be covered with a layer or layers of fine wire gauze, the power of conduction which the fine metal filaments possess, and the fact that they reduce slightly the area of the tube and so increase the rate of flow through the orifices of the mesh, prevent the downward propagation of the wave. Under these conditions, the ratio of air to gas can be raised to over 3 volumes of air to the 1 volume of gas; and the green zone shrinks down on to the surface of the gauze, and shows itself as a seething layer in which the green colour has reverted to a very pale blue.

The importance of the regulation of the ratio between the gases having been recognized, the air holes in most of the burners used for laboratory and heating purposes were then fitted with cut-off rings, consisting of a loose ring of metal with holes in it, which could be slid round over the holes in the side of the chamber; so that when the two sets of holes coincided, the full air supply could be obtained. By drawing the solid metal of the ring more or less over the under holes, the area of

the air supply could be reduced; and in this way it was possible to adjust the condition of the flame to the work required of it. It will be evident that it is the admixture of air with the coal gas before combustion that causes the production of a non-luminous flame; and the old theory to account for this phenomenon was that the oxygen burnt up the hydrocarbons in the gas before their decomposition set free any solid particles of carbon to render the flame luminous. Knapp and others, however, showed that oxygen was not necessary for the production of a non-luminous flame, but that the luminosity could be destroyed by diluting the gas before combustion by such non-inflammable and inert gases as nitrogen, carbon dioxide, and steam; and the experiments of Blochmann, Landolt, and Heumann showed that nitrogen played a most important part in the action.

Some years ago, I attempted to ascertain the relative importance of the oxygen and nitrogen in rendering the flame non-luminous; and for this purpose I employed a bunsen burner, fitted at the bottom of the tube with two supply pipes instead of the ordinary gas-jet and lateral air holes. Each pipe was connected with a small meter, so that the flow of gas and air could be measured. The first determination was the quantity of air that was necessary to render the flame non-luminous; and it was found to require 13·5 volumes of air for 6 volumes of gas (13·5 volumes of air contain, roughly, 2·7 of oxygen and 10·8 of nitrogen). When 6 volumes of coal gas were passed into the burner with 10·8 volumes of nitrogen, a flame was obtained which had only a slightly luminous tip; while with 2·7 volumes of oxygen to the 6 volumes of coal gas, a luminous flame was obtained which flashed-back unless the burner was provided with a gauze top.

A bunsen burner burning coal gas alone gave on the photometer, with 5 cubic feet per hour, 5·6 candles; but with the addition of 2·2 cubic feet of oxygen, 3·1 candles. Using nitrogen, however, in the proportion of 9 cubic feet to 5 cubic feet of gas, the luminosity was so feeble that it could not be read. It follows, therefore, that the amount of oxygen in the air necessary to destroy the luminosity does less than one-half the work; and, accordingly, another experiment was tried with varying amounts of oxygen, the results being as follows:—

	Candle Power.	
5 cubic feet of gas alone	5·6	
5 „ „ to 1·1 cubic feet of oxygen	5·4	
5 „ „ „ 1·5 „ „ „	8·0	
5 „ „ „ 2·2 „ „ „	3·1	gauze used
5 „ „ „ 2·5 „ „ „	0·0	„

The next determination to be made was the amount of nitrogen that was needed in order to bring about complete non-luminosity by dilution only. Nitrogen was supplied to a coal-gas flame burning at the rate of 6·2 cubic feet per hour; and it was found that 14·2 cubic feet per hour of nitrogen were needed to effect this result—an amount which is practically the same as that of the air required before.

1 volume of gas required 2·30 volumes of nitrogen.
1 „ „ „ 2·27 „ „ air

This seems to show that the oxygen acts merely as a diluent; but if this were so, the mixtures of oxygen and nitrogen containing a larger percentage of oxygen than ordinary air should have the same effect on the luminosity of the flame as air. This, however, is disproved by the following results:—

Volumes of Varying Mixtures of Oxygen and Nitrogen Required to Render 1 Volume of Coal Gas Non-Luminous in a Bunsen Burner.

Gas.	Volume of Mixture Required.	Composition of Mixture. Nitrogen.	Oxygen.	Volume of Oxygen Present in Amount Required.
1 volume	2·30	1	nil	nil
1 „	2·30	5	1	0·38
1 „	2·27	4	1	0·45
1 „	2·02	3	1	0·50
1 „	1·49	2	1	0·50
1 „	1·00	1	1	0·50
1 „	0·50	nil	1	0·50

From this, it will be seen that, until the percentage of oxygen reaches the amount present in air, the diluting influence of the nitrogen overpowers the effect of the oxygen in the destruction of the luminosity; but with 25 per cent. and over of oxygen, the retarding influence of the nitrogen has no effect on the activity of the oxygen,

The effect of various gases in bringing about non-luminosity was then tried; but the employment of a wet meter for measuring purposes rendered the number of these limited.

Volume of Gases Required to Render 1 Volume of Coal Gas Non-Luminous.

1 volume of coal gas requires	0·50	volumes of oxygen
„ „ „ „	1·26	„ carbon dioxide
„ „ „ „	2·27	„ air
„ „ „ „	2·30	„ nitrogen
„ „ „ „	5·11	„ carbon monoxide
„ „ „ „	12·40	„ hydrogen

So that a combustible diluent which increases the temperature of the flame is required in far larger quantity than a non-combustible diluent, in order to render the flame non-luminous.

The varying effects of diluents have been attributed to the influence of density; but it has been shown by Heumann that a flame can be rendered non-luminous by cooling as well as by dilution. If a luminous flame be caused to spread itself over a cold surface, it became non-luminous; but the luminosity could be restored by heating the surface over which the flame plays. If, therefore, a diluent had the power of extracting more heat from a flame than another, it would be more active in reducing the luminosity, so that a smaller quantity would be required to render the flame non-luminous; and on comparing the specific heats of the gases used in the last experiment, the reason for the small quantity of carbon dioxide is at once seen.

Specific Heats of Equal Volumes.

Oxygen	0·2405
Carbon dioxide	0·3307
Nitrogen	0·2370
Air	0·2374
Carbon monoxide	0·2370
Hydrogen	0·2359

Experiments show that this is in all probability the true explanation, as in the flames rendered non-luminous by diluents the inner cone for the first 1½ inches is decidedly cooler than in the luminous flame, owing to the cooling action of the nitrogen or carbon dioxide. Above this point, however, the influence of the oxygen begins to be felt, and the non-luminous flame is here hotter than the luminous flame; while the hottest portion of the flame is to be found half way between the tip of the inner and outer cones. With inert diluents, however, the hottest points are found at the side and tip of the outer cone when the air necessary for combustion is obtained.

With a bunsen burner, in which the mixed gas and air give a green inner cone, although a low temperature is found at the bottom of the inner cone, due to the excess of air, yet the increased quantity of oxygen causes a rapid oxidation in the upper portion, and a smaller and hotter flame is produced. From these experiments, and also from the researches made by Heumann, it will be seen that several causes aid in the destruction of luminosity in a flame, chief among which are oxidation, dilution, and cooling.

The chemical changes taking place in a bunsen flame are far more simple than those which are going on in the luminous flame. Taking ordinary London gas having the composition—

Hydrogen	52·16
Unsaturated hydrocarbons	3·50
Saturated hydrocarbons	36·25
Carbon monoxide	3·68
Carbon dioxide	0·00
Nitrogen	4·10
Oxygen	0·31
Sulphuretted hydrogen	0·00
	100·00

A gas of this composition would require about 5 times its own volume of air for its complete combustion. When a bunsen burner burns with a blue non-luminous flame, the ratio of gas to air is about 2 to 1—less than half the amount necessary for complete combustion; while with the green inner cone, 2·5 of air mix with 1 of gas. So that the bunsen flame obtains from the mixture only about one-half the air necessary for its complete combustion, the remaining portion being obtained from the exterior of the flame during combustion. This is the cause of the double cone in the flame; the inner cone being formed by the incomplete combustion of the gas with the admixed air, and the outer cone by the combustion of the products of this incomplete combustion by means of the external air. This can be proved by the use of an apparatus devised by Mr. Lewis T. Wright, and perfected by Professor Smithells, in which the two parts of the flame can be separated. This dual action is practically complete when the ratio of air to gas is 2·6 to 1, and the green cone is produced. The action of the mixture in the inner cone may be approximately expressed by the following equations:—

		Hydrogen		Oxygen		Water		
		H_2	+	O	=	H_2O		
Ethylene		Oxygen		Carbon monoxide		Water		Hydrogen
C_2H_4	+	O_2	=	2 CO	+	H_2O	+	H_2
Methane		Oxygen		Carbon monoxide		Water		Hydrogen
CH_4	+	O_2	=	CO	+	H_2O	+	H_2

And the resulting carbon monoxide and hydrogen, in about equal proportions, diluted with twice the quantity of steam, and the unchanged nitrogen, burn at the expense of the oxygen of the external air forming the outer cone. A small quantity of carbon dioxide is also always found, probably due to the oxidation of some of the carbon monoxide by the steam; and the gaseous mixture which forms the outer cone has an approximate composition of—

Water vapour	16 per cent.
Nitrogen	60 „
Carbon monoxide	9 „
Hydrogen	10 „
Carbon dioxide	5 „
	100

It does not seem possible that such a mixture, containing as it does less than 20 per cent. of combustible gas, should burn and produce the intense heat found in the outer cone of the bunsen burner; but Professor Smithells has shown that, under ordinary conditions, the heat of the inner cone is added to that of the outer. So that in the combustion the outer cone is always hotter than the inner. That this is so, can be clearly shown by using the Smithells tube, and, having widely separated

the two cones of the flame, holding a mantle in the outer zone, which fails to heat it to incandescence. But on now allowing the inner cone to rise in the tube, the mantle becomes more and more luminous, until the cone has resumed its proper position in the centre of the flame, when the mantle gives its full incandescence.

It is quite clear that the ratio of gas to air needed to give the best results in a bunsen burner intended for use with an incandescent mantle must be the one which yields the hottest outer zone to the flame; and it might be expected that this would be arrived at by only just allowing sufficient air to mingle with the gas to render it non-luminous, as there then being a larger proportion of combustible gas to burn at the surface of the mantle, one might expect a higher temperature at that point. This, however, is not the case, as the heat from the combustion in the inner zone can only escape through the outer zone; and the maximum effect on the mantle is produced when as nearly as possible one-half the combustion takes place in the inner zone, at the expense of the air drawn in with the gas through the air holes of the bunsen, while the second half is burnt on the surface of the mantle itself.

This was proved experimentally by closing the air holes and removing the injector from a mantle burner, and fitting in its place a T piece, through the arms of which the gas and air measured by the standard meters were passed. The gas supply was kept constant at 5 cubic feet per hour at a pressure of 1·5 inches of water, and the air regulated to give the desired appearance to the flame. The rate of flow of gas and air was then taken, and a well fitting mantle placed on the flame, the illuminating power ascertained, and a Le Chatelier thermo-couple placed so that the twist just touched the mantle at a point 1 inch above the burner head. Every precaution was taken to ensure accuracy; and the results were as follows:—

Condition of Flame.	Ratio of Flow. Gas.	Air.	Ratio. Gas.	Air.	Candle Power per Cubic Foot of Gas.	Temperature. °C.
Under aerated	4·5	10·00	1	2·20	14·4	1880
Best aeration	4·5	12·75	1	2·75	20·0	1915
Over aeration	4·5	15·25	1	3·40	17·7	1905

On analysis, the gas was found to contain:

Hydrogen	60·4
Saturated hydrocarbons	28·1
Unsaturated hydrocarbons	4·0
Carbon monoxide	5·0
Carbon dioxide	0·0
Oxygen	0·5
Nitrogen	2·0
	100·0

And, by exploding with oxygen, it was found that, for its complete combustion, 1 volume of gas required 5·5 volumes of air. From these experiments, it is clear that there is a point in the aeration of the bunsen flame which gives the highest temperature in the portion where the mantle is situated, and that above or below this ratio the light yielded by the mantle suffers.

Experiments were then made to determine the effect upon the light emitted by the mantle of different degrees of aeration; the arrangement of the apparatus being such that the burner could suck in the air it needed in the usual way from a bulb—the gas being burnt at a constant rate under a pressure of 1·5 inches of water, while the flow of air could be varied. On plotting out the results of the experiment as a curve in which the upright shows the candle power, and the lower side the ratio of volume of air to 1 volume of coal gas, the result shows that, with a 16-candle gas, on increasing the aeration the candle power of the mantle steadily rises until a maximum is attained with a mixture of 1 of gas to 2·5 of air, or just about one-half the amount of air required for complete combustion. On increasing the aeration above this point, the candle power fell steadily.

A serious trouble with mantle lighting is the carbonization of the mantle, which commences with a slight sooty deposit at one spot, and which then rapidly grows over the surface of the mantle, not only reducing the light emitted, but giving rise to traces of carbon monoxide in the products of combustion. When the flame is under aerated, and contains a ratio of less than 2·2 volumes of air to 1 of gas, some methane escapes combustion in the inner zone of the flame and burns with the carbon monoxide and hydrogen in the outer flame; and it is this which causes the trouble.

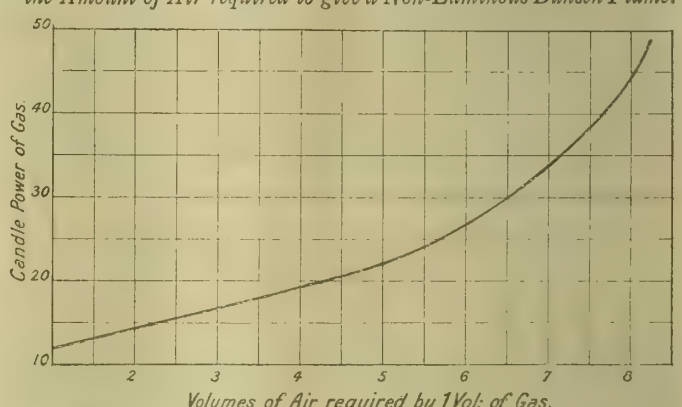
On replacing the ordinary tube of a bunsen burner with one made of platinum, and if the ratio of gas and air be so arranged as to give a blue non-luminous flame, on heating the platinum tube the flame becomes luminous, although not to such an extent as would have been obtained from the original gas. If the tube be allowed to cool down, the flame again becomes non-luminous, showing that the luminosity is solely due to the restoration of heat to the flame, and not to any alteration in the composition of the gas. But with a bunsen burning with a green inner cone, luminosity cannot be produced by heating the mixture of gas and air. On now taking an ordinary bunsen with a brass tube, and surrounding the blue non-luminous flame with a platinum gauze mantle open at the top, so arranged that the sides of the flame heat the mantle to a high temperature, the top of the flame will become luminous, owing to the platinum superheating the flame gases from inner cone and causing them to decompose with separation of carbon particles. The same result is obtained with an ordinary mantle open at the top; and it is to this cause that the deposition of carbon on the mantles is due.

It will often be found that the carbon begins to deposit on the rod which supports the mantle, and which is fixed in a small plate in the burner head. Above this plate, there is a zone of unburnt gas which is raised to a high temperature by the radiant heat from the walls of the mantle; and the same conditions as before for the deposition of carbon are brought about. When once this carbon has started to form, its catalytic action causes the decomposition of the hydrocarbons still present to proceed with greater rapidity; so that, in time, both the upper part of the rod and the mantle become so crusted with carbon as not only to reduce the light emitted to a minimum, but to cause the formation of distinct quantities of carbon monoxide in the products of combustion.

The amount of air needed to give a non-luminous bunsen flame varies with the richness in hydrocarbons of the gas; and the higher the candle power, the greater must be the volume of air used for each volume of gas.

It is found by experiment that, although the increment in the volume of air needed for each extra candle power in the value of the gas is fairly constant for gases below 20-candle power, it rapidly rises when richer gases are used; and the following curve (in which the figures in the side represent the candle power of the gas, and the figures on the bottom line the ratio of air to 1 volume of gas) shows the amount needed by gas of from 16 to 50 candle power.

DIAGRAM *showing the Influence of the Candle Power of the Gas on the Amount of Air required to give a Non-Luminous Bunsen Flame.*



The candle power of the original gas also affects the light which is to be obtained from the mantle.

If an ordinary burner and mantle be purchased and tested first with 16-candle gas, then with 15, and finally with 14-candle power gas, it is often found that it gives a better light with the 15 than the 16 candles, and a further improvement with the 14-candle gas. This, however, is dependent upon the fact that the burner is drawing in less than the necessary amount of air to give the best conditions of combustion in the inner zone, and that the right degree of aeration is being more and more nearly approached with the poorer gas. But when care is taken to ensure the correct ratio of air and gas consumed in each case, it is found that for qualities of gas between 14 and 18 candle power, there is a gain of about 3 per cent. in the light emitted by the mantle for each candle illuminating power in the gas.

When Welsbach first introduced the incandescent mantle, the burner which he used in 1885-86 consisted of a small bunsen burner of the ordinary type, with a tube of about the same length as in an ordinary laboratory burner, on to which was fitted a gallery to carry a chimney, and a head stamped out of thin sheet metal. The length of the fitting was, however, objected to by consumers who had up to that time only been accustomed to screwing a flat-flame or Argand nipple on to their fittings; so the burner tube was very soon shortened, and the head carrying the gallery, which fitted over it, was made to slightly increase this length.

Many forms of these burners have been used; the differences being chiefly dependent on the construction of the head. Some consist of open circular slots, others of flat gauze discs with a small baffle in the centre, some had gauze domes, and others steatite or cut-metal tops. But, owing to the construction of the burner, they all had one peculiarity, and that was they under-aerated the gas before combustion; and, in consequence, a chimney was required with them in order to create an up-draught, and so bring air rapidly in contact with the burning gas on the surface of the mantle.

When no chimney was used, the unburnt gas from the inner zone had to travel a short distance from the surface of the mantle through which it was passing before it obtained the necessary air for its combustion; hence the layer of highest temperature was outside the mantle, which, in consequence, was not raised to the highest degree of incandescence. When the chimney was put on, however, the uprush of air that it created burnt the escaping gas on the surface of the mantle itself, and the best results were obtained. Burners of this class are still the ones most used; and it is now fully realized that if the amount of air sucked in by the burner is not at least half

the total volume of air that is needed for the complete combustion of the gas, a chimney of such length as to create a sufficient draught to consume all surplus gas on the surface of the mantle must be used. Taking a 14 or 15 candle power gas, a 6-inch chimney is generally sufficient to supply the necessary air; while with a rich gas, such as is supplied in Edinburgh, a 10 or 12 inch chimney is not too long for the work it has to do.

It is now beginning to be found that the chimney even is capable of improvement, and that if, instead of allowing all the air to be drawn up from the bottom, holes are made in the chimney just above the level of the burner head, the air impinges more directly on the mantle, and a slightly better result is attained; while the idea, originally due to Sir Edward Frankland, and revived every few years since, of heating the air supply by making it pass down between an outer glass and the chimney before ascending the interior of the chimney itself, has also been applied to mantle burners. Unless very carefully adjusted, however, the loss of light due to absorption by the glasses nearly makes up for the slight gain.

Mantle burners in which regeneration has been attempted have also been tried. But the fact that air or gas can be heated separately and then utilized to give a very hot flame does not apply to the mixture of the two; as when a mixture of air and gas is heated, oxidation of the gas commences, and the loss of combustible matter due to this cause outweighs the advantages of preheating.

Real improvements in the burners employed in mantle heating commenced in the early nineties. At this period, Chemin and Bandsept both began working at the idea of adding air to the gas in small portions so as to gain a more intimate mixture of the two before combustion. Chemin's burner, however, was never a practical success; but Bandsept succeeded in producing a burner which, up to the present time, has never been excelled. Using a conical injector of such a character as to spread the jet of gas issuing from it, he placed above it a short truncated cone, which upwardly converged in such a way that the area of the upward flow of the jet of gas practically filled it; and above this, again, he placed another cone of the same character having a still wider opening at the top. Several of these ever-widening cones being used, and a suction being created in each, air was allowed to be drawn in through small holes in the base of the cones, and, mingling with the upwardly flowing stream of gas and air, entered a larger upwardly diverging cone, which acted as an expansion cone and relieved the pressure that otherwise would have been created by expansion on nearing the heated burner head—the gases being finally mixed by passing through atomizers consisting of double layers of wire gauze, perforated metal thimbles, or other devices, which would complete the admixture of the air and gas immediately before combustion.

The work done by Bandsept in perfecting the bunsen for mantle heating was enormous; and on glancing back through his Belgian patents, one finds nearly every feature of such modern burners as the Kern had been worked out by him before 1896. His burners are still the best that have been introduced, and are, indeed, the form of chimneyless burner adopted by the French Auer Company.

In 1894, De Mare made a number of different forms of burner for his plumes and for mantles, and improved the suction given by his jet of coal gas by placing above it a tube having the form of two cones united at their summits, which largely increased the uprush of the mixture, and also added slightly to the amount of air drawn in with the gas. The so-called "Simplex" burners, which are now largely used, are made upon the principles enunciated by De Mare in his patent.

In the burners made upon the principles first put forward by Bandsept and De Mare, the superior rigidity of the flame, due to the increased rate of outflow of the mixture and the aeration being brought up to the best point for exciting the incandescence of the mantle, the chimney can be dispensed with. Perhaps the best known chimneyless burner at the present time is the highly vaunted Kern burner, in which the form of head devised by Bandsept in one of his earliest patents is added to the suction-tube, formed of truncated cones, patented by De Mare, giving a burner which yields practically the same photometric results.

It must always be remembered that the statements of illuminating power yielded by various incandescent mantles and burners is always open to the interference of several important factors, the chief one among which is fit of the mantle. Most observers seem to imagine that as long as the mantle will go over the burner head, and the rod that supports it is of the prescribed height, the full illuminating power which the burner and mantle are capable of yielding is given. This, however, is an entire mistake, as unless the mantle not only fits the head, but also the flame, perfectly, serious discrepancies at once arise. And although, when a perfectly fitting mantle is obtained, such chimneyless burners as I have described will give as high as 24 candles per cubic foot of gas consumed, they are just as often found to give only 14 candles. If the burners and mantles commercially sold be taken and tested carefully, the average comes out at about 18 or 19 candles per cubic foot of gas. Until absolute uniformity in the construction of the burner, and in the shape of the mantle, can be obtained, these discrepancies cannot be avoided, and it is only by taking the greatest possible precautions that fair results can be obtained.

I cannot help thinking that manufacturers make a very great mistake in claiming illuminating powers for their mantles and burners which have only been obtained in isolated cases where by chance perfect conditions have been attained, as the non-fulfilment of the results in practice gives rise to disappointment to consumers, and discredits the particular form of burner.

In conclusion, I can only regret that the shortness of the course has prevented me from dealing with a large number of points which otherwise I would have liked to have touched upon.

DETERMINATION OF BENZENE AND ETHYLENE IN COAL GAS.

The following is an abstract translation of a contribution by Professor F. Haber, Ph.D., to the "Journal für Gasbeleuchtung," on the above-named subject.

Last year, Dr. O. Pfeiffer described a modification of the method of Harbeck and Lunge for the determination of benzene in coal gas.* He has since referred to his method as the most rapid and exact of any existing system. His retrospect of the latter does not, however, allude to the method of Haber and von Oechelhaeuser.† The author consequently is constrained to draw attention to this plan, the utility of which has been substantiated by further researches.

The method, as already described, determines the benzene and ethylene in coal gas by difference. The total amount of benzene and ethylene is found by the usual absorption plan; and then the ethylene alone is determined by titration. The titration depends on the fact that ethylene and bromine vapour combine forthwith, and form ethylene bromide; while benzene vapour and bromine vapour do not act on one another. It does not appear necessary to quote further experimental results in support of the observation that the bromination of ethylene takes place quantitatively, as Treadwell and Stokes and C. Winkler have likewise found that it is correct. But Haber and Oechelhaeuser were the first to point out that, under suitable experimental conditions, benzene vapour is so far indifferent to bromine vapour that an analytical method may be based on this indifference. An oral communication by Dr. Bunte, to the effect that the condensation product of the washing of coal gas with bromine contains much unbrominated benzene, drew their attention to the subject of the action of bromine and other halogens on benzene. They ascertained that air, to which 2·5 to 2·6 volumes per cent. of benzene had been added, might be agitated for two minutes in a Bunte burette in diffused light, with bromine water, without the strength of the latter being affected, provided the bromine water was such that 10 c.c., after addition of any excess of potassium iodide, required, on titration, about an equal volume of decinormal solution of thiosulphate.

This fundamental observation was verified by experiments in three different directions, with great exactness. In the first case, it was proved that extension of the time allowed for the reaction of the benzene vapour on bromine vapour to many hours, did not effect a reaction between them to any considerable extent. Next the mass of the reacting gases was made sufficiently great for a very slight conversion to fall within the limits of estimation of the product; and, thirdly, mixtures of the vapours produced by the gasification of commercial benzol, which is not quite pure, were employed, as well as benzene vapour. The first two modifications aimed at proving that benzene vapour and bromine vapour react at the most only in infinitesimal quantities; while the third was directed to overruling the objection that coal gas contains, besides benzene, small quantities of its higher homologues, which might cause some deviation in the action. The results of experiments in these directions, carried out in conjunction with Herr S. Leskiewicz, confirm the exactness of the method described, and give it fresh support.

The system of Harbeck and Lunge is of quite another nature. It consists in converting the benzene to dinitrobenzene, which is weighed. Dr. Pfeiffer's modification of the method, which he regards as a simplification of it, consists in agitating a sample of the gas with nitro-sulphuric acid, in place of passing a stream of the gas through the acid. The system of Harbeck and Lunge is comparatively tedious. It was, however, not intended by its inventors for use for technical purposes, but rather for precise determinations. Dr. Pfeiffer's modification does not appreciably lessen the tediousness of the method.

The researches, of which the results have been referred to in the foregoing, on the behaviour of bromine water and benzene vapour, were carried out in the manner described below.

Experiments with Bromine Vapour and Benzene Vapour.

Two thin glass bulbs were filled, one with commercial bromine, the other with pure benzene, free from thiophene, and twice fractionated within 1° C. They were introduced with some pieces of glass into a separating funnel of 4·375 litres capacity. The funnel was then exhausted as completely as possible, and shaken strongly until both bulbs were thoroughly shattered, and their contents vaporized. The funnel was then left for some time; and afterwards 200 c.c. of 3¼ per cent. solution of potassium iodide was introduced through the outlet-nozzle of the funnel. The pressure was then equalized, and the iodine liberated in the funnel titrated with standard solution of thiosulphate. A blank

* See "JOURNAL," Vol. LXXIV., p. 1121. † *Ibid.*, Vol. LXIX., p. 410.

testing was next made to ascertain the consumption of the thiosulphate when a bromine bulb only was introduced into the funnel. All the tests were carried out at the temperature of the room (about 61° Fahr.). The results are given in the annexed table.

—	Weight of Bromine.	Weight of Benzene.	Time allowed for the Action of the Benzene on the Bromine.	Amount of Solution of Thiosulphate Consumed.	
				Total.	Per Gramme of Bromine.
	Gramme.	Gramme.		Cub. Cent.	Cub. Cent.
1	0·6472	0·1720	20 minutes.	39·80	61·50
2	0·5862	Nil.	..	36·10	61·60
3	0·4241	0·1705	20 minutes.	26·15	61·66
4	0·7898	Nil.	..	48·55	61·47

The strength of the thiosulphate solution agreed at the beginning and end of the experiments. It was 0·20516 time the strength of normal solution. Theoretically, 60·93 c.c. of this solution would correspond to 1 gramme of bromine. Probably a little chlorine in the commercial bromine employed accounted for the consumption of thiosulphate actually being rather greater. The change in the consumption of thiosulphate due to contact of the benzene vapour with the bromine was practically *nil*; whereas if the benzene were converted to monobrom-benzene, the thiosulphate consumed would have been less by 10·6 c.c. in the first, and by 10·7 c.c. in the second experiment, than when that reaction did not occur. The percentage of benzene vapour on the volume of the separating funnel was 1·2 per cent. in both cases, which is about the same as the percentage of benzene vapour in ordinary coal gas. Hence the bromine had not acted upon the benzene vapour in the funnel.

Experiments with Bromine Water and Benzene Vapour.

The same quality of benzene was used as in the preceding experiments. A bulb containing benzene was introduced into the separating funnel, which was then exhausted, and 75 c.c. of bromine water was admitted through the outlet-nozzle in the following manner: The funnel was inverted, and the outlet-cock was opened very slightly, while the above volume of bromine water was run into the tubulure of the outlet-cock, from a pipette, at the rate at which it passed into the funnel. The tubulure was then washed by running in, by the same method, 25 c.c. of distilled water. The bromine vapour which remained in the pipette, and the drops of bromine water collected near the nozzle of the pipette, were expelled into a solution of potassium iodide for estimation. A blank testing, in which the benzene vapour was omitted was carried out between each pair of experiments. The bromine water was stored in a 4-litre flask. The following results were obtained:—

	Amount of Thiosulphate Solution used.
Without benzene	33·5 c.c.
With 0·1610 gramme benzene in diffused light at 60° Fahr. for 20 minutes	33·4
Without benzene	33·5
With 0·1940 gramme benzene in diffused light at 61° Fahr. for 20 minutes	33·3
Without benzene	33·33
With 0·1980 gramme benzene in feeble daylight at 61° Fahr. for 3 hours	33·1
Without benzene	33·3
With 0·1340 gramme benzene overnight at 62° Fahr. for 15 hours	32·7
Without benzene	33·05

The results showed that the strength of the bromine water, as indicated by the testings made without the benzene, gradually decreased, according as air was admitted to the storage flask to replace the bromine water removed. The treatment with benzene reduced the strength of the bromine water to a very small extent. In the most prolonged test, which lasted 15 hours, the reduction in strength was equivalent to

$$\frac{33{\cdot}3 + 33{\cdot}05}{2} - 32{\cdot}7 = 0{\cdot}47 \text{ c.c.}$$

of thiosulphate; whereas complete conversion of the 0·1340 gramme of benzene used to bromobenzene, would have caused a reduction in strength equivalent to 8·44 c.c. of thiosulphate. In the test which lasted for 3 hours, the actual reduction was 0·215 c.c.; the theoretically possible would have been 12·5 c.c. In the two tests which lasted 20 minutes, the actual reduction was yet smaller. Thus it appeared that reaction took place very slowly between the bromine and benzene. It was probably favoured by the presence of a comparatively large volume of water. But in view of the fact that, in the course of 20 minutes only 1 per cent. of the theoretically possible conversion occurred, it was reasonable to conclude that in the two to three minutes treatment of coal gas with bromine water, which is prescribed by Haber and von Oechelhaeuser, practically no reaction at all would take place. It could only extend to a few thousandths of the volume of benzene present; and as this does not exceed 1·5 per cent. of the gas, it would be quite inappreciable in its effect on the result, even in exact analyses, putting aside rougher technical observations.

Experiments with the Vapour of Impure Benzene and Bromine Water.

An impure benzene of which 48·5 per cent. distilled between 79—80° C., 30·5 per cent. between 80—83° C., 13·5 per cent. between 83—100° C., and 6 per cent. above 100° C. was used, with bromine water of about half the strength of that previously employed; and 150 c.c. of the bromine water was taken for each test. In the separating funnel, therefore, there were present during the time allowed for the reaction the 150 c.c. of bromine water and 50 c.c. of water used for washing the tubulure of the funnel. The following results were obtained:—

	Amount of Thiosulphate Solution used.
Without benzene	37·65 c.c.
With 0·1420 gramme benzene in diffused light, at 65° Fahr. for 20 minutes	37·25
With 0·1770 gramme benzene in Welsbach gaslight, at 65° Fahr. for 20 minutes	36·88
Without benzene	36·52
With 0·1615 gramme benzene, at first in Welsbach gaslight, then overnight for 14 hours, at 65° Fahr.	35·6
Without benzene	35·6

Reduction in strength of the bromine water took place more rapidly than in the earlier series of tests. The change in strength, due to the treatment of the bromine water with the benzene vapour, was, however, in the last series so small that it seemed doubtful if any reaction occurred.

In all the cases investigated, however, the action observed between bromine vapour or bromine water and benzene vapour was so slight that it was negligible so far as the analytical process of Haber and von Oechelhaeuser was concerned. Indeed, the reaction which was observed to occur after some time might clearly have been due to impurities in the bromine, which was merely a good commercial sample. Such bromine was chosen for the work intentionally, as the process was intended for technical use, in which only the commercial article could reasonably be employed. It would, however, be improper to employ any grossly impure bromine for the work.

In conclusion, the method of working employed by Haber and von Oechelhaeuser may be described afresh. The capacity of the portion of a Bunte burette between the lowest mark and the stopcock is determined. Then about 90 c.c. of the gas to be examined is introduced into the burette, and the volume so taken is read off. The water is drawn from the burette exactly down to the stopcock; and then after a lapse of some minutes the water which has run down from the sides of the burette to the capillary is likewise drawn out. Then 35 c.c. of bromine water from a large storage vessel is taken in a cup, and 10 to 15 c.c. is run up into the burette, and the level is read. Next a few drops of water are run up to wash the bromine water which remained in the capillary into the burette. Then, by inclining and rotating the burette, the gas-space is filled with bromine vapour. Sufficient bromine water should have been used to give the gas-space of the burette a brown colour. After two or three minutes, strong solution of potassium iodide is admitted and agitated. The contents of the burette are then washed completely into a beaker; and the free iodine present is determined by titration with thiosulphate. The pressure and temperature are observed at the same time.

Both before and after the test 10 c.c. of the bromine water is taken from a cup by means of a pipette (previously washed out with bromine water), and discharged by blowing into potassium iodide, which is then titrated. The pipette should have been calibrated for discharging in this manner. The mean of these two titrations is taken for calculating the result. One litre of decinormal solution of thiosulphate corresponds to 1121 c.c. of dry ethylene at 0° C. and 760 mm. The volume of gas under these conditions is converted in the usual manner to the corresponding volume when saturated with aqueous vapour at the prevailing pressure and temperature of the room. The volume of ethylene is calculated from the difference between the strength of the volume of bromine water used in the burette and that of an equal volume of the original store of bromine water as found from the mean of two titrations. The bromine water should be of about decinormal strength, or even rather weaker.

It is to be observed that, in determining the volume of the lower portion of the Bunte burette by weighing the water which runs from it, some more water collects, owing to draining from the sides of the burette, after the first lot has been run off; and this additional amount must not be ignored. The volume to the stopcock only, and not to the nozzle of the burette, is dealt with. The water which remains in the nozzle below the cock, when the bromine water is about to be admitted, passes up with the latter into the burette.

WATER-HAMMER IN PIPES.

In the "Review of the Continental Press" in the current number of the "Engineering Magazine," the above subject is dealt with. The writer points out that, though the action of what is generally called "water-hammer" or "hammer-blow" in mains has so often made itself apparent that its effects are well known, precise knowledge as to the causes and actual magnitude of these shocks has been lacking, owing to the experimental study of the subject having until recently been very slight. Some experiments made by Professor R. C. Carpenter, of Cornell University, at Ithaca, gave data concerning water-hammer in small pipes; but apart from these, the subject had

not been scientifically investigated until some recent, and very valuable, experiments in Russia. Made under the supervision and at the instance of M. Nicholas Simin, Chief Engineer of the Moscow Water-Works, and conducted in detail by Professor N. Joukowsky, of the Moscow Imperial Technical School and the Moscow Imperial University, they are discussed very fully in a paper presented by the latter before the Academy of Sciences of St. Petersburg, of which the following is an abstract.

The observations were made upon pipes of 2, 4, and 6 inches in diameter, laid upon the ground, and connected with the 24-inch main of the Moscow water system; valves at the ends of the pipes allowing the flow to be interrupted very quickly to produce changes in the hydro-dynamic pressure in the pipes. The results of the tests are especially interesting, since they show what had hitherto not been known—that all the phenomena of hydraulic shock may be explained by the formation and propagation of shock-waves in the pipes; these waves being due to the compression of the water and the extension of the walls of the pipe. After a review of the various theoretical studies which had previously been made of the action of shock in water-pipes, including the account of the experiments of Professor Carpenter, Professor Joukowsky goes on to describe the arrangement of the apparatus used in making the tests from which his deductions were made. The pipes were laid in the yard adjoining the Alexiew pumping-station, the lengths being as follows: 2 inch, 2494 feet; 4 inch, 1050 feet; and 6 inch, 1066 feet. The pipes were so laid that the terminals came close to the points of departure from the large main; thus enabling the same observers to control the closing of the valves and the observation of the instruments at both ends. Arrangements were provided for weighing the quantity of water discharged from any pipe in a given time, and by previous calibration the velocity required to discharge a known weight of water had been determined; so that this weighing of the water gave an accurate measure of the velocity in a pipe at any experiment. Several devices were employed for determining the pressures. A series of Bourdon pressure-gauges were placed at known intervals along the lengths of the pipes, and provided with friction indicators, showing the maximum pressure to which the needle attained for any test. The rapidity of propagation of the shock-waves was measured by a chronograph, recording, by means of electrical connections, the time of shock at points 700 feet distant; while the rise and fall of pressure at various points in the pipes was recorded by a special arrangement of the Crosby indicator. The corrections required in the use of these instruments are discussed in the paper, and the readings are tabulated and specimens of the diagrams given. The conclusions arrived at are as follows:—

1.—The hydraulic shock is propagated along the pipe with a constant velocity, which, so far as could be observed, is independent of the magnitude of the shock. This velocity is dependent upon the material of the pipe and upon the ratio of the thickness of its walls to the diameter of its bore. For ordinary cast-iron water-pipe, this ratio diminishes somewhat as the diameter increases; and hence the velocity of the shock-waves is somewhat less for large pipes than for smaller ones. For pipes of moderate size—2 to 6 inches bore—the velocity is about 4200 feet per second; and for larger pipes, of (say) 24 inches bore, it is about 3290 feet. The velocity of the shock-wave is the same whether the shock is produced by arresting the flow at the discharge of the pipe, or by suddenly raising the pressure at the beginning.

2.—The hydraulic shock acts with uniform force upon the length of the pipe. Its magnitude is proportional to the loss in velocity of the flow of the water and to the velocity of propagation of the shock-waves in the pipe itself. For ordinary cast-iron pipe of 2 to 6 inch bore, we have for each foot of velocity lost by the water a shock of about 4 atmospheres; while for a pipe of 24 inches diameter the shock is about 3 atmospheres.

3.—The existence of a periodical oscillation of a shock in a water-pipe is indicated by the reflection of the shock-wave between the beginning and end of the pipe.

4.—The flowing water has seemingly no influence upon the shock; this appearing to be dependent only upon the loss of velocity. The shock is reflected just the same in a pipe through which water is flowing as in a vessel containing stationary water, other conditions being equal.

5.—A dangerous increase in shock may appear in the passage of the shock-wave from a pipe of large diameter to one of smaller diameter. In such a case, the force of the shock, when it reaches the closed end of the pipe, is doubled; and as this doubling may be repeated several times, the pressure may attain great magnitude.

6.—The simplest method of preventing shocks in water-pipes is to introduce devices compelling the slow opening and closing of valves and cocks. For this purpose the time required to close the valve should be proportional to the length of the pipe. Air chambers, if placed in the line of the pipe near the valve, will almost entirely prevent the shock; but it is difficult to keep them filled with air. If a safety-valve is placed upon the pipe to relieve the pressure, it leaves a shock depending upon the strength of the spring.

7.—Shock diagrams taken from different points in a pipe enable the position and magnitude of accumulations of air to be determined. The shock diagram may also be used to determine the location of a leak in a pipe, and to obtain general information as to its condition.

REGISTER OF PATENTS.

Anti-Vibratory Incandescent Burners.—Fritt, G. H., Bentham, F. H., and Stott, J. H., of Bradford. No. 9380; May 4, 1899.

The object of this invention in connection with burners for incandescent gas lighting, is to arrange the parts of the burners so that they will effectually prevent vibratory shocks destroying the mantles. It consists essentially in the use of an adjustable ring fitted in the bunsen tube to support the spring carrying the body of the burner; an adjustable ring fitted in the bunsen tube within the spring supporting the body of the burner, so as to prevent undue oscillation of the upper portion of the burner; a conical tube made to slide up and down on the bunsen tube, and within the part carrying the outer body of the burner, so as to allow universal movement, and at the same time prevent the passage of gas or air from or into the burner; and other small detail improvements.

Gas-Engine Exhaust Silencers.—New, A. G., of Woking. No. 12,357; June 14, 1899.

This invention is designed to allow of the intermittent discharge of the exhaust gases from gas-engines, by the combination of a chamber into which the gases are discharged, and a valve controlling their escape from the chamber, arranged in such a manner that the valve is closed during the periods of discharge, and opens between those periods, whereby the velocity at which the exhaust gases escape from the chamber is reduced.

Fig. 1.

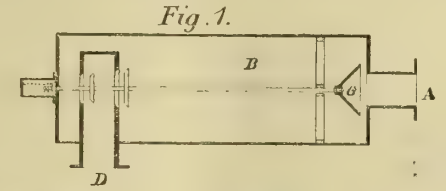


Fig. 2.

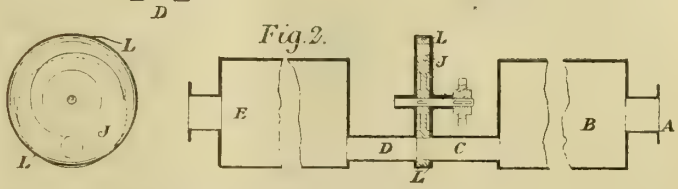


Fig. 1 is a longitudinal section of an automatically operated silencing device; fig. 2 shows one mechanically operated.

B is a chamber into which the exhaust gases are led from the engine through the pipe A. The only means of escape from B is through the pipe D, which is controlled by a valve or valves.

In fig. 1 a pair of valves are fixed upon a spindle F, provided at the one end with a funnel-shaped mouth G, and at the other end with a spring, which tends to keep the sliding-spindle in the position shown. The passage D (fig. 1) is provided with openings into the chamber B; and these openings are so shaped and arranged that the valves can completely close them if the spindle be moved longitudinally in its bearings or guides (from right to left), against the action of the spring.

The manner in which the device works is as follows: When, during the exhaust stroke of the engine, the exhaust gases enter the chamber B, they impinge upon the funnel-mouth G, thereby causing the spindle to slide longitudinally, and consequently close the openings into D. The exhaust gases are therefore unable to escape until their action upon G has ceased, and until the spring has been able to cause the spindle to return to its original position. The valves are then removed from the openings, and the gases are enabled to escape to the atmosphere. The velocity at which the gases escape will be less than that at which they entered the chamber B, owing to their temporary retention.

In fig. 2 a rotary valve, consisting of a disc J mounted on a shaft in bearings in a case L (the disc having a circular and tapering slot), controls the escape of the exhaust gases from the chamber B to a second chamber E, through the pipes C and D. The chamber E may be in open communication with the atmosphere through a suitable passage, or the passage may be provided with a second controlling valve similar to the one formed by the disc J. The valve-shaft is provided with a chain-wheel driven by the engine at a constant speed—at as many revolutions per minute as there are exhaust strokes per minute; and the relative positions of the disc J to the operations forming the complete cycles of the engine, are such that the disc, during each cycle, interrupts free communication between the pipe C and the pipe D, in the periods when the exhaust gases are entering the chamber B, and gradually establishes free communication between them during the intermediate periods.

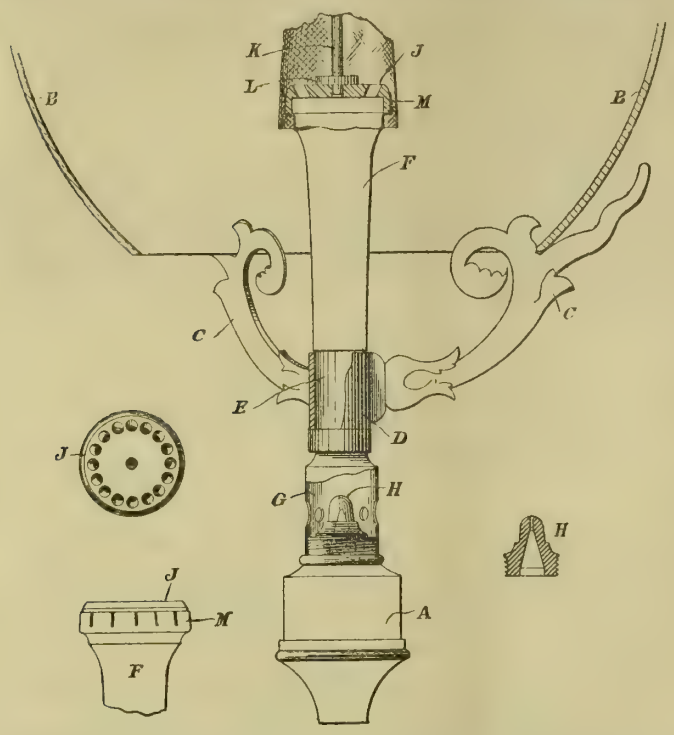
Street-Lanterns for Incandescent Gas-Burners.—Talbot, H., of East Dulwich, S.E. No. 13,310; June 27, 1899.

The object of this invention is to so construct a street-lamp lantern that it may be readily removed for repairing purposes, without necessitating the dismounting of the burner and incandescent mantle. This is attained by forming the lantern without a bottom, and attaching to the lantern frog or cradle, or any other lantern plate, a frame, on to which the lantern is fitted, and to which it is secured in any convenient manner by adjustable clips or catches, after the burner has been fitted to the service-pipe. In this way, the lantern can be lifted off the pillar for repairs, without removing the burner.

Low-Pressure Incandescent Lighting Apparatus.—Sugg, W., of Westminster. No. 23,398; Nov. 23, 1899.

Any detailed account of the patentee's proposal is unnecessary, as full particulars of his present invention were given in the "JOURNAL" for March 13, p. 680. It may, however, be pointed out, in giving on p. 1442 the illustration accompanying the specification—an elevation, partly in section, of the whole apparatus, as arranged for "low-pressure" incandescent gas lighting; a top plan view of the burner proper; the manner of securing the burner proper in the mouth of the burner-tube,

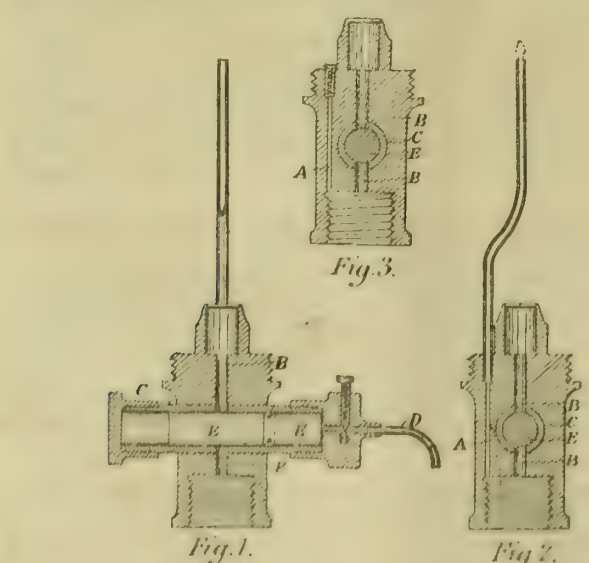
which will be what is known as an "air burner," as is usual in burners for incandescent gas lighting, but specially modified for the purposes of this invention; and a sectional elevation of the gas-nozzle—that the claims made are as follows: 1.—A low-pressure apparatus for incandescent gas lighting, under ordinary circumstances, consisting of a governor, a globe supported by arms carried by the burner, an air-burner, and a mantle, all combined and arranged as shown. 2.—An air-burner consisting of a disc of steatite ⅛ inch thick, having a solid central portion, and one row of holes near the edge, the axes of the holes being at an angle of 25° from the vertical. 3.—The combination with the burner proper of a heat-resisting peg for carrying the mantle, provided with a



disc or washer of steatite, to ensure the steadiness and verticality of the peg. 4.—Placing the burner proper at the end of the burner-tube, at a distance at least of 4½ inches from the tip of the gas-nozzle. 5.—A gas-nozzle adapted to supply a stream of gas at the rate of 4 cubic feet per hour, having a straight outlet-passage of slightly less than 1 mm. in diameter, and length of 4 mm., in combination with a chamber having inlet-holes for air in the walls—the gaz-nozzle being arranged with relation to the air-holes so that the tip of the nozzle shall be slightly above the line of the top of the holes. 6.—Means for holding the steatite burner consisting of spring tongues formed around the edge of a bell-mouth burner-tube, by cutting a series of nicks therein, and adapted to press with an elastic pressure upon the edge of the burner.

Lighting Gas from a Distance.—Anspach, J., of Berlin. No. 4606; March 10, 1900.

This invention relates to a pneumatically-operated device, which allows one or more gas-lights to be ignited from a distance by means of a lighting-flame or a self-igniting device. It relates further to a peculiar form of construction, which enables several jets connected with the same air-pipe (for instance, the jets of one or more gas-rings or separate single burners) to be lighted successfully, in such a way that, according to practical requirements, a suitable limited number of all the connected jets may be lighted or extinguished as desired.



Figs. 1 and 2 are vertical sections at right angles to each other, of the arrangement for a burner having a pilot or constantly burning lighting flame. Fig. 3 is a section (corresponding to the one in fig. 2) of a burner in which the escaping gas is not ignited at a pilot or lighting flame, but by condensation and absorption in a platinum fabric, or at a chemically-acting lighting device.

In figs. 1 and 2, the body which is to be screwed on the mouth of the gas-pipe is provided with two longitudinal bores A, B, and a cross bore C. The always-open bore A leads to the pipe of a constantly-burning lighting-flame. A pipe is inserted in the bore C, which pipe is closed at one end by a cap, and at the other end stands in communication with the pipe D of the air-duct, and contains an easily-moving regulating piston E. The latter has an annular recess which, in the right-hand end position shown in the drawings (which is produced by the suction of air), is displaced away from the bore B, so that no gas can pass through it to the burner, and thus come in contact with the lighting-flame. If, on the other hand, the air be compressed in the pipe D, the piston E moves into its left-hand end position, in which the recess coincides with the bore B; and the gas then flowing through it is ignited at the lighting-flame. The passage may be more or less closed by a pointed screw entering a recess below. In fig. 3, the bore A is closed by means of a screw; and the escaping gas is ignited at a self-lighting device arranged over it.

If several burners provided with this arrangement are connected by branch-pipes D with a main air-pipe, at the ends of which an air-suction apparatus and pressure-pump are situated; and if the separate air-ways are graded by adjusting the screws to different depths in a certain succession in size, on the compression of the air by means of the pump, the piston E will be first moved to the left, for the purpose of lighting the burners belonging thereto, which has its cylinder connected with the passage with the widest opening. On the further compression of the air, there will then be displaced the piston whose cylinder connects with the passage of the next narrower opening or section; and the lighting of the burner belonging thereto will take place. In this way, two jets will be burning. On further compression of the air taking place, a third, fourth, and so forth, jet is lighted—and always in the succession of the decreasing size of the air-passage to the separate regulating piston—until finally all the jets connected with the pipes are lighted; while any limited number of jets may be lighted, if, after the lighting of the last jet which is to be lighted, the piston of the air-pump ceases to compress.

Gas-Engines.—Dougill, A., of Leeds. No. 5089; March 17, 1900.

This invention has for its object the construction of gas-engines in such a manner that the end of the piston exposed to the explosions of gas and air may be retained at a lower and more even temperature than is the case where the pistons are of the ordinary kind. In this way, the liability is reduced of the end of the piston exposed to the explosions becoming unduly heated and expanding, so that the friction of it against the cylinder is increased to such an extent that the liability of the piston "jamming" within the cylinder is obviated. This is accomplished by constructing the piston with a water-jacket or chamber within it, having inlet and outlet openings arranged so that water may flow through the jacket or chamber in such a manner that the piston is retained at a temperature about equal to that of the cylinder.

APPLICATIONS FOR LETTERS PATENT.

8860.—Tweedie, R. O., "Burners for incandescence gas lighting." May 14.

8890.—Peard, R. B., "Gas-stoves." May 14.

8937.—Vahle, J. A., and Davies, C. J., "Acetylene gas generating apparatus." May 15.

8942.—Hooker, W., "Incandescent gas-burners." May 15.

8958.—Metz, C. H., "Gas-engines." May 15.

8973.—Genese, D., "Acetylene lamps." May 15.

8983.—Coulson, M., and Clayton, R., "Fire-places for burning gaseous or liquid fuel." May 15.

9013.—Maccallum, P. F., "Internal combustion engines." May 16.

9026.—Stansfield, A., and Meters, Limited, "Prepayment gas-meters." May 16.

9055.—Dawson, C. E., "Internal combustion engines." May 16.

9088.—Plaissetty, A. M., "New process for the incandescence of gas." May 16.

9094.—Saville, G. E., "Scrubbing apparatus for the removal of ammonia and other impurities from coal gas." May 17.

9127.—Grundy, F. B., "Incandescent mantles." May 17.

9142.—Strong, H. A., "Method of cooling gases." May 17.

9174.—Anderson, J., "Coin-freed gas-meters." May 18.

9285.—Germantz, W., and Erste K. K. priv. Metallsärge-auch Ornamentenfabrik and Leichenbestattungs-Unternehmung "Concordia" A. M. Beschorner, "Water-meters." May 19.

Preventing the Pollution of the Leeds Water Supply.—In connection with the Leeds Water-Works, the Corporation are now the owners of 32 farms at Fewston, representing 565 acres, nearly the whole of them having been purchased without arbitration. The Water Committee have now to face the remaining larger and more important landowners, who will not come to terms; and there are in all 78 owners yet to be dealt with. As the farms come into the possession of the Committee, everything possible is at once done by sewering and drainage works to prevent any chance of the city water supply being polluted.

Bingley Gas Affairs.—In his annual statement on the working of the Gas Department at the meeting of the Bingley District Council last week, Mr. Gatecliff mentioned that, in the year ending Dec. 31 last, the total production of gas was 94,501,600 cubic feet—an increase of 8,573,600 feet compared with the previous year. The total sales amounted to £11,291; and residuals produced £2491. The gross profits were £1792; but he explained that, owing to increased expenditure, the balance of profit was only £22. Discussing the effect of the higher cost of coal, he said there was no doubt that during the coming year it would mean an additional expenditure of from £1500 to £2500. Under these circumstances, he should suggest at the next meeting of the Committee that the price of gas be advanced 3d. per 1000 cubic feet. It was expected that there would be an increase in the receipts from coke and other residuals; and he thought an advance of 3d. would be sufficient to meet the extra expenses. A special meeting of the Committee is also to be held to consider the question of the purchase of the Cullingworth Gas-Works.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

Mr. Carpenter's Paper on Inclined Retorts.

SIR,—Your correspondent, Mr. Brackenbury, confuses the issue to the solution of which my paper was offered as a contribution.

The mechanical and the carbonizing efficiency of a retort-house plant are two different things. I did not consider it desirable to incur the expenditure necessary to carry the former to its extreme limit. But, as regards the latter, I omitted no precaution necessary to attain a high degree of success.

With regard to the selection of coal. A Durham contractor said, in my presence, last year: "We can get an extra 6d. per ton for our coal on the Continent, as it suits their inclined retorts." I need not point out that a good deal of money may be spent in the retort-house to save 6d. per ton on the coal handled there.

Mr. Brackenbury's gibes at London Engineers show that, on at least one other subject besides that under discussion, he speaks without personal knowledge.

CHARLES CARPENTER.

May 28, 1900.

The Calorimetry of Coal Gas.

SIR,—Mr. J. F. Simmance, in your issue of the 22nd inst., takes the trouble to emphatically dispute a claim which has never been made either by Dr. Colman or Professor Junkers, nor by myself as agent for the latter. The claim that has been made, and I venture to think substantiated, is that Professor Junkers has constructed a calorimeter which is new, practical, and effective—not that he has introduced into England the principle of absorbing the heat from a stream of gas products by a stream of water (the two being separated by thin walls of metal). After reading Mr. Simmance's letter and consulting his references, nobody will deny that Mr. Hartley invented a calorimeter in which this principle is used; but that does not appear to give him a claim to be considered the inventor or co-inventor of Junkers' calorimeter.

Unfortunately, the description of the Hartley instrument in the Transactions of the Gas Institute of 1884, p. 123, is so vague that it is hard to say exactly how it worked. This much, however, is quite clear from comparison—that the two instruments, although both calorimeters, are at least as widely different inventions as (for instance) the Lenoir and the Otto inventions, although both are gas-engines.

Does Mr. Simmance consider it an injustice to the memory of Lenoir that the engine invented by Herr Otto, of Cologne, is not called the "Lenoir-Otto" gas-engine?

HERMANN KÜHNE.

May 25, 1900.

PARLIAMENTARY INTELLIGENCE.

Gleanings from the Committee Rooms.

The work of Mr. Oldroyd's Committee has made the past two weeks remarkable in the annals of the gas industry; and in that work one can see some of the lines on which future gas legislation will run. While adhering to their objection to a floating standard of illuminating power and price, the terms in which they delivered their decision the previous Friday on the South Metropolitan Bill enabled the Committee last Wednesday to so broaden the conditions as to make it possible for the Company to accept them, and to proceed with the Bill; and if no evil befals it in its future stages, a great precedent will have been set for the supply of natural coal gas, unencumbered by enrichment. With one burden less to bear—and it is a big one, too, in many cases—gas undertakings will meet with still greater ease the competition of other forms of light, heat, and power. The charges for prepayment meter supplies in the Metropolis have also been brought under regulation in a manner which will hurt no one, and which will not blight the prospective development of the system. We have also seen the utter rout of the forces from Spring Gardens, who have been engaged in the inglorious task of trying to erect barriers across the path of progress.

Reviewing the work of the week in the order in which it was undertaken, the first two days were occupied by the Committee in considering the lightest and final Bill on their list; and no doubt the honourable members were right glad to be within sight of the end of a particularly tiresome set of measures. This last Bill was that promoted by the Wandsworth and Putney Gas Company, who came before the Committee with a clean record, and results which testified to good management, and a liberal consideration for the interests of the consumers. In the policy which has brought about this condition of things, one can trace the influence of the master-mind of Mr. H. E. Jones, who is a Director of the Company, and years ago was the Engineer—a position which his son (Mr. H. H. Jones) now occupies. Even in the case of this well-managed Company, the London County Council appeared as opponents; but why, one cannot conceive, unless it be through sheer officiousness. The Company supply 14-candle power gas at 2s. 2d. per 1000 cubic feet; and their present capital is only equivalent to £339 per million cubic feet of gas sold. If such figures do not speak well for a Company, and commend it as worthy of being trusted with greater powers, then it is difficult to see what will do so. The Company asked to be allowed to convert their capital, to which the stock objection was raised that it concealed from the public the fact that respectable dividends were being paid. Then the Company wished to raise additional capital, not exceeding £300,000, by the creation and issue of ordinary stock, with borrowing powers to the extent of one-third; and Mr. Balfour Browne advanced very good reasons for the granting of such large powers. Authorization to close certain useless lanes intersecting the site on which the Company propose to carry out some considerable extensions was also sought. Among the several unreasonable requirements of the County Council, they pressed for the Company being placed under similar provisions to those in force in connection with the three large London Companies; but why this Company more than any other Suburban Company was not made clear. They also asked for a reduction of the initial price of 4s., and objected to the Company's request that certain buildings should be exempt from the provisions of the London Building Acts. Like the County Council, the Wandsworth District Board of Works opposed on every conceivable point, although, it appeared, a Committee of the Board had arrived at an agreement with the Company, which the Board afterwards repudiated.

Mr. H. E. Jones was the first witness for the Bill; and after he had given the Committee a large supply of irrefutable evidence, a suggestion came from Mr. Worsley Taylor, for the County Council, that possibly an adjournment would result in a settlement. A conference took place; but the following morning found the parties as far from agreement as ever—the propositions of the opponents being so extreme that the Company could not possibly accept them. In fact, all through the proceedings before this Committee, the County Council had shown themselves so irrational that the Chairman more than once in the closing sittings evinced a little passing irritation. Under the circumstances, the Company's case proceeded; and Sir F. Bramwell, Mr. Corbet Woodall, Mr. E. H. Stevenson, Mr. H. H. Jones, and others all testified to the reasonableness of the Company's proposals. After such a compact body of evidence, the County Council were evidently convinced that further serious opposition would be futile; and they contented themselves with magnanimously throwing up the sponge on the understanding that clauses on certain minor matters would be introduced. The Wandsworth District Board offered a little resistance to some of the proposals, but with unimportant effect; and an appeal for a reduction of the standard price was also made on behalf of Battersea. Without calling on Counsel for the promoters to respond, the Committee passed the preamble of the Bill, subject to certain conditions previously offered by the promoters. Before the clauses were considered on Wednesday, the Wandsworth Board retired. The new clauses provide for the widening by the Company of Warple Way (which came into prominence in the building-line litigation), for a specified purity and pressure of gas, and for the setting up of an additional testing-station at the Town Hall or in some other sufficient building. The photometers to be used for the purpose of testing the gas supplied by the Company are to be of either of the most improved forms prescribed by the Gas-Works Clauses Act, 1871, as may be selected by the Gas Examiner. Looking at the case all round, it is not surprising the Company scored such a big and gratifying success.

The whole of Wednesday's sitting and Thursday afternoon were devoted by the Committee to the consideration of the clauses of the measures of which they had approved. In the first place, there was a superfluity of discussion regarding the form the clauses of the Bill should take which is to regulate the charges for prepayment meters and fittings in the Metropolis. Antagonism and frivolous obstinacy on the part of the London County Council had prevented an agreement with the Companies as to the phraseology and compass of the clauses; and therefore the Committee found themselves called upon to arbitrate between two sets—one by the County Council, and the other by the Gas Companies collectively. The Committee, it will be remembered, had on the previous Friday determined that the maximum additional charge for prepayment meters and fittings in the Metropolis should be 10d. per 1000 cubic feet, and that the remnant of the County Council Bill should be the channel by which legislative effect should be given to this decision. The modest little measure which has left the Committee room will never in future be identified with the Bill which was sent forth from Spring Gardens to shackle the London Gas Companies. Nothing now remains of the original but a small portion of the preamble, and the ponderous face title "The Gaslight and Coke, Commercial Gas, and South Metropolitan Gas Companies Bill." Even this is only being retained for purposes of identification in its remaining stages through Parliament, and ultimately it will be styled and known as the "Metropolis Gas (Prepayment Meter) Act, 1900." The result of the discussion on Wednesday morning (which is reported at length elsewhere) can be very briefly told. The form of clauses presented by the Companies was preferred by the Committee; and so from beginning to end, the representatives of the County Council had to bear the humiliation of seeing their proposals set aside in favour of the Companies whom they had sought to bind. Shortly, then, the Bill as it now stands provides that the price to be charged for gas under the prepayment system is not to be more than that charged to ordinary consumers; that the maximum sum to be charged in excess of the price of gas for the hire of the prepayment meters and fittings is to be at the rate of 10d. per 1000 cubic feet; and that the Companies are, in collecting money for gas supplied by means of prepayment meters, to give a receipt for the same in a form which shall show clearly the rate per 1000 cubic feet charged for gas, and in addition, the rate in respect of meters and fittings charged therewith. The maximum charge for the hire of a prepayment meter without fittings is to be at the rate of 10 per cent. on the cost of the meter. Provision is also made for the revision of the rate of charge by an arbitrator to be appointed by the Board of Trade.

In the history of the Metropolitan Gas Supply, there is more than one instance of Parliament having reposed unbounded faith in Mr. George Livesey; and he has justified the trust. Through Mr. Oldroyd's Committee, the House of Commons have again shown their confidence in him by passing the South Metropolitan Company's Bill, the progress of which through the Committee up to the point where the preamble was declared proved was recorded last week. The Committee, in making their announcement, it will be remembered, objected to what the Chairman termed the "floating standard" contemplated by the Bill, and suggested that the illuminating power should be 14 candles and the initial price 3s. 1d. per 1000 cubic feet. If this had been a hard-and-fast decision, instead of merely a suggestion, the Company, under their present circumstances, would have been compelled to withdraw the Bill; but Wednesday's proceedings showed that the suggestion was merely a proposed basis on which the Committee and the promoters could discuss a means of overcoming the objection of the former to the "floating" standard. By the exercise of some little diplomacy by Mr. Livesey on the one side and by the Committee on the other, an arrangement has been effected by which the Company are to be let down to the mentioned low standards of illuminating power and price in two steps; and so the Bill has been saved. The piloting of the measure past the shoals and reefs that have beset its course thus far has been a difficult matter; but it has been accomplished. And if it now succeeds in safely

completing its voyage through the parliamentary seas, its passage will be a triumph for the cause of cheap and rational gas supply.

When the Bill came up for the consideration of the clauses on Wednesday, it was feared by many that its career would be rapidly closed. But such an eventuality, it was quickly apparent, was foreign to the minds of the Committee, who were as anxious as its author to see this scheme for the reformation of part of the London gas supply go through; and, before Lord Robert Cecil had finished explaining the necessity for a transition period, the Chairman mentioned that the same thing had occurred to him after he had delivered the Committee's decision the previous Friday. Lord Robert showed that, having made their contracts for coal to produce 16-candle gas, to comply with the Committee's suggestion at the beginning of the half year following the passing of the Bill, would impose a serious loss on the Company. He therefore submitted that the proposal in the Bill should stand, with an addendum to the effect that whenever, under the provisions of the Act, the standard price of gas was reduced, it should not thereafter be raised. The original proposal was that the standard price should vary according to the illuminating power of the gas as follows: 3s. 3d. (which is 3d. less than the present standard) for gas having the power of 16 candles or more, 3s. 2d. for gas of 15 and under 16 candle power, and 3s. 1d. for gas of 14 and under 15 candle power. When the Bill was drafted, the promoters had no idea that the price of coal was going to rise to the extent it has done; and Mr. Livesey was called to show what effect this would have. The Company have bought coal at 8s. per ton advance; and on the 1,100,000 tons they carbonize in a year, the increased price will add £440,000 to their expenses. Reckoning that they will obtain a return of £100,000 from coke, this will leave £340,000 to make up. A 1d. increase per 1000 cubic feet gives the Company £42,000; so that 2s. 8d. is the lowest price at which they can, under present circumstances, hope to supply gas. By further calculations, Mr. Livesey showed the Committee that, by reducing under these conditions the initial price to the 14-candle standard, the proprietors would receive only 3¼ per cent. at the market price of the stock. Therefore, he urged, the only way out of the difficulty was to come down by steps; but at the same time he made it quite clear that he did not withdraw in the slightest degree from his position as to the necessity for abolishing enrichment.

Considerable argument ensued between the Chairman, Mr. Livesey, and Lord Robert Cecil, in the course of which Mr. Livesey frankly confessed that, in introducing the Bill, the Company had been too keen to fall in with the recommendations of the Select Committee of last year; and that they were giving more to the consumers than they would save. The Committee were obdurate on the point of leaving the reduction of the standards to the will of the Company; but at the same time they were equally as desirous as Mr. Livesey to get the Bill through. It was the Chairman's idea that there should be fixed periods within which the reductions should take place; and, after one or two short-period proposals, he suggested that the Company should descend by commencing the supply of 15-candle gas on July 1, 1901, and 14-candle gas on July 1, 1903. Even this Mr. Livesey would not take the responsibility of accepting; but the time for the midday adjournment having about arrived, he obtained the permission of the Chairman to consult his colleagues, who were holding their usual Board meeting at the Company's chief offices. True to his engagement in regard to time, Mr. Livesey returned with the intelligence that the Directors were prepared to accept a time-limit if the imposition of the 14-candle power standard was postponed until four years after the commencement of the 15-candle standard on July 1, 1901, with a promise to reduce it sooner if at all possible. He explained that, to effect savings, the system of manufacture would have to be altered; and the Company could only make the necessary changes as carbonizing plant became worn out. The proposal was a reasonable one; but, after what had already transpired during the morning, nearly everybody present was astonished at the ready acquiescence of the Committee. For the lower quality gas, the conditions of testing and the penalties are to remain as at present. A three months' notice of a reduction of illuminating power is to be given to the County Council and the Local Authorities, and also to the consumers by advertisement. The consumers are to have two years from July 1, 1901, in which to apply for the new burner (designed for the lower quality gas) as promised by Mr. Livesey, and to which reference was made last week.

The County Council have reserved the right to oppose the Bill on one or two points in the House of Lords; and a leading official of that pugnacious body promises another attack on the Gas Companies next session. This official has informed Mr. Livesey that the Council intend to again introduce their Portable Photometer Bill. Mr. Oldroyd, however, while he cannot control future legislation, has stated that, in dealing with the South Metropolitan Bill, they have proceeded upon the basis that the testing would remain the same as now. To this statement due regard will certainly be paid by any Committee who may be inflicted next session with the task of considering the reactionary proposal for random photometry.

The question of the protection of property owners in the neighbourhood of gas residual works was raised in connection with the Salford Corporation Bill, which was last week before a House of Lords Committee presided over by Lord Newton. The Corporation wish to carry on the manufacture and conversion of residuals upon certain land owned by them near the Manchester Ship Canal, part of which is at present leased to Mr. Lord for the same purpose. Mr. Lord purchases the tar from the Corporation under a seven years' agreement; and at the end of the contract, the works may be taken over at a valuation. The petitioners were Messrs. W. Brown and Son, who own cottage property in the neighbourhood. It was proved that up to now they had made no complaint of nuisance arising from Mr. Lord's works; but they alleged they had suffered injury, and asked for protection. Weighty testimony was given by Mr. Herbert Parker, a Local Government Board Inspector, who stated that he had from time to time visited Mr. Lord's works, and had never had cause to complain of nuisance. This evidence and that of several other witnesses (among them Mr. Alfred Colson) convinced their Lordships that there was no necessity to insert a protective clause.

The Bill promoted by the Walker and Wallsend Union Gas Company to enable them to supply electricity within the borough of Jarrow and the urban district of Hebburn, and to raise additional capital, was last Thursday before Mr. J. W. Lowther's Committee. The Bill was unopposed; and the necessary proofs having been submitted, it was ordered to be reported to the House.

HOUSE OF LORDS.

The following further progress was made with Private Bills last week:—

Bill read the first time and referred to the Examiners: East London Water Bill.

Bills read a second time and committed: Bedford Gas Bill, Woodbridge District Water Bill.

Bills reported: Maidenhead Gas Bill, Southport Water Bill.

Bill reported, with amendments: Westgate and Birchington Water Bill.

Bills read the third time and passed: Barnsley Corporation Bill, Glastonbury Corporation Gas Bill, Rotherham Corporation Bill.

Bills Royal Assented: Grantham Gas Bill, Kingston-upon-Thames Gas Bill, Newport (Mon.) Gas Bill, Redhill Gas Bill, Rugeley Gas Bill, Wetherby District Water Bill.

The Morecambe Urban District Council (Gas) Bill and the Water Orders Confirmation Bill were referred to a Select Committee, consisting of Lord Fermanagh (Chairman), Lord Bagot, Lord Carysfort, Lord Erskine, and Lord Muncaster; to meet on Tuesday, June 19.

A petition was presented against the Water Orders Confirmation Bill, from owners, &c., in Sunningdale and Windlesham.

HOUSE OF COMMONS.

Friday, May 25.

THE SUPPLY OF CARBURETTED WATER GAS.

Mr. Steadman asked the President of the Board of Trade whether there was any legislative regulation or restriction in regard to the use of and supply by the London Gas Companies of carburetted water gas; whether he was aware that in 1898 a Departmental Committee appointed by the Board of Trade recommended that the admixture of water gas with ordinary coal gas should be limited to 12 per cent., and that, by a Parliamentary Return in the same year, it was shown that some of the London Companies were even then using considerably over double that proportion; and whether, in view of the fact that there was reason to believe the amount had since been largely increased, and that water gas was four times as poisonous as coal gas, and could not be detected by its odour, he would consider the advisability of taking steps to initiate legislation on the subject, as had long been urged by medical and sanitary authorities, and by some means acquaint the public with the fact that they were being supplied with a poisonous article in the name of ordinary gas, so that due care might be taken in its general use.

Mr. Ritchie: The honourable member must not assume that I admit to the full the accuracy of all the statements contained in the question, some of which might be made the subject of argument and controversy; but the answer to the first paragraph is in the negative. With regard to legislation, I can merely say that, if undertaken, it should be general in its character, and not confined to London. In any general legislation, my right honourable friends the Secretary of State for the Home Department and the President of the Local Government Board would probably have a larger interest than the Board of Trade; and I cannot make any promise on the subject at this period of the session.

The following further progress was made with Private Bills last week:—

Lords Bill read the first time and referred to the Examiners: Gas and Water Orders Confirmation Bill.

Bills reported, with amendments: British Gaslight Company (Staffordshire Potteries) Bill, Exmouth Urban District Water Bill [Lords], Gaslight and Coke, Commercial Gas, and South Metropolitan Gas Companies Bill, Great Berkhampstead Water Bill [Lords], Lambeth Water Bill, Menstone Water (Transfer) Bill [Lords], Mid-Kent Water Bill, Motherwell Water Bill [Lords], Newtown and Llanllwchaiarn Urban District Gas Bill [Lords], Paignton Urban District Water Bill [Lords], Portland Urban District Council (Gas) Bill, Rickmansworth and Uxbridge Valley Water Bill, South Metropolitan Gas Bill, Wandsworth and Putney Gas Bill.

Bills read the third time and passed: Cleethorpes Gas Bill [Lords], East London Water Bill, Higham Ferrers Water Bill [Lords], Kingston-upon-Thames Gas Bill [Lords], Otley Urban District Council Water Bill [Lords].

The East Stirlingshire Water Bill, the Falkirk and District Water Bill, and the Hemel Hempstead Corporation (Water) Bill were referred to a Select Committee, consisting of Colonel Gunter (Chairman), Mr. H. E. Kearley, Mr. Souttar, and Mr. Pike Pease; to meet on Tuesday, June 19.

Two notices in regard to the export of coal stand upon the paper. Mr. Harwood (Bolton) purposes moving "That it is expedient that a duty be levied upon the coal exported from the United Kingdom," and Mr. D. A. Thomas (Merthyr Tydfil) will move, as an amendment, "That in the opinion of this House it would be inexpedient to revive in any form the export duty on coal until a full inquiry has been made into the coal resources of the United Kingdom; and that such inquiry should be instituted forthwith."

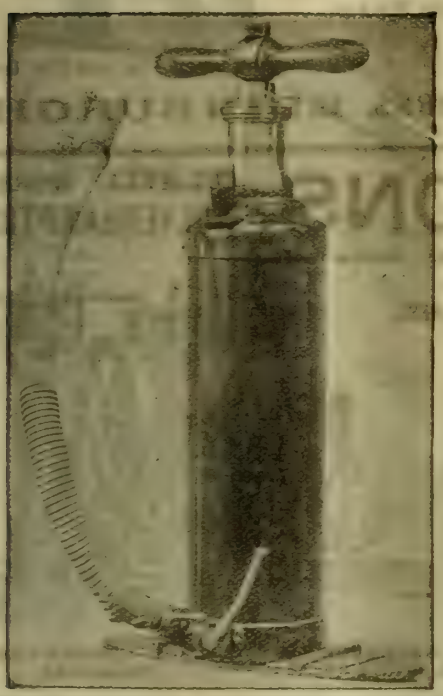
Fatality at the Ashton Gas-Works.—An inquest was held last Wednesday by Mr. J. F. Price, County Coroner, touching the death of John William Cheetham, a labourer, 36 years of age, who had lately been employed by Messrs. R. & J. Dempster at the Ashton Gas-Works. A man named Caldwell said that on the 16th inst. he was working on a scaffold about 35 feet from the ground, and was engaged in hoisting buckets of mortar by means of a pulley. The rope became fast, and caused a bucket to slip; and deceased, who was working below, was hit on the head. A doctor was summoned, and Cheetham was removed to the Infirmary. He was found to be suffering from a fractured skull, and was operated upon, but death took place on Sunday. The Jury returned a verdict of "Accidental death."

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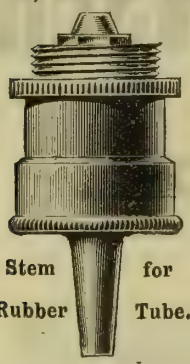
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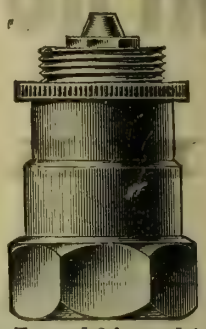
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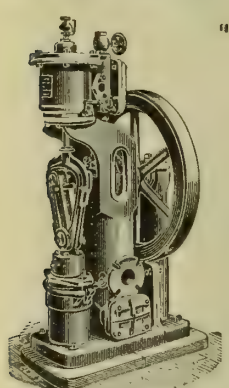


Fig. 703. "SINGLE RAM" STEAM-PUMP.

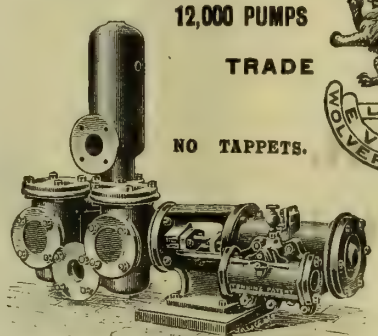


Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

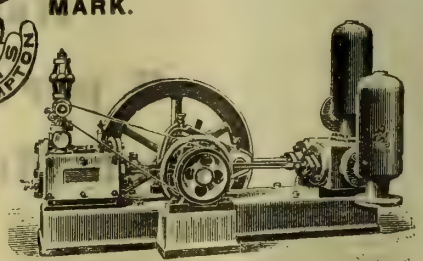


Fig. 688. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

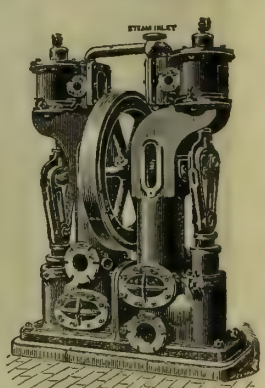


Fig. 719. "DOUBLE-RAM" STEAM-PUMP.

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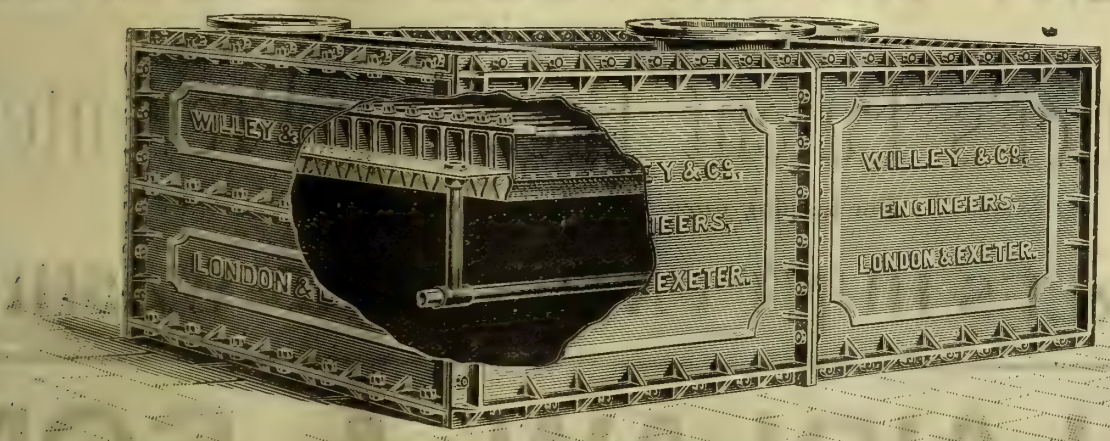
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SIEMENS WATER-METERS,

PREPAYMENT GAS-METERS.



—DRY METER.—



—WET METER.—

EDINBURGH: SIMON SQUARE WORKS. | **GLASGOW:** ALLIANCE FOUNDRY. | **LONDON:** 6, LITTLE BUSH LANE.

HOUSE OF COMMONS COMMITTEE.

Wednesday, May 23.

(*Before Mr.* OLDROYD, *Chairman, Mr.* EMMOTT, *Mr.* NICOL, *and Mr.* STANLEY LEIGHTON.)

THE GASLIGHT AND COKE, COMMERCIAL GAS, AND SOUTH METROPOLITAN GAS COMPANIES BILL.

The Committee this morning proceeded to the consideration of the clauses of the above Bill.

Mr. WORSLEY TAYLOR, Q.C., Mr. TALBOT, and Mr. B. WILKINSON, appeared for the County Council. The other Counsel engaged were: Mr. LITTLER, Q.C., and Mr. H. A. RIGG, for the Corporation of the City of London; Mr. POPE, Q.C., Mr. CLAUDE BAGGALLAY, Q.C., Mr. DANCKWERTS, Q.C., and Mr. R. J. NEVILLE, for the Gaslight and Coke Company; Mr. LITTLER, Q.C., Mr. BAGGALLAY, Q.C., and Mr. SNAGGE, for the Commercial Gas Company; and Mr. BALFOUR BROWNE, Q.C., Lord ROBERT CECIL, Q.C., and Mr. L. W. S. ROSTRON, for the South Metropolitan Gas Company.

Mr. CRIPPS (Parliamentary Agent to the London County Council) said he proposed to read the Bill as amended by the Council to meet the decision of the Committee.

Mr. DANCKWERTS understood the Committee had said that the Companies were to be at liberty to propose a form of clauses to carry out the decision of the Committee. The Companies had prepared such clauses; and he asked the Committee to consider them as alternative to the proposed clauses of the County Council, and not merely by way of amendment of the clauses the Council put forward. The Companies had, as it were, re-drafted the County Council Bill. If the proposals of the Companies were considered on their merits, he was confident the Committee would see that the Companies had more than loyally, even liberally, attempted to put into shape the decisions of the Committee.

The CHAIRMAN said the Committee would consider both sets of clauses.

Mr. BAGGALLAY, on behalf of the Commercial Company, stood by what Mr. Danckwerts said.

Mr. TALBOT assumed that the ordinary procedure would be followed—viz., that the promoters would bring up the clauses; and the opponents direct attention to any defects they might think existed.

Mr. CRIPPS said, as the County Council proposed, the Bill would read—

A Bill for making further provision as to testing the illuminating power of gas supplied by the Gaslight and Coke, the South Metropolitan Gas, and the Commercial Gas Companies in the Administrative County of London, and for regulating the supply by those Companies of prepayment meters and fittings in connection therewith; and for other purposes.

Whereas the greater part of the Administrative County of London is supplied with gas by the Gaslight and Coke Company, the South Metropolitan Gas Company, and the Commercial Gas Company in their respective districts:

And whereas the price which the said Companies may charge for gas is regulated under the provisions of divers Acts of Parliament:

And whereas a system has been widely adopted by the said Companies by which prepayment meters and other fittings are supplied by the Companies to consumers, and the consumers so supplied pay from time to time to the Companies sums which include both the price of gas and a charge in respect of the supply of such meters and other fittings:

And whereas it is expedient that the charges to be made by the Companies in respect of gas supplied by means of such meters and fittings should be regulated, and the amount of such charges stated to the persons who pay them:

And whereas the objects of this Act cannot be attained without the authority of Parliament:

May it therefore please your Majesty

That it may be enacted, and be it enacted by the Queen's Most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal and Commons in this present Parliament assembled, and by the authority of the same as follows:—

The CHAIRMAN: Do you concur as regards the preamble?

Mr. DANCKWERTS: We leave out the whole of the preamble until we reach the part of it which the Committee amended, on the ground that the whole of it is needless and simply overloading the Bill.

The CHAIRMAN: We had better have the form of the promoters. It is a recapitulation of fact and of the experience upon which legislation has proceeded. We will accept the proposal as read by the promoters.

Mr. DANCKWERTS remarked that the title of the Bill had not been amended.

Mr. CRIPPS said this could not be done till a later stage.

The CHAIRMAN said the title had always seemed ridiculous.

Mr. BAGGALLAY agreed that they could not alter the title at present; but the short title in the clause could be altered.

After further discussion, it was agreed that clause 1 should read:—

This Act may be cited for all purposes as "The Metropolis Gas (Prepayment Meter) Act, 1900."

Clause 2 was accepted by the Committee in the following form:—

In this Act, "the Council" means the London County Council; "the Corporation" means the Mayor, Commonalty, and Citizens of the City of London; the expression "the Companies" means the Gaslight and Coke Company, the Commercial Gas Company, and the South Metropolitan Gas Company; and the expression "the Company" means each of the said Companies; the word "fittings" means pipes, burners, stoves, and other fittings used in connection with the consumption of gas supplied by means of prepayment meters; the expression "prepayment meter" means any meter or appliance by which the quantity of gas supplied is regulated according to the amount of money prepaid therefor.

Mr. DANCKWERTS, in order to guard against a new kind of meter being invented in which there could be prepayment otherwise than by a penny in the slot, sought to place the word "automatically" before the word "regulated," at the end of the clause; but the CHAIRMAN took exception to the word, and it was accordingly not added.

Mr. CRIPPS said the first new clause he proposed was 2a. The first sub-section was as follows:—

With respect to the supply of gas by means of prepayment meters, the following provisions shall have effect (that is to say):—(1) The price to be charged by each of the Companies for such supply shall be after the same rate as the price charged per 1000 cubic feet to consumers supplied by such Company by ordinary meters, together with an additional charge at a rate not exceeding 10d. per 1000 cubic feet consumed in respect of the cost incurred by such Company for, and in relation to, the providing, letting, fixing, repairing, and maintaining of meters and fittings connected therewith, cost of collection, inspection, and any other extra cost incurred by the Company incident to such supply.

Mr. DANCKWERTS objected to the clause, because it was not very clear as to the price the consumer was to pay for fittings. The proposals of the Companies were—

3.—The Companies respectively shall not be entitled to charge, or charge, for any gas supplied through a prepayment meter any greater charge, rate, or rent than the Companies are respectively entitled by law to charge for gas supplied through any other kind of meter, or by any other method of supply.

This was short, and very plain.

4.—The Companies shall not be entitled to charge, or charge, for the hire of any prepayment meter and fittings to be used therewith any sum other than a sum of money calculated according to the quantity of gas supplied through such prepayment meter; and the maximum sum to be so charged shall be at the rate of 10d. per 1000 cubic feet, supplied in manner aforesaid, such sum to include the hire of one meter and the fittings used therewith.

This was also very plain. The sixth clause carried out the other decision of the Committee—

6.—The Companies shall, in every contract relating to the hire of prepayment meters and fittings to be used therewith, and in every receipt for such hire, state separately and distinctly the charges respectively made for the gas and for the hire of such meters and fittings.

Mr. TALBOT said this dealt with the same thing as paragraph 3 of his clause. It should come later.

The CHAIRMAN: Let us go through the proposed clause 2a.

Mr. CRIPPS said the second and third paragraphs in the County Council's new clause were—

2.—The index of the prepayment meter shall be *primâ facie* evidence of the quantity of gas consumed; and on that quantity the collector shall make the charge for gas. Any excess in the value of the coins found in the meter shall be returned to the consumer; and any deficiency in value shall be paid by him. In the event of the consumer refusing to pay such deficiency on demand, the Company may discontinue the supply of gas and remove the meter and fittings, and may recover such deficiency in any manner in which the rents or sums due to the Company for gas are recoverable.

3.—The Company shall, in collecting any money for gas supplied by means of prepayment meters, give a receipt for the same in a form which shall show clearly the sum per 1000 cubic feet charged for gas, and in addition the extra sum in respect of meters and fittings charged therewith under this Act; and the total receipts for such extra sums shall be shown in the Company's accounts in manner prescribed by the Official Auditor appointed by the Board of Trade.

Mr. DANCKWERTS: The last part is already existing law.

Mr. CRIPPS said that their clause 2b was—

If at any time after the expiration of seven years from the passing of this Act, the Council or the Company make a representation to the Board of Trade to the effect that the maximum charge to be made in respect of prepayment meters and fittings under this Act ought to be altered, the Board of Trade, after such inquiry as they may think fit, may make an order varying such maximum charge, and such maximum charge shall from and after such day as may be mentioned in the order be deemed to be substituted for the maximum charge prescribed by this Act. Provided that such charge may be altered in like manner after the expiration of any or every period of seven years after any alteration under this section.

The adoption of this would involve the omission from the Bill of clauses 3 to 15 inclusive.

Mr. DANCKWERTS said his two clauses were very plain. He had read clause 6. As to clause 7, there had been a doubt whether some of the Gas Acts applied to prepayment meters. Therefore they proposed—

7.—Prepayment meters shall be deemed to be within the provisions of the Sale of Gas Act, 1859.

Clause 8 would enable the consumer to demand prepayment meters without fittings.

8.—The maximum charge for the hire of a prepayment meter without fittings shall be at the rate of 10 per centum per annum on the cost of the meter to the Companies respectively; and the Companies' Acts respectively applicable to ordinary meters, shall apply within the Companies' respective districts to prepayment meters.

In this case, the safeguards in favour of the consumer were incorporated. Clause 5 was the inquiry section. It was intended to meet the objection of Sir Courtenay Boyle to the Board of Trade being called upon to fix the rate. It was as follows:—

5.—The rate fixed by the last preceding section shall be open to revision by the Board of Trade in manner following (that is to say):—If at any time after the expiration of seven years from the date of this Act, or any inquiry under this Act, any of the Companies, or the Council, or the Corporation request the Board of Trade in writing to revise the said rate, the Board of Trade shall appoint a competent and impartial arbitrator, who shall hold an inquiry and fix a rate to be substituted aforesaid; Provided that the Board of Trade may at any time, if they think fit, at such request put into operation the provisions of this section. At least twenty-eight days before the holding any inquiry under this Act, the Board of Trade shall give to each of the Companies, to the Council, and to the Corporation notice of such inquiry, and of the time and place thereof; and each of the Companies, the Council, and the Corporation shall be entitled to attend and to be heard at such inquiry.

Under this, if a new kind of meter or fitting, which might be cheaper than the existing one, were invented, it could be adopted. This was the original County Council section. He submitted that the clauses the Companies proposed carried out the decision of the Committee in a very simple way.

Mr. TALBOT said his clients did not think that the incorporation of the Sale of Gas Act, 1859, was necessary; but, to clear up any doubt, they were prepared to accept the proposal.

Mr. DANCKWERTS said he had not himself thought it necessary; but the section had been prepared to satisfy Sir Courtenay Boyle.

The CHAIRMAN: The Committee are of opinion that the clauses submitted by the Companies are clearer—meeting a greater variety of cases, and the possible invention of a new class of meter. The ground is pre-

pared; and we should propose to accept these provisions, unless Counsel have something to say against them.

Mr. TALBOT said that, taking the thing as a whole, they had no objection to the general scheme as proposed by the Companies. On one or two points of detail, he would suggest they should be improved. As to the words of clause 4 as proposed, it appeared to him that they were unduly narrow as compared with the South Metropolitan clause which his clients had adopted. Their proposal was to make the whole charge incurred—gas used, meter, fittings, cost of collecting, and all the other things in the words of the South Metropolitan clause—incident to the supply. What was desirable, and what was the wish of the Committee, was that there should be a charge to include everything. Anything that left the matter open for a special contract between the Company and the consumer, might be objectionable.

Mr. DANCKWERTS said that they might have added, at the end of clause 4, the words:

The said charge shall include the providing, letting, fixing, repairing, and maintenance of the meter and fittings, and the cost of collection, inspection, and every other cost included by the Company in connection with the meter and fittings.

Mr. TALBOT said he agreed with that. He did not know whether there was any substantial objection to his revision clause. They proposed to leave it to the Board of Trade to decide the matter, after an inquiry. The Companies proposed that the Board of Trade should be specifically directed to appoint a competent and impartial person which, presumably, they did.

The CHAIRMAN: The proposal of the Companies would better meet the feeling and disposition of the Board of Trade. They do not wish themselves to interfere in the matter. I have just consulted with my colleagues; and they quite think they would be disposed to appoint an arbitrator.

Mr. TALBOT: There will be an inquiry by having an impartial man. If it is desired to put it in that way, I shall not object.

Mr. DANCKWERTS: We have proposed this in order to meet Sir Courtenay Boyle's objection.

The CHAIRMAN: On the lines of the Official Auditor. He is not an official of the Board of Trade, but acts under their authority, and has a warrant for his appointment.

Mr. DANCKWERTS: We propose that in the clause which states that the Board of Trade shall appoint a competent and impartial arbitrator, who shall hold an inquiry, after the word "inquiry" we should add "and fix the maximum rate." We should have no objection to that.

Mr. TALBOT submitted that the arrangement they had proposed was preferable. It was unnecessarily cumbrous to require a special contract in each case; and they would provide that the Companies might be required, when they collected the money, to give a receipt in writing. They proposed that this information should be embodied in the receipt.

Mr. DANCKWERTS said it was for the Committee to decide that point.

Mr. TALBOT said that, in some respects, a formal contract followed by a receipt was more elegant; but practically a receipt at recurring periods would give the consumer all the information he wanted, and would obviate the necessity of giving a formal receipt in every case.

The CHAIRMAN: As to "contract" in the first line of the Company's clause 6. There is no "contract" is there? Perhaps Mr. Livesey can tell us that.

Lord R. CECIL: We do give contracts.

Mr. DANCKWERTS: The South Metropolitan Company do as a rule; and the Gaslight and Coke Company do also under some of their Acts.

Mr. TALBOT said that if the Companies chose to put themselves under the burden, his clients would have no objection; but they thought there should be a receipt on each occasion showing all the particulars.

Mr. DANCKWERTS proposed that in his clause 6 they should adopt the words "the Company shall give a receipt for any money paid in respect of gas supplied."

Mr. TALBOT said that in the third paragraph of his clause 2A the words were "shall show clearly the sum per 1000." Mr. Livesey preferred the word "rate," in place of "sum."

Mr. DANCKWERTS said that his learned friend's clause should stop at the words "charged therewith under this Act." The Auditor of the Board of Trade already had larger powers than would be given by the clause; and the words proposed would cut down those powers.

Mr. TALBOT: I am told that is not so.

The CHAIRMAN: In place of clause 6, we will take clause 3 of the promoters as amended; and it will read as follows:—

The Company shall, in collecting any money for gas supplied by means of prepayment meters, give a receipt for the same in a form which shall show clearly the rate per 1000 cubic feet charged for gas, and in addition the rate in respect of meters and fittings charged therewith under this Act.

Clauses 7 and 8 were then agreed to as follows:—

7.—Prepayment meters shall be deemed to be within the provisions of the Sale of Gas Act, 1859, provided that the periods which, according to the said Act, are to be calculated from the date of its passing, shall, for the purposes of this section, be calculated from the passing of this Act.

8.—The maximum charge for the hire of a prepayment meter without fittings shall be at the rate of 10 per centum per annum on the cost of the meter to the Companies respectively; and the Companies' Acts respectively applicable to ordinary meters shall, so far as applicable, apply within the Companies' respective districts to prepayment meters.

The last clause adopted was as follows:—

The costs, charges, and expenses preliminary to and of, and incidental to, the preparing, applying for, obtaining, and passing of this Act shall be defrayed as payments for general county purposes within the meaning of the Local Government Act, 1888.

The Bill, as amended, was then ordered to be reported to the House.

The Sunlight (Acetylene) Gas Company, Limited, of Dublin, have recently carried out the public lighting of Dunfanaghy (Co. Donegal), and have contracted with the Gort District Council to light the town. Gort has a population of about 1500; and at present has no light of any kind. In addition to 32 public lamps, it is proposed to supply private consumers from the same pipes.

HOUSE OF COMMONS COMMITTEE.

Wednesday, May 23.

(*Before Mr.* MARK OLDROYD, *Chairman, Mr.* EMMOTT, *Mr.* NICOL, *and Mr.* STANLEY LEIGHTON.)

SOUTH METROPOLITAN GAS BILL.

To-day the Committee proceeded to deal with the alterations in the above Bill required to carry out their decision.

Mr. BALFOUR BROWNE, Q.C., Lord ROBERT CECIL, Q.C., and Mr. ROSTRON were for the promoters. The other Counsel engaged were: Mr. F. R. FITZGERALD, for the Ecclesiastical Commissioners; Mr. FREEMAN, Q.C., and Mr. G. J. TALBOT, for the Vestries of Camberwell, Rotherhithe, Battersea, Bermondsey, and Newington; Mr. WORSLEY TAYLOR, Q.C., Mr. FREEMAN, Q.C., and Mr. G. J. TALBOT, for the London County Council; Mr. CORRIE GRANT, for the Vestry of St. George, Southwark; and Mr. LITTLER, Q.C., and Mr. RIGG, for the Corporation of the City of London.

Lord R. CECIL: I think it will be most convenient that I should explain what alterations have been made in the Bill in deference to your decision; and then we will go through the clauses. I am not quite sure that the Bill before you is accurately altered. That is a difficulty. You asked that in the preamble the word "standard" should be inserted before "illuminating power." This, of course, we have done, or it shall be done; and the preamble will read: "And whereas it is expedient to alter the standard illuminating power of the gas supplied by the Company and the standard price to be charged therefor, and also to alter the variation of dividend dependent on the increase or decrease of such standard price as provided for by the Act of 1896." Now as to the remainder of the alteration that you suggested, I should like you to leave that over till I have said what I have to say about the alteration we propose in order to meet the rest of the Committee's decision. We shall, of course, do our best to carry out the decision of the Committee; but if we were to abolish the 16-candle standard and the 15-candle standard to-morrow, the Company would be put in this difficulty: They have ordered a large supply of coal from Yorkshire, which gives them at present rather a higher standard, I think, even than 16 candles. They have had to do it owing to the great rise in the price of coal in the North. If they were compelled to bring their standard down to 14 candles instantly and their initial price 2d., this would mean a very serious loss to the Company, because they have made all their preparations; and although they fully recognize the desirability of eventually reaching a fixed and not a fluctuating standard, they hope that the Committee will allow them to proceed by steps, and not by a jump. I am going to call Mr. Livesey, because it is a matter of very great importance; and he will explain in detail what the proposal is. We propose to deal with clause 5, which is the operative part of the Bill. We should propose to leave clause 5 in as it was drafted: "From and after the first day of July or the first day of January, whichever shall first occur after the passing of this Act, the standard price of gas supplied by the Company shall vary according to the illuminating power of such gas, and shall be as follows (that is to say): 3s. 3d. for gas having the power of 16 or more candles; 3s. 2d. for gas having the power of 15 candles and under 16 candles; and 3s. 1d. for gas having the power of 14 candles and under 15 candles;" and then add: "Provided that, whenever under the provisions of this Act the standard price is reduced, it shall not be thereafter raised." That is to say, we are going to reduce, as soon as we can commercially do it; but it will give us a little time to turn round in, subject to this—that there will never be a floating standard. Once we agree to take the standard price below 3s. 3d., we shall have to keep it below, in the same way as once we get below 3s. 2d. we shall have to keep it below. As soon as we can reduce it to 3s. 3d., then we shall not be able to raise it again. That I hope will meet the difficulty the Committee felt about a floating standard, and at the same time will make it practically possible without great loss.

The CHAIRMAN: You are merely attempting to provide for a transition period?

Lord R. CECIL: Precisely.

The CHAIRMAN: That did occur to my mind after we left the room on Friday; and I was wondering whether you could insert a later date, and continue the supply of gas of 16 candles up to that date, and then go down to 14 candles.

Mr. RIGG said they were in a very difficult position in the City, having regard to the decision of the Committee that the illuminating power was to be 14 candles. This was very important, and affected the Corporation, as a public authority, in regard to the price of gas. Now the Committee were asked to go back upon that decision—to say in certain cases they would allow the illuminating power to be 16 candles, and so on, and to hear evidence and alter their decision on the preamble.

The CHAIRMAN: No; I submit that this is not an alteration of our decision. Our decision was that it would never do to have a floating standard—that is to say, a standard to be fixed after the event—testings to be taken, and according to the testings the candle power to be declared at a later stage. This we objected to; but, as practical men, we quite see that you cannot jump from 16-candle power to 14-candle power, without some transition period, and some of the Committee, I know, have in the interval been considering what would be the best form to adopt. Some of us thought that perhaps a six months' later date than that now in the Bill would give the Company time to work off their present stock of coal without disadvantage to themselves. Of course, we do not wish to impose any disadvantage on the Company in adapting themselves to the new methods.

Mr. TALBOT: I may say we suggested that.

Lord R. CECIL: I am advised by Mr. Livesey that this is the best means of carrying out the decision.

The CHAIRMAN: On this clause, as a matter of detail, we shall be glad to hear Mr. Livesey.

Mr. *George Livesey*, re-called.

Lord R. CECIL: I want you to explain to the Committee the difficulty you have felt in carrying out the decision so as to reduce the standard immediately from 16 to 14 candles without any provision for the transition period?

Witness: I am afraid I must go into a rather long explanation. When we thought of promoting this Bill last year, with the idea of carrying out the suggestion of last year's Committee, and to get this necessary alteration in the quality of the gas, it was the farthest thing from our thoughts that the price of coal would ever go up again as it did in 1873. We were selling gas at 2s. 1d.; and I said to my people, over and over again, that the margin of 5d. up to 2s. 6d. was the outside that we could ever expect to have to raise our price to. At 2s. 6d., the dividend to our shareholders would have been the same under Sir James Rankin's recommendation as under our old sliding-scale of £5 4s. per cent. That was our view even in February last, at our shareholders' meeting; and when we explained the Bill at the Wharncliffe meeting, we put that before them—that they would be no worse off, under any circumstances, than they were then. But since February, the price of coal has gone up so enormously that we have bought at 8s. a ton advance; and that advance in the price of coal will necessitate in the next half year our increasing the price to 2s. 8d. per 1000 cubic feet at least—2s. 8d. per 1000 cubic feet I am certain it must be. I may put it in this way: On our 1,100,000 tons in the year, that will add £440,000 to our expenses; we shall not get £100,000 back out of our coke. This would leave us with £340,000 to make up; and reckoning £42,000 per penny, it comes to an increase of 8d. over our 2s. 1d. This would bring us to 2s. 9d.; and I am within the mark when I say 2s. 8d. is the lowest price at which we could hope to supply gas. At 2s. 8d. per 1000 cubic feet, if we were immediately to adopt the 14-candle power gas, our shareholders (under the present system they are entitled to 5 per cent.) ——

The Chairman: At 2s. 8d.?

Witness: Yes; but they would be entitled then to only £4 13s. 4d. They are now getting £5 6s. 8d.; and they were entitled last year to £5 14s. 4d. I persuaded them to forego the 7s. 4d., which is £20,000 a year, in order to help to reduce the price. Well, you will say it is not a serious matter to reduce from £5 6s. 8d. to £4 13s. 4d.; but there is something peculiar about our shareholders. Since 1890, we have issued all our stock in small amounts to the consumers and employees. They have invested £724,000 in the Company in the last ten years at market price under the auction clauses; and that market price, even at our own highest dividend of £5 6s. 8d., gives them only £3 16s. per cent. To reduce the 5 per cent. dividend, would reduce the interest to 3½ per cent.; and to reduce the £4 13s. 4d., which we should have to do under the 14-candle standard, would bring their interest down to 3¼ per cent., which, of course, is a very ridiculous figure for a trading business. In issuing the stock to these shareholders, we have adopted the principle that has recently been adopted by the Government and the London County Council in their loans, of fixing the price that was fixed by the auction clauses, saying: "You can have this stock at such a price in amounts of £5 and upwards." We have favoured the small investor; we have limited the amount to about £50. I think in no case has it been more than £70; and thus 3000 or 4000 consumers have taken stock on the faith of this, and are only getting 3¾ per cent., and to come down to 14 candles with the initial price would reduce them to 3¼ per cent. Now, I could not face them. I could not go to them, and say: "We have given away this because, under the old system, you would have had 5 per cent., and under the present one you will only get £4 13s. 4d." Therefore the only way in which we can come down is by steps. I do not know whether I have made myself clear.

Lord R. Cecil: Therefore you say you must come down by steps. You do not wish it to be thought for an instant that you go back from anything you said as to the necessity for abolishing enrichment?

Witness: Not a word. I am satisfied that it is the right thing to do.

And you absolutely pledge your Company to abolish enrichment?—Yes. We have bought largely of Yorkshire coal. We got it a little cheaper than Newcastle coal; and this Yorkshire coal gives us nearly 17 candles at present.

That you have been compelled to do, owing to the exceptionally high price of the northern coal?—Yes; so that we cannot perhaps come down to 15 candles immediately.

It has been suggested that your difficulty might be met by fixing a future date in the Bill for the coming into operation of the 14-candle standard and the 3s. 1d. standard price. Will you explain why that is impracticable?—Well, it is not so easy a matter to reduce the quality, as some gentlemen have said, by drawing in air or working the exhauster rather harder. We are quite prepared at once to adopt the suggestion of the Committee that the gas shall be homogeneous. We can immediately knock off the enrichment, which costs us £20,000 a year; but how we are to come down to 14 candles, I do not know at present. If we can get a cheaper supply of coal, we might do it; it will probably be done by an alteration of our system of manufacture, and that will take some years. What I say is, that we will come down from 16 to 15 candles as soon as we possibly can; and we will come down from 15 to 14 candles as soon as we possibly can. But I cannot say when.

You can say this—that once you have come down, you will never go up again?—Certainly.

Is your proposal, then, to put this proviso in clause 5 that has been read to the Committee—that is, to prevent your ever going up again?—Yes.

Subject to that, you propose to keep in force in principle, until you have got down, the proposal as to letting the initial price depend upon the average of your illuminating power?—Yes. In making this proposal, we have been very liberal to the consumers. But we have made it; and we stand by it.

Just let me understand. The original proposal was on an illuminating power average of six months?—Yes.

Owing to objections that were made by the petitioners, did you draft clause 6 (*a*), or cause it to be drafted, which makes it dependent on the average of one month?—That is their own clause; they drafted it.

There is a little error in that clause; 16½ and 16 ought to be 17?—Yes.

You have clause 6A before you. I think it will be convenient if I read it: "For the purpose of determining and regulating the increase and decrease of the dividend of the Company by the increase or decrease of the illuminating power of the gas, the following provision shall have effect: (*a*) The average of all the official testings made in each month of each half year shall be multiplied by the quantity of the gas sold by the Company during such month. (*b*) The figure thus obtained for each of the six months in any half year shall be added together and divided by the total quantity of gas sold by the Company during such half year; and the figure thus obtained shall be deemed to be the illuminating power of the gas for such half year. (*c*) In calculating such average, all testings showing a higher illuminating power than 16½ candles shall be taken as showing 16 candles and testings"—17 candles that ought to be?—That is while we are supplying over 16-candle gas.

"Shall be taken as showing 17 candles; and testings showing a lower illuminating power than 14 candles shall be taken into account in calculating the average. Subject as aforesaid, the provisions now in force with respect to the forfeitures by the Company for defect in illuminating power shall continue of full force and effect when on any day the illuminating power of the gas supplied by the Company is less than 14 candles. (*d*) The Company shall, during the first ten days in each month, inform the London County Council what was the amount of gas sold by the Company during the preceding month." The effect of this will be that, until you get down to 14 candles, or rather until you get down to 15 candles, you will be at 16 necessarily?—If the average quality is what it is now.

You remain at 16?—We remain at 16, as it will remain for some time.

If it falls to 15, your standard price will go down to 3s. 2d.?—If the average falls to 15·99.

And it will never be raised again?—No.

If it falls to 14 candles, it will go down to 3s. 1d.; and then the clause will automatically come to an end, because it can never be raised again, whatever your illuminating power is?—That is so.

Do you think, as a practical man, that this substantially carries out the object, as you understand it, that the Committee have in view? And is it the only practicable way to do so?—It is to my mind the only practicable way; there is no other way.

Unless some provision was made to deal with this transition period, the effect would be that the shareholders would be giving a 15-candle gas for a 14-candle price?—To put it in another way, if we were to accept the 14-candle standard at once, our shareholders would never be in so good a position as they are now until the price was reduced to 1s. 10d. Considering that we are not bound to come to Parliament—we have plenty of capital and everything we want to last us at least seven years—what would my shareholders say?

Mr. Littler suggested, in cross-examination, that if the South Metropolitan Company did not supply the Gaslight and Coke Company's area south of the Thames, there would be nothing by which the prices of the two Companies could be compared, because they would not be selling the same article.

Witness replied that there would be a fixed relation between the two—1d. difference in the initial price for each candle. If the Gaslight and Coke Company supplied 16-candle gas, and the South Metropolitan Company 15-candle gas, the former Company would be entitled to 1d. per 1000 cubic feet more.

That does not show that the Gaslight and Coke Company are to be entitled to 1d. per 1000 cubic feet more. It simply says what your prices are to be; it does not show that there is to be any relation between them. How are we to insist upon our privileges?—I cannot tell you.

Without doing it formally, you absolutely repeal the privileges which we have by your Bill?—Yes; and very properly.

I am supposing they do not get rid of their southern district?—I beg your pardon; that would be 1d. more than they would be entitled to.

That relation is not established in the Bill?—It could be put in.

Mr. Neville: I do not think this can be put in the Bill. I do not think anything that is put in the South Metropolitan Bill can affect the Gaslight and Coke Company.

Mr. Littler: If it cannot, there is an injustice being done in passing this provision.

Witness: I do not see the difficulty. I thought you were referring to the public lights difficulty.

The Chairman: I think the Committee might express an opinion at this juncture. We could not accept this method of testing gas—not even as a temporary method. Therefore the Bill would have to go if that be adhered to. We are quite willing to make provision as far as possible for a temporary intermediate stage. We acknowledge your difficulties, and recognize them. Our suggestion would be that up to the 30th of June, 1901, you should continue to supply 16-candle gas as now. That is twelve months more, practically; then from the 1st of July to the 31st of December, 1901, you should supply 15-candle gas; and from the 1st of January, 1902, you should supply 14-candle gas. You require twelve months for the intermediate stage?

Witness: I do not know what time we should require, really. We will get down as fast as we can, and as much as we can; but you cannot tell what would be the price of coal next June.

I do not see that the price of coal affects it at all?—It affects it in this way, that the dividend received by our shareholders ——

But you see that adverse condition of your stockholders arising from your having to put up your standard, does not affect the illuminating power of your gas. It is an incident for which you cannot be held responsible by your shareholders, and which really the Committee cannot take into consideration?—Well, let me say, to reduce from 16 to 15 candles, the only immediate saving we see is the saving of enrichment, which costs us £20,000 a year. We must give up £42,000 in order to place us in the same position; and to reduce from 16 to 14 candles, we must save £84,000 a year somehow—how, I do not know until we have tried.

The Chairman: That is a matter which you must have considered before you came to the Committee with your proposal.

Lord R. Cecil: Coal has gone up so very exceptionally, that it has put out the whole calculation.

The Chairman: But the shareholders will be put out by this rise in coal, apart from anything which is enacted in this room.

Lord R. Cecil: But it will greatly increase it if you reduce the initial price.

The Chairman: Well, that is your proposal. The Committee have not insisted on any reduction in price other than that which was proposed in the Bill; and we accept all those provisions. We went so far as to accept the sliding-scale at 1d. per candle, which was suggested. Therefore you are not mulcted by any action of the Committee. It is your own proposal, if you are in a dilemma.

Witness: Only our proposal left it to us to reduce when we could.

But your proposal is too fluctuating. If you feel it is necessary to have

twelve months instead of six months at 15 candles, we should be prepared to grant that?—I really cannot say when we can come down to the 14 candles.

Still, it gives you two years?—Yes; but we must alter our system of manufacture, and that may take five years. It has taken us fifteen years to alter the system of firing from common to regenerative.

By Mr. EMMOTT: He was afraid the shareholders would say he had given them bad justice, and had done more than justice to the consumers and employees.

The CHAIRMAN: I take it you can get down to 14½ or 15 candles; and even if you sold at 15 candles when you were under a standard of 14 candles, you would not lose very much. You can get down by the cessation of enrichment?

Witness: But we have to do two things: We have to get down to 14 candles, and to save £84,000 a year to place us in the same position that we are in now.

The opinion is, and has been from the first, that your shareholders would not be quite so well off under the new arrangement as under the old—that in the transition period you will suffer a little while you are taking off your 2 candles?—If I could tell them: "When you get down to the 2s., you will be better off"—but I cannot, at the 14 candles.

Mr. EMMOTT: As a matter of fact, with 2s. 2d. you could pay more than you are paying?

Witness: Yes; more than we are paying.

Lord R. CECIL: Would you be prepared to leave the time of the reduction of your initial price and candle power to the Board of Trade. In order to meet what the Chairman has said, you do not feel that you could fix a time yourself; but you are prepared to leave it to an impartial authority to say when that reduction should take place, having regard to the price of the coal?

Witness: I think we might do that.

In reply to the CHAIRMAN, who said a very relevant and important matter in the consideration of the Committee was the question of the burners, witness said that when the gas was reduced to 15 candles the Company would supply the burners. It would not be necessary to supply one sort of burner for 15 and another for 14 candle gas. The burner for the 15-candle gas would be specially adapted to 14-candle gas; the margin of inefficiency at 15 candles would not be large.

The CHAIRMAN: Your difficulty does not arrive with the first stage—you could begin with the first stage at once?

Witness: As far as stopping the enrichment is concerned; but we have had to buy a large quantity of Yorkshire coal, which gives gas of nearly 17 candles. The public would be getting that; and we cannot reduce the quality of gas until we change the coal.

According to the evidence, the cessation of enrichment would in a large measure account for the 2 candles. Supposing we say it goes halfway—that the one act of cessation would enable you to approximate to 15-candle power. It is very possible, with the extra quality coal you have, you would be supplying 15½ candles, and might even get to 16 candles; but this is no worse than you are to-day, because now you have a 16-candle standard, and according to your test you are very often approaching 17 candles in quality?—Yes.

You would be no further away from your standard, and therefore entail no further loss to your shareholders than you do now, when you practically give ½ to ¾ candle over your standard?—Well, in the first place, enrichment in our case costs about £20,000 a year; and it does not amount to a candle. With the coal we use, we should supply 15½ candles certainly on the average; and we are now supplying 16·3 or 16·4 candles.

There would not be much difference?—No.

Mr. NICOL: To go from 16 to 15 candles, and doing away with enrichment—that is, £20,000 a year. How much more would you lose?

Witness: £22,000 more.

That is £42,000 by reducing from 16 to 15 candles?—£42,000. That is 1d. per 1000 cubic feet.

£20,000 of that you get by enrichment?—Yes.

So that you lose, even with coal, £22,000?—Yes.

Surely you considered that before you came here?—Yes; we did. If we could have kept to a 2s. 6d. price, we should not have raised any question about it. We were willing to give the public the benefit. The price must go up to 2s. 8d. or 2s.9d. That is the difficulty in meeting the shareholders.

The CHAIRMAN: But that is a matter which does not arise out of this Bill. It will come upon you and your shareholders, irrespective of legislation?

Witness: Yes; and if we had known it, we should not have introduced the Bill at all.

Mr. NICOL: The fact is, you were too keen to fall in with the recommendations of the Select Committee?

Witness: Yes; that is the long and the short of it. We have offered more to the consumers than we shall save.

By the CHAIRMAN: He thought the Company could go down to 15 candles by July 1, 1901.

The CHAIRMAN: The Committee are unanimously of opinion that after that we are prepared to give you two years before you go to 14 candles. Therefore, from July 1, 1901, to June 30, 1903, it would be 15 candles; and from July 1, 1903, and onwards, 14 candles?

Witness: Yes.

I think this will give you ample time to manipulate the cessation of your enrichment, and to gradually consume all the supply of coal which you now have in stock?—The enrichment we can stop at any time when we have cleared off the enrichment spirit. All I can say is, that I must refer to my Board the question of the 14 candles and the two years.

That does not affect us?—I am not in a position to accept it.

No; but we impose it as a condition. If you do not accept it, of course, there are ways and means of expressing that opinion by withdrawing your Bill?—I should be very sorry, after all this trouble with everybody, to do that.

I think I may say that the Committee also would be sorry. We are anxious to see this through, and should therefore be prepared to adjourn the consideration for a short time, and take up another measure, if, in the meantime, you will consult with your friends? We have a Board meeting to-day. I will attend the meeting, and then come back.

After a considerable interval,

Lord R. CECIL said: I think we have a solution which will meet the Committee's views. (To witness:) Will you explain what the position is now?

Witness: The Board can take a limit of time; but we want a little more than you propose, Sir, and for this reason: The only way in which we see that we can expect to save this £80,000 a year (£20,000 by enrichment and £60,000 otherwise) is by altering our system of manufacture; and this can only be done as the retorts wear out. Our retorts will work for 2000 days—that is, about six years; but we think that if the limit were extended till July 1, 1901, for 15 candles, and four years more for the 14 candles (to do it in less time, if we can), we could fix that. The two years is too short. It would never do for us to pull out retorts (they are most expensive) before they wear out; but as they wear out, we could reset them and entirely remodel our works. The work for this year, let me explain, is already practically done. We cannot begin until next spring.

The CHAIRMAN: You propose to begin with 15-candle power when?

Witness: As you suggested, on July 1, 1901.

Mr. EMMOTT: You want four years from then for the 14 candles?

Lord R. CECIL: You desire that from and after July 1, 1901, your candle power shall be 15, and your initial price 3s. 2d.?

Witness: Yes.

And that from and after July 1, 1905, your candle power shall be 14, and your initial price 3s. 1d.?—Yes; it will take us quite four years to alter our retorts.

Mr. NICOL: That is a delay of two years beyond the suggestion thrown out by the Committee.

Lord R. CECIL: Yes; and if it is possible to reduce the time, I understand Mr. Livesey to say they will do so.

Witness: Yes.

Mr. TALBOT: I only wish to understand it. The effect of this proposal is that the Company would preclude themselves from reducing to 14 candles—from doing that which was the object of the Committee's decision—until 1905.

The CHAIRMAN: No; they do not preclude themselves, but they take that as the maximum limit of time.

Mr. TALBOT: They preclude themselves, if the price is fixed up to 1905.

The CHAIRMAN: Oh, no. Whenever the Company alter their scale they will alter their price; and what the witness is asking is that the maximum of sufferance for 15 candles should extend to June 30, 1905.

Mr. TALBOT: I do not propose to discuss it. I only wished to understand the point.

After the Committee had conferred,

The CHAIRMAN said: The Committee will accept the proposal, on the understanding that those are the extreme dates which will be allowed—that when the period for the 15-candle gas comes, you will be subject to the same tests as you are now for 16-candle gas?

Witness: Exactly.

And subject to the same penalties for equal deviation?—Exactly.

And if at any time earlier than July 1, 1905, you are able to go down to the 14 candles (it must be done in half years), from the half year when you so proclaim yourself ready to proceed, the public will have the advantage of the 1d. reduction, and you yourselves will be bound not to hark back?—Certainly; and if we cannot reduce to 14 candles in five years, the price must be reduced anyway.

Lord R. CECIL: Probably the best plan would be that we should give notice that we are prepared from and after a certain date. Of course, the final limit is July 1, 1905. If Mr. Livesey finds himself in a position to make the reduction earlier than that period, he will give a public notice of, say, three months before the beginning of the next half year; and then the reduction will take effect as from that date instead of July 1, 1905?

Witness: Yes.

The CHAIRMAN: But from July 1, 1905, the lower price takes effect, whether there is a lower candle power or not?

Witness: Yes.

In that case, you will have clauses to draft?

Lord R. CECIL: I am afraid I shall have to ask for a short adjournment to draft that clause.

Witness: Might I say one word? I was very pleased to hear your remark that the testing is to go on on the same lines as at present. Of course, there must be no alteration in the system of testing; otherwise that might materially affect the apparent quality of the gas. It must go on on the same lines as at present. I was informed by a leading official of the London County Council that next year they are going to introduce their portable photometer Bill again; and if those tricks are played——

The CHAIRMAN: Next year's Parliament must decide its own legislation.

Witness: But your impression is that the testing is to be the same as now?

The CHAIRMAN: Yes; that has been the basis all through.

Thursday, May 24.

The Committee to-day proceeded to the consideration of the clauses; but before doing so, it was pointed out that the preamble was not conformable with the alterations to be made in the Bill in connection with the illuminating power of the gas and the prices to be charged. The necessary verbal amendments were accordingly made in the preamble.

Mr. TALBOT said that clause 5, which dealt with the illuminating power, had words at the end bearing upon the giving of notice of reduction in such power to the consumer. It said "giving three months' previous notice of their intention to the consumers of their gas and to the London County Council." He thought the notice should be defined in some way. There should be a written notice given; and provision should be made for its publication.

Lord R. CECIL said the Company could not be expected to give notice in writing to each of the consumers. Difficulties would arise if this were required.

Mr. TALBOT: The notice to the public should be by advertisement in the newspapers.

Lord R. CECIL: There is no difficulty about that. I am obliged to my learned friend for calling attention to the matter. We will state in the clause that notice shall be given by advertisement in the newspapers or to the London County Council.

Mr. TALBOT: I think we should have both.

Lord R. CECIL: I do not object to that.

Mr. TALBOT: The Clerk to the Camberwell Vestry, on his own behalf and for the other Local Authorities, is anxious that under this clause provision should be made for giving notice to each of the Local Authorities in the district. There are twenty Vestries; but the Local Authorities under the London Government Act whose districts will be affected are about seven in number.

The clause was then amended so as to conclude as follows:—

Giving three months' previous notice in writing of their intention to the London County Council, and to the Town Clerks of the several Metropolitan Borough Councils in the district of supply of the Company, and by advertisement in one London daily paper and in one paper circulating in the said district.

Mr. LITTLER: As to the position of the Corporation of the City of London, I wish to say that we have very carefully considered it, as regards ourselves and all the consumers north of the Thames; and we feel in a serious difficulty, because we still—and I say it with all respect to the Committee—think that we are right, and that the Bill as it has been passed, without the provisions we desire to see inserted in it, will make a present to the Company of £40,000 a year. I am not going to re-argue the matter for a moment; but I do wish to make quite clear the position we take up. The matter is one we regard as so important that we cannot discuss it on clauses. We think it is of the essence of the Bill, and, therefore, a matter of preamble; and we trust you will not deem it disrespectful if we do not take any further part in discussing the measure—for that reason, if for no other.

The CHAIRMAN said that something in the nature of a description of the standard burner would be required in the Bill.

Mr. TALBOT drew attention to the new clause 7A. He said it provided that the Company should supply suitable burners in lieu of those in use. The Committee had decided to grant a reduction in the illuminating power of the gas, but had done so on the idea that this would be met by the adoption of a certain burner. There was, however, a twelvemonth's time limit for the supply of the burner. His clients saw no reason why the consumer should have a time limit put on him, beyond which he should not be able to apply for a burner. He would suggest that there could be no good reason on the part of the Company for not supplying a proper burner at any time. He thought an amendment in that sense necessary to secure the results contemplated by the Committee.

The CHAIRMAN said there ought to be a time limit; for a man must decide in his own mind whether or not he would trust himself to the Company. He might decide not to have the burner; and in five years' time he might wake up one morning, and say: "I will have my burners altered."

Mr. TALBOT: How can it hurt the Company, even if he does? They will have plenty of burners in stock.

The CHAIRMAN: The Company ought to know when a certain part of their business is finished.

Mr. TALBOT: They must always have new consumers; and to these they will supply burners as a matter of course.

Lord R. CECIL: We are only dealing with existing consumers.

Mr. TALBOT: Perhaps the Company can satisfy the Committee on this point. I shall be glad to hear their case.

The CHAIRMAN: I do not want them to satisfy me. I am satisfied.

Lord R. CECIL: If it will meet my learned friend's views, we will put in "two years," instead of "twelve months."

Mr. TALBOT: You are giving until 1905 for 14-candle gas. There may be a consumer satisfied with 15-candle gas up to that time; but after that he may want the new burner. There does not seem to me to be any very substantial objection to my proposal.

The CHAIRMAN: We have one year for 15-candle gas.

Mr. TALBOT: Yes; and within twelve months after July 1, 1901, according to the clause, the burners must be supplied. That covers the first year of the 15-candle period.

Lord R. CECIL: In the Dublin case, which is the precedent for this, there was only three months allowed.

The CHAIRMAN: The public practically have two years now—up to twelve months after July 1, 1901. The matter will be before the public for two years. If twenty-four months is put in in place of twelve months, that will mean three years' notice.

Lord R. CECIL: That is so. We agree to the insertion of the words "two years," in place of "twelve months."

The clause was amended accordingly.

Mr. TALBOT: As to the question between the 1d. and 3d.

The CHAIRMAN: You mean the 1d. per candle power?

Mr. TALBOT: The 2s. 8d. for the 1d., as against the bonus.

The CHAIRMAN: We felt that, seeing the standard is now, at the recommendation of the Committee, lowered a further 2d. on consideration of the illuminating power, it would be difficult to get an additional 3d. below the standard so reduced; and we thought any achievement in that direction should have a bonus attached to it.

Mr. TALBOT: I presume the Committee have considered the effect of this Bill on the capital of the Gaslight and Coke Company, in so far as it enables the South Metropolitan Company to purchase a part of that Company's district. We shall have to go into it between the proceedings in this House and in the House of Lords, in the hope of coming to some arrangement with the promoters. If we cannot come to an arrangement, we must reserve our right to oppose that part of the Bill in the other House.

The CHAIRMAN: We have thought that over; and it seems to us that we should be going beyond the preamble of the Bill in prescribing anything in regard to the manipulation of the capital of the Gaslight and Coke Company. We do not see that we have any *locus standi* to deal with it. If in another place something can be provided in the shape of a clause, well and good. We have nothing before us.

Mr. TALBOT: The best way to proceed would be to cut out the reference to the purchase.

The CHAIRMAN: We do not wish to inflict a disability on this Company. In all probability, the other Company will attempt to deal with the matter before long. It is "on the cards" that the clause will not be operative until the other Company have obtained power. Will an empowering clause in this Bill enable the other Company to sell?

Mr. TALBOT: We are very much afraid that it will.

Lord R. CECIL: The first part of clause 25 says—

The Company may purchase: (1) That portion of the undertaking, works, lands, hereditaments, mains, and property (real and personal) of the Gaslight and Coke Company which is situate in that part of the Administrative County of London which is on the south side of the River Thames (hereinafter referred to as "the transferred undertaking"), and all powers, rights, privileges, and authorities of that Company so far as they relate to the transferred undertaking, for such price or consideration, and generally upon such terms and conditions, as may be agreed on between the Company and the Gaslight and Coke Company; and the Gaslight and Coke Company may sell the same to the Company accordingly.

So that the sub-section empowers the one Company to sell and the other to purchase.

Mr. COATES: And clause 26 gives power to the two Companies to enter into an agreement.

Lord R. CECIL: We shall be glad to discuss the matter with the County Council between this House and the other; so as to remove, if possible, the only point of difference between us. I do not see that anything can be done now.

Mr. TALBOT: We reserve to ourselves the right to oppose the sliding-scale in the other House. I say no more about it.

Lord R. CECIL, in reply to the Chairman, said the promoters did not alter the testing arrangements at all. They simply varied the standard power and the initial price. The present Bill would become a Special Act; and the whole of the existing machinery under the Act of 1880 would apply to it.

Mr. TALBOT: We are quite agreed as to the intention; but we are not sure that it would not be better to put in words making it clear that this is a Special Act within the meaning of the Act of 1880.

Lord R. CECIL: There is no doubt about the intention.

The following, as an addition to clause 7 (which describes the burner to be used for testing the illuminating power), was then brought up and agreed to:—

Provided that when, under the provisions of this Act, the prescribed illuminating power shall be 14 candles, the said burner shall be used with the chimney prescribed by the Gas Referees for gas of the illuminating power of 14 candles.

Mr. TALBOT said he was not in a position to discuss the matter now. The County Council would consider it hereafter.

The Bill, as amended, was then ordered to be reported to the House.

HOUSE OF COMMONS COMMITTEE.

Monday, May 21.

(*Before Mr.* MARK OLDROYD, *Chairman, Mr.* NICOL, *Mr.* TENNANT, *and Mr.* STANLEY LEIGHTON.)

WANDSWORTH AND PUTNEY GAS BILL.

This Bill, under which power is taken to convert the capital of the Wandsworth and Putney Gaslight and Coke Company, and to raise additional capital to construct works, came to-day before a Select Committee of the House of Commons constituted as above.

Mr. BALFOUR BROWNE, Q.C., Lord ROBERT CECIL, Q.C., and Mr. MOON were for the promoters. The other Counsel engaged were: Mr. WORSLEY TAYLOR, Q.C., Mr. TALBOT, and Mr. BERNARD WILKINSON, for the London County Council; and Mr. PEMBROKE STEPHENS, Q.C., and Mr. VESEY KNOX, for the Wandsworth District Board of Works. An appearance was reserved on behalf of the Vestry of St. Mary, Battersea.

Mr. BALFOUR BROWNE, in opening, said the Company at present had 71 miles of mains, 14,000 consumers, and a large number of prepayment meters. One object of the Bill was to convert the capital, as a number of companies had done. It was proposed to convert £15,000 of 1856 10 per cent. stock into £30,000 "A" consolidated 5 per cent. stock; £15,000 of 1856 7½ per cent. stock into £31,200 "B" stock; £40,000 of 1866 ordinary capital into £80,000 "B" consolidated stock; £15,750 converted 1856 and 1866 capital into £31,500 "B" consolidated stock; and £56,468 of 1880 ordinary capital into £112,936 "B" consolidated stock. The "B" stock was to bear interest at the rate of 3½ per cent. per annum. Then it was proposed to consolidate the debenture capital—amounting altogether to £32,000—into an equivalent amount of 3 per cent. consolidated debenture stock. The standard price of the Company was fixed, in 1880, at 4s. per 1000 cubic feet; and they were now supplying the cheapest gas of any company south of London, with the exception of the South Metropolitan Company—their price for 14-candle power gas being 2s. 2d., which was 1s. below the average of the fourteen Suburban Companies of London. The Company were able to do this, because their capital, having regard to the production of gas, was very small—being only £339 per million cubic feet sold. The Company were, however, indebted to their banker to a considerable amount. They were asking for power to raise £300,000 of new capital, which was absolutely required for the immediate needs of the Company. The only objection there could be to granting this power, was that it might enable the Company to remain too long away from Parliament. The idea in the report of the Committee of last year was that Gas Companies ought to come to Parliament every five years; but he deprecated too frequent applications by a small company, because it meant the accumulation on capital account of sums of money which were unremunerative. The matter, however, was one for the Committee to judge of. The Company calculated that in future they would not be able to keep the capital down to £339 per million cubic feet, but that the figure would be nearer £500. Even this figure, however, would be very much below the average. The Company were at present exceedingly cramped; and they were therefore buying land for extension purposes. This land was on the river and railway, which gave facilities for taking coal in and carrying coke out, and in a district in which there could be no objection to the presence of gas-works, because they would be surrounded by manufactories. Difficulty arose from the fact that the site was intersected by a certain number of roads and footpaths. These were mainly useful for people going to the works; but as most of the works concerned would be swept away, there would be no necessity for them. There would be no disadvantage at all to the public in shutting up these lanes, and the

Company would want all the scheduled land within ten years. The opponents to the Bill were the London County Council and the Wandsworth District Board of Works, also the Battersea Local Authority, who, however, had reserved Counsel. As to the Wandsworth Board of Works, he could not imagine why they were there. They had appointed a Committee to confer with the Directors of the Company; and the conference was held, and an agreement arrived at. But the Board subsequently repudiated the settlement. The Company supplied a large amount of gas for other than illuminating purposes—that was to say, for heating and for driving gas-engines. They were of opinion that the Committee would not say that 14-candle gas was not sufficient in Wandsworth and Putney, when they had decided that this was a good gas for the south of London.

The Chairman: It is 14-candle gas with conditions.

Mr. Balfour Browne: The promoters were neighbours of the South Metropolitan Company. With regard to the petitions against the Bill, the County Council, in paragraphs 5 and 6, spoke about the proposed conversion of stock; and in paragraph 7 they said: "Your petitioners would point out that the effect of this consolidation and conversion of capital would be to cause an addition to the saleable value of the Company's capital, while it would confer no benefit upon the public or the consumers of gas." Well, this subject had been threshed out again and again at the instance of the County Council and others, who had always failed. Many companies, both in London and the Provinces, had been allowed to convert their capital. The petition continued: "And, further, that the proposal would have the effect of concealing from the public the fact that the Company are paying 15½, 13, and 12½ per cent. upon the various classes of the Company's nominal paid-up capital (£139,250), which, together with a sum of £58,972 received for premiums and applied for capital purposes, represents the money received into the capital account of the Company and expended, or to be expended, on the undertaking, and would cause it to appear that the Company are only obtaining dividends at the rate of 7¾ and 6¼ per cent. upon their ordinary capital." In paragraph 8, they said: "Your petitioners humbly submit that if this consolidation and conversion is allowed by your honourable House, the Company should be required to publish their statements of capital account in such a form that the effect of the conversion both on nominal capital and dividend may be clearly shown."

Mr. Worsley Taylor remarked that he had no doubt they would be able to arrange this.

Mr. Balfour Browne said he would leave the point on that understanding. Then as to the ordinary stock clause, the petitioners said: "The Company also seek power to raise additional capital, not exceeding £300,000, by the creation and issue of ordinary stock, and to borrow in respect thereof not exceeding £100,000."

The Chairman: What is the capital?

Mr. Balfour Browne: £230,000, including the debenture stock.

Mr. Tennant: And what is the rate of interest on the old stock?

Mr. Balfour Browne: Five per cent. Paragraphs 10 and 11 dealt with the acquisition of lands, which he had already explained. Paragraph 12 had reference to the laying of mains, and other ordinary matters; and he would pass it over. Paragraph 13 was unnecessary—pointing out how London was at present supplied with gas. The Committee were aware of all those matters. In paragraph 14, the petitioners said: "Your petitioners humbly submit that the district within the area of supply of the Wandsworth Company has now become so developed with building, that if further powers be conferred on the Company it is expedient that they should be placed under similar provisions to those which are in force in regard to the rest of the Metropolitan Gas Supply." He should resist this to the utmost. The Company were not under any of the Metropolitan Acts; and they had never been treated as a Metropolitan Company. There were thirteen or fourteen Suburban Companies, all round London, similarly situated to the promoters of this Bill. If there were any general legislation to bring all these Companies in, the Wandsworth and Putney Company no doubt would be included; but he objected to the Company, when they came forward alone seeking an extension of their powers, being treated as a London Company. The petition went on: "Your petitioners object to the new powers of raising capital proposed by the Bill, and submit that they are excessive; and they further submit that, if further powers are conceded to the Company, the standard price of the Company, which is now at 4s. per 1000 cubic feet, should be reduced." This he also resisted as strenuously as he possibly could. Rather than have this done, he would withdraw the Bill, and refuse to raise the capital which was necessary for the supply of the district. The Company had raised a large amount of capital under the Act of 1880; and people had subscribed to it, and had paid large premiums for the stock, on the understanding that the dividend should be on a standard price of 4s. per 1000 cubic feet. It would be dishonest to the persons who had so subscribed, to say that they should take a standard price lower than 4s. If the standard were altered, the Company would have been allowed to go to the public altogether under a false impression. He had never known Parliament to go back on a power given in the manner now proposed. The only precedent which could be quoted for what was now asked was the Lea Bridge case; but the alteration was allowed in that instance on the express ground that no capital had been raised under the provision of the sliding-scale. It was a scale in the air, and had not been used. He asked the Committee not to touch the sliding-scale. The 15th paragraph said: "It is proposed, by clause 29 of the Bill, that the insurance fund of the Company may accumulate until it amounts to a sum equal to one-twentieth of the paid-up capital of the Company. Your petitioners would point out that, inasmuch as the proposed conversion of capital would increase the nominal amount of the capital of the Company, the limit of the insurance fund would be correspondingly increased; and your petitioners submit that the limit of the insurance fund ought not to be increased as the result of such conversion, which does not in any way increase the probable demands upon the said fund." He should be willing to assent to the insurance fund not being increased. The 16th paragraph dealt with the same thing. The 17th said: "Power is sought by the Bill to take houses in the County of London, occupied to a considerable extent by persons of the labouring class, as defined in the Standing Orders of your honourable House relating thereto. Your petitioners are continuously engaged as the Authority under 'The Housing of the Working Classes Act, 1890,' in removing or improving insanitary and crowded areas in the County of London; and they are continuously making large expenditure out of moneys raised by the creation and issue of stock in carrying out schemes for the improvement of unhealthy areas, and otherwise under the said Act for the rehousing of persons displaced." This was all true; but these schemes for rehousing the working classes had to receive the assent of the Home Office, and he did not think the general law in the matter was likely to be altered in favour of the London County Council. The petitioners next said: "Your petitioners humbly suggest that it would be convenient if the arrangements to be made under the Bill for providing new dwellings for persons of the labouring class were made in concert with your petitioners. Your petitioners submit that a satisfactory scheme should be settled and provided for in the Bill." He did not suppose the Committee wished to undertake the function of the Home Office. Therefore, he would ask them not to provide for any scheme. Paragraph 18 said: "By clause 38 of the Bill, it is proposed to exempt certain buildings of the Company from the London Building Acts, which are administered by your petitioners. Your petitioners deny that any public necessity can be shown to exist for the proposed exemption; and they object thereto." Well, the Company were under the Building Acts. The 19th paragraph set forth: "Your petitioners submit that further powers should be inserted in the Bill prohibiting the Company from using for buildings any of the lands which are shown on the deposited plans, but are beyond the general line of building in the street, and for providing that the effect of the London Building Acts shall not be evaded by the Company. The powers sought by the Bill will injuriously affect the tramway depôt of the South London Tramways, which your petitioners have the right to purchase; and your petitioners object thereto." He did not know how this was; but it was a small matter, and he should leave it to be settled by his learned friend in examining witnesses. He would not go into the remaining points. The material opposition was in regard to the standard price; and it was also desired that the Company should be put under the restrictions that the three London Gas Companies were under. The Company would not now be, and never had been, a Metropolitan Company. Turning to the petition of the Wandsworth Board of Works, paragraph 2 commenced: "Your petitioners are the Highway, Lighting, Sewer, and Sanitary Authority of the Wandsworth district, in the County of London, constituted under the Metropolis Management Act, 1855, and the Acts amending the same, comprising the parishes of Wandsworth, Clapham, Putney, Streatham, and Tooting Graveney, having an area of over 14½ square miles, a population of over 200,000, and a rateable value of £1,354,172." If the petitioners were the Lighting Authority, he presumed the London County Council were not. Which was the right Authority to look after the matter? The paragraph continued: "Your petitioners, and the ratepayers and inhabitants of their district, are consumers of gas supplied by the Company. The rights, property, and interests of your petitioners and of the community represented by them will be prejudicially affected by the powers sought by the Bill, in the manner, and for the reasons, hereinafter appearing; and they object thereto. The preamble of the Bill, after reciting the expediency of converting and consolidating the existing capital of the Company in the manner thereinafter set forth, further recites that the demand for gas within the Company's limits of supply is increasing, and it is expedient that the Company be authorized to raise additional capital to acquire additional lands and to construct additional works, as hereinafter provided, in order to enable them to meet such increased demand." This was just the usual thing. Clause 4 set out the Bill; and as to clause 5, in regard to accommodation for the working classes, the petitioners, he understood, were now satisfied with the Bill. Paragraph 6 said: "By clause 4 of the Bill, certain restrictions are proposed to be imposed upon the Company on displacing persons of the labouring class in the County of London. The provisions of this clause are unsatisfactory; and your petitioners say that their approval of the scheme for providing new dwellings should be obtained before the same be carried out." Was not this ridiculous? The Home Office would have to approve of any scheme decided upon; and yet neither the County Council nor the Board of Works were satisfied. Each of them wanted to have a voice in approving of a scheme. Paragraph 7 said: "By clause 6 of the Bill, it is proposed that, in addition to any other lands which the Company seek powers by the Bill to take or purchase, the Company may, for the purposes of their undertaking, purchase, take, and hold (by agreement, but not otherwise) any lands and hereditaments, not exceeding in the whole 20 acres, which the Company may from time to time require for the purposes of their works and undertaking. It is evident from these provisions that the Company contemplate the acquisition of other land which may be situate in the immediate neighbourhood of their works; and your petitioners respectfully submit that such a proposal should not be sanctioned. The Company have no immediate or prospective necessity for such a large quantity of land; and the acquisition thereof would cause an unnecessary and unremunerative addition to their capital, tending to prevent a reduction of their charges." A great portion of this land was already in the hands of the Company; and the clause in the Bill objected to was the ordinary one which found a place in all measures of this description. If besides the land immediately required, power was taken to purchase 20 acres, it was only that the Company might be able to treat for the acquisition. The clause would not give them power to build new gas-works on the site. This would require fresh parliamentary sanction. The powers they sought were simply to enable them to go into the market and buy the land, to prevent buildings being put upon it, which would make it very dear. It was land which would in all likelihood be required for the undertaking in the future. In the 8th paragraph, the petitioners set out the streets and roads which the Bill proposed to authorize the Company to stop up and discontinue for the public use. The paragraph went on to say: "Your petitioners, among others, now use the roads in question, and will in the near future use them more frequently. Your petitioners therefore submit that the powers sought by the Bill should not be granted to the Company at all, or in any event unless, and until, they provide, sewer and pave, and light at their own expense, a road 40 feet wide." He could never consent to the construction of a new road 40 feet wide right through the Company's works. In paragraph 9, the petitioners said: "The acquisition and demolition by the Company of so much rateable property, has affected and diminished the rates within your petitioners' district; and the effect of the proposed acquisition and demolition of rateable property will still further diminish such rates.

Your petitioners therefore submit that the proposed further destruction of rateable property should not be authorized, or only upon condition that the Company make good such diminished rates, both in respect of property already acquired and that proposed to be acquired." The poor-rate authorities were quite alive to the increase in the rateable value, because at the last quinquennial valuation there was a great fight as to what was the value of the works; and the rate now fixed was far more than that which would have been paid by the property displaced. The proposal at the end of the paragraph was altogether a new departure. Clause 10 of the petition had reference to the part of the Bill dealing with conversion of capital; and he would not refer to it again, as he had mentioned it already. Paragraph 11 began: "Clause 16 of the Bill provides that the existing standard price of the Company's gas is to continue unaffected. This price is 4s. per 1000 cubic feet; whereas the standard price of the South Metropolitan Gas Company, which supplies a part of your petitioners' district adjoining the district of the Company, is 3s. 6d. per 1000 cubic feet." The Company were aware of this; but the price would not be 3s. 6d. in future. After a reference to the report of the Committee of last year, which did not apply to this Company, the clause concluded as follows: "Your petitioners submit that the Bill should be amended to give effect to all the recommendations of the Committee referred to, so far as the same shall be applicable, and in particular that the Company's standard price for gas should be reduced." He would ask the Committee not to do what would really constitute a confiscation of the property of the Company. Paragraph 12 ran: "Your petitioners further submit that the provisions of the Bill for offering the proposed new stock for sale by public auction are insufficient for the due protection of the public and the consumers and ratepayers of your petitioners' district, and that the notices of such sale by auction proposed to be given by clause 23 of the Bill are insufficient." He did not know what these were—they were the ordinary notices, he supposed, which had been given effect to in other cases. The petition was a long one; and he would not go right through it, if his learned friend would indicate the paragraphs he thought material.

Lord R. Cecil: Paragraphs 13 and 16.

Mr. Balfour Browne said that paragraph 13 was as follows: "Your petitioners object to the powers proposed by clause 33, enabling the Company to lay pipes in streets not dedicated to the use of the public; and say that such powers should only be granted (if at all) subject to the sanction and approval of your petitioners as to the position of such pipes." They said that if the pipes were not dedicated to the public, they belonged to private people. Why these powers should be subject to the consent of the petitioners, when the pipes did not belong to them, he did not know. Paragraph 16 commenced: "The Company are not subject to the provisions of the Metropolis Gas Act, 1860, and the Gaslight and Coke and other Gas Companies Amendment Act, 1880; and their prescribed illuminating power is only 14 candles." This was the same point as that raised by the County Council. The petitioners said: "Your petitioners submit that the powers sought by the Bill should be granted (if at all) only upon condition that the above-mentioned Acts, or any other General Acts relating to the supply, illuminating power, purity, and pressure of gas in the County of London, and the testing-places and testing apparatus thereof, be incorporated in the Bill. For the reasons set out, and many others, your petitioners object to the Bill, and deny the existence of any public necessity for the construction of the proposed works at all commensurate with the injury to property and public and private interests which will be inflicted upon your petitioners and others if the Bill pass into an Act. Your petitioners submit that the Bill, as presented, is needlessly oppressive and confiscatory in its character, and should not pass into law." He should have thought that the confiscation would have been on the side of the petitioners, when they came to alter his standard. No owners of property objected to the Bill—only these two Local Authorities. The Bill was simply to get further land and capital; and they could not go on discharging their duty to the public unless they got that. What they were asking for might be too much or too little. If it was right, the Committee, he thought, would pass the Bill; but in all seriousness he asked them to say whether, in a Bill of this nature, they were going to alter the whole of the previous legislation, and pitchfork this district into the legislation which up to the present had been confined entirely to the Metropolis. He thought they would not do that. And he also thought they would not touch the standard price. The Battersea Local Authority had petitioned against the Bill; but in their case Counsel was reserved. Their point was that the standard price was too high, and ought to be reduced. In this they joined with the other petitioners, and urged that Parliament should break faith with the Company. He asked the Committee not to yield to these petitions.

Mr. *H. E. Jones*, examined by Mr. Moon, said he was Deputy-Chairman of the Company. He was Engineer from 1862 to 1869, and had been a Director most of the time since. The undertaking was very small till six or seven years ago, when it began to develop with great rapidity, especially since the introduction of the system of supplying gas by prepayment meters to the working classes, to which class about a half of the customers belonged. The Company had nearly as many slot-meters as ordinary consumers, which was very unusual. The charge for slot-meter fittings was 11d.; the many clerks, &c., who used them liking a better kind of chandelier and stove than the working classes were generally content with. Tenpence would be quite enough for the fittings required by the working men. The 11d. included interest, depreciation, repairs, and so forth. Owing to the great care with which the capital had been expended, and to the bulk of it having been raised and sold by auction under the moderate dividend of 7 per cent., the Company required the smallest amount of profit of any in the neighbourhood, out of the gas, to pay their dividends; and they therefore supplied gas far more cheaply than any company comparable to them in the South of England. The present price was 2s. 2d. per 1000 cubic feet; the obligation under statutes on the Company being to supply 14-candle power gas. As a fact, the gas was of over 15-candle power. They used a slight amount of enrichment, but chiefly as a makeshift in time of pressure. The district was large and straggling—there being 71 miles of mains; so that, although the number of consumers per mile was 173 the amount of gas taken per consumer was only 48,000 cubic feet, against 51,000 feet which was the average of the twelve Suburban Companies. The population of the Company's area was now about 92,000. The Company had fully exhausted all the land they had power over by the former Act, and had been fortunate in securing immediately adjoining the existing works some 9½ acres of additional land, which, together with some not yet bought, the Company now sought the authority of Parliament to use for gas purposes. This land abutted on the Thames, and was bounded practically on the south by the London and South-Western Railway, which cut it off from the better class portion of the district; and, further, the land lay between the existing works on the west, and a tramway stables on the east. If the business was to be developed, no better site could possibly be found. But it happened to be intersected by some narrow footpaths and a winding lane, not 9 feet wide at places, which the Company proposed to stop up. There was, however, practically no traffic, except that in connection with the Company's works. As to the suggestion that the illuminating power of the gas should be increased, witness entirely agreed with Mr. Livesey on the subject; and he pointed out that the Company were kept in order by the active competition of the London and County Brush Electric Light Company. Under the sliding-scale, for every £3063 gained or lost by the reduction or addition of 1d. to the price, the shareholders' proportion was £355, while that of the consumers was £2708. The Company believed that their progressive course in reducing the price of gas would be interrupted if there were any increase in the illuminating power. Coming to the capital requirements, witness said the present sale of gas was 651 million cubic feet a year; the daily average output of a maximum week being 3,350,000 feet. The rate of increase was just under 8 per cent. per annum compound, which meant that the business would be doubled in about nine years. The total capital expenditure at Christmas last was £238,098; and there had been spent since £13,372—making a total of £251,470. Besides this, there was owing to the bank £30,000. The further expenditure necessary was £3500 for land, £4500 for the gas-holder, £3500 for the tank, £1250 for purifiers, and £2000 for oil-gas plant, which made the capital expenditure £296,220, against a capital authorized of £236,000; so that the Company were very much at the mercy of the Committee. Of this £296,220, £43,500 for stoves and £39,000 for coin-meter fittings, was outside the ordinary requirements of capital for the supply of gas. Deducting this amount, left the capital for works and mains at £213,720. This amount, on the annual sale of 651 million cubic feet, worked out at £328 per million, which was very low. Of this sum, the Company had incurred to their bankers and others liabilities in excess of their present powers for £60,000. After the completion of the work in hand, it would be necessary to commence an installation of works on the scale of 2 million cubic feet per diem, or (say) 400 million feet per annum, to provide for the increase of the next five years, which, at £330 per million feet, would cost £132,000, to which there was to be added £2000 the cost of obtaining the present Act, and £17,500 for rehousing—providing under the requirements of the Local Government Board the equivalent of 70 houses—making £211,500. A further addition to capital in respect of coin and ordinary meters was allowed of £58,750. This sum, with the £211,500, made a total of £270,250. When this was expended at the end of the five years, the Company would require to start afresh on an additional section of works, which, on a scale of 2 millions per diem, would require £132,000, and, *plus* £39,000 for coin-meters, ordinary meters, and fittings, make the total required in nine years £441,250. As against this, the Bill asked for £300,000 of share and £100,000 of loan capital. If the present rates of metal, building materials, and wages continued, at least 25 per cent. more than these sums would be necessary. As to the conversion of capital, the proposal was simply to halve the standard dividend and double the stock, which would not increase the dividend a farthing, though it might benefit the holder of stock, because the public had a liking for low rather than high dividends. It was provided that the Company should not raise more than £60,000 of capital in any one year. As to the petition of the London County Council, the small scale of the undertaking and the past history of Metropolitan gas legislation necessarily excluded it from being brought into the same range as the three London Companies, the capital of which averaged over seven millions apiece. As to the objections of the Wandsworth authority, the estimate included provision for dealing with the houses involved in a way which satisfied the Local Government Board. All the houses pulled down so far had been insanitary, and practical rookeries; so that it was hardly fair the Company should undertake even as much as they did under the Bill. Power as to 20 acres of land was taken, as it would be necessary for the Company to look out for land for extensions, and to acquire it without waiting until they had to schedule it to an Act, and so greatly enhance its value. Regarding the content with reference to the standard price in the petition, witness pointed out that the cost of producing gas was enormously increased—about 10d. per 1000 cubic feet—by the advance in the price of coal; and it was therefore not a suitable period to consider an abatement of the standard. Indeed, such an abatement could not be made, in view of the fact that for the last twenty years capital had been sold by auction upon the faith of the dividends, and that the dividends had been paid fully up to the standard price. As to the new capital, the Company were open to take any provision for interest on it which the Committee might think proper; but if the dividend were cut down, it would realize less premium at auction, and therefore not be so favourable to the consumer.

Cross-examined by Mr. Worsley Taylor: The Company had not been before Parliament for the last twenty years; and in this time there had been considerable changes in the district and in the attitude of people towards gas. The Company were now asking to more than double their capital. He agreed that, in the circumstances, the legislation applicable to the Company should be reviewed and brought fairly up to date. The east of the district had little to distinguish it from the area of the South Metropolitan Company, which it adjoined, but where the conditions were very different. The testing of the gas was done by an officer of the Local Authority, who visited the works for the purpose without giving notice. There had been no complaints of bad gas from the Local Authority. Formerly the Company were under obligation to supply 12-candle gas; and subsequently the figure was raised to 14. The testing was governed by the Local Acts of 1856 and 1866, and by the General Act (the Gas-Works Clauses Act) of 1871. The Local Authority could test at one place only—that place being at the works—and only between certain hours. He did not think there was any objection to the authorities having a testing-place where they liked, so long as it was satisfactory, and on a good main. He would object strongly to come under the same

obligations as the London Companies. Besides the testing for sulphuretted hydrogen, there were tests for ammonia with the London Companies, but not out of London. The Company were prepared to take the Crystal Palace Company's clause with regard to sulphuretted hydrogen. On the question of the standard price, he agreed that the 10 per cent. capital received 15 per cent. dividend, and the next stock 13½ per cent. Whenever the sliding-scale worked properly, the price of gas went down and the dividend rose. The Company, in expending their capital, had increased the works as well as the mains. In 1880, the sale was 148 million cubic feet. The slot-meter supplies had increased; the number laid on being: 1895, 1380; 1896, 2800 odd; 1897, 3860; 1898, 5181; 1899, 6000 odd; and now the total was above 7000. In 1895, the sale of gas was 412 million cubic feet; and in 1899 it had increased to 621 million feet.

By Mr. Vesey Knox: The photometer used at the works for testing was, he believed, new within the past ten years. He had had no complaints regarding the nature of it. The district was increasing very rapidly, but not with very high-class consumers. He should say it could not be the fact that the Company were annexing 1½ acres of public street without compensation. If it were the case, the Company would be glad to pay liberally. He had no objection to giving notice of intention to sell stock by auction to the Borough Council of Wandsworth.

It was proposed that in future there should be a variation of 1s. 9d. for every penny in the price. This was to apply to the new shares only—not to the old. The reason was that, by an oversight, when the sliding-scale was used at first they allowed the 1d. for ¼ per cent. to rule both the 10 and 7 per cent. stocks, the result being that the 7 per cent. got a good deal larger increment if the price went down than the 10 per cent. One received 1s. 10d., and the other 1s. 7d. for the same reduction in price.

Mr. Worsley Taylor said that witness had agreed that there should be certain alterations with regard to the testing; and, in order to save time, he suggested an adjournment so as to allow an agreement, if possible, to be arrived at.

The Chairman: In that case we had better adjourn.

Mr. Worsley Taylor: Do you put your back against the wall with regard to the standard price?

Witness: Not in the least.

Are you willing to consider the question of the alteration of the standard price, or do you wish that to be discussed and disposed of by the Committee?—I would rather have the decision of the Committee on a point of this sort, if it would not be troubling them too much to deal with it.

The Committee then adjourned; it being understood that witness would meet and confer with the petitioners, with a view to coming to a settlement.

Tuesday, May 22.

Lord R. Cecil said he thought Mr. Jones was anxious to explain what passed at the meeting of the Company, the Wandsworth Local Authority, and the London County Council the previous day.

Mr. *Jones* said the Local Authority were inflexible on the one point on which the Company had their backs to the wall—namely, that they should be regarded as a Metropolitan Company. They insisted that the Company should come under the Metropolitan Gas Referees, and adopt the 16 candles, and other provisions with regard to testing and purity, in force in the Metropolis. Then they asked that the pressure should be tested where they chose, and without notice; and he consented to this. The next proposition was that the Company should accept a reduction of 6d. in the standard price, and that there should be nothing given to the Company which would be a compensating factor. The alternative was that the Company should take the same legislation as the South Metropolitan Gas Company in the Bill the Committee had already passed. Besides this, the Company were not only to make the northern road 40 feet wide, but to enlarge the narrow footpath to a 40-foot road. Then the County Council wished to reduce the capital by half; whereas the needs were so extreme that the Company were in debt £60,000 already. They insisted on the Metropolitan legislation; and he therefore thought it unnecessary to go on. Under these circumstances, they came before the Committee again.

Lord R. Cecil: In other words, the proposals made by the other side were so extreme that practically there was no possibility of arriving at a conclusion at all?

Witness: They were inflexible.

Mr. Vesey Knox said that, having regard to the decision of the Committee on the last Bill, he should not insist on the gas being of 16-candle power if there were concessions on other points.

The Chairman: Why do you say that this morning, after refraining from saying it yesterday?

Mr. Vesey Knox: I understood that was our position yesterday.

Mr. Worsley Taylor said he thought it was unfortunate, and a little unusual, that one should have a full account given to a Committee of everything which took place while parties were trying to negotiate a settlement. One did not wish to keep anything back; but such procedure did not conduce to a settlement.

In reply to Mr. Worsley Taylor, witness stated that the points at issue between himself and the County Council were as to the capital, some improvement in the method of testing for both illuminating power and purity, and the standard price. He was still prepared to discuss these questions with the County Council.

Mr. Worsley Taylor said he believed witness had mixed up the position of the County Council and the District Board in the negotiations.

The Chairman: We have had enough of this. The negotiations have failed; let them drop.

Mr. P. Caldwell, Parliamentary Agent for Battersea, informed the Committee that his clients' objection was now to the standard price only.

In further reply to Mr. Worsley Taylor, witness said he was not prepared to give way at all in the matter of capital, because it was very expensive to come to Parliament. Once in nine years was quite often enough for a Company like this. There was no possible way in which the Company, as now existing, could take any advantage from the issue of the capital as proposed. To remove any doubt from the mind of the Local Authority, he thought there was no objection to there being another testing place at the Town Hall, or at some other convenient spot upon a large main. He objected to giving more than one additional testing-place; there was hardly a company in the kingdom of the same size which had more than one testing-station. The Gas Examiner was appointed by the Wandsworth Local Authority; he should object to his being appointed by the London County Council. It was the vice of the London system that the Gas Examiners were appointed by that body, who had certainly shown a sort of hostility to the Companies. The appointment of these impartial men should be given to the Board of Trade, rather than to the Local Authority. With regard to the conversion of the capital, it had not been proved to him that this always resulted in an increase in the value of the stock, though generally, he believed, the average investor would rather buy a 5 per cent. than a 10 per cent. stock, because there was more certainty in the lower dividend.

Cross-examined by Mr. Pembroke Stephens (who said Mr. Worsley Taylor's cross-examination had covered all the points, except one, which he wished to raise), witness said, in reply to the suggestion that power was taken practically to absorb 1½ acres of public ways without equivalent, that the Company were prepared to widen Warple Road on the north side. They had bought property there; and as far as it extended, they would widen the road.

Re-examined by Lord R. Cecil: The Company would not injure the public by stopping these ways; and therefore he saw no reason why they should give compensation. The Company objected to the County Council being the testing authority.

Some further remarks were made at this point, regarding the meeting on the previous day, in the course of which

Mr. Talbot said Mr. Jones had presented an inaccurate version of what passed. Mr. Jones absolutely refused to meet the County Council, unless the County Council could answer for the agreement of the District Board, which, of course, they could not do. It was entirely a misrepresentation to say the County Council were standing out.

The Chairman said he had consulted the Committee as to whether they should put the Company under the jurisdiction of the Gas Referees by placing them practically within the Metropolitan area; and they had decided not to do so. As to whether they should put upon them any similar procedure as obtained within the Metropolitan area, was another matter.

Witness said the Company were willing to supply the most modern photometer and appliances, and the best burner.

By Lord R. Cecil: The Company were prepared to do anything which any Suburban Company did now; but they were not prepared to be put under the conditions which prevailed with regard to the three great Metropolitan Companies. As to the standard price, he objected to any alteration of the condition on which the shareholders subscribed their money. There had been negotiations with reference to an alteration of the standard; but they failed.

Sir *F. Bramwell*, examined by Lord R. Cecil, said he had known the Company for some years past, and had studied it for the purposes of this inquiry. He believed it was a model Company, having a low price of gas and low capital per million cubic feet. The situation of the works was extremely good as regarded getting materials in and out, and being secluded from other property to which they might be a nuisance. He agreed that it was necessary to extend the works. Having lived in the neighbourhood of the works, he knew the footpath proposed to be stopped up, but was unable to conceive that there was any considerable traffic there, as it led practically only to or from the works. The selling price of gas being but a little more than 50 per cent. of the standard, was evidence of good management. It would certainly be unjust to diminish the standard price, on the strength of which capital had been subscribed.

In cross-examination, witness said he had not heard that the County Council proposed to build steps by Wandsworth Bridge, and so make a way for foot passengers through the area the Company were acquiring. He could not conceive that anyone going over the bridge would use the steps. There was a shorter route to Wandsworth than would be thus afforded. To force the Company to make one good way in place of the two narrow thoroughfares, would be to make them give excessive compensation.

By the Committee: The present conditions for gas-testing afforded sufficient security to the consumers; but there would be no objection to another station on an arterial main. He did not believe the capital asked for would be sufficient, unless there was a return to normal prices. Raising capital at as large a premium as was proposed, would not tend to extravagance, because if the Company were extravagant, away would go the dividend.

Mr. *Corbet Woodall* gave evidence in support of the proposals in the Bill. The extra capital power sought (£400,000) was reasonable. He assumed that in ten years the sale of gas would have increased by 865 million cubic feet, which, at a capital expenditure of £500 per million, meant £432,500. The figure of 865 millions was based on an increase of 10 per cent. per annum. He agreed that the land taken was admirably suited for gas-works purposes, and that the undertaking was well managed.

Cross-examined as to why the prescriptions of the London Gas Referees should not apply to the Company, he said the broad distinction between the three great Metropolitan Companies and this Company was that the London Companies necessarily manufactured gas at a number of works, and it was impossible therefore with one or two stations to make sure that the gas was properly tested; but with the Wandsworth Company, there was only one works, and a works testing-station would ensure that all the gas was of uniform quality. He saw nothing in what was known as the "Notification" of the Gas Referees with reference to the taking of tests, applicable to the London Companies, which was not also applicable to this Company.

By Mr. Nicol: The cost of a testing-station was about £200 a year. He deprecated very much indeed the multiplication of testing-stations in this district.

Mr. *E. H. Stevenson*, examined by Lord R. Cecil, thought the capital asked was too low, and that it would not last the usual period—viz., twelve or fifteen years. He agreed as to the excellence of the management of the Company, and thought a second testing-station would be extravagant and

useless. Witness was being examined about the footpath and lane which the Company propose to stop up, when

The Chairman said the Committee quite realized the position of the two footpaths; and all they wanted in regard to them now was evidence as to the traffic there.

Further examined, witness said not the slightest injury would result to the consumer from the standard price being 4s. and the selling price 2s., per 1000 cubic feet. Grave injury would accrue to the public if the standard price were altered, because the capital as sold now fetched a high premium; whereas if the investor knew that the standard was liable to revision from time to time, he would rarely give more than par for the stock, because he would be uncertain of the return. The consumers were far more interested in the financial management of the Company than the shareholders. In this case the proportion was about 10 to 1.

Mr. Talbot said, with regard to testing, the County Council would be met if the Company would agree to the establishment of such additional testing-places as the Committee might think fit, and would accept such conditions with regard to testing for illuminating power, purity, and pressure as the Gas Referees might prescribe from time to time, and, further, accept the Notification which Mr. Woodall had said was applicable to the Company.

The matter was discussed, but in the end not accepted.

J. Clarke, an ex-inspector of police, gave evidence of the foot and vehicular traffic at Waterside from Aug. 21 to Sept. 9 last, between the hours of 8 a.m. and 7 p.m. The foot passengers ranged between 20 and 60, and the vehicles between 4 and 10 per day. Of the foot passengers, a number went to get drink at a public-house since acquired by the Gas Company; while others went to a house in course of erection. The average was about 39 foot passengers and 7 vehicles daily.

Chas. Bradley, another ex-inspector of police, gave similar evidence with regard to the same thoroughfare between Nov. 27 and Dec. 9, when, on an average, there were 12 passengers and 13 vehicles per day connected with the Company, and 5 passengers and 1 vehicle not connected with the Company. Practically, the place was not used at all. Church Walk, one of the thoroughfares affected, was even less frequented.

Mr. *H. H. Jones*, Engineer and Manager of the Company, agreed with the evidence given regarding the growth of the district. At present the works were strained to the utmost to give the necessary day and night supplies; and to cope with the pressure at night, he had to reduce the pressure in the day. On occasions last winter, they could have sold quite half-a-million cubic feet more than it was possible to in future. When the holder now being erected was completed, the works would be just equal to the maximum day's consumption. The works, land, and capital provided for in the Bill were absolutely necessary.

Dr. *Howell*, Chairman of the Company, in supporting the Bill, said the Company had always done their best to serve the public and the consumers, and had succeeded in every sense.

Lord R. Cecil: That is our case.

Mr. Talbot: Might I request you would intimate the points on which you understand the Company to be prepared to agree to modifications of the existing law? There are the additional testing-place, the modernization of the photometer, the Crystal Palace clause with regard to purity, and the modification of the clause with regard to pressure.

The Chairman: I do not know anything about the last point. We have not had the pressure dealt with. I do not want to introduce it if it is understood between you.

Mr. Talbot: It is subject to that modification. For the moment, we will take Mr. Jones's concession with regard to that. I understand the Company will bring up clauses on the matters I have mentioned. I do not propose to trouble the Committee further on the part of the County Council.

Evidence was then called for the Wandsworth District Board.

Dr. *H. W. Hake*, examined by Mr. Vesey Knox, said he was Gas Examiner to the Board. The photometer in use was an antiquated instrument; and although he had complained, he had not been able to secure a new one. The ventilation formerly was altogether unsatisfactory; but after a good deal of correspondence, he had secured rather better ventilation of the burner. The Company had always stood by their Act; and therefore the only way to get relief in future was by the insertion of clauses in the Bill. It would be much better to have a testing-station away from the works, because then one would get a sample of the gas actually supplied to the district.

By the Chairman: There should be two testing-stations at different places away from the works. He tested about once a month; but this fact was not to be taken as indicating satisfaction on his part. He did not think he would gain anything by testing more often at this station. The standard was 14 candles; but on only one or two occasions had he found the gas below 16 candles. The instrument, however, was not scientifically accurate. He thought it recorded a higher illuminating power than was actually the case. The tests for purity, sulphur, and ammonia should be the same as under the Gas Referees. This would be more satisfactory from the consumers' point of view. The Company, as regarded pressure also, should come under the requirements of the Gas Referees. The pressure should be at least 10-10ths at night.

Mr. *Peter Dodd*, Surveyor to the Wandsworth District Board of Works, said the actual area of the streets the Company proposed to close up was 1 acre 2 roods 12 poles. There was a demand, if not for two, at least for one highway; and the Board had arranged to widen Waterside to 40 feet, this being a thoroughfare which led to 7 acres of undeveloped land. They had also arranged with the Electric Light Company, who had works adjacent, to pave Bell Lane.

Mr. *A. R. Gridley*, a member of the Wandsworth Board, said difficulty might arise later, in consequence of the power the Company took to lay mains in private roads (which might be taken over subsequently), if the mains were laid too near the surface, and thus became liable to be affected by steam-rollers, frost, &c. The power of the Company to lay mains in such roads should be subject to the reasonable approval of the Board. The Board should also have authority to approve the re-housing scheme.

Mr. Vesey Knox then addressed the Committee on behalf of the Wandsworth District Board. The most important point to be dealt with was the standard price, with regard to which the facts were agreed—viz., that 4s. per 1000 cubic feet was a high standard; that 14 candles was a low illuminating standard; and that this was fixed at a time when the population of the district and the output of gas was little more than one-third what it was now. It would be difficult to find a district that had been altered more since the standard price was fixed. If, therefore, it was admissable, as a general principle, that the standard price should be altered where a district had changed, there could not be a stronger case than the present. It was said to be unreasonable that a local authority should ask that the standard price, once fixed, should be altered. When the standard price was settled, there were a number of conditions which went to make the parliamentary contract; one being the illuminating power of the gas. It was obvious that the illuminating power did affect the standard price, because in one case, where the present Committee allowed the Company to alter the illuminating power, they required also a variation of the standard price. As a fact, the Company had supplied gas of higher quality than they were required to do, so that they had not regarded the parliamentary contract fixing the standard price and illuminating power as one to be availed of to the full in a district which was increasing. Before 1880, when the standard price was fixed, the Company had issued, under the old maximum system, £70,000 of stock, which was actually more than half of their stock. The highest aim then was to get 10 per cent. on a portion, and 7½ per cent. on the remainder. But the sliding-scale had altered the parliamentary contract enormously to the advantage of the holders of the stock; so that they had been receiving 15 per cent. in one case and 12½ per cent. in the other. This being so, when the Company came for an increase of capital, it was quite fair for the Committee to say the conditions of the district had altered, and that it was only right the Company should be made to conform, as regarded standard price, to the condition of the rest of the Metropolis, and to the requirements of their district. It was not now contended that the illuminating power should be altered; but as they were forbearing in that respect, and the Company would therefore be able to supply gas without enrichment, it was only reasonable that there should be some alteration—whatever the Committee thought fit—in the standard price. There was also a point with regard to the large capital powers; but that he would not press, if the Committee thought fit to alter the standard price. If the standard price was approximated to that of the South Metropolitan Company, the Board thought nine years might be a reasonable time to allow the Company to stay away from Parliament. If, however, the Committee felt they were not justified in altering the standard price, he asked them to reduce the capital powers to such a figure as would be sufficient for five instead of nine years. Having briefly referred to the subject of laying mains in private roads, and to the rehousing scheme, the learned Counsel spoke as to the roads. It was only reasonable that, if these roads were closed, the Company should make some equivalent. There was no reason for varying the general law to the extent the Company sought. In addition to widening Warple Way, the Company should be required to make a highway to be laid out in consultation with the Board of Works.

Mr. Caudwell, on behalf of Battersea, pressed for a reduction of the standard price. If the price were not reduced, there would be two parts of Battersea where the standard illuminating power would be 14 candles; but in one case, where the supply was from the South Metropolitan Company, the standard price would be 3s. 1d., while in the other, where the supply was from the Wandsworth and Putney Company, the standard price would be 4s. per 1000 cubic feet. There should be some approximation of the two limits; and Battersea would be content if the standard of the Wandsworth Company were reduced to 3s. 6d., the illuminating power remaining as at present.

The Chairman, without calling on Lord Robert Cecil to reply, said the Committee had pretty well made up their minds on this Bill. They had decided that the preamble was proved, subject to the conditions offered by the promoters, and to which the Committee would assent when they saw them in detail in the clauses.

Wednesday, May 23.

Mr. Pembroke Stephens, on behalf of the Wandsworth Board of Works, said the Board had brought forward several points on which they thought improvement were called for. Some of these points were dealt with by the proposals of the promoters, and on others the Committee decided against the Board. Under these circumstances, the Board felt it would be hardly respectful to raise the same points on clauses. Therefore, as the Board could not usefully take part in the discussion on the clauses, he was instructed to retire.

The Committee then proceeded with the consideration of the clauses: the following being accepted by them as carrying out their decision:—

Further proviso to clause 8: Provided further that the Company shall, where their existing works abut on Warple Way, widen such thoroughfare to the width of 40 feet; and as and when they acquire other property abutting on Warple Way under the powers of this Act, they shall from time to time widen such thoroughfare to the same width.

Clause 37a.—Notwithstanding anything in the Acts of 1856, 1866, and 1880 contained, and for the purposes of the application of the Gas-Works Clauses Act, 1871, the following provisions as to the purity and pressure of the gas supplied by the Company shall have effect (that is to say)—(*a*) All gas supplied by the Company shall be supplied at such pressure as to balance from midnight to sunset a column of water not less than eight-tenths of an inch in height and to balance from sunset to midnight a column of water not less than one inch in height. (*b*) The gas supplied by the Company shall not contain more than 20 grains of sulphur in any form in 100 feet of gas. (*c*) No forfeiture shall be incurred in any case with respect to which it is proved before the Justices that the excess of impurity was occasioned by unavoidable cause or accident, and unless that excess shall amount to 2 grains upon the average of six consecutive week-days, or 10 grains upon any one day. (*d*) In the event of the Gas Examiner finding any such impurity in the gas, he shall forthwith give notice thereof to the Company at their office.

Clause 37b.—In addition to any other prescribed testing-place, the Board of Works for the Wandsworth District (hereinafter called "the District Board") shall, prior to the first day of December, 1900, provide, and thereafter maintain, a sufficient building, or set apart a portion of the Town Hall, Wandsworth, as and for an additional testing-place; and the Company

shall, prior to the first day of January, 1901, provide and erect, and thereafter maintain, in such building, or portion of the said Town Hall, testing apparatus for testing the purity and illuminating power of the gas supplied by the Company, in accordance with the provisions of the Gas-Works Clauses Act, 1871, as varied by this Act; and the District Board shall afford to the Company their officers and servants free access to such testing-place at all times. Such apparatus shall be under the control and management of the Company; and sections 30 and 34 of the Gas-Works Clauses Act, 1871, shall, for the purposes of this Act, be read and have effect as if in section 30 the said testing-place had been referred to in addition to "the premises of the Company," and as if in section 34 the testing "apparatus" had been referred to instead of the testing "place."

Mr. TALBOT said there was only one point in dispute, and that was as regarded the photometer. Mr. Jones, he understood, had said he was ready to accept the most modern form of photometer; and to give effect to this, he (Counsel) proposed a clause that any photometer to be used for the purpose of testing the illuminating power of the gas to be supplied by the Company shall be of the best description known at the passing of the Act, and, failing agreement between the District Board and the Company as should be prescribed by the Board of Trade. It was not desired that there should be a prescription from time to time, but once for all. The Company were already under the Act of 1871; and what they proposed, therefore, was no concession at all.

The clause handed in on behalf of the Company was as follows: "The photometer to be used for the purpose of such testing shall be either of the most improved forms of photometer prescribed by the Gas-Works Clauses Act, 1871, as may be selected by the Gas Examiner of the District Board."

The CHAIRMAN said the idea in the mind of the Committee was that the most modern form of photometer was the one now prescribed by the Gas Referees for the Metropolitan Companies.

Mr. *H. E. Jones* remarked that this photometer was the most recent; but they had not had much experience of it. He objected to it, because it involved the use of pure pentane, which there was difficulty in getting. There were very few of these instruments in use; and there was little knowledge of them.

Lord R. CECIL said Mr. Jones would be quite content to take the best photometer that could be got under the general law of the country; but he wished to maintain that his Company were under the general legislation applying to the whole country, and not that referring specially to the Metropolis.

Eventually the clause, as an addition to clause 37b, was agreed to in the following form:—

The photometers to be used for the purpose of testing the gas supplied by the Company shall be of either of the most improved forms of photometer prescribed by the Gas-Works Clauses Act, 1871, as may be selected by the Gas Examiner of the District Board.

The remaining clauses having been approved, the Bill passed the Committee, and was in due course reported to the House.

LEGAL INTELLIGENCE.

The Intimidation of Gas Workers at Newport (Mon.).

At the Newport County Police Court last Saturday week, Evan Lewis Jenkins, the Local Secretary of the Gas Workers' Union, and Osmond Webley and Ivor Birt Jeffries, two of the displaced workmen from the Crindau works of the Newport Gas Company, appeared on remand for unlawfully using threats to John Henry Nicholls, with a view to compel him to abstain from work. As already reported, some new charging-machines have been introduced at the Company's works; and a few weeks ago twenty men were discharged because they would not use the machines. Nicholls, the complainant, who is from Truro, acted as instructor of the new machines, and had lived on the Company's premises owing to threats that he would get a "leathering" if he came out. On the previous Sunday morning, he and another man, named Pascoe, slipped out by the railway siding for a stroll, leaving the line at the bridge, and going over the fields to Caerleon. As they returned on to the embankment, on the way back, they met the defendants. Webley said: "We have met face to face at last," with the addition of a derogatory expression. Then he raised a stick as though he was going to strike, and advanced towards him, but did not strike him. Jenkins then asked why complainant did not come out to see him; and he replied that he did not do so because of the threats. Jenkins asked him to write to his employer at Truro to withdraw him; and complainant said he should get the sack if he went back. Jenkins also told him that no man would stop at the works and be able to live at Newport afterwards, especially the darkies (coloured men), who would not go back alive. Jenkins added that complainant had better clear out as well, and that the Union were picketing the works to cause as much expense to the Company as possible. Jeffries said and did nothing. The three men were each fined 40s. and costs, or in default one month's imprisonment.

Increase in the Price of Gas at Newcastle.—The Newcastle and Gateshead Gas Company have notified the Corporations that the price of gas from the June readings will be raised from 2s. to 2s. 4d. per 1000 cubic feet, subject to the usual 10 to 15 per cent. discount. This is partly owing to the fact that the price of coal has gone up nearly 100 per cent.; and the Company felt it imperative, in consequence, to raise the charge for gas by 14 per cent.

Gas Poisoning at Bingley.—Stephen Holdsworth (aged 23) died at Bingley last Wednesday from the effects, it is believed, of gas poisoning. The deceased had been in the employment of a firm of printers for the past two or three months; and it seems that on the 15th inst. he replaced the ignition tube of a gas engine with a new one. It is supposed that the whole of the feed pipes were not shut off, and that Holdsworth inhaled a quantity of gas during the operation of replacing the broken tube. Later in the day, the man complained of being unwell, and towards the end of the week his condition became serious, death taking place on Wednesday. The medical opinion is that death resulted from congestion of the brain following upon gas poisoning.

MISCELLANEOUS NEWS.

WEST RIDING COALOWNERS AND GAS COAL CONTRACTS.

The Protest Against the Proposed New Conditions.

In the "JOURNAL" for the 1st inst. (p. 1136), reference was made to an interview which had taken place between representatives of the West Yorkshire Coalowners' Association and of the Gas Committees of the Corporations of Leeds, Bradford, Halifax, Huddersfield, and Keighley, with reference to the new terms of contract for gas coal which the coalowners are seeking to impose. We learn from the "Leeds Mercury," from which the particulars already given were obtained, that the general comment upon the new proposals is that an attempt is being made to relax the conditions which affect the vendor, and to tighten to an unreasonable degree those which affect the purchaser, while it is suggested to advance the contract price of gas coal no less than 5s. per ton. At the interview already reported, a vigorous protest was made by Alderman Lowden, Chairman of the Leeds Gas Committee, against the terms. At the close, it was arranged that the matters in dispute should be further discussed at an adjourned conference; the Corporations to be represented by the Chairman, Vice-Chairman, and Engineer of each Gas Committee, and the coalowners by a Special Committee appointed by them. This adjourned conference took place last Tuesday afternoon at the Great Northern Station Hotel, Leeds. Our contemporary states that each of the new clauses was discussed, and that, on behalf of the Gas Committees, certain modifications were proposed, though it was submitted that the whole list ought to be withdrawn. In reply to a question as to why certain of the proposals were made, it was said that the coalowners desired to protect themselves. It was admitted that they had had no cause to complain, so far as the Corporations represented were concerned; but as to some other purchasers, it was stated that the circumstances were different. With regard to the winter and summer deliveries, it was contended by the representatives of the Corporations that if the 60 and 40 per cent. were insisted upon, 6d. per ton at least should be allowed to meet the extra expenditure which stacking would entail. The object of the coalowners in reducing the winter delivery and increasing that of summer is doubtless that they themselves may be relieved of the necessity of stacking—an arrangement which, it is suggested, would keep the market in a condition more favourable to their interests than it would be with stocks in hand. The conference closed with the understanding that the coalowners would take the proposed modifications into consideration, and let the Committees know whether or not they are prepared to accede to all or any of them. Our contemporary adds that the coalowners are now in a strong position, owing to the large demand for coal; but it is said that the Corporations, and other gas producers, if they have to submit now, will certainly consider the advisability of seeking relief in some other direction, and that possibly endeavours will be made by them to acquire and work the coal they need.

MANCHESTER CORPORATION GAS SUPPLY.

Settlement of the Coal Contracts.

At their Meeting last Friday, the Gas Committee of the Manchester Corporation had before them the tenders received for the supply of coal and cannel during the ensuing year. After considering the various offers sent in, the Committee decided upon purchases to the extent of about 250,000 tons, which, with the quantities in hand and to come in under existing contracts, will cover their requirements up to July, 1901. The Committee, we understand, were already pretty well assured for the bulk of the twelve months. The prices at which the new purchases are being made have not been communicated to the Press; but they are considerably in excess of last year's rates, and probably represent an advance about equal to that which coalowners generally are asking on this year's contracts. We learn from the Superintendent of the Gas Department (Mr. Charles Nickson) that the tenders sent in were not so numerous as they were last year, and the quantities offered were considerably less.

BIRMINGHAM CORPORATION GAS SUPPLY.

The Annual Report of the Committee.

The Birmingham City Council had before them last Tuesday the annual report of the Gas Committee, and the various recommendations contained therein, as published in the issue of the "JOURNAL" the same day.

Mr. J. H. LLOYD first moved that the Committee be authorized to appropriate £29,821, being the net profit of the department for the year ended March 31 last, to the credit of the improvement rate. He said the Committee thought the accounts very satisfactory, considering the difficulties of the year. They showed a surplus of £29,821, in addition to the £4000 interest on reserve fund, £10,379 in aid of public lighting in the city, £2388 in aid of lighting the courts within the city, and £3490 in aid of the public and the court lighting outside the city; making a total of £50,079 contributed for public purposes from the gas undertaking. The net surplus was £178 less than £30,000—the amount they had hoped to hand over to the rates this year; whereas last year the amount handed over was £320 8s. more than the £30,000. A difference of £499 profit between two years on a turnover of three-quarters of a million was so small that, without explanation, the two years might be assumed to be practically alike. The contrary was the case. They were dissimilar; and the past year had been one of considerable anxiety, owing to the rise in materials and of manufacture. The increased cost altogether was £98,500, made up as follows: Manufacturing £90,250 more, distribution £3150 more, superannuation allowances and sundries £1930 more; and to this must be added £2500 for increased payments for interest on capital and sinking fund, and £660 loss of bank interest—making an exact total of £98,490. The receipts, however, increased also. They had sold £36,000 worth more gas. Residuals had realized £60,000 more, and sundry receipts £2000 more—making an increased total of £98,000, which had enabled the Committee to meet the £98,500 increased

IMPORTANT NOTICE.

For the PROTECTION of WELSBACH AGENTS and the TRADE GENERALLY.

1.—MANTLES.

It is highly desirable that, in their own interests, the Agents of the Welsbach Company and the Trade generally should clearly understand that statements to the effect that the "Monopoly of the Welsbach Company came to an end with the expiration of the 1886 Patent"

ARE UNTRUE.

The present process, under which the Welsbach Mantles are made and which infringers imitate—described by the Court of Appeal as "**a remarkable and astonishing discovery of LATER TIMES,**" was first disclosed in the 1893 Patent, the **Welsbach Company's Patent Rights** in which

EXIST UNTIL 1907

and the Company will continue to uphold its rights, and to suppress all infringers of Mantles as well as of Burners.

In a circular dated 28th February last, the Sunlight Company states that the Welsbach Company "failed against their predecessors," the New Incandescent (Sunlight Patent) Company, Limited. The Judgment of Mr. Justice Buckley, of which the following is an extract, **will show how little truth there is in this statement:—**

> "In my opinion there has been an infringement of the Patent. . . . . I make the order therefore for an enquiry as to damages, and for delivery up . . . . and I therefore give the costs as between Solicitor and client."

It is also suggested that the Welsbach Company's action against the Sunlight Company for Infringement of the 1886 Patent has also failed, whereas the fact is that the Judge declined to **grant an interim injunction** on the ground that the duration of the (1886) Patent was so short. The Sunlight Company were ordered to keep an account, and the action for damages for Infringement against them will come on in due course. As the present Sunlight White Mantle is identical with that which Mr. Justice Buckley found to be an infringement, it will be seen that the Welsbach Company were entirely justified in the warnings they have given.

There is a further action pending against the Sunlight Company for infringement of the Welsbach Company's 1893 Patent, and it is claimed that the Sunlight Mantle is an even closer infringement of the 1893 Patent than of that of 1886, in which case it was held that the Defendants infringed "by using the material, namely, Thoria, suggested by the Patent of 1886." But for the delay resulting from the repeated applications of the Sunlight Company to the Court, this action on the 1893 Patent would have been settled before the expiration of the 1886 Patent.

The Welsbach Company is therefore still compelled to warn Dealers and the Public against BUYING, SELLING, or USING the SUNLIGHT WHITE MANTLE.

2.—BURNERS.

The Welsbach Company **repudiate absolutely** the statement that the New Welsbach Kern Burner is an infringement of the De Mare Patent, and the threats of the Sunlight Company should be ignored. At the time the Welsbach Company acquired the Kern Patent, they satisfied themselves that the Kern Burner did not infringe the De Mare Patent. The crude suggestions for a burner contained in De Mare's specification have been exhaustively tested by the Welsbach Company, and found useless.

The "Kern" Burner was brought out in 1897, and is unlike anything to be found in the De Mare Patent, **which makes no reference to a "chimneyless" burner.**

It cannot be too clearly understood that the New Welsbach "Kern" Burner embodies **absolutely new and original features** based upon a most interesting and valuable scientific discovery.

The Welsbach Company, convinced of their rights, have notified the Trade that they are prepared to defend any action which may be brought with respect to the "Kern" Burner, and to indemnify the persons attacked from all consequences.

The Welsbach Incandescent Gas-Light Company, Limited,

78, York Street, Westminster,

LONDON, S.W.

A "NEEDFUL" EXPLANATION.

We note an Advertisement in the "JOURNAL," under the name of the NEW CONVEYOR COMPANY, stating that they had taken over the business of the AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED; and, as it may create a false impression, we beg to say there are **NO VALID PATENTS** existing in connection with Inclined Retorts (beyond a few small and subsidiary ones, dealing with details).

We are prepared to erect Inclined Retort Plants, with Conveying and Elevating Machinery, Overhead Tanks, Hoppers, and Measuring Chambers, complete and **FREE OF ROYALTY.** In the list of places given, only a few were erected by the New Conveyor Company—nearly all the remainder being erected by the undersigned.

JONAS DRAKE & SON, OVENDEN, HALIFAX.

GRAHAM, MORTON, & CO., LIMITED, LEEDS.

W. J. JENKINS & CO., LIMITED, RETFORD.

WINSTANLEY COMPANY, COVENTRY

BRADDOCK'S PATENT PENNY-IN-THE-SLOT

(ALSO SHILLING-IN-THE-SLOT)

PREPAYMENT WET AND DRY GAS-METERS

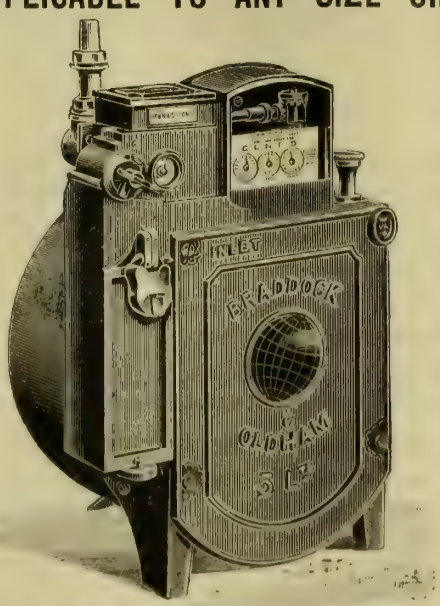
STRONG AND DURABLE. SIMPLE, YET EFFECTIVE.

THE ATTACHMENT IS APPLICABLE TO ANY SIZE OR KIND OF GAS-METERS.

The Attachment is kept as distinct from the Meter as possible, and does not interfere with the ordinary Index of the Meter.

METER REPAIRS ARE NOT COMPLICATED.

NO DELICATE PARTS.



No. 222. BRADDOCK'S CAST-IRON CASE WET PREPAYMENT METER.

By the patent arrangement of Crown Change Wheel and fixed long Pinion, the price may be very readily altered *in situ*.
Any number of Feet per Penny may be allowed.

MOST CONVENIENT AND DEFINITE SYSTEM.

NO FINE WHEELS.

J. & J. BRADDOCK (BRANCH OF METERS LIMITED), **Globe Meter Works, OLDHAM,**

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cost, and only decreased the usual £30,000 paid to the rates by £178. The price of gas had been retained at the lowest figures, the net average rate being 2s. 2·07d., notwithstanding a rise in the price of coal in June last of about 1s. 2d. per ton. For some months in the early autumn, it seemed probable that the result would be different; but the increase in the gas used and the rapid rise in residuals had raised the surplus to almost the usual amount. Coke had realized £95,622—the highest amount ever reached by the department; and this fact was largely due to the foresight of the Secretary in inducing the Committee to raise the price rapidly and substantially. The cost of the manufacture of gas had already gone up enormously through the rise of coal; and they did not know that they had even now reached the top. Their contracts for the next twelve months would be made in June, as usual; and if the reported demands of the coalowners were successful, there must undoubtedly be a serious rise in the price of gas. The high price of coke was now beginning to check sales; and they might have to pay increased rates for coal, with diminishing prices for coke. The effect of such high prices in coal would naturally diminish the quantity of gas used. Every shilling per ton put on the price of coal meant, on the present tonnage, £26,715 a year extra cost to the department. All over the country the tendency would be to use more oil where it could be bought at a reasonable figure. There was also a tendency among the larger gas-works to diminish the candle power of the gas. During the great coal strike, their own officials were in favour of temporarily diminishing the illuminating power of gas; but the Committee hesitated. The time might, however, come when they would have to do so. The general progress of the department was good. The increase in the quantity of gas consumed amounted to 395,865,000 cubic feet, or 7·6 per cent. The maximum daily make reached had been 33,546,000 cubic feet; and the maximum weekly make 197,589,000 feet.

Mr. Bishop seconded the proposition, which was adopted.

Mr. Lloyd also moved that the Committee be authorized to borrow such further sums as they may from time to time require for the purposes of the works sanctioned by the Council; the amount not to exceed £500,000. He said that the department had only £45,195 of authorized capital unexpended. This sum was insufficient to meet the remaining requirements for new works, &c. In addition the Local Government Board required the Committee to deal with £175,000 accumulated sinking fund balance. They must either invest it or pay off loans; while hitherto it had been in the business, and had, therefore, been advantageous. The Local Government Board pointed out that this was not precisely in accordance with the wording of the Act. The department had not had to apply for an increase of capital since February, 1883 (seventeen years ago), when the amount of gas sold was half what it was this year. They had, therefore, doubled the output without increasing the capital. The Council would probably like to know some of the objects for which the sum was needed. It was based on the probable requirements of the next ten years. In the report of Feb. 1, 1898, it was stated that the amount intended to be spent in 1900, 1901, and 1902 was £243,000. In addition, he was sorry to say that the plant at Adderley Street was gradually wearing out, and would have to be replaced. This might cost £150,000. The prepayment fittings and stoves for the next ten years were likely to cost £80,000. Ten years' additional mains, based on the average of the last ten years, would amount to £75,000; and ten years' meters, including the prepayment meters, to £150,000. They would also want additional working capital, machinery, stocks, &c., £50,000, and, finally, the item to which he had referred—the £175,000 which the Local Government Board required to be transferred. This totalled to £923,000; and the Committee thought they should have power to borrow £500,000.

Mr. Bishop seconded the motion.

Mr. Lloyd, in answer to a question, said there was already a reserve fund of £100,000 in existence; and this was the maximum amount allowed.

The motion having been adopted, it was resolved that the salary of Dr. Colman, Chemist at the Saltley works, should be increased to £400 per annum.

Mr. Lloyd, in moving the approval of the report, referred to the complaints in the newspapers concerning the department. There was, he said, a great variety of them, and some were very old. The Secretary informed him that there were 100 this quarter as against 50 in the December quarter; but when they compared 100 with 62,500 consumers, the number was not very large. He could see nothing in the complaints to justify the idea that the meters were wrong. Every year about 4000 or 5000 meters were tested; and it was to the interest of the department that it should be so. Many of the complaints appeared to come from people who had not watched their consumption. In one case where complaint was made, it was found that a gas-fire had been put in during the quarter, and in another case several fresh brackets had been put in the house, while in a third there had been serious illness in the house.

Alderman Fallows seconded the proposition.

Mr. Parkins argued that the profits did not compare at all favourably with those of other undertakings. In the charges for gas, there was a disgraceful disparity of £40,000 between the amount charged to small and large consumers. They were charging the mechanics, working men, and small tradesmen too much, and were making them pay for many of the items on the expenditure side of the revenue account. He advocated the adoption of a uniform charge for gas.

Mr. Hennessy contended that the users of the penny-in-the-slot meters were particularly badly treated. The cost of the meters and fittings, and the expenses of collection, were much more than recouped by the interest on the money paid in advance.

Mr. Toller suggested that inclined retorts had been a failure; and with regard to this and other portions of the plant said that the object seemed to be, not to see how much gas could be got out of a ton of coal, but how much coal could be got rid of in a given time.

Mr. Lloyd, in replying, said the reduction of the price of gas to 2s. per 1000 cubic feet to large consumers was specially agreed to by the Council with a view of encouraging the use of gas-engines. The prices in connection with the penny-in-the-slot supply did seem rather large; but they had been arranged by the Committee after a careful consideration of all the data. As to inclined retorts, they had passed the experimental stage, and were almost universally reported to be exceedingly successful. They certainly were very favourable indeed for the men.

THE PRICE OF GAS AT LEEDS.

The Leeds Corporation Gas Committee last Wednesday decided to recommend the City Council to advance the price of gas by 3d. per 1000 cubic feet on and from July 1 next. The price at the present time is 2s. per 1000 cubic feet; and the increase for the remaining nine months of the financial year will produce about £25,000. This sum will just about cover the anticipated advance in the price of coal to be purchased for use between December and April. The Gas Department have a good stock of coal in hand sufficient to last until towards the end of the year; but this does not remove all difficulty. The coal which is thus available was purchased at an advance of about 1s. or 1s. 6d. per ton; and this is a factor to be reckoned with practically at once. In other words, the coal from which gas will be produced for the next six months alone represents an addition of something like £12,000 to the expenditure. The enhanced values of residuals and the greater consumption of gas for stoves saves the situation somewhat—coke is fetching 4s. per ton more than at the beginning of the year—but, on the other hand, there are higher wages to be paid, and increased rates and taxes, as compared with the position of the department twelve months ago. Only last Wednesday the Gas Committee resolved to advance the wages of the yardmen from 22s. to 24s. per week, of the purifiers from 24s. 3d. to 26s. per week, and of the bricklayers at Meadow Lane works from 9d. to 9½d. per hour.

STAFFORD CORPORATION GAS AND ELECTRICITY SUPPLY.

The Past Year's Working.

At the Meeting of the Stafford Corporation last Tuesday—the Mayor (Mr. W. C. T. Mynors) in the chair—the Gas and Electricity Committee presented their report for the year ending the 31st of March. It showed that the total quantity of gas made in the twelve months was 157,853,000 cubic feet, and that sold to private consumers 148,429,000 cubic feet; being an increase of 11,299,000 cubic feet upon the year 1898-9. The leakage and unaccounted-for gas was further reduced from 7·47 per cent. to 5 per cent. In consequence of the enhanced price, and the larger quantity carbonized, coals cost £8330; being an increase of £1064. The manufacturing charges were £4117; being an increase of £329, which was spent upon renewals and alterations of plant. Distribution charges amounted to £785; being an increase of £179. Management cost £547—an advance of £184, due to additional collectors being required in consequence of the large number of new consumers on the prepayment system. The working expenses were £8350. Adding the cost of coals made a total of £16,680, as compared with £14,583; being an increase of £2097. The revenue from the sale of gas and public lighting was £19,974, showing a substantial rise of £1609. The amount received for residual products, after deducting expenses, was: Coke, £3695; tar, £1365; and sulphate of ammonia, £991—a total increase of no less than £1574, which more than compensated for the increase in the cost of coal by £509. The total revenue for the year amounted to £26,122, and the total expenditure was £15,725; leaving a gross profit of £10,397, which was about £850 more than for 1898-9. The net profit was £3646, out of which £500 was paid as an instalment to the district fund. This being the close of the first year of profit-sharing among the workmen, and the accounts being so satisfactory, the Committee set aside a sum equal to 4½ per cent. bonus to all employees on weekly wages, to which under the scheme the men were entitled. The Committee recommended that £2000 should be transferred to the district fund in reduction of rates, in addition to the £500 already paid over, making £2500 for the year; that £500 be placed to the reserve fund; and that the balance be carried forward, out of which will be paid the bonus to employees. The total expenditure upon capital for the gas undertaking has been £105,779, and the capital repaid amounts to £36,707—leaving £69,072 owing; and the total paid out of profits in the reduction of rates will, with this year's contribution, amount to £34,850. The electric energy generated at the electricity works for the year was 118,341 Board of Trade units—being an increase of 19,593 units, or 20 per cent. more than last year; and the equivalent in number of 8-candle power lamps connected is 8558—an increase of 1212. The total revenue from electricity, meter-rents, &c., amounted to £1772; being an increase of £329. As the total expenditure was £983, there was a gross profit of £789. Interest charges on loans amounted to £560, and instalments of principal in reduction of capital to £604; making a total of £1164, and leaving a debit balance upon the year's working of £375. This, *plus* £81 brought forward, must be provided for out of the district fund. In order to further popularize the use of electricity, the Committee have reduced the price to a uniform charge of 5d. per unit, and abolished meter-rents. They are taking steps to augment the productive capacity of the gas and electricity works, in order to be in a position to meet the increased consumption in both departments.

The Engineer and Manager (Mr. J. Ferguson Bell) had prepared his usual analysis of the accounts of the Gas Department, which accompanied the report. It showed that the capital employed last year was at the rate of £4 9s. 11d. per ton of coal carbonized, and 9s. 6d. per 1000 cubic feet of gas sold. The coal used was 15,765 tons; and the quantity of gas made was 157,853,000 cubic feet, of which 148,429,000 cubic feet were sold. On the tonnage basis, the make was 10,013 cubic feet, and the sale 9415 cubic feet. The net cost of coal was 2s. 10·67d.; the total working expenses were 9s. 11·60d.; the gross profit was 11s. 10·31d.; and the net profit 4s. 5·79d. Adding last year's balance, 1·72d., we get 4s. 7·51d. On the basis of the quantity of gas sold, the figures stand as follows: Coal (net), 3·68d. per 1000 cubic feet; total working expenses, 12·7d.; gross profit, 15·12d.; and net profit, 5·72d. Adding last year's balance, 0·18d., we have a total of 5·9d.

The Committee also reported that they had considered the report of the Gas Engineer to the Sub-Committee appointed to look into the question of carburetted water gas, as well as a report of the Sub-Committee; and they recommended that plant for the production of this gas be erected. The Committee examined various tenders obtained for providing and laying down such plant; and, in the event of the scheme being approved by the Council, they recommended that that of Messrs. Humphreys and Glasgow, amounting to £3385 for the principal, and to £2731 for the auxiliary plant, be accepted. To meet the Engineer's

estimated expenditure on the scheme—viz., £8000—and to provide for probable further capital outlay in extension of the gas undertaking, the Committee recommended that application should be made to the Local Government Board for their sanction to the raising of a loan of £10,000.

Mr. Wright expressed his pleasure in moving the consideration of the report, as it showed that the gas undertaking had passed through the most successful year of its existence as part of the property of the Corporation. Having recapitulated the financial details set forth in the report, he went on to say that the Committee did not propose to increase the price of gas, which must be a source of gratification to the consumers, seeing that the charge has been raised in so many places. With regard to the bonus, a scheme had been formulated, but, acting on the advice of the Town Clerk, it had been withdrawn for the present—a legal difficulty having arisen. In preparing the scheme, the Committee were greatly indebted to Mr. George Livesey, the Chairman of the South Metropolitan Gas Company. In return for the bonus, the Committee expected to receive attention to their work, and regular attendance from the employees on weekly wages; and they hoped that it would be a strong bond between the Committee and the workmen, and that all concerned would pull together for the benefit of the works. In consequence of the increased demand for gas which had been made year by year, the Committee were face to face with the necessity of putting down additional plant. They had taken every step they considered possible to arrive at what was best to be done. The manufacture of water gas had, of late years, made rapid strides; and, on the recommendation of their Engineer and Manager, the Committee took up the consideration of the question, and had presented a report thereon. If they extended the coal-gas plant, the probability was that the retort-house would have to be enlarged and a new gasholder erected. The cost of this would make a big hole in £20,000. On the other hand, carburetted water-gas plant could be put down for something like £8000. Members of the Committee had visited certain places for the purpose of inspecting carburetted water-gas plants; and, after giving full and careful consideration to the question, the Committee had come to the conclusion that the proper thing to do was to instal this plant. The increasing consumption of gas was due to the growing use of cooking-stoves, and its extending use in factories. Therefore the Committee were obliged to look ahead. Having enumerated the advantages of water-gas plant, the speaker went on to say that it would be seen the Committee proposed to send out the water gas with the coal gas to the extent of 30 per cent. All the gas undertakings of note in the country, where extensions were necessary, were putting down this plant, and the Sub-Committee were convinced that it was the proper thing to do at Stafford. While the Committee had given £2500 from the Gas Department in relief of the rates, there was a deficiency of about £500 on the Electric Light Department, and it was charged to the district fund. The result was really very satisfactory, because the debit balance from the previous year was £513, so that there was an improvement of £140 on the year. He had now to make a regrettable announcement. They were about to lose the services of their Engineer; and he was sure that every member of the Council would congratulate him on the appointment he had received at Derby. It had always been Mr. Bell's desire to give the members every information in his power; and in him they had a most efficient and a most energetic and painstaking Manager. They could all hope that Mr. Bell would have long life, and go on improving his position in the gas world.

After some conversation on the subject of the decision to introduce water-gas plant, which resulted in an amendment to refer the matter back to the Committee being lost by 17 votes to 4, the report was adopted.

SALES OF STOCKS AND SHARES.

At the Mart, Tokenhouse Yard, E.C., last Wednesday, Mr. Alfred Richards conducted an important sale of gas and water stocks and shares. The first lots offered consisted of a new issue of £4500 of ordinary 5 per cent. stock of the Plymouth and Stonehouse Gas Company (last dividend 6⅓ per cent.). They were sold at the rate of £120 per cent.; the total realized being £5400. Some fully-paid £10 ordinary shares in the West Surrey Water Company (last dividend 6⅓ per cent. per annum) were next put up, and fetched £16 10s. and £16 17s. 6d. Ten fully-paid £5 "B" shares in the Romford Gas Company (last dividend 9 per cent.) were sold for £9 10s. per share. A few £5 shares in the Horley District Gas Company, Limited, on which 3½ per cent. has been paid, went for £4 apiece. Some original consolidated stock of the Southend Gas Company, paying 5½ per cent., fetched £111 and £112. A small parcel of £1 shares in the Buntingford Gas and Coke Company, Limited, carrying 5 per cent. dividend, were sold for £1 3s. each. Some £10 "A" shares in the Waltham Abbey and Cheshunt Gas Company (last dividend 7½ per cent. per annum) fetched £15 5s. each; some "B" shares of the same nominal value, carrying 5½ per cent. dividend, realizing £13 each. A £5 share in the St. Margaret's Gas Company, Limited, on which 6 per cent. was paid last year, was purchased for £5 12s. 6d. Some "B" stock of the Barnet District Gas and Water Company (last dividend 8 per cent. per annum) was sold at the rate of £200 per cent.; some "C" stock, carrying 1 per cent. more, realizing £227 10s. per cent.; and some "D" (water) stock, the last dividend on which was at the rate of £6 6s. per annum, £150 per cent. Some 4 per cent. perpetual debenture stock of the Tottenham and Edmonton Gas Company fetched £107 10s. per cent.; consolidated "A" stock (6 per cent.), £125 and £126; do. "B" stock (4½ per cent.), £101. A few £10 shares in the Woking Water and Gas Company were sold for £10 10s. each. A parcel of £100 of 4 per cent. perpetual debenture stock of the Colney Hatch Gas Company changed hands at £107 10s. A few £10 "A" shares in the Harrow and Stanmore Gas Company (last dividend 8 per cent.) fetched £16 and £16 5s. apiece; some £10 "C" shares realizing £12 5s. The last lot sold was some £10 shares in the South African Lighting Association, Limited, on which 10 per cent. per annum has been paid for several years. They fetched £16 each.

At a sale at Wrexham yesterday week, some £10 shares in the Wrexham Gas Company realized up to £16 2s. 6d. each, £100 consolidated stock in the same Company produced £220, £100 consolidated stock in the Wrexham Water Company made £175, and £50 consolidated stock in the Brymbo Water Company fetched £54. At Bromsgrove on Tuesday, 400 "B" £10 shares in the Bromsgrove Gas Company, bearing dividend at the rate of 7 per cent., were disposed of at prices ranging from £10 8s. to £11 2s. 6d. At a sale at Lewes on the same day, 30 lots of £20 original capital stock of the Lewes Gas Company sold for £40, and 27 lots at £39. Nine original fully-paid £25 shares in the Lewes Water Company fetched £80 each; and 23 new £25 shares, created in 1869 and 1883, were sold at prices varying from £50 to £48. For twenty-four twenty-fifths of a £25 share, created in 1891, £65 was given. Ten new £25 shares in the Company, also created in 1891, were sold at £69, £68 10s., and £68. Some original £25 shares in the Winchester Water and Gas Company, with accruing dividends, were also disposed of on Tuesday at from £59 to £60 per share. The dividends on these shares have for many years past been at the rate of 10 per cent. per annum. Some £25 "A" shares in the Dorking Gas Company were sold on Wednesday at £115 and £116 apiece; original shares in the Water Company fetching £34 and £36 each. At Cranleigh, on the same day, some £10 shares in the Cranleigh Gas Company, Limited, were disposed of at prices ranging from £10 to £10 3s. per share. At a sale at Colchester on Friday, original "A" £20 shares in the Colchester Gas Company realized £49 10s. each, and new "B" shares £34 and £34 5s. each.

THE GAS SUPPLY OF NEW YORK.

The latest indication respecting the situation of the gas supply of New York City was given, says the "American Gaslight Journal," at the recent annual meeting of the Standard Gaslight Company. It appears that the gathering was in every sense harmonious; the Board of Directors remaining unchanged, except for the substitution of Mr. J. U. Brookman for Mr. Russell Sage as President—whose "involuntary resignation" took place some time ago. The reports submitted showed that the Company had largely increased their business, and that they were prepared to expend a considerable sum of money to still further extend their trade in the city district north of the Harlem River. The tenour of the annual statements also supported the contention that money was to be made by selling gas at 65 c. per 1000 cubic feet. Our contemporary remarks that it could, of course, be said that there would have been more in gas at the legal rate of $1·05; but the shareholders were granted the privilege of thinking this out for themselves. A review of the proceedings at the meeting, so far as it could be made by one who did not share in its deliberations, would seem to indicate that the controllers of the Company are in at least fair sympathy with the aims of those who direct the fortunes and property of the Consolidated Gas Company. If such is the case, the legitimate successors to the property of the New York and East River and Equitable Gaslight Companies will, it is expected, shortly have a hard time in making both ends meet. For if the Standard Company confess to making little profit at 65 c. per 1000 cubic feet, where is the New Amsterdam Company to come in? Bonds are the securities which must prevail under modern financial laws. Of these the Consolidated Company have virtually none, the Standard but few, and the New Amsterdam many. The situation in the gas supply of New York City is stated to be reaching the critical stage; and the signs of the times go to show that regularity and honour, as evinced in the course pursued by those who direct the affairs and control the fortunes of the Consolidated Company, are about to prevail.

ELECTRIC LIGHTING NOTES.

The Rhyl District Council have agreed to accept certain tenders, amounting to £16,543, for executing different sections of their electric lighting scheme. They have also allocated £250 for land, and £2206 for legal expenses and other charges. Application is to be made to the Local Government Board for a loan of £19,000.

The Gloucester Corporation have already spent £43,450 on their electric lighting undertaking; and they now require a further £9425 for extensions and £8575 for the erection of a refuse destructor. At an inquiry on Thursday, it was stated that applications had already been received for 13,350 lights; and the extensions would bring up the capacity of the works to 20,000 lights.

Those leisured people the Yeadon District Council spent a further three hours last Tuesday discussing the electric light question. Grievous to relate, the talk at times was of a personal nature; and two of the members said very hard things about each other. If the topic of electric lighting causes people to use unkind words one to another, that is a good reason to add to the several others why it should be left alone. The Yeadon Councillors wound up their animated proceedings by deciding to ask the Board of Trade to extend the time of the Council's Provisional Order, and also to ask the Leeds City Council if they were prepared to supply electricity in bulk to Yeadon in conjunction with the proposed tramway scheme.

An inquiry, which occupied some six hours, was held by Colonel Slacke at Maidstone last Tuesday, in respect of an application by the Corporation for the authority of the Local Government Board to the borrowing of £40,000 with which to carry into effect an electric lighting and dust destruction scheme. To the second part of the scheme there was strong opposition from influential ratepayers; and ultimately it was thought wise to withdraw it. This decreased the amount required to £34,000. There was also considerable opposition on financial grounds. The price of gas in the town is low—2s. 4d. per 1000 cubic feet; and many ratepayers are of opinion that the electric lighting undertaking will prove a financial failure.

Last Wednesday, Mr. W. A. Ducat, a Local Government Board Inspector, sat at the Municipal Offices, Keighley, to inquire into an application by the Corporation for sanction to the borrowing of £45,000 for works of electric lighting. It was stated that the estimated expenditure included £31,460 on plant and buildings, £3146 Engineers' expenses and contingencies (10 per cent.), £9122 cost of site to be purchased from the Gas Department at Low Bridge, and £1250 cost of first twelve months' running—making a total of £44,978. The proceedings were in the main formal, though the Inspector seemed very anxious to know how it was the Gas Committee proposed to charge the Electricity Department £9122 for land which already belonged to the Corporation.

METROPOLIS WATER SUPPLY.

The Carrying Out of the Intercommunication Scheme.

At the Guildhall, Westminster, on Monday last week, Mr. Charles Perrin, the Official Examiner under the Metropolis Water Act, held an inquiry in reference to the scheme of general intercommunication between the works of the Metropolitan Water Companies authorized by the Metropolis Water Act, 1899.

Mr. A. T. Lawrence, Q.C., and Mr. Lewis Coward appeared for the associated Water Companies; Mr. Freeman, Q.C., and Mr. Daldy represented the London County Council.

Mr. Lawrence, in opening the case, said the scheme provided for intercommunication between the different Companies, the utilization of the Battersea works of the Southwark and Vauxhall Water Company as a central station, and the provision of pumping plant and filter-beds at Hampton. From this source there would be a supply of several million gallons of water a day to any of the Companies who needed it. Under the scheme an approximate quantity of 10 million gallons a day could be supplied, if necessary, to the Chelsea Company, 22 millions to the East London Company, 19 millions to the Grand Junction Company, 12 millions to the Kent Company, 18 millions to the Lambeth Company, 20 millions to the New River Company, 20 millions to the Southwark and Vauxhall Company, and 19 millions to the West Middlesex Company. There had already been an expenditure upon the works executed to the extent of £155,754; and a further outlay of £472,233 was about to be incurred, which would bring up the total cost to £627,987.

The following witnesses gave evidence in support of the scheme and as to the estimated cost of the works: Mr. E. Collins, Distributing Engineer of the New River Company; Mr. Walter Hunter, Engineering Director of the Grand Junction Water Company; Mr. W. B. Bryan, Engineer of the East London Water Company; Mr. J. W. Restler, Engineer of the Southwark and Vauxhall Water Company; and Mr. T. F. Parkes, Engineer of the Lambeth Water Company.

Mr. Freeman, for the London County Council, said they were not there in any hostile spirit to oppose the scheme; and if the Companies could satisfy the Local Government Board that what they were seeking legitimately came within the purview of the Act of 1899, and that the estimates were reasonable, the Council would not object to their carrying out the works contemplated.

Mr. Lawrence briefly replied, and the inquiry closed.

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

An Explanatory Report by the Parliamentary Committee.

At the Meeting of the London County Council last Tuesday, the Parliamentary Committee presented a long report reviewing in some detail the proceedings which led to the rejection, on the 29th of March, of the Council's Bill for the purchase of the undertakings of the London Water Companies, and the subsequent withdrawal of their Welsh Supply Bill. Towards the close of their report, the Committee said: "We regret that the Government has not thought fit to avail itself during the present session of the results of the labour and money expended by the Council, especially having regard to the offers as to modifications which have been made on behalf of the Council. These offers of compromise not having been accepted, however, it will be necessary shortly for the Council to consider anew what action it should now take in the matter. It must be noticed that in advising the rejection of the Council's Bill, the Government gave no indication that they would themselves deal with this question; but we presume that if the opportunity afforded by the session of 1901 is not to be lost, so far as the question of obtaining a settlement with regard to this long outstanding matter is concerned, the Government will in the near future give some indication of what they propose to do." The Chairman of the Committee (Mr. E. A. Cornwall) dealt at length with the history of the water question. He said he thought the Council had some right to expect that their Bills would have been fully considered this session. The Royal Commission on Water Supply had clearly reported in favour of purchase by a public authority. It was grossly unfair that the Council's Bills were not allowed to go to a Committee. Some people thought and said that the Progressive party wished to acquire the water undertakings for the aggrandisement of the London County Council; but he would tell them that the Council could have been the water authority in 1895 and again in 1896. They were, however, not prepared to sell the ratepayers by giving the terms which the Companies desired. Mr. H. P. Harris pointed out that it was not true to say that the Council had generally accepted the recommendations of the Royal Commission. The Bills of the Council differed very considerably from the report of that Commission; and with regard to the question of the authority, none of the proposals to bridge over this difficulty had been effective. Mr. M'Kinnon Wood said it was the monstrous report of the Moderate party suggesting a Water Trust which had obscured the question ever since Mr. Cohen, M.P., said that the action of the Moderate members in the House of Commons had been the same as that which they had taken in the past, and which they had always stated in the Council they intended to take. If the Progressive party had supported the report of the Royal Commission, the matter would soon have been settled. Sir A. Arnold remarked that the report of the Royal Commission was worse than dead, for none of the authorities round London had indicated their consent to its terms. The policy of the Council held the field, and, in his opinion, it would ultimately be adopted. Mr. Westacott pointed out that at all events the outside counties had declared that they would never be under the domination of the Council. He protested against the waste of the ratepayers' money in promoting such Bills as those introduced this session, and pointed out that up to the present the Council had expended no less than £56,440 on the water question. Mr. Shaw Lefevre expressed the belief that the Trust proposed by the Royal Commission was absolutely impossible. The Council had no security whatever that the Government would take up this matter next session;

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1428.

Issue.	Share	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
690,000	10	Apl. 11	10½	Alliance & Dublin 10 p. c.	20—21	..	5 0 0
100,000	10	,,	7½	Do. 7 p. c.	13½—14½	..	5 3 5
900,000	100	Jan. 2	5	Australian 5 p. c. Deb.	102—104	..	4 16 2
200,000	5	May 16	6	Bombay, Ltd.	6—6½*	..	4 12 4
40,000	5	,,	6	Do. New, £4 paid	4—4½*	..	5 6 8
380,000	Stk.	Feb. 28	12	Brentford Consolidated	250—260	..	4 12 4
270,000	,,	,,	9	Do. New	185—190	..	4 14 9
60,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb.	118—123	..	3 5 1
720,000	Stk.	Mar. 14	11½	Brighton & Hove Orig.	235—240	..	4 15 10
225,220	,,	,,	8½	Do. A. Ord. Stk.	175—180	..	4 14 5
999,500	Stk.	Feb. 28	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	30	Mar. 29	10	British	39—40	—½	5 0 0
50,000	10	Feb. 28	12	Bromley, Ord. 10 p. c.	24—26	..	4 12 1
79,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	May 16	6	Buenos Ayres (New) Ltd.	9—9¼*	..	6 6 4
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	99—101	..	3 19 3
150,000	20	Mar. 14	8½	Cagliari, Ltd.	24—26	..	6 6 11
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	14—15	..	5 6 8
65,000	50	May 2	6	Do. 6 p. c. 1st Mort.	55—57	..	5 5 3
550,000	Stk.	Apl. 11	13½	Commercial Old Stock	275—285	..	4 14 9
296,425	,,	,,	10½	Do. New do.	210—220	..	4 15 5
288,237	,,	Dec. 14	4½	Do. 4½ p. c. Deb.	141—144	..	3 2 6
800,000	Stk.	Dec. 14	9	Continental Union, Ltd.	155—165	—2½	5 9 1
200,000	,,	,,	7	Do. 7 p. c. Pref.	175—180	..	3 17 9
51,600	Stk.	Feb. 23	14	Croydon A 10 p. c.	335—340	..	4 2 4
173,400	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
555,000	Stk.	Feb. 28	5½	Crystal Palace Ord. 5 p. c.	116—120	..	4 7 6
60,000	,,	,,	5	Do. 5 p. c. Pref.	130—135	..	3 14 1
486,090	10	Jan. 26	11	European, Ltd.	19—20	..	5 10 0
364,060	10	,,	11	Do. £7 10s. paid	14—15	..	5 10 0
14,993,075	Stk.	Feb. 9	4⅛	Gas-light and Coke	4 p. c. Ord.	95—97	—½	5 1 0
2,800,000	,,	,,	3½		3½ p. c. max.	96—98	..	3 11 5
3,799,735	,,	,,	4		4 p. c. Con. Pref.	116—118	—1	3 7 10
3,993,975	,,	Dec. 14	3		3 p. c. Con. Deb.	96—99	—½	3 0 7
70,000	10	Nov. 15	8	Hongkong & China, Ltd.		13½—14½	..	5 10 4
2,800,000	Stk.	May 16	10	Imperial Continental		202—205*	..	4 17 7
473,600	Stk.	Feb. 9	3½	Do. 3½ p. c. Deb. Red.		100—103	..	3 8 0
75,000	5	Dec. 14	6	Malta & Medn., Ltd.		4½—5½	..	5 14 3
560,000	100	Apl. 2	5	Met. of Melbourne	5 p. c. Deb.	105—109	..	4 11 9
250,000	100	,,	4½		4½ p. c. Deb.	105—107	..	4 4 1
541,920	20	Nov. 15	3½†	Monte Video, Ltd.		10½—11½	..	6 1 8
667,946	Stk.	Feb. 28	9½	Newc'tle & Gatesh'd Con.		215—220	..	4 4 1
299,855	Stk.	Dec. 29	8½	Do. 8½ p. c. Deb.		104—107	..	3 5 5
150,000	5	May 16	8	Oriental, Ltd.		7—7½*	..	5 6 8
135,000	5	,,	8	Do. New, £4 10s. pd.		6½—6¾*	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.		1¼—1⅜*	..	4 11 5
				* Ex. div.			

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
60,000	5	Feb. 23	7	Ottoman, Ltd.	5—5½	..	6 7 3
500,000	100	Dec. 1	6	People's Gas of Chicago 2nd Mtg. Bonds	102—106	..	5 13 2
851,070	10	Apl. 27	7	River Plate Ord.	10¼—10¾	..	6 10 3
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	100—102	..	3 18 5
250,000	10	Apl. 11	8	San Paulo, Ltd.	11½—12½	..	6 8 0
185,000	Stk.	Mar. 14	10	Sheffield A.	24⅝—24⅞	..	4 1 0
209,053	,,	,,	10	Do. B.	244—246	..	4 1 4
447,427	,,	,,	10	Do. C.	244—246	..	4 1 4
5,600,000	Stk.	Feb. 23	5⅓	South Metrop., 4 p. c. Ord.	124—127	+1	4 3 11
1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb.	98—100	..	3 0 0
380,940	Stk.	May 16	5	Southampton Ord.	115—120*	..	4 3 4
70,825	,,	Dec. 29	4	Do. 4 p. c. Deb.	120—125	..	3 4 0
120,000	Stk.	Mar. 14	6	Tottenham and Edmonton A. 5 p. c. B. 3½ p. c. 4 p. c. Deb.	120—125	..	4 16 0
250,520	,,	,,	4½		93—98	—2	4 11 10
55,100	,,	Dec. 14	4½		113—117	..	3 8 5
182,380	10	Jan. 12	5	Tuscan, Ltd.	7—8	..	6 5 0
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.	101—104	..	4 16 2
				WATER COMPANIES.			
780,399	Stk.	Dec. 29	11	Chelsea, Ord.	305—310	..	3 11 0
150,000	,,	,,	5	Do. 5 p. c. Pref.	157—162	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	145—150	..	3 0 0
175,785	,,	Mar. 29	4½	Do. 4½ p. c. Deb.	145—150	..	3 0 0
1,720,560	Stk.	Apl. 11	7	East London, Ord.	188—193	—2	3 12 6
654,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb.	145—150	..	3 0 0
390,000	,,	,,	3	Do. 3 p. c. Deb.	99—101	..	2 19 5
700,000	50	Dec. 14	7½	Grand Junction 10 p. c. max.	102—105	—1	3 11 5
810,000	Stk.	Mar. 29	4	4 p. c. Deb.	130—135	..	2 19 3
708,000	Stk.	Feb. 23	14	Kent	307—312	..	4 9 9
160,000	,,	,,	7	Do. New, 7 p. c. max.	200—210	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.	290—295	..	3 11 2
406,200	100	,,	8	Do. 7½ p. c. max.	207—212	..	3 15 6
350,000	Stk.	Mar. 29	4	Do. 4 p. c. Deb.	130—133	..	3 0 2
500,000	100	Feb. 23	13½	New River, New Shares	415—420	..	3 4 3
1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb.	132—137	..	2 18 5
902,300	Stk.	Dec. 14	7½	Southwark and Vauxhall Ord.	195—200	..	3 15 0
126,500	100	,,	7½	7½ p. c. max.	185—190	..	3 18 11
489,200	Stk.	,,	5	5 p. c. Pref.	160—165	..	3 0 7
1,019,585	,,	Apl. 11	4	4 p. c. A Deb.	129—134	..	2 19 9
1,155,066	Stk.	Dec. 14	10	West Middlesex	283—288	..	3 9 5
200,000	,,	,,	4½	Do. 4½ p. c. Deb.	147—152	..	2 19 3
200,000	,,	Mar. 14	8	Do. 8 p. c. Deb.	99—101	..	2 19 5
				*Ex div.			

† Next dividend will be at this rate.

and the gravest possible injustice would be done to London if the purchase of the water undertakings was allowed to be carried out by any other body than the Council. Mr. Burns, M.P., said the money which Mr. Westacott had mentioned as having been spent by the Council in promoting Water Bills was the price they had to pay for having a syndicated Administration in office, a monopoly Government in power, and a Moderate party at Spring Gardens playing the game of the Water Companies. The only public authority which could possibly take charge of the water supply of London was the Council, which was the equivalent of the 800 Corporations throughout the United Kingdom, and should be treated in the same way. After a few remarks from Mr. Beachcroft, the report was received.

THE WATER SUPPLY OF BIRMINGHAM.

Annual Report—The Elan Valley Works.

The annual report of the Water Committee was submitted at the meeting of the Birmingham City Council last Tuesday.

The report showed that the water-rents for the year increased by 5·14 per cent., against 4·56 per cent. in the previous year. The cost of pumping advanced by £3711, being due, not only to the greater quantity of water pumped, but to an increase in the unit of cost per 1000 gallons. This was more than accounted for by the rise in the price of coal; and, according to present appearances, the unit of cost would be further largely increased by this cause in the current year. The accounts also showed a considerably greater expenditure on maintenance of engines and boilers, in consequence of the thorough overhauling and repair of the plant at all the stations. The profit and loss account exhibited an adverse balance of £6479, which had been written off against the special water fund in accordance with the Act of 1892. This result was due to the growth in the charges for interest in consequence of the expenditure of capital on the Elan supply works. In the parliamentary financial forecast, the result of the year's operations was estimated to show a deficiency of £20,438; so that the realized result was £13,959 better than the forecast. The special water fund possessed a balance of £124,975, against £100,185 in the forecast. Notwithstanding the restrictive measures adopted, which reduced the consumption in the latter part of the summer, the quantity of water distributed showed an increase of 6 per cent. over the quantity for the previous year. The consumption of water on measured supplies increased by 8 per cent., and on the domestic and unmeasured supplies by 5·4 per cent. Taken on the usual basis of five persons to a house, the population in supply on March 31 was 753,970; being an increase of 3·1 per cent. over the population in supply at March 31, 1899. The endeavours of the Committee to find temporary sources of supply had met with no success; and the measures adopted for increasing the yield of the present sources have given disappointing results. If the experience of the last two years was repeated this summer, further measures of compulsory curtailment of supply would be imperative; but the Committee would only introduce an intermittent supply as a last resource. They appealed to consumers to exercise the most rigid economy during times of drought. Regarding the Elan Valley works, the report stated that the weather of the past winter had not been favourable for the execution of the works; and consequently comparatively little progress had of late been made with the building of the various dams. At Caban Coch, the excavation for the middle portion of the dam had been completed, and the building of that section commenced. At Careg-ddu, the dam itself was now complete; and the viaduct over it was making good progress. At Pen-y-gareg, the wall was built up to 55 feet below the crest; and at Craig Goch to 40 feet below the crest. A start had been made on the portion of the aqueduct to be carried out by administration. This Dol-y-mynach tunnel must be finished before the Caban reservoir was filled, and was therefore now being pushed on with three eight-hour shifts a day. The preparations for the work had led to a reconsideration of the proposals for constructing the dam at Dol-y-mynach—that was, the next reservoir on the Claerwen above Caban Coch. This dam was not included in the first instalment of the works as they were originally undertaken; it having been proposed to divert the Claerwen water into the tunnel by means of a temporary weir. The site of the dam would be submerged when the Caban reservoir was full; and if the construction of the dam was postponed as originally proposed, it would be necessary to lower the water in the Caban reservoir very considerably, so as to clear the site when the time for construction arrived. The Committee had therefore given instructions to the Engineer to proceed with the foundations and building of the dam up to a level of 830 feet above Ordnance datum—that was 8 feet above the top water-level of the Caban reservoir, leaving the remainder—70 feet—to be built when the second instalment of the works was undertaken. The cost of the works thus transferred from the second to the first instalment was estimated at £82,200. The amount expended on the works in the Elan Valley during the year ended March 31 last was £170,219—giving a total of £829,132. With regard to the aqueduct, the Committee stated that Messrs. John Aird and Sons' contract—Elan to Dolau—was now practically finished. On Messrs. Morrison and Mason's contracts—Dolau to Knighton, Knighton to Downton, Downton to Cleobury Mortimer, and Cleobury Mortimer to Hagley—work was proceeding, although the progress was not so rapid as could be desired. In connection with the Severn crossing, it had been found that the strata lying above the solid rock on the east side of the river were deposited at such an angle, and were in their nature so treacherous, as to render them entirely unsuitable as a support for the back of the abutment and wing walls of the bridge, or for the support of the pipes. The Engineer considered it necessary that the whole of the bridge abutments should be carried down to the solid rock, and that a cast-iron tunnel should be laid to contain the syphon-pipes. The Committee regretted the extra cost which would be caused by this alteration, which, however, it was impossible to foresee, and which could not be dispensed with. The amount involved was £29,070.

Alderman Lawley Parker, in moving the adoption of the report, stated that the department were paying £10,000 a year more for coal now than twelve months ago.

The report was adopted.



COAL PRICES TO GO HIGHER IN SUMMER.

It is almost certain, the *Morning Leader* thinks, that 30s. a ton for coal will be passed before long. For a month or two the price may possibly drop to 29s., supposing there is a fine summer; but in August the almost unbroken steady rise of twelve months will again continue its career.—*Westminster Gazette*, *May* 9, 1900.

We shall be glad to provide Gas Departments with TRAINED INTERVIEWERS (Ladies or Gentlemen), to impress this on their Consumers, and to show that GAS, although advanced in Price, is cheaper than COAL as a Fuel. Please communicate with us if you decide to increase your Day and Summer Consumption.

May we refer you to Gas Departments in all parts of the United Kingdom, as to Methods and Results?

THE TONBRIDGE LOCAL AUTHORITIES AND THE WATER COMPANY'S ORDER.

Consent Dispensed With.

Among the applications for Provisional Orders in the present session is one by the Tonbridge Water Company for power to construct further works, extend their limits of supply, sell water in bulk, raise additional capital, and for other purposes. The promoters were unable to obtain the consents of the Tonbridge Urban District Council, the Sevenoaks Rural District Council, and the Penshurst Parish Council, which were necessary; and they asked the Board of Trade to exercise the powers conferred by section 4 of the Gas and Water Works Facilities Act, 1870, of dispensing therewith. The Board thereupon appointed Mr. Ingram B. Walker as Commissioner to hold a public inquiry at Tonbridge with reference to the application, and to report to them on the matter (*ante*, p. 884). At the inquiry, the promoters stated that they no longer proposed to include the parish of Penshurst within their limits, and consequently the consent of the Parish Council and of the Rural District Council (the Road Authority of that parish) became no longer necessary. The consent of the Urban District Council was required in view of the powers sought by the promoters for the construction of additional works. The objections urged by the Council did not, in the main, relate to these works; and Mr. Walker reported to the Board of Trade that, in his opinion, the increase in the population demanded a larger supply of water, and that the works proposed should be authorized. After considering Mr. Walker's report, the Board decided to dispense with the consent of the Council, and to grant an Order subject to certain modifications and amendments.

KIMBERLEY WATER-WORKS COMPANY.

The Annual Meeting of this Company was held on Monday last week, at the Cannon Street Hotel, E.C.—Mr. J. Jackson in the chair.

The Secretary (Mr. W. Vincent) having read the notice convening the meeting, the report of the Directors was presented. It contained extracts from a special report by the Manager, explanatory of the effect of the war and the working of the undertaking in the past year. In the course thereof, he stated that the quantity of water sold was 116,747,884 gallons; being a reduction of 16,750,092 gallons as compared with the previous year. The whole of this falling off could be attributed to the war. Up to the end of September, they had, as compared with the figures for the first nine months of 1898, sold 1,155,807 gallons more; and as the weather continued dry to the end of the year, it was expected that this increase would have been fully maintained. From the 15th of October the town was put on short allowance, but for which the sales would have been fully 3 million gallons better than they were for the year 1898.

The Chairman, in moving the adoption of the report, apologized for the absence of the Chairman (Mr. A. J. Macdonald) through serious illness, and went on to say that the past year had given the Directors endless anxiety respecting the state of the Company's property. In addition to the importance of the town as a centre of population and the site of the richest diamond mines in the world, the presence of Mr. Rhodes rendered Kimberley an attractive objective to the Boer forces from the outset of the war. However disadvantageous his presence might have been as a bait to the enemy, it had been more than compensated for by the brilliant services rendered by him and by the employees of the great enterprise over which he presided. Within a few hours of the entrance of General French into Kimberley, the Directors received the welcome intelligence that the property of the Company was practically safe, and that it had sustained only comparatively little injury. He thought that all interested in the concern might congratulate themselves on their good fortune in this respect. The damage to the Company's business, so far as the Directors could at present judge, was confined to a loss of stores to the amount of £1700, and injury to plant and buildings to the extent of £800. Provision for this had been made in the balance-sheet. There had also been a decrease of £5000 in their takings, directly owing to the war. The figures in the report of their Engineer showed several satisfactory features, all tending in the direction of increased economy. Of the falling off of 17 million gallons in the consumption, 15 millions were attributable to the decreased requirements of the mines. Dealing with the commercial aspect of the Company's affairs, he said the profit made amounted to £23,827. Adding to this £818 interest on investments, and £5000 taken from the contingent fund, they had an amount of £29,646 to be dealt with. Of this sum, £5976 had been absorbed in interest on debentures and debenture stock; £685 represented the usual items of depreciation; £2500 was reserved for losses (the greater part of which they hoped to recover); £958 was written off as depreciation on investments during the year; and the dividend of 5 per cent. for the year would absorb the balance, £15,750. The war, which for the last seven or eight months had been devastating South Africa, appeared to be approaching a satisfactory issue. From the outset the Company had had a prosperous career in Kimberley, under the free institutions of a British colony; and they might reasonably expect to have a fair share of the generally increased prosperity of the country that must accrue from the conversion of the mischievous little States on our borders into component parts of the Empire.

Mr. C. Critchett seconded the motion; and, after a short discussion, it was carried unanimously.

In consequence of the large expense incurred in opposing in Parliament the Exmouth Water Company's Bill, the Budleigh Salterton District Council find that a rate of at least 3s. 6d. in the pound would be necessary in the current financial year in order to discharge the whole of their liabilities. This would mean a heavy drain upon a large number of ratepayers; and therefore it has been resolved to apply to the Local Government Board for sanction to pay off the whole or part of the parliamentary expenses by way of a loan.

SAWER & PURVES,

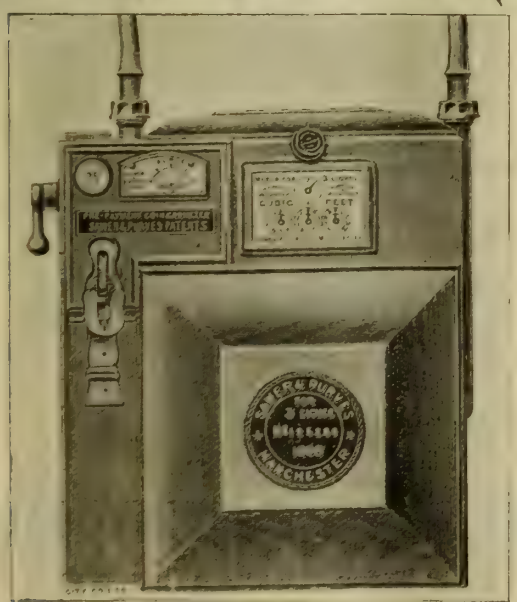
(BRANCH OF METERS LIMITED),

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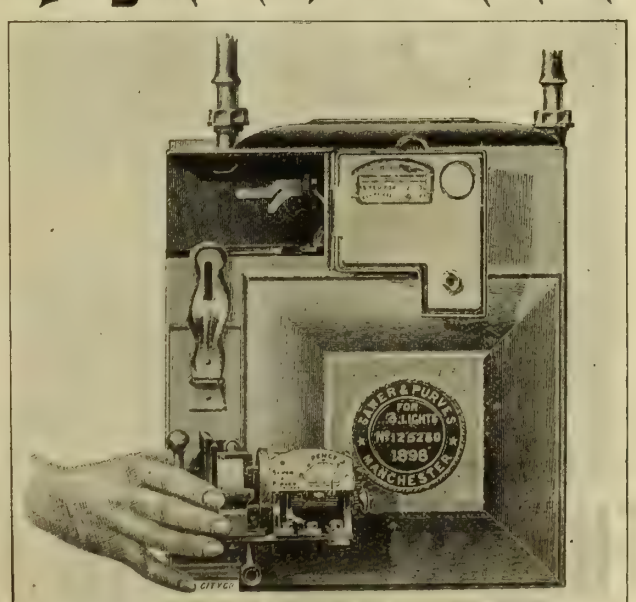
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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

For the vacant gas managership at Perth a short leet of seven was first made, and now this has been cut down to three: Mr. D. Easson, of Maybole, Mr. W. B. M'Lusky, of Selkirk, and Mr. A. Waddell, of Broughty Ferry. Mr. Easson was for many years Assistant-Manager at Perth under Mr. Whimster. The appointment is to be made on Monday.

It was reported to the Peebles Gas Commissioners, at their meeting this month, that the increase in the output of gas during last month was equal to 24·6 per cent., and that since the financial year began, the total increase in the output has been 4,328,000 cubic feet. The annual make is 14½ millions. This increase, for a town of the size of Peebles, is phenomenal. Mr. Williamson, the Treasurer to the Commissioners, read the conditions of what he said had been rather inaptly described as a bonus scheme, but which was simply the adoption of a piecework system in connection with the make of gas. During the year, he said they had paid £47 more in wages than they did in the previous year. Then Mr. Williamson proceeded to refer to the comments which I made upon the scheme when it was introduced, and which, he thought, were not quite warranted by anything which was put forward by the Commissioners. "The correspondent stated," he said, "that the object the Commissioners had in view was to induce the men to produce a greater quantity of gas out of every ton of coal than they had hitherto done. Any such scheme as that would be a great benefit; but it had passed the wit of the Commissioners meanwhile. The correspondent further said it was not a good thing, and betokened suspicion of the men engaged in the works. On the contrary, they highly appreciated the workmen. It was simply an effort to bring a system of piecework into operation in a gas-works; and he did not see any reason why it should not be carried through. If there should not be such a great make of gas next year, the men would not receive so much pay. If they worked harder, they would receive more pay—always in proportion to their work." In further speaking to the scheme, Mr. Williamson "explained that the work varied. At some periods, there was not sufficient work to justify taking on a man. Then the men had to fill extra retorts; and when the time came, an extra man was taken on, when the work became lighter again. Under the scheme, the men would have a return for the harder work." In reply to a question, the Manager (Mr. A. Bell, junr.) said that the men were highly in favour of the scheme, and liked the idea of being paid in a lump sum. I may say that the scheme is that the Commissioners pay the men 3¾d. for every 1000 cubic feet of gas they produce. As it is not known what quantity of gas may be produced (required) until after it is produced, the men are paid a stated wage; and then, at the end of a certain period, they receive the balance. This is what is meant by the lump sum. I cannot say that I like the scheme yet. If, technically, it be not a plan for the getting of more gas per ton of coal, it is now admitted to be a device for inducing the men to work harder at times. In other words, instead of the Commissioners being at the loss of half of a man's wages, by paying whole wages when there is only half work, the loss is to be put upon the men, one set of whom, inside the works, are to be called upon to work harder in order to keep another set of men from being taken on. The scheme was adopted. It is very ingenious; but its foundation is not very stable. Not only will it create hostility among workmen, as a class, but if ever there should be an abnormal reduction in the output of gas, the scheme would go to pieces, because, while the men are in favour of receiving a lump sum at the end of the year, it is not to be expected of them that they would tolerate, not only a reduction of their stated wage, but also a demand for the refunding of a proportion of their wages overpaid.

The Town Council of Cupar have come to terms with the Gas Company as to the public lighting. The Company have hitherto undertaken the duty of working the lighting department. They now decline it; and the Town Council are to take it over. The gas consumed is to be paid for by the Corporation at a rate 17½ per cent. under that charged to ordinary consumers. This is very liberal; and it was gratifying to observe that it was so regarded by the members of the Town Council, in agreeing to the terms.

The Stonehaven Gas Company held their annual meeting on Monday. It was reported that there had been a total income of £2385, and an expenditure of £1637. The profit was £748. Out of it, a dividend was paid at the rate of 3s. per share; and a balance of £230 was carried forward. The Chairman (Mr. T. Mitchell) said that since their last annual meeting they had lost the services of a very valuable official, by the lamented death of their late Manager, Mr. Ross. He had been connected with the Company all his life; and during the last 35 years had been their faithful and trusted Manager. The balance-sheet which had been set before them was a very satisfactory one. The increase in the quantity of gas sold had been considerable, amounting to about 10 per cent., or £173; while the increase in the sale of tar, &c., had been £35. This was the largest increase they had had up to the present time. With such increases all round, they might have made larger profits; but they had to pay a higher price for coal, and this they had done without making a corresponding increase in the price of gas. On the whole, the concern was in a thoroughly sound condition.

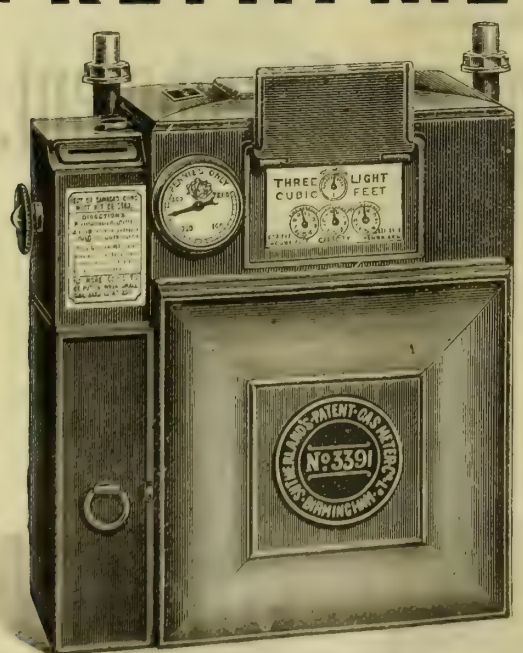
A branch of the Gas Workers and General Labourers' Union was "organized" at Brechin on Wednesday night, by a Mr. Blackwood, from Glasgow, the General Secretary for Scotland of the Union. About forty members joined. It is not said how many of these were gas workers, and how many general labourers; but it may be assumed that if ever any action be taken by this branch, it will be the gas-works, and not any work in which general labourers are employed, that will be its object. Mr. Blackwood recommended the organization as, in his opinion, the largest and wealthiest of its kind in the world. "Of its kind" was, for the speaker, a very safe phrase, seeing that there is not another organization similar to it to be found.

Mr. John M'Andrew, who gives no address, writes a problem letter regarding the Paisley Corporation gas undertaking, which, as I do not understand, I give as it appeared in the "North British Daily Mail" on Tuesday last. It was as follows: "Being somewhat in touch with our

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THE SUTHERLAND GAS-METER COMPANY

ESSEX WORKS, BIRMINGHAM.

over-bepraised gas-works, I have no desire whatever to draw a wet sponge over the face of an old friend. I simply wish to place before your many readers in this quarter the true bearing of the case as shown by the annexed figures, a clear and honest front. I find that it is proposed by a Committee of the Gas Commissioners to deviate from an ordinary mercantile practice to convey to the so-called stock capital the amount of £8705 for extension of the works, actually paid away a sum that truly belongs to the expenditure account, and relieve the pressure on said account, and thereby to show surplus balance that had no existence. Indeed, the amount paid for the extension of the works does not nearly bear a fair equivalent of gas made, or quality of gas given. This is by no means fair. The borrowing powers does not constitute a right of tampering with figures that represent an amount paid out for work done. Such is the method that has been acted on, year after year, since 1884. True, fancy often lends a charm to fiction all for glory and a fair fame, that a favourable return and a rosy hue may be given to the management. I offer the following details that may interest your many readers; Gas record for eleven months ending April 30, 1900: Coals received, 40,541 tons; coals carbonized, 38,729 tons; average price per ton, 12s.; amount, £23,278 8s. Gas made, including 9,882,000 cubic feet from oil and coal, 373,473,000 cubic feet. Wages and salaries, £14,716, for the eleven months. Financial record: Total income, including drawings from the bank, £56,166; also including temporary loans and mortgages, also payment to the bank (this is charged in the expenditure account), and then £8705 for extension to the works, £109,449; total expenditure, including extension of works, &c., £109,226 —balance at credit on 11 months' work, £223. I find that on April 30, 1900, a sum quoted as owing to the bank amounting to £11,280; also gas-rents received, £30,561; arrears, £4205—£34,766. For coals and wages alone the amount exceeds the drawings by £3228 8s. This is by no means a healthy state of affairs." No notice has been taken of the communication.

The Edinburgh Town Council on Thursday agreed to a recommendation by the Electric Lighting Committee, that the charge for electric current be advanced from 3½d. to 3¾d. per unit for lighting; that the charge for public lighting be reduced from £14 to £13 per lamp; and that the charge for current for motive power remain at 1½d. per unit. Bailie Mackenzie, the Convener, said that the estimated surplus for the coming year was £4285. The increase in the price, he explained, was due to the great increase in the price of coal and the large capital expenditure upon the new station. It had been suggested to him that the increase in price should have been ½d. per unit. The Committee discussed this; but the majority thought that possibly the larger rise might have the effect of decreasing the consumption and applications, and in this way increasing the evil it was intended to remedy. Some members of the Committee expressed a fear that too little provision was being made for the reserve fund, considering the large capital involved; but it should not be overlooked that, of the money spent during the last two years—over £300,000 —a large part had gone into work not very perishable (land, buildings, subway, copper strip, and solid cable), while the machinery and plant obtained in these two years might be said to be just started, so that in reality it was only the more perishable portions of the early plant that need be considered at the present stage.

The Treasurer's Committee of the Water Committee of the Glasgow Town Council on Thursday of last week submitted their estimate of the revenue and expenditure from May 31, 1900, to May 31, 1901, based upon the current rates and charges. The total estimated expenditure in connection with the water-works was £220,221, with a probable credit balance of £8111—making a total of £228,332. The estimated revenue was £205,612, with a probable credit balance for the year 1899-1900 of £22,720—making a total of £228,332. The General Committee recommended (1) that the amount of the domestic water-rate to be assessed and levied within the limits of compulsory supply for the year 1900-1901 be continued at 5d. per pound; (2) that the amount of the domestic water-rate beyond the limits of compulsory supply be continued at 10d. in the pound; (3) that the rate to be charged for the same period against proprietors in terms of the City of Glasgow Act, 1891, for pumped water supplied for domestic purposes beyond the limits of compulsory supply, be reduced from 7d. to 6d. per pound; (4) that the public water-rate be continued at 1d. in the pound; and (5) that the tables of rates and charges, and terms and conditions of supply, for water to be supplied for other than domestic purposes (including the hydraulic power supply) during the year 1900-1901 remain the same as for last year. The report was adopted, on the motion of Mr. Carswell; a counter proposal for a remit to consider whether water supplied beyond the compulsory area should not be reduced from 7d. to 6d. per pound only receiving the support of five members.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 26.

Sulphate of Ammonia.—The week opened with an active market; and a considerable business was done at the western ports. Later, a quieter tone supervened; but the closing quotations are £11 5s. to £11 8s. 9d. per ton, delivered f.o.b. at the ports. Supplies have not been over plentiful; and the firmness of makers, who have not much to dispose of, has somewhat checked business. On the other hand, urgent orders having for the most part been covered, buyers seem again disposed to hang back. There is still good inquiry for delivery over the summer months. But buyers will only operate at a discount on spot values; and meantime makers are firm at £11 10s. per ton, f.o.b. Leith.

Nitrate of Soda is a shade easier; the closing quotations being 8s. 3d. per cwt. for ordinary, and 8s. 6d. for fine, quality.

LONDON, *May* 26.

Tar Products.—With the exception of pitch, most of the other products are weak, and but little business passing. Pitch itself is fairly stiff; but the price is to some extent nominal. As very little business is doing, creosote and oils are easier, and are being talked to lower figures still. Benzols are not at all active; but the increase in the number of inquiries

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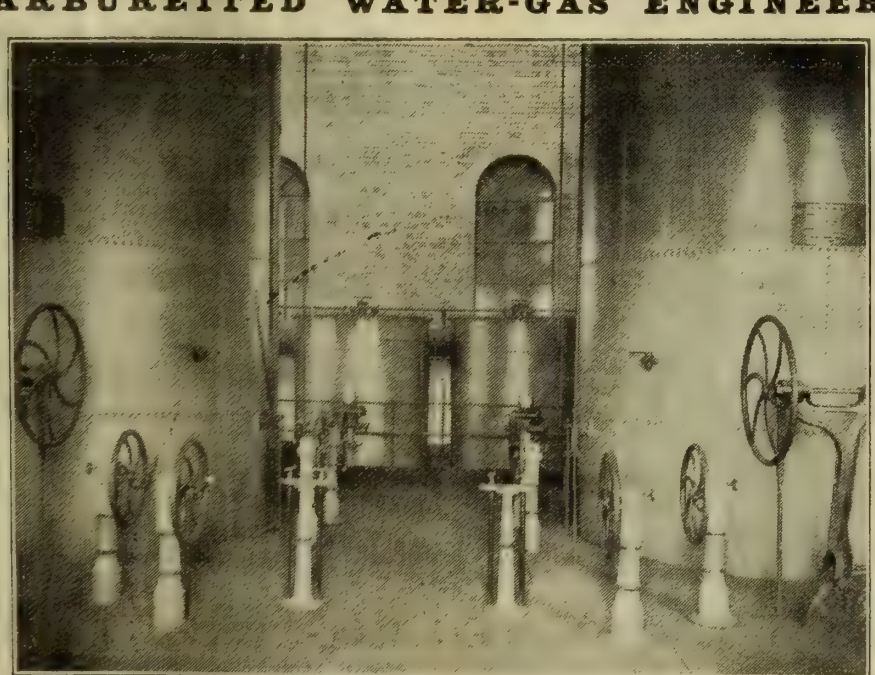
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for forward delivery looks as though buyers expected an improvement rather than the reverse.

Values obtaining during the week are: Tar, 17s. 6d. to 27s. 6d. Pitch, east coast, 38s.; west coast, 35s. Benzols, 90's, 6d.; special qualities for gas, 8d.; 50's, 8½d. Toluol, 1s. 1d. Solvent naphtha, 1s. 1d. Crude naphtha, 3½d. Heavy naphtha, 1s. Creosote, 2½d. Heavy oils, 3¼d. Carbolic acid, 50's, 2s. 3d.; 60's, 2s. 9d. Naphthalene, 55s. to 75s. Anthracene, "A," 4d.; "B," 3d.

Sulphate of Ammonia.—The improvement of last week is still maintained; and business ranges from £11 5s. to £11 10s. per ton, less 3½ per cent.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—No further change of any moment can be reported in the position generally throughout the coal trade of this district. As stated last week, the acceptance by the Railway Companies of the 5s. per ton advance over last year, has virtually decided the position with regard to other contracts. During the past week, the Manchester Gas Committee have settled for their supplies of gas coal—subject to the Council's approval—at a "considerable advance" on last year's rates, the amount of which is not stated. A large business is also steadily being put through in other quarters; and in all these cases the full advance of 5s. over last year is being obtained without difficulty. With regard to other descriptions of fuel, the better qualities of round coal are beginning to hang somewhat, and here and there are accumulating in stock, but not as yet to any large extent. In fact, at some collieries the output is still short to supply deliveries for all the requirements of customers; and in one or two cases even house-fire coals are being bought from outside districts. Common round coals continue in brisk inland demand, for steam and forge purposes; and there is also an active inquiry for slack. But supplies of this description of fuel are more plentiful on the market, owing to surplus quantities coming in from Staffordshire and Yorkshire; and as these are obtainable at under the prices quoted by Lancashire collieries, stocks of engine fuel are in some cases accumulating in waggons on the pit-sidings. Prices, however, at Lancashire pits are all through fully maintained at late rates; and notwithstanding the competition of slack, collieries prefer to hold stocks which they consider will be more than wanted during the approaching Whitsuntide stoppages of the pits, rather than attempt to push sales at lower figures. At the pit, prices range from 13s. and 13s. 6d. per ton for common, to 14s. 6d. and 15s. 6d. for best house coal, 13s. for steam and forge coal, and 10s. 6d. to 11s. 6d., according to quality, for slack. Shipping business continues slow; and though the official rates have been reduced to 14s. 6d. per ton for unscreened, and 15s. 3d. for screened coal, delivered at the Mersey ports, these prices are scarcely being readily obtained, with collieries outside the Association offering at less. Coke continues in pressing request, with prices firm.

Northern Coal Trade.—There has been a slight reduction in the production of coal this week, due to the local rejoicings; and this and the approaching holidays, seem to have stiffened the prices. There is a steady demand for fuel generally; and the collieries are now working fully. Best Northumbrian steam coals are from 18s. 6d. to 19s. per ton f.o.b.; and steam smalls continue rather scarce at from 13s. to 13s. 6d. In the gas coal trade, the demand is still very large, there being an increased export of gas coals to some of the northern ports; so that little or no effect is felt from the reduction of the local consumption. Best Durham gas coal is quoted at from 17s. to 17s. 6d. per ton f.o.b. One or two additional contracts have been concluded of late; but they have not been of large extent, and there is very little variation in the prices. This time the coalowners seem to have been able to command the market; and they have generally asked the price that has been named. In the coke trade, there is continued activity and high prices. Gas coke is very firm, and in one or two cases the prices have been raised; but the larger contracts will probably not be fixed until nearer the end of the half year. About 16s. per ton may be taken as the medium f.o.b. price for gas coke in the Newcastle district.

Scotch Coal Trade.—Coal has been scarcer, on account of the miners having worked shorter hours, in an effort to introduce an eight-hour working day. Prices have, however, only been nominally affected. A very strong demand continues. The quotations are: Main 14s. to 14s. 3d. f.o.b. Glasgow, ell 15s. 6d. to 16s. 6d., and splint 15s. 6d. to 16s. The shipments for the week amounted to 225,054 tons—a decrease of 10,192 tons upon the previous week, but an increase of 35,467 tons upon the corresponding week of last year. For the year to date, the shipments have been 3,885,569 tons—an increase of 856,223 tons upon the same period of last year.

Wages of Leeds Gas Workers.—The wages of the purifiers employed at the Leeds Gas-Works have been raised from 24s. 3d. to 26s. per week, and an increase of 2s. has been added to the weekly pay of the yardmen; making the wages of the latter 24s. a week. The advance, which is subject to confirmation by the Council, has been given in compliance with an application made on behalf of the men some time ago by Mr. J. E. Smith, the District Secretary of the Gas Workers' Union.

Malta and Mediterranean Gas Company, Limited.—At the meeting of this Company on the 12th prox., the Directors will report a satisfactory increase in the sale of gas, in the revenue from residual products, and from fittings and meters, in the year ending March 31 last. On the other hand, there has been an increase in the cost of coal, as well as under the head of taxes incurred at the Sicilian stations. From the available balance, the Directors recommend the declaration of the usual dividends upon the first and second preference capital, and a dividend of 4 per cent. upon the ordinary capital; making, with the interim dividend of 2 per cent. paid in December last, 6 per cent. for the year, and leaving a balance of £312 12s. 5d. to be carried forward to the next accounts.

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Heywood and Middleton Water Undertaking.—The annual report of the Heywood and Middleton Water Board has been issued. The Water Engineer (Mr. James Diggle) states that, after making provision out of revenue for sinking funds, amounting in the whole to £2902, there remains a deficiency of £386 upon the year's working, against £411 in the previous year. This deficiency would have been converted into a substantial profit if the bank rate of interest had not been so excessively high, and had no special payments been made to the Corporation of Rochdale for purchase of water, and also to the millowners on Naydon Brook for deficient supply of compensation water during the drought last summer. In the district supplied by the Board, there are 13,462 consumers; and the net income for the year was £20,362 7s. 7d.

The Present Condition of the Coal Market.—The "Iron and Coal Trades Review" says that "a great deal of nonsense" is being talked in the daily Press on the subject of the present situation in the coal trade, which is generally described as one of "famine." Our contemporary acknowledges that there is a large demand for coal, and that prices are high, but assures its readers that "there is no greater demand, and prices are no higher, than three months ago, and coalowners have not this year realized such high values for coal as in some cases they did last year." The writer goes on to say: "Prices, however, are too high to be entirely satisfactory. The cost of fuel is reacting unfavourably on industries generally, and there is a widespread belief that the present values cannot be maintained much longer. All such pious opinions are of little value. No one knows what may happen next. In the meantime, many large consumers—gas companies, railways, and others—are working on short contracts, believing that we are near the beginning of the end of the present coal boom."

The Coal Production of the World.—Last Thursday, a return was issued to an order of the House of Commons, dated the 9th ult., showing the production, consumption, and export of coal, and the number of persons engaged in the first named work, in the principal countries of the world, in each year from 1883 to 1898. It appears therefrom that the quantity of coal yielded by the five most important coal-producing countries in the first named year was as follows: United Kingdom, 163,737,000 tons; Germany, 55,943,000 tons; France, 20,759,000 tons; Belgium, 18,178,000 tons; United States, 102,868,000 tons. In 1898, the totals had risen to 202,055,000, 96,310,000, 31,826,000, 22,088,000, and 196,406,000 tons. This was the last year for which definite statistics were obtainable, but the following provisional figures are given for 1899: United Kingdom, 220,085,000 tons; Germany, 101,622,000 tons; France, 32,331,000 tons; Belgium, 21,918,000 tons; United States, 218,376,000 tons. The average value per ton at the pit's mouth in the above-named countries for 1898 was: 6s. 4¼d., 7s. 4½d., 9s., 8s. 9½d., and 4s. 5d. The average price of British coal at the pit's mouth for the past year was not procurable at the date of the report; but the average, including coke, patent fuel, &c., per ton exported (f.o.b. from the United Kingdom) during the last three years was 8·98s., 9·92s., and 10·72s. These figures show continuous rise, which has been still more marked during the first four months of the present year, in which the average export price has been no less than 15·5s. per ton.

A Second Main from Thirlmere to Manchester.—The Water Committee of the Manchester Corporation have decided to bring the question of laying a second main from Lake Thirlmere for the conveyance of water to the city before the City Council. The cost is estimated at between £400,000 and £500,000.

The Winsford District Council Propose to Purchase the Gas-Works.—At the meeting of the Winsford District Council last Thursday, a letter was read from the Secretary of the Over and Wharton Gas Company, Limited, stating that the Directors were prepared to sell the undertaking on a valuation by Mr. Thomas Newbigging, subject to the approval of the shareholders. In 1894 Mr. Newbigging reported on the matter; and in a letter about the same period, he advised the Council to purchase the undertaking. It was agreed that the Company be written to, stating that the terms of their letter were acceptable.

Additional Storage for the Lytham Gas-Works.—Colonel A. J. Hepper, R.E., lately held an inquiry at Lytham into an application of the District Council for power to raise £2200 for gas-works purposes. The Clerk (Mr. C. A. Myers) stated that the present gasholder had a storage capacity of 144,000 cubic feet, and it was proposed to add another lift which would bring it up to 270,000 cubic feet. Mr. W. Newbigging stated that during the past ten years the consumption of gas at Lytham had increased 107 per cent.; the quantity made in 1888 being 18 millions, and in 1898 41 millions. The increase in the sale of gas for the year ending March, 1899, over the previous year, was 20·76 per cent.; while for the past year it was at the rate of 38·70 per cent. This was much greater than the average rate of increase throughout the kingdom for the same period—viz., 5 per cent. It was therefore inevitable that the proposed extension would be necessary. The addition would increase the total gasholder capacity to 414,000 cubic feet.

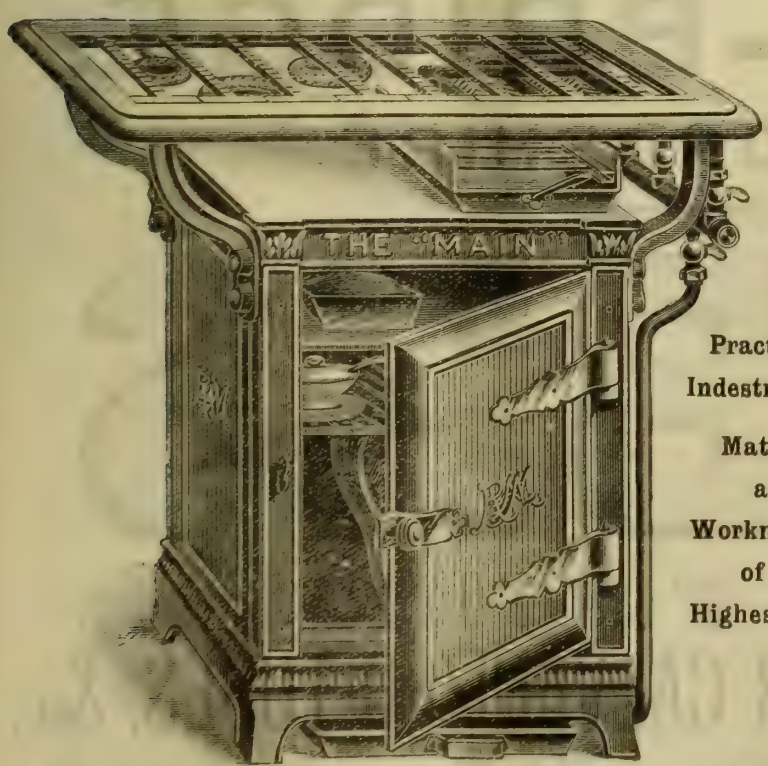
Barnoldswick Gas and Water Supply.—We have received from the Clerk to the Barnoldswick Urban District Council (Mr. Charles Thornton) a copy of the year-book for 1900-1901, which has been prepared for the use of the members. We learn therefrom that the amount originally authorized (in 1893) to be borrowed for gas-works purposes was £14,200; the loan being for a period of 32 years. Of this sum, £12,842 is outstanding. A further sum of £1500 was sanctioned in 1895, and of £1524 two years ago, of which a small portion, with interest, has been repaid. Various sums, amounting in all to £11,277, have been borrowed on account of the water-works, a considerable proportion of which is still owing. The quantity of gas made in the year ending March 31 last was 19,520,700 cubic feet; being an increase of 2,002,700 cubic feet, or at the rate of 11·4 per cent., on the make in 1898-9. The quantity sold was 18,228,800 cubic feet, of which 12,801,700 cubic feet was for lighting, 3,911,500 cubic feet for cooking, heating, and motive power, and 1,515,600 cubic feet through automatic meters. The total accounted for was 18,573,000 cubic feet; showing a loss of only 4·8 per cent. The price charged is 3s. 6d. for lighting and 3s. for cooking, &c., with a discount of 3d. The quantity of coal carbonized was 2085 tons; the residuals produced being 133 tons 5 cwt. of tar and 173 tons 4 cwt. of ammoniacal liquor. The revenue from the gas-works in the past year was £3568; from the water-works, £1349.

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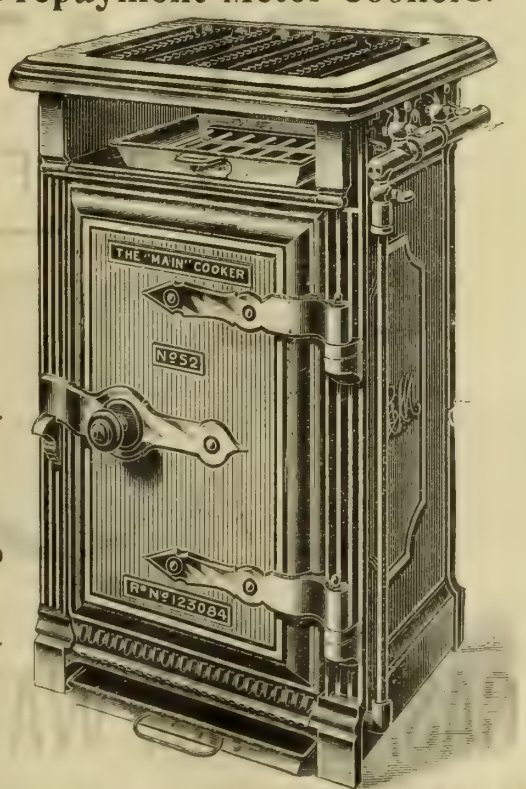


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Birmingham's New Reservoir at Frankley.—About fifty of the members of the Birmingham Association of Mechanical Engineers have been to Frankley to inspect the Corporation new water-works; and the greatest interest was evinced by them in the undertaking. They found that the reservoir covers an area of 25 acres, with a depth of about 32 feet, and will have a holding capacity of 200 million gallons. The main walls are nearing completion; the men now being engaged in lining them with blue bricks. The bed of the reservoir is being asphalted; and the work appears to be well in hand. Several of the filter-beds are close upon finished.

Coventry Corporation Water-Works.—The annual report of the Coventry Corporation Water Committee states that, owing to a change in the date of collection, the receipts for the past year show a decrease; but as £2500 was outstanding at the end of the financial year which will fall into the receipts for the current year, the balance will be redressed. The expenses for the year increased by about £400. They included £600 on account of repairs to the engines at Spon-end, which are still in progress. There is a balance, after providing for all capital charges, of £1213. There is also a large sum in hand; and so the Committee recommend the Corporation to make a grant of £3000 this year in aid of the borough fund.

Newbury Corporation Gas Supply.—At the last monthly meeting of the Newbury Town Council, the report, balance-sheet, and working statement of the gas undertaking for the year ending March 31 last, were presented. The gross profit—£2350—was the largest realized. The gas unaccounted for was 397,000 cubic feet less than in the preceding year. The balance-sheet showed that considerable improvement has been effected. The Committee recommended that £2500 be borrowed, as suggested by Messrs. Alfred Lass, Wood, and Drew, the Auditors, to defray the expenses for services, meters, and stoves, and to meet similar expenditure in the immediate future. Alderman Smith moved the adoption of the report. In doing so, he said there had been an increase in the output of gas of some 3 million cubic feet, and 376 tons more of coal had been carbonized. Slot-meters for the smaller houses had been introduced, and had proved a success, adding upwards of 1¼ million cubic feet to the consumption. There had been a most satisfactory increase in the profits, arising from the fact that they had been blessed by a very extraordinary year. The price of residuals had gone up on every hand, and this had resulted in an advance of £500 profit on that score; while the Committee had been fortunate in securing a very low contract for their coal, which was not likely to be effected again. This state of things was due to the energy of the Committee and the excellent management of Mr. Davey, under whose care the cost of producing gas had been reduced from 2s. 9d. to 2s. 2d. per 1000 cubic feet. Out of the profits it was proposed to set aside £600, which, with a sum of about £300 of unallotted profits from last year, would leave them with £1000 in hand. He did not think the price of coal would go up so high as was expected. However, if it was advanced even 2s. or 3s. per ton, he firmly believed the Committee would still be able to present a satisfactory account. The report was adopted.

Bradford Gas Discounts and Accounts.—The Gas Committee of the Bradford City Council have resolved that the system of gas discounts at present in force in the city should be continued, but that the accounts of owners and occupiers of each separate property should be kept distinct, and that the grouping of gas accounts should be discontinued.

Portsmouth Water-Works Company.—The report of the Directors of this Company for the half year ending the 31st of March shows that the available balance on the profit and loss account is £25,219, out of which they recommend the payment of the full statutory dividends. This, after deductions for void houses, &c., will leave a balance of about £9621 to be carried forward. During the past half year, 2399 yards of additional street service-mains were laid in new roads; making a total of about 46 miles of trunk and 127 miles of service mains. The additional services connected with the mains during the half year were 439; making the total number of premises now under constant supply by the Company 39,756. The quantity of water pumped from Havant and Bedhampton in the six months was 1,294,566,000 gallons, or an average daily supply for all purposes of 7,113,000 gallons; being an increase of 758,000 gallons daily as compared with the corresponding period of 1898-9. The quantity supplied for domestic use was equal to an average of 29¼ gallons per day per head of the population, exclusive of all supplies by meter. The number of fire hydrants now fixed in the Company's districts is 3112. The Engineers (Messrs. Joseph Quick and Son) report that the engines, boilers, reservoirs, and works are in good order. The report was adopted at the meeting of the Company last Thursday.

The Salary of the Plymouth Water Engineer.—At a meeting held a short time since, the Plymouth Town Council had under consideration the question of the salary to be paid to the new Water Engineer. Mr. Sandeman, who, as already mentioned, vacates the position, received a commencing salary of £250, which was eventually increased to £400. The Water Committee recommended that his successor should be paid £300, and that £50 a year should be added until a maximum of £500 is reached. He is also to be allowed to have two pupils. Alderman Bond said this was the unanimous recommendation of the Committee, who realized that the Water Engineer would have control of a property of the value of more than half-a-million of money. Mr. R. J. Bazley thought the salary proposed was too alarming. If they agreed to pay the same sum as when Mr. Sandeman was appointed, it would be very liberal, as they had no new works in view. He proposed, as an amendment, that the salary should commence at £200, and that the maximum should be £300. The pupils would probably bring in £100 a year. The Mayor (Alderman Pethick) said this was only the wages of a mechanic. They could not offer an engineer £200 a year. Alderman Bond remarked that events had shown that Mr. Sandeman had never been paid for his services. They had been having the use of his brains, and they would want the brains of another man. After further discussion, the recommendation of the Committee that the salary should commence at £300 and rise to a maximum of £500 was adopted, but with the provision that the annual increment shall be £25 a year, instead of £50, as proposed by the Committee.

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Water Charges to Bradford Manufacturers.—A deputation from the Bradford Dyers' Association, the Yorkshire Woolcombers' Association, and the Slubbing Dyers' Association waited last Wednesday on the Water Committee of the Bradford City Council in regard to the proposed increase in water charges. It was pointed out by Mr. Thomas Speight, one of the Directors of the Woolcombers' Association, that any proposed increase in the charges would seriously affect the finances of the Water Committee. Many large consumers would sink wells and take means to soften water, and would economize in other ways. It will be remembered that it was proposed to raise the price from 6½d. to 8d. per 1000 gallons for all water used over 400,000 gallons; but when the matter came before the City Council it was referred back. After last Wednesday's conference, a Sub-Committee decided to recommend the Council to raise the price from 6½d. to 7½d. per 1000 gallons for all water consumed over 400,000 gallons.

Formation of a Reservoir Rating Association.—The first meeting of the Committee appointed at the conference of Local Authorities recently held for the purpose of bringing about a change in the law relating to the assessment of reservoirs (*ante*, p. 1140) took place last Wednesday at the Cannon Street Hotel. Mr. T. Croysdale (Sunbury) having been unanimously elected Chairman of the Committee, he said their first business would be to give the Committee a title. Several names were suggested, and "The Association for Promoting the Equitable Rating of Reservoirs" was fixed upon. Mr. Scott (Sunbury) was unanimously appointed Hon. Secretary of the Association. A resolution was then passed asking each delegate to obtain the authority of his Council to contribute a sum, not exceeding £20, towards the expenses. Mr. Scott suggested that the constitution of the Association, showing what the objects were, should be drafted; and it was left to the Clerk (Mr. Goddard) to prepare this, and present it to the next meeting.

Messrs. R. Dempster and Sons, Limited, of Elland, have secured the contract from the Desborough Gas Company for remodelling their works. It consists of extensions to the carbonizing plant previously erected by the firm, condensers, exhauster, coal-store roof, &c.

Messrs. W. C. Holmes and Co., of Huddersfield, have received orders for their patent "New" scrubber-washer from the Coatbridge Gas Company, the Johnstone Gas Commissioners, the Hastings and St. Leonards Gas Company, and the Carlton Iron Company, Limited (third order).

Messrs. J. Taylor and Co., of Bolton, have in hand solid plate lead saturators of their latest make for the Durham Coke and Bye-Products Company, Limited, for their Malton Works, the Heywood Corporation Gas Department, the Abingdon Gas Company, the Blackburn Corporation, and the Kendal Corporation Gas Department. We are informed that the Blackburn and Kendal saturators were specially notified in the specifications, by the Gas Engineers to those Corporations, when asking for tenders from gas-plant makers for the erection of complete sulphate of ammonia plant.

We have received from the Loomis-Pettibone Company, of New York, who have taken over the business formerly carried on under the name of Mr. Burdett Loomis, of Hartford (Conn.), a pamphlet setting forth the value of gaseous fuel, and giving particulars of the Loomis plant for making producer and water gas. The Company make a speciality of the installation of this plant and gas engineering generally; but they also act as consulting or constructing engineers. We are informed that the Company have secured a number of large contracts for gas plants to be used chiefly for manufacturing purposes, and are at present engaged upon installations for the production of gas for use in engines. It is stated that with those already at work one brake horse-power per hour is obtained with the gas produced from 1 lb. to 1¼ lbs. of bituminous coal. The Company are at present erecting large plants for the production of gas to be employed for forging, welding, heating rivets, &c., and driving gas-engines.

The third ordinary general meeting of Meters, Limited, was held in Manchester last Tuesday—Alderman Miles in the chair. The Directors' report showed a gross profit of £30,676, and a net profit of £18,701, out of which it was proposed to pay a dividend at the rate of 5½ per cent. on the preference shares and 5 per cent. on the ordinary shares, to write off the remainder of the preliminary expenses (£1966), transfer £2000 from the forfeited share account and £2000 from the profit and loss account to the reserve, and carry the balance of £526 to the next year's accounts. The Chairman, in moving the adoption of the report, said he regarded it as very satisfactory, particularly when the shareholders took into consideration the difficulties they had had to face during the past year. All the materials used in their manufacture—copper, tin, and iron—had been largely enhanced in value; while, on the other hand, they had only been able to make a slight advance in the price of the goods they manufactured as from the 1st of October last, and this had been so small as to be scarcely appreciable. Their orders were larger than they were last year, and their turnover was more; and if they could only continue in this state, he thought they had every reason to expect success. Mr. F. H. Orme seconded the motion, which, after some discussion, was carried unanimously.

WHITSUN HOLIDAY.

NOTICE TO ADVERTISERS.—In consequence of the **WHITSUN HOLIDAY**, orders with respect to **ADVERTISEMENTS** should be received at the Office *not later* than **THE FIRST POST ON SATURDAY NEXT.**

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale than all other Oxides combined. Purity and uniformity of quality guaranteed.

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Andrew Stephenson, Agent. All communications *re* Oxide to the Company as above.

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"VOLCANIC" FIRE CEMENT.

Resists 4500° Fahr. Best for use in GAS-WORKS.

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"Volcanism, London." London, E.C.

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Offices: Commercial Buildings, Leeds.
Correspondence invited.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.

Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.
Read Holliday and Sons, Ltd., Huddersfield.

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Brotherton and Co., Ammonia Distillers.
Works: Birmingham, Leeds, and Wakefield.

TO GAS AND WATER OFFICIALS.

HIGH-CLASS Cycles at reasonable and low Prices. Guaranteed for Twelve Months. Sent on approval. For Cash or Gradual Payment System. Send for Catalogue, Post Free.
Melrose Cycle Company, Coventry.

BENZOL, specially made for the Enrichment of Gas.

Ellison and Mitchell, Limited, Kilnhurst, near Rotherham.

PRACTICAL RETORT SETTERS.

GEORGE NUTTALL & CO., 32, Havelock Road, Saltley, Birmingham.

Regenerator or other Furnaces erected to Engineers' own Designs. Best Work Guaranteed. Please write for Estimates.

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First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Addresses:
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JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

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Brotherton and Co., Tar Distillers.
Works: Birmingham, Leeds, and Wakefield.

ENRICH your Gas with cheap Benzol.

Specially prepared, free from sulphur. At to-day's Price of Benzol, ILLUMINATING POWER costs less than ONE-THIRD OF A PENNY PER CANDLE.
Apply to Sadler and Co., Middlesbrough.

SULPHURIC ACID for Sale.

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JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.

For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.

Telegraphic Address: "Porter, Lincoln."
[For Illustrated Advertisement, See May 8, p. 1178.]

CANNEL, COAL, ETC.

JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.

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BALE & CO.'S Oxide of uniform quality. SPECIAL FIRE CEMENT, OXIDE PAINTS, OILS, SULPHURIC ACID, &c.

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SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c., Central Plumbing Works, Town Hall Square, Bolton. Special attention to Repairs.

Before placing Orders, please write for Estimate.
Telegraphic Address: "Saturators, Bolton."

PATENTS FOR INVENTIONS.

Messrs. J. C. CHAPMAN & CO., Chartered Patent Agents, ADVISE ON ALL MATTERS CONNECTED WITH ABOVE.

Information and Handbook on application.
70, Chancery Lane, London, W.C.

DRAUGHTSMAN, experienced in the Design and Construction of all kinds of Gas Plant and Buildings, is open to Engagement.

Address G. W., care of Street's Agency, 30, Cornhill, E.C.

ADVERTISER (Age 26) requires Situation as FITTER. Four Years in present Situation in Yorkshire. Good Reference.

Address No. 3501, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, a Situation as Working MANAGER or FOREMAN in Gas-Works. Good Carbonizer. Erect and Repair Plant; Main and Service Layer. Practical Gas-Fitter. Good Testimonials. Abstainer. Age 49.

G. Watson, 45, Freeth Street, Oldbury, near Birmingham.

DRAUGHTSMEN, Two wanted, accustomed to Structural Ironwork and General Engineering.

Apply to W. J. Jenkins and Co., Limited, Retford.

WANTED, Three General Gas-Fitters, having experience in fixing Cooking and other Stoves.

Apply to the Engineer, Gas-Works, Coventry.

EXPERIENCED General Engineer's DRAUGHTSMAN wanted.
Apply, stating Age, Experience, and Salary required to WEST'S GAS IMPROVEMENT COMPANY, LIMITED, Albion Iron-Works, Miles Platting, MANCHESTER.

WANTED, at once, a good Stoker.
Must be a good Shovel Charger, and be able to look after Engine and Exhauster. Wages 28s. per week. Seven Days or Nights.
Application, with References, to the MANAGER, Gas-Works, BEXHILL.

GAS-METER TRADE.

WANTED, Experienced Representative, having good connection, to represent METER FIRM in the Provinces.
Apply, giving all Particulars, to JOHN WRIGHT AND Co., LIMITED, Essex Works, BIRMINGHAM.

WANTED, a level-headed and practical Man to LAY OUT new Foundry and SUPERINTEND and take charge of CASTINGS for Gas Cooking-Stoves on up-to-date and economical System. Good and permanent position for suitable person.
Apply, by letter, to No. 3492, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

APPLICATIONS are invited for the post of MANAGER of the HEATING and COOKING DEPARTMENT of a Gas Company situate abroad, which will shortly be vacant.
Applications, giving Capabilities, and Details of past Experience, should be addressed to No. 3504, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a competent and experienced Retort-House FOREMAN, for a Provincial Works, making 350 million cubic feet of Gas yearly. Must be accustomed to Regenerative Firing and Machine Stoking.
Apply, by letter, stating Wages required, and enclosing *copies* of References, to No. 3503, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, immediately, Two or Three steady STOKERS, for Shovel Charging. Permanency to reliable Men. Good Wages given.
Apply, stating Age, Married or Single, and how soon able to commence Duties, to
J. H. TROUGHTON.
Gas-Works, Newmarket,
May 26, 1900.

WANTED, a Steady, Reliable Stoker, for Small Gas-Works, accustomed to Shovel Charging and attending to Engine and Exhauster, and to make himself generally useful. Would be required to do from Two to Three Months' Night Work in Summer. Wages 28s. for Seven Months and 26s. for Five Months. None but steady Men need apply.
Apply, by letter, with Testimonials, to No. 3500, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

HORSHAM GAS COMPANY, LIMITED.

WANTED, by the above Company, a competent Man as CLERK, COLLECTOR, and METER INSPECTOR. One well acquainted with the general routine of a Gas Office, and capable of preparing Balance-Sheets.
Applications, stating Age, Experience, present Employment, and Salary required, accompanied by *copies* of not more than three recent Testimonials, endorsed "Clerk, &c.," to be sent to the Chairman of the Company, Gas Office, Horsham, on or before the 6th of June, 1900.
(Signed) W. E. BARNEY,
Secretary.
May 24, 1900.

SMALL Purifier (second-hand) Wanted, Cheap.
Send Size and Price to JAMES ROGERS, Maldon, ESSEX.

WANTED, a cheap, Second-Hand GASHOLDER of 6000 to 8000 cubic feet capacity, with Cast Iron or Steel Tank. To be erected a short distance from a Seaport in South East of Ireland.
Offers, by letter, to No. 3502, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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FOR SALE—A Vertical Exhauster and ENGINE, with Two Plunge Pumps, 12-inch Valves and Connections, made by George Anderson. Can be seen working.
For further Information, apply to CHARLES POTTS, Secretary and Manager, Gas-Works, Raglan Street, Hyde, near MANCHESTER.

CONDENSERS, Washer-Scrubbers, "Cutler" patent CONDENSERS (14) 6 in. to 12 in. PIPE CONDENSERS, Patent WASHERS by "Livesey," "Holmes," and "Cockey," EXHAUSTERS up to 60,000 Cubic Feet per hour. ENGINES, BOILERS, &c. Several TOWER SCRUBBERS, PURIFIERS, METERS, GOVERNORS, PUMPS, TANKS, VALVES, &c.
J. FIRTH BLAKELEY AND Co., Gas Engineers, DEWSBURY.

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OWING to Extensions, the Altrincham Gas Company have FOR DISPOSAL a 30,000 Cubic Feet per hour EXHAUSTER (Beale's Patent, by Bryan Donkin and Co.). The Exhauster is in good serviceable condition, and can be seen working.
For further Particulars, apply to the undersigned.
J. E. LAMB,
Manager.
Gas-Works, Altrincham,
May 24, 1900.

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FOR SALE—Two Lancashire Boilers, each 6 ft. diameter by 20 ft. long, with Mountings. Been in use only a short time. Made by the Yorkshire Engine Company, Limited, Sheffield.
Apply to NEWTON, CHAMBERS, & Co., LIMITED, Thorncliffe Iron-Works, near SHEFFIELD, where the Boilers may be seen.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

TAR AND AMMONIACAL LIQUOR.

THE Directors of the Oakengates Gas Company invite TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR, produced at their Works during Twelve Months, ending June 30, 1901.
Tenders, endorsed, and sent to the undersigned, on or before June 14.
E. PARKER,
Manager.
Gas Offices, Oakengates,
May 26, 1900.

LURGAN GASLIGHT AND CHEMICAL COMPANY, LIMITED.

COAL WANTED.

THE Directors invite Tenders for the supply of 3300 Tons of best quality screened GAS COAL, and 100 Tons of STEAM COAL, delivered into the Works at Lurgan, or placed on Lighters, or on Rail, at Belfast.
Eight Hundred Tons of the required quantity should be Scotch Coal, suitable for use in Hislop's Patent Regenerative Furnaces.
The Coal must be delivered in such quantities and at such times as the Directors may fix; but a large proportion can be taken before the 1st of November.
Each Cargo to be accompanied by a Certificate as to place of origin.
Tenders (in sealed envelope), accompanied by reference to Gas-Works using the Coal offered, should reach me not later than Saturday, the 2nd of June, 1900.
The Directors do not bind themselves to accept the lowest or any Tender.
FRED. W. MAGAHAN,
Secretary.
Gas-Works, Lurgan,
May 7, 1900.

URBAN DISTRICT COUNCIL OF OLDBURY.
(GAS DEPARTMENT.)

THE Gas Committee of the Urban District Council of Oldbury are prepared to receive TENDERS for the supply of 10,500 Tons, or thereabouts, of screened GAS COAL for delivery during the Year ending the 31st of August, 1901, in such quantities and at such times as ordered, carriage free, at the (1) Oldbury Basin, G.W. Railway, and (2) L. & N.W. Railway, Oldbury.
The Coal must be of first-class Quality, well screened, freshly wrought, and perfectly free from Bats, Pyrites, and other Foreign Matter.
Sealed Tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Gas Coal," must be delivered to the undersigned, not later than Saturday, June 16 next.
The Gas Committee do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right to apportion the whole quantity as they may think fit.
Tender Forms, and any further Information, may be obtained from the undersigned on application in writing.
By order,
A. COOKE,
General Manager.
Gas-Works, Oldbury,
May 25, 1900.

URBAN DISTRICT COUNCIL OF OLDBURY.
(GAS DEPARTMENT.)

THE Gas Committee of the Urban District Council of Oldbury are prepared to receive TENDERS for the supply of 150 Tons of OIL, suitable for the Manufacture of Carburetted Water Gas.
The Oil to have a Flashing-Point of not less than 73° (Abel's Test), and not less than any higher degree of Temperature which may be specified in any future Act of Parliament, or Regulations to be made thereunder.
The Oil to be delivered, free of all charges, into the Storage Tank of the Council at the Gas-Works, in such quantities and at such times as required, during a period of One Year from the 31st of July, 1900.
Tenders to be at a price per Imperial Gallon.
Analysis of the Oil, with full Description, must be sent in with each Tender along with a sealed sample of the Oil offered.
Sealed Tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Gas Oil," must be delivered to the undersigned not later than Saturday, June 16 next.
The Gas Committee do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right to apportion the whole quantity as they may think fit.
By order,
A. COOKE,
General Manager.
Gas-Works, Oldbury,
May 25, 1900.

TENDERS FOR TAR.

THE Directors of the Croydon Commercial Gas and Coke Company invite TENDERS for the purchase of their surplus TAR for One Year, commencing on the 1st of July next.
Specifications for the Contract will be forwarded on application. Rail communication direct to the Works.
Tenders, endorsed "Tender for Tar," must be delivered not later than Thursday, the 7th of June, to
WILLIAM J. RUSSELL,
Secretary.
Katharine Street, Croydon,
May 25, 1900.

TENDERS FOR GAS COAL.

THE District Council Gas Committee of Padiham invite TENDERS for the supply of GAS COAL.
Specification and Form of Tender may be obtained on application to the undersigned, or at the Gas Offices.
Tenders to be sent in not later than Saturday, June 9, 1900, addressed to the Chairman, and endorsed "Tender for Gas Coal."
J. R. SMITH,
Clerk.
District Council Offices, Padiham,
May 22, 1900.

CHIPPING NORTON GAS COMPANY.

TENDERS FOR GAS COAL.

THE Gas Committee of the above Company invite TENDERS for the supply of from 500 Tons to 1100 Tons of best screened GAS COALS, to be delivered f.o.r. at the Gas-Works Siding, in such quantities and at such times as the Manager may direct, for a period of Six or Twelve Months, from July 1 next.
Sealed and endorsed Tenders to the SECRETARY, Gas Company, CHIPPING NORTON.

BOROUGH OF RAMSGATE.
(GAS DEPARTMENT.)

THE Gas and Water Committee desire TENDERS for the construction of a RETORT-HOUSE; also IRON ROOF, JOISTS, &c.
Specifications and Quantities may be obtained from William A. M'Intosh Valon, Gas Offices, Ramsgate, on payment of £5 5s., which will be returned on receipt of a *bonâ-fide* Tender, together with Specifications and Quantities fully priced out.
Tenders must be sent in, addressed to the Chairman of the Gas and Water Committee, Boundary Road, Ramsgate, not later than Ten a.m. on Monday, June 11, 1900.
The Committee do not bind themselves to accept the lowest or any Tender.
W. A. HUBBARD,
Town Clerk.

TENDERS FOR COAL.

THE Directors of the Derby Gaslight and Coke Company are prepared to receive TENDERS for the supply of 40,000 Tons of screened SOFT COAL and SOFT COBBLES or NUTS, to be divided in One, Two, or more Contracts, as the Board may decide; but they do not bind themselves to accept the lowest or other Tender or Tenders.
Forms of Tender may be obtained from the undersigned.
Sealed Tenders, endorsed "Tender for Coal," and addressed to the Chairman of the Finance Committee, must be delivered at the Offices of the Company, Friar Gate, on or before Thursday, June 7.
By order of the Directors,
RICHARD FISHER,
Secretary.
Gas Office, Derby,
May, 1900.

PAIGNTON GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the Paignton Gas Company are prepared to receive TENDERS for the supply of about 2000 Tons (or such other quantity as may be agreed on) of best approved GAS COALS, in such monthly quantities as may be required by the Company.
Tenders to state the Price of the Coal, delivered at Paignton Station, Great Western Railway, free of all charges.
The Directors do not bind themselves to accept the lowest or any Tender.
Further Particulars may be obtained on application to Mr. C. G. Dawson, the Company's Manager.
Sealed Tenders, endorsed "Tender for Coal," specifying the description and quality of Coal, to be sent on or before the 9th of June addressed to the undersigned, Gas Offices, 5, Victoria Street, Paignton.
F. W. PUDDICOMBE,
Secretary.
Paignton, May 19, 1900.

CITY OF HEREFORD.

THE Gas Management Committee of the Corporation invite TENDERS for the supply of best screened large GAS COAL for One Year, from the 1st of August next, to be delivered free at the Gas-Works Siding, Hereford, in such quantities as may be required from time to time.
The estimated Quantity required will be about 9500 Tons.
Full Particulars and printed Forms of Tender may be obtained on application to the undersigned.
Tenders, endorsed "Tender for Gas Coal," are to be sent in addressed to the Chairman, Gas Management Committee, Mansion House, Hereford, by Saturday, June 9.
The Committee do not bind themselves to accept the lowest or any Tender.
By order,
WILLIAM PARLBY,
Gas Engineer and Manager.
Gas-Works, Hereford,
May 23, 1900.

CONTENTS.

EDITORIAL NOTES:—

GAS, LIGHTING, &c.— PAGE.

The South Metropolitan Bill to be Opposed in the Lords . . . 1489
The Welsbach Company's New Prices and their Effects . . . 1490
The Case for a Commission of Inquiry on Coal 1490
The Southern District Association—Gas-Mains and Electrolysis. 1491
Towards the Solution of the Old-Age Pension Problem. . . . 1491

WATER AND SANITARY AFFAIRS—

The London County Council and the Water Question 1492
The Annual Report of the Thames Conservancy. 1492

ESSAYS, COMMENTARIES, AND REVIEWS:—

Gas and Water Companies in the Stock Market 1492
Electric Lighting Memoranda 1492
The Paris International Exhibition—The Side-Shows; The City's Attractions 1493
Some Features of the Opposition to the South Metropolitan Bill. 1495
The Material Progress of the Working Classes 1496

NOTES:—

Warming and Ventilating Engineering. 1497
Pictet's New Oxygen Process 1497
A New Paint Medium 1497
Vacuum Steam Heating 1497
New Competitors with Gas 1497
Success with Water-Meters 1497
Some Particulars of Electric Incandescent Lamps 1497

COMMUNICATED ARTICLE:—

A German Form of Condenser. By Theodor Hiller, of Charlottenburg 1498

TECHNICAL RECORD:—

Southern District Association of Gas Engineers and Managers—Excursion Meeting in Bristol 1499
The Guide-Framing of Gasholders 1499
Mr. D. Irving on Electrolysis in Gas and Water Mains, and the Bristol Method for Its Prevention 1501
A Century of Chemistry at the Royal Institution 1502
The Oxidation Process for the Treatment of Sewage 1502

CORRESPONDENCE:—

The Calorimetry of Coal Gas 1503

PARLIAMENTARY INTELLIGENCE:—

House of Lords—Progress of Bills 1503
House of Commons—Progress of Bills 1503
A Correction. 1503
The Parliamentary Committee on Municipal Trading 1503
House of Commons Committee—
East London Water Bill 1504
Lambeth Water Bill. 1507

LEGAL INTELLIGENCE:—

Compensation for an Accident at the Bristol Gas-Works 1508

MISCELLANEOUS:—

The South Metropolitan Gas Bill and the Price of Gas to London Local Authorities 1508
Whitwick and Coalville Gas Arbitration—Umpire's Award . . . 1508
Stourbridge Gas Undertaking—The Annual Profits and the Price of Gas 1508
The Coal Contracts of the Wallasey District Council 1509
Fatal Accident at the East Greenwich Gas-Works 1509
Meeting of the Monte Video Gas Company, Limited 1509
Electric Lighting Notes 1510
Gas-Piping in Buildings 1510
The London County Council and the Water Question—The "Sterilization" Clause; Legislative Proposals for Next Session 1511
Gas and Water Companies' Stock and Share List 1511
Notes from Scotland 1512
Current Sales of Gas Products 1513
Coal Trade Reports 1514

PARAGRAPHS:—

PERSONAL: Mr. G. Hollins; Mr. Vincent Hughes; Alderman Sir John Harwood; Mr. W. B. M'Lusky; Mr. Charles M. Ohren . 1496
The Papers at the Gas Congress in Paris 1494
"The Law of London Gas Companies"—Midland Association of Gas Managers—The Electricity Generating Plant at the Paris Exhibition—British Association of Water-Works Engineers . 1498
Loss of Water by Leakage in Paris 1502
Ripon Gas Finances—Gas and Water Profits at Barrow . . . 1503
A Cumberland Water Scheme 1514
The Quality of the South Metropolitan Company's Gas—New Joint-Stock Companies—A Plumber's Carelessness Wrecks a New House—An Increase in the Price of Gas at Swansea Irritates a Corporation Committee—Leigh Gas and Water Supply—Grand Junction Water-Works Company—Yorkshire Coalowners and Gas Coal Contracts—Tipton Gas Department 1515
Gas-Works Extensions at Colne (Lancs.)—The Award in the Horsforth Water Arbitration—Wolverhampton Water Supply—Fatal Accident at the Dublin Gas-Works—Proposed Incandescent Gas Lighting at Bideford—Bideford Water Supply—Middleton Gas and Electricity Supplies—Staffordshire Potteries Water Company 1516
The New Water-Works for Todmorden—Gas Discounts and the Grouping of Gas Accounts in Bradford 1517

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WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

Telegraphic Address: "GASKING, LONDON."
Telephone Number: Holborn 121.

EDITORIAL NOTES.

The South Metropolitan Bill to be Opposed in the Lords.

AT Thursday's meeting of the Court of Common Council of the City of London, Mr. A. C. Morton moved that the Town Clerk be instructed to call the attention of the Northern Metropolitan Local Authorities to the South Metropolitan Gas Bill, with the object of uniting them in further opposition in the House of Lords to that part of the measure which proposes to take power to purchase the Surrey-side district of the Gaslight and Coke Company. The motion was adopted unanimously, from which it appears that the Company are to be again attacked for offering to put themselves in a position to co-operate with their neighbours in carrying out a recommendation of the Powers of Charge Committee of last session. Nothing else was to have been expected. The position of the two Gas Companies, as well as of all the gas-consuming interests of the area north of the Thames served by the Gaslight and Coke Company, is anomalous; and how all these relations are to be rearranged without inflicting loss upon somebody, will in all probability be found beyond the wit of man to suggest.

The state of affairs as they at present exist is easily described. When the last amalgamation of the Gaslight and Coke Company—that with the London Gas Company—was effected in 1883, the Board of Trade insisted that the consumers in the Surrey-side district of the Company should always have their gas at the South Metropolitan charge for the time being. The amalgamating Company, whose intention was then to proceed to the absorption of the South Metropolitan Company, not only accepted this condition, but also the consequential obligation to supply all the public lights in the whole of their district at the same rate. There were those who shook their heads at the time over this engagement; but the difference of price between the two Companies was not great, and it appeared to be diminishing. The subsequent arrestation of the course of amalgamation in the interest of the Gaslight and Coke Company, changed the engagement into an "entanglement;" and the subsequent history of the big Company did not tend to justify the wisdom of those who went into it so lightly. Meanwhile, the obligation became a valuable consideration to the Northern Local Authorities, who thus found themselves sheltered against those economic vicissitudes which by last year had constrained the Gaslight and Coke Company to charge their private consumers 11d. per 1000 cubic feet more than the South Metropolitan price. When the same authorities took up the complaint of the private consumers against this difference, they could not resist the evidence that the excess in the north was partly due to the exceptional and unnatural arrangement governing the price of gas for the public lighting. Here, then, was an economic wrong which might be redressed by the simple device of severing the transpontine connections of the Gaslight and Coke Company. Relieved of their "entanglement," the Company could save something for the ordinary consumers. But this remedy appears to the interested Local Authorities to be worse than the disease. They are willing enough that the private consumers of the Gaslight and Coke Company should get their supply cheaper; but they naturally object to be deprived of the tangible, if illegitimate, advantage they derive from the actual condition of things.

Their desire to retain what they have, and still defend the cause of the private consumer, is, as we have called it, perfectly natural. No public lighting authorities could be expected to consent to give up a discount worth from £30,000 to £50,000 a year without receiving some sort of compensation. The difficulty is to formulate a scheme to the satisfaction of all parties. Mr. Littler fought the point before Mr. Oldroyd's Select Committee. Mr. Oldroyd himself thought the difference immaterial, inasmuch as the consumer and ratepayer north of the Thames has to pay gas bills and rates out of the same pocket. Mr. Littler disputed this; contending that what the Local Authorities pay for public lighting goes immediately into the pocket of the Gas Company, from which it does not necessarily emerge. He treated the £30,000 a year as an asset, capitalizing out at a million sterling, which the Gaslight and Coke Company would realize by the act of parting with their southern property to the South Metropolitan Company. It is fair to say that the latter Company have not taken into consideration this element of

value in the estimate they have published of the worth of this property to them. But if the question were to go to arbitration, as some desire, it would clearly be their duty to bring this and every other pertinent consideration before the Court. Mr. Littler's speech was largely addressed to the particular aspect of the sliding-scale which was so evidently in the mind of the Committee—that it ensures for the private consumer the benefit of all economies secured by the Company. This he denied—declaring that the Company might put it into their cash reserve, and afterwards use it for paying unearned dividend. Mr. Littler failed to impress the Committee; and accordingly he reserved for his clients, the City Corporation, the constitutional right to appeal to the House of Lords' Committee which it has now been agreed to exercise. How the difficulty is to be overcome is not foreshadowed in any of the past proceedings. No acceptable saving clause has yet seen the light. It has been said that nothing of the kind touching the interest of the Gaslight and Coke Company can be added to the South Metropolitan Bill; but this is perhaps an extreme opinion. However, the point is interesting, and of great importance for all the parties concerned.

The Welsbach Company's New Prices, and their Effects.

The proceedings of the Welsbach Company have been so freely criticized on various counts, that there is a peculiar satisfaction in the recognition that at last the responsible heads of the concern have given the plainest proof of their possession of sound common sense and a true commercial instinct. As announced elsewhere, the Company have made a sweeping reduction in the prices of all their specialities, with the result that these are now within a measurable distance of the rates which have so powerfully contributed to make the incandescent gas-burner the light of progressive Germany. All that will be necessary henceforward, to enable this system of gas lighting to fulfil its destiny, is to maintain, and wherever possible improve, the quality of all the elements and accessories of the system, and to organize the work of popularizing it so that English people may be put in the fullest possession of their new advantages in this regard, with the smallest possible trouble and thought on their part. We would heartily congratulate the Welsbach Company on their wise liberality in thus anticipating the inevitable order of events. Cheap incandescent gas-burners are bound to come, sooner or later; and it would have been fatal to the Welsbach Company to have persisted in an impracticable attitude. It now remains for the British gas industry as a whole to forget old sores, and take up the pressing task of developing the potentialities of the incandescent light as this has not yet been attempted. There is no denying the truth that, for various reasons, our people have not taken very kindly to the incandescent gas-light. This remark applies chiefly to gas technicians as a body. The very worst phase of the obstructive British spirit of dislike to every innovation which calls for a little patience and even less intelligence, was shown in the London County Council's opposition to the Bill of the South Metropolitan Gas Company. There one eminent scientific person after another professed—they were mostly Professors—to hold the incandescent system of gas lighting in small esteem. These exalted partisans of obsolescent gas-burners failed to impress the Committee of Parliament. But they would appear more distinctly "out of the running" than ever, if their testimony had to be taken afresh this week.

All true friends of the gas industry of this country should now set themselves heartily and unreservedly to grasp the bearings of the new position thus inaugurated. We may not all be unreservedly admirers of the incandescent gas-light as we know it; but let us admit that it is actually in possession of the field, and is far and away the most economical artificial light in the world. This being true of it, how weak and foolish it is to hold it at arm's length, either by reason of baseless dislike, or because it requires a little helping on its way to the affections of the public. Does anybody who may read these lines suppose that if it were given to the electricians, or the acetylene people, to be able to claim justly the possession of the cheapest light on earth, they would not push the advantage for all it might be worth? Let gas managers and others therefore take some fresh thought in this regard; and if they have scorned their great advantage in the past, let them mend their ways. Here is a means of gas lighting with which statutory candle power has nothing to do, and which even reduces to utter insignificance such a consideration as the price of gas. Which is likely to be better pleased—the user of a clean gas by means of burners consuming at rates of from 2½ to 4 cubic feet per hour, and getting a lighting effect of from 40 to 80 candle power, or he who is left to pay for 16 to 20 candle gas from which he does not get more than from 6 to 12 candles effect at the same rate of consumption? Those gas companies who shut their eyes to the possibilities of the immediate future of their lighting business, will deserve all the hard things that a censorious public has ever said of their standard of intelligence and business capacity.

We refuse to believe that British gas companies are all officered by Rip van Winkles. They have been justified hitherto in regarding the incandescent gas-light as a luxury with which the well-to-do consumer might be left to provide himself. It has, besides, been passing through its period of probation. This stage, if not quite over, is nearly closed. Like the bicycle, the incandescent gas-light is about as perfect as ordinary working hands can make it. Nothing more was needed to commend it to the good graces of gas technicians than a little concession on the part of the manufacturers under a monopoly of which the end is in sight. The Welsbach Company have turned over a new leaf. Whether or not this has been done in time for themselves, remains to be seen. But at least they have shown once more that it is never too late to mend. Now it is the turn of the gas industry to make a suitable response, to the advantage of the public, of the holders of gas property, and of the trade in the cheapest light upon earth. The change comes at a psychological moment, when gas must be raised in price by reason of the higher cost of coal. What is that to the saving rendered possible by cheap incandescent gas lighting? Gas at 10s. per 1000 cubic feet is, light for light, cheaper to the user of incandescent burners than gas at 2s. 6d. per 1000 cubic feet to the thriftless householder who adheres to his old flat-flame burners. But putting the saving wholly in the comparative smallness of consumption of gas by the ordinary run of incandescent burners, and throwing in the increased lighting effect for nothing—is it conceivable that English people are so much more foolish than the Germans, Dutch, or Swiss, that they will remain blind and deaf to the advantage of adapting themselves to the new fashion? Of course, they need instruction; but the same help that has led them to so extensive a use of gas for cooking and warming, and has popularized the prepayment meter, will make the incandescent light universal—if only the task is undertaken heartily, and with full faith and sympathy. At last the incandescent gas-light is within the reach of the British prepayment meter consumer, as it has long been of his Continental compeer. It is an opening of which no man living can see the end. With 25 cubic feet of gas selling in the cottage for a penny, making the little room like day for ten hours at this cost, the Dark Ages of candles and oil-lamps will be driven away for ever from whole regions of working-class homes.

The Case for a Commission of Inquiry on Coal.

The extraordinary rise in the price of coal, which is adversely affecting the large majority of the population of the country, has so far received scant attention in the House of Commons; but it may be expected that the subject will before long be brought to the front. The effect of the present long-continued dearness of coal is only just beginning—it has, indeed, not yet begun—to be fully realized, as the large consumers who buy under contract, such as Gas and Railway Companies, have not up to the present had to pay the abnormal prices which they will have to provide for under their new contracts. When the customers of these concerns begin to feel the worst of the pinch, the question is likely to be brought urgently to the notice of Parliament. That the subject has not yet been debated, is, indeed, a matter of accident, as Mr. George Harwood, the member for Bolton, had put down for Tuesday last a motion declaring that it is expedient that a duty be levied on all coal exported from the United Kingdom. But the day named was lost through the early commencement of the Whitsuntide holidays. It is, however, understood that the resolution will be kept upon the paper, together with the amendment that was put down by Mr. D. A. Thomas, the member for Merthyr, to the effect that it would be inexpedient to revive in any form the export duty on coal until a full inquiry has been made into

the coal resources of the United Kingdom, and that such an inquiry should be instituted forthwith. Whatever may be one's views upon the question of imposing a duty on the coal exports of the country, there can be no two opinions as to the wisdom of fully inquiring into all the facts bearing upon the problem, and of obtaining the advice of those best qualified to judge as to the effect upon the nation generally of such a radical change in our fiscal system, before committing ourselves to a policy of taxation or prohibition of exports.

Mr. Thomas, in a letter to a contemporary, puts forward, in favour of appointing a Commission to inquire into the whole question of our coal supplies, arguments which have been more than once used and emphasized in the "JOURNAL" during the past few months. The principal ground for such an inquiry is that what is of real and pressing importance to us as a commercial nation is, not that we should know how many years it will be before the coal resources of the country will approach exhaustion, but that it should be ascertained for how long the best quality and most easily obtained coal will last. It would be of little satisfaction or practical importance to know we have enormous quantities of coal as yet unwrought, if the cost of raising that coal to the surface were such as to fatally handicap us in the severe competition we have to face, and the still more severe competition that may be in store for us, in the markets of the world. The necessity that we should know—in order that we may by that knowledge shape our future commercial policy—for how long we can depend upon supplies of cheap fuel, of itself constitutes a sufficient ground for the appointment of a Commission of experts in mining geology and engineering and of practical business men.

It must, further, be borne in mind that, since the days of the Royal Commission of 1866-71, two factors, then unforeseen, have become of great importance in the coal problem—namely, the tremendous growth of the fuel export trade, and the entering of America into the world's coal market as a producer on a vast scale, and with practically unlimited resources. The Argyll Commission dealt almost entirely with the question of home resources and consumption. It is now necessary that the fuel question should be considered in its world-wide and international aspects. It cannot, however, be denied that, looked at from the side of our own consumption and supply alone, it would be of profit that the latest facts and statistics should be collated and fully considered. We hope that those members who have sought to bring the necessity for the appointment of a Commission or Committee of Inquiry into the whole question of our coal resources before the notice of Parliament, will persevere in their endeavours, and will eventually attain their object. Now that the war is so rapidly approaching a satisfactory termination, the general public and the House of Commons will have more leisure and inclination to consider matters of importance at home.

The Southern District Association—Gas-Mains and Electrolysis.

AT Bristol, on Thursday last, the Southern District Association of Gas Managers were well entertained by their President (Mr. D. Irving), and spent a very pleasant day. It was the first time that the united Association had met so far to the westward; and the result was a highly gratifying increase of the attendance of those members who hail from the more remote regions between the Channel and the Severn Sea. The only technical interest of the meeting centred in the subject of the precautions taken by the Electric Tramways Company to prevent electrolysis of the mains and pipes in roads occupied by their service. This is one of the best of its kind in the kingdom; and when fully developed in accordance with the plans actually in course of execution, the Bristol electric tramways will be a really remarkable undertaking. We are able to give Mr. Irving's statement of the law and practice of this important matter, as they apply to the interest of the Bristol Gas Company. So far, no noticeable injury has been suffered by either gas or water mains, although it is found that a good deal of vagrant current travels along the latter. It is early days to say much on the point. No difficulty has been experienced in keeping the electrical service within the lines laid down by the Board of Trade for the protection of the mains, especially since the return of current by the tramway metals has been helped by one of Professor Elihu Thomson's "boosters," which provides an additional path for the return current. Still, it is impossible for those who are responsible for the preservation of gas and water property to ignore the gravity of an altogether new and additional cause of depreciation of buried pipes, which, if it acts at all, must tend to accelerate the ordinary process of destruction. Whatever may be the real significance of the terms employed to denote electrical quantities—whether a difference of potential between pipe and rail of one volt or of seven volts is of any importance or not—the point is that it is always operating while the line is working, which is for the greater part of the day and night; and it is always tending in one way, and that the course of ordinary decay. The action is constant, and cumulative. It is therefore something to be watched. A hundred years is a long time; but cast-iron mains are credited with this length of working life under favourable conditions. Sixty years is the period allowed to many local authorities for redeeming loans applied in purchasing gas undertakings. What if the mains are going to last only thirty years, or less? There is no reason for taking an unnecessarily alarmist view of the matter; but, at least, it must be reckoned a disturbing element and a breach of the security once enjoyed by all pipes of proper strength comfortably put to bed at a sufficient depth in the ground.

Towards the Solution of the Old-Age Pension Problem.

WHEN the question of a State or rate aided system of Old-Age Pensions for the deserving poor has been under discussion in the columns of the "JOURNAL," we have more than once made it the occasion to remark upon the failure of politicians and social reformers to take into account, or to give adequate consideration to, the fact that the old age of no small number of working people is already provided for by their employers, or by schemes instituted and supported by those employers. The advocate of the State-provided pension generally, to judge by his arguments, begins by assuming that, unless a working man have by his own thrift and providence made provision for the days when he will no longer be able to earn his living, that man will either be a burden to his relations or go straight to the workhouse. The practical man with some acquaintance with actual facts know that, so far from this being the case, no inconsiderable number of workpeople are in the service of employers who believe, and have good reason to believe, that the prospect of a reasonable pension when past work attracts to their service, and retains as faithful servants therein, the better class of workmen. Some employers undertake the entire burden of providing for the old age of their hands. For instance, as Colonel Makins last year informed the Powers of Charge Committee, the Chartered Company (who cannot employ fewer than 12,000 to 14,000 men) pension their aged servants under a regular scale. Other employers subscribe to the Provident Institutions of which their men are members, and which include superannuation among their other benefits. It would be most interesting, and would be surprising and instructive to the aforesaid social reformers, if statistics could be obtained showing the percentage of the workmen of this country whose maintenance in old age is so guaranteed.

The subject is recalled to mind by the report of the first granting of pensions (to the number of 100) to members of the South Wales Miners' Provident Fund—an occasion which elicited from Sir William Thomas Lewis, who is by no means a sentimentalist or visionary, the remark that "the dream of his life was realized." This fund (to which the men contribute 3d. and the masters 5d. per week) only applies to a limited number of men in a restricted area; but Sir William Lewis sees in its new application—as we see in it and in other schemes similar to or resembling the Welsh Miners' Society—an indication of the possible solution, by different methods, of the problem which it has been sought to solve by legislation. He further believes it to be "only a beginning of the benefits which will ultimately result from a "combined effort on the part of employers and employed." It is, indeed, most satisfactory to observe the tendency towards the settlement of a question which, so far as legislation thereon is concerned, becomes more difficult the more closely it is examined. Sir Michael Hicks-Beach said the other day that, so far, every scheme he had seen since the report of Lord Rothschild's Committee was, to his mind, open to two great objections. It would impose an intolerable burden on tax or rate payers, and it would do more harm than good to the poor. As the Government have

also intimated—what is obvious—that the present is not a time for undertaking any schemes involving the expenditure of large sums of money, it is highly probable that, before any scheme for settling the question is adopted by Parliament, this question will, to a very large extent, have been disposed of by those who have no ulterior motives beyond the betterment of the working classes, and the improvement of the relations between employers and employed. Every sign of a settlement by such means is very welcome, and especially so when, as in the particular case before us, the plan forms part and parcel of a comprehensive scheme for providing compensation for accidental injuries, in lieu of the provisions of the Workmen's Compensation Act. We have always held that the two questions of old-age and accident insurance might well be dealt with in a mutual scheme under the Act.

WATER AND SANITARY AFFAIRS.

The London County Council could not separate for the Whitsuntide holidays without having another debate on the London Water Question. They are nervously anxious in regard to the present position of affairs. Their Bills have been rejected, and no intimation has been given by the Government of any intention to deal next session with the subject of the water supply of the Metropolis. Consequently, Londoners are left to the tender mercies of the Water Companies. This, in the eyes of the Progressives on the Council, is a bad position; but there is something far more serious behind. The Staines Reservoirs Act of 1896 contains the now familiar "sterilization" clause, which provides that, in the event of the undertaking of any of the three Companies concerned in that scheme being purchased, otherwise than by agreement, within seven years, no claim is to be made in respect of any advantages accruing from the passing of the Act. The operation of this clause will cease in this particular instance in 1903, and in other cases two and five years later. The limit, therefore, is 1908. As the Council do not see the prospect of purchase being effected by the earliest date mentioned above, they are desirous of promoting a Bill next session to extend the operation of the clause till the latest one.

Objection was raised by members of the Moderate party to the initiation of more legislation by the Council, and suggestions were thrown out that an endeavour should be made to ascertain the intentions of the Government, who, it was thought, ought to take the next step in the direction of settling what seems to be an almost interminable question. But if this step was to be towards legislation on the lines of the report of the last Royal Commission—and on what other lines could it proceed?—then Mr. M'Kinnon Wood, the successor to Mr. Dickinson as Chairman of the Water Committee, objected to it. Of course, the Council do not like the proposed Water Trust, and they regard the recommendation to constitute such a body as part of the attack now being made upon municipal enterprise. Mr. Wood strongly supported the Council's policy, believing that in so doing he was defending the true principles of municipal government. In the result, the Committee obtained the necessary sanction to promote their Bill; and subsequently the Standing Orders were suspended to allow of recommendations on the subject of applications to Parliament next session on the water question being submitted to the Council up to the limit of time allowed for giving the necessary "Gazette" notices. There is a prospect, therefore, of seeing the Council in Parliament again next year, incurring more expense, but with what result we will not venture to predict. In the words of the Chairman of a Select Committee, uttered on a recent occasion: "Next year's Parliament must decide its own legislation."

Now that there is a possibility of the Thames being drawn on to a larger extent than at present to furnish the Metropolis with an adequate supply of water, it is satisfactory to learn, from the recently issued annual report of the Conservators of the river, that during the past year they continued their efforts to carry into effect the largely extended powers conferred upon them by their Act of 1894 for the prevention of the pollution of the main stream and its various tributaries. During last year, the pollution from 17 towns and villages, representing a population of upwards of 36,000, was diverted from the tributaries; and pressure was brought to bear upon the Local Authorities of places where works have not yet been carried out to prevent pollution. Legal proceedings were instituted in fourteen cases for non-compliance with the provisions of the Act, and four convictions obtained. Of the rest, three were adjourned and seven withdrawn on undertakings being given by the offending parties. Some reference is made to the drought in the summer and autumn months of the past year. Up to May, there was plenty of water in the river; but in June the quantity began to fall off. From July to September, the average flow over Teddington Weir was very much below 200 million gallons a day. But in October it improved; and in November it was 927 millions. The construction of a new weir and flood channel at Penton Hook has been commenced; and, in connection therewith, provision will be made for measuring the flow of the river at that point, as provided by the Staines Reservoirs Act of 1896. The Conservators derive a by no means insignificant income from the Water Companies; the accounts accompanying the report showing that last year they were paid £2450 in respect of the lower, and £22,204 on account of the upper navigation. Of the sum paid in 1898, a balance of £2756 was brought forward. As the total revenue for the upper navigation was only £32,132, it will be seen that the Companies contributed a very large proportion of it.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1511.)

Business on the Stock Exchange last week was decidedly better; and it seemed to improve cautiously step by step. Of course, the war was the chief factor, though there were others, too, which could by no means be disregarded. At first the tendency was somewhat sensitive uneasiness lest our approach near Johannesburg should be the signal for wanton destruction of property. Then, this apprehension allayed, everything was bright on the expectation of an immediate occupation of Pretoria. Then, again, hope was deferred; and affairs in France and China became disquieting. But the good feeling always seemed to outweigh the other; and the markets became buoyant, and seemed to really encourage each other. There was also a fairer appearance of the public coming in. So prices generally are the better all round. The Money Market increased in ease; and there was a fairly wide expectation that the Bank rate might be lowered again on Thursday; but it was not destined to be. The Gas Market underwent a remarkable change. We noted last week that there was something like a turn of the tide looming ahead; and the turn has come. Business was not very active, and, indeed, it was decidedly less so than in the week before. This, however, was only natural towards the close of an account, with the Whitsuntide break following upon it. But whereas for some weeks quotations had been steadily falling, last week it is to be noted that, without exception, all changes of quotation are in the upward direction. Gaslight ordinary led the way with a rapid advance from 95 to 102, no doubt for some sufficient reason, though it may not be easily discerned. Attention was so concentrated on the ordinary, that the secured issues quite escaped notice. South Metropolitan were in favour, and had a moderate advance in price. Commercials were again quite stagnant; stock being apparently very scarce in the market. There was hardly any business done in the Suburban and Provincial group; and quotations stood unchanged. The Continental Companies participated in the general cheerfulness; and all three of them, Imperial, Union, and European, had a rise. Several of the undertakings in the remoter parts of the world had a moderate advance; Buenos Ayres, River Plate, Melbourne, and Hong Kong being the gainers. Business in the Water Companies was only moderate; but there, too, a better tendency was apparent.

Changes in quotation were few in number and slight in degree; but all were in the upward direction.

ELECTRIC LIGHTING MEMORANDA.

The Electrical Power Bills—Speculation Deprecated—Necessity for Attending to Details Where Professors Disagree A Study in Electric Lamp Posts.

The Committee of the House of Commons who have had under their consideration the grouped electric power supply Bills have made the announcement that they approve generally of the idea of enterprises of this kind, and think that facilities should be afforded them in the public interest. This is of the nature of a general declaration in favour of the preambles of all the Bills, and is meant to warn promoters and opponents of the particular measures still awaiting the attention of the Committee, to confine themselves to the particular merits of the case. Our contemporary the "Electrical Review" naturally welcomes this declaration of the mind of the Committee with enthusiasm, and remarks that howsoever it may disappoint the

many opponents of the measures relating to the supply of electricity (in bulk) which are now before Parliament, it must be hailed with satisfaction by the electrical world. The journal goes on to anticipate how, "armed with the necessary parliamentary authority, vast companies can be floated to supply a cheap and economical source of power over large areas. By this means, industries may be promoted in districts where hitherto, owing to the absence of water or other motive power, or the difficulty of obtaining coal, no industrial progress has been made." It might have been thought that wise and experienced well-wishers to electrical enterprise would shy at the very thought of a possible recrudescence of the "vast company flotation" nuisance in this connection. About the very worst thing that could possibly happen to the electrical industries and interests of this country would be this same revival of electrical speculation, such as flourished twenty years ago.

It is particularly vain to talk of big company flotations for the supply of electricity in bulk, inasmuch as this is one of the particular dangers of which Sir James Kitson's Committee have been warned, and which Parliament will certainly spare no pains to disperse. It is one thing for the Committee to approve generally of the idea common to all the present year's crop of electrical power Bills; but it will probably prove to be quite another thing that will determine their approval or otherwise of particular schemes. Supreme rights over large areas for supplying electrical power either in bulk or by retail will not be granted to every applicant of the "carpet-bagger" kind. Respectable local interest will certainly be regarded as essential to the successful promotion of any such venture. There is no British coal field so remote from all native care that any party of speculators hailing from Westminster or Old Broad Street have only to deposit a Bill for exploiting it in this way to command the assent of Parliament. Quite the contrary. Parliament is in no mind to let local authorities who do or do not happen to have already gone into the business of electric lighting, play the part of dog-in-the manger to duly accredited electrical supply companies; but the mere "foreign mercenary" will receive no favour. This is as it should be. The company-monger and the electrical schemer must be kept under if the new movement is to have any success at all. In the hands of good men of business, who know the kind of service they want, and can employ the right people to do their work, electricity generation and distribution on the large scale may possibly flourish in British manufacturing regions better even than it does at Niagara, in which example it is not possible to repose unquestioning belief.

Only—and this is the chief consideration—all permanent success will be attained gradually, and strictly as the fruit of experiment and attention to local requirements. The industrial world knows all about the "principle," and does not care a pin for eloquent generalities about pit-head electricity generation, such as pad the pages of popular magazines. Men in business want to know which is the best and cheapest way of working a particular pump, or punching machine, or drill. They are quite cold to abstract disquisitions on the advantages of electrical pumping, or whatever it is. They only care for the driving of their own pump. This is the cue for the electricity seller. Mr. Swinburne has given it to him, some time ago, in his sarcastic description of the stupid and wasteful style in which British works managers are yet content to carry dripping steam pipes all over the yard to supply isolated machines; and it is futile at present to talk about the new electrical departure as competent to create industries in districts where there is nothing of the kind now. The creation of an industrial population is a slow business, to which go many elements other than that of the supply of cheap and easily distributed motive power. That may come, of course, with time; but the immediate need is to carry the power where it is actually wanted. We mention this tolerably obvious consideration, because the hypothetical discussion of remote possibilities in connection with any matter of engineering is to be avoided by everybody who wishes to convey the impression that he means business "here and now."

It is well understood of gas engineers that they cannot, as a class, pretend to any special knowledge of the science of electricity. They admit the existence of such a science, and look up with respect, bordering upon awe, to the clever people who are able to work sums in the measures proper to it. It is only a few of the very sceptical among the various classifications of engineers who are no electricians, who can be heard to express a doubt as to whether the electricians really know all that they seem to about their own technic—just as Darwin did not believe that all Germans knew their own language. This scepticism is too shocking. Yet in the current number of the "Electrician" there is something which at the first glance seems to justify a little of it. Not long ago, Professor George Forbes, who is understood to have been the harnesser of Niagara, read a paper on the long distance transmission of power by electricity. Now Professor Perry writes to say that he "thought the paper a practical joke." The correspondence is worth reading; but it occurs to one to ask in what other branch of science could a paper by one leading light be similarly stigmatized by another?

Mention has been made in our "Editorial Notes" of the hideous electric arc lamp standards with which the Vestry of St. Martin's have disfigured the neighbourhood of Charing Cross. There is notoriously no accounting for tastes; and recently these particular standards, which were denounced by a correspondent of "The Times" as being of "an atrociously debased and vulgar character," were specially illustrated in the "Municipal Journal" as being "the most artistic lamp possible" for the Vestry to obtain. It is stated that the Vestry took the unusual course of inviting tenders for designs, and "about fifty of the leading electrical engineering firms entered into the competition," which, of course, amply accounts for the result. Fancy asking a "firm of electrical engineers" to design a street lamp post! It is carefully set down that the Vestry made a point of having designs unlike anything that could be seen elsewhere; and the approved patterns have been duly registered as their property. There is not likely to be a strong rush of applicants for permission to reproduce the design.

THE PARIS INTERNATIONAL EXHIBITION.

The Side-Shows—The City's Attractions.

One would have supposed that an Exhibition which contained 121 classes would have furnished sufficient attractions to the visitor to render unnecessary the introduction of anything extraneous. That the organizers of the monster display now being made in Paris were not of this opinion is evidenced by the fact that they have admitted a goodly number of side-shows which serve as diversions from the more serious business of examining the exhibits, and furnish amusement, and in some cases instruction, after the galleries of the Exhibition are closed. And in so doing it must be acknowledged that they have only followed the lead of others who, in recent times, have projected undertakings of a similar character, though necessarily on a much smaller scale. There has been no exhibition of late years without its "extras." As far as the one in Paris is concerned, those of our readers who accompanied us in the rapid walk we took through the Exhibition last week will have obtained some idea of their nature and location; but we may mention again that they will be found on the quays on both sides of the Seine, in the gardens of the Trocadéro, and on the Champ de Mars. A few particulars concerning them may be of interest by way of supplement to what has already appeared.

Taking first the Champ de Mars, the object which, after the lighting, will probably first attract the attention of visitors connected with the gas industry, is the Optical Palace—a conspicuous building to the west of the Eiffel Tower. Evening is the best time for a visit. The admission is 1 fr. 50 c., and the advertisement promises sixty different attractions for this comparatively small sum. But probably one-third of them will suffice. The great feature, in more senses than one, is the gigantic telescope, nearly 200 feet long and 5 feet in diameter. The tube is made of sheet steel in 24 sections bolted together. Only Jules Verne and his readers have succeeded in reaching the moon from the earth; but M. Gautier, of the Bureau des Longitudes, the constructor of the telescope, has succeeded in bringing our silver satellite down to us so that we can see pretty well what she is like. As she will be full on the 13th, probably some members of the Gas Institute party will take the opportunity of making her acquaintance. The catch phrase of the Optical Palace is: "*La Lune à un Mètre!*" This is perhaps a pardonable exaggeration; but, at all events, this luminary is brought to within about 44 miles. The telescope is supported by five stonework and iron pillars rising from the large hall in which it stands, and at its extremities by the floors of the galleries. Its axis is 23 feet above the ground. The difficulty of pointing this monster to the sky presented itself to the constructor; and he solved it by simply not pointing it at all. As a matter of fact, the object to be looked at is reflected in a large Foucault mirror, moved by clockwork, and thence through the telescope, on to a plate of glass at the far end. The glasses used are crown and flint—the former weighing 500 lbs., the latter 800 lbs.; and they are valued at somewhere about £28,000. Their magnifying power is upwards of 8000 diameters; whereas the highest powers hitherto obtained have not exceeded 3500 diameters. Some interesting photographs of the moon are shown in one of the halls. An instructive feature of the palace is the series of twenty glass cases in which an attempt has been made to represent the various stages in the formation of the earth. There is a Pasteur room, and also one in which luminous microbes make a feeble attempt to displace incandescent gaslight. The other attractions of the palace are of a varied character, and need not be particularized. The lighting is by electricity supplied from the cables serving the left bank of the Seine. The one leading to the building is 3¼ inches in diameter; and about 12 miles of wire convey the current—3000 ampères, continuous and alternating—over the edifice. The alternating current is obtained by 22 transformers; the smallest giving out 400,000 volts, the largest 1,200,000 volts. They furnish altogether 13,000,000 volts. In addition to the numerous arc lamps required for the lantern views, the current serves 14,000 incandescent lamps of 16 and 32 candle power. Before leaving the palace, notice should be taken of the decorations in the Foucault Gallery.

The other attractions in the neighbourhood of the Eiffel Tower do not call for more than brief notice. At the back of the Optical Palace are Venice in Paris—the ancient city of the Doges transferred to the French capital; the Transatlantic Panorama, by which the visitor is transported to Algiers; and the Celestial Globe, a sphere about 400 feet in circumference, elaborately decorated with certain mythological figures representing the

constellations. On the other side of the Tower is the Luminous Palace, constructed entirely of glass, and illuminated by 12,000 incandescent electric lamps. Two broad flights of steps lead to a large hall in which articles of jewellery are on sale. Underneath are some glass blowers at work. Near it are the Costume Palace (showing the changes which have taken place in costume throughout the ages) and the panorama of a voyage round the world, with animated figures.

At the south-west corner of the Champ de Mars, and not far from the Machinery Section, will be found a deservedly popular attraction of the Exhibition—the Swiss Village. It consists of a really creditable representation of Swiss scenery—mountains, pine forests, cascade, lakes, châlets, &c. All the characteristics of village life are reproduced here. Features of historical interest are the Clock Tower at Berne and the houses in which Rousseau and Madame Rachel were born and Napoleon took lunch when crossing the St. Gothard.

In the gardens of the Trocadéro, the most picturesque features are the Algiers Street, and the Tunis and other Courts. The street is part of the Exhibition; but payment is necessary if the visitor desires to witness the gyratory or saltatory performances of the denizens, the sonorous clang of whose instruments of music (?) is heard all too plainly outside. Not far from this spot is an interesting show called Andalusia in the Time of the Moors, in which an endeavour has been made to reproduce the principal monuments of Spain at that period, including the celebrated Tower of Giralda in Seville, which was seriously damaged by an earthquake in 1884. The neighbourhood of the Trocadéro should not be left without a visit to the underground mineral workings (*le monde souterrain*) which have been constructed in the catacombs beneath the gardens. Here a tolerably good idea may be obtained of a mine and of the kind of operations which are carried on there. The entrances are on either side of the cascade. While here, the adjacent building (not an "extra"), containing the Russian and Siberian exhibits, including that of Nobel Bros., may be inspected, if this has not already been done.

There is nothing more in the way of attractions until we reach Old Paris, which was incidentally mentioned last week. It deserves, however, more attention than we were then able to bestow upon it. Visitors who are conversant with the events of the middle period of French history—whether through the medium of the school-book or the more agreeable one of the romance—will find much to interest them in strolling through this section of the Exhibition. Coming from the Trocadéro, we have approached it from the wrong end, and must therefore transport ourselves to the entrance near the Pont de l'Alma.* The visitor enters by the Port St. Michel and reaches the Pré aux Clercs, with the Rue des Vieilles Ecoles in front of him and the Rue des Remparts on his right. It was in the Pré aux Clercs that the army of Henry IV. was encamped when he was besieging Paris in 1589; and it was the scene of many a duel. The Maison aux Piliers is specially interesting from the fact that it was the first Hôtel de Ville which Paris possessed; having been purchased for the purpose by Etienne Marcel, Mayor of Paris, in 1357. In the Rue des Vieilles Ecoles, with its curious shops and fantastic signboards, stands the house in which Molière was born; and near it the Maison du Grand Coq—the cradle of the French Press—in which Renaudot, the doctor-journalist, started the "Gazette de France." This was also, and necessarily, the quarter in which the printers and booksellers of the time carried on business. The Rue des Remparts ends in a building in which will be found the "Pomme de Pin"—a music hall of the Middle Ages. A little farther on, at the foot of the staircase leading to the theatre, stands the pillory of the abbey of St. Germain des Prés, founded in the sixth century. We next come upon the church of St. Julien des Ménétriers—a building which dates from the thirteenth century. Up to the time of the Revolution it was the property of the Corporation of Jugglers and Fiddlers. Leaving the church, the back of the square is occupied by the markets, after which begins the Châtelet quarter, with the Pont au Change. This curious bridge of houses, which was built between 1599 and 1609, was burnt down in 1621, but was rebuilt in 1639 and again in 1858-9. The sixteenth and seventeenth centuries dominate the Pont au Change; but in the Rue de la Foire St. Laurent we come right into the eighteenth. Here, however, we have the ancient palace of St. Louis, Philippe le Bel, Charles VI., and Louis XII. In taking leave of Old Paris (a very good view of which may be obtained from one of the river steamers), we must congratulate the architect—M. Robida—upon the skill which he has brought to bear in carrying out this interesting historical reproduction.

Quitting the old, we come almost at once upon the new. In the Rue de Paris are to be found the lighter attractions—the "frivolities"—of the Exhibition; and, as we remarked last week, they may be taken or left as the visitor pleases. The writer is of those who think that the *dictum* of Horace—"*Dulce est desipere in loco*"—pronounced two thousand years ago, holds good to-day. It is pleasant to indulge in a little frivolity at the proper time and in the right place. And what more convenient season than a holiday, or better place than Paris? We will therefore briefly enumerate the principal features of this Paris street: The Dancing Palace, in which the dances of all nations may be seen; the Palace of Humour, containing a collection of drawings, sculptures, lantern exhibitions, &c.; the *tableaux vivants*; the inverted tower; the marionettes; and the concert-room.

The foregoing are the principal extraneous attractions of this wonderful Exhibition. Let us now look for a moment at those of the city in which it is located. Of course, the chief, to anyone connected with the lighting industry, is the extraordinary quantity of illuminant used. If we English are a nation of shopkeepers, our friends across the Channel may almost be called a nation of *restaurateurs*. Restaurants abound, and they must be well lighted; and so must the shops. "Paris by gaslight" was at one time, and probably still is, an item in the programme of the tourist managers; and the drive through the brilliantly lighted city was not by any means the least interesting of their "trips," even to an ordinary visitor. How much more so will it be to a gas engineer. The high price of gas in Paris, as we have several times pointed out in the "JOURNAL," does not militate against its very liberal use. Twenty years ago Paris was considered to be very well lighted; but soon after Jablochkoff made the great discovery which led to the introduction of arc electric lighting, the Gas Company showed what they could do in the way of improved illumination by gas. Ten years later, the incandescent gas system began to make a little headway; and now the Company have taken it up, and have shown to the world, on the Champ de Mars, the Place de la Concorde, and in many of the principal thoroughfares, what are its capabilities. Let the visitor place himself in front of the Opera House, and in the three principal streets before him—the Avenue de l'Opéra, the Rue de la Paix, and the Rue du Quatre Septembre—he will see how streets can be lighted by gas and by electricity. Should a performance be going on, a glimpse at the interior of the house will be a revelation.

As the city is light by night, so, as a general rule, is it bright by day. It is this brightness which imparts to it its irresistible charm for those who usually live under more sombre skies—which gives to its citizens the gaiety which is characteristic of them. Paris, as all the world knows, has passed through very troublous times; and yet to-day their effect is scarcely visible. A few years ago, the ruins of the Cour des Comptes bore witness to the ravages of her foes from without as well as of those of her own household; but these have been removed. The Strasburg statue on the Place de la Concorde, however, still testifies to the fact that certain events have not yet been obliterated from the memory. Mr. Augustus J. C. Hare, in the Introduction to his two charming volumes on Paris, of which a second edition has just been published, says very truly that "it seems as if the great object of French men and women in every class were to make life as easy and pleasant as possible—to ignore its present and to forget its past troubles as much as they can." Voltaire pitied a Frenchman who allowed himself to be conquered by depression—

"Que je plains un françois quand il est sans gaieté!"

Pleasure in Paris becomes a business. There are many diversions and distractions in the city—some specially provided, it would seem, for the delectation of English, American, and other visitors; for it is stated that the Parisians themselves do not patronize them. But in the writer's opinion one of the most enjoyable is to be found, as Mr. Hare points out, in the half hour spent upon the Boulevards, in the Tuileries Gardens, or in the Champs Elysées, on a fine afternoon, watching the stream of human life passing on. The *flâneur*, the *petit rentier*, the *homme d'affaires*, the *grande dame*, the *demi-mondaine*, the *jeune personne* on her way from business—all these may be seen while taking a modest *bock* or a *café noir* (with or without the *petit verre*) upon the Boulevards; and it is this constantly changing outdoor life which constitutes, as we have said, the irresistible charm of the White City.

As some of the members of the Gas Institute who will shortly visit Paris will possibly do so for the first time, it may be permissible to offer two pieces of advice—viz., to avoid touts in the streets, and keep a sharp eye on coins taken as change, as both may lead to the saving of money. French silver coins anterior to 1863, except 5 fr. pieces, are not current; nor are Papal coins and the 50 c. and 1 and 2 lire coins of Italy, or the silver coins of Switzerland bearing the figure of Helvetia in a sitting position, with the exception of the 5 fr. piece. With these words of caution, we may leave Paris and its Great International Exhibition (which was visited on Sunday, the 27th ult., by no fewer than 364,000 paying people) to those who, we trust, are for a short period about to enjoy both.

* It may be mentioned that the usual charge for admission (1 fr. by day and 2 frs. at night) is doubled on Fridays and halved on Sundays.

The Papers at the Gas Congress in Paris.—The President of the Organizing Committee of this congress (M. Th. Vautier) has issued a circular on the subject of the copies of the reports of the proceedings, &c. The reports will be sent, after the congress, to all who are present, as well as to the subscribers. But, in order to facilitate discussion, it is intended, where the MS. has been received in time, to distribute prints of the papers several days in advance. As this will entail considerable expense—there being about 1100 supporters of the congress—the Committee have decided to charge for these advance proofs in cases where the recipients do not, after having obtained them, attend the meeting. The price will be 10 frs. Forms of application for these prints accompany the circular, and it is requested that they may be returned before the 25th inst. to M. Vautier, No. 65, Rue de Provence, Paris.

SOME FEATURES OF THE OPPOSITION TO THE SOUTH METROPOLITAN BILL.

In the course of the remarkable proceedings of the House of Commons Committee on the South Metropolitan Gas Company's Bill, for enabling the Company to rid themselves and their customers of the superstition of enrichment of the supply, many striking things came out in the opposing expert evidence which go to discredit the modern suggestion that professors and doctors of science would be better guides of the national industries and manufactures than the engineers and business men who usually manage these undertakings. The need for the higher scientific training of those who must occupy the leading positions of industrial organizations is one of the commonplaces of the newspaper and the platform. It is doubtless a justifiable contention, on the broadest grounds; but it is very certain that few well-wishers to the gas industry of the United Kingdom, at any rate, will see much support for it in the character of the testimony offered on the side of the London County Council before Mr. Oldroyd's Committee. Here all the breadth of view, readiness to conform to the most advanced technic, and appreciation of the economic facts of the actual and prospective relation of town's gas to the requirements of the people, were on one side; on the other was a mass of photometrical pedantry and of blindness to everything outside the laboratory, which no common-sense tribunal could for a moment feel itself bound to respect.

We have already commented in the "JOURNAL" upon the South Metropolitan Company's main proposal, and upon the justification offered for it, and have explained that the whole of the benefit of supplying natural, unadulterated coal gas was by the scheme of the Bill to be given to the public. It would have been pardonable to imagine that, under these conditions, there could be no opposition to the proposal on its merits. In the wisdom of the Progressive London County Council, however, all departure, even the best intentioned, from legalized use and wont was to be opposed. The opposition moreover undertook to prove that the change of statutory illuminating power of the South Metropolitan gas from 16 candles—which in promoting the Portable Photometer Bill they said the consumer did not get—to 14 candles, which they also said is about what most consumers have been in the habit of receiving, would greatly increase the gas bills. This contention was based upon nothing but laboratory experiments avowedly conducted *ad hoc*, and interpreted with misapplied ingenuity to establish conclusions which were invariably beside the mark. Mr. W. J. Dibdin began it. He is a photometrist and nothing more, in this connection. He posed the premiss that, with so-called 16-candle gas, an ordinary consumer obtains from his favourite Bray's No. 4 burner, a certain amount of light, which he (the photometrist) calls 100. Then, if the photometer shows the gas supplied to this hypothetical individual to be no more than 15·2 candles illuminating power, he straightway turns up his light until he gets the same amount of light as before—result, an increased consumption of 35 per cent.! Again, when the photometrical value of the gas falls to 14·2 candles, the miserable sufferer with the Bray burner has to flare away 80 per cent. more gas to satisfy his nice craving for the same intrinsic brilliancy of effect. It is prodigious; but the Committee were cold to the line of reasoning started from such a visionary point.

Dr. Clowes followed Mr. Dibdin, with some excursions into new ground which will be discussed presently. Dr. Percy F. Frankland was also in Mr. Dibdin's train; but he could add little fresh proof, as to the injury the consumer would suffer, beyond his general opinion. Dr. Hehner declared that, in order to obtain the same amount of light from a common flat-flame burner with 14 as with 16 candle gas, a far greater amount of gas would have to be burnt than would be compensated for at the rate of a penny a candle. Mr. Isaac Carr appraised the injury to the consumer at 9d. per candle; Mr. C. R. Bellamy said the London gas consumer would lose in illuminating power 27 per cent.; and Mr. T. Fairley said that the increase of consumption would be about 15 per cent. per candle. Not one single shred of proof, based upon actual cash payments or bulk of gas distributed, was brought in support of these *ad captandum* assertions. Why, if Mr. Fairley is right, any gas undertaking in the United Kingdom not tied to a particular illuminating power, or actually trying to supply (with more or less regularity) gas of an illuminating power above its legal standard, can get a 15 per cent. increase of rental any year by the simple expedient of dropping the illuminating power by a single candle! Has it ever been done?

According to Mr. Dibdin, consumers of 14-candle gas ought to pay gas bills 80 per cent. larger (in gas consumed) than those supplied with 16-candle gas. Do they? Mr. Bellamy thinks the 14-candle victims are damnified by 27 per cent. Mr. Carr says 9d. per candle. How is it that the sufferers by the Wandsworth and Putney, the Brentford, the Crystal Palace District, and other Suburban Gas Companies who sell 14-candle gas on one side of many a street, while a London Gas Company serves the other side, have never discovered their loss? One case of the kind would have had more effect with the very matter-of-fact Committee which had to deal with the Bill than all this presumption unsupported by a tittle of fact. Unhappily for all this farrago of theory, there was evidence before the Committee to show that, where the convention of high candle power for gas has been abandoned, the public have not suffered. Nobody was called to prove that the ex-consumers of cannel gas in the West-end of London burnt a cubic foot more of the 16-candle gas which was substituted for it. All technicians remember the uproar that arose when the Glasgow gas was to be dropped from 25 to 20 candles, and the absolute quiescence with which the change was effected. The London County Council did not call a witness from Glasgow. Why was nothing said of the shrinkage of consumption that, according to Mr. Dibdin's theory, should have ensued, but did not, upon the extension of the supply of 16-candle gas by the South Metropolitan Company over the old 14-candle districts of the Phœnix, the Surrey Consumers, and the Woolwich Gas Companies?

So much for the technical question which the London County Council's string of experts sought to answer with reference solely to the performance of admittedly the least efficient kind of burner—the common flat-flame, by means of which the careless and extravagant householder is still often content to burn his gas with a lightning efficiency of about a candle per cubic foot per hour. Against the suggestion that the question did not wholly depend on the presumed everlastingness of this British carelessness and extravagance—that the consumer has it in his power to get twenty to thirty times more duty out of his gas if he chooses—Dr. Hehner and others declared that it would take many years to popularize incandescent gas lighting in England, as it is popular in Germany. It was asserted that such lighting could not be cheap until certain patents expire. Well, witnesses for the Company demurred to the insinuation that English gas consumers are natural born fools as compared with the Continental populace, while agreeing that the spread of incandescent gas lighting has been restricted in this country for sufficiently notorious reasons. It is with the greater pleasure, therefore, that we learnt during the past week that the Welsbach Company have been as good as their word—mentioned in the course of the Committee proceedings—and will henceforward sell their mantles and burners upon something like a commercial scale of prices. If this eminently wise decision of the new Welsbach management is backed up by adequate enterprise in arranging for the maintenance of incandescent lights at anything approaching the open rates prevailing on the Continent, it will speedily be seen who in the recent inquiry was making for enlightenment, and who was working to perpetuate obscurity.

In conclusion, we have to say that if there is one thing more blameworthy in a man of science than shutting his eyes to the light of the best thought and practice in his own line, it is going outside his proper province to give the weight of his name and position to utterly extraneous objections to whatever proposals he may be engaged to oppose as an expert. In these proceedings one is sorry to find Dr. Clowes forgetting the sage maxim, *ne sutor ultra crepidam*, and talking about the existence of danger to the public interest in the profit-sharing arrangements of the South Metropolitan Gas Company. This farcical suggestion should at least not have emanated from a Chemist and Superintending Gas Examiner. It might have been a natural remark in the mouth of Mr. John Burns, perhaps; but coming as it did from a Scientific Adviser of the London County Council, it created a very bad impression. It was left for Dr. Clowes also to be in the sole company of Mr. Isaac Carr in imputing that a "purposely and intentionally vitiated gas is diverted to some other channel, and does not go to the testing-station." This was how the Chairman put the point to Dr. Clowes. To Mr. Carr, the Chairman mentioned the word "fraud," without any extenuation; and so it stands in the official notes and in our special report. Neither witness appeared to be able to avoid the issue thus presented.

Not to dwell upon these incidental and gratuitous unpleasantnesses, which those whom it was sought to prejudice thereby will be the first to forgive, it must be the general judgment that the attempt to set up mere photometry as master of the gas industry was well repelled. It is doubtless of use, in a way and to a degree, to have these definitions of candle power of gas for statutory purposes; but the idea of illuminating power must not in the practical mind be dissevered from the conditions under which it is ascertained, and from the sense in which any such measurement is properly to be understood. Persons too much given to photometry get a habit of speaking of 16-candle gas as if this or any standard of illuminating power existed outside the photometer room. It does not. It is a concomitant of many things. Nobody outside a proper testing-room ever saw a 16-candle gas-flame, except by accident. What is called the legal 16-candle gas-flame, obtained by the use of the standardized burner, is a creature of the conditions. Nobody would produce it for any other purpose than that of testing. It never was a commercial or a practically useful flame, even for an argand; and argands were not for the multitude. All that the County Council experts had to say against the incandescent gas-burner, and more, could be alleged to the disadvantage of the argand burner, without which, photometrically speaking, there is neither 14 nor 16 candle gas. Why, then, all the pother? Simply because public authorities, not actually in business, are apt to be led by officials, who are not men of business either, and whose whole life and training tends to focus their attention on rules and regulations, means and instruments, procedure and penalties, and who outside their office doors, are not in the great movement of the living world of trade and manufacture.

THE MATERIAL PROGRESS OF THE WORKING-CLASSES.

The very considerable betterment in the circumstances of the working-classes in recent years has been patent to the most superficial observer of social history, and is the source of much satisfaction to those who hold that the welfare of the nation ultimately depends upon the prosperity and contentment of all classes. There is, of course, always to be remembered the fact that prosperity is not necessary to contentment, nor contentment necessarily the outcome of prosperity. But those are considerations the truth of which is more clearly recognized by the wealthy than by the indigent. It is also undoubtedly true that while riches cannot, of themselves alone, procure happiness, they can—in the case of the majority of human beings—largely conduce thereto; while poverty is (except in the true philosopher a rare, if not an extinct, species) of itself a hindrance to happiness and, not infrequently, a source of great misery and of social unrest. Our present business is not, however, to discuss in the abstract the true value of wealth as a factor in human happiness, but—leaving anyone who may so choose to make his own estimate of the influence of better conditions of life upon the character and true well-being of the working-classes—to consider the data available for estimating the extent to which the circumstances of those classes have improved in the near past. A mine of interesting figures bearing upon this subject is to be found in a paper on "Working-Class Progress since 1860," read some while since before the Royal Statistical Society by Mr. G. H. Wood, and reproduced, with a report of the subsequent discussion thereon, in a recent issue of the Society's "Journal."

In order to determine the relative prosperity of a wage earner in different years, it is necessary to ascertain, not merely the actual weekly earnings in each of those years, but, also, the purchasing power of money during the same periods, and, further, the extent to which earnings were affected by regularity or want of employment. To the first and third of these considerations Mr. Wood especially applied himself, and his paper contains a large bulk of carefully digested statistics relating thereto. The final results are displayed in a very interesting chart, whereon five curves are drawn, showing (for the period of from 1860 to 1896) the movements in wages, the consumption of food and other commodities per head, and the state of the labour market as regards the percentage of unemployed, as well as the variations in the marriage and pauper rates. The wages curve is drawn in accordance with a calculated yearly index number, and the consumption of commodities curve in accordance with an elaborate system of what are known to the statistician as "weighted averages."

Two points immediately strike one upon glancing at the chart—namely, the improvement in the wage earnings of the working-classes since 1860, and the tremendous and almost continuous increase in the consumption of commodities such as food, clothes, beer and wines, &c., during that period. All the curves also move, in sympathy, with strange exactness. As Mr. Wood observes, "the interdependence of social movements could scarcely be better illustrated." The puzzle is to determine which, if any, of the curves represents the cause of these movements. The table would have been more complete and instructive in this respect if a curve representing the fluctuations of prices throughout the period under consideration had been drawn thereon. Moreover, as has been said, to arrive at the true relation between the state of prosperity enjoyed by a wage-earner at two different periods, it is necessary to ascertain, not only the amount but also the purchasing power of his earnings. What is the relation, so considered, between the material prosperity of the working-classes to-day, and forty years ago?

Mr. Wood's chart only carries us from 1860 up to the year 1896, which was a year of trade depression. Nevertheless the curves show that wages stood 42 per cent. higher in 1896 than they did in 1860 and the two following years. If the curve could be carried up to the present day, it would undoubtedly show a very considerable further increase. The consumption of foodstuffs, cotton and wool, wine, spirits, and beer per head of population increased in the same period by 53 per cent. Mr. Wood does not give any data for arriving at the quantities of these commodities purchasable by each pound of wages earned in each of the years covered by his statistics; but information enabling one to institute such a comparison between the final years of each of the last five decades is to be found in an article in the current number of the "Contemporary Review," by Mr. M. G. Mulhall, on "The Imports and Exports of Forty Years." According to the statistics contained in this article, the consumption of imported food in 1899 was 800 lbs. per head of the population—valued on the average at £12 6s. per ton. In 1859 it was 200 lbs. per head, costing £19 per ton. That is to say that £1 will buy as much food now as would have cost £1 10s. forty years ago. The fall has been most marked in grain, meat, and groceries. The consumption of imported fibre (cotton, wool, flax, &c.) has increased from 680,000 tons per annum for the decade of 1865-9 to 1,300,000 tons per annum during 1895-9, while the value has fallen from £94 per ton to £37. In other words, £1 will at the present time buy as much raw material for making clothes as could have been purchased thirty years ago for £2 10s. 10d. So far as the imports of manufactured goods are concerned, it is not possible to give any reliable comparative figures, as thirty years ago we imported few manufactured goods except articles of considerable value, whereas now we get boots and shoes, hardware, and many other articles of cheap manufacture from abroad. It can, however, be safely said that, in respect of such goods, the working man gets much more for his money now than he did a quarter of a century ago.

There is one item in the worker's budget, of which no account was taken in Mr. Wood's paper, and that is the important one of rent. The tendency in all urban districts has undoubtedly been for rents to increase; and this fact must be set against the upward movement of wages, and the cheapening of the other necessities of life. The balance of advantage is, however, largely in favour of the working-classes.

In view of the present much inflated condition of trade and prices, it is interesting to note, from Mr. Wood's chart, how surely the high tide is followed by the ebb, and especially to observe the tremendous downward sweep of both the wages and the employment curves subsequent to the abnormally high-water mark of 1873—when coal and iron were as scarce and dear as at the present time. Were these curves continued up to this year, the first (the wages curve) would certainly go well beyond the level of 1873, and the second (the employment line) would be as high as it then was. But the improvement since 1888 has been much more gradual than that from 1869 to 1873; and, it is to be hoped, it will not be followed by so rapid and violent a fall. The fall will, however, be doubtless severe.

PERSONAL.

Mr. G. Hollins has recently been appointed Manager of the St. Ives (Hunts.) Gas-Works—the position formerly occupied by Mr. W. J. Best.

We learn that Mr. Vincent Hughes, Gas Manager and Secretary to the Tipton District Council, has obtained the appointment of Gas Engineer to the Smethwick District Council, in succession to Mr. B. W. Smith, who, as already announced, has gone to Walsall. Mr. Hughes is a member of the Gas Institute, having joined in 1883.

It has been resolved by the Town Hall Committee of the Manchester City Council to recommend the latter to confer the freedom of the city upon Alderman Sir John Harwood, in recognition of his long and distinguished public service for the city. Sir John is Chairman of the Water Committee; and his name will always be associated with the great scheme by the accomplishment of which the water of Lake Thirlmere is carried to the city.

As will be seen by our "Notes from Scotland," Mr. W. B. M'Lusky, of Selkirk, has obtained the appointment of Gas Engineer to the Perth Corporation, in succession to Mr. A. Wilson. Mr. M'Lusky, who is only 32 years of age, received practical training in gas manufacture and distribution at the Port-Glasgow Gas-Works, and was Assistant Gas Manager there from 1887 to 1891, when he was appointed Manager of the Kirkcudbright Gas-Works. In 1894, he was appointed Engineer, Manager, and Treasurer of the Kelso Gas-Works; and in 1897 the Directors of the Selkirk Gas Company offered him his present situation without competition. His work at Kelso embraced a scheme of complete renewal and extension of plant—all the plans and specifications being prepared by him in his leisure time. His work at Selkirk has resulted in the reduction of the price of gas from 3s. 9d. to 3s. 1½d. per 1000 cubic feet, and the leakage from 11 to 6 per cent. We congratulate Mr. M'Lusky upon his appointment, and cordially wish him continued success in his more extended sphere of work.

An interesting ceremony took place at the Crystal Palace District Gas-Works on Thursday afternoon, when a presentation was made by the officers and workmen of the Company to Mr. Charles M. Ohren, the Secretary, on the occasion of his silver wedding. The gift consisted of a silver epergne and two silver fruit dishes, with a commemorative inscription and an illuminated address: "To Charles M. Ohren, Esq., Secretary, Crystal Palace District Gas Company,—We, the undersigned, on behalf of the officers and workmen of the Company, desire to offer you our hearty congratulations and good wishes on the occasion of your silver wedding, and to ask your acceptance of the accompanying epergne as a token of our esteem and regard, and in recognition of the invariable kindness and courtesy we have received from you.—Signed, on behalf of the subscribers, Sydney Y. Shoubridge, Horace A. Floate, Harry J. Heading, J. W. Auchterlonie, William Maltster." The presentation was made, in the presence of a large gathering of the staff, by Mr. Shoubridge, the Engineer of the Company, who closed his remarks with the hope that Mr. and Mrs. Ohren might be spared to see not only their golden, but their diamond wedding—a statement which was very cordially endorsed by all present. Mr. Ohren expressed his great appreciation of the gift, and especially of the kindly feeling which had prompted it. He mentioned that he was now the oldest officer in the Company's service, having nearly completed his 32nd year. In that time he had seen many changes; but, fortunately, they had always secured good friends to fill the gaps which had been caused from time to time. He regarded this as a matter for congratulation, both on account of their personal comfort and the interests of the Company, whose prosperity they all had at heart. Hearty cheers were given for Mr. Ohren, whose popularity was further attested by many personal congratulations, in which we cordially join.

NOTES.

Warming and Ventilating Engineering.

It is to be hoped that the formation, under promising auspices, of the new Institution of Heating and Ventilating Engineers will have the desired effect of raising the standard of this class of work in the United Kingdom. Several circumstances have contributed to the neglect in England of the science and technic of the systematic warming and ventilation of interiors, with the depressing result which is notorious. Mr. D. M. Nesbit, the President of the Institution, observed recently in his address to the members that domestic hot-water circulating work in this country has not received the amount of attention and development it deserves. The first step to improvement in this respect is the deliverance of hot water and steam heating and ventilation practice from the domination of Society plumbers. The next is to convince architects and influential people generally as to the importance of this branch of sanitation; so that it shall not continue to remain, like the artificial lighting, an afterthought in building. The appearance of the steam radiator in English buildings is still exceptional; but there are indications that it may in the immediate future run the gas-fire hard. It has already put the unwieldy hot-water heating coil in the shade. The standardization of radiators and their connections is already demanded; and the next few years may not impossibly see the warming and ventilation of town buildings placed upon the same degree of importance as the style of architecture of the frontage.

Pictet's New Oxygen Process.

It is reported from America that Professor Raoul Pictet, of Geneva, whose name is identified with the early liquefaction of air and other gases, has recently demonstrated a method of his own invention for the separation of the oxygen and nitrogen of the air at ordinary pressure and on a commercial scale. The process is described as simplicity itself. It begins with an initial production of a certain quantity of liquid air, which is stored in tubes. Then through this is forced a stream of air under a pressure of only about 1 atmosphere. This air is cooled by the liquid air; and as it escapes into a chamber beyond the refrigerator the two gases of which it is composed separate themselves by gravity only, and pass off at different levels. The oxygen, being slightly the heavier, flows off at the lower tube, while the nitrogen leaves by the higher pipe. In addition, the carbonic acid of the air is reduced by the low temperature to the liquid form, and runs off in this state. In the commercial machine, it is expected that, with an expenditure of 500-horse power, the daily output will be 500,000 cubic feet of oxygen, with corresponding yields of nitrogen and liquid carbonic acid. The last-named product is already a marketable commodity. A market for the oxygen in bulk has to be found. Professor Pictet proposes to apply it to the promotion of combustion at high temperatures, when the furnaces so worked might compete with those utilizing the electric arc. The nitrogen can be used for the production of nitric acid, and possibly in the synthesis of ammonia.

A New Paint Medium.

It is reported that a French Chemist, M. Le Roy, has suggested an innovation on the time-honoured preparation of paints for structural uses, by the substitution of a chloride of carbon, more particularly the compound known as carbon tetrachloride, for the turpentine or other spirit generally used as a solvent or diluent. The suggested turpentine substitute is described as a limpid, colourless fluid, boiling at 170° Fahr., and having a specific gravity of 1·56 (water being unity). Thus it is very volatile—much more so than turpentine, which boils at 330° Fahr.; while it is not inflammable, and its density is great. Both turpentine and methylated spirit are lighter than water—the spirit used to dissolve hard varnishes conspicuously so; and therefore when any paint containing a heavy pigment is mixed with them the colour soon falls down, and the paint must be frequently stirred to preserve its intended physical character. This is not always done by the painter. Carbon tetrachloride, being much heavier than water, tends to bring the specific gravity of the liquid portion of the paint nearer to that of the pigment itself, thus preventing rapid settlement. The advantage of a non-inflammable paint thinner is obvious; while the greater volatility of the carbon compound helps to make the paint or varnish dry more quickly. Moreover, the carbon tetrachloride can be employed in any proportions with all the usual paint solvents, including carbon bisulphide. The varnishes made with it are claimed to be exceptionally hard and brilliant. The cost is not stated.

Vacuum Steam Heating.

It appears from the proceedings at the last meetings of the Institution of Heating and Ventilating Engineers, that the latest approved kind of systematic warming apparatus for interiors is steam-heat radiation, at or below atmospheric pressure. Mr. Nesbit recommended this system of heating in a paper read at the January meeting of the Institution; and the subject was discussed at the meeting last month. It seems to be the outcome of a good deal of practical experience of different methods of systematic heating; and it is declared to be free from most of the defects of other methods. A feature of it is that all air is thoroughly extracted from the radiators and the piping; and air is the cause of most of the troubles of steam heating plants. Another advantage is the noiselessness of steam circulating at such low pressures. Exhaust steam from an engine can be adapted for heating in this way without throwing any back-pressure. In fact, the work of heating is done almost entirely by the latent heat; the condensed water coming back at very near boiling-point. Mr. Nesbit claims that very great economy of fuel over every other system of heating, is attainable by the vacuum plan of steam circulation, which, of course, entails an exhauster or vacuum pump. This is no great consideration for a large building or block of buildings; and the new system accordingly seems to be the most formidable rival to gas heating yet introduced for town use. It is at least something with which the sellers of town's gas must reckon in the near future, and is one more proof that gas does not enjoy a monopoly.

New Competitors with Gas.

Attention was lately drawn in this column to the appearance of a new competitor with the gas-cooking stove, in the petroleum "blue-flame," or wickless heating burner. Already these newcomers are making a large and increasing showing in the "Ironmonger" advertising pages. Gas manufacturers and their "sundrymen" are thus menaced with a novel and possibly highly effective form of competition, which can only be met in the ordinary commercial way by keeping up the standard of gas kitchener design and keeping down the price both of the gas and of the apparatus for burning it. Obviously, the way in which ironmongers have in most towns lost the trade in gas-stoves will inspire them with the desire to push the sale of the oil-heater, for which they also supply the fuel. While oil cooking and heating stoves, with wicks, are being offered as usual in new patterns for the season's trade, there are also being advertised oil brass and iron melting furnaces, and petroleum vapour cookers "of entirely novel construction," and of various makes. There are oil water-heaters on the "geyser" principle; and it is unnecessary to more than mention the vogue of the oil-engine. Lastly, in Germany at least, considerable headway is reported in the trade in incandescent spirit lamp lighting, which is recognized as a powerful rival to acetylene lighting. There is no prohibitive duty on alcohol in Germany; and consequently large quantities of spirit are used for industrial purposes. One of the most interesting of these is that of lighting with the aid of cheap incandescent mantles, thus making a portable light of high illuminating power and low cost.

Success with Water-Meters.

The town of Lexington, Kentucky, was reported by Mr. S. A. Charles to the American Water-Works Association as having 99 per cent. of the consumers' services metered. This is the result of 15 years' experience; and Mr. Charles strongly recommends the system. Success, it is admitted, largely depends upon the method of administration. The meters should be the property of the company or corporation, who can then keep them in working order; and they should be all of one make if possible. They should be fixed in boxes in the footpaths; so as to be readily accessible without troubling the householder. Portable testing plant, for the occasional satisfaction of the consumer, is provided in the shape of a tank containing 10 cubic feet. The Lexington meters are all geared to register only 99 per cent. of the water passing through them, which means that at ordinary temperatures the registration will always be in favour of the consumer. A common objection to a metered water supply is the complication of the accounts. This is obviated in Lexington as much as possible by making all entries in numbers instead of by names. Thus all accounts are made out to the number of the meter, not to the name of the consumer. One inspector indexes from 300 to 400 meters per day, reading to the nearest 100 cubic feet, except in the case of a final settlement. The system is strongly recommended for new districts, especially if of an industrial character, as preventing much discontent. It is obvious, however, that with town's water as cheap as it usually is in England, such a system would be an unnecessary expense to the consumer.

Some Particulars of Electric Incandescent Lamps.

Some interesting particulars of the incandescent electric lamp trade of America have been supplied to the Franklin Institute by Mr. Francis W. Willcox. Naturally, Mr. Willcox believes there was no such thing as ornamental or decorative illumination before the advent of electric lighting—probably never having seen an old French cut-glass chandelier. He remarks truly enough, however, that the adaptability of the incandescent electric lamp is greatly in excess of anything possible with other means of artificial lighting. A whole new field was opened by the production of miniature electric lamps, which are made of all shapes and sizes down to the "pea" lamp—no larger than a fair-sized pea, and ranging as low as one-quarter candle-power. One of the latest applications of these small lamps is to the telephone service, thus replacing the noisy bell signal by a silent flash of light. This is a boon to humanity. Actually, the regular trade knows lamps of nine different candle power ratings, three different economies, and at least six different bases. This makes 162 distinct types. Multiplied by the 50 different voltages recognized, there are thus 8100 distinct types of lamps in the ordinary trade—to say nothing of special orders. It is claimed that in

American electric lighting practice, the supply companies have taken the free renewal of lamps into their own hands, with the best results to the lamp trade. The rule is to renew the consumers' lamps whenever they show a falling off of 20 per cent. of their original rated illuminating power. The practical lifetime of all the leading makes of lamps is determined experimentally. So-called 16-candle power incandescent electric lamps are reported good so long as they do not fall below 12-candle power actual.

"The Law of London Gas Companies."—Under this title, Mr. Thomas J. Barnes, of the Middle Temple, has just published through the office of the "JOURNAL," as announced elsewhere, a synopsis of the public and private statutes affecting the Metropolitan Gas Companies, with comments and a short history. The book, to which we shall refer at greater length next week, is a section only, considerably varied for the present purpose, of a more comprehensive work on the whole law of lighting, which is practically ready for the Press.

Midland Association of Gas Managers.—The spring meeting of this Association will, as already announced, take place at Stafford next Thursday; and, though the amount of business to be transacted will be very small, the proceedings will be invested with special interest, inasmuch as the President (Mr. J. Ferguson Bell) will be the recipient of the hearty congratulations of his colleagues on his appointment to the position of Engineer and Manager of the Derby Gas Company. According to the programme issued by the Hon. Secretary (Mr. C. Meiklejohn, of Rugby), the members will be received by the Mayor (Alderman W. C. T. Mynors), who is Chairman of the Gas and Electricity Committee, and Alderman Wright, J.P., in the Council Chamber, shortly after noon. When the routine business has been transacted, they will proceed to the gas and electricity works of the Corporation, over which they will be conducted by Mr. Bell. In the afternoon, brakes will be provided to convey the party to Cannock Chase, Shugborough, and through Ingestre Park (the seats of the Earls of Lichfield and Shrewsbury), to Sandon, and thence back to Stafford. In the evening, the members will dine at the Swan Hotel, at the invitation of Mr. Bell.

The Electricity Generating Plant at the Paris Exhibition.—Although the electric lighting plant at the Paris Exhibition has not been "up to time," there is a manifestation of a determination to show that it is at all events "up to date," for the Editors of the two principal Paris electrical papers—M. Hospitalier, of "L'Industrie Electrique," and M. Montpellier, of "L'Electricien"—are, with the assistance of 33 well-known engineers and writers on electro-technical subjects, publishing in a series of numbers a complete account of the installation. Owing to the backwardness of the arrangements at the Exhibition, only one number has appeared; but our contemporary the "Electrician" says that if the remainder attain the same standard of excellence and command of detail as this, the publication will be a valuable one. It furnishes particulars as to the general organization of the electricity supply service, from which it appears that the total output is 20,245 kilowatts, necessitating altogether 36,155 indicated horse power at the engines. It is gratifying to find that, notwithstanding the encouragement which was doubtless given to French and German firms to do their best at this great show, the largest output of electricity is made by two British firms—Messrs. Siemens Bros., Limited, and Messrs. Willans and Robinson, Limited—the 2400-horse power engine of the latter coupled to the 1340-kilowatt dynamo of the former sending out 2630 ampères of continu ous current at 500 volts. This is not the biggest set in the Palace of Electricity; and its large output is due to its high speed.

British Association of Water-Works Engineers.—The fifth annual general meeting of the Association will be held at Cardiff, on the 19th inst. and three following days, under the presidency of Mr. C. H. Priestley, the Water Engineer to the Corporation. According to the programme issued by the Secretary (Mr. Percy Griffith), the proceedings will be opened in the Council Chamber of the Town Hall with a reception by the Mayor (Mr. S. A. Brain, J.P.), who will welcome the Association to Cardiff. The business will be transacted at the South Wales Institute of Engineers. Two papers will be read—viz., "The Rating of Water Undertakings," by Mr. F. J. Bancroft, B.Sc., of Hull; "The Relationship between the Cost of Water Wasted and the Cost of Detection and Prevention of Waste," by Mr. A. J. Jenkins, formerly Assistant Water Engineer at Cardiff. In addition, there will be a lecture by Dr. A. C. Elliott, Professor of Engineering in the University College of South Wales, on "The Strength of Bricks and Brickwork," with demonstrations on the 100-ton testing machine; and descriptions of the Cardiff, Pontypridd, Rhondda, and Barry Water-Works will be circulated. The visits and social functions include inspections of the Bute Docks, the Barry Docks and Water-Works, the Dowlais Iron-Works, the Cardiff Water-Works, the Lewis Merthyr Collieries, and the Merthyr Tydfil Water-Works; the annual dinner at the Esplanade Hotel, Penarth, on the evening of the 20th; and various luncheons. For members remaining over Saturday, the 23rd, pleasant steamboat excursions could be arranged. The meeting promises to be a most instructive and enjoyable one for all able to take part in it.

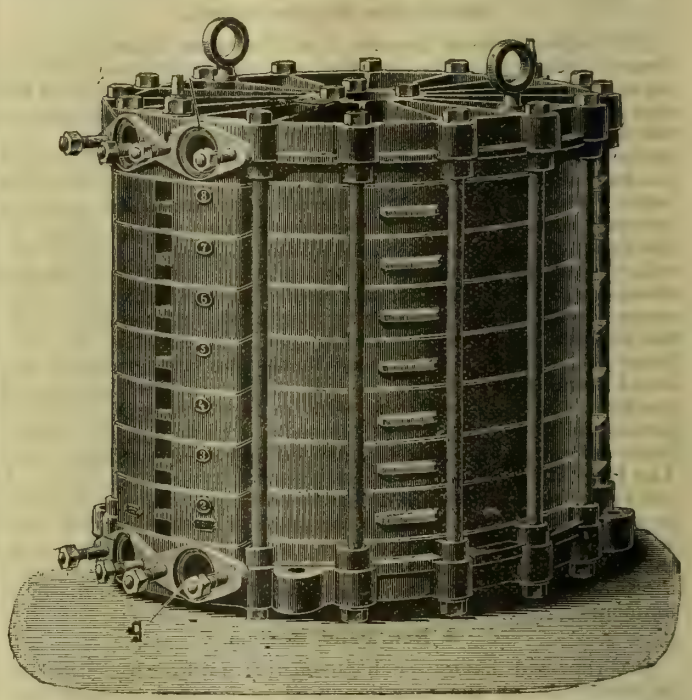
COMMUNICATED ARTICLE.

A GERMAN FORM OF CONDENSER.

By THEODOR HILLER, of Charlottenburg.

Making gas from English coals, it sometimes happens that naphthalene appears in a disagreeable manner and quantity in our gas-mains. However sufficiently cooled, great quantities of naphthalene deposits are at times found in the connections between the condenser-washers and the scrubbers; so that blocked service pipes interrupt the gas supply.

To avoid producing naphthalene, as well as to get out most of the ammonia from the gas, an ammonia-water condenser is employed at my works, manufactured by Messrs. Pape, Henneberg, and Co., of Hamburg. As shown in the engraving, the apparatus is constructed of cast-iron plates fitted on both sides with channels in spiral shape. These plates are put upon one another; and the channels of two neighbour-plates are separated by wrought-iron sheets in order to communicate heat from one channel to the next. The channels of one plate communicate with the channels of the next plate by small chambers cast into the plates. By this device, there are secured two connecting channel-ways, one for the ammonia water, in order to be cooled, the other one for the cooling water itself. Both fluids pass through the apparatus pretty quickly, in contrary directions; being separated only by the temperature-sheets, which are made of wrought iron.



The device secures a splendid exchange of warmth, and completely cools in the same way, as can be seen from the following figures: The ammonia water, 15 litres a minute, enters at a temperature of 30° R. into the condenser, and leaves it at 13·5° R. The cooling water enters at a temperature of 12° R., and leaves at 13·5° R. The apparatus, however, is easily able to deal with a quantity of 40 litres a minute. Therefore, it possesses in the Charlottenburg Gas-Works 2·7 times more cooling capacity than will cool the ammonia water down to the desired temperature.

Referring to the content of ammonia in the coal gas, the following particulars may be mentioned. By using the ammonia-condenser and working in the "Standard" washer-scrubbers with cooled ammonia water, the content of ammonia is thus stated: Entering the "Standard" washers, the gas contained 241 grammes of ammonia; and leaving the scrubbers, there was only found 1 gramme of ammonia per 100 cubic metres of gas—a record that at no former time has ever been reached. Meantime deposits of naphthalene were not noticed.

By introducing these condensers, we obtain a considerable augmentation of ammonia water, by which the pecuniary returns from that product have largely increased. The capital outlay for the condensers is soon covered by the larger income from the increased ammonia water. They need only a small place for installation, do not require any attendant, and can be easily dismounted for cleaning purposes. The cooling water may be used afterwards for several kinds of purposes—for instance, as feed-water to boilers, for extinguishing coke, and so on.

The value of the services rendered by Mr. John Chew as Gas Engineer to the Blackpool Corporation have been frequently deservedly recognized by members of that body, and especially by those constituting the Gas Committee. We are pleased to find, therefore, that the appreciation of the latter was testified at their last meeting by an advance of £100 per annum in Mr. Chew's salary.

TECHNICAL RECORD.

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

Excursion Meeting in Bristol.

The Spring Meeting of the above-named Association was held in Bristol last Thursday, under the presidency of Mr. D. Irving, Assoc.M.Inst.C.E., the Superintendent of the Stapleton Road works of the Bristol Gas Company. There was a good attendance of members and friends. At the invitation of the President, luncheon was partaken of at the Royal Hotel, when the usual loyal toast was cordially honoured, accompanied by the singing of the National Anthem. Mr. C. C. Carpenter proposed "The President;" and the toast was heartily received. In responding, Mr. Irving remarked that the Southern District Association had been most favoured in its meetings. On the last occasion they heard the heart-cheering tidings of the relief of Ladysmith; and now they had the additional glad news that Lord Roberts was almost in possession of Pretoria. The Hon. Secretary (Mr. J. W. Helps) then read a description, prepared by the President, of the arrangements made for the prevention of electrolysis in the gas and water mains in Bristol. This will be found on p. 1501. At the close of the business, the members paid a visit to the St. George and city electric power stations, and drove through Clifton to the Zoological Gardens, where high-tea was served. The weather was fine, and a most enjoyable day was spent—the beautiful neighbourhood of Clifton being seen at its best.

THE GUIDE-FRAMING OF GASHOLDERS.

The following is an abstract translation of a paper on this subject by Herr Hacker, of Berlin, which originally appeared in the "Journal of the Association of German Engineers," and has been reproduced by our Austrian contemporary "Der Gastechniker."

I.—*Uncertainty as to the Distribution of the Pressure of the Wind on the Ordinary Guide-Framing.*

It is impossible to determine exactly the pressures which have to be taken up by any one roller of a gasholder which is guided by a large number of rollers and is exposed to the force of gales and the weight of snow. Even though every scientific means be used to estimate these pressures, the result will not be reliable; for in the estimation it will necessarily have been assumed that the rollers bear closely on their guide-rails, whereas in structures of such magnitude as gasholders, the most exact construction does not make this possible. When the holder stands at a given height, and the temperature is known, the exact bearing of the rollers on the guides can be attained by means of adjustable rollers; but when the holder is at some other height, or the temperature is different, the rollers will no longer bear closely on the guides. The iron structure of the holder and the surrounding framing rapidly respond to fluctuations of temperature, and expand or contract accordingly; whereas the substructure of the framing, which is below the level of the ground, undergoes little or no change of form on the same account. In addition, the bell is subjected to changes of form due to the force of gales and to the radiation of the sun striking on one side of it.

These considerations make it evident that very precisely adjusted rollers must result in jamming. In actual cases in point, it will be noticed that only about 3 out of 18 or 24 rollers are in contact with their guides; while there is a clear interval between the other rollers and the guides. Hence the material is subjected to very great strains. If in fig. 1 the larger circle is taken to represent the guiding surfaces of the guide-rails, and the smaller circle the similar surfaces of the guide-rollers on the



Fig 1.

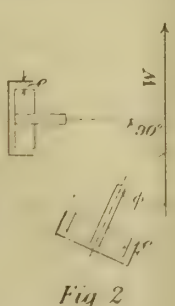


Fig 2

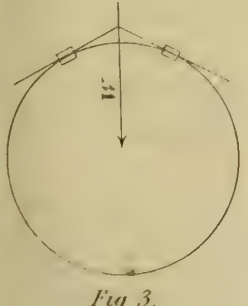


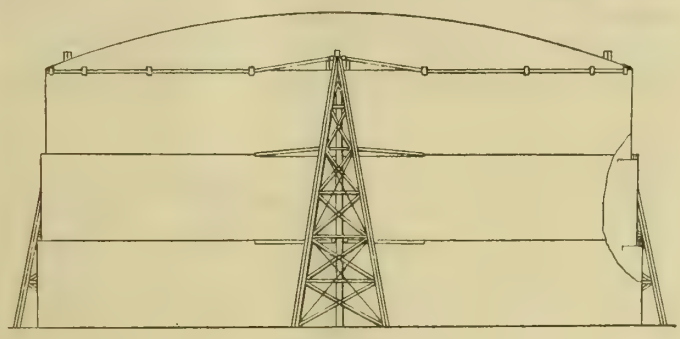
Fig 3.

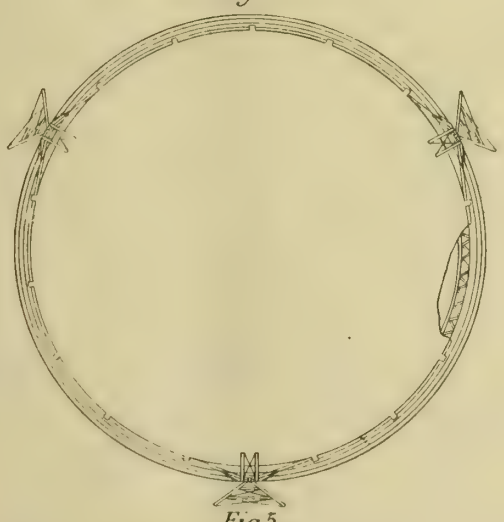
rigid crown of the holder, then for any given direction of the wind there is only one roller, which takes up the whole of the pressure. That this is so may be readily seen if the case is regarded in which the wind throws the holder from one side to the other, when the lower curb, on account of the water which has to be displaced, follows the movement of the upper part slowly. Thus a great shock occurs, just as, for example, when snow slides off from one side of a holder when in use, a standard on the opposite side snaps. The flexibility which the cups afford favours the assumption that their radial rollers grip the guides better than those of the crown; but in this case, also, distribution of the pressure on a greater number of rollers can by no means be relied upon. With tangential rollers it is much the same. If in fig. 2 the axis of one tangential roller is regarded as inclined by 90°, and that of another by ϕ to the direction of the wind, while the indispensable play e is equally great for all the rollers, then the first roller has to traverse a distance e and the second a distance e sec. ϕ in order to make contact with their guides. The latter distance is the greater; therefore the first roller alone comes in contact, and the whole pressure actually has to be borne by two rollers.

In the case of a flexible cup, it is quite possible that other rollers will also come in contact with their guides, but the effect is questionable. Indeed, if the construction is not very exact, it is not improbable that two rollers not far distant from one another will first make contact, as is shown in fig. 3, and will have to bear the whole force of the wind at a very high pressure. Such a case may readily happen with flexible cups, as the force of the wind presses in that part of the wall of the gasholder on which it strikes, and so tends to flatten it. The distance between two rollers may thus be so much increased, that, if only the usual small amount of play exists, they will be pressed against the guides; while the other rollers will not touch their guides.

II.—*Three Independent Columns for Guiding a Gasholder.*

The evils indicated in the foregoing can be avoided by guiding the holder at three places only, as is pourtrayed in figs. 4 and 5. The crown of the holder is circumscribed by a rim, which engages with the columns through guide rollers, as is shown in fig. 6. Both rim and rollers are supported by the top curb; but are not rigidly fastened to it. The rollers R are guided by the column E, and are attached to a frame A, which is supported by the bearers B secured to the crown, and is so arranged


Fig. 4.


Fig. 5.

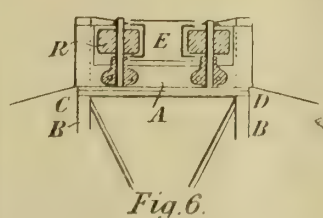


Fig. 6.

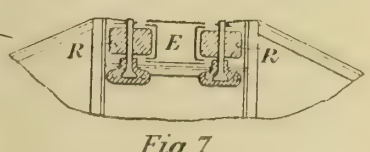


Fig. 7.

that it can slide on the base C D. The spindles of the rollers can move to and fro in their bearings. Tangential contact only can occur, not radial contact. In order that the bell may not be able to turn completely within the rim, the latter is rigidly fixed to it at a point about midway between two columns; elsewhere it is retained by eyes only to the crown of the bell.

Supposing the holder is inclined to one side, it rests for a long distance on the rim, which takes up the pressure. If the wind heaves it over from one side to the other, the first force of

the shock is taken up by the stretching of the rim, which had not previously been strained; and thus the effect of the shock on the rollers and their carriages is much diminished. For the cups, it appears more advantageous to make the rim of angle-iron; and to connect it by lattice work with the cup, as is shown at the right-hand side in fig. 5. The cups are thereby stiffened, and protected against severe deflection.

The forces at the standards are transmitted to the outer cups by plates in frames of angle-iron, 20 to 26 feet long, joined to the cups by a large number of rivets, so that no single rivet is subjected to excessive strain. For the guiding of the rollers which are at the cups, provision is made for the transmission not only of tangential but also of radial pressure to the standards. These rollers are therefore rigidly fixed, as shown in fig. 7.

As the encompassing fence of framing hitherto common is replaced by only three columns, this method of guiding costs, inclusive of rims, rollers, &c., less than half the usual method —even if the unsubstantiated distribution of pressure on the rollers is assumed in the case of the latter, and no account is taken of the above-mentioned lessening of the shock. In both instances, the same co-efficient of tensile strength of iron, and the same pressures of wind and of snow, have to be taken.

The crown and cups may be inspected when in any position by means of a winding stair alongside one of the columns, and a short step. For ready access to the cups, the rims mentioned above may be shifted towards the outside instead of the inside, and protected by means of plates. Railings could be fixed to the cups, so that the one on the lower cup projects beyond that on the upper; and, consequently, the railings would slide one within the other when the cups were in their lowermost positions. The lifts might be, as usual, guided against one another and the tank, by means of tangential or radial rollers running on guide-rails.

III.—*Calculation of the Ring round the Crown, and of the Forces transmitted to the Columns.*

The calculation of the ring round the crown, and of the forces transmitted by it through its rollers to the columns, is very simple. There are but three forces, in a tangential direction, which have to be taken up by the standards; and these are readily ascertained from the three static equations which are

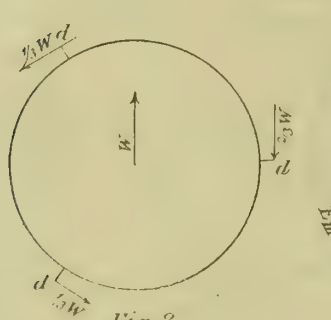


Fig. 8.

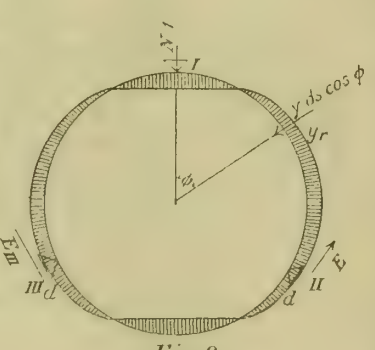


Fig. 9.

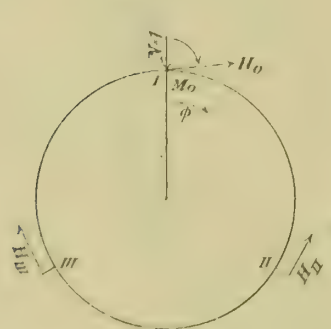


Fig 10.

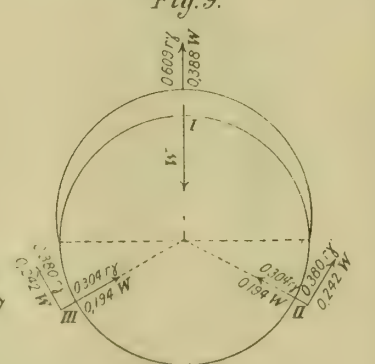


Fig 11.

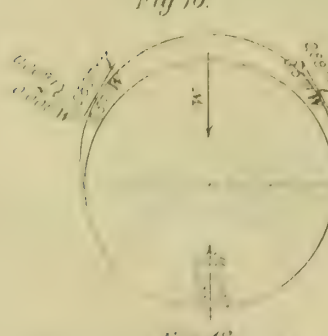


Fig 12.

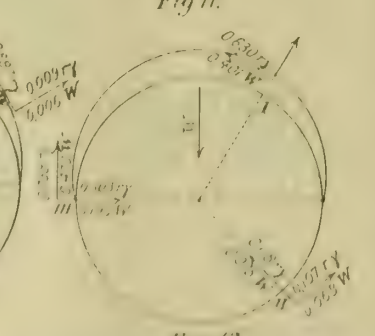


Fig 13.

applicable to the case. The greatest force occurs with the wind in the direction shown in fig. 8, and amounts to two-thirds of the total thrust W due to the wind pressure. The strength of the ring must be calculated on this basis. The forces which the cups transmit to the columns are not so readily determined. These forces are not only directed tangentially, but, on account of the elasticity of the cups, radially also. The cups must be regarded as consisting of elastic rings, to which are fastened at equidistant points three stays, which are hinged at their ends *d* (fig. 8) to fixed points—viz., the middle of the guide-columns. The resistances exerted at the points *d* on the columns may be each resolved into a radial force N, and a force H at right angles thereto. There are then six unknown quantities, and only three static equations embodying them. The problem is, therefore, insoluble. But it is to be observed that the three forces N—but not the three forces H—have to be regarded as statically supernumerary; for, in certain directions of the wind, one of the forces N would suffice to take up the pressure of wind.

The three forces N might be determined in various ways, but best of all by the application of Maxwell's law in the following manner. It is first assumed that the point *d* may be radically shifted; and it is then determined what radial displacements a force N_1 directed on the column I effects at any point of the ring. These radial displacements are shown by the shaded surfaces in fig. 9. If γ is the pressure of the wind on that unit length of the ring which is at right angles to the direction of the wind, then there falls on the stretch *ds* of the ring, which makes an angle ϕ at the centre with the direction of the wind, a normal pressure $\gamma \cos \phi \, ds$. Supposing the radial displacement at this position is y_r, the radial displacement resulting therefrom at N_1 is $\gamma \, ds \cos \phi \, y_r$. In this manner, the displacement produced at N_1 by the total pressure of the wind may further be found. The pressure of the wind, however, likewise produces radial, and at first unknown, forces N_{II} and N_{III} on the columns II. and III. These forces may be determined in the manner indicated above for the displacement caused at N_1; and they may be expressed by N_{II} and N_{III}. The point I does not become displaced radially; and one must, therefore, assume that there is there a force N_1 such that it throws back this point into its original position, and that this displacement for $N_1 = N_1 = 1$, and that the displacements are proportional to the forces. The same method of investigation can be applied to the columns II. and III.; and in this manner three equations can be found, from which the three unknown forces N_1, N_{II}, and N_{III}, and their reactions at H_1, H_{II}, and H_{III}, can be ascertained.

To find out the displacements of a force N = 1, let us imagine the force operating at I in fig. 10, and directed radially inwards, and, further, the ring cut through directly on both sides of the support. Then, in virtue of symmetry, there acts at each cut end, a force $\frac{N}{2}$, an unknown moment M_0, and an unknown tangential power H_0—both positive in the sense indicated in fig. 10. If y_r is the displacement of a point radially, then $\frac{d^2 y_r}{ds^2} = \frac{M}{EJ}$ in which M is the moment at this point, E the modulus of elasticity, and J the moment of inertia of the ring. As the ring is formed of bar-iron work, the dimension J can be sufficiently exactly found by taking for the calculation the two webs only. E and J might be assumed to be invariable.

$$\text{From } \frac{dy^2}{ds^2} = \frac{M}{EJ} \text{ we get}$$

$$\frac{dy}{ds} = \int \frac{M}{EJ} \, ds = \int \frac{M}{EJ} \, r d\phi$$

It is required to determine the displacements denoted in fig. 10 horizontally and taken as positive to the right with y_w, and the values at right angles taken as positive upwards with y_1.

The origin of the ordinates may be at I. The *x*-values may be regarded as positive for y_w to the right, and for y_1 downwards. Then we have further $\frac{dy_r}{ds} = \frac{dy_w}{dx} = \frac{dy_1}{dx}$. These values denote the angles between the line of flexure and the circle, which are equally great for each system of co-ordinates.

From the above, it follows:—

$$y_w = \int \frac{dy_w}{dx} \, dx = \int \frac{M r d\phi}{EJ} \, dx$$

and as $dx = r d\phi \sin \phi$

$$Y_w = \frac{r^2}{EJ} \int M \sin \phi \, d\phi$$

Similarly it is found that

$$y_1 = \frac{r^2}{EJ} \int M \cos \phi \, d\phi$$

and finally

$$y_v = y_w \sin \phi + y_1 \cos \phi.$$

Moreover,

$$M = M_0 + H_0 r (1 - \cos \phi) - \frac{Nr}{2} \sin \phi$$

For $\phi > 120°$ there is still at M the moment for H_1. It is $H_1 = \frac{3}{4} \sqrt{\frac{3}{4}} N$. If the length of the support is assumed to be on the average $0{\cdot}04r$, then the moment for H_1 is equal $-H_1 r (1{\cdot}04 - \cos \phi_1)$ where $\phi_1 = \phi - 120°$.

It would go beyond the limits of this paper to proceed further with the calculation; and it need only be observed that the constants of the integrals and the unknown values for H_0 and M_0 are to be determined from the following conditions:—

1.—For $\phi = 0$ and $\phi = 180°$

$$\frac{dy_w}{dx}, \frac{dy_1}{dx} \text{ and } y_w \text{ are} = 0$$

2.—The ends *d* of the supports at the points II. and III. for $\phi = 120°$ and $= -120°$ can only be displaced in a radial direction.

The radial displacements are found with N = 1, for ϕ between 0 and 120° thus:

$$y_r = \frac{r^2}{EJ}\left(M_o + H_o r\left(1 - \frac{\phi}{2}\sin\phi\right) - \frac{\bar{N}r}{2}\left(\sin\frac{\phi}{2} - \frac{\phi}{2}\cos\phi\right)\right) + C\cos\phi$$

and for ϕ between 120° and 240°, thus:

$$y_r = -\frac{H_1 r^3}{EJ}\left(1{\cdot}04\,(1 - \cos\phi_1) - \frac{\phi_1}{2}\sin\phi_1\right)$$

in which $\phi_1 = \phi - 120°$; $\bar{N} = 1$; $M_o = 0{\cdot}28363r$; $H_o = 0{\cdot}07568$; $H_1 = 0{\cdot}57735$; $C = -0{\cdot}44002r$. The force $\bar{N} = 1$ shifts its point of application radially by $\frac{-0{\cdot}08071r^3}{EJ}$, and the points of the ring on both columns II. and III. by $\frac{0{\cdot}03239r^3}{EJ}$

If the direction of the wind forms with the radius, with $q = 0$, the angle α, the normal wind pressure on a length of the ring ds is equal to $\gamma r d\phi \cos(\phi \pm \alpha)$. With this value the formulæ I. and II. are to be multiplied, for integration within the pressure of the wind extending over a semicircle, and so proceeding to the determination of the unknown normal forces N on the supports, as is shown above. In figs. 10, 11, and 12, the results are given for three cases, and for twelve directions of the wind, in which W denotes the total wind pressure, equal to $\frac{\pi}{2} r^1, \gamma$.

IV.—*Strain of the Cups.*

The bending strains, which the cups have to withstand in virtue of their taking up the pressure of the wind and transmitting it to the columns, are similarly determined. The ring is again regarded as severed at one point; and by estimating the unknown forces and moments at that point, having regard to the given wind pressure, equations and integrals are obtained for the deflections. The conditions which the latter impose on the columns then lead up to the determination of the unknown forces, moments, and integral constants, as well as the resulting deflections. Only that case which produces the greatest strains need be taken into consideration here—viz., when the wind pressure bears as far as possible obliquely on the cups. This occurs with the direction of the wind, shown in fig. 11.

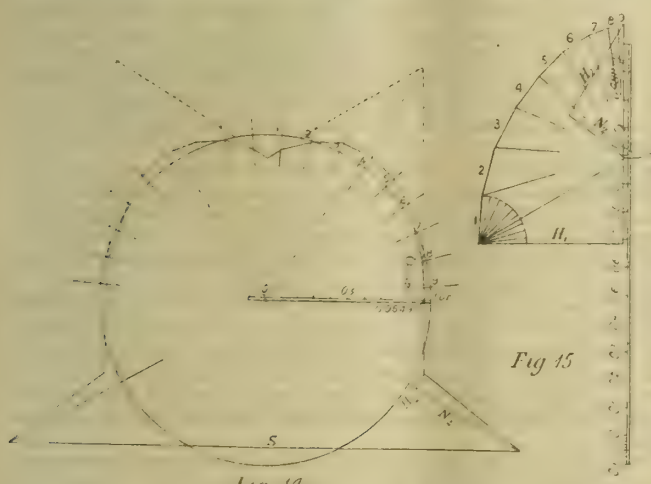


Fig 14.

Fig 15

A pressure line for the wind pressure, according to these calculations, is shown in fig. 14, and a plan of the forces for the wind pressure in fig. 15. These will be seen to agree, if allowance is made for the small errors of every graphic construction. In the left-hand lower corner of fig. 15, the value of the wind pressure decreasing to cos ϕ can be measured off. Exact calculation gives the moments at column I. as follows: For $\phi = 0$: $-0{\cdot}0627\,r^2\gamma$; for $\phi = 35° 55'$: $+0{\cdot}0298\,r^2\gamma$; and for $\phi = 88° 30'$: $-0{\cdot}0312\,r^2\gamma$. The latter is the greatest moment between the columns. It is made up of a force $H = 0{\cdot}4811\,r\gamma$, and an arm of a lever $0{\cdot}0649\,r$, which can be checked by subsequent measurements by the polygon of forces. For example, if the radius of the cup is 27 metres, the height of the lift 8 metres, and the wind pressure 200 kilos. per square metre, then

$$M \text{ max} = 0{\cdot}0312 r^2\gamma = 0{\cdot}0312 \times 2700^2 \times \frac{200 \times 8}{100} =$$

3640·500 kilo-centimetres.

On account of the share taken by the second cup, about 3500·000 kilo-metres may be taken into calculation. If the structure of the rings, measured horizontally—*i.e.*, into the cups in addition to the ring—amounts to 150 centimetres, it gives this an elasticity of $\frac{3500{\cdot}000}{150}$ 23·333 kilos. For this the ring attached to the cups must, for a strain of 1000 kilos. per square centimetre, have an effective cross section of 23·33 square centimetres. As pointed out above, under heading II., special stiffening of the columns is necessary on account of the greater maximum moment of $-0{\cdot}0627r^2\gamma$. With the height of the cups taken at 150 centimetres the deflections are trifling—only 3 centimetres, and they are even diminished further by the supporting action of the gas pressure.

ELECTROLYSIS IN GAS AND WATER MAINS.

The Bristol Method for its Prevention.

At the Meeting of the Southern District Association of Gas Engineers and Managers in Bristol last Thursday, the following paper, prepared by the President (Mr. D. Irving), was read.

The introduction of electric traction in the crowded streets of our large cities naturally caused considerable apprehension to the various gas, water, lighting, telegraph, and telephone companies who were already in possession of the subsoil. Grave fears were entertained, and not without reason, for the safety of the mains and cables of these companies. The Bristol Tramways Company being one of the pioneers in the introduction of electric traction in England, it was thought that a brief account of the regulations made by Parliament in the Acts of the Company, and the regulations issued and enforced by the Board of Trade, for the protection of the mains of the Water and Gas Companies concerned, and of how these regulations had been practically carried out by the Traction Company, would be of interest to the members of this Association, especially as electric traction is now being so largely adopted throughout the country.

With electric lighting systems, whether the supply is high-tension alternating currents or high or low tension continuous currents, all conductors are continuously insulated throughout their entire length, and, as a rule, in the best possible manner, with the result that it is not probable, and some electricians say not possible, that there should be any stray current to escape that would seriously affect gas and water pipes. It will be readily understood that where such leakage does take place the fault is immediately developed, and the main is at once automatically burned out, cutting off the current. The slightest leakage can also easily be detected by the daily tests. And, further, it is evidently of such vital importance to the electric lighting undertaking to prevent all such loss, that they may safely be relied upon to guard their own interests.

It is now generally accepted that with well insulated and strongly armoured cables and connections no fear of electrolysis of water or gas mains need be feared from lighting installations. The electric system employed for traction generally is the continuous uninsulated one. The overhead trolley wire is fed from the positive pole of the generator; the current passes through the motors fixed under the cars, performing its work of propelling, and is then delivered to the rails, which, as you know, are connected to earth throughout their entire length. Up to this point the circuit current is confined to a definite path; but on reaching the rails the trouble begins. The current may follow the rail back to the power station, or ramify through the earth to the nearest water or gas main—always, of course, like all forms of pent-up energy, taking the path of least resistance. It is the current passing from one metallic body to another, especially when embedded in certain classes of city earth, that causes electrolysis of rails and pipes. If the current in running along the rail reaches an open joint, it will pass into the earth and back into the rail or nearest pipe, and so on in and out.

It will be at once seen that the whole question of leakage and electrolysis depends upon the proper electrical bonding of the rails, which are sufficient in themselves, except on very large sections, and offer abundant conductivity to carry the current. The bonding of these rails has been a matter of much study and gradual development. Great improvements have been made since the first introduction of electric traction in this country. The tram rails in Bristol have a sectional area of 8·9 inches, and are "fished" together with no less than five plates—one on each side of the web in the usual manner, and one covering the entire under side and two strips on the upper side of the bottom flange of the rail, bolted up with 14 bolts. The rails are double bonded at each joint with copper bonds $\frac{7}{16}$ inch diameter, electrically connected to the web of each rail. There is also a third electric connection formed by Edison's plastic bond, carefully prepared and fixed between the rail and the fish-plates. In addition to these bonds, and in order to make certain of one continuous conductor, a double cross copper bond is fixed every 120 feet length of rail, so that, should any individual rail bond fail, the cross bonds, which are each $\frac{7}{16}$ inch diameter, will take up the current. No less than 7s. per single joint is being spent on electric bonds by the Traction Company, in order to secure the property of their neighbours and the economical and profitable working of their own undertaking.

In addition to this careful and improved system of bonding rails, so as to retain the return current and make the rails the way of least resistance, a "booster" has been introduced by the Consulting Engineer of the Tramways Company, whereby the negative current is drawn from the tram rail very much in the form of a gas-exhauster drawing gas.

In the Bristol Tramways Act, 1894 (57 & 58 Vict.), the following clauses, forming part of section 31, were inserted for the protection of the Bristol Gas and Water and other Companies:—

1.—The Company shall employ either insulated returns or uninsulated metallic returns of low resistance.

2.—The Company shall take all reasonable precautions in constructing, placing, and maintaining their electric lines and circuits, and other work of all descriptions, and also in working their undertaking, so as not injuriously to affect, by fusion or electrolytic action, any gas or water pipes, or other metallic pipes, structures, or substances.

3.—The exercise of the powers by this Act conferred with respect to the use of electric power shall be subject to the regulations set forth in the first

schedule to this Act, and to any regulations which may be added thereto or substituted therefor respectively by any order which the Board of Trade may, and which they are empowered to, make from time to time, as or when they may think fit, for regulating the employment of insulated returns, or of uninsulated metallic returns of low resistance, for preventing fusion or injurious electrolytic action of or on gas or water pipes, or other metallic pipes, structures, or substances, and for minimizing, as far as is reasonably practicable, injurious interference with the electric wires, lines, and apparatus of other parties and the currents therein, whether such lines do or do not use the earth as a return.

4.—The Company using electric power contrary to the provisions of this Act, or to any of the regulations set forth in the first schedule to this Act, or to any regulation added thereto or substituted therefor by any order made by the Board of Trade under the authority of this Act, shall for every such offence be subject to a penalty not exceeding ten pounds, and also, in the case of a continuing offence, to a further penalty not exceeding five pounds for every day during which such offence continues after conviction thereof: Provided always that, whether any such penalty has been recovered or not, the Board of Trade, in case, in their opinion, the Company, in the use of electric power under the authority of this Act, have made default in complying with the provisions of this Act, or with any of the regulations set forth in the first schedule to this Act, or with any regulation which may have been added thereto or substituted therefor as aforesaid, may by order direct the Company to cease to use electric power, and thereupon the Company shall cease to use electric power, and shall not again use the same unless with the authority of the Board of Trade; and in every such case the Board of Trade shall make a special report to Parliament notifying the making of such order.

The Board of Trade have also issued, and carefully enforced, the following regulations:—

6.—When the return is partly or entirely insulated, the Company shall, in the construction and maintenance of the tramway, (*a*) so separate the insulated return from the general mass of earth and from any pipe in the vicinity, (*b*) so connect together the several lengths of the rails, (*c*) adopt such means for reducing the difference produced by the current between the potential of the uninsulated return at any one point and the potential of the uninsulated return at any other point, and (*d*) so maintain the efficiency of the earth connections specified in the preceding regulations, as to fulfil the following conditions—viz.: (1) The current passing from the earth connections through the indicator to the generator shall not at any time exceed either 2 ampères per mile of single tramway line or 5 per cent. of the total current output of the station. (2) That if at any time and at any place a test be made by connecting a galvanometer or other current-indicator to the uninsulated return and to any pipe in the vicinity, it shall always be possible to reverse the direction of any current indicated by interposing a battery of three Leclanché cells, connected by series, if the direction of the current is from the return to the pipe, or by interposing one Leclanché cell if the direction of the current is from the pipe to the return. In order to provide a continuous indication that the condition (1) is complied with, the Company shall place in a conspicuous position a suitable, properly connected, and correctly marked current-indicator, and shall keep it connected during the whole time the line is charged. The owner of any such pipe may require the Company to permit him, at reasonable times and intervals, to ascertain by test that the conditions specified in (2) are complied with as regard his pipe.

7.—When the return is partly or entirely uninsulated, a continuous record shall be kept by the Company of the difference of potential during the working of the tramway between the points of the uninsulated return farthest from and nearest to the generating station. If at any time such difference of potential exceeds the limit of 7 volts, the Company shall take immediate steps to reduce it below that limit.

You will note that the latter part of clause 7 of the regulations provides that the difference of potential shall not exceed the limit of 7 volts. I am glad to be able to inform you that the potential difference in Bristol does not now exceed from 2 to 3 volts—a result unheard of some two or three years ago.

However much some may be inclined to regret the introduction of electric traction in our crowded streets, there is no doubt that it renders a great public service. A system which can take a workman from his work in the city, and put him down nearly at his own cottage door, three or four miles out in the country, for the sum of one penny, is well calculated to assist towards solving the pressing problem of overcrowding in our large cities.

The Bristol Tramway Company are, I understand, spending over half-a-million pounds in improving and extending their system; and I feel compelled to express my admiration for the bold, enterprising, and generous conception of their schemes, and the energetic, persistent, and thorough manner in which all their work is executed by the Managers and Engineers of the Company.

A CENTURY OF CHEMISTRY AT THE ROYAL INSTITUTION.

In previous issues of the "JOURNAL" (pp. 1108, 1354) we have noticed the course of four lectures which Professor Dewar has been giving at the Royal Institution on the above subject. In his third lecture, he completed his account of Davy's scientific work, and went on to refer to that of Brande, who was connected with the Institution for forty years. He described Brande as a man of great culture, whose reputation was high as a lecturer. His chief work was on the borderland between chemistry and physiology; but he was not an investigator of the first rank. Passing on to Faraday, Professor Dewar gave a list of his chemical investigations. In organic chemistry his chief work opened up new ground, for he first prepared compounds of chlorine with carbon, and also combined iodine with a hydrocarbon. He was in a position to extend, by the use of the galvanometer, the electro-chemical inquiries of Davy. Another subject investigated by him was the limits of evaporation. His work in this direction was parallel to Davy's attempts to get high vacua in order to discover the behaviour of electricity in space as nearly void of matter as possible. Davy perceived that the Torricellian vacuum would be improved by cooling. This led to the discussion of Faraday's work on the liquefaction of gases, which began when, at Davy's suggestion, he heated hydrate of chlorine in a closed tube, and obtained liquid chlorine. Faraday fully appreciated the possibility of utilizing liquefied gases for the attainment of very low temperatures, and was the first to employ ethylene, now in common use for the purpose.

In his concluding lecture, Professor Dewar spoke further on the subject of Faraday's work—dealing with that distinguished investigator's achievements in organic chemistry. He said Faraday succeeded in what appeared to be the surprising feat of replacing the hydrogen in an organic body with an electro-negative substance like chlorine; he was also the first to obtain what would now be called a sulpho-acid, by dissolving naphthalene in sulphuric acid. Another fortunate discovery he made was benzene, which formed the basis of the whole coal-tar industry, and was also important from another aspect, inasmuch as Kekulé's theory of the structure had influenced the whole theory of modern chemistry. Faraday's work in organic chemistry received a great extension at the hands of the late Sir Edward Frankland, his successor, the scope and variety of whose researches made him second to none as an experimenter of the modern type. His work was largely identified with organic synthesis; and he was the first to formulate the conception of atomicity. In the domain of physical chemistry, one of his investigations had to do with the theory of flame. He found that the luminosity varied as the pressure of the atmosphere in which the flame was burning; and hence he argued that it could not be due altogether to the presence of solid incandescent particles. His technical work included elaborate investigations on water supply and on coal gas manufacture and analysis.

THE OXIDATION PROCESS FOR SEWAGE TREATMENT.

A series of lengthy articles by Professor Dunbar, of Hamburg, has lately come to a conclusion in the "Journal für Gasbeleuchtung." In the course of them, the author deals with the whole question of the biological processes for the purification of sewage in a very exhaustive manner. He commences with a critical retrospect of the methods for the treatment of sewage, in which he indicates that the so-called biological processes are based on fundamental ideas which have been known and put to the test long ago. They effect the purification of the liquid on the principle of intermittent filtration, which has been practically applied for a century in the irrigation processes. The biological processes, however—whether the oxidation process or the septic tank process—hasten the working in comparison with the irrigation process, through the use of oxidizing bodies made artificially from the most suitable materials in place of the natural cultivated soil. Intermediate between the former processes and the irrigation process lies the method of purifying sewage adopted in many towns of the United States, which consists in the intermittent filtration originally suggested by Frankland, carried out on open drained tracts of land. This process, by disregarding the production of crops, affords a heavy saturation of the soil with sewage, though not to the extent to which the artificial oxidizing bodies in an impervious tank can be soaked with the sewage.

Professor Dunbar proceeds to show that no single process can be considered applicable in all cases; and he gives many hints on the selection of the process to be adopted in particular instances of sewage purification. The disinfection of town sewage, and the destruction of pathogenic organisms in it, he treats as a distinct question, quite independent of the purification of the effluent. He then refers to the experimental works erected and tried in Hamburg in 1895, on which an exhaustive report is published. In these works, several methods of treatment were thoroughly tried on the sewage of that city. The effluent from the settling-tank was dealt with by the use of the slag from the city rubbish destructor in place of coke as the oxidizing body; and the success of this trial far exceeded expectation. The experiments proved that typical town sewage could be purified for months without the use of chemicals by the oxidation process, even in quantities equivalent to the sewage from more than 10,000 persons per acre. The purification effected was such as is only rarely attained on irrigation lands. The oxidation process proved at least as good as the septic tank process; while Professor Dunbar regards it as more rational, and in most cases less costly. For small installations, however, the septic tank system may, he thinks, be preferable under some conditions.

Loss of Water by Leakage in Paris.—According to some figures recently published in the "Revue Industrielle," there was considerable loss of water by leakage in Paris in the year 1898. The particulars are rather old, but their teaching will probably be equally good now. It appears that the daily consumption of water in that year averaged about 60¼ million gallons, whereas the quantity paid for was only about 46⅓ million gallons. The Municipality acknowledge that there is a difference of about 30 per cent. in the quantity of water consumed and that which is paid for.

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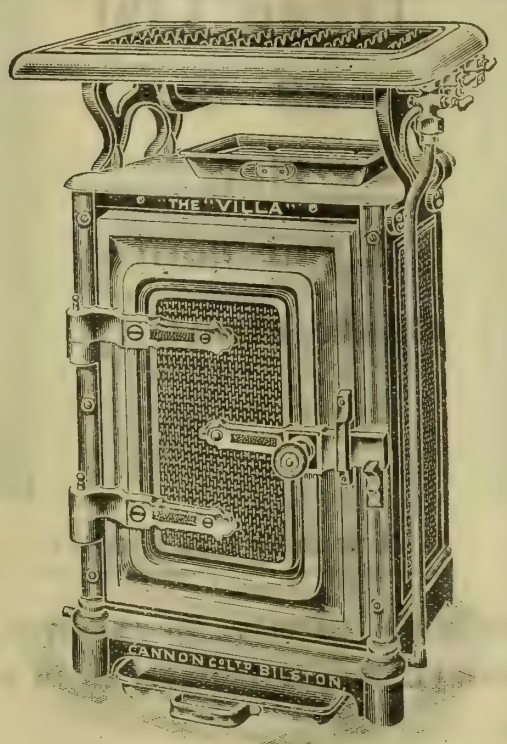
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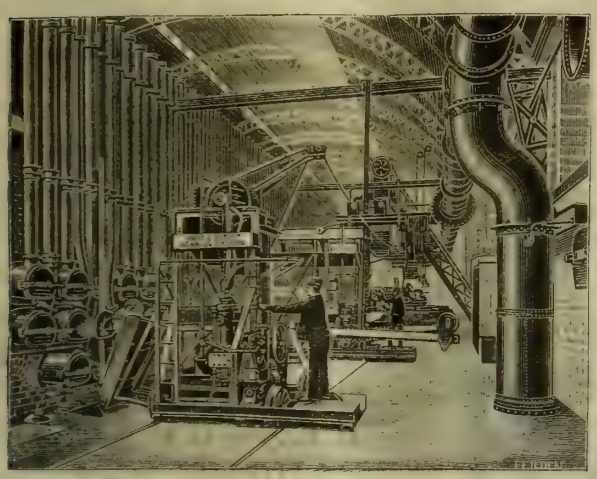
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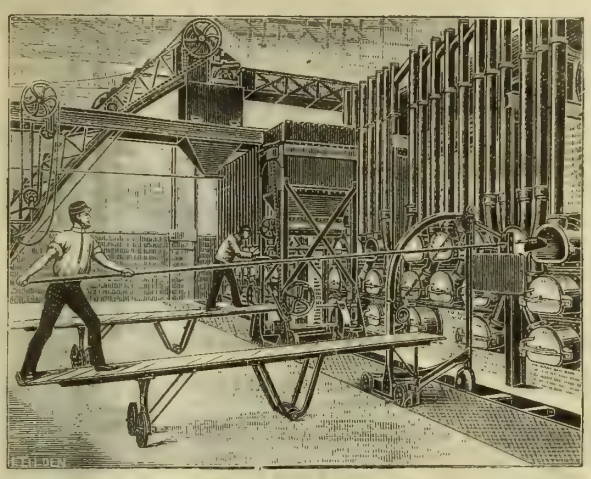
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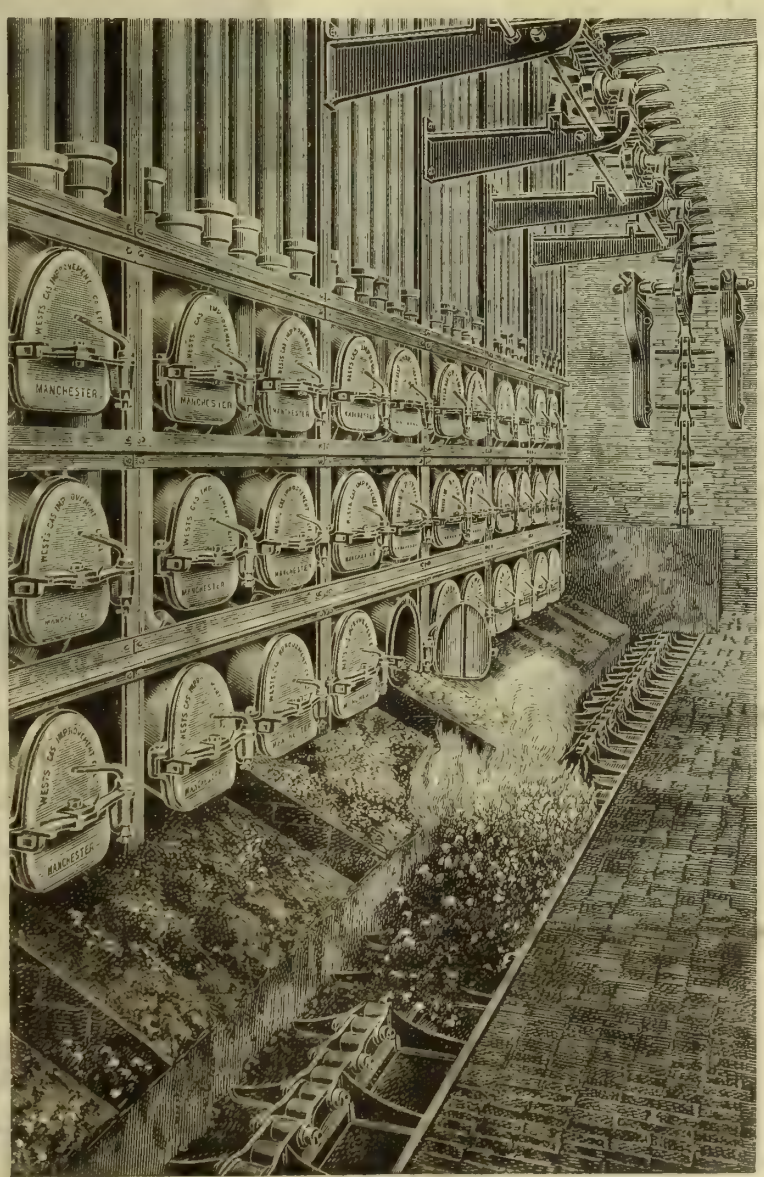
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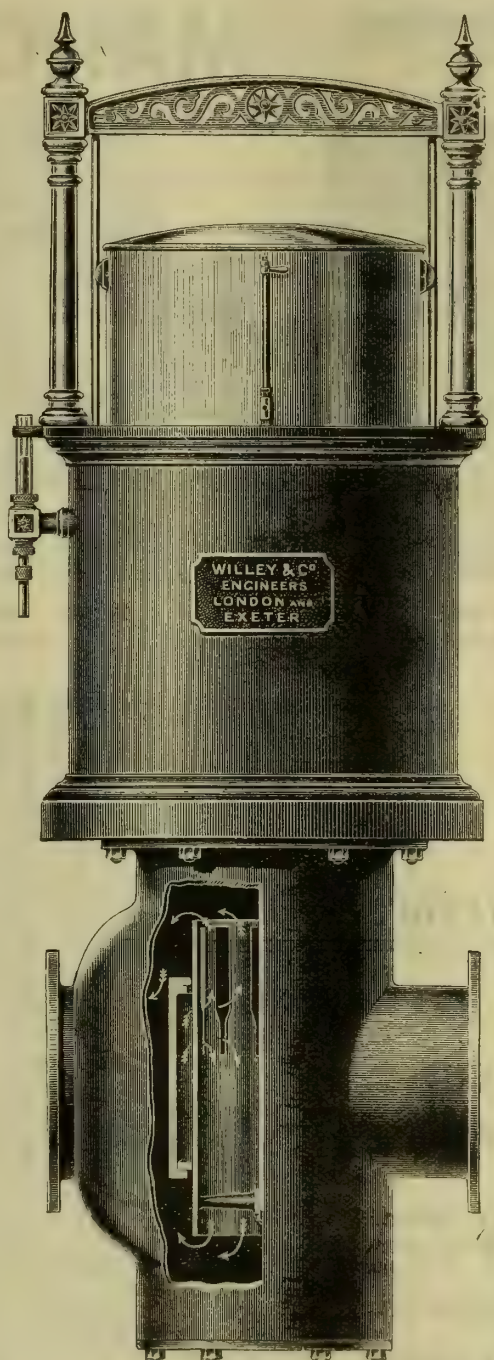
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The Calorimetry of Coal Gas.

SIR,—I must thank Mr. Kühne for his admission of the correctness of my contention that Mr. Hartley invented the principle which is embodied in, and is the essence of, modern gas calorimeters—including that known as Junkers'. It was the recognition of Mr. Hartley's invention in this connection that I was anxious to establish.

Mr. Kühne goes a little farther, and leads one to examine into how much we are indebted to Herr Junkers in the matter of gas calorimeters. I, therefore, take his specification, and compare the system due to Hartley —namely, "the principle of absorbing the heat of a stream of gas products by a stream of water (the two being separated by thin walls of metal)"—with what might be termed the preamble of Herr Junkers' patent, as follows: "In calorimeters hitherto known, the quantity of heat yielded by a source is ascertained by heating a determined quantity of water or other liquid in a vessel, secured as much as possible against loss of heat; and then the increase of temperature is taken note of. In opposition to the foregoing, in the present calorimeter, the quantity of heat developed from a constant source is transmitted to a continually flowing body, such as liquid or gas. The quantity of heat of such source is then determined from the body in transit, and also from the increase in temperature which the body experiences as it passes through that part of the apparatus taking up the heat—that is, when a state of permanency has been created, wherein as much heat of the constant source is taken up by the body in transit as the source produces."

I am quite willing to believe that Herr Junkers was not aware of Mr. Hartley's work when he was responsible for the above extract. Indeed he could not have been, as Mr. Hartley's arrangement was that "water should flow over a thermometer, and thence into a case surrounding the burner, and into a metal jacket enveloping the calorimeter."

The burner was thus in the centre of a cylindrical chamber at the bottom of the instrument, and was so placed with the avowed object of avoiding loss by radiation. The gas was measured by a meter, and the issuing water tested for temperature, and the quantity passing ascertained. This system, it will be seen, was adopted eight years before Herr Junkers made the statement that no such method was known.

We, therefore, ought not to forget the fact that the principle which is the *raison d'être* of the Junkers' calorimeter, is due to Hartley.

May 31, 1900. JNO. F. SIMMANCE.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress was made with Bills on Monday last week, when the House rose for the Whitsuntide holidays:—

Bill brought from the Commons, read the first time, and referred to the Examiners: St. Albans Water Bill.

Bills reported, with amendments: Bury and District Water (Transfer) Bill, Salford Corporation Bill.

Bills read the third time and passed: Margate Corporation Bill, Westgate and Birchington Water Bill.

The Airdrie, Coatbridge, and District Water Trust Bill, and the North Warwickshire Water Bill were referred to a Select Committee, consisting of Lord Ribblesdale (Chairman), the Earl of Lichfield, Lord Clanwilliam, Lord Hylton, and Lord Hare; to meet on Wednesday, June 20.

HOUSE OF COMMONS.

The following further progress was made with Bills on Monday last week, when the House rose for the Whitsuntide holidays:—

Bill presented, read the first time, and referred to the Examiners: Perth and Paisley Gas Provisional Orders Bill.

Lords Bills read the first time, and referred to the Examiners: Margate Corporation Bill, Westgate and Birchington Water Bill.

Lords Bills read a second time and committed: Bristol Water Bill, Falkirk Corporation Bill.

Bill reported, with amendments: Local Government Provisional Orders (Gas) Bill.

Bill read the third time and passed: St. Albans Water Bill.

A Correction.—Owing to the misreading of a contraction in the shorthand writer's transcript of his notes of Mr. H. H. Jones's evidence on the Wandsworth and Putney Gas Bill, given last week (p. 1453), the meaning of one of his opening statements was obscured. What Mr. Jones said was that, "on occasions last winter, they could have sold quite half-a-million cubic feet more than it was possible to *manufacture*."

Ripon Gas Finances.—The Town Clerk of Ripon (Mr. M. Kirkley) has issued his report on the finances of the city for the year ending March 25. In regard to the Gas Department, it is stated that the profit on the year's working was £416; but after paying sinking fund and interest, there was a deficit of £687. There was, however, a balance in hand of £630 on capital account. The sum of £600 had been repaid on old loans, which now amounted to £1900, and £300 on new loans, of which £9700 was outstanding.

Gas and Water Profits at Barrow.—In moving the adoption of the Gas and Water Committee's report at the meeting of the Barrow Town Council yesterday week, Colonel Strongitharm said that, in spite of the adoption of electricity, there had been an increase of 437 in the number of gas consumers. The income was £29,562—an increase of £738, although the Steel Company were now using electricity instead of gas. The net profit on the gas undertaking was £5187—an increase of £205. The accounts of the Water Department were equally satisfactory; the profit being £6681, or an increase of £1581 on last year.

THE PARLIAMENTARY COMMITTEE ON MUNICIPAL TRADING.

The Joint Committee of the Houses of Lords and Commons, appointed to consider and report as to the principles which should govern the powers given by Bills and Provisional Orders to Municipal and other Local Authorities for industrial enterprise within or beyond the area of their jurisdiction, sat for the first time on the 22nd ult., under the presidency of the Earl of Crewe, for the purpose of taking evidence. The names of the members of the Committee have already been given (*ante*, p. 1354).

The first witness called was Sir Courtenay Boyle, Permanent Secretary of the Board of Trade; his evidence relating to the various channels of municipal enterprise. He said it was safe to regard water, gas, and tramway undertakings as monopolies; but electric lighting had been treated differently. The Act of 1888 contemplated competition in electric lighting, and the practice of the Board of Trade was to allow competition between two undertakers in each area. From a return which had been made, he found that in England and Wales there were 173 water undertakings carried on by municipal authorities, and 53 in Scotland. In the case of water, municipalities must go outside their areas to get water; and therefore it seemed to him arguable that they should be allowed to supply water outside their districts. At present, without the special sanction of Parliament, a municipal authority could not supply gas outside their limits, or compete with an existing company within their district. Sometimes a corporation bought an undertaking supplying gas outside their district, and this necessarily implied that if they purchased they might continue that supply. In cases of purchase, a maximum price for gas was generally fixed. Apart from the supply of gas, there were certain things which came within the category of trading. One of these was dealing in residual products, which were an important factor in determining the price at which gas could be sold. When a corporation took to supplying burners and artistic gas-lamps, it went a little further. The Board of Trade were chary about sanctioning the sale of fittings, and still more so about their manufacture by municipal bodies. In the United Kingdom there were 222 authorized gas undertakings belonging to municipal bodies, which yielded a gross profit of £1,181,675—equivalent to 6·3 per cent. on the capital employed; while the profits on the 439 undertakings belonging to companies were equivalent to 7 per cent. on the capital expended. This seemed to show that municipalities were inclined to pay rather less regard to profits than were the companies. The general policy of Parliament had been not to authorize competition between a local authority and a going authorized gas undertaking; but there was no objection, as a rule, taken to the purchase of gas undertakings by municipalities. As to electric lighting, about 300 authorities owned their own electric light undertakings. The electric lighting legislation of 1882 was held to be defective inasmuch as it only granted 21 years to companies before their undertakings became purchasable by the local authorities; and the Act of 1888 extended the period to 42 years. No allowance was made for goodwill in the purchase of these undertakings; but it was generally otherwise in the case of gas-works. Electric supply outside the district of a local authority was effected either by directly permitting the authority to go beyond their area or by a transfer of powers granted to bodies outside. There were instances in which Parliament had authorized the supply of electricity in bulk outside the district; but, as a rule, the Board of Trade tried to confine concessionaires to a particular geographical area, though this need not necessarily be conterminous with the area of the local authority. He knew of no instance where a forcible transfer had been permitted. The grant to a local authority of power to supply outside their district naturally made that authority a trading body in the outside area. If they lost, the municipal ratepayers lost to benefit the outside district; if they gained, the municipal ratepayers gained at the cost of the outside authority. As to whether it was a right policy he could offer no opinion. It would be rather difficult to have a sliding-scale. Application had been made for power to supply electric light fittings; but the Board of Trade had always objected to corporations being allowed to make or sell these articles. If their supply was necessarily incidental to that of electricity, it might be permitted, but not otherwise. For instance, the provision of a good supply meter (when one was found) might well be entrusted to corporations, but not burners and things of that kind. The wiring of houses for electric lighting had never been handed over to corporations. The thing supplied was electric energy, which might be employed for lighting, motive power, or any other purpose. Its use was unlimited by statute or otherwise. Coming to tramways, witness said there had been a distinct progress in the policy of Parliament with regard to the ownership and working of them. Tramways had been owned by municipalities since 1868; but their working by these bodies had grown up comparatively recently. The Standing Orders had been gradually altered to allow this. It was a matter well worth the consideration of the Committee whether it would not be better, in the case of outside districts, that the tramways should be owned by a Joint Board rather than that a municipality should trade as a company outside their area. The invention of electric traction would certainly affect this question, because with it the tendency would grow to construct tramways of greater length. Municipal tramways generally had been fairly lucrative, and applications for leave to work them were increasing year by year. Asked to give instances of novel power being asked for by local authorities, witness mentioned, among others, applications for powers to provide apparatus for games and recreations and to charge for the use thereof, to provide games for the use of the public, to maintain refrigerators and cold-air cells, to provide bathing tents, and to provide Turkish baths. The London County Council applied for special power in 1895 to establish workshops in which to make the clothing and boots required by the Council. He had also seen an advertisement by a corporation to the effect that they were prepared to accept sums of money on deposit. The Board of Trade were not, he thought, concerned in the novelty of the powers asked for; this being a matter almost entirely for Parliament. They were, however, very much concerned in knowing what Parliament thought should be done. As a Department entrusted with the granting of Provisional Orders, they must look to Parliament for guidance. He wished to pay a tribute to the excellence of the management of their affairs by municipalities, as there were many instances of economical, wise, and effective administration.

His point was that when they went to trade outside their own districts Parliament should consider on what principles, and under what limitations and terms of organization, they should go. This was, he thought, broadly, the whole of the difficulty.

At the second meeting of the Committee, which took place on the 25th ult., Mr. Albert Gray, Counsel to the Chairman of Committees of the House of Lords, gave some interesting evidence. Dealing first with gas supply, he related a fact in regard to gas-fittings which was found in the first Private Gas Act introduced, and which, he said, had a bearing on municipal trading. The Act referred to was that of the Gaslight and Coke Company, introduced in 1810, which contained a provision expressly forbidding the Company to furnish or sell any stove, pipe, or machinery of any kind for conveying gas into buildings. In a subsequent Act of 1816, there was a clause, not only forbidding the Company from selling fittings, but also from employing workmen to fix in any building fittings for the supply of gas. This, it would appear, was to prevent the establishment of a monopoly for all purposes. After some years, this became inconvenient, and power was given to companies to supply fittings. When, in the sixties, gas undertakings began to be acquired by local authorities, they took them over with all the powers possessed by the companies, including those to provide, and also, he believed, to manufacture, gas-fittings. A typical instance occurred in 1879, in the case of Stratford-on-Avon, the Corporation of which took over a private gas undertaking, and power was given to "manufacture, sell, provide, supply, and deal in" meters, fittings, pipes, &c. The term "fittings" would embrace a chandelier such as the one hanging in the Committee-room. As Sir Courtenay Boyle had stated, the power to manufacture and supply fittings had been taken out of Bills during the last two sessions, and a clause had been inserted expressly stating that the powers should not include the powers to manufacture and supply fittings. The clause was also inserted in the companies' Acts, so that, in the event of the undertakings passing into the hands of the local authorities, these powers shall not be exercised. Asked whether he had anything to say as to the working of gas undertakings by municipalities outside their own area, witness said he had no observations to offer, but should like to remark in regard to water supply that powers were sometimes applied for extending over a larger field than was necessarily covered by gas, and it was a matter for consideration whether a combination of small local authorities might not be an advantageous way out of the difficulty. He cited the case of the South Essex Water Board, recently referred to in the "Journal." Two Bills affecting a number of districts in South Essex came before Parliament—one promoted by a combination of Local Authorities, who proposed to go for their supply 20 miles out of the district, and the other by the local Water Company, who wanted to go 40 miles off. Witness suggested whether it was desirable that a number of small Local Authorities should attempt to carry on a large undertaking involving a considerable amount of travelling to go to the place of meeting. This difficulty, he said, seemed to have occurred to the promoters of the Water Board, because the Bill contained a clause dealing with the qualifications of members, which stated that a person could not be elected to the Board unless he was, or had been, a member of one of the constituent Local Authorities. This difficulty, he pointed out, did not apply to the great municipalities. Not only had they a greater number of members to draw from, but also larger funds. They were in a position to keep a first-class staff, and to carry on the undertaking in a thorough manner. In support of his contention, witness referred to the formation of the Derwent Valley Water Board, composed of representatives of several great Municipalities, to take and distribute water from the Derwent. With regard to electric lighting, the power to supply outside a local authority's district had been given ever since the passing of the Electric Lighting Act of 1882. If a local authority were in possession of electric lighting plant, they might compel a company to take electric energy from it. This, of course, meant a saving; and there was no reason why there should be a double electric plant in a town where one would do. It might be that the local authority would then be more likely to purchase the company's undertaking. The power to manufacture electric light fittings had recently been struck out of Electric Lighting Bills also. The veto which a local authority had over a tramway scheme promoted by a company appeared to him at the present day to work very badly. He thought it was the intention of Parliament that the consent of the local authority should be what might be called a "clean" consent. There had, however, unfortunately sprung up a practice of demanding conditions; and in some cases a demand was made that the local authority should share the profits of the undertaking during the term of the company's tenure. It was obvious that when such a demand was made, a company was in a cleft stick. Tramway companies were sometimes compelled to allow the use of their electric wire poles for lighting, for sewer ventilation, and for advertisements. One Tramways Bill, introduced in the present session, contained a clause providing that free passes over the tramways should be given to officials of the Corporation; but it was struck out. Another provided that a Tramway Company should pay the Corporation, as an annual rent for the use of the streets, £10 a year per mile for ten years, and £20 per mile in subsequent years. Asked if the Chairman of Committees would consider it an unfair condition, and strike it out of an Electric Tramway Bill, if a corporation required the promoters to take their electricity from the municipal generating station, witness said he would not consider that an "unfair" requirement.

The Committee then adjourned till after the Whitsuntide holidays.

HOUSE OF COMMONS COMMITTEE.

Thursday, May 10.

(*Before Colonel* Gunter, *Chairman*, Sir George Pilkington, *Sir* W. Hornby, *and Sir* W. B. Gordon.)

EAST LONDON WATER BILL.

This was a Bill to obtain authority to build additional reservoirs and to raise further capital.

Mr. Pember, Q.C., Mr. Claude Baggallay, Q.C., Mr. Talbot, and Mr. Cully appeared for the promoters. Lord Robert Cecil, Q.C., and the Hon. Sidney Holland represented the Hertfordshire County Council; Mr. E. Morten, the West Ham Corporation; Mr. J. E. Earle, the Middlesex County Council; Mr. Balfour Browne, Q.C., and Mr. Squarey, Messrs. Ridley, Whitley, and Co.; Mr. Balfour Browne, Q.C., Mr. Worsley Taylor, Q.C., and Mr. Freeman, Q.C., the London County Council; and there were other petitioners not appearing by Counsel.

Mr. Pember, in opening the case, said the Bill was the same as that passed by the House of Commons last year, but which was afterwards, somewhat to the surprise of most people, thrown out by a Committee of the House of Lords. By various Acts up to 1897, many additions had been made to the capital of the Company, mainly with a view to the improvement of their storage accommodation, which was, he would say, in an unduly scanty condition. In 1898, the Company had been obliged to stop the continuous supply; and in 1899, they had to obtain water from other Companies. The proposed new reservoirs were to be at Chingford, and there were at present two in course of construction at Walthamstow. It was with the full knowledge that the Company purposed making these reservoirs, that Lord Balfour of Burleigh's Commission reported that, in their opinion, the Rivers Thames and Lea would afford enough water to supply London to 1931, and that of this supply the Lea could be relied upon to yield 52½ million gallons. He need not go into the question of the supply in 1895 and 1896; and in view of the reservoirs not being completed last year, there would have been another failure, but for the fact that, by the operation of Mr. Chaplin's Act, they had been able to get assistance from their neighbours. The storage of the Company had certainly in the past been too small. In 1892, their storage was only 610 million gallons. The Bill of 1893 was to enable the Company to remedy this deficiency, and to construct the first of the new reservoirs to which Mr. Bryan, their Engineer, drew attention before Lord Balfour's Commission. The Bill was in that year rejected; but the following year they again promoted it, when it passed the second reading, though only by a majority of one. That Bill raised the storage from 610 to 1200 million gallons; and by the Bill of 1897—which was a further instalment—the storage was raised to 2400 million gallons. Under the present Bill, the Company expected to get an additional 5300 or 5500 million gallons, which would give them reservoirs of a storage capacity of some 7500 or 7700 million gallons. This would complete Mr. Bryan's original scheme, as put by him before the Royal Commission of 1891. The estimated outlay was £1,338,000, which, owing to the increased cost of labour and materials, was rather higher than last year. The scheme was based on a supply of 35 gallons per head per day to the present consumers, and a decennial increase of 18·2 per cent. of the population. These were the figures which, after some debate, had been adopted by Lord Balfour and his colleagues. Looking forward to the year 1931, the Commission estimated the total need of London at 420 million gallons a day. He thought they might hope that, when the projected reservoirs were finished, the East London population would be free from the fear of scanty water supply for at least twenty years to come. The East London Company's was in the main a Lea supply; though they had power to take 10 million gallons daily from the Thames. The second object of the Bill was to make provision for a temporary supply. The gist of their clauses was that, from time to time, with the consent of the Local Government Board and the Thames Conservators, they might take, in case of emergency, either from their own intake or from the intake of any other Company, more water than they were able to draw now on any one day, provided that the whole amount taken in any half year should not exceed a daily average of 10 million gallons. For this privilege, they are from the first to pay the Conservators at the rate of £1000 a year.

Mr. *W. B. Bryan*, examined by Mr. Baggallay, said he had been for eighteen years the Chief Engineer of the Company. The Company supplied 53,560 acres out of the 85,692 acres which was their statutory district. The New River Company and the South Essex Company also supplied within their area. The total population within their limit of supply was now about 1,352,000. The increase of supply had been almost entirely in Essex, which was due largely to the facilities offered by the Great Eastern Railway Company. Their principal source of supply was the River Lea. They had the power, and they exercised it, of taking water from the River Thames; and their third source was wells and gravel springs. Roundly, they took 30 million gallons a day from the Lea; and they drew possibly 8 million gallons from the Thames. From the wells they obtained a very variable supply. They did not pump any water at all during the times of floods in the Valley of the Lea, but allowed the chalk to become thoroughly saturated, so that when they had to pump they would be able to draw upon their underground supplies. Practically all their storage was at Walthamstow. The reservoirs authorized by the Act of 1897 were not yet completed; and it would be quite two years before they were available. In 1890, he prepared a scheme which he laid before Lord Balfour of Burleigh's Commission, with regard to the provision of storage in the Lea Valley, by which he proposed to provide reservoirs to hold 7130 million gallons. In 1893, they promoted the first Bill to give effect to the scheme; and the present one was the completion. In 1898, his attention was called to the deficient storage, by their having been compelled to put the districts on an intermittent supply, because their storage was depleted. They had some wells now in progress. When these were completed, they would be able to get from the River Lea 37¼ million gallons a day, from the River Thames 10 millions, from the wells 20 millions, and from the gravel springs at Hanworth about 2 millions. This would give a total of 69·4 million gallons a day, from which a deduction of 5·4 million gallons had to be made for the purposes of the River Lea navigation. Substantially, they had about 64 million gallons of water available, if they had the storage to utilize it. He based their wants on 35 gallons per head per day for a population of 1,830,000, which they estimated would be the population to be supplied at the end of 20 years. This amount was taken as the public requirements by all the London Companies. As to the population, that was based on the figure of 18·2 per cent. as the decennial increase, which was adopted by Lord Balfour's Commission. To give this supply, 64 million gallons a day would be necessary, to provide which they would require a storage of 77·4 million gallons. To meet the needs of the district, it would be necessary to construct the final instalment of his original scheme. The reservoirs at Walthamstow were not yet completed. The new reservoirs to be constructed under this Bill would be immediately north of

the Company's Chingford pumping-station, and would be partly in the county of Middlesex and partly in the county of Essex. The area of the two would be 846 acres, and the capacity 5300 million gallons. This would give them slightly more storage than they required; but they always had a certain quantity of bottom water which it was not advisable to use. To enable them to carry out the work, they would have to make a diversion of the River Lea. The channel would be to the east of the reservoirs. The cost of the works would be £1,338,000—rather higher than would have been the case last year. This was due to the increased cost of labour and materials. The capital proposed by the Bill was £1,800,000.

The CHAIRMAN asked how it was proposed to raise the money.

Mr. BAGGALLAY said by the issue of debenture stock, which would be sold under the auction clauses, and would be redeemable at par at any time after 25 years. The interest would be 3 per cent.

Witness (continuing) said besides the construction of the reservoirs, they would require money for engine power and machinery. They estimated the cost of this at £100,000, and of mains and services £200,000. The last item would be spread over about twenty years. These sums were all allocated by clause 44 of the Bill, leaving about £160,000 not specifically "ear-marked." This would be available for contingencies, or for any further buildings and machinery which might be required.

The CHAIRMAN inquired if it would be available for sinking wells.

Witness said the money would be available for all the purposes of the Company. In the construction of the new works, they had been obliged to take 180 acres of Lammas lands. The Company proposed, in exchange, to provide 5 acres of land at Waltham Cross and 5 acres at Chingford, which would be converted into public playgrounds. Under the Bill, they proposed to impound the water of the river when it was high, and to store it so as to supply the flow in time of drought. He had no doubt of the efficiency of his scheme, which he had presented to Lord Balfour's Commission. As to the portion of the Bill dealing with the temporary supply, the Company would only use the powers with the consent of the Local Government Board and of the Thames Conservators. They had arranged to get assistance from other Companies; but in time of drought, the Companies who would help them might themselves be without a surplus. They asked to be able, in times of emergency, to take by themselves, or through other Companies, a temporary extra supply from the River Thames. The amount thus taken was to be limited to a maximum of 30 million gallons a day, and a maximum amount within the half year of a daily average of 10 million gallons. In 1898 and 1899, the Company were obliged to seek assistance from other Companies; and in 1898, they had to get the Southwark and Vauxhall Company to break an express enactment, so as to save the East-end from a water famine.

Friday, May 11.

Mr. *Bryan* was to-day further examined by Mr. BAGGALLAY. Witness was first asked as to the amount of water the Company were able to furnish in the summer of 1898. He said in June of that year they supplied 42½ million gallons daily; and in July, 45 million gallons daily. In August, they gave a constant supply up to the 22nd of the month, and afterwards an intermittent one. Up to the 22nd, the quantity was 43 million gallons daily; and after that date, 42½ millions. As to the sources of their supply, they got from the Lea 9½ million gallons in July, 1 million gallons in September, and 4·6 million gallons in October. From the Thames and their wells, they obtained 17 million gallons in July, 19 million gallons in August, 19 million gallons in September, and 18½ million gallons in October. From their storage reservoirs they obtained 17½ million gallons in July, 9,900,000 gallons in August, 4·6 million gallons in September, and in October their storage was exhausted. In July, they had to obtain assistance, and got 1 million gallons from the New River Company. In August, they obtained 5,600,000 gallons a day; and in September, 6,129,000 gallons. In September, they received assistance also from the Southwark and Vauxhall Company and the Kent Company. They took water from other Companies long before they gave the intermittent supply, so as to keep the storage as large as they could. They took, indeed, all the New River Company could spare. In September, the Southwark and Vauxhall Company gave them 5,200,000 gallons, and the Kent Company 200,000 gallons. The Southwark and Vauxhall Company had to lay a pipe to help them. Their storage reservoirs, which had been full on June 20, were empty by the end of September. During September, they gave a daily supply of 25 gallons of water per head, 18 gallons of which was a purely domestic supply. If the consumers had had cisterns, the effect of the drought would have been greatly minimized. The provision of domestic cisterns was one of the recommendations in the report of Lord Llandaff's Commission. The Company consulted Mr. Mansergh, Mr. Eaton, and Mr. Hill; and they all agreed that the best plan of meeting the difficulty was to carry out the scheme which he had proposed to Lord Balfour's Commission. Last year they gave a continuous supply, and at a very high pressure; but to do so, they had to obtain assistance, under Mr. Chaplin's Act, from the other Companies. Regarding their position, they had thought it desirable to take only seven years for the construction of both their new reservoirs. In his view, what they were now doing was in accordance with the recommendations of Lord Balfour's and Lord Llandaff's Commissions. The proposal to take the water from the Thames on a six months' average was exactly that suggested by Lord Llandaff's Commission, who recommended that the water should be drawn when the river was in flood, when the storage reservoirs could be filled without affecting the flow. As to the opposition of Messrs. Ridley, Whitley, and Co., they did not object to the Bill last year when the proposals were the same. The East London Company were the owners of the whole river bed, which they purchased from the Ecclesiastical Commissioners some years ago; and since 1867, they had diverted the water above the Chingford Mill (which they bought), and carried it to their Walthamstow reservoirs.

Cross-examined by Lord R. CECIL: At the present time, the Company had no capital available for new works. Of the new capital proposed to be raised, a sum of £160,000 would be available for the general purposes of the Company. They did not propose to sink any new wells; but he could not pledge himself that none should be made.

Witness was afterwards cross-examined by Counsel on behalf of other petitioners against the Bill.

Monday, May 14.

Sir *Frederick Bramwell*, examined by Mr. TALBOT, said he had given great attention to the London Water Supply. In his opinion, the proposed new works were necessary for two reasons—first, on account of the enormous increase in the population to be supplied exterior to London; and, secondly, on account of the consecutive droughts lately experienced. These droughts were unprecedented, and had led to the revision of conclusions that were formerly accepted by water engineers. He was familiar with the sources from which the Company obtained their supplies. These were the Lea, the Thames, the gravel beds bordering on the Thames, and the wells in the chalk. The flow of the River Lea varied considerably, not only in the different seasons, but in different years; and it had varied in the way of diminution for a number of consecutive years.

The CHAIRMAN; If I follow you, you mean that at one period of the year a very heavy flow comes down into the Lea, and at other times it is much less?

Witness: Yes.

Therefore, I presume, your view would be that they should be able to take water when there is a flush of it?—That is so; the obvious way of dealing with the waters of a river which does not flow with regularity is to impound the water which otherwise would uselessly flow into the sea, for the purpose of dealing it out in the times of short water from the storage which has then been provided. That is a truism as regards dealing with the supply of almost any river.

In further examination, witness said at times of full river a great deal of water ran to waste by Blackwall, which was the natural outlet of the River Lea. In his opinion, the method proposed in the Bill was a sound one; and it was the principle recognized in the reports of Lord Balfour's and Lord Llandaff's Commissions. The present scheme was just doing for the Lea what the Staines reservoirs were doing for the Thames—affording a means of impounding the surplus water. Assuming that the water of the Lea was to be used for the supply of London, he knew no more suitable or economical plan of carrying out this object than what was proposed in the present Bill. As to the petition of the Hertfordshire County Council, he understood they objected to the taking of underground water which might injure the flow of the rivers. The provision of increased storage would have the effect of relieving the Company from the necessity of drawing on the wells. But the pumping of the East London Company was in every case from under a thick bed of impermeable clay; and he could not understand how this could in any way deplete the surface waters of the Lea. In his opinion, the distant supply of water would not come so long as the Thames and the Lea could supply London; and therefore the alternative of storage only remained, and this was the object of the Bill.

The CHAIRMAN asked witness whether, in the event of the water supply being taken over by a Board or Chamber, the fact of having their reservoirs sanctioned would in any way trouble the authority.

Witness: I cannot see the possibility of it. I am assuming that Parliament and the public have determined to put off until needed any distant source of supply. If that be so, we are left with the alternative of storage. I know, and can conceive of, no better means of storing the Lea water than what is the subject of the Bill; and I am perfectly certain that the carrying out of these works would simply be anticipating that which any prudent authority in charge of the district would be compelled to do. Continuing, witness said in 1950 it was said they would need both the Welsh, or distant supply, and what the rivers Thames and Lea could give as well; and in that case all the works they proposed on the Lea would be used.

Mr. *James Mansergh*, examined by Mr. GULLY, said he had had forty years' experience in the design and construction of water-works. He was a member of the Commission presided over by Lord Balfour of Burleigh. He was fully acquainted with the works of the East London Company. In 1892, Mr. Bryan laid before the Commission his scheme of reservoirs, which was practically the one proposed in the present Bill. The Commission were fully satisfied with his plan. Some of the reservoirs, as designed by Mr. Bryan and presented to the Commission in 1892, would have been made by instalments; but the drought of the last five years had shown that they should be commenced at once, and finished as soon as possible. The demand was more urgent than in 1892. He had visited the site of the reservoirs, and generally approved the plans. They were very easily constructed reservoirs. A trench would be dug all round, through the gravel overlying the clay; and a puddle wall would be tied down into the clay, so as to complete the water-tight basin, and then the puddle wall would be carried up, and supported by banks on each side in the usual way. There were no heavy or difficult works. He had looked at the estimates, which were fair at the present time. In his opinion, it would be the greatest folly to abandon the Lea. If London continued to grow the next 50 or 60 years as it had done in the past, not only would the whole of the water that could be drawn from the Thames and the Lea and the chalk be needed, but also what could be obtained from the Welsh scheme of Sir Alexander Binnie. Both of these services would be required; but before they went elsewhere, he felt very strongly that the Thames and the Lea should be fully exhausted. The Welsh works, including the reservoirs and the aqueduct, could not be completed in less than twelve or fifteen years. He was carrying out a scheme for the Birmingham Corporation, with an aqueduct 80 miles in length; and though they got their Act in 1892, they would barely complete the works in 1902. The aqueduct for London would be over twice as long; and the difficulties would be very great. Whether the Companies continued to administer the water-works of London or not, the works proposed in the Bill must be carried out, because the water from these sources would ultimately be required. As to the quantity of water, the Balfour Commission decided that from the Thames, the Lea, and the chalk there would be an ample supply till 1931. The Commission of Lord Llandaff, with the advantage of having the Welsh scheme before them, had extended this period by ten years, to 1941. But this, of course, was largely a question of storage. He himself was strongly in favour of getting water from mountain streams; but although he might think it an excellent thing to secure pure mountain water, it would be great folly not to utilize every drop in the Lea. Before the end of the century, all the water from these sources, and from the scheme designed by Sir Alexander Binnie, would

be exhausted. He had no doubt about that. Where they would have to go after that, he could not say.

Sir G. PILKINGTON: I understood that the Welsh scheme would provide almost as much as you liked to take?

Witness: Oh, dear, no; there is a limit. When we were fighting the Birmingham scheme, I took the trouble to investigate the whole of these Welsh mountains, right away from Rhyl on the north to Glamorganshire on the south; and I made out that, in addition to what we were taking for Birmingham, there might be obtained for London 400 million gallons a day. This is not an inexhaustible quantity. The area is limited, the rainfall is limited, and the facilities for making reservoirs are limited.

The rainfall is heavy I suppose?—The rainfall is, of course, heavier than here. It is an average of perhaps 65 or 66 inches, against less than half that quantity here; but you must not go away with the idea that it is an inexhaustible source of supply. There are a good many other authorities already tapping the Welsh supplies. Still, I think the Welsh mountains are the next place to go to for London. I quite agree with Sir Alexander Binnie about that.

Mr. *G. H. Hill*, examined by Mr. BAGGALLAY, said he was a member of the Royal Commission in 1893 on the Metropolitan Water Supply. He was well acquainted with the East London system, and agreed that the present proposal was the final instalment of the scheme which had been submitted by Mr. Bryan to the Balfour Commission. No circumstances had arisen since 1893 to necessitate any modification of the scheme as submitted to, and approved by, the Balfour Commission; the only point was that the experience of the last two or three years showed most distinctly that no time ought to be lost in the construction of the works. In the case of Manchester, it was very likely the Corporation would not have been allowed to go to Thirlmere, if they had not been able to show that they had practically utilized nearly the whole of the water in the Langley Dale district. Parliament was very strong upon the point that if it handed over a particular district to any water authority, it required that the district should be fully utilized before they went into a new area. In October, 1898, he, with Mr. Mansergh and Mr. Eaton, was consulted by Mr. Bryan as to the steps the Company should take to provide against a repetition of the drought they had just gone through. They concurred in recommending the adoption of the scheme which was introduced last session. This scheme, taken with the 10 million gallons a day which the Company could draw from the Thames, and 2 million gallons from the gravel beds at Hanworth, would give a daily supply of 64 million gallons, which would satisfy the needs of East London for the next twenty years. The proposed new reservoirs would contain 5300 million gallons, and the existing and authorized reservoirs 2200 million gallons. The total storage would thus be 7500 million gallons. There was ample water to fill, and keep filled, these reservoirs. In the last eighteen years, the average daily flow of the River Lea at Feilde's Weir had been at the rate of 98½ million gallons a day; so that, as far as quantity went, there was plenty of water. The great advantage of a scheme such as was proposed, was that they could take the water when there was plenty, and use it in times of drought.

Replying to the CHAIRMAN, witness said, in his opinion, the two new reservoirs would be absolutely necessary, whoever supplied London with water. In 1898 and 1899, during the water famine, the Company were assisted by other Companies; but it was quite possible that, in a very dry year, these Companies would require the water for their own districts, and would have no surplus.

Mr. *E. M. Eaton*, examined by Mr. GULLY, said he was acquainted with the works of the East London Company, and nearly the whole course of the Lea. Having regard to the increased population, the proposed new reservoirs were absolutely necessary, if the Company were to fulfil their statutory obligations. He had made a calculation of the water that came down the Lea between August, 1897, and December, 1898—a period of 17 months. During this time, the excess quantity passing down the Lea beyond what the New River Company had power to take was 23¼ million gallons a day. Beyond this, there would be required for the purposes of the East London district a further amount of 14¼ million gallons, which the new reservoirs were intended to supply. The scheme proposed in the Bill was a perfectly proper one; and he saw no reason to modify either the reasoning or the calculations which were come to in designing the reservoirs.

Mr. *R. A. Middleton*, examined by Mr. GULLY, said he was one of the Engineers of the Staines reservoirs and was Assistant Commissioner to the Royal Commission presided over by Lord Balfour of Burleigh. On that occasion, he carried out an extensive examination of the rivers, streams, springs, and wells, with a view to see how they were affected by pumping. The result of pumping above the pumping-station was *nil*. Below the pumping-station, the quantity of water taken out at that station must go to deplete the volume of the underground flow or trend of the water in the chalk; but this was spread over such a large area, that it was very small in effect. In his opinion, any decrease in the flow of the streams or the wells was due to a deficiency of rainfall, and not to the effects of pumping.

Mr. *W. Hunt*, of Snaresbrook, examined by Mr. TALBOT, said he was well acquainted with the River Lea. He first went to Chingford Mill, and left there in 1882. All the water which passed the mill went to the East London Company's reservoirs; and that he used rejoined the river about a mile lower down, and one-third of a mile below the works of Ridley, Whitley, and Co. He kept all the water he could in his own hands, and never heard that Messrs. Ridley, Whitley, and Co. had any right in it.

Mr. SQUAREY said that, in view of the fact that his clients were trying to arrange terms with the Company, he would not cross-examine witness on the question of the water-rights.

This was the case for the promoters; and evidence was then called on behalf of the Hertfordshire County Council.

Mr. *U. A. Smith*, examined by Mr. SYDNEY HOLLAND, said he was Engineering Adviser to the Hertfordshire County Council. He knew the wells existing in the Lea Valley. These were the wells belonging to the East London Company, to the New River Company, to private individuals, and to the local Water Company. Almost everybody who wanted a well came to the Lea Valley; and the County Council feared that the money raised under the Bill would be expended in the sinking of new wells. In his opinion, if more wells were dug, the water levels in the county would be further lowered, and the flow of the streams reduced. The Balfour Commission had reported that 57 million gallons was the limit of the quantity which could be safely taken from the Lea Valley; and of this, 40 million gallons was allocated to the New River Company and the East London Company. At the present time, the pumping capacity of the two Companies was 68 million gallons a day.

Witness handed in a table of the quantity of water pumped by the two Companies in the Lea Valley during July, August, and September, in each year from 1881 to 1889. Up to 1889, the pumping was under 10 million gallons a day; but in 1899, the figure had risen to 37·21 million gallons, which was dangerously near the limit of 40 million gallons.

The CHAIRMAN: Then you are, I presume, strongly in favour of the Companies taking surplus water, when there is an abundance in the river, into storage?

Witness: Exactly; and the more they take, the better.

Therefore you are in favour of having these reservoirs made?—Quite so. In fact, we should prefer that the reservoirs were even larger.

Mr. BAGGALLAY cross-examined witness at considerable length, with the object of proving that the diminution in the flow of the streams was due to the low rainfall, and not to the sinking of the wells.

Mr. HOLLAND then addressed the Committee on behalf of the County Council of Hertfordshire. He said the Council appeared there because they seriously believed that the effect of the great increase of pumping in Hertfordshire was depleting their wells and lowering their streams. Mr. Baggallay, in one of his questions, had said the effect of the proposed new reservoirs would be to render unnecessary the making of new wells. If so, the Council welcomed the scheme; and they only opposed the Bill because they considered that, as the finance clause was at present, any surplus funds which could be devoted to any purposes of the Company might be expended in the sinking of wells. They felt very strongly that, when the Company went to Parliament for these large powers to build reservoirs, it was fair to say to them: "Build your reservoirs so large that you will not require any further wells." There was another clause in the Bill to which they strongly objected—the power to supply water in bulk to other authorities outside their district. He suggested that the clause was only put in to get a very valuable asset for the Company in case the undertaking was bought up by a Water Board, or even if such a disaster should occur as that they should be bought by the London County Council, which everybody would lament. It seemed extraordinary that the Company should, in one breath, talk about the difficulty of supplying water, and in another breath want to supply a lot of people outside their area. In view of the district, and the number of the population in it, he could safely leave that to the Committee. There was one other point. There was the greatest difficulty in getting a proper record of the wells; and he claimed that the County Council should have the right to ask for these records. The Balfour Commission had distinctly recommended that obligations should be laid upon any Company or Local Authority pumping water from the chalk, to keep accurate observation of the effect of their operations on the level of the water in the wells from which they pumped. Lord Llandaff's Commission concurred in the suggestion; and they asked that the Committee should have access to these records.

The CHAIRMAN: You are asking this Committee to make a precedent.

Mr. HOLLAND said he was only urging them to carry out the recommendation of the Royal Commission. He could not put it higher than that.

Mr. BALFOUR BROWNE followed on behalf of the London County Council. The Bill, he said, was in two parts. They proposed to have the means of giving a temporary supply. He hoped to show that this was entirely unnecessary. Secondly, they took power to make these large reservoirs, which were intended for a permanent supply. He hoped to show that the Committee should not give the Company the power they sought, because at the present time purchase had been recommended, and would inevitably take place. What was proposed was, he urged, an extravagant way of providing water, and it would have to be done at an extravagant cost out of the pockets of all the consumers of water in London. The temporary supply was provided for by Mr. Chaplin's Act of 1899. If the Company were bought up to-day, it would be as a defaulting Company—as a Company who in the past had to have their supplies supplemented from other Companies' resources. He did not believe that the question of purchase could be long postponed. The Llandaff Commission certainly reported against purchase by the London County Council; but they did report in favour of purchase, and whether the purchase was carried out by a Board created by a Government Bill or not, he felt sure that in a few years the undertakings of the Water Companies would pass into the hands of a municipal authority. What was the position of the East London Company? They had not got the water, because they were now asking for it. They could secure a temporary supply under the Government Bill; but this would not enhance their value. Notwithstanding this, they were seeking powers which they knew would increase the value of their undertaking. If there was any inconvenience owing to the scarcity of water, the London County Council would be the last people to try to get the Bill rejected; but he hoped to prove to the Committee that the Companies, taken all together, had enough to supply for some years to come without the present scheme. As to permanent supply, he admitted fully that if the East London Company had to exist for all time as a separate Company some such scheme as was proposed might be necessary. If they remained alone, they would require more storage; but if, as he contended, they were to be bought up by a public body or a Water Commission, or (which was still possible) by the London County Council, these reservoirs were absolutely unnecessary. Then the Commission reported that the provision of storage on the Lea was at least six times as expensive as on the Thames, and that the purchaser of the eight Companies would do the work cheaper. He asked the Committee to say that the temporary supply was unnecessary, because the Government Bill met it; and the permanent supply was unnecessary, because it would prejudice the great question of the water supply of London.

Before the evidence on behalf of the County Council was taken,

Mr. MORTEN addressed the Committee for the Corporation of West Ham. He urged that, in view of the probable purchase by a Water Board, a clause should be introduced into the Bill, similar to clause 3 of Mr. Chaplin's Bill, to prevent any enhanced value being given to the undertaking if the Committee allowed the Company the powers they sought.

Tuesday, May 15.

Mr. *W. H. Dickinson*, examined by Mr. FREEMAN, said he was Chairman of the London County Council, and had been for nine years Chairman of the Water Committee. The opinion of the Council had for some time been that the undertakings of the eight Water Companies should be purchased by some public authority. The subject of purchase by the County Council had been introduced partly by pressure brought upon them by the representatives of the East London district. The question of the East London supply was the most important, because of the fact that the Company had nearly drained the Lea dry. In 1890, the Water Committee inquired into the whole question, and came to the conclusion that the Companies had very nearly reached their daily limits. They applied to the Government to hold an inquiry; and the result was Lord Balfour's Commission. Witness detailed the various Bills which had been introduced by the Council to deal with the water question. The Council were still of opinion that the water supply should be in the hands of a public authority; that arrangements should be made for an additional supply; and that such supply should not be drawn from the Thames and the Lea. Lord Balfour's Commission reported that, whereas London now required 200 million gallons a day, in thirty years from now 400 million gallons would be needed. The question arose whether these extra 200 million gallons could be supplied; and the Committee thought it would be wiser to go to a wider source. With this view, the Council promoted the scheme for a Welsh supply. The Council were unanimously in favour of purchase. Some of the members, however, considered that such purchase should be by a Joint Board, though the majority thought it should be by the Council. The policy of purchase had been supported by Lord Llandaff's Commission. He was acquainted with the Bill, which provided for largely increased storage in the Lea Valley. In his view, these reservoirs would not be provided if the water supply was in the hands of a public authority. The method proposed by the Bill was an extravagant one, in view of the fact that the whole supply would at some future time be in the hands of a central authority. There was no risk to the East-end if the present project was not carried out. The Company's authorized works would not be completed for two years; and last year, which was a season of drought, they had been able, with the aid of the other Companies, to give a supply without difficulty. He objected to the reservoirs being sanctioned, on the ground that they were premature in view of purchase being imminent. The only result would be to largely increase the value of the undertaking when it was purchased. If the Committee granted to the Company the powers to construct these new works, he thought the same clauses should be put in which were inserted in the Staines Reservoirs Bill—a proper sinking fund clause and a sterilization clause.

In cross-examination by Mr. PEMBER, witness admitted that the responsibility of supplying the district was vested in the East London Company.

In reply to the CHAIRMAN, witness said his reasons for being there was to protect the public against any enhancing of the value of the Companies when they came to be bought. The new body who took over the water supply should have the freest hand as to where the necessary storage should be.

Mr. PEMBER intimated that his clients had been able to arrange with Messrs. Ridley, Whitley, and Co.

Lord R. CECIL said that, as the promoters had agreed to modify their proposals, he would not, on behalf of the Hertfordshire County Council, oppose the Bill further. The Company had agreed not to expend any sum of money raised under the powers of the Bill in sinking new wells, and to restrict their power of supplying water in bulk to the urban districts of Cheshunt and West Ham, and such part of the county of Essex as was contained within a straight line drawn from Bishop's Stortford to Lee, near Canvey Island.

Sir *Alexander Binnie*, Engineer in Chief of the London County Council, examined by Mr. FREEMAN, said he found the total capacity of all the Company's reservoirs, if the present proposal was carried out, would be 7400 million gallons. The Company proposed to obtain from these reservoirs 37·4 million gallons; so that for each million gallons they provided storage to the extent of 192 or 193 million gallons. On the other hand, the authorized draught on the Thames by the eight Companies was 185½ million gallons, and the storage which Lord Llandaff's Commission considered sufficient for this quantity was 6177½ million gallons; so that on the Thames the storage was only 33·3 million gallons for each million gallons supplied. The quantity of storage for a daily yield of 300 million gallons was, by the same report, estimated at only 17,500 million gallons. The capacity of the storage the Company already possessed and in construction was 2400 million gallons, and this, in his opinion, was sufficient to supply the 37·4 million gallons in a period like 1893, 4, and 5. In fact, in 1899, when only 1210 million gallons storage was completed, the East London Company did not at any time run short, because a good many communication pipes had been, under Mr. Chaplin's Act, completed. The Companies had already expended £156,000 on this scheme of intercommunication; and they were at present asking the Local Government Board to sanction a further expenditure of £472,000 for the same purpose. So that if the other Companies were able to help the East London Company in 1899, they would be still better able to do so in the future. The method proposed in the Bill was, he considered, wasteful.

In cross-examination by Mr. BAGGALLAY, witness said his view was that a scheme involving an expenditure of more than a million pounds should not be allowed to pass till the Water Board or Trust, which would be formed, had had an opportunity of considering it. The question of purchase had been considered since 1852. There was a very general consensus of opinion in favour of it.

Mr. BAGGALLAY: It would have been a very unfortunate thing if, for 48 years (since 1852), the Water Companies had had to live from hand to mouth, on the chance of purchase?

Witness: It would be advantageous to the public if they had been put upon terms at a much earlier period.

Do you suggest any Company could have provided for the wants of London if they had had to live from hand to mouth during these 48 years?—I think the state of London is a scandal to our legislation. It is the only town which has not its water supply in its own hands.

Cross-examination continued: In his opinion, the East London Company was a defaulting Company, who could not discharge their statutory duties without the aid of other Companies; and they were seeking by the present Bill to be able to do so, and thus increase the price which would be paid for the undertaking. He did not think the proposed reservoirs would ever be made.

Mr. *G. F. Deacon*, examined by Mr. FREEMAN, generally corroborated the evidence of Sir Alexander Binnie. The reservoirs were, in his opinion, not desirable, because they were extremely wasteful, and the same thing could be attained in other ways.

This concluded the case of the London County Council.

The Committee having been addressed by Counsel,

The CHAIRMAN said: The Committee find the preamble of the Bill is proved; but they add the sterilizing clause as regards purchase. That is clause 3 in the Metropolitan Water Act.

Wednesday, May 16.

To-day, the various clauses were considered. The sterilizing clause was to the effect that if the undertaking of the Company is purchased within seven years by any public body or trustees, "Nothing in the Act shall be deemed or construed to authorize the Company to bring into account, or make any claim in respect of, any advantages conferred on them as resulting from the passing of this Act. Provided that in the event of such purchase the Company may bring into account the actual cost of any capital expenditure made by them in execution of the powers of this Act." The number of years during which the sinking fund may be suspended was reduced from seven to three.

The Bill was ultimately ordered to be reported, as amended, to the House.

HOUSE OF COMMONS COMMITTEE.

Thursday, May 17.

(*Before Colonel* GUNTER, *Chairman*, *Sir* GEORGE PILKINGTON, *Sir* W. HORNBY, and *Sir* W. B. GURDON.)

LAMBETH WATER BILL.

The object of the Bill is to authorize the Company to raise additional capital amounting to £750,000, and to carry out further works.

Mr. PEMBER, Q.C., Mr. CLAUDE BAGGALLAY, Q.C., and Mr. RIGG represented the promoters. Mr. RICKARDS, Q.C., and Mr. F. W. PEMBER appeared for the Chelsea Water Company; Mr. W. MACKENZIE, for the Surbiton Urban District Council; Mr. J. W. GREIG, for Mr. Henry Cooper, owner of the Cedars Estate, Ditton; Mr. WORSLEY TAYLOR, Q.C., and Mr. NEPEAN, for the Esher and Ditton Urban District Council; Mr. LITTLER, Q.C., and Mr. J. SHAW, for Mrs. H. Moreing, owner of land at Esher; Mr. J. C. EARLE, for the Middlesex County Council; Mr. PEMBROKE STEPHENS, Q.C., for Mr. H. Speir and Mr. E. F. Sandys; and Mr. BALFOUR BROWNE, Q.C., Mr. WORSLEY TAYLOR, Q.C., and Mr. FREEMAN, Q.C., for the London County Council.

Mr. PEMBER, in opening the case, said the aim of the Bill was to construct a large storage reservoir at Molesey, a water-tower at Esher, and to lay a 54-inch main from Molesey to Long Ditton. The reservoir would be at the back of Molesey, where the Company's intake was from the the Thames; and the line of pipes would go down to Long Ditton, where the Company had filter-beds and works. They proposed to take land for a water-tower and for additional filter-beds. There was another clause in the Bill, by which they proposed to take land by agreement, not exceeding in extent 20 acres, for the purposes of the Company. The County Council of Middlesex had feared they might purchase part of that land in Middlesex; but the Company had no intention of doing so, because all the works were on the Surrey side of the river. They had consented to do what the Committee required in the case of the East London Bill—to insert a clause as to the seven years' sterilization. They would have preferred that this should only apply for three years; but, under the circumstances, they had agreed to accept the clause, as inserted in the East London Bill.

Mr. H. L. CRIPPS, the Parliamentary Agent of the London County Council, said he could not at once consult a body like the Council. But they felt that this case was so similar to the East London, that they would not be justified in troubling the Committee. If the Water Companies were all in one hand, the reservoir would not be required; but if the Lambeth Company were to retain a separate existence, it might be necessary. If the sterilization and sinking-fund clauses were inserted in the Bill, he did not propose to carry the opposition of the County Council further.

Mr. EARLE said the Company had agreed that no land should be taken in Middlesex under the powers of the Bill; and after what the London County Council had done, he did not propose to re-argue the question before the Committee.

Mr. PEMBER (continuing) said the Urban District Councils of Esher and Surbiton objected to the mains going under their streets at all. They contended that the Company should lay the pipes on their own land; but, in his opinion, one of the main purposes for which roads existed was to accommodate gas and water pipes, and things of that kind. Then there was opposition to the water-tower at Esher. The Company had been asked over and over again to supply water at a high pressure to the parts of the district at a greater elevation than they were bound to serve. To carry out this, they proposed to erect a water-tower on the highest point available; and had chosen some land belonging to Mrs. Moreing. They had scheduled 12 acres; but this was, of course, much more than they would require. The Lambeth Company was one of the oldest in London, dating from 1785. They had a large district of 102 square miles—from the Thames to Croydon, and from Esher to Lewisham—though, by the system of districting adopted by the Companies, they did not supply the whole area. The demand and population were both largely increasing. Their present authorized take of water from the Thames was 24½ million gallons a day; and they had also been in the habit of drawing from the gravel beds near the Thames 7 million gallons daily, which the Conservators claimed should be treated as taken from the river. This was a long standing quarrel, which had been settled by the Bill. The present and existing storage was 462 million gallons—only 14 days' supply on the maximum daily demand of 1899. The population supplied

was 719,000; but at the existing rate of increase, in 1910 the population would be 914,000, and in 1920 1,162,000. In 1898 and 1899, the daily supply of water had reached 36·77 and 36·83 gallons per head. The new storage reservoir would hold 1000 million gallons, as contrasted with the 5000 million gallons which had been granted to the East London Company. The extent of the reservoir would be 78 acres. The learned Counsel then went through and criticized the various petitions against the Bill.

Mr. *Harry Wilkins*, Secretary of the Company, gave particulars of the various stocks and of the financial position of the undertaking. There had been a great increase in the district, both in population and demand. The present daily supply was, on the average, 25,162,060 gallons. In 1898, they had for one month a demand of 32 million gallons daily, and for a short time 33 million gallons. They found the consumption of water of late years increasing. This was partly due, no doubt, to the tendency to fix baths in smaller houses. In their experience, more water was needed in a frost than in a drought, because there was so much loss from breakage of pipes and from customers leaving the taps running. The new distributing main would be laid 2 ft. 9 in. below the surface. They had always found this distance sufficient; but they had had an experience which was almost unparalleled. The Company had a 7-inch main laid at a depth of 3 ft. 4 in. frozen; while a smaller pipe laid at a depth of just under 2 feet escaped. With regard to the future requirements, if the population increased at the present rate, in 1910 a quantity of 40 million gallons daily would be needed, and in 1920 nearly 51 million gallons. The total resources of the Company at present were 34 million gallons a day. The Company were not now affiliated to the other Companies; but they would shortly, by the intercommunication scheme, be brought into union. As at present situated, however, they had no water to supply if the pipes were connected. The storage capacity, when the authorized works were completed, would be 462 million gallons. The intended reservoir would increase this storage by 1000 million gallons. The area of the new reservoir was 187 acres. The site was land completely surrounded by the Rivers Ember and Mole, and was practically an island. The estimated cost of the scheme was £530,000. The new 54-inch main would take the unfiltered water from the Molesey reservoir to the filter-beds at Long Ditton.

Mr. Nepean said the objection of the Esher and Ditton Urban District Council was to the mains going along their high road.

Witness (continuing) said they proposed also to erect a tower at Esher. The Esher people had asked for a supply to reach the houses beyond the statutory limit of height; and the only method of furnishing this was by erecting a tower on the highest point available. With regard to the land at Long Ditton for the filter-beds, the Company had acquired part by agreement, and had, but without success, tried to come to terms with Mr. Cooper. They had offered to effect an exchange of land, or to pay him the same price as that at which they had purchased superior land; but Mr. Cooper had declined to treat.

Witnesses having been called to give evidence as to the engineering features and the estimated cost of the scheme, the opposition to the Bill was opened. It was contended on behalf of Mrs. Moreing that her estate would be injured by the erection of a water-tower on the land, and on behalf of Mr. Cooper that the Company were under no such pressing necessity as would entitle them to compulsorily acquire his property.

Friday, May 18.

On behalf of the Surbiton Urban District Council,

Mr. *Taylor*, Surveyor to the Council, stated that a great number of mains and pipes were laid in their roads. In the Maple Road there were already six water-mains, in addition to sewers and gas-mains.

Mr. Worsley Taylor, for the Esher and Ditton Urban District Council, urged that the Company had no right to disturb and injure their public roads, when, by purchase or easement, they could get land adjoining in which to place their mains. If the water were for the purposes of the district, they would have nothing to say; but the mains were to be put down for the supply of other distant populations.

Mr. *A. J. Henderson*, Engineer and Surveyor to the Council, said he had twice had experience of the roads being broken up for the purpose of laying mains during the fifteen years he had held the office. Speaking generally, the laying of the mains had a most prejudicial effect on the roads, and materially damaged the neighbourhood.

Mr. Baggallay having briefly replied on behalf of the Company,

The Chairman stated that the Committee would pass the preamble of the Bill, but would strike out the portion which related to the Esher water-tower.

LEGAL INTELLIGENCE.

Compensation for an Accident at the Bristol Gas-Works.

At the Bristol County Court yesterday week, his Honour Judge Austin was called upon to settle a point as to the distribution of funds in connection with a claim against the Bristol Gas Company by Priscilla Davey, the widow of a gas stoker, under the Workmen's Compensation Act. Mr. E. J. Watson, who represented the applicant, told the Judge that the husband met with an accident in February at the Stapleton Gas-Works. He slipped, fell, and fractured his thigh, and died from the effects of the injury. Respondents had paid £130 into Court; and the widow agreed to accept it. There were living with the widow two daughters—an invalid of 25 and a girl of 17. He asked for an order for a distribution of the funds under section 5 of the Workmen's Compensation rules. He wanted to satisfy the respondents that a receipt from the widow might be a good discharge of the claim. His Honour said that he would consult the Registrars as to the order to be made. He would be inclined to let a substantial sum go out at once to the widow, and a substantial amount remain in Court, subject to the applications to be made from time to time to take out sums for the invalid (it being desirable to retain something to meet contingencies); and some small sum might remain in Court for the younger daughter until she attained the age of 21.

MISCELLANEOUS NEWS.

THE SOUTH METROPOLITAN GAS BILL AND THE PRICE OF GAS TO LONDON LOCAL AUTHORITIES.

At Thursday's Meeting of the Court of Common Council, Mr. Alpheus C. Morton, a member of the Streets Committee of the Corporation, introduced a motion standing in his name, with respect to Part V. of the South Metropolitan Gas Bill now before Parliament, and which has just passed the House of Commons Committee. Mr. Morton dealt with the history of the question of the price charged to local authorities in London for gas for public purposes—pointing out the action the Corporation took in 1868 in obtaining the clauses which enabled the various Metropolitan Gas Companies to amalgamate, and to the efforts that the Corporation successfully made in 1883 (when the amalgamation of the Gaslight and Coke Company with the London Gas Company took place), in getting clauses put into the Scheme (which afterwards became an Order in Council), enabling the northern local bodies to have gas for public lighting at the price charged by the South Metropolitan Company. Mr. Morton stated that the sum that the new Municipal Boroughs would lose, unless the 1883 clause could be kept alive, would be between £30,000 and £50,000 per annum; and that with gas at 1899 prices—viz., Gaslight and Coke Company 3s., and South Metropolitan Company 2s. 1d.—the amount would be considerably over £30,000 a year. It was all very well, said Mr. Morton, to state that, under the 1876 sliding-scale, the sum saved would go to the consumers—in fact, some people said seven-eighths of it. He, however, was not so sure of that; it might go into a reserve fund. Anyway, "I prefer to have eight-eighths in hand to seven-eighths in the 'bush'," said the councillor. It was stated by the member for Farringdon Ward that the sum in question capitalized would come to a million of money. There was no opposition to the motion, which was unanimously carried in the following terms: "That it be an instruction to the Town Clerk to direct attention of the Local Authorities on the northern side of the River Thames to the South Metropolitan Gas Company's Bill in Parliament, and to request them to present petitions to the House of Lords against the proposal of the Company to purchase the portion of the district of the Gaslight and Coke Company on the southern side of the river, as this proposal, unless the Bill be amended, would have the effect of largely increasing the price of gas to the authorities on the north side of the river beyond the rate fixed by the Amalgamation Scheme of 1883 of the Gaslight and Coke Company and the London Gas Company."

THE WHITWICK AND COALVILLE GAS ARBITRATION.

The Umpire's Award.

The Coalville Urban District Council were, by an Act of 1899, authorized to purchase the undertaking of the Whitwick and Coalville Gas Company; and the arbitration proceedings to determine the price to be paid for the undertaking were reported in the "Journal" for April 24, p. 1067. It may be remembered that Mr. Corbet Woodall, M.Inst.C.E., was appointed Arbitrator by the Council, and Mr. Alfred Colson, M.Inst.C.E., of Leicester, by the Company. Mr. J. Shiress Will, Q.C., was the Umpire. The figures of the valuers who gave evidence varied considerably. On the part of the Council, the value was put at £22,911; and for the Company as much as £55,360 was claimed. In addition to the price of the undertaking, the Company were entitled to the cost of obtaining their Act of 1898, and to the expenses of winding up. The Act also provided for compensation to officers and servants for loss of employment. The award of the Umpire, which has just been declared, fixes the price of the undertaking at £39,900; the costs of the Act of 1898, at £1193; the expenses of winding up, at £200; and compensation to the Secretary £400, and to the Sub-Manager £200. The Manager, being continued in the service of the Council, received no compensation. One of the main controversies in the case, it should be noted, was whether the net profit of the Company was maintainable owing to the rise in the price of coal.

STOURBRIDGE GAS UNDERTAKING.

Annual Profits and the Price of Gas.

The Stourbridge District Council had before them yesterday week the report of the Gas Committee, which included the monthly and annual reports of the Manager and Engineer (Mr. W. North). The former showed that there were now 2548 prepayment meters in use. The year's working had been fairly good. There was an increase of £707; but, on the other hand, £1580 more was paid for coal. The gross profit was £8753, and the net balance £1865. The Committee recommended an increase of 4d. per 1000 cubic feet in the price. Mr. Purkis (Chairman of the Gas Committee) gave reasons why an increase in the price was necessary. Mr. Haskew urged that a large portion of the net profit of £1865 should go back to the ratepayers' pockets. If there was any benefit to the town from the works, the present ratepayers ought to have it, and not leave all the benefit to posterity. Had anything adverse occurred from the town taking over the works, the present ratepayers would have been responsible; and they should have any benefit there was from the profit on the undertaking. He agreed that a reserve fund was necessary; but they had a reserve fund in the ratepayers' pockets. Mr. Worthington said it was remarkable that the Committee wanted to raise the price of gas by 4d., seeing that they had a profit of £1800 last year. Mr. Collis contended that the proposal to increase the price was unnecessary, unwise, and impolitic, and asked the Chairman of the Gas Committee to agree to a smaller advance. The increase proposed would only recoil upon themselves. The Chairman (Mr. I. Nash) supported the proposal of the Committee, but said he believed the Council had now sufficient reserve, and ought to be able to contribute a proper amount to the reduction of the rates. A contribution of £1000 a year from the gas profits would mean a reduction of 4d. in the pound in the rates. The Committee's proposal was adopted.

COAL CONTRACTS OF THE WALLASEY DISTRICT COUNCIL.

There was a little discussion on the question of the coal contracts at the meeting of the Wallasey District Council yesterday week. The Gas and Electrical Committee recommended the acceptance of the following tenders for twelve months from the 30th of June next: 3000 tons of Audley and Bunker's Hill screened gas coal at 17s. 2d. per ton, 3000 tons of Wigan screened 4-feet gas coal at 16s. 7d. per ton, 2000 tons of Arley gas coal at 16s. 7d. per ton, 4000 tons of best screened Staffordshire gas coal at 17s. per ton, 4000 tons of best washed and screened gas nuts at 16s. 3d. per ton, and 2000 tons of Wigan screened 4-feet gas coal mixed with cannel at 16s. 6d. per ton. The Engineer reported in connection with the supply of cannel that there were none of the tenders that he could recommend for acceptance; but fortunately there were about 3900 tons of cannel still to be delivered under the present contract, and he would therefore be able to get along until about January next. He submitted a letter from the same contractors offering to supply 1000 tons of Abram cannel broken into 4-inch cubes, ready for retorts, at 29s. 2d. per ton, delivered at Birkenhead, commencing after the expiration of the existing contract, and also offering an additional 500 tons. The Committee recommended the acceptance of this offer.

In the discussion, Mr. Bradford inquired whether there was any special reason why the Council should fix a contract so far ahead as next January, as was proposed in the last recommendation. It was possible that prices might be much lower at that time than at present. In reply, Mr. M'Geoch said there was no prospect of prices becoming better for twelve months at least. All the collieries in Lancashire, Derbyshire, Wales, and Cheshire had put up the price of coal 5s. per ton, and no one could get coal at a less price than the Council were paying. He had thought that they would have been obliged to follow in the steps of other authorities, and raise the price of gas, owing to the increased cost of coal—indeed, he considered they would have to put on the 3d. that was recently taken off; but owing to the good supply of cannel in hand, he hoped they would be able to maintain the gas at its present price. The extra cost of coal amounted to about £5000, so it would be seen that the gas profits went to the colliery proprietors and not to the ratepayers of Wallasey.

The Committee's recommendations were adopted.

FATAL ACCIDENT AT THE EAST GREENWICH GAS-WORKS.

At the St. Alphage Mission Hall, Greenwich, Mr. E. N. Wood recently held an inquiry into the circumstances attending the death of Francis George Rayner, aged 25, which resulted from an accident sustained by him while unloading coal at the East Greenwich station of the South Metropolitan Gas Company. Mr. J. J. Washington appeared for the Company; and Mr. T. Owner, one of Her Majesty's Inspectors of Factories, was in attendance. Charles Glazier stated that deceased, who was his brother-in-law, was accustomed to loading coal. Witness, who was also employed at the gas-works, last saw deceased alive just before he went on board the *John Macintyre* to work. In reply to the Inspector, witness said he saw the skip just before it was hoisted. He did not notice any defect in it, and did not pay sufficiently close attention to see whether the clutches fastening it were properly fixed. The skip started in the wrong position, owing, witness thought, to the crane being too far over the hold. The man who filled the skip shouted to the hatchway man to hold on, and the skip was brought out and landed on the deck of the vessel. Witness did not think there was anything wrong with the skip, which he had just seen outside the Court. James Goodson, a coal porter, stated that he was acting as hatchwayman. The skip came up sideways, and witness called to the crane driver to land it on the deck. The driver lowered the skip steadily, and witness put the hook in the centre. After adjusting the hook, he gave the signal to the crane driver to lift, and the skip was raised. Witness then heard of the accident. Edward Martin, the driver of the crane, said he lowered the skip very slowly on to the deck, and when he again lifted it he could see by the light of the hatchway that the hook was in the centre. When witness had raised the skip about 30 feet, it began to slew; and when the crane was about at full speed, the skip turned over. Witness shouted to those underneath, and stopped the crane. The deceased was 40 feet below the skip when the coal fell. William Brown, another coal porter, said he was in the forehold of the vessel, in the next tank, to deceased, about 10.30 p.m., when he heard the crane driver shout. He saw a lot of coal coming down, and jumped out of the way, dragging his companion with him. When the dust had cleared off, they saw the deceased lying with his head between the two tanks, and nearly covered with coals. They picked him up, and found he was dead. Mr. J. Tysoe, the Superintendent of the station, said the skip was of the type in general use, and he considered it was in perfect working order. It had been used for 15 years without an accident. William Bowman, an engineer, said he had had more than nine years' experience in unloading coal. He had examined the skip outside the Court, and found it was in good condition for working. Dr. Davies deposed to the deceased being dead when he saw him. He said there was a severe depressed comminuted fracture of the skull, and death would be instantaneous. The Jury returned a verdict of "Accidental death."

MONTE VIDEO GAS COMPANY, LIMITED.

Difficulties of a South American Undertaking.

The Ordinary General Meeting of this Company was held last Tuesday, at Winchester House, Old Broad Street, E.C.—Mr. T. C. Tatham in the chair.

The report and statement of accounts (to which reference was made in the "Journal" for the 22nd ult.) having been taken as read,

The Chairman moved their adoption. He commenced his remarks with a feeling allusion to the death of the late Chairman (Mr. A. K. Mackinnon), and recalled to mind the vast amount of time and attention that that gentleman had given to the affairs of the Company. Among other points, he mentioned that Mr. Mackinnon was Consul for Uruguay in this country, and was very jealous for the honour and integrity of the Municipal Authorities of Monte Video. He felt very keenly that, at the time when the Company's concession expired, they were not treated with that justice they had a right to expect, and that others were preferred while they had not an opportunity of going in for a new concession as, the Directors thought, their concession secured to them. At the same time, their late Chairman was of opinion that, sooner or later, this would be acknowledged, and equivalents granted to them. Turning to the balance-sheet, the Chairman pointed out that the total capital receipts outstanding were less by £5360 than last year. This was accounted for by the payment off of debentures to that amount. The debenture debt was now £38,180, having been reduced to this figure from its original amount of £58,080. The reserve account now stood at £54,100, insurance fund at £12,500, and the contingency account at £8172—making a total of £74,772. The balance on profit and loss account was £19,155, which was an increase of £2602 over the preceding year. On the other side of the balance-sheet, they had written off capital out of profit and loss £1057; and £1879 had been added to capital expenditure, for new mains, services, and meters. Stocks showed a total decrease of £1112; and materials for use were less by £793. The Government account amounted to £5611. This, he wished the shareholders to understand, the Government did not repudiate; on the contrary, they said it would be paid. It was due with interest; but for this the Directors had taken no credit. The Government had owed them considerable sums before; and, though very often they had been slow payers, they had on all occasions satisfied the debt in some way or another. Investments and other property amounted to £39,765. This sum included the various stocks in which a considerable portion of the reserve fund was invested, and which were worth in the market some £1500 more than they took credit for. In regard to the financial result of the year's working, he said that after paying all outgoings, the profit amounted to £21,945, to which they added interest and discount amounting to £1029, and a small profit on exchange £132—making in all £23,106 to be dealt with. From this they took the interest on debentures £2177, also £717 for bad and doubtful debts; and they wrote off from capital £1057. Finally, they had to deal with the balance of £19,155, out of which they proposed to pay a dividend, and carry forward a balance, which was small, but he hoped was an earnest of better things to come. The proposed dividend was not a satisfactory one, especially bearing in mind that this was a South American Company; and therefore subject to many vicissitudes which did not occur to English companies or to companies in more settled countries. But when he recalled to mind circumstances of which the shareholders had been advised from time to time, he thought they would agree that they had passed through some considerable difficulties; and he hoped he might say they had come to the end of a long lane. In 1888, they were lighting all the leading public streets in Monte Video; and for this service they received during that year £22,500. Now they only lighted a small suburb, for which they received £265; so that there was about £22,250 which used to come to them which they did not now receive. The Electric Light Company who supplied the streets was practically a Government concern; and it worked under advantages which were denied to the Gas Company. The Electric Company had a very large capital—£350,000; and they had not yet paid a dividend. Of course, competition with a Company like that was somewhat difficult. When the price of gas was reduced, they had every right to suppose that the private lighting would have materially extended. Had it done so, they would certainly have again reduced the price of gas materially to increase the consumption; and the result of this would undoubtedly have been that they would have had a better dividend. During the last two years, the number of private consumers had increased very considerably—by more than 700; but the consumption of gas had not increased in the same proportion, because less gas was now used with the improved means of lighting. He did not see why, as the city grew, and things looked better, they should not get a larger number of private consumers, paying a moderate price and receiving a good article; and he believed the Company would then stand on a firmer and stronger basis than it had hitherto done. He should not like to mislead the shareholders to think this was coming about quickly, or that it was certain to come. But he thought it right the Directors should tell the shareholders what were their difficulties, their hopes, and their aspirations.

Mr. M. T. Hood seconded the motion.

Mr. Trethewy considered that the item of sundry debtors (£16,200) was a heavy sum; it was an increase of £1228 upon last year's account.

Mr. J. Treleaven (Managing Director of the Launceston Gas Company), in the course of a long speech, said they had been told by the Chairman that they had lost the public lighting; and they all knew the public lighting in nearly every town had a great effect upon dividends and the consumption of gas. Tests in many large centres in England had proved that they had a superior thing to the electric light in the incandescent gas-burner; and if it was applicable in England, it was applicable in foreign parts. The Chairman had told them the electric light undertaking in Monte Video had a capital of £350,000; but they themselves had a capital of £541,920. How they got such an amount of capital, with such a small outcome, he was at a loss to understand. He felt there had been a leak in the ship for a long time; and if they went on, this leak would sink the ship, because the capital was so large that it would require £27,096 a year to pay 5 per cent. upon it. Their £20 shares could now be bought on the Exchange at about 10¼. The only way to get their gas consumed was to show the people of Monte Video how to produce illumination at the smallest possible cost; and, even if each individual used less gas, they would have the number wonderfully increased. He would earnestly ask the Directors to take into serious consideration the question of competing with the times; and even if in doing so they paid no dividend in the coming year, the value of the shares would be enhanced in two years' time.

Explanations in regard to one or two other matters were asked for by shareholders.

The Chairman, in reply, said that sundry debtors included the amounts due for gas, residuals, fittings, &c., on the day to which the accounts were made up. The amount of gas which they produced was 75 million cubic feet, which was nothing like the quantity they ought to make; and they had capacity for sending out a deal more. In every conceivable way they had tried to extend the use of gas for purposes other than lighting;

but it was a most difficult thing to get people in South America to depart from their habits. The price of gas in dollars worked out to 14s. 9d.; and the Directors were very anxious to reduce it. Everything that Mr. Treleaven had suggested had been foreseen and acted upon. As to the Company being over-capitalized, it should be remembered that it was started many years ago when people gave very large sums for concessions; and whatever the capital was now, it was their inheritance, and they must do the best they could with it. There was, however, no need to write it down. He also commented upon the fallacy of comparing foreign with English companies.

The motion was adopted.

A dividend of 8s. per share, making, with the interim distribution, 3½ per cent. for the year, was declared.

Mr. Simpson Rostron, in moving the re-election of the Chairman and Mr. Robert Morton as Directors, pointed out that, while the number of consumers increased last year by 13·93 per cent., the sale of gas only advanced by 4½ per cent. This meant simply and solely that a large part of the consumers were burning the gas in incandescent burners, so obtaining more light while using less gas.

The motion was unanimously carried.

The Auditors were next re-appointed; and resolutions having been agreed to recording the shareholders' appreciation of the services of the Directors and staff at home and abroad, the proceedings terminated with a vote of condolence with the family of the late Chairman.

ELECTRIC LIGHTING NOTES.

New plant, for which the contract price is £22,837, is to be erected at the Leicester Corporation electric lighting works. This is part of the scheme authorized by the Council on Oct. 24 last.

For the buildings required in connection with the Heywood Corporation electric lighting scheme a tender, amounting to £3073, has been accepted; and for the chimney shaft, 120 feet high, a contract for £630 has been entered into.

In connection with the Keighley Corporation electric lighting works, the Electricity Committee have recommended the acceptance of tenders for plant amounting to £7104. Messrs. Clayton, Son, and Co.'s offer has been selected for Lancashire boilers, economizers, and pumps.

Two men employed at the Mars Iron-Works, Ettingshall, were on Friday taken to the General Hospital at Wolverhampton, having sustained injuries from an electric shock. It was found that both were dead. They had come into contact with an exposed part of a wire connected with the electric lighting plant on the works.

The Electric Lighting Committee of the Dudley Town Council have issued a report recommending that the Corporation wire the premises of all consumers of electricity free of charge, but not to include brackets, pendants, or other fittings, and that £10,000 be borrowed to cover the cost. They also recommend that consumers shall have, until further notice, the option of being supplied at 5d. per unit throughout, or at 6d. per unit for two hours a day, to be determined by the Corporation or their Engineer, and 1½d. per unit for the remaining twenty-two hours; and that no rental be charged for meters.

We learn from a local paper that the Electric Lighting Committee of the Hanley Corporation have incurred the following losses: In 1897, £188; in 1898, £377; and in 1899, £2269—total, £2834. The Editor of the paper referred to would not be surprised if it were found that several hundred pounds had been lost in addition since the present year began; but the figures given above cannot, he says, be got over. In the return made to the Board of Trade for last year, there is the statement: "Balance carried to the general district rate account, £2269"—meaning, apparently, that this is the sum which the ratepayers will have to make good. He adds: "What the public want to know is why, in the first place, there was any loss at all; in the next place, how the loss came to take the tremendous jump from £376 in 1898 to £2269 in 1899; and lastly, is the loss still going on, and, if so, when it is likely to cease and give way to a profit."

The annual report of the Electric Light Committee of the Hull Corporation for the year ended March 31 was presented for adoption at their last meeting. This is the seventh year's working of the undertaking. At the beginning of the past financial year, £94,958 had been expended in buildings, plant, and equipment; and during the year the Committee incurred further liabilities to the extent of £38,844. The total capital expenditure is £133,802. Two 800-horse power sets were erected, and on March 31 there were 1326 consumers connected, taking 940,192 units of current during the year, against 960 consumers and 749,690 units in the previous year. The Committee have 54 motors taking supply from the mains, of sizes varying from ⅛ to 35-horse power, many of which were connected during the past year; and a 50-horse power motor will shortly be coupled up. The gross receipts were £19,290; the expenditure was £10,631; and the gross profit, £8659. Deducting the contribution to the sinking fund, interest on loans, amount written off for depreciation of meters, &c., the net profit is £1924—a much larger amount than that realized in the previous year.

The electricity works of the Buxton Urban District Council have recently been opened. The Provisional Order was obtained in 1894, but no steps were taken to give effect to it until 1898, when Professor Kennedy was invited to report on the system of electric supply best suited to the conditions and requirements of the district. He advised a three-wire low-pressure system; the pressure being about 230 volts. A handsome brick building was erected on a site near the gas-works, at a cost of £5000; while the expenditure to date on machinery, feeders, mains, lamps, posts, &c., amounted to £14,000. The station equipment consists of three water-tube boilers, capable of evaporating 4500 lbs. of water per hour; four high-speed engines of a total of 320-horse power, and coupled direct to six four pole continuous-current dynamos, having a total capacity of 198 kilowatts. For the day load, a battery of accumulators has been installed, containing 260 cells, with a capacity of 250 ampère hours and a maximum discharge rate of 100 ampères. The feeding and distributing mains consist of concentric lead-covered and armoured cables for the feeders, and triple concentric cable for the distributors. The Local Government Board's sanction to a loan for the works was for £24,769; so that the Council have a balance in hand to provide further machinery, if necessary, for which space has been reserved

GAS-PIPING IN BUILDINGS.

Recent cases of asphyxiation by gas in Boston (U.S.A.) led Mr. J. Lyman Faxon, the Architect of the building for the High School in that city, to contribute to the "Transcript" an interesting article on the dangers arising from gas-fittings and the methods of avoiding them. The following abstract of the article appeared lately in the "Engineering Record."

The Building Department and Board of Health of Boston have recently formulated a new code of regulations governing the installation of gas-piping. While it is quite specific upon comparatively unimportant points, it misses altogether the prime essentials and all-important features of the matter—viz., the system or plan of such installation. It is all very well to be specific as to the kind of piping, joints, couplings, &c., and method of securing them; but herein do not lie the chief causes of danger. The bulk of the work put in by gas-fitters is not installed in an imperfect manner or with inferior materials, as things go. Under the present antiquated system of installations, fatalities are just as likely to occur where the piping has been installed with the best materials and honest workmanship. Further fatalities will continue to occur, under any system, when deliberately planned for suicide, and until the public discontinue the senseless and dangerous habit of turning the gas down to a low candle power, as is often done in the case of sickness, or because some person cannot go to sleep in the dark, or the householder wishes to save the gas bills.

Cases of suicide by gas are probably not one in 100 of the fatalities; and 99 out of 100 are due to improper installation as to system or plan of the work. The habit of lowering the gas, so far as saving by turning down the flame is concerned, has the following result: A clean burner full on consumes about 5 cubic feet of gas per hour, and gives approximately from 12 to 15 candle light; at half cock, it consumes 2½ cubic feet per hour, and gives approximately the light of 3 candles; and when turned down to 0·75-candle power, it consumes 1¼ cubic feet per hour. So that, as the light is turned down, the consumption of gas is increased disproportionately, due to incomplete combustion. While saving something on the gas bills, this reduction of the flame increases the danger.

The natural flow of gas in piping, when under pressure or free from obstructions, is upward, and towards the freest combustion. It can be forced, by pressure, down pipes; but if the pressure is unequal, by reason of imperfectly disposed piping or by larger consumption at other points, its flow will be towards those parts of the system which are under the greatest pressure or freest consumption. It is, therefore, of the greatest consequence that the pressure in any system of piping shall be equal and constant at all points. The pressure in vertical pipes increases about 10 per cent. for every 30 feet of rise, and diminishes about 5 per cent. for every 30 feet of fall; so that the difference in pressure between two burners 60 feet apart vertically will be about 15 per cent. of the initial or normal pressure. This accounts for the extinguishing of the gas-flame when turned down low.

The present system of gas-piping is radically wrong, entirely inadequate, and extremely dangerous. Building laws are framed to safeguard life in regard to structural stability, fire, egress, the effects of electricity, and insanitary arrangements, but in respect to gas-piping practically no improvement has been made for a quarter-of-a-century, and it is still the rule to follow the same old dangerous system. It ought to be clear to the lay mind—and certainly so to the architect, builder, and gas-fitter—that no gas-pipes in a building should be run vertically down; and yet thousands of pipes are so installed. Generally speaking, the present system of installation is to take the main supply-pipe from the meter to some central point in the basement of the building, whence a vertical riser is run to the top storey; diminishing in size as it ascends, and taking off at each floor a branch supply-pipe, with tap circuits or feeders to the ceiling and wall lights of the storey below—all ending in dead-ends. There is rarely any sub-division of the system into individual circuits. The outlet-taps are usually taken off the bottom of all horizontal lines of piping, instead of the side or top of the pipe—thus causing all such taps and the appended fittings to constitute receptacles for condensation, instead of providing for the return of condensation to the base; and, further, there is no provision whatever for equality of pressure throughout the entire system. Now, under this arrangement, let us state a case, and a common one, in any building of three storeys or more: Time, 10 o'clock p.m.; place, room on a lower floor, with occupant sleeping, gas-flame turned down to ¼-candle power, windows and doors closed, and no ventilation. At 12 o'clock, or later, party returns from theatre with friends to room in top storey, and turns on all burners full. The flame in the lower room is extinguished by the drawing of the flame into the pipe, caused by the excessive use of gas in the upper rooms; in a few moments the draught is relieved, gas is ejected into the lower room through the open burner, and the occupant is asphyxiated in three or four hours if the accident is not discovered.

The proper system for installing gas-piping Mr. Faxon outlines as follows: (1) Each and every separate storey or apartment in a house, hotel, office, or other building liable at any time to contain a sleeping occupant, should have its circuit from the base or initial source. (2) All gas-heaters and gas-stoves should have separate circuits from the initial source. (3) All corridor, hall, and vestibule lights should likewise have separate circuits. (4) All circuits should have pipes for equalizing pressure, making complete circuits throughout individual systems from the initial sources, up, round, and back to their source. He has found in practice that the sizes of such pipes must be about five-eighths that of the main supply circuits, and that proper installation costs from 20 to 25 per cent. more than under the old system. (5) The individual main circuit supply-pipes should be taken off a properly calculated header or drum, and each circuit cut off by a suitable valve at the header; thence the individual circuit should be run to a centre of distribution of branch and tap circuits. All vertical pipes should be run up, and not down; and all off-takes should be at the side or the top of the pipes, and in no case at the bottom. All piping should pitch towards the initial source, to allow for condensation. The main circuit pipe should be continued throughout and round the entire individual system, and returned from the farthest point to, and connected with, the base or initial circuit pipe. This is of the utmost importance. Properly installed, the danger of the gas service will not only be reduced to a minimum (provided people exercise care in the use of the burners), but the quality and illuminating power of the gas will be materially increased. This

system has been used by Mr. Faxon for about ten years in his practice; so that it is not in any sense an untried theory.

The foregoing abstract may be completed by the following quotations from the specifications prepared by Mr. Faxon for the High School buildings already referred to: "Pipe the building throughout for gas to the several outlets indicated on the plans and sections; also to all outlets and fixtures in and for the benches, hoods, and other apparatus in the several laboratories, according to the best work and requirements. The pipe and fittings are to be of the best make; and care is to be taken to see that lines and fittings are free of scales and obstructions, and of the standard sizes for the supply to the number of burners at individual outlets. All piping in and for the chemical laboratory to be of finished brass tubing, and fittings iron pipe sizes. The main supply is to be entered from the street service, and a meter provided and set in the boiler-room. The main from the meter is to supply a 'drum' or header, off which are to be taken the several circuits hereafter specified; and each circuit pipe is to be fitted with a finished brass full-way valve, and tagged with a nickel-plated name-plate, designating the individual circuit. Mains and branches are to be run as direct as possible, along with electric conduits—in no case passing under or over such conduits when avoidable; and all outlet ends are to terminate in boxes (provided by the electric lighting contractor), the rims of which are to be set flush with the face of the finished plastering. All branches are to be taken from the side or the top of the mains, not from the bottom; and all piping for the wall outlets is to be run up, and not down. All piping is to have an even and constant grade and pitch to the initial sources, and all traps or pockets are to be avoided. Piping and fittings are to be secured by iron hold-fasts—no screws or nails will be allowed; and all outlets are to have the quarter fitting within the outlet-boxes, and not at the back of them, and the outlets capped. All the main circuits are to be installed so as to provide for a continuous and connected circuit and circulation from the initial source, up, over, and down, and returning to the base of supply, to ensure a constant and even pressure throughout and at each individual outlet. The amount of lighting power at each outlet is to be equal to the combined candle power provided for at each outlet. The gas-fitter is to co-operate with the electrical contractor, and effect the installation of gas-piping parallel to, and in connection with, the installation of the electric conduits. The complete installation is to be tested by the Gas Company, at the expense of the Contractor; and the Company's certificate of inspection and approval is to be deposited with the Architect."

The Acetylene Light Syndicate, Limited, is not a particularly prosperous concern. According to the accounts recently sent out, the issued capital is shown to be £4151; debentures, £3275; loans, £900; sundry creditors, £2323; and overdraft at bank, £1396—making with other small amounts the total liabilities £12,090. As assets certain patents figure for £1831; plant, engines, &c., for £3770; carbide process plant for £1281; sundry debtors for £577; and stock for £598, &c. Having taken credit for these and other items, the accounts state that there is a net loss of £2872.

LONDON COUNTY COUNCIL AND THE WATER QUESTION.

The "Sterilization" Clause—Legislative Proposals for Next Session.

At the Meeting of the London County Council last Tuesday—Mr. W. H. Dickinson in the chair—a report brought up by the Water Committee at the previous meeting, in reference to what has become known as the "sterilization" clause in recent Water Acts, was under consideration. The Committee pointed out that in the Staines Reservoirs Act, 1896, the clause ran as follows:—

If the undertaking of any of the three Companies be purchased within seven years from the passing of this Act otherwise than by agreement by any public body or trustees, nothing in this Act contained shall extend or be deemed or construed to extend to authorize the Company to bring into account, or to make any claim in respect of, any advantages conferred on them by, or resulting from, the passing of this Act.

In the Southwark and Vauxhall Water Act, 1898, the period was ten years. In one instance—that of the Southwark and Vauxhall Water Act, 1884—the time has already expired; while in the Staines Reservoirs Act above referred to it will expire in 1903, and in two other Acts (the Staines Reservoirs Act, 1898, and the Southwark and Vauxhall Water Act, 1898) in 1905 and 1908 respectively. The Metropolis Water Act, 1899, which provides for intercommunication of supplies between the Companies, also contains a similar clause, the operation of which will cease in 1906. The Committee went on to say that the fact that, under the Staines Reservoirs Acts of 1896 and 1898, which authorize an expenditure of £1,250,000, the great advantages of this clause to the ratepayers would be lost if purchase were not effected by 1903, was one of the several reasons urged in favour of legislation during the present session. It was obviously quite possible that, even if the Government introduced a Purchase Bill next year, the purchase might not be completed in time, and would then be attended with greatly enhanced expense. The present position was that the Council's Bills had been rejected, but no promise had been made on behalf of the Government that the subject would be dealt with next session. It was therefore of great importance to the ratepayers that the period during which the clause would apply should be extended. They therefore recommended "that a Bill be promoted by the Council in the next session of Parliament to provide that, in the event of a Bill being passed for the purchase of the Water Companies' undertakings within the period up to 1908, the clauses in the several Acts of the Companies known as the 'sterilization' clauses shall be deemed to be in operation up to that date; and that the preceding recommendation be referred to the Parliamentary Committee."

Mr. Beachcroft objected to the Council initiating further legislation on the water question, and moved, as an amendment—"That, in the opinion of the Council, there ought now to be no delay in the settlement of the water question, but that further legislation should be initiated by the Government, and accordingly that the First Lord of the Treasury should be asked whether such legislation is contemplated."

Mr. R. A. Robinson seconded the amendment.

Dr. Collins thought the suggestion that they should again go to the

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1492.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 11	10½	Alliance & Dublin 10 p. c.	20—21	..	5 0 0
100,000	10	,,	7½	Do. 7 p. c.	13½—14½	..	5 3 5
800,000	100	Jan. 2	5	Australian 5 p. c. Deb.	102—104	..	4 16 2
200,000	5	May 16	6	Bombay, Ltd.	6—6½	..	4 12 4
40,000	5	,,	6	Do. New, £4 paid	4—4½	..	5 6 8
880,000	Stk.	Feb. 23	12	Brentford Consolidated	250—260	..	4 12 4
270,000	,,	,,	9	Do. New	185—190	..	4 14 9
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb.	118—123	..	3 5 1
220,000	Stk.	Mar. 14	11½	Brighton & Hove Orig.	235—240	..	4 15 10
226,320	,,	,,	8½	Do. A. Ord. Stk.	175—180	..	4 14 5
999,506	Stk.	Feb. 23	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Mar. 29	10	British	39—40	..	5 0 0
50,000	10	Feb. 23	12	Bromley, Ord. 10 p. c.	24—26	..	4 12 4
79,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	May 16	6	Buenos Ayres (New) Ltd.	9—9½	..	6 6 4
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	100—102	+1	3 18 5
150,000	20	Mar. 14	8½	Cagliari, Ltd.	24—26	..	6 6 11
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	14—15	..	5 6 8
50,000	50	May 2	6	Do. 6 p. c. 1st Mort.	55—57	..	5 5 3
550,000	Stk.	Apl. 11	13½	Commercial Old Stock	275—285	..	4 14 9
200,325	,,	,,	10½	Do. New do.	210—220	..	4 15 5
288,237	,,	Dec. 14	4½	Do. 4½ p. c. Deb.	141—144	..	3 2 6
900,000	Stk.	May 31	9	Continental Union, Ltd.	155—165*	+4	5 9 1
200,000	,,	,,	7	Do. 7 p. c. Pref.	173—175*	+1½	3 18 8
51,600	Stk	Feb. 23	14	Croydon A 10 p. c.	335—340	..	4 2 4
173,400	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
555,000	Stk.	Feb. 23	5½	Crystal Palace Ord. 5 p. c.	116—120	..	4 7 6
60,000	,,	,,	5	Do. 5 p. c. Pref.	139—135	..	3 14 1
486,090	10	Jan. 26	11	European, Ltd.	19½—20½	+½	5 7 4
354,060	10	,,	11	Do. £7 10s. paid	14½—15½	+½	5 6 5
14,999,675	Stk.	Feb. 9	4%	Gas- 4 p. c. Ord.	9½—102	+½	4 16 0
2,500,000	,,	,,	3½	light 3½ p. c. max.	96—98	..	3 11 5
3,799,755	,,	,,	4	and 4 p. c. Con. Pref.	116—118	..	3 7 10
3,999,975	,,	Dec. 14	3	Coke 3 p. c. Con. Deb.	96—99	..	3 0 7
70,000	10	May 31	8	Hongkong & China, Ltd.	13½—14½*	+½	5 10 4
2,999,000	Stk.	May 16	10	Imperial Continental	203—206	+1	4 17 1
473,600	Stk.	Feb. 9	3½	Do. 3½ p. c. Deb. Red.	100—103	..	3 8 0
75,000	5	Dec. 14	6	Malta & Medn., Ltd.	4½—5½	..	5 14 3
560,000	100	Apl. 2	5	Met. of 5 p. c. Deb.	107—110	+1½	4 10 11
250,000	100	,,	4½	Melbourne 4½ p. c. Deb.	105—107	..	4 4 1
841,920	20	May 31	8½	Monte Video, Ltd.	10½—11½*	+½	6 1 8
687,946	Stk.	Feb. 23	9½	Newc'tle & Gatesh'd Con.	215—220	..	4 4 1
299,755	Stk.	Dec. 29	8½	Do. 8½ p. c. Deb.	104—107	..	3 5 5
150,000	5	May 16	8	Oriental, Ltd.	7—7½	..	5 6 8
135,000	5	,,	8	Do. New, £4 10s. pd.	6½—6¾	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.	1½—1¾	..	4 11 5

* Ex. div.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
60,000	5	Feb. 23	7	Ottoman, Ltd.	5—5½	..	6 7 3
500,000	100	June 1	5	People's Gas 2nd Mtg. of Chicago Bonds	102—106*	+3	5 13 2
851,070	10	Apl. 27	7	River Plate Ord.	10½—10¾	..	6 10 3
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	101—103	+1	3 17 8
250,000	10	Apl. 11	8	San Paulo, Ltd.	11½—12½	..	6 8 0
135,000	Stk.	Mar. 14	10	Sheffield A.	245—247	..	4 1 0
209,053	,,	,,	10	Do. B.	244—246	..	4 1 4
447,427	,,	,,	10	Do. C.	244—246	..	4 1 4
5,600,000	Stk.	Feb. 23	5½	South Metrop., 4 p. c. Ord.	125—128	+1	4 3 3
1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb.	98—100	..	3 0 0
380,940	Stk.	May 16	5	Southampton Ord.	115—120	..	4 3 4
70,825	,,	Dec. 29	4	Do. 4 p. c. Deb.	120—125	..	3 4 0
120,000	Stk.	Mar. 14	6	Tottenham A. 5 p. c. and B. 3½ p. c.	123—125	..	4 16 0
250,520	,,	,,	4½		93—98	..	4 11 10
55,100	,,	Dec. 14	4	Edmonton 4 p. c. Deb.	113—117	..	3 8 5
182,380	10	Jan. 12	5	Tuscan, Ltd.	7—8	..	6 5 0
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.	101—104	..	4 16 2
				WATER COMPANIES.			
780,399	Stk.	Dec. 29	11	Chelsea, Ord.	305—310	..	3 11 0
150,000	,,	,,	5	Do. 5 p. c. Pref.	157—162	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	145—150	..	3 0 0
175,785	,,	Mar. 29	4½	Do. 4½ p. c. Deb.	145—150	..	3 0 0
1,720,560	Stk.	Apl. 11	7	East London, Ord.	188—193	..	3 12 6
654,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb.	145—150	..	3 0 0
390,000	,,	,,	3	Do. 3 p. c. Deb.	99—101	..	2 19 5
700,000	50	Dec. 14	7½	Grand Junction 10 p. c. max. 4 p. c. Deb.	104—107	+2	3 10 1
310,000	Stk.	Mar. 29	4		130—135	..	2 19 3
708,000	Stk.	Feb. 23	14	Kent	307—312	..	4 9 9
160,000	,,	,,	7	Do. New, 7 p. c. max.	200—210	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.	290—295	..	3 11 2
406,200	100	,,	8	Do. 7½ p. c. max.	207—212	..	3 15 6
350,000	Stk.	Mar. 29	4	Do. 4 p. c. Deb.	130—133	..	3 0 2
500,000	100	Feb. 23	13½	New River, New Shares	417—422	+2	3 4 0
1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb.	132—137	..	2 18 5
902,300	Stk.	Dec. 14	7½	South-wark Ord. 7½ p. c. max. and 5 p. c. Pref.	195—200	..	3 15 0
126,500	100	,,	7½		185—190	..	3 18 11
499,200	Stk.	,,	5		160—165	..	3 0 7
1,019,585	,,	Apl. 11	4	Vauxhall 4 p. c. A Deb.	129—134	..	2 19 9
1,165,966	Stk.	Dec. 14	10	West Middlesex	285—290	+2	3 9 0
200,000	,,	,,	4½	Do. 4½ p. c. Deb.	147—152	..	2 19 3
200,000	,,	Mar. 14	8	Do. 8 p. c. Deb.	99—101	..	2 19 5

*Ex div.

Government and ask their views on the water question was a little redundant. It was quite possible for legislation to be initiated without taking any such step. The Council had put forward a policy which was acceptable to the majority of the London electors. To approach the Government would, in his opinion, only be a waste of time.

Mr. HARRIS expressed the opinion that it was highly desirable for the Council to approach the Government before any resolution was passed in favour of further legislation. The only way in which they could settle the water question was through the Government, who held the keys of the situation.

Mr. WHITMORE, M.P., also considered that the only way of settling the matter was by the Government. At present the First Lord of the Treasury could not answer the question suggested in the amendment. The Government should, however, be pressed to deal with the subject at the earliest possible moment. This could best be effected by the Council unanimously passing a resolution thereon.

The amendment was rejected.

Mr. WHITMORE then moved, as a further amendment—"That, in the opinion of the Council, there ought now to be no delay in the settlement of the water question, and that Her Majesty's Government should initiate legislation on the subject as early as may be possible."

Mr. COHEN, M.P., seconded the amendment.

Mr. M'KINNON WOOD (Chairman of the Water Committee) thought the opinion expressed in the amendment would not have the slightest weight with the Government. It was to be assumed that the legislation desired by those who supported the amendment was on the lines of the report of the Royal Commission. He severely criticized the Trust as proposed by the Commission, and said that the suggestion for the constitution of such a body was only part of the attack which was now being made on municipal enterprise. In standing up for the Council's proposal in reference to the London water supply, he believed he was defending the true principles of municipal government.

After some further discussion, the amendment was, on a division, rejected by 70 votes to 35, and the recommendation of the Committee adopted.

The Council then proceeded to consider another report brought up by the Committee at the previous meeting. They stated that, in view of the Standing Orders of the Council, which require that schemes involving parliamentary sanction shall be brought up not later than the first meeting in June, they had directed their attention to the question of the action which the Council should be advised to take next session with regard to legislation. They pointed out that, neither in replying to the deputation who waited upon him, nor in the debate in the House of Commons, in which he opposed the second reading of the Council's Bills, was any indication given by the President of the Local Government Board of the course which the Government intended to pursue; nor was it known whether they were likely to propose legislation based on the recommendation of the Royal Commission in favour of purchase. After giving the matter due consideration, they advised the Council to adopt the same course as in the last two years, when, by a suspension of the Standing Orders, the Committee were enabled to present their report after the summer recess. They recommended—"That the Standing Orders be suspended so far as they would affect proposals for legislation in the session of 1901 dealing with the Metropolitan water supply, and that the Water Committee be authorized, if they deem it advisable, notwithstanding the Standing Orders, to recommend applications to Parliament on this subject at any time not later than Nov. 13, 1900."

The recommendation was adopted.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Many will learn with regret that Mr. Kinloch Anderson, who has taken so great an interest in the gas supply of Edinburgh and Leith since the creation of the Gas Commission there, in 1888, has been laid aside from work by illness—a sudden seizure of a paralytic nature. Happily it is not severe; and there is strong hope of his recovery. Should he be unable to return to his place in the Commission, his loss will be very much felt. There is not any member who has the work of the Commission at his finger-ends as has Mr. Kinloch Anderson. The subject of his illness was mentioned by Provost Mackie, of Leith, who presided over a meeting of the Commissioners on Monday. He said they had all heard with much regret of Mr. Anderson's illness; and they would be glad to learn that he was now very much better. Mr. Waterston suggested that the Clerk should write a kindly letter to Mr. Anderson, on behalf of the Commissioners; and this was agreed to unanimously.

The report of the Engineer (Mr. W. R. Herring) showed that during the month of April the gas made at the three stations of Edinburgh, Leith, and Portobello, amounted to 120,420,000 cubic feet, an increase of 3,816,000 cubic feet over April of last year. Between May 16, 1899, and the end of April, the total output of gas was 1,832,331,000 cubic feet, an increase over the corresponding period of the preceding year of 97,812,000 cubic feet. This, it was explained, was equal to an increase of 5·52 per cent. In the corresponding period of the preceding year, there was an increase of 4·4 per cent.

The Finance and Law Committee reported the redemption of a £10 annuity of the Edinburgh and Leith Gas Company, at the price of £292 10s. This is equal to 29⅓ years' purchase. In the year 1908, it becomes open to the Committee to redeem all the annuities at 28½ years' purchase, so that the price at which this annuity has been extinguished is very moderate.

The Perth Gas Commission met on Monday to make an appointment to the post of Engineer and Manager. Meeting in committee, they proceeded to vote upon the three applicants who were on the short leet. This resulted as follows: Mr. A. Waddell, of Broughty Ferry, 15; Mr. W. B. M'Lusky, of Selkirk, 13; and Mr. D. Easson, of Maybole, 12. Mr. Easson was dropped; and the final vote resulted as follows: Mr. M'Lusky, 14; Mr. Waddell, 12. The meeting was then made an open one of the Commission; and on the motion of Lord Provost Macgregor, Mr. M'Lusky was unanimously appointed. It was, the Lord Provost



COAL PRICES TO GO HIGHER IN SUMMER.

It is almost certain, the *Morning Leader* thinks, that 30s. a ton for coal will be passed before long. For a month or two the price may possibly drop to 29s., supposing there is a fine summer; but in August the almost unbroken steady rise of twelve months will again continue its career.—*Westminster Gazette, May* 9, 1900.

We shall be glad to provide Gas Departments with TRAINED INTERVIEWERS (Ladies or Gentlemen), to impress this on their Consumers, and to show that GAS, although advanced in Price, is cheaper than COAL as a Fuel. Please communicate with us if you decide to increase your Day and Summer Consumption.

May we refer you to Gas Departments in all parts of the United Kingdom, as to Methods and Results?

said, a matter of congratulation to every one of them to know that they were to have as Manager one so well qualified and experienced as Mr. M'Lusky. He trusted that the future of the gas-works in Perth would be to the satisfaction of the whole community, and to the credit of Mr. M'Lusky. Mr. Watson, Convener of the Works Committee, who seconded, said he thought they had been very fortunate indeed in securing for the appointment a gentleman of the capabilities of Mr. M'Lusky. Mr. M'Lusky, who is 32 years of age, was trained as a gas engineer, and holds certificates in chemistry, machine construction, building construction, and drawing. He has special experience in coal analysis. I also beg to offer my congratulations to Mr. M'Lusky on his promotion to so important a post at so early an age. He has plenty of work in front of him; and he has the spirit and the ability which will enable him to face it. There are few men in the ranks of gas managers who have a mind so well stored with facts and reflections relative to gas supply, or who have a greater readiness in the application of their knowledge to circumstances as they arise.

It is not before time that the Perth Gas Commissioners are setting about the removal of the works to a new site. There is no room to work in the present buildings; and, as for storage, materials have to be piled up any way. The store of coal has been built up in bulk till it has affected the stability of one of the buildings. The front wall is so bulged out that it has been necessary to put on a watchman to prevent people walking where it is dangerous.

The statement is made that it has become a practice in Perth to insert what are known as coal checks in prepayment meters. As many as 60 of these were found in meters on Monday, which was the removal term day in Scotland. A criminal prosecution is spoken of.

The Bothwell and Uddingston Gas Company have issued their report for the year ending April 30. The balance at credit of the revenue account, after charging all renewals and bad debts, amounts to £3057—being an increase of £591 over that of the previous year. The amount at the credit of the profit and loss account, after writing off £498 for depreciation, and including a balance of £939 from the previous year's account, is £3367. The Directors recommend a dividend at the rate of 10 per cent., the addition of £500 to the reserve fund, and the carrying forward of £1067. The quantity of gas manufactured was 44,700,000 cubic feet; and the amount consumed was 41,975,500 cubic feet—about 4,000,000 cubic feet increase. Unaccounted-for gas amounted to 6 per cent., which was slightly less than a year ago.

I mentioned last week that the Municipality of Cupar were about to take over the public lighting of the burgh from the Gas Company. It will be better in every way that the public lighting should be in the hands of those who bear the responsibility. This responsibility is not only to the citizens in the matter of lighting the streets, but to the wider public who may frequent the streets, in the shape of liability to recompense in the event of injury. The Commissioners have felt this in an action which was brought against them in the Sheriff Court, at the instance of a female factory worker, who claimed £6 as damages for injuries which she sustained on account of the streets not being sufficiently lighted. Sheriff Armour gave her decree for £3 7s. 4d. His opinions may be of interest, as showing the attitude of a fresh mind upon the methods of public lighting. He was far from saying that the Commissioners were precluded from utilizing the light of the moon when it was available; but this must be done in a reasonable manner, and with reasonable provision for its failure, as was not uncommon, on a wet, cloudy December afternoon. It seemed impossible to affirm that the defenders' method of utilizing the moon's light at the time the accident happened was reasonable, or that there was any suitable light at the place; and, accordingly, he had no alternative but to give decree against them. The primary cause of the accident was the darkness that prevailed at the spot; and it seemed idle to say that the plaintiff should have walked on the south side of the street, or held her hand out in front of her. On this principle, her only safe course would have been to have carried a lantern.

The two following items appeared in a Glasgow newspaper this week: "In connection with the fixing of gas coal contracts, it may be stated that never before did so many coalowners withdraw their first offers and affix a further advance in quotations. No end of litigation was threatend by gas companies; and in most cases the coalowners had to hold by their first offers. The early prices for cannel averaged 19s. 9d. per ton; but latterly the quotation was 20s. 6d. to 21s." "Some of the Scotch private coal companies are earning enormous dividends. A local concern has just distinguished itself by declaring one of 75 per cent." The latter is most probably correct; the former I regard as merely guesswork.

CURRENT SALES OF GAS PRODUCTS.

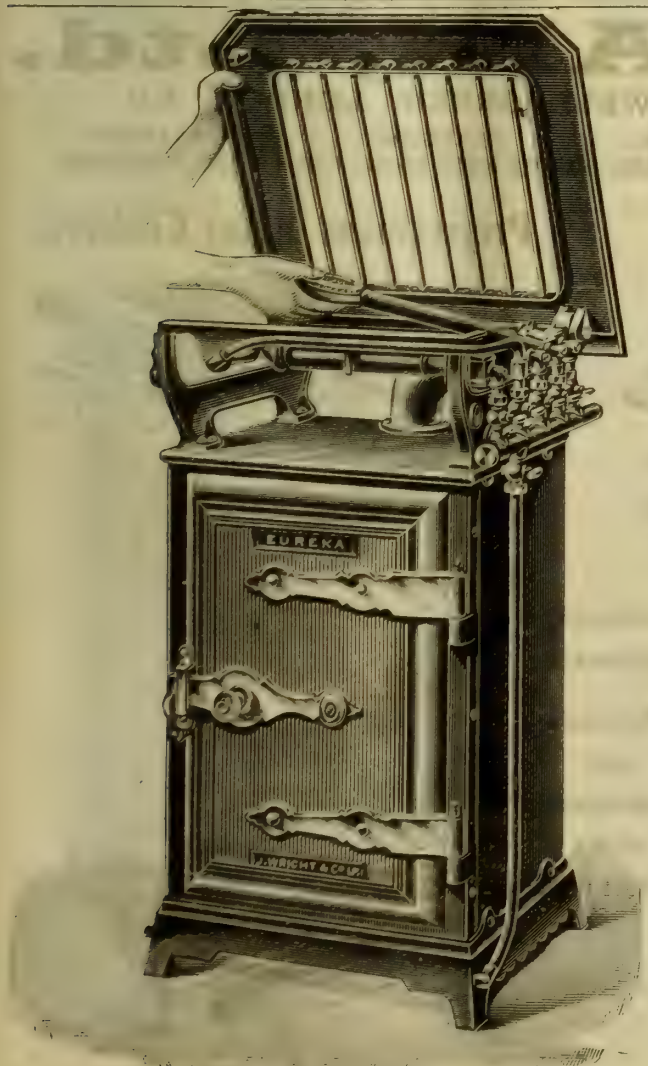
LIVERPOOL, *June* 2.

Sulphate of Ammonia.—The market has been quiet throughout the week; and prices have been barely maintained—closing quotations being £11 3s. 9d. to £11 7s. 6d. per ton f.o.b. at the ports. There has been a fair amount of inquiry. But buyers have been for the most part unwilling to operate except at a discount upon present prices; and this makers whose stocks are light have been slow to concede. The business transacted has therefore been of a very limited character. In forward delivery no business of importance has transpired; and quotations remain about £11 10s. per ton.

Nitrate of Soda is easier; the quotations being 8s. 3d. per cwt. for ordinary, and 8s. 6d. for refined, quality.

LONDON, *June* 2.

Tar Products.—There is an absence of strength in most of the articles on this market. Urgent sellers are offering at a reduction in the prices of several of the staple products. The scarcity of timber, and the difficulty in procuring material, has undoubtedly shortened the use of creosote; while the increased production of this product—chiefly in Scotland, from blast furnaces—has also damaged its prospects. Benzols are steady; and the formation of a Benzol Committee, which includes most of the large producers, it is hoped will prevent some of the violent



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fluctuations which have marked this article for some time. A slightly better feeling exists in respect to solvent naphtha, as well as the burning quality; but makers have stocks, and no important improvement can come until these are moved. Again there is more inquiry for anthracene; makers being firm in their ideas of value.

The average quotations during the week are: Tar, 17s. 6d. to 27s. 6d. Pitch, east coast, 37s. 6d.; west coast, 34s. 6d. Benzols, 90's, 7d.; special qualities for gas, 9d.; 50's, 10d. Toluol, 1s. 2d. Solvent naphtha, 1s. 1d. Crude naphtha, 3½d. Heavy naphtha, 11d. Creosote, 2½d. Heavy oils, 3d. Carbolic acid, 50's, 2s. 3d.; 60's, 2s. 9d. Naphthalene salts, drained, 30s.; pressed, 70s. Anthracene, "A," 4d.; "B," 3d.

Sulphate of Ammonia.—The little spurt that commenced last week has apparently spent itself. At the moment, sulphate is neglected; and buyers are holding off for lower prices. Few makers have any stocks, and only a small business is being done; the average value at present being £11 2s. 6d. to £11 5s. per ton, less 3½ per cent.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—During the past week there has been an extra pressure for supplies of all descriptions of fuel, to carry merchants and consumers over the Whitsuntide holidays; and this has for the time being checked any tendency to slacken off which was previously becoming noticeable. The important gas coal contracts are now being rapidly settled; and in all cases the basis is that of an advance of 5s. per ton over last year's prices. This represents from 13s. to 13s. 6d. per ton at the pit for the lower qualities, such as Wigan four-feet gas coals, and 14s. to 14s. 6d. for the better qualities of screened Arley coals. These prices apply to the larger contracts, with perhaps 3d. or 6d. per ton more obtained in odd cases on some of the smaller quantities. Not only have the coalowners taken advantage of the position to secure this advance of 5s. per ton, but there has been a very drastic overhauling of the contract conditions; and clauses which, during the past two or three years, have been very much complained of as bearing unfairly upon collieries, have been altogether eliminated. In fact, coalowners just now have the "whip-hand," and are making use of the position to the utmost to their own advantage. The better qualities of round coal are in fairly brisk request for house-fire purposes; and other descriptions of fuel, including the lower qualities of round coal and slack, are in pressing demand for iron making, steam, and general manufacturing purposes. All the coal the collieries are raising is going away; and the main difficulty they have to face is to provide sufficient supplies to keep customers going during the prolonged Whitsuntide stoppages of the pits, as practically there are no stocks whatever upon which they can fall back. Prices at the pit are firm at the full rates last quoted—namely, 13s. and 13s. 6d. per ton for common round coal, to 14s. 6d. and 15s. 6d. for the better qualities, and from 10s. 6d. to 11s. 6d., according to quality, for engine fuel. Shipping is moderate, with Association list rates unchanged at 14s. 6d. per ton for unscreened, to 15s. 3d. for screened steam coal, delivered at the Mersey ports. But these prices are not being very readily obtained; and in some cases collieries outside the Association are offering at rather lower figures. Coke meets with an exceedingly active demand; and on forward contracts advances on current rates are being secured. At the ovens, furnace cokes are now quoted at 24s. 6d. to 25s. per ton, with foundry sorts about 31s. to 32s.

Northern Coal Trade.—Though the demand for coal has been influenced by the scarcity of steamers to carry it away, yet on the whole there has been a better demand felt during the last few days. Possibly, this may be partly in preparation for the holidays. Steam coals, however, were rather lower in price last week; and 18s. to 18s. 6d. per ton f.o.b. may be looked on as the current rate for best Northumbrian qualities. Gas coals are active in demand—the deliveries on old contracts being considerably above those usual in the middle of the summer; while there are heavy shipments in progress to the Baltic. Thus the large output of the collieries is well taken up; and it may be said that gas coals are still relatively scarce. Local contracts have been taken up at or equal to about 16s. per ton f.o.b.; while for occasional cargoes about 17s. per ton is the f.o.b. price. In some quarters, however, the opinion is beginning to prevail that prices have now reached their maximum. Coke is very steady, without much change in the price—about 35s. per ton f.o.b. for best Durham coke for export. The gas coke trade is again dull, and must be expected to continue so till the settlement of the mid-year contracts. The production of gas coke is about at its lowest; and stocks are very limited at all the works near navigable waters.

Scotch Coal Trade.—A strong demand still continues. The miners are not working quite so steadily as they did during the winter, with the result that supplies are getting less, and prices are advancing. It has been resolved by the coalmasters to increase the price of splint for consumption in iron-works by a shilling per ton. The price is now 14s. per ton at the pit, as compared with 7s. 6d. this time last year. The quotations are: Main 14s. to 14s. 3d. per ton f.o.b. Glasgow, ell 15s. 6d. to 16s. 6d., and splint 15s. 6d. to 16s. The shipments for the week amounted to 232,661 tons—an increase of 7703 tons upon the previous week, and of 50,106 tons upon the corresponding week of last year. For the year to date, the total shipments have been 4,115,230 tons—an increase of 919,406 tons upon the same period of last year.

A Cumberland Water Scheme.—At a meeting at Wigton last Tuesday, a General Committee of representatives of the Holm, Cultram, Wigton, and Aspatria District Councils unanimously passed a resolution recommending that the Overwater and Ellen water scheme, by which it is proposed to supply a wide area to the north and north-west of Cumberland, be adopted, and that preparation be made for a Bill in Parliament. The Engineers (Messrs. Pickering and Crompton, of Whitehaven) stated that, in case the public authorities failed to act, the scheme would be carried out by private enterprise. Other particulars of this scheme were given in a paragraph in the "JOURNAL" for May 8.

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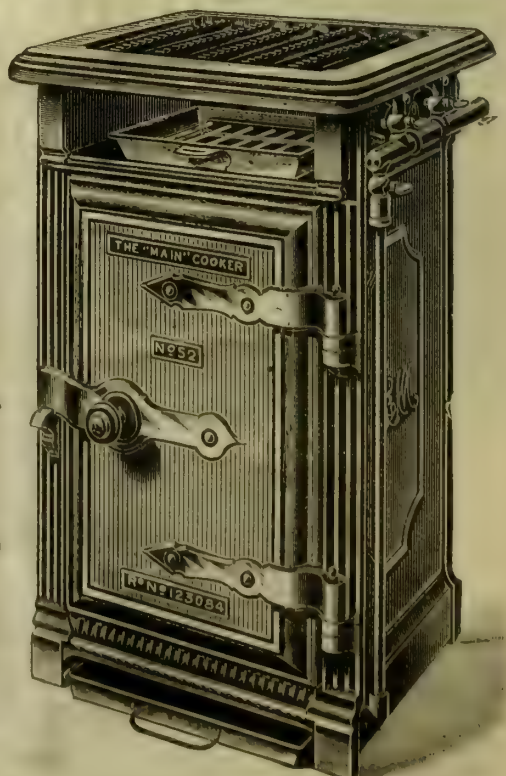


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The Quality of the South Metropolitan Company's Gas.—At the meeting of the London County Council last Tuesday, the Chairman of the Public Control Committee (Mr. N. Robinson), replying to a question by Mr. Steadman, M.P., said it had been found that there was "a good deal of carbon dioxide in the gas furnished by the South Metropolitan Gas Company;" and he warned the public that the gas was more dangerous than the ordinary coal gas.

New Joint-Stock Companies.—The Paignton Dowson Gas Company has been registered with a capital of £656, in £1 shares, for the purpose indicated by the title. The Manchester Acetylene Gas Company, Limited, has been formed with a capital of £50,000, in £1 shares, to acquire the business of the Manchester Acetylene Gas and Carbide Company, Limited, and the patents of A. Kay relating to improvements in gas-valves and apparatus for generating and storing acetylene gas.

A Plumber's Carelessness Wrecks a New House.—A disastrous explosion occurred at the house of his Honour Judge Humphrys, at St. Ives, last Friday week. An escape of gas was observed in one of the rooms; and a plumber, in trying to discover the leak, lit a match, and the explosion immediately followed. The interior of the house was completely wrecked. Laths, plaster, crockeryware, and furniture were scattered in all directions. The plate-glass windows were blown out front and back; and some of the stones in the front of the building were forced out of position. It is a new house, only just occupied. The plumber had a narrow escape, and was burnt about the face, but not seriously.

An Increase in the Price of Gas at Swansea Irritates a Corporation Committee.—The Streets Committee of the Swansea Corporation are much annoyed with the Gas Company, and some of the members said all manner of hard things about them at a meeting last Tuesday. The cause of irritation was a communication from the Company giving three months' notice to terminate the agreement as to the cost of public lighting, so as to allow of an increase from 2s. 10d. to 3s. 4d. per 1000 cubic feet. The reason given was "the great increase in the cost of coal, materials, and labour." Mr. Lee remarked that by the time the agreement ceased, the Corporation would have their electric lighting scheme completed. Mr. Merrills: August twelve months. The Chairman (Colonel Pike) asked the feeling of the meeting, and Mr. Hopkin said it was that they ought to own the gas-works. Alderman Morgan said he was disgusted at such an imprudent demand being made on the town and Corporation. At Birmingham, the price of gas had been decreased from 2s. 6d. to 2s. 2d., and yet, after this, a profit of £50,000 was made. Then take Plymouth, where they had no coal-field, and yet only 2s. 2d. was charged for public lighting. All he hoped was that the electric lighting works would be pushed forward; and he could not help thinking there was a kind of fatality about the present action of the Company, for they could not have done anything more detrimental to themselves if they had deliberately thought it out. He protested against the Company being allowed to stop the progress of the town, as he asserted they were doing at present. It was decided to send a communication pointing out the cost of gas to public authorities in other towns.

Leigh Gas and Water Supply.—The annual reports on the gas and water undertakings of the Leigh Town Council show a gross profit of £9586 on the former, notwithstanding the payment of 1s. 3d. per ton more for fuel than in the year ending March 31, 1899. There was a profit of £203 on the water undertaking.

Grand Junction Water-Works Company.—The report and accounts of this Company for the half year ending the 31st of March have been issued, in view of the ordinary general meeting on the 13th inst. The balance applicable for distribution is £68,596, as compared with £57,982 in the corresponding six months of 1898-9; and the Directors recommend dividends at the rates of 7½ and 7 per cent. per annum—the latter being on the "D" shares. After meeting the charges in connection with the Staines reservoirs, and paying these dividends, the undivided profit will be £21,646, against £16,904 at the commencement of the half year.

Yorkshire Coalowners and Gas Coal Contracts.—The West Yorkshire coalowners met last Tuesday afternoon, at the Great Northern Hotel, Leeds, to consider the suggestions made by the Gas Committees of the Leeds, Bradford, Halifax, Huddersfield, and Keighley Corporations as to the proposed new terms of contract for the supply of gas coal. As already stated in the "JOURNAL," they more particularly object to the proposal to limit the quantity of coal delivered to the gas-works during the winter months to 60 per cent. of the whole contract. The colliery proprietors point out that they do a large trade in house coal during the winter, and to deliver a considerable proportion of their output to the gas-works in those months would seriously interfere therewith. As the result of the meeting, the Secretary (Mr. Day) was instructed to write to the Chairman of the various Committees affected, intimating that the coalowners could not see their way to alter their proposal in regard to the delivery of coal. They consented, however, to slightly vary the wording of certain of the clauses in the new terms.

Tipton Gas Department.—The accounts of the Gas Department of the Tipton Urban District Council for the year ending the 31st of March last, as certified by Mr. J. E. Rowley, the Auditor, have been issued. They are accompanied by a working statement by the Engineer and Manager (Mr. Vincent Hughes), who, as mentioned in our "Personal" column, has obtained the appointment at Smethwick rendered vacant by the removal of Mr. B. W. Smith to Walsall. The total capital expended at the close of the year was £84,635. The sale of gas, residual products, &c., produced a revenue of £15,826, as compared with £14,425 for the preceding year; the expenditure being £9455, against £8483. The gross profit was consequently £6371, as compared with £5942. The net profit was £2104, which, added to the £3987 of accumulated profits, made a total of £6091. Deducting £250 paid in aid of the district rates, there is left a balance of £5841 to carry forward. The quantity of coal and cannel carbonized was 9338 tons (20 cwt.); and of gas made, 99,609,000 cubic feet, or 10,667 cubic feet per ton. Of the 99,754,624 cubic feet of gas which passed the station meter, 91,148,541 cubic feet were sold and used on the works; the loss by leakage, condensation, &c., being 8,606,083 cubic feet, or 8·62 per cent.

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WINDSOR ST. WORKS, BIRMINGHAM	2,000,000
SALTLEY WORKS, BIRMINGHAM	2,000,000
COLCHESTER	300,000
BIRKENHEAD	2,250,000
SWINDON (New Swindon Gas Co.)	120,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000
WINDSOR ST., BIRMINGHAM (Second Cont.)	2,000,000
HALIFAX	1,000,000
TORONTO	250,000
OTTAWA	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
TORONTO (Second Contract; Remodelled)	2,000,000
BELLEVILLE	250,000
OTTAWA (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000
BUFFALO, N.Y.	2,000,000
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.,	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
LEICESTER	2,000,000
ENSCHEDE (HOLLAND)	150,000
BUENOS AYRES (RIVER PLATE CO.)	700,000
BURNLEY	1,500,000
KINGSTON-ON-THAMES	1,750,000
ACCRINGTON	500,000
TONBRIDGE	300,000
STRETFORD	500,000
OLDBURY	300,000
TODMORDEN	500,000
SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
YORK (Second Contract)	750,000
ROCHESTER (Second Contract)	500,000

Gas-Works Extensions at Colne (Lancs.).—On Wednesday, Mr. H. P. Boulnois, one of the Local Government Board Inspectors, considered an application by the Colne Corporation to borrow various sums of money, among them £12,100 for gas-works purposes. It was stated that the profits from the gas-works had increased from £235 in 1887 to £3518 in 1899-1900. It was proposed to increase the producing capacity of the works by 50 million cubic feet per annum; making the total capacity 220 million cubic feet.

The Award in the Horsforth Water Arbitration.—Mr. R. E. Middleton, M.Inst.C.E., the Umpire in the arbitration between the Horsforth District Council and the Horsforth Water Company in connection with the purchase of the works of the latter (see *ante*, p. 1012), has issued his award. Mr. H. A. Johnston and Mr. C. Gott, who acted for the Company, placed the value of the undertaking at £56,276; the valuations of Mr. E. M. Eaton and Mr. E. J. Silcock for the District Council being £26,874 and £26,743 respectively. The amount of the award is £41,969 12s. 5d.

Wolverhampton Water Supply.—For some years the Wolverhampton Corporation Water Committee have been endeavouring to discover an additional source of water supply. At present water is obtained from wells at Cosford, which yield in good seasons 3 million gallons per day; and at Tettenhall and Goldthorn Hill, which produce about 250,000 gallons per day. The output of the wells is, however, found to be inadequate at times, and borings have been made at Dimmingsdale; but they have now proved unsuccessful. Other sites examined have also been rejected; and it is understood that the Committee propose to submit for the approval of the Corporation a scheme for deepening the wells at Tettenhall. They were sunk by the old Water Company half-a-century ago; and it is believed that, if they are taken to a greater depth, the output will be much increased, and will bring up the quantity to a volume sufficient for the needs of the district for some years to come.

Fatal Accident at the Dublin Gas-Works.—On Monday last week, an inquest was held by Dr. Louis Byrne, City Coroner, at Sir Patrick Dun's Hospital, on the body of John Bradiley, a workman who was killed by falling from a scaffolding at the works of the Alliance and Dublin Consumers' Gas Company. It was stated in evidence by the foreman in charge of the work for the Contractors (Messrs. T. Piggott and Co., Limited) that there were two sets of scaffolding, and the one on which the deceased was standing was erected inside a gasholder tank, and was 20 feet high. It was suspended by wire ropes, and the accident was caused by one of them breaking. The deceased fell to the metal floor of the tank, and received very serious injuries. Witness said he had had twenty years' experience of this class of work. The scaffold was erected under his supervision, and he was perfectly sure that it was thoroughly sound. He had strict orders to have the best scaffolding, and to spare no expense in its erection. He was a foot from where the deceased fell when the scaffolding gave way without warning. He believed it was capable of bearing a weight to the extent of 1 ton 14 cwt., in addition to four men. He had tested it a fortnight previously. Dr. G. Taylor described the injuries, and said the deceased died of shock and hæmorrhage. The Jury returned a verdict of "Accidental death."

Proposed Incandescent Gas Lighting at Bideford.—A few months ago the Bideford Town Council appointed a Committee to confer with the Gas Company on the subject of the public lighting, about which there has been considerable complaint. At a meeting of the Council on Thursday last, it was decided that the Committee should continue their services, and that the Company should be asked to light the main streets of the town by incandescent burners.

Bideford Water Supply.—A report presented to the Bideford Town Council last Thursday showed that the quantity of water in store is only 17½ million gallons, against 21½ million gallons this time last year. For the first five months of the year, the rainfall has been only 1·68 inches, as compared with 2·68 inches in 1899 and 4·21 inches in 1898. At present the water is turned off at 10 p.m.; and the Water Committee recommended that the question of further curtailment should be left in the hands of the Mayor.

Middleton Gas and Electricity Supplies.—At the meeting of the Middleton Town Council last Thursday, Alderman Walker presented the annual report of the Gas and Electric Lighting Committee. The gross receipts of the Gas Department for the year were £20,398; and the expenditure (less annuities, sinking fund, &c.), £13,180—leaving a gross profit of £7218. The net profit was £1970. The amount of gas manufactured was 8,985,700 cubic feet more than in the previous year; and this he thought was very satisfactory. In regard to electrical matters, Alderman Walker said successful negotiations had been carried through between the Corporation and the British Electric Traction Company for the provision by the Municipal Authority of motor power to drive the trams being laid between Chadderton and Manchester, *viâ* Middleton.

Staffordshire Potteries Water Company.—The meeting of this Company was held at Hanley last Wednesday. Reporting upon the working during the year ending March 25 last, the Directors stated that the revenue was £47,383; being an increase of £2636. The profit was £23,913, to which must be added the balance brought forward from the previous account (£1461), making a total of £25,374. After providing for the interim dividend, there remained a balance of £13,824, from which the Directors recommended a dividend at the rate of 9 per cent. on the consolidated ordinary stock, making, with the interim payment, 8½ per cent. for the year, and a dividend at the rate of 7 per cent. per annum on the consolidated new ordinary stock. After paying these, £992 will remain to be carried forward. The increasing demand of the district for water, it was stated, was being fully anticipated, and further works were now in progress with the view of meeting all requirements. The Directors regretted to record the death since the last meeting of Mr. J. Beaumont Piercy, who for a period of 32 years was Secretary of the Company. In moving the adoption of the report, the Chairman (Mr. J. F. Wileman) said that last year he had the pleasure of congratulating the holders of new stock on the attainment of their full statutory dividend, and this year he had to congratulate the old stock holders on having gained one more step in that direction; and there seemed to be every reason for thinking they would soon be in possession of their full statutory rights. The report was adopted; and, among other business, the salary of the Secretary (Mr. H. J. Wildin) was increased £100 a year.

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CONTENTS.

EDITORIAL NOTES:—

GAS, LIGHTING, &c.— PAGE.

"Free" Electric Wiring, and Assisted Gas-Fitting 1539
The Design of Lamp Stands and Columns 1539
The Meeting of the Association of Municipal Corporations . . 1540
For the Committee on Municipal Trading 1540
Co-operators in Congress 1540

WATER AND SANITARY AFFAIRS—

The Right Hon. G. Shaw-Lefevre on the London Water Question 1541

THE INCORPORATED GAS INSTITUTE—

ANNUAL MEETING IN LONDON—
Inaugural Address of Mr. E. H. Stevenson, M.Inst.C.E. 1542

ESSAYS, COMMENTARIES, AND REVIEWS:—

Gas and Water Companies in the Stock Market 1545
Electric Lighting Memoranda 1545
Some Views of Workshop Lighting. 1546
Liquid Air and the Liquefaction of Gases 1547

NOTES:—

The Decay of Stones in London Air—The Rusting of Iron—Lighthouse Engineering at the Paris Exhibition—The Proportions of Retaining Walls—Carbide of Calcium not a Dangerous Fire Risk 1549
Metallic Joints for Masonry Arches. 1550

COMMUNICATED ARTICLE:—

The Cost of Coal. By N. H. Humphrys, Assoc.M.Inst.C.E., F.C.S. 1550

TECHNICAL RECORD:—

Midland Association of Gas Managers—Meeting at Stafford—
General Business 1552
Description of the Stafford Gas and Electric Light Works . . 1552
The President's Dinner—A Point Concerning the Proposed Amalgamation of the Institute and Institution 1554
Association of Gas Engineers of Holland—Forthcoming Meeting 1554
Association of Gas and Water Engineers of Austria-Hungary. . 1554

REGISTER OF PATENTS:—

Starting Arrangements of Gas-Motors—Lanchester, F. W. . . . 1555
Purifying Acetylene—Goodwin, R. 1555
Incandescent Gas Mantles—Helmecke, H. 1555
Testing Gas-Piping for Soundness—Schuster, E. 1556
An Inverted Gas-Mantle Burner—Bernt, J., and Cervenka, E. . 1556
Making Incandescent Mantles—De Léry and Richardson. . . . 1556
A Double-Chimney Incandescent Gas-Burner—Golby, F. G. (Müller, A.) 1556
Gas-Burners—Bray, J. W. 1556
Safety-Valves for Gasholders—Thwaite, B. H. 1556
Gas and Like Fluid Meters—Greenall, J. 1557
Patent Notices 1557

CORRESPONDENCE:—

Mr. Carpenter's Paper on Inclined Retorts 1558
The Welsbach Company's New Prices and their Effects . . . 1558

LEGAL INTELLIGENCE:—

Wholesale Thieving by Boys from Slot-Meters at Widnes—The Operation of Special and General Acts—The Assessment of Premises for Water-Rates—The Lighting of Private Streets—A Gas-Meter Dispute at Blackpool 1558

MISCELLANEOUS:—

Report of the Welsbach Incandescent Gas-Light Company . . . 1559
The Labour Dispute at the Newport (Mon.) Gas-Works 1559
Association of Municipal Corporations—Private Bill Legislation; The Supply of Water Gas; Municipal Trading 1560
Irish Trade Unionists and the Supply of Water Gas in Dublin . 1561
Public Lighting at Devonport—Proposed Adoption of the Incandescent Gas System. 1561
Bolton Corporation Gas Supply—The Past Year's Working . . 1561
Oldham Gas Department—Annual Report; Increase in Price. . 1562
The Price of Gas at Stockport 1562
West Bromwich Gas Undertaking 1562
Middleton Corporation Gas and Electricity Supply. 1563
The Gas Department of the Hinckley Urban District Council— 1563
The Gas Undertaking of the Teignmouth District Council . . . 1563
The Honley District Council and the Gas-Works 1563
The Wath-upon-Dearne Gas Order—Consents of Local Authorities Dispensed With. 1564
Meeting of the Cape Town and District Gas Company. 1564
Meeting of the Shanghai Gas Company 1564
Electric Lighting Notes 1565
Gas and Water Companies' Stock and Share List 1565
The Position of the Water Supply of Manchester 1566
Opening of New Water-Works for Penmaenmawr 1566
Notes from Scotland 1567
Current Sales of Gas Products 1569
Coal Trade Reports 1569

PARAGRAPHS:—

OBITUARY: Mr. T. S. Borradaile; Mr. J. F. Sawer; Mr. Samuel Jones 1548
PERSONAL: Mr. W. Hearson; Herr Friedrich Siemens; Mr. A. Wharton; Mr. P. S. Hoyte; Mr. Henry Fowler; Mr. Vincent Hughes; Mr. Thomas May. 1548
The "Solar" Incandescent Gas-Burner 1542
The Export of Carbolic Acids, &c.—The "Planet" Acetylene Generating Plant—The Dispute between the Paris Gas Company and the Municipality—Sir Henry Roscoe on Bunsen . . 1550
Batley Gas Profits—The Profit-Making Undertakings of the Halifax Corporation 1557
Liverpool and the Wallasey Water Supply 1562
The Danger of Blowing Out the Gas—Three Persons Injured in a Gas Explosion—Sales of Shares—Tonbridge Water-Works Company, Limited—Exeter Water Supply—Cockermouth Gas Supply—The Quality of the West Surrey Water Company's Supply. 1570
Failure of the Gas Supply at Hungerford—The Grouping of Gas Accounts at Bradford—Darlington Town Council and Carburetted Water Gas—Breaking Public Lamps at Lancaster—Proposed Purchase of Hartlepool Gas and Water Works by the Corporation—The Belfast Corporation's Gas Coal Contracts—The Price of Gas at Fenton 1571
Belfast Corporation Gas Supply—The Gas Workers and General Labourers' Union 1572

EDITORIAL NOTES.

"Free" Electric Wiring, and Assisted Gas-Fitting.

IT has been observed that there is a great deal of human nature in man. We notice in another column the collapse in Worcester of the so-called "free-wiring" business carried on in the city during the past three years by a Company working under an agreement with the Corporation Electricity Department. The Company stood to win custom by offering to wire houses "free." But, as a matter of fact, the accommodation was anything but gratis. The misled patrons of the Company were charged a penny per unit extra for their electricity; and this was collected by the Corporation as agents for the Company. By all accounts, the arrangement was not popular in Worcester, although it seems to suit other places better. So little trade did the Company do here, that at last, in desperation, they declined to wire bedrooms and places where the electric light was not likely to be much used, and wished to pick and choose their supporters from those citizens who would probably need light for a pretty long time every day. Of course, this made the penny extra charge for the "free" wiring mount up nicely. But the consumers did not see the fairness of it, neither did the Corporation, who were made to bear all the odium of selling dear electricity. Consequently, the agreement has been terminated; and the Corporation are now thinking of making a better arrangement with the same object of assisting to electric lighting those householders who cannot do their own wiring.

We mention this Worcester experience here for the sake of the side-light it throws upon the different nature of the trades in electric lighting and in gas. Although charging by meter is common to both businesses, this method of arriving at the amount the user or consumer should pay is not on all-fours in both cases. The user of electricity who keeps his lamps going for a long time every day is generally held to be unfairly treated in a meter system, as compared with him who, while debited with the same gross consumption, uses it by means of a greater number of lamps only alight for a brief period of any day. The gas consumer may burn his gas just whenever he likes. There is a difference, of course, in the degree of eligibility from the gas manufacturer's point of view between the regular and constant and the irregular and seasonal consumer of gas; but no point is ever made of it directly. It is clear that if the long-period user of electric lights is also charged for his fittings extra on what is conventionally called the quantity of electricity he uses, he is still worse treated by the vendors of the supply. He occupies usually, in an electric lighting connection, a similar place to that of the prepayment-meter consumer of gas; but the difference between their cases is that it is no hardship to the latter to pay for his fittings in the price of his gas. The arrangement is not altogether logical; but it is based upon considerations of practical convenience and a fair determination of the average extra cost of his order to the undertakers of the service. Some ought to pay more, some less, according to several variable conditions. But it would be impossible to vary the amount of every consumer's payment with strict regard to all the individual circumstances; and therefore the rate is made uniform. And, unlike the electricity user, the gas consumer who is assisted in this way never complains. This is partly because it rests with himself to stop payment at any time, if he chooses, which the usual hire-purchase contract does not permit.

The Design of Lamp Stands and Columns.

IN a recent paper read before the Applied Art Section of the Society of Arts, Mr. Nelson Dawson spoke strongly of the absence of artistic merit from most modern metal work. He specially objected to the vulgar misapplication of the word "Art," as in inverted commas, to distinguish something as being more ornamental than useful. There is, of course, a kind of artistic work which is not useful at all—such as a setting of an emu's egg on a chased silver-gilt stand. This kind of thing is art; but Mr. Dawson frankly confessed that it did not interest him in the least, because it has no influence on men and women. If this standard were applied generally, a good many collectors' treasures and museum articles would be placed out of bounds. But doubtless Mr. Dawson had very good reason. He wishes to see common useful things—the iron bedstead, the street-lamp post, and the gas-pendant—made not only well but

of good appearance. For instruction in the right way of it, he advises the modern public to go to the antique. The Greeks, for example, of the Bronze Age, which is abundantly illustrated in the British Museum, were grand workers in metal. From the most delicate object to the most useful, "from the hand-mirror of the Greek beauty to "the lamp, or the steelyard scale—the fire-basket or lamp-"stand, all are in bronze, and everything is carefully con-"sidered in design and execution." It is not easy to name the exact quality that compels this admiration; only it is there, and it is not found very plentifully elsewhere. Mr. Dawson specially mentions the lamp-stands. These, he observes, must have been a very noticeable feature in the Greek house; and by the great amount of care bestowed on their making, they were likely enough handed on in the family, as the grandfather's clock is nowadays. "About 4 feet high, they generally consisted of a delicately-"fluted column, with circular moulded top and base. This "column stood on a three-way foot, often consisting of "three legs of animals, or shape approximating thereto, "well modelled, and finished in the most beautiful manner. "At the top came a three-way arrangement of branching "arms, on each of which a lamp might be hung; and sur-"mounting the whole was not infrequently a bronze figure "or group about 6 inches high. One of the best in our "British Museum is a charming little bronze of a Greek "woman dragging her unwilling son—evidently to bed. "Probably the bringing out of the family lamp was the "signal for the younger members to retire." It is impossible to enhance by any comment the beauty and suggestiveness of this passage. The very soul of lamp-fitting design is here; and there is no reason why it should not be materialized again. Would it be impossible for the Society of Arts to encourage good design and construction in common things, by instituting a scheme of annual judgings by trustworthy guides, like Mr. Nelson Dawson? Surely a lamp-post which carried off the Blue Ribbon of the year would sell well. Valuable prizes would not be necessary to success in this movement.

The Meeting of the Association of Municipal Corporations.

The Association of Municipal Corporations met in Dublin recently, under the presidency of Sir Albert Rollit, M.P., when sundry questions of moment in respect to the practical working of municipal institutions were mooted and discussed in businesslike fashion. Indeed, the transactions of the Association are usually a model of the common-sense handling of burning questions of practical politics to be expected of an assembly chiefly composed of Town Clerks. Ever since the times of the model Town Clerk—him of Ephesus, of immortal memory—and probably for ages before, Town Clerks have been pre-eminently the embodiment of that practical kind of law which has been characterized as systematized common sense. The professional gentlemen who met in Dublin on the 2nd inst. gave proof that the traditional aptitude for affairs has not deserted their order. They first discussed the cost and procedure in regard to the promotion of Municipal Bills in Parliament. Although taken separately, the question of the Borough Funds Act is really a part of the general problem of how Local Authorities are to get good and necessary Bills through Parliament at a reasonable cost, without giving them encouragement in a career of legislative fussiness. At present, the problem is without solution. It is easy enough to adduce awful examples of the victimizing of certain Municipalities in the matter of parliamentary expenses; but these might be set off by a far greater number of cheap Acts obtained every session. It is opposition that costs. If Local Authorities would always run straight, they would get their statutory facilities cheaply enough. When they do not mean fairly, their enterprises will prove costly under any system of Private Bill Legislation. The Lord Mayor of Dublin thinks that delegation of powers and local inquiries would save much expense. He is mistaken. Counsel and expert witnesses are expensive enough when they work near home. They do not charge less when they have to travel. This lesson may be learnt from experience of arbitrations. It is the "policy" of Local Authorities, which so often makes them worry other local interests to no real advantage, and the functionaryism of their chief officials, that are chiefly responsible for the parliamentary troubles of these bodies. Those Corporations which are not for ever trying to make history according to the fashion of the hour have little reason to make complaint of the burden of parliamentary expenses.

The Town Clerk of Longton had a very practical motion to support at the Association meeting. This was to bring pressure to bear upon the Board of Trade and the Local Government Board in order that Local Authorities owning gas undertakings might not be hindered from availing themselves of carburetted water-gas plant. We must refer readers to our report of these proceedings in another column for particulars. There appears to be a deadlock in this regard between the two Government Departments. Eventually, a resolution was passed asking the Board of Trade to promote legislation for carrying out the recommendations of the Departmental Committee of the Home Office on Carburetted Water Gas. Yet somehow this does not seem to be altogether what the gas-supplying municipalities wanted. We should have thought more highly of the Association if the meeting had grappled with the scandal of Corporation accounts, and passed a really strong resolution in favour of honest book-keeping and competent audits.

For the Committee on Municipal Trading.

When Parliament reassembles and the Committees get to work again, one of the busiest of them all will be the Joint Committee on Municipal Trading. It is stated in some trade periodicals that an organized effort will be made to obtain an expression of opinion from the Committee on the vexed question of the expediency of local authorities dealing in gas-fittings. Sir Courtenay Boyle has already told the Committee that the Board of Trade are dead against any extension of corporation enterprise in this direction; and it is a very sore point with ironmongers and others in many provincial towns. The Board are not at all in sympathy with the "Progressive" notion that public services and trades should be municipalized whenever this can be done, on general principles. The view of the Department is rather the contrary—that regulation and supervision in the public interest is the proper function of local authorities, and not trading. There may be reasons why particular undertakings should be transferred to municipal control; and, on the whole, British local authorities acquit themselves very fairly of responsibilities of a trading character. But the Board of Trade does not cherish any illusions on the subject. It cannot say that the public derive any great balance of advantage from a municipalized service. A Progressive journal has hastened to remark upon this that municipal witnesses will tell the Committee that, in almost every instance where gas companies have been bought out by local authorities, the price of gas has been considerably reduced. This is supposed to be an argument; but in order to give it any value, it would be necessary to show that the reductions in price would not have been made, or would have been of smaller amount, if the undertakings had remained private property. This gap in the proof cannot, of course, be filled. It is to be hoped that the Committee will not omit to consider the question of corporation trading under the two aspects, with and without profits, applied to other municipal purposes. This is really the one general question for which the Committee might be expected to find a general answer. Most of the other subjects which will be ventilated in the course of the inquiry are only susceptible of treatment in specific instances. There is plenty of information to be had from foreign examples, if the Committee care to have it brought before them—especially as to the various expedients in vogue to secure pure and competent administration and efficient management for municipalized concerns.

Co-operators in Congress.

When a "congress" is attended by 1100 delegates, it can fairly claim to rank as an event. This was the case of the congress of the Co-operative Union which has just been held at Cardiff; and accordingly no other credential should be required, in the judgment of those who are interested in the fortunes of this important movement, to recommend the proceedings of the meeting to their respectful notice. Unhappily, however, painful experience shows that in the multitude of counsellors there is not always wisdom. This country is overrun every year with big gatherings of small people; and the impression created by the multiplication of these mass meetings is that quantity and number do not make up for the lack of quality. The Co-operative Congress ought to be a conspicuous event; but, as a matter of fact, reports of its doings did not occupy much space in

the newspapers." It was remarked as curious, by the President of the year, that although the revered founder of co-operation was a Welshman, the movement does not flourish particularly well in Wales. Another rather disconcerting circumstance mentioned from the chair was that many Co-operative Societies remain outside the Union. Now the Union stands for the educative and inspiring aspect of co-operation; while the isolated Societies merely represent those whose interest in the idea is briefly but comprehensively expressed in the common term "divvy."

This is not a nice word; and some of those who know most about the working of the Societies in certain towns hate the sound of it. All care for the higher things of the movement is too often lost in the greed of gain. The President of the Union recognized and grieved over this deplorable truth, and proceeded to inquire why the Union, as a working-class democratic institution, should not take the lead, apart from all political parties, in "informing "the public mind on such questions as the land laws, "taxation of land values, old-age pensions, the housing "problem, &c., &c." The only proper answer to this query is that, before any institution can lead and inform public opinion, its members must qualify themselves for the task by learning, reflection, and the formation of wise and clear judgments. This preliminary qualification is about the last thing that is regarded by the usual run of "working-class democratic institutions." The counsels they chiefly approve are quackery; and the men whom they delight to listen to are mostly charlatans and parasites. And the honest men among them are too fond of talking at large about matters which they do not understand; while their auditors like to have it so. This is the real reason why the statement that a Co-operators' Congress of 1100 delegates has been held anywhere in the country leaves the ordinary citizen cold and indifferent. If the fact were mentioned in any chance company, from a dinner party to a street-corner group, the response would be, "What of it?"

Nor can the reputation of these gatherings be lifted higher until those who figure most conspicuously on such occasions are somebodies, with something to say. At Cardiff, the President undertook to state the cause of Poverty. He ascribed it to the "fundamental fact that "the masses of the people had been disinherited." This startlingly new and luminous statement was, of course, received with "applause," according to the newspaper report. The President went on to say that "if the land "of any country be treated as the property of one class ". . . there must be at the bottom of the social scale "brutishness, vice, ignorance, want, and starvation." And so forth. Mr. W. C. Steadman, M.P., and some of the other speakers, agreed with the President in referring the existence of Poverty to the fact of land being property. What threadbare fustian is all this! If those who think they believe it would go to the many and vast waste places of the earth where land is anybody's or nobody's property, and proceed to establish there a society from which Poverty should be automatically excluded, the world would devoutly thank them. As it is, it is not worth while to air such notions in Cardiff. Altogether, the transactions of the congress were particularly disappointing. They were pretty much of the same kind as what is humorously called the "business" of Trade Union Congresses—mostly chatter about abstractions couched in language of empty platitude, and serving no useful end whatever.

WATER AND SANITARY AFFAIRS.

In the current number of the "Speaker," Mr. Shaw-Lefevre sets forth his views on the present position of the London Water Question. As the opinions expressed in the article are those held by the party in the London County Council of which the right honourable gentleman is a member, we presume he may be regarded as the spokesman of that party; and he is unquestionably entitled to assume the position. As a former President of the Local Government Board, he is far more competent to speak on this subject than are some of his colleagues at Spring Gardens; and his utterances will command a great deal more attention than the not too refined language which is frequently employed when the water question is under discussion. It is a remarkable thing that on this question certain public men seem to be seized with a kind of hydrophobia which makes them rabid. Mr. Shaw-Lefevre, however, occupies a political and social position which justifies him in speaking with some authority; and if his arguments do not carry conviction to his opponents, they are none the less entitled to consideration. Moreover, the article in the "Speaker" may be almost accepted as a manifesto by the Progressive party in the Council, who, unless something definite is done before next year, will probably make the water question a prominent item in their programme.

Mr. Shaw-Lefevre attributes the rejection of the Council's Purchase Bill this session to the "band of Water Directors "and their many shareholders" in the House of Commons, who were, he says, "opposed to purchase in their own "interests, and who cared little who were to be their suc-"cessors." With all respect, we submit that they were only exercising judicious watchfulness over their property. They came forward, in the absence of anyone else, to provide London with a supply of water; and they have endeavoured to bring their works into a condition to meet the demands made upon them—and, it may be added, of late years in the face of persistent obstruction. As to being "opposed to purchase," they certainly are, if the terms are to be settled by the buyers only; and we presume Mr. Shaw-Lefevre would act similarly in the case of any important property of which he might be trustee. With reference to the alleged indifference of the Companies as to who are to be their successors, we believe that, singly and collectively, they are anxious, if their undertakings are to be transferred, that they shall go into the hands of those who can manage them to the greatest advantage of all parties concerned. If they think that the County Council are not the body to be entrusted with this duty, they are only in agreement with a very large number of people, including the members of the last Royal Commission.

The writer goes on to say that the loss of the Council's Bill, and the absence of any indication on the part of the Government of their intention to deal with the water question themselves, places the latter in the position of being "hoist with their own petard." He does not allow for the Government having their hands too full of colonial affairs to leave them much time for initiating legislation on a subject which certainly cannot be regarded as very urgent. But if, as he says, the last Royal Commission was "not expected or intended to lead to legislation, but "the reverse," then the present attitude of the Government surely accords with that expectation. Mr. Shaw-Lefevre says the constitution of the Commission was such as to justify the confident belief that the principle of purchase would be condemned, and shown to be "inexpedient and "impossible." We question whether the selection of the members was made with any such view; but even if it was, the fact that they unanimously reported in favour of purchase is evidence, it seems to us, of the thoroughness and impartiality of their inquiry. But although the report confirmed, as Mr. Shaw-Lefevre acknowledges, "nearly "all the contentions of the Council," the latter are not satisfied with it. Their objection lies in the word "nearly," for, as is well known, the Commissioners were as united in their condemnation of the Council as the purchasing body as they were in recommending purchase.

The writer deals next with the portion of the report bearing upon the future supply, and contends that the carrying out of the storage reservoirs in the valleys of the Thames and Lea, which will be indispensable for ensuring a sufficient quantity of water from these rivers, will be attended with great difficulty, unless the work is done by an authority—that is to say, a single body—having possession of all the undertakings. Well, the Water Companies, if associated, would be practically equivalent to such an authority, as far as combined action is concerned; and it is to be regretted that their collective scheme of the present session had to be withdrawn solely on a point of procedure. But while Mr. Shaw-Lefevre seems to approve of the construction of additional reservoirs, he condemns as unnecessary the proposal embodied in the Bill of the East London Water Company which has passed the House of Commons; the existing and authorized storage of the Company being, he says, sufficient for securing the last 10 million gallons of water daily available from the Lea, against the recurrence of such a drought as that of 1898. He asserts that no public authority would dream of constructing these works, as they could provide for this additional quantity of water by drawing from the Thames, "or from Wales, in the

"event of the Welsh scheme of supply being decided "upon." He acknowledges, however, that it will be difficult for Parliament to refuse to sanction works which are said to be necessary to enable the Company to fulfil their legal obligations, though he makes out that a million of money would be saved by provision being made in some other way. He repeats his strictures upon the engineering details of the Staines reservoirs scheme which he renewed a few months ago, and again on the 29th ult., in letters to "The Times;" the particular feature of this undertaking which seems to cause him anxiety for the safety of the structure being the puddle wall. We shall leave so purely technical a matter to be dealt with by the Engineers who are responsible for the work. As far as we are aware, they have not taken any notice of their critic's reflections upon their professional skill.

When Mr. Shaw-Lefevre talks about a "public autho-"rity," he of course means a very different body from the one contemplated by the Royal Commission, whose Water Trust he scoffs at as a "most impracticable and futile "proposal" that is not worthy of being seriously discussed, having been universally condemned. He says it is inconceivable that London, which now pays four-fifths of the water-rates, would be content with the nomination of one-third of the members. He objects to the appointment by the Government of the Chairman and Vice-Chairman of a Board dealing with local affairs as being without precedent and as establishing a most unwise one. He considers that the direct responsibility, to the water consumers and the ratepayers, of the parties controlling the water supply would be lost, and that the latter would be in constant conflict with the County Council. According to him, the whole scheme is already "stone-dead." This being the case, he puts upon the Government the responsibility of devising another for the new water authority as an alternative to the County Council. He thinks the attempt to do this will result in a compromise. It is quite certain that the Council are powerless to carry out their proposals without the sanction of the Government; and he believes the latter will not venture to settle any scheme in the face of the opposition that they would encounter from Spring Gardens. The Council are, it appears, not unwilling to give way on the question of the outside authorities having a share in the control of the water supply; but they wish to have a free hand in the discussion of this subject. They claim that they alone are competent to negotiate with the Water Companies for the purchase of their property; and to take the matter out of their hands would, they believe, result in the loss to London of "millions of money." They urge that while it may be unwise on their part to insist upon their own solution of the water question, at the risk of defeating the purchase scheme, they think they are justified in claiming that the actual purchase shall be effected by them with the assistance of their officers.

In bringing his article to a close, Mr. Shaw-Lefevre suggests, as it is impossible to predict what course the Government will take, that the reasonable one would be to open negotiations with the Council, though, he says, this is hardly to be expected with the present President of the Local Government Board, "who has shown the most "extreme hostility to the Council." Hope is expressed, however, that either the matter will be taken out of his hands, and be dealt with by the Leader of the House, or the long-expected reconstruction of the Government will take place, and some other chief—will it be one who has previously filled the position?—found for the Department, "on whom the responsibility for dealing with a question "so intimately affecting London will rest." Mr. Shaw-Lefevre thinks it is difficult to conceive a greater task for a statesman desirous of acquiring fame in constructive legislation than the settlement of the London Water Question, which, as he truly says, has so long baffled successive Governments. But doubtless he has someone in his mind who would be quite equal to it, though he judiciously refrains from saying so.

The "Solar" Incandescent Gas-Burner.—We have read with interest the description, in some German technical contemporaries, of the "Solar" incandescent gas-burner which is produced by the firm of Bruno, Schömann, and Co., of Berlin. It consists only of two tubes, a glass draught protector, and a chimney gallery resting on the draught protector. The life of the mantle is stated to be prolonged, and its renewal facilitated, by the special construction of the burner.

THE INCORPORATED GAS INSTITUTE.

PROCEEDINGS AT THE THIRTY-SEVENTH ANNUAL GENERAL MEETING,

HELD AT THE

ROYAL UNITED SERVICE INSTITUTION, WHITEHALL,

JUNE 12 AND 13, 1900.

Mr. E. HERBERT STEVENSON, M.Inst.C.E., President.

INAUGURAL ADDRESS.

Gentlemen,—The first duty that devolves upon any man who is elected to a post, whatever that post may be, is to return thanks for his election. But in this Institute, and in other societies, it appears to be practically the last duty which he has to perform. The year of my presidency has passed; and now at its close I have to express my thanks for the honour you conferred upon me in electing me to this position. For my part, I am glad that I was not called upon to state my appreciation of your kindness at the beginning of my term of office, because I have not now to express the hope that you will deal gently with my failings, but to acknowledge the invariable kindness and courtesy of which I have been the recipient. Besides this, I am enabled to offer my most sincere thanks to the members of the Council for the very loyal way in which they have supported me in all matters during my year of office. The year has been one of exceptionally hard work for the Council, in consequence of the special efforts that have been made to bring about a reconciliation between the two bodies now representing this section of the great engineering profession. Had it not been for the hearty co-operation of the Council, both by advice and active work, and especially the very valuable assistance of our indefatigable Honorary Secretary, I should have despaired of ever bringing the work of this year to a successful issue; for, unfortunately, I am not so conversant with the views of the country members as other gentlemen on the Council, and probably should have looked at many matters we have had to deal with from a different standpoint to that of most of you.

I may say, however, that I have served you to the best of my ability, and have always tried to advance the interests of this Society, and, above all, of the profession. But still, I wish you to understand that in so far as you may approve of what has been done, and what we are about to suggest should be done, the credit is due much more to my colleagues on the Council than to myself.

I do not intend to address you at great length, as our time is more limited than usual this year; and we have also an unusual matter coming before us which will probably curtail to some extent the time for reading and discussing papers. I shall, therefore, only refer at length to two subjects which are present to all our minds. For this reason, and because we are to have a very interesting lecture from Mr. Webber on "The New Gas," we have also been obliged to seriously restrict the number of papers to be read before you this year. But I think you will find ample matter has been provided to fully occupy the two days allotted.

The meetings of this year are likely to be remembered, not only because of the subject which I have mentioned having to be discussed and settled, but also because of the grave difficulties in which the gas industry as a body finds itself at the present time. The year just past has been one of anxious thought for the future to every one of us in a greater or lesser degree, according to the varying work we have had to do or the responsibility we have undertaken; and I think that the year upon which we are entering will also, in some respects, be one of still greater anxiety, especially to those of us who have under our charge the management of works. It is not the first, nor even the second, time within my recollection that the gas industry has passed through a very trying time; and there are many of us here who remember both the coal troubles which arose in 1873, and the scare which ran through the Stock Markets in or about 1880, when many people believed that the knell of the gas industry had been sounded, and that it was a matter of only a comparatively short time before it would be reckoned among the wrecks of the past.

The trouble which has now come upon us is, I think, not

so bad as that during the last coal famine, when the prospect before gas companies did indeed appear desperate. In fact, even Parliament was so impressed with the dangers to gas companies that a Special Act was passed enabling the Board of Trade to inquire into the circumstances of any gas undertaking which applied to them before the 1st of August, 1875, for a revision of the maximum price, and authorizing an increase of such price to be sanctioned if thought fit. The Gaslight and Coke Company and the Imperial Gas Company applied to the Board of Trade under their Special Acts for a revision of price—the Gaslight and Coke Company having their price for common gas raised from 3s. 9d. to 4s. 4d. per 1000 cubic feet, and the Imperial Gas Company from a similar price to 4s. 8d.; and there were three or four other undertakings that applied for revision under the General Act. In most cases, this was granted to last for a period of twelve months or thereabouts. But, in reality, it was found that the alarm was only another example of the well-known truth that one should not meet troubles half way; for it was found generally that the state of affairs necessitating the passing of the Act was beginning to disappear almost before the Act came into effect.

It is a common saying, and one which is illustrated every day of our lives, that history repeats itself; and if it does so in other concerns, why should it not do so in the history of the gas industry? There are, of course, other matters which may slightly vary the effects of a recurring coal famine affecting most gas companies; but so far as I can see, they are mostly in favour of the companies. If we examine the past history of the coal trade in relation to gas-works, I think there is every reason to meet this difficulty with a more cheerful spirit than the writings in the Press and the public utterances of many of our leading men would indicate. Taking the returns of the South Metropolitan Gas Company for the last thirty years, of which I happen to have the records in Field's Analyses, we find that the price of coal in 1870 was 14s. 4·03d. per ton. It fell slightly the following year; but it rose in 1872 to 16s. 7d., and in 1873 to 24s. 10·37d. per ton. From that date to 1880 there was a continuous reduction in price to 10s. 10·30d. per ton, when it again rose slightly, until, in 1891, it was 14s. 0·13d. From that date, again, the reduction was at first sudden and then continued gradually until in 1896 it reached the lowest point of 10s. 2·61d. per ton. It rose very slowly in 1897, and again in 1898 and 1899—the price last year being 11s. 11·28d. per ton. In all probability the price of coal will this year be some 8s. or 9s. advance upon the cost last year. It may be somewhat less with respect to large companies; but I happen to know of several smaller ones where it approximates very nearly to 9s. increase. It must not be forgotten, however, that the whole of this increase will not come into effect on the working of this year; and in any case it is not probable that the price will rise to the extreme of 1873. Is it likely that coal can continue to stand at the present price for any great length of time? I doubt it; and I see no reason why we may not hopefully look forward to the course of events following the old precedents. Of course, we cannot expect to return to the late happy state in the immediate future; but if companies and consumers will only fairly share the extra burden put on the industry, it will soon pass away and only be remembered as a bad sort of dream. I have no great anxiety as to those undertakings that are in the hands of local authorities, for not only can they raise the price of gas, but that long-suffering individual the ratepayer will now possibly find out how very useful he may be.

I have said that it appears to me that the companies are not in as bad a position now as they were in 1873. The chief reason which causes me to be of the opinion that to whatever height the price of coal may go the positions of companies cannot be as bad as in 1873, is that the large majority of them are now working under a standard price and sliding-scale instead of a maximum price; and nearly all are supplying gas at considerably less than the standard price. Except in consequence of the Gas-Works Clauses Amendment Act, 1873, it was impossible then for a company to increase the charge for gas beyond, very often, a very limited amount; but now the possible increase, in the case of standard price companies, is practically only limited by what the consumer can be induced to pay. Of course, raising the price of gas will have the effect of reducing the dividends; but a company working under a sliding-scale has such a very large margin through which it may raise the price of gas, that it is almost an impossibility for a company which even pays its way at the standard rate, to be in a similar position to companies in 1873, when some of them found, or expected to find, it impossible to make both ends meet when charging the maximum price. Again, I find that even if a larger amount is not received for residual products per 1000 cubic feet of gas sold, yet the net cost of coal is considerably less, and doubtless it will so continue.

Gas undertakings as a body are also in a much better position, in that they do not require nearly so much capital in proportion to the quantity of gas sold as was the case in the earlier days of the gas industry, or even thirty years ago, when very little gas was sold for cooking or heating purposes. I have found from returns of certain large companies, that in the summer months more than half the gas sold is supplied between 6 a.m. and 6 p.m., and is therefore presumably required for other than lighting purposes. The consequence is that the works are kept more evenly employed, and that the capital required in providing holder accommodation and main and service pipes and meters is proportionately reduced. Further, every year as it passes finds gas being used in an ever-increasing degree for motive, heating, and cooking purposes; and, certainly with respect to the two latter, there is no fear, at present, of any competition from oil or electricity.

I think we may take heart in the full assurance that the dark times through which we are now passing will not be of long duration, but that, in a comparatively short time, we shall more nearly approach the position in which we were a short time ago. There is always, of course, the certainty of greater competition from the electric light, and possibly from the use of oil; but in so far as we have been affected by the increase in the cost of coal and materials, we may be sure that the electric light is also suffering in at least the same degree. From information which has been given to me with respect to the prices now ruling in various parts of the country for refined oil used in lamps, I find that the increase in price is much more proportionately than the increase in the price of coal.

There is a further gleam of light shining through the gloom now surrounding us, which I think will tend to raise the spirits of many who have the conduct of gas undertakings in their hands. I refer to the very recent, and still uncompleted, legislation of this session in respect of the South Metropolitan and the Wandsworth and Putney Gas Companies. Up to the present, it has appeared as though Parliament had decided that the illuminating power of gas should be practically the same throughout England, Ireland, and Wales, quite irrespective of the geographical position of a town or district, and altogether ignoring the quality of the coal in the neighbourhood, or, if there were no coal, the difficulty of obtaining what would produce the required candle power. In the old days, the illuminating power was fixed at 14 candles. But for the last twenty years or thereabouts it has been 15 candles; and even in Lancashire or South Yorkshire, where the coal will make gas of a higher power, it has been usual to prescribe the same. Should the Bills of the two Companies become law, it will be a sign that a change is likely to come over the views of Parliament, and that they will in future consider more fully than they have done in the past all the local circumstances; and, in many cases, it will mean that all aids to increasing the natural illuminating power of a coal may be discarded. Whether Parliament will always expect a company to make a reduction of the standard price when they obtain a reduction of the illuminating power time only will prove; but there is no doubt as to the advantage which will accrue to any gas company now supplying 14-candle gas when it next applies to Parliament, if this legislation becomes the custom in the future. As a matter of fact, gas undertakers are kept in order, like everyone else, more by fear of competition or loss of business than by restrictive legislation; and now that both rich and poor can obtain other artificial light, it may be hoped that Parliament will admit that we may be allowed a freer hand than hitherto—being fully assured that if we do wrong we shall suffer the usual penalty. For this faint hope of greater ease and cheapness in manufacture we have to thank, first, the improvement in burners, and, secondly, those men who very bravely led what appeared to be almost a forlorn hope, and convinced a Committee of Parliament that they were in the right.

I think you will expect me to deal somewhat fully with

the proposals that will be laid before you on the question of the re-union of the two professional bodies representing the gas industry; and I shall do my best to make plain to you why your Council have taken up the question, and what we have done. When we met last year, there were references to this matter by several speakers. Especially was the matter dealt with by our late President, Mr. Stewart; and I do not think there was one dissentient voice. Indeed, so far as the Council could judge, the meeting appeared to be very strongly in favour of a union between the Institution of Gas Engineers and the Gas Institute being carried out, if proper conditions could be arranged between them. In fact, we felt that the meeting had given us a mandate to do our best to promote unity within the gas profession, if it could by any possible means be brought about. We have, therefore, throughout my year of office, tried in every way to bring matters to such a pass that the Institution of Gas Engineers on the one hand, and we on the other, should be able at our annual meetings to arrive at a definite conclusion.

I do not suppose there is any one present who will not admit that it is a good thing for brethren to dwell together in unity; and there can be doubt in the mind of any unprejudiced person that one strong society, no matter what its object may be, is more powerful than two rival societies formed out of the same limited constituency, especially when they are divergent in some of their views. It is just about twenty years ago since the original Society changed its name and became the Gas Institute. It happened that my father was the first President of that Institute; and it will be somewhat curious if I should be the last President of the Society bearing the title of the Gas Institute. Just about half-way between that time and the present, came the troubles which finally resulted in the division between the members of the Gas Institute, the secession of many leading men in the profession, and the consequent formation of this Society as the Incorporated Gas Institute and the other Society as the Institution of Gas Engineers.

Such a state of affairs cannot be defended upon any other ground than that there is some question of principle so strongly marked that there is no hope of either party being convinced of the reasonableness of the views of the other party. There have been several attempts to bring about re-union; but probably sufficient time had not passed to soften the feelings which had caused the rupture, and neither Institution felt willing to make the slightest concession to the other. Now, however, we know that both Societies are largely governed by a better spirit. The old soreness has passed away; and the Institution of Gas Engineers have, at their recent meetings, held out to us the right hand of fellowship when they unanimously passed a resolution desiring union, and it would be a grand thing if we could as unanimously accept such offer of reconciliation. I am afraid, however, that this is a consummation which can hardly be expected; for a question of principle on one side has in the past kept us apart, and the conditions of re-union, which affect to a much greater extent some of our members than they do any of the members of the Institution, involve the consideration of this question of principle, and the giving up on the part of some of our members, perhaps not a principle, but at least a position, which is dear to them. I can quite understand how hard some of us may find it to do this, and that in a few cases it may appear to be a matter of principle not to agree to such a course. But I do trust that even those who do not agree with the proposals will seriously consider whether it is not better for the members of the gas profession to be united than that they shall retain their position, and that if they cannot support, at least will not oppose, the arrangement come to by the Joint Committee.

After the meetings of last year, one or two letters passed between Mr. Dougall and myself on the one hand, and Mr. Helps and one or two gentlemen on the other, with the result that Mr. Helps called upon me and quite unofficially discussed the matter. I reported this to the Council, and they then decided that a Committee of their body should meet a Committee nominated from the Council of the Institution—the two forming a Joint Committee who should try to formulate terms whereby the desired amalgamation could be brought about, subject to the approval or alteration of the respective Councils. It was very easy to arrange such a meeting, as the one party was just as keen to meet and discuss the matter in a friendly manner as the other; and I desire here to put on record the great assistance we received from Mr. Helps and his colleagues, not only in the drudgery of the work in drafting the rules, but for their invariable courtesy and consideration throughout the whole of the negotiations.

It was very soon made apparent that the Institution only put forward one condition as a *sine quâ non*, and that has been embodied in clause 4 of the Memorandum of Association of the proposed new Society; while, on the other hand, we were informed that upon every other point the Institution would be willing to most favourably consider any suggestions we had to make. In carrying on the negotiations and consultations, we found that the members of the Institution acted most loyally in this spirit; and the rules of the proposed Institute, of which you have all had copies, are the result of our deliberations.

The clause to which I have just referred is, I think, the only one on which much discussion or any serious difference of opinion can arise. It is as follows:—

4.—No person shall be qualified to be or remain a member of the Institution who shall be actively engaged in or about the management or business, either as principal, managing director of a joint-stock company, or as agent or traveller of any trading company, firm, or concern doing business with gas undertakings, whether as vendor or as purchaser.

It has always been known to every one of our members what was the essential condition upon which the Gas Institution would consent to amalgamate with us; and when you applauded the utterances of those in favour of this course at the meetings last year, you must have had this fact in your minds. I think you will all admit that this clause does not go in the slightest beyond what we knew would be required of us; and therefore I expect no one will be surprised at its being included and given a prominent place in the Memorandum of Association.

You will see that this definition embraces not only those who have never had a professional training, but also those who, being thoroughly qualified to have charge of a gas undertaking, have turned their talents to, and are actively engaged in, the more purely commercial enterprise of providing such things as are required by gas undertakings in carrying on their business. There are a considerable number of gentlemen who obviously will be affected by this disabling clause; and, therefore, the Council were of opinion that it would enable this matter to be passed with a minimum of discussion, and possibly without any dissentient voice, if we could obtain from all of our members who would probably be excluded under this clause, an expression of willingness to resign their membership in this Institution in the event of the proposed rules meeting with your approval generally. They therefore requested me to write a letter, which should be sent to each member affected, and also asked me to write personally special letters to a limited number of gentlemen. These letters were sent to 103 gentlemen, of whom the very large majority are either extraordinary members or associates; and the result was, I think, quite up to our expectations. Replies were received from 57 gentlemen willing to resign, 2 replied that they were not engaged in trade, 39 have not replied, 2 replies are doubtful—not absolutely dissenting, but not agreeing—and only 3 expressed an unqualified refusal. If "silence gives consent," we may calculate upon those who have not replied as at least not being unfavourable—unless they voice their discontent at this meeting; and if this be so, we have the extraordinary result that out of 101 gentlemen affected by this rule only 5 are not in favour of it, and only 3 strongly disapprove.

I have been told that if this condition of membership be strictly enforced, as it will be, it will result in the Society being deprived of all the best talent in the profession; but I think you will agree with me that this is taking too gloomy a view of the case. Everyone must see that the rule is applicable only to those whose major interest is on the commercial side of the gas industry rather than on what might be strictly called the engineering or managerial side of the business of a gas undertaking; while it is not intended to come into action, and, indeed, cannot be enforced, against those who employ their brains to invent an article or process which may be used by gas undertakings, but who do not also personally engage in trading with such concerns. There is no doubt that the terms proposed will somewhat hardly affect a few of our members. Especially do I refer to those members who, having occupied the position of engineers and managers of works, and having been in the leading ranks of the profession, have turned their attention almost entirely, if not altogether, to commercial life, and thus come under the

disability referred to. I may say that, personally, I shall very much regret the severing of the connection between such men and the Society representing the gas profession; and I trust that, whatever be the decision of this meeting, it will not have the result of severing the friendships, often the growth of many years, between any of our present members. It must, however, be apparent that differences cannot be made between men who are competitors in providing goods required by gas undertakings. It has, therefore, been found necessary to so frame the rules of the proposed new Society that even those who have been thoroughly trained in the profession shall resign membership of the Institute should they ever take part in business as defined in clause No. 4. The result of the letters written personally by myself was that only one gentleman declined to resign the position he holds in this Institute, and, indeed, he said that he was not in sympathy with the proposed amalgamation, and therefore, of course, I could not expect him to accede to my request.

I cannot leave this matter without putting on record the generous way in which many gentlemen have agreed to withdraw from membership, and especially the action taken by Mr. Hepworth and Mr. West, who have sent in their resignations as a proof of their desire that there should be no obstacle to re-union raised in consequence of their unique position. We all know and respect these gentlemen. They have both occupied this chair, and as Honorary Secretary Mr. Hepworth guided the deliberations of the Council for some years, endearing himself to all who came in contact with him; and I think, therefore, we cannot give too much praise to him, and to other gentlemen like him, who have put the good of the profession before their own personal feelings. But at the same time, I do not wish to reflect in any way upon those gentlemen who, probably also desiring to act as they consider best for the general good, unfortunately do not look at the matter from the same standpoint, and are not able to give their active support to the scheme, and therefore consider that they ought not to be called upon to give up what is to them a matter of principle.

For obvious reasons it was thought advisable that neither of the titles of the old Societies should be retained, and we have, therefore, done the best we could in the circumstances. The title of the new Society has not been absolutely settled; but it is suggested that it should be

. It will be seen from the Articles of Association that every member and associate member of this Institute and of the Gas Institution, who is not disqualified under Clause 4 of the Memorandum of Association, has a right to occupy a similar position in the new Institution without having to pass through the process of election. The subscription for existing members remains as before—that is, one guinea—although it is proposed that in the future new members shall pay a subscription of two guineas instead of one guinea, and that new associate members and members shall pay an entrance fee of one guinea. There is no doubt that gentlemen wishing to become members or associate members of the new Society can generally very well afford to pay the entrance fee and subscriptions required; and as they will be applicants for election under the new rules, with a full knowledge of them, there will be no hardship put upon them. They will enter as associate members, and only pay the higher subscription as they rise in the profession and their circumstances improve. Practically, the main alteration in the rules under which we are now incorporated is based upon Clause 4 of the Memorandum of Association, though there are slight variations of our present rules which will increase the possibilities of greater usefulness in the future. Besides this, power has been taken for the members of the new Society to remove from membership those who become disqualified under Clause 4, which I have so often mentioned, or those who are objected to for any unprofessional conduct. The rights of such members, however, are fully safeguarded by the course to be adopted, the number of votes to be obtained, and also the number of members which form a quorum. In every way it appears to me that the rights of members and associate members are fully safeguarded in the formation of the new Society.

I have gone thus fully into the history of the steps taken to bring about re-union, because it is so important that every member should thoroughly understand the positions which the two Institutions now occupy. The Institution of Gas Engineers has already expressed its view by the vote of a general meeting; and we will now shortly have to express the views of this Institute by our votes. I trust that, in the discussion which is sure to arise, and in the divergent views which I am afraid will be expressed, we shall all of us be able not only to discuss the matter without any personal feeling, but that we shall be actuated solely by the desire to advance the dignity of the profession and the interests of the gas industry.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1565.)

The course of movements on the Stock Exchange last week was a thorough disappointment. It had been confidently hoped and expected that the fall of Pretoria would be the signal for a reassured public to come into the markets again and buy freely. Consequently, few must have been prepared to find that, when the Exchange reopened on Tuesday, there was a generally dull and flat tendency that nothing could shake off. With all apprehension regarding the war removed, with cheap money, and with fine weather, the tendency ought to have been the other way. However, so it was; and the prices of everything in pretty well every department, from Consols downward, had an appreciable fall. This sort of thing is apt to go from bad to worse, and to aggravate its own evils, as it makes people more and more shy of following ordinary signs. The Money Market was in a very easy condition all the week; and so far as may be judged from indications, there is nothing in the air to alter it. Business in the Gas Market was not particularly active. But it had a good sound healthy appearance; and without any fitful spasmodic jumping, a nice degree of progress was made in the reinstatement of reasonable prices. Advances in value are neither numerous nor large; but the improved tendency is none the less sound for that. In Gaslights, there was a very fair amount of business done in the ordinary. From ¼ premium on the opening day, it worked its way up to 102½ before the close. The secured issues attracted hardly any notice, and were unchanged. In South Metropolitan, only a very moderate amount of business was done; but prices steadily hardened, and the quotation left off a couple of points better. A single transaction in each Commercial issue was the total of the week; and here again good middle figures were marked. In the Suburban and Provincial group, there was very little doing; but prices were steady. The only change was a fractional advance in British. Among the Continental Companies, Imperial was by far the most active, and it rose a point; but Union preference was set back. None of the remoter undertakings presented any feature of interest. Business in the Water Companies was much the same as usual; but movements were rather irregular. New River and Southwark had a slight advance; while Chelsea moved in the other direction.

The daily operations were: There was not much activity in the Gas Market at the opening; but prices were firm. British rose ½. In Water, New River advanced 1; but Chelsea receded 2. Business was rather more plentiful on Wednesday, with a very good tendency ruling. South Metropolitan and Imperial Continental rose 1 each; and Gaslight ordinary ½. In Water, Southwark ordinary gained 2. Thursday's operations were much the same, with steady prices; and South Metropolitan advanced 1. Business fell off in point of volume on Friday; but prices for the most part were firm. Gaslight ordinary rose ½, but Continental Union preference relapsed 3. Saturday's business was moderate; and quotations closed without further variation.

ELECTRIC LIGHTING MEMORANDA.

The Costliness of High Voltage Supplies—"Free" Wiring—The Experience of Worcester—Different Systems of Charging for Wiring.

In a recent issue of the "Builder," it was observed that in all probability all the direct-current electric lighting companies in this country will soon be supplying at 200 volts and over. The Board of Trade limit is 250 volts, and already this pressure has been adopted on a large scale in Glasgow. It is remarked that this high pressure will not tend to make the electric light more popular. It cheapens the supply of current. But then, it is objected, most people want to buy light; and our contemporary vouches for the fact that 100-volt lamps give 25 per cent. more light than 250-volt lamps taking the same energy. Nor is this the worst of it. Not only should the consumer get a rebate of 25 per cent. if he is not to be a loser by the higher voltage; but he is put to other disadvantages. "If he uses open type arc lamps, he must put five in series across the mains. Hence, if he only desires one lamp, the whole five must be turned on; and it will be impossible to practise those little economies by means of which electric lighting is made inexpensive. Another drawback is that one faulty lamp will make the other four unsteady." It has been suggested that this difficulty can be avoided by using enclosed type arc lamps made to work across the 250-volt leads. But according to some Glasgow experiments, these lamps give less than one-third of the light that may be had from ordinary incandescent lamps at the same cost, which

reduces the suggestion to a mockery of the consumer. The "Builder" concludes that if electric lighting undertakers must supply at 250 volts, they ought to provide a continuous current transformer to those consumers who desire to use arc lamps, and fix the meter on the low pressure side of the transformer. This criticism of the latest phase of the electric lighting business confirms what we have repeatedly advanced here, to the effect that modern improvements in the technic of central station working are not to the advantage of the consumer. Gas companies, at any rate, with cheapened incandescent burners at command, can afford to smile at electricians' improvements which increase the cost and trouble of electric lighting.

Electricians, *en revanche*, have been blessed with many verbal attractions. Nobody knows what the early electric lighting speculators owed to the inspired coiner of the term "2000-candle power" as applied to their common type of arc lamps. What did it matter if these luxuries cost highway authorities anything from £25 a year apiece upward—see how nobly the candle-power multiplied up! And the same kind of felicity in naming things remains the electricians' peculiar privilege. A notable example of this is the blessed phrase "free wiring." The current issue of the "Electrical Review" devotes its principal leading article to a sarcastic examination of the arrangement commonly foisted on the gullible public under this attractive title. It is unaffectedly regretted that the name of the inventor of this term is not known to fame. He is of those to whom the electric lighting business owes far more than it does to the painful plodders among armatures and volts and such-like technicalities. It is so delightful to the retail shopkeeper and small householder to get something given to them free of charge. But the true inwardness of free wiring for electric lighting can only be appreciated by those who have had intimate experience thereof. Of such is Mr. E. E. Hoadley, the City Electrical Engineer of Worcester, where there is a branch of the National Free Wiring Company. He informs our contemporary that the results of three years of the Company's operations in the city "can only be looked upon as disappointing." During the first year the Company had 18 patrons, the following year 17, and this year, before shutting shop in Worcester, they only secured nine customers; and those whom they did secure discovered that the extra penny per unit put on to pay for the "free" wiring meant a surcharge of 25 to 30 per cent. on the electricity bills.

Consequently, the Worcester branch of the Free Wiring Company did not flourish. But the need for something more worthy of the name of assistance to the poor householder, if he was ever to be entered on the books of the Corporation Electricity Department, greatly impressed Mr. Hoadley. Accordingly, he and the Town Clerk prepared a scheme which was approved by the Council; and the Local Government Board have graciously expressed their willingness to consider an application for a loan for the purpose if the money is repayable in ten years. This electrical counterpart to the prepayment meter system in gas supply—which never pretended to be free of charge to the consumers—is not to be based on the addition of anything to the price of the unit. The wiring is to be put in by local contractors—thus avoiding the objection to municipal trading in fittings—to the specification and account of the Corporation. The consumer will be asked to pay down 10 per cent. of the cost on the completion of the job, and the balance as he likes, spread over three, five, or seven years, with 4 per cent. interest. The quarterly instalments will be put upon the electricity bill, but kept separate from the charge for the supply. There is nothing revolutionary in this; but it is interesting to note the reasons adduced for not charging for fittings with the current, similarly to the usual practice in automatic gas-meter supplies.

It is that to surcharge the wiring on the unit makes the user of lamps for long periods pay more than the consumer who uses his light for a short time per day—thus reversing the principle of the Brighton system of charging. Mr. Hoadley admits that even so there will be the possibility that a tradesman may only instal lamps in his window or shop, where they will be used but a short time daily, and may not care for them in dark passages, &c., where they would be required for many hours per day. This objection, however, as he artlessly observes, will in some measure be overcome, as every such installation will be planned by an official of the Corporation Electricity Department, "who will advise the consumer how to use his lamps to the best advantage." Ahem! The officers of the Worcester Corporation Electricity Department will need to be excellent diplomatists if they are to succeed in persuading intending customers of the department that their advice is disinterested. Here, again, the weakness for preferential dealing is manifested by this well-meaning Electricity Works Manager. They cannot help it. The Brighton system has bewitched them, and driven from their minds the "previous question" as to whether preferential dealings are fair and just. Nevertheless, it may be conceded that the principle of charging separately and independently for the supply, whether of electricity or gas, and for the fittings to which the consumer is assisted is the logical one. Making the latter charge an excess upon the former is only an expedient for getting at a fair result in the simplest way. It is not altogether illogical, however, because in the long run all the working expenses of the undertaking are represented in the cost of the supply, and any exceptional expense can be charged to the supply direct. The subject is a very interesting one, and it will be instructive to watch the development of the Worcester experiment.

SOME VIEWS OF WORKSHOP LIGHTING.

Brief notice has already appeared in the "Journal" of a paper on "Artificial Light," with special reference to the lighting of engineering workshops, read last month by Mr. A. E. A. Edwards before the Birmingham Association of Mechanical Engineers. It is a highly satisfactory sign of the times that factories and workshops of every description are now being much better and more comfortably furnished with necessaries and conveniences for the doing of the best work by the best hands than was thought needful only a few years ago. The North of England and Scotland used to be very backward in this respect; but the increase of trade of late years has involved the reconstruction and enlargement of many abominable old shops, to the great benefit of both the employers and the workpeople. Among other improvements, that of better artificial lighting is very conspicuous. For this the electric arc light is chiefly responsible. When lamps of this kind were put into workshops, the true aspect of these places was brought to light in more than one sense. As Mr. Edwards truly observes, many dark corners, haunted by habitual skulkers, were then for the first time shown up. What engineer does not remember the dismal, soul-depressing places the shops were in the old times, especially in the early mornings and on foggy days? One's earliest memory of smiths' shops or moulding sheds is generally of a squalid, filthy inferno, with black figures moving about round dully-glaring points which were heated metal. The electric arc lamp changed all that, as by magic. It brought with it also a new sense, on the part of works managers and proprietors, of the value of clean, bright reflecting wall and ceiling surfaces.

Of course, no sooner was the electric arc installed in workshops than its defects exhibited themselves. The quality of the lighting left much to be desired. In their anxiety to display the utmost brilliancy of which the lamps were capable, and to bear out their boasts of so many thousands of candle power per lamp, the electricians began with naked arcs. The glare of these blinded the men; while the sharp shadows thrown among the machinery and on the floor were very annoying. Both electricians and their employers discovered that lights and lighting are two different things; and, accordingly, they turned to the study of the latter. The need was for diffusion; and many attempts were made to attain this object by new and special ways. The naked arc was put into clouded glass globes, to the demolition of its claim to candle power measured in thousands. This was only a mitigation of the evil. Then the idea was adopted of lighting by reflection from the whitened ceiling only, or from special reflectors suspended over the screened arc lights. This expedient was greatly favoured for a time; but it proved to be extravagant.

Eventually, it dawned upon those interested in the subject that there was no special science of electric lighting; and that success in the practice of artificial lighting could only be attained by leaving the source of the illumination out of the question, while they studied the effects actually produced and required. This put electric light on an equality with lucigen lights or gas-light, as a means to an end. Mr. Edwards distinguishes between lights and lighting, from the commencement of his paper. Naturally, therefore, the first point he makes is the great difference of light-reflecting capacity of various surfaces upon which the rays of a lamp may fall. He quotes Dr. W. E. Sumpner, Principal of the Technical School, Birmingham, for the following results of experiments designed to ascertain the value of this capacity for different surfaces. White paper, according to this authority, will reflect 80 per cent. of the light which falls upon it; tracing cloth, 30 per cent.; yellow wall paper (clean), 40 per cent.; yellow wall paper (dirty), 20 per cent.; blue wall paper, 25 per cent.; brown wall paper, 15 per cent.; deep chocolate paper, 4 per cent.; planed deal (clean), 45 per cent.; planed deal (dirty), 20 per cent.; macadam road about 8 per cent.; a dead black surface, 1 per cent.

So far, good. Mr. Edwards then proceeds to apply these data in a manner of his own. He says: "Let us examine what this means. We have, say, a room white all over, with a lamp of 100-candle power placed inside it. The rays of light strike the walls, ceiling, and floor, and 80 per cent. of them is reflected. This reflection is equal to another lamp of 80-candle power in the room, whose rays are also thrown against the surfaces and 64-candle power reflected. These rays are in turn again reflected to the extent of 51-candle power, and so on. The result is that the illumination of the room is increased to five times what it would be if the surfaces were all dead black. If the room had been painted brown, the resultant illumination in the room would be equal to 15 per cent. in addition to the 100-candle power of the lamp. The conclusion we arrive at is that a 25-candle power lamp in a white room will give the same effective illumination as a 100-candle power lamp in a brown room." The practical lesson drawn by the author from these figures—that it pays to keep shops well whitewashed—is reasonable; but one must regretfully point out that Mr. Edwards has otherwise been sadly misled by his data.

Suppose it to be true that a white ceiling or wall will reflect 80 per cent. of the amount of light that falls upon it, neglecting angular incidence, if we wish to know what this amount is, we must first ascertain the amount of the incident light. This consideration does not enter into Mr. Edwards's computation. He

only takes the case of a "room," and a light source of 100-candle power intensity, measured in one direction. What is the distance from the lamp to the wall or to the ceiling? Mr. Edwards forgets the "law of squares." A white wall would only reflect 80-candle power out of 100-candle power if the distance between it and the lamp were nothing, which is absurd. Moreover, when one considers the quantitative diffusion of light over a room from a central source, it is necessary to start from the spherical, not the straight line measurement of the power of the source.

It is therefore certainly not true that the author has made a proper application of Dr. Sumpner's determinations of the light-reflecting power of surfaces. It is difficult to say what would be a proper quantitative use of them. They indicate rather the comparative brightness of surfaces to the eye, and also suggest how the effect of light sources may be modified to suit conditions and subserve different purposes. Nothing can multiply the initial illuminating power of a light source; but the diffusion of the light can be very greatly modified. There is reason, as we have admitted, for the whitewashing of workshops; but even this rule is open to exceptions and qualifications. Even a correct measurement of the amount of artificial light supplied in a workshop is not enough to prove proper and adequate lighting. This depends, in the last place, upon the ability of the workers to make the utmost use of it, which is a question of the state of their eyes. A glare of light and a whitewashed wall together will so shut up the iris that its owner will scarcely be able to see anything at all. Assuming, therefore, that a workshop is properly lit from overhead by day, with a north light, we should say that the best way to treat the interior surface for artificial lighting would be to wash all above a 6 feet dado with lime broken by the addition of a little chrome. Raw lime white is painfully crude and cold-looking; and the loss of light by warming it up is nothing. The bottom 6 feet of walls and columns should be chocolate colour, as much to rest the eyes of the operatives as for other reasons. It is practically impossible to have a light coloured floor in an engineering workshop; but this ought certainly to be aimed at wherever attainable.

With regard to the shading or partially obscuring of artificial lights by globes, Mr. Edwards and others should learn to discriminate between "shades" and softeners or refractors of light. The value of any accessory to the lamp is a question largely of its position relative to the work and the worker. The true aim is to get the lighting without seeing the source. If this can be secured by simply elevating the lamps above the line of sight, so much the better. The downward lighting can then be increased —to compensate for the loss due to the raising of the source— by the use of superior reflecting shades. It is not at all necessary nowadays to submit to any loss of light for the sake of softening or refraction by means of glasses. Mr. Edwards truly says, "You can easily obstruct 40 per cent. of the effective light in your shops by using frosted glass." But the use of frosted glass is a barbarous superstition. What about the "Luxfer" prisms for borrowed or basement lighting? Optical science, moreover, has come into the market with artfully-moulded refracting globes for every kind of light, which save more light than they obstruct. And for how many years has the "Christiania" form of gas-globe existed to prove that even opal glass can be employed to screen off the direct vision of a light source, to the positive advantage of the worker beneath it? These are truths that a modern writer on the subject of lighting should not overlook. Mr. Edwards, it is to be feared, is not a very well-posted or reliable guide in these matters. For example, he lays "great stress on the fact that gas-burners in your workshops should be horizontal. This remark applies with equal force to churches and public buildings." This is worse than barbarism. Mr. Edwards declares that he is "supported in this idea by one of the best known and most scientific gas engineers in the country." This is very remarkable.

Yet the author discourses well and sensibly concerning other points of gas lighting. He advises the use of governor flat-flame burners in preference to the gas-governor on the outlet of the meter or the branch to every floor of a factory. The use of governor instead of ungoverned burners is, of course, to be commended; but it is not wise to discourage the addition of a service or branch governor where the sizes of the interior pipes are ample, as should always be the case. The pressure of the gas in the street mains is constantly increasing; and with so many gas fires and cooking ranges now in use everywhere, there is much roaring-away of gas in the absence of the service governor. Again, Mr. Edwards admits that "incandescent gas lighting is perhaps the most economical system of lighting we have at present, in places where there is very little vibration and where the lights are fixed." There is no occasion for any qualification of the cheapness and serviceability of the incandescent gas-burner. It is far and away the cheapest artificial light in its degree; and as for the susceptibility of the mantles to destruction by vibration, this is a youthful weakness which the system will outgrow. Mr. Edwards did not mention any intensified incandescent gas lighting system, which was a pity.

On the other hand, the author gave an interesting piece of original information relating to the use of incandescent burners with Dowson gas. "Dowson water gas with No. 3 burner, with 135 nipple and 20-10ths pressure and 4·8 cubic feet of gas per hour, gave 8 to 10 candle power. Then the gas was carburetted by being charged with benzoline. The consumption measured between the carburettor and burner, was 4·5 cubic feet per hour, 2½ gallons of benzoline were required to carburet 1000 cubic feet of gas. Therefore the cost of gas works out as follows: Dowson gas per 1000 cubic feet, 2½d.; (say) 3 gallons of benzoline at 9d., 2s. 3d.; cost of good lighting gas per 1000 cubic feet, 2s. 5½d. The light from this carburetted Dowson gas was in every respect equal to that obtainable from ordinary coal gas." This statement is vague in several respects. Vagueness, or lack of precision of statement is one of this author's faults. It appears again in what should have been a useful comparison of the cost of home-made electric lighting, by gas power, and the same lighting by means of gas. "The cost of running the plant averages 4·0d. per unit, or 0·24d. per 16-candle power lamp per hour, after making due allowance for repairs and providing a sinking fund to realize outlay in 20 years. The cost of lighting the same factory by the gas would have been 2d. per gas-light of the same candle-power." Surely, there is a mistake or a misprint here. Even with a common flat-flame burner and with Birmingham gas, a 16-candle power light would only cost about 0·125d. per hour, reducible to one-third the price for incandescent burners, which so modern an establishment would be certain to favour.

LIQUID AIR AND THE LIQUEFACTION OF GASES.*

Stripped of the absurd claims which some enthusiasts make for liquid air as a producer of perpetual motion, the subject of the liquefaction of air, of hydrogen, and of what were once designated permanent gases has much fascination for the student of physics, as well as for that section of the public whose interest in science has no deeper source than idle curiosity, or a desire to be in the fashion. We will not venture a guess as to the percentage of the crowded audiences at the Royal Institution gatherings that might be ascribed to the latter class; but we have our opinion. In the book before us, Dr. Sloane—a strong believer in the future possibilities of liquid gases—has set himself to tell the story of the attempts—extending over a century, and culminating in much success—to reduce elements normally gaseous to the liquid, or even the solid, form. His book is not only a historical and scientific record, it is also largely biographical. A sketch is given of the lifework of all the men whose names are most intimately connected with the liquefaction of gases.

Earliest among these comes the name of Michael Faraday—errand boy, book-binder's apprentice, self-taught *savant*. It is interesting to recollect that the question as to who deserved the credit for Faraday's success in the liquefying of chlorine—Sir Humphry Davy who suggested, or Faraday who conducted, the experiments culminating in that liquefaction—was the cause of Davy's ungracious opposition to Faraday's election as Fellow of the Royal Society. This was early in Faraday's life. His experiments in gas liquefaction gave way for over twenty years to his work in the field of magnetism and electricity. He returned to his old love in later life, and in 1845 embodied the results of his experiments in liquefying various gases in a paper communicated to the Royal Society of London. Among those he afterwards succeeded in solidifying, are mentioned sulphur dioxide, sulphuretted hydrogen, nitrous oxide, hydriodic acid, hydrobromic acid, and ammoniacal gas. He failed to liquefy hydrogen or oxygen at a pressure of 27 atmospheres, nitrogen or nitric oxide at 50, carbon monoxide at 40, or coal gas at 32 atmospheres. He, however, showed the way, in large measure, to those who came after him; and to him belongs the credit of the pioneer. "In his use of a volatile freezing mixture in a vacuum, combined with mechanical pressure applied to the gas, we recognize the elements of the work of most of his successors in the work of liquefying gases." A chapter is devoted to the labours of other, and minor, early experimenters, among them Colladon and Thilorier—the latter the first producer of solid carbon dioxide. An explosion of one of Thilorier's cylinders, resulting in the death of the operator, served to illustrate the extreme danger of many of the experiments conducted, of which danger Faraday had frequent and painful proof. The work of Raoul Pictet, the Swiss *savant*, to whom Dr. Sloane's book is inscribed, occupies the following chapter. It is a record of strenuous, enthusiastic labour, which is far, let us hope, from being ended. The story of his liquefaction of oxygen is given at some length, and is accompanied by a full description of the apparatus employed. In another chapter his experiments in the application of low temperatures to the treatment of disease and to the purification of chemicals are described.

Eminent among Pictet's contemporaries and rivals the name of Louis Paul Cailletet is closely connected with the liquefaction of the so-called "permanent" gases. It is interesting to note that the first gas that he succeeded in liquefying was acetylene—a success achieved, however, in the course of experiments not directed to that particular object. This incidental discovery led him to make further experiments, which finally resulted in the liquefaction of oxygen. Working independently, and on different lines, Cailletet and Pictet obtained this result almost simultaneously (December, 1877); but the claim of priority is awarded to the former. The two rivals afterwards became intimate friends. One of Cailletet's most notable discoveries was the use of liquid ethylene as a refrigerant, of which Dewar afterwards

* "Liquid Air and the Liquefaction of Gases." By T. O'Conor Sloane, Ph.D. London: Sampson Low, Marston, and Co.

made extensive use in his liquefaction experiments at the Royal Institution. A chapter on the work of two Polish scientists, Sigmund von Wroblewski and Karl Olszewski, who chiefly experimented upon oxygen and hydrogen, leads up to that describing the labours of the man with whose name the liquefaction of gases is most intimately connected in this country—Professor James Dewar, Faraday's successor at the Royal Institution. The construction of Dewar's vacuum bulbs for containing liquid air—the vacuum preventing heat being conveyed to the liquid, just as it prevents loss of heat from the film of an incandescent electric lamp—is described at length, and Dr. Sloane (who in some other respects appears anxious to decry the value of Dewar's work) is of opinion that Professor Dewar is "amply justified in maintaining that the vacuum he produces is higher than any of which man had ever yet dreamed." The liquid itself is contained in a bulb within the vacuum bulb, and the insulation is rendered more effective by an ingenious plan. A little mercury is left in the outer bulb, and, being chilled by the inner (or liquid air) vessel, condenses upon the outer surface of the latter, forming a mirror which reflects the ether, or radiant heat, waves. Professor Dewar produces his vacuum by the Torricellian vacuum method, combined with that of freezing mercury vapour.

Some interesting results are given of Dewar's experiments in reducing metals to liquid air temperatures. Soft metal, such as solder, will, at the temperature of boiling oxygen, support fifteen to twenty times the weight it can sustain at ordinary temperatures, and becomes elastic like a watch spring. "The inhabitant of a world where the temperature approximated the absolute zero would have much stronger iron and steel with which to build his bridges; and he might make his watch springs out of pewter, and his bells out of tin." Passing over the account of Dewar's production of oxygen-ice and air-ice, we come to the "classic date," May 10, 1898, when he first obtained liquefied hydrogen in quantity as a "static liquid." The boiling temperature of hydrogen was found to lie between $-237°$ and $-239°$ C. As Dr. Sloane remarks, the story of the liquefaction of gases may be said to culminate in the production of liquefied hydrogen. "The date is but a few months before the period in which this book was written. It seems a most appropriate time in which to put together the long chronicle of a hundred years' efforts to liquefy gases." Since Dr. Sloane's book was published, Professor Dewar has succeeded (as was described in a paper by him read before the recent congress of the British Association) in obtaining solid hydrogen, which presents the appearance of frozen water, and not, as had been anticipated by many, that of frozen mercury—a fact which definitely negatives the theory that hydrogen is a metallic element. In the discussion at Dover, the dangerous character of these experiments was emphasized. Dr. Ludwig Mond congratulated Professor Dewar upon being alive to tell the tale; while Sir William Crookes pointed out that the danger lies not only in the possibility of air leaking in and forming an explosive mixture, but also in the fact that during the passage of the dry gas through the narrow tubes it becomes electrified, and there is a chance of sparking occurring, with most violent detonation. Sir William—who, in Professor Dewar's absence, read the paper—announced that the Professor had further succeeded in liquefying helium by means of liquid hydrogen. The hydrogen employed in these experiments is, we believe, obtained by the action of pure sulphuric acid on pure zinc.

Leaving the account of Dewar's exploits, we are introduced to the American liquid-air celebrity, Charles E. Tripler, to whom was attributed the invention of that wonderful motor, previously noticed in the "Journal," which was to solve the problem of perpetual motion; the energy of 3 gallons of liquid being supposed to produce 10 gallons (an arrangement which conjures up a vision of a second Deluge—of liquid air—all produced from one motor). However, we find no mention of this wonderful machine in the account of Tripler's work in Dr. Sloane's book; only a glowing story of how, whilst "Dewar, working on the lines laid down years before by Pictet, and assisted by liberal gifts from one of the London Guilds and from private individuals, liquefied gases at vast expense," and produced a "few teaspoonfuls" of liquid hydrogen, Tripler, "a private individual, has erected a plant at his own expense, and for years past has liquefied air on a scale of which Dewar and his associates never dreamed." We must confess we cannot see what it has to do with the scientific value of a man's work, whether the funds wherewith he is enabled to carry out his experiments are provided by an institution or out of the man's own pocket. We do not judge a scientific man's value in this country by the number of "almighty dollars" he may possess. Mr. Tripler, who thinks nothing of sending gallons of liquid air hundreds of miles by rail in common tin buckets lined with felt, proposes to "utilize the heat of the sun" in obtaining motive power with liquid air—how, exactly, we are not told. We shall await the achievements of this man of science, who breathes liquid air and thinks in solid hydrogen, with great interest, not unmixed with scepticism. It is noteworthy, however, that "the construction of his liquefiers has not been fully divulged."

Further chapters are devoted to descriptions of the apparatus used by Joule Thomson, Linde, and Hampson respectively. [An account of the plant designed by Dr. Hampson was given in the "Journal" of the 15th of May, 1900.] Some illustrations of various interesting experiments with liquid air provide the "popular" section of the work; and, finally, Dr. Sloane recounts some of the practical uses to which the intense cold produced by the application of liquefied gases has been put, and speaks of future possibilities. Pictet was the first to suggest the use of cold-air wells in the treatment of disease; and various medical men are quoted as believing in their efficiency in some cases. A use to which liquid air is much more likely to be put is that of purifying chemicals by crystallization. Chloroform, alcohol, and ether are all mentioned as being successfully purified by this method. One of the proposed uses of liquid air is as a constituent of an explosive. Serious objections to explosives so constituted are found in practice, we believe, owing to the uncertainty of the strength of the mixture, and the rapidity with which it deteriorates. Dr. Sloane, however, says that such an explosive was used for several months in a coal mine at Pensburg, Bavaria, with success. As to the possibilities of liquid air as a motive power, Dr. Sloane, advisedly, we think, does not venture to prophesy. He guardedly remarks that "liquid air, *if it could be produced cheaply enough*, would represent an ideal substance for the production of energy." The parenthesis we have italicized hits the real obstacle on the head. We notice that the cost of Charles E. Tripler's buckets of liquid air is not mentioned.

The book is a most interesting one; and we congratulate the author upon the manner in which he has brought together and arranged the results of the experiments of the many great chemists who have laboured to achieve the liquefaction of gases. In doing so, however, we cannot refrain from saying that we could wish the book were free from a bias in favour of the work of American, as contrasted with that of English, chemists. In the world of science—at any rate, in a historical record—there should be no nationalities. We have only to add that the work is excellently illustrated, and possesses a useful index.

OBITUARY.

We regret to learn of the death of Mr. T. S. Borradaile, the inventor of the gas-regulator with which his name is associated, and for some time Secretary of the Pará Gas Company.

The recent death, in his fiftieth year, is announced of Mr. J. F. Sawer, of the late firm of Messrs. Sawer and Purves, meter makers, Manchester. Deceased, who was a Mason, was known to gas engineers in all parts of the country.

The death on the 5th inst. is announced of Mr. Samuel Jones, Manager of the Pernambuco Gas-Works. He was a member of the Gas Institute, having been admitted an Associate while assistant to Mr. C. A. Craven, at Pernambuco. On the return of that gentleman to England, Mr. Jones succeeded him, and was elected to full membership of the Institute in 1887. He was 48 years of age.

PERSONAL.

Mr. W. Hearson, of the Saltley Gas-Works, Birmingham, has been appointed, out of fifty applicants, Manager of the St. Ives (Cornwall) Gas-Works, in succession to Mr. Eldred Faull, resigned.

Herr Friedrich Siemens, of Dresden, the well-known inventor of regenerative gas-burners and fires, is the first to receive the honorary degree of Doctor of Engineering at the Dresden Imperial Technical College.

Mr. A. Wharton, the Manager of the Plymouth Gas-Works, has placed his resignation in the hands of the Directors. We are informed that this step has been rendered necessary "by the ill-health of members of his family." Mr. P. S. Hoyte, who has been Assistant-Manager during the whole of Mr. Wharton's residence in Plymouth, has been appointed Engineer and Manager, and will take up the duties when Mr. Wharton leaves. Mr. Hoyte was a pupil of Mr. W. R. Chester, at the Nottingham Corporation Gas-Works, and removed to Plymouth on his appointment as Assistant-Manager there.

Mr. Henry Fowler has been appointed Gas Engineer to the Midland Railway Company, in succession to Mr. James Brooks, whose retirement on account of ill-health was noticed in the "Journal" for the 8th ult. Mr. Fowler was born at Evesham, and educated at the Grammar School there. He received his technical education at Mason College, Birmingham, where he obtained the Engineering Diploma. He served his apprenticeship in the locomotive works of the Lancashire and Yorkshire Railway at Horwich; and, after being employed in several departments, he was appointed Gas Engineer in 1895. He has paid special attention to the use of oil gas and acetylene for carriage lighting, and obtained a Telford Premium for the paper he read before the Institution of Civil Engineers in 1898. He is a Whitworth Scholar, an associate member of the Institution of Civil Engineers, and a member of the Institution of Mechanical Engineers.

In the "Journal" last week we announced the appointment of Mr. Vincent Hughes, of Tipton, as Gas Engineer to the Smethwick District Council. Mr. Hughes was educated at the Dudley Grammar School, where, for three years in succession, he obtained a silver medal, chiefly for the higher mathematics (the last one being the first prize of the year). He received his early professional training in the drawing office of Messrs. Cochrane and Co., of the Woodside Engineering Works,

Dudley, where for four years he was engaged on gas apparatus, roofs, bridges, &c. He was afterwards employed by Mr. Henry Lovatt, the well-known railway and dock contractor of London and Wolverhampton. He then went to Barrow-in-Furness, as Assistant to Mr. A. C. Fraser, the Manager of the gas and water works, and was subsequently appointed his Chief Assistant at the Bolton Corporation Gas-Works. While engaged there, extensions involving an outlay of about £200,000 were carried out. Seventeen years ago, when Tipton acquired power from the Birmingham Corporation to supply their own district with gas, Mr. Hughes was selected for the position of Manager; and he has since had sole control. The works were erected to supply 60 millions per annum; and the output is now about 110 millions —nearly double. This has necessitated considerable additions and alterations to the plant. The leakage during the first year was 19 per cent.; but, as the result of Mr. Hughes's vigilance, it has been reduced to 8½ per cent.

On the 31st ult., Mr. Thomas May, who for the past thirty years has held the position of Manager of the Canterbury Gas and Water Company, was the recipient of a handsome testimonial from the men on his retirement. The ceremony took place in the offices; the presentation being made by Mr. H. C. Page, the new Manager. He said he had been requested to ask Mr. May's acceptance of the gifts as a small token of the esteem in which he was held, and as a pleasant memento of many happy days spent in Canterbury. The employees one and all wished him long life, good health, and prosperity in his well-earned rest. The presents consisted of a handsome liqueur stand, a cake-basket, a malacca cane, and a silver-mounted umbrella. The stand bore the following inscription: "Presented to Thomas May, Esq., by the staff and employees of the Canterbury Gas and Water Company, on his retirement after thirty years' service as Manager, 31st May, 1900." Mr. May, in acknowledging the gifts, said that he hardly knew how to adequately express his thanks for this mark of esteem, for he had neither wished for nor expected any recognition. He had been Manager for thirty years, and he was pleased to say he had always been on the best of terms with both the men and the Company, as he hoped and trusted they would be under their new Manager. Three cheers were given for Mr. May, and a hearty vote of thanks was accorded to Mr. Page for making the presentation.

[Referring to the change in the managership of the St. Ives (Hunts) Gas-Works, noticed last week, it should have been stated that Mr. Hollins has only been appointed *pro tem.*]

NOTES.

The Decay of Stones in London Air.

The perennial agitation for the suppression of smoke in London has recently bubbled up into a cry for the protection of the stone-work of Westminster Abbey from the destroying action of the smoke and fumes from the factories in Lambeth. The "Builder" pertinently points out that this trouble is not a new one; the Abbey stones having been perishing for hundreds of years. According to evidence given in 1861 before the Committee appointed to inquire into the decay of the stone in the then new Houses of Parliament, the stone in the Abbey was at that time mostly decomposed and in a very bad state. A preservative process was even then being employed. In fact, there is not a shadow of doubt that the mischief is of long standing, and cannot be charged to the Lambeth factories. Our contemporary remarks that it has been customary for many years to malign the factories "over the water" for their supposed effect in decomposing stone in Westminster; "but history seems to show that they are not entirely to blame, even though in recent years the general pollution of the atmosphere of the Metropolis must in some measure be responsible for the decay of stone in London." If due value were allowed for the greater clearness of London air since the general introduction of gas fires and cookers in all parts of the Metropolis, the conclusion would be that matters cannot be so bad in this respect as they used to be.

The Rusting of Iron.

The process of the rusting of iron is again discussed in "Engineering," which remarks that ordinary red rust is essentially an oxide of iron containing combined water and practically identical with jewellers' rouge, which is nearly pure ferric oxide. The ordinary chemical explanation of the process of rusting is that the iron combines with the oxygen of the air, together with moisture; but it is observed that the simple chemical equations representing the action do not correspond with the actual facts, or explain why iron placed in contact with an alkali does not rust. An explanation of this fact has been sought in the suggestion that the presence of carbonic acid gas is necessary for rusting to take place. This is the familiar two-stage explanation of the phenomenon, due to Professor Crum Brown. It appears, however, that Mr. W. R. Dunston, F.R.S., has found reason for doubting this hypothesis; and has carried out a series of experiments which go to show that for the formation of rust it is only essential that the iron shall be in contact with liquid water, and with oxygen. Reasoning on the results of his experiments, and on the fact that the alkalies prevent the formation of rust, Mr. Dunston suggests that the real active agent in the process is hydrogen peroxide. To test this, iron was suspended in water to which were added substances, some of which decompose the peroxide, while others have no such action. In every case there was no rusting where peroxide was destroyed; while it always occurred in the other cases.

Lighthouse Engineering at the Paris Exhibition.

In an "Engineer" article on lighthouse engineering at the Paris Exhibition, it is remarked that perhaps in no branch of engineering science has there been more development since the previous Exhibition of 1889. In the interim, the late M. Bourdelles has introduced his celebrated *feu-eclair* type of optical apparatus, which enables a far higher intensity of flash to be obtained without any increase of the luminous power of the source; while the duration of the flash is reduced to the small fraction of a second which is necessary for its perception by the human eye. In the French lighthouse service, extensive use is now made of incandescent gas-lights, even for first order lighthouses. High-pressure coal or oil gas is employed for these lights, the latter being made by a small plant installed in the lighthouse, which is rendered possible by reason of the smallness of the consumption. For the same cause, the cost of maintenance and the consumption of oil in the incandescent lights works out to less than the expense of the old-fashioned oil-lamps. An important point in the same connection is that the incandescent lights require so little attention that the French service light-keepers are able to sleep during what are technically called their watches, which makes the work considerably less trying. All maritime countries are copying the same appliances—*feu-eclair* lights with incandesent gas-burners—to the supersession of the costly and troublesome electric light.

The Proportions of Retaining Walls.

The interest of engineers in the design and construction of retaining walls is sharpened by such accidents as the recent failure of the Austin dam on the Colorado River, U.S.A., particulars of which are given in the "Engineering Record" for May 19. This was an important structure of masonry, 60 feet high, over the crest of which in heavy floods the water of the river poured in a wave 9 feet deep. It is the opinion of a competent observer, resident in the neighbourhood, that the dam failed through undermining. The cataract of flood water over the crest carried away the river bed from the toe of the dam on the down-stream side, with the result that the last flood carried the dam away, doing great destruction to property and causing the death of seven of the workpeople in the adjacent power-house. Another correspondent of the same paper recalls in this connection the failure of the Bouzey dam, which was of similar design and construction. He contends that in all masonry water dams the wall should be as thick at any point as the height of the water above it, unless the dovetailed masonry construction of the Eddystone lighthouse is followed, with the object of preventing the ashlar courses sliding on their beds. It is stated that, warned by experience, American Railway Companies are now making all their retaining walls for earth as thick as they are high, notwithstanding the fact that the pressure of earth is never so great as that of water unless it is waterlogged. Where this simple rule is not followed, any saving in the thickness advocated is at the expense of the extra labour of dovetailing the courses, or by tilting the courses normally to the overturning force.

Carbide of Calcium Not a Dangerous Fire Risk.

The large number of insurance agents and adjusters who are now in Ottawa settling the losses incurred through the recent lamentable fire, have lately had before them an object-lesson which should remove any doubts which may have been entertained as to the safety of storing carbide of calcium. According to a communication we have received from Mr. Andrew Holland, of the Board of Trade, Ottawa, when the fire reached the furnace-room of the Dominion Carbide-Works, everything in it that would burn was consumed. Three pigs of carbide, however, in three crucibles, remained in perfect condition as evidence that they did not explode. The grinding and mixing department and warehouse were in another building, and every effort was made to prevent the fire from reaching it; but the very strong wind blowing and the vast rush of flame enveloped all the buildings in the vicinity, and they were in a few minutes reduced to ruins. In the carbide warehouse there were 15 tons of carbide, packed in rolled steel cans with screw covers. When the floor burned, the carbide dropped through into the cellar, in which a foot of water had collected from the firemen's hose. Here was an ideal combination for an explosion, if carbide is an explosive. Several cans were broken in the fall, owing to the intense heat having opened the seams, and the carbide was dumped into the water. Gas was generated in immense quantities; but it simply burned with a low steady flame, making less show than two cartloads of coke on fire in the immediate vicinity. Had the cellar been dry, the carbide could have been all saved after the fire; but it continued to soak up the water and make gas for some days, and the burning gas kept the carbide so hot that it could not be handled. As it was, about a ton of it was shovelled out and packed in new cans. Two of the cans were dug out whole from the hot mass, and saved with the carbide, though they were burnt like old worn-out stove-pipes. The insurance agents

who examined into the matter declare their conviction that carbide is not a dangerous fire risk.

Metallic Joints for Masonry Arches.

A suggestive article on the provision of metallic joints for masonry arches lately appeared in the "Engineer." It opens up a matter of great interest for constructors of the light reinforced concrete work now so much in vogue. In the older, traditional style of masonry constructions, it was customary to allow a very large margin of strength and stability with regard both to standing and moving loads. This principle does not apply to the lighter system of construction, which is on the contrary specially designed to answer its purpose without waste of material. Specifically, the question becomes one of the hinging of arches, in order to allow for the movement due to changes of the line of pressure. It appears that another variety of the general problem of the stability of masonry arches has been studied by M. Tavernier, Engineer-in-Chief of the Ponts et Chaussées, who has made experiments on the building of stone arches with metallic joints between the voussoirs. He successfully ran lead joints 2 inches thick between stones over 6 feet in height. Lead was chosen for this purpose because it will not transmit to a bearing surface a pressure exceeding 2 tons per square inch, which is not sufficient to crush hard stones. The degree of thickness to be given to the lead joint depends upon the area of the bearing surface; since the binding effect of the surfaces tends to prevent it from squeezing out. From a very satisfactory test of a stone arch of the respectable dimensions of 50 feet span with 3 feet rise, M. Tavernier is led to believe that his method of constructing arches has a useful future. It practically constitutes a jointed arch without the actual detail of a made hinge. This opening for engineering research may be commended to the attention of the well-endowed engineering colleges of the United States, which are sometimes credibly reported as being in want of fresh fields for experiment.

The Export of Carbolic Acids, &c.—By a recently published Order in Council, dated the 15th ult., the prohibition subsisting, under Her Majesty's Proclamation of the 11th of January last, on the exportation of picric acid (trinitro-phenol), trinitro-cresol, carbolic acid (phenol), and cresylic acid (cresol), is taken off.

The "Planet" Acetylene Generating Plant.—We have received a descriptive account of this plant, and of the extensive works at Heilbronn at which it is manufactured. The generator is designed to ensure the evolution of the acetylene at a low temperature; and to that end the charge of carbide is immersed in forty to fifty times its weight of water. Consequently the gas leaves the generator perfectly cool, and tolerably free from impurities. A purifier with a water seal is supplied for use with the generator; and a special purifying material is recommended for use with it. It is said that 1 lb. of the material is capable of purifying 400 cubic feet of acetylene. The plant is made in several sizes, and appears safe and intelligently designed.

The Dispute between the Paris Gas Company and the Municipality.—Our readers may remember that in the abstract translation of the last report of the Paris Gas Company which appeared in the "Journal" for the 24th of April, reference was made to the law suit pending between the Company and the Municipality on the subject of certain moneys applied in redemption of capital, a decision on which by the Council of State was then awaited. It has since been given, and is adverse to the Company. The Municipality said the amounts in question formed part of the profits divisible between the Company and themselves under the terms of the Treaty; and they sent in a claim for 26,000,000 frs. The examination of the accounts which led to the proceedings was made in 1895 by the Chairman of the Finance Committee of the Council; and the Company have been ordered to pay into the municipal exchequer the sums appropriated year by year since that date, amounting to 6,000,000 frs., and 10,000,000 frs. more between the present time and 1905, when the concession will expire. The Court would not allow the entire claim, on the ground that the accounts prior to 1895 had been passed by the municipal officials without question.

Sir Henry Roscoe on Bunsen.—At the Royal Institution, on the 1st inst., Sir William Crookes read, in the unavoidable absence of the author, a lecture prepared by Sir Henry Roscoe on Bunsen and his work. After describing the personality and directing attention to the amiability and modesty of the great Heidelberg chemist, the lecturer passed on to deal with his scientific work. He stated that Bunsen laid the foundation of many branches of chemical science, and in pure chemistry, in chemistry applied to the arts and industry, in physical chemistry, and in chemical geology, his researches had long ranked as classics. In connection with Bunsen's achievements in gas analysis, the invention of the burner bearing his name was alluded to, as well as the grease-spot photometer. But of all Bunsen's researches, the one which, according to the lecturer, would undoubtedly stand out pre-eminently as time rolled on, would be that connected with spectrum analysis, which formed the dawn of a new stellar and terrestrial chemistry. Finally, reference was made to Bunsen's investigation into the measurement of the chemical action of light, in which the lecturer had had the good fortune to be associated with him. The lecture was illustrated with photographs of Bunsen and the apparatus he employed.

COMMUNICATED ARTICLE.

THE COST OF COAL.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

Four or five months ago, when the rise in price of coal became so marked as to create some feeling of alarm, many managers of gas-works consoled themselves with the reflection that their contracts did not run out till Midsummer, and that the inevitable slump could not be staved off beyond that period. Unfortunately, the spring season found gas companies with very small stocks, and therefore purchasing much earlier than usual; thus stiffening an already strong market. And now, before the summer is well on, some collieries are already refusing to contract for forward supplies, and others will not entertain applications, not merely from fresh customers, but for any increase on last year's deliveries. We must go back to 1873 for anything like a parallel to the present position of affairs. Midsummer is well in sight, and brings with it the unwelcome conviction that there is something stronger to be encountered than a mere passing crisis, which can be covered by the undivided balance of profits or by a trifling dip into the reserve fund; and that we must, during the ensuing twelve months, be prepared to meet a coal bill of unprecedented proportions. From 25 to 50 per cent. on the price of coal means an item that, after everything possible in the way of reducing expenditure, increasing the returns of residuals, and so on, has been done, leaves a wide margin to be met, either by the accumulated funds or by a rise in price of gas.

Nor are the majority of gas undertakings in a good position to meet such a heavy strain on their resources. Many struggled through the coal crisis of 1893 without asking their customers to share the burden. As a consequence, they found themselves a year or two later with a crippled reserve, and labouring under the state of things that invariably follows a starved repair and maintenance account; and in 1897, before they had time to pull themselves together, coals began to move up again. The prices of 1899, upon which the present rise is figured, were very appreciably—perhaps 10 per cent.—higher than those of 1896-7. The general rule has been to sell gas at the lowest remunerative price. As a result, the year 1899 found many who could barely hold their heads above water so far as earning full dividends is concerned; and even if the *status quo* had been maintained, they would be in a position calling for grave consideration.

So the question now pressing upon the minds of those responsible for the financial management of gas undertakings is: How is this increase of expenditure, amounting to some 10 per cent. of the total outlay, to be covered? Can any other items on the expenditure side be reduced, or can we do with a more modest balance available for profits? Turning to the income, can the returns from residuals be increased? Or must we, as a last resource, fall back upon a rise in the price of gas? It is not too much to say that the expenditure has already been carefully cut down to the lowest possible point. Starving the works, by avoiding painting and other necessary repairs, is simply borrowing from the future at a high rate of interest; and the same may be said of the policy of carefully shifting into the capital account every little item on behalf of which a plausible excuse may be found. Loading up the stock account with everything that can possibly be charged forward is equally reprehensible; and it is much better to show a plain, if unsatisfactory, statement than to trespass on the resources of the future, in order to compensate for the contingencies of the present.

But where is the inventor? Financiers do not want to be bothered with the new-process man when times are good and dividends secure. He may lapse into a state of hybernation, or take his chance as a clerk or foreman, if willing to accept a little lower remuneration than the ordinary, in order to compensate for the fact that his fancy for experiment and research may lead to a little occasional neglect of routine duty. But when expenses threaten to encroach upon the balance available for profits, then the inventor is asked why he does not step into the gap. Why do you not deal with the transit of solid materials? Why do you not gasify the tar, and thus increase the yield? Why do you not make an incandescent mantle that can be retailed for 2d., and is strong enough to bear reasonable handling? These are the sort of questions that are put by impatient investors, who appear to regard the inventor as a modern "Slave of the Ring," capable of bringing out anything that they like to demand. The progress of our industry, as indicated by the reduction in the cost of manufacturing, purifying, and distributing gas, has been a record of steady work in the refinement and improvement of details, rather than one of startling innovations. The furnace, the retort, the condenser, and the purifier, have all been re-cast, from time to time, as increased experiences and resources of modern science may suggest. The generator furnace, the inclined retort, the charging and drawing machines, the conveyor of solid materials, and other advancements, have imperceptibly, but surely, established themselves. There has, however, been nothing of the striking or sensational character, of a kind likely to obtain a place in solid block type on the contents bills of our daily papers, or run the rounds of the Scientific Press; and at present there is no indication that the inventor is prepared to respond, to any important extent, to the demand for larger yields or cheaper working.

As regards reduction of dividends, the prospect is equally unpromising. A very large proportion of share capital has been bought at auction sales on terms that force the delusive prospect of a nominally high rate of dividend to give place to the plain reality of interest on the market value of money only. A substantial reduction of dividend would, therefore, inflict some loss and hardship in a quarter where they are not deserved, and would, in the end, recoil upon the undertaking itself, by depreciating the value of the shares. With regard to new capital, the price obtained would fall in proportion; and although the nominal rate of dividend would fall, the actual sum of money required, reckoned as a percentage on the paid-up capital, would not be appreciably affected.

But then there are the residuals, supposed by many to be a veritable panacea for all the financial ills that may befall a gas undertaking. Time was when the income from residuals was a mere trifle. The coke was sold at a cheap rate; the tar and liquor were allowed to go into the nearest ditch; and the ashes, clinker, brick rubbish, &c., were given away. Under such prevalent circumstances, some go-ahead company or other, more far-seeing than their *confrères*, started a retail coke trade, made tar pavement with the tar and ashes, used the ammoniacal liquor as a fertilizer, and by such means managed to make a sufficient sum out of the residuals to pay the dividends. The managers of those days had difficulties to contend with that we know nothing of, and obstacles to overcome which were even more important than the commercial value of residuals. Most companies would at the present time think it extraordinary if they could not make considerably more out of residuals than a sum sufficient to pay the maximum dividends; but at the early period under consideration, the idea of paying dividends out of residuals, and consequently selling gas at the bare cost, attracted a great deal of attention, and took popular root. The idea seems to have spread among a large portion of the public, that the capabilities of the residual market are equal, not only to the payment of dividends, but of everything else also; and that the income from gas is quite an incidental matter. Therefore, whatever the ideas of the coal master, the iron merchant, or the labour party (which is rather a different thing from the labourer himself) may be, the gas company are told in effect: "Pay it out of the residuals, and do not talk about raising the price of gas."

To what extent may the residuals be expected to respond to the heavy demand that may be put upon them? The need for their assistance is more pressing now than at any previous time; and anything that can be done to improve the residual market is worthy of careful attention. The principal residuals are coke, tar, and ammonia; and besides these there are sulphur (as represented by the spent oxide), retort carbon, and cyanogen compounds. The only one that at all synchronizes with the price of coal is the first-named—coke. It happens that dear coal usually means good trade all round, in which chemicals generally have their share; so that the prices obtainable for tar, sulphate, sulphur, carbon, &c., are likely to be better, and not worse. Concerted action has already been taken, and with a certain amount of success, in the matter of tar and sulphate; but it is remarkable that coke has been left to take care of itself, each gas undertaking doing that which is right in its own eyes as regards its disposal. Instances could be quoted showing that on occasions the scope of vision is closely limited by the circumstances connected with the current year's working, and fails to take in anything in the way of establishing a permanent improvement. But it is pertinent to ask whether something cannot be done for the price of coke. The state of the coal market is to an extent reflected in that of coke. Stocks are low, the supply is being reduced in proportion to the demand by the withdrawal of considerable quantities of coke for the manufacture of water gas—a sort of double-barrelled transaction that reduces the production of coke in proportion to the quantity of coal gas replaced, and at the same time makes an independent demand upon the coke-heap. Cannot the tactics which have made the best of a stiff coal market, from the coal factor's point of view, be repeated in the case of coke? The curse of the coke trade in the past has been the cheap job lot, brought by an outside contractor from a large centre of production a distance of 50 or even 100 miles, and then sold at a price that forces the hand of the local gas company. What would be the position of the gas coal trade to-day, if there were cheap job lots of coal to be had? Surely the time is now ripe for the disposal of so-called "surplus" coke in a manner that will not injure and lower the tone of the trade generally.

It must not, however, be supposed that, even at the best, the residuals can be made to cover more than half the increased cost. Most gas companies make their contracts at Midsummer, and for a year ahead, with the result that, if a rise in the market comes in the autumn, they are able to make hay while the sun shines, by getting better prices for coke during the remainder of their contract. But the thing cuts both ways; and in calculating the possibilities of the coke market during the ensuing twelve months, we must not overlook the effects of a possible fall in the price of steam and house coal, which will come sooner or later. If we have a mild winter, a substantial fall may be expected early in 1901, and would cause a corresponding reduction in the value of gas coke. With this reservation, it must be admitted that the present prospects of the coke trade are exceedingly good; and, as already remarked, the time is opportune for assisting it by the usual methods adopted for forcing or stiffening prices.

Any undertaking, however, that has been selling at bare cost—that is, including the statutory dividends as a part of the cost—will have to face the question of putting 3d. to 6d. on the price of gas, or else of taking a corresponding sum from the reserve. Whatever the decision may be, the position should be clearly explained to the public. The experience of those who bore the whole burden themselves in 1893, without asking their customers to help, was instructive, if unsatisfactory. To say they received no thanks is not enough. When the fall came in 1894, some expectation of a reduction in price was exhibited. The argument used was that, if the company could afford to sell gas at such and such a price while coal was at (say) 20s. per ton, they could afford to sell it a great deal cheaper when coal had fallen to 15s. The managers of gas undertakings may, if they choose, struggle along at the old prices, and no notice will be taken; but if a fall of some shillings per ton in coal should occur, the old argument will come up again, and there will be a demand, or at least an expectation, of a reduction in the price of gas.

A great deal of importance has—and very rightly—been attached to "cheap" gas; but it is notorious that the rage for cheapness has in many trades been carried too far. Our prisons, workhouses, asylums, and hospitals could together make up a casualty list, composed of down-trodden toilers, ruined and bankrupt tradesmen, underpaid assistants, and so on, equal in extent to the terrible casualty list which is one of the prices of our successes in South Africa. It is also possible to carry the desire for "cheap" gas to an extreme. There is much in the remark made by an American gas engineer to the effect that in one town where the gas is sold at 5s. per 1000 cubic feet the public may be more satisfied than in another where it is sold at 3s. 4d., because, in the first case, not only is care taken that the supply should be unexceptionable in quality and quantity, but the consumers have been carefully educated in the matter of using gas to the best advantage. The company not only take care that every consumer should know where and how to get the latest and best advice as to the proper methods of utilizing gas, but that they should be able to obtain the proper appliances put up ready for use on reasonable, if not liberal, terms. The second company have only one idea, and that is to cut down expenses. The overworked and badly-paid staff have no inclination—even if they had the time—to give advice to the consumers. They are so pinched in the matter of retort and gasholder capacity, that their full attention is necessary in order to keep up a proper supply; and at the best they cannot avoid an occasional reduction of pressure, bad quality, or imperfectly purified gas. The broad result is that the public, left to themselves, use old-fashioned uneconomical appliances; and although the gas is cheap, they are always complaining of heavy bills. It is possible, by educating the gas consumer, to reduce the gas bills, although the cost per 1000 cubic feet remains the same; and of the two, there are obvious reasons why a reduction in the quantity consumed is more likely to give satisfaction, and lead to increased business, than a reduction in price. And if gas consumers are to be supplied at the lowest possible price, that price must of necessity be a fluctuating one, and it must rise as well as fall. If a rise is considered to be objectionable in any way, or a serious injury to the business, the only way is to exercise caution in the matter of reduction, and maintain a large reserve or balance of profits in hand.

There may be reasons against raising the price; but at this juncture there are others in favour of such a course. The price of coal is a fact that is patent to everybody; and an announcement that, in consequence of the increased cost of coal, it is necessary to raise the price of gas (but that it is hoped that the advance will be merely a temporary one), should not arouse opposition from ordinary fair-minded and reasonable men, who would accept it as a rational step, and indeed would be inclined to be suspicious, and to imagine that the shareholders had some shuffling and underhanded method of taking care of themselves, if the rise did not take place. In any case, there is no real or lasting advantage to be gained by postponing the erection of really necessary extensions, by cutting down the staff, or by other heroic attempts to reduce expenses, and thus avoid the necessity for increasing the price, even at some sacrifice of efficiency. It is necessary, or at least desirable, that the gas supply should be cheap; but it is even more important that it should be unexceptionable as to quality, quantity, and purity.

The memorial to the late Mr. G. J. Symons, F.R.S., the distinguished meteorologist and founder of the British Rainfall Organization is to take the shape of a gold medal to be awarded from time to time by the Council of the Royal Meteorological Society for distinguished work in connection with meteorological science.

Professor Vivian B. Lewes has in the press an exhaustive work on "Acetylene Gas; a Handbook for the Student and Manufacturer." The book contains over 250 illustrations, and comprises a history of acetylene, its preparation, properties, and chemical reactions, together with a complete list of legal enactments (in full) concerning its use and manufacture, patents, and other important data. Messrs. Archibald Constable and Co. are the publishers.

TECHNICAL RECORD.

THE MIDLAND GAS ASSOCIATION AT STAFFORD.

The members of the Midland Association of Gas Managers visited their President (Mr. J. Ferguson Bell) at Stafford last Thursday; and the magnificence of their reception will be something which they will long remember. Mr. Bell himself was active and generous to a degree; and the genial Chairman of the Gas Committee (Alderman C. H. Wright), and the members, entered with a perfect magnanimity into the event. From beginning to end of the day's proceedings, they did not spare themselves in hospitably entertaining the visitors, in looking after their comfort, and in adding in every conceivable way to their interest and pleasure—all of which was recognized not only as a great compliment to the Association, but as a tribute of the high esteem in which Mr. Bell is held by the Corporation, and of the kind feeling which they bear towards him on his departure to a larger sphere of labour. There were only two matters for regret—one was that the Mayor, Alderman W. C. T. Mynors, was unavoidably prevented from personally assisting in the graceful hospitality at his residence and elsewhere (as referred to later in this report), and the other that during the day heavy showers of rain fell, but which, all else being cheerful and bright, were lightly heeded. In addition to the members of the Corporation and Association, several of Mr. Bell's personal friends shared in the delights of the day's outing.

The company first assembled in the Council Chamber of the Guildhall; and there a few matters in which the members of the Association were mainly concerned were dealt with.

A Courteous Welcome.

On the President taking the chair,

Alderman Wright apologized for the absence of the Mayor (Alderman W. C. T. Mynors), who unfortunately was engaged as Arbitrator in a Light Railway case in the north of the county. Proceeding, he offered the members, on behalf of the Corporation, a very hearty welcome. He said they naturally recognized that a body of business men like the Association ought to receive a welcome from the representatives of any town they might visit. Upon this occasion, the members could readily understand, as their respected Engineer (Mr. Bell) was President for the year, it gave his brother members of the Committee and himself much greater interest and pleasure in offering to the Association the heartiest welcome possible. They hoped the members would have a pleasant day; and after they had finished their ordinary business (which he understood was of a light character), the Committee would be glad if they would visit the gas and electricity works. Although not large—the town only possessing just above 20,000 inhabitants—still they, as a Committee, were very proud of the works. They had endeavoured, and it had been the aim of Mr. Bell, to bring them up to present-day requirements, upon the methods suggested by present-day science. They had just decided to increase the works by adding a water-gas plant; and he was sorry their Engineer would not be with them to see the completion of this addition. As the members knew, Mr. Bell would be shortly leaving Stafford; and what would be their loss (which they felt very much) would be to the advantage and gain of the Derby Gas Company, whose Chairman he hoped to see later in the day, in order that he might personally congratulate him upon having secured the services of their Engineer. Mr. Bell had been a most faithful, energetic, and able Manager at Stafford. He had kept himself educated with the times in the matter of electrical plant; and this, he (the speaker) supposed, it was to the interest of all the members to do. They had had their electric lighting plant the last five years. It was erected under Mr. Bell's entire supervision, with, of course, the aid of an outside expert; and under his management, it had proved a complete success so far as they had gone, and very shortly the Corporation were going to extend it. Of the works, the members would hear more later. He added that in Stafford they were very proud of their antiquity. They could boast that the present Mayor was nearly the 400th; and their Charter went back—they had been a borough, and had rights granted to them—for over 700 years. In the heartiest manner possible, he repeated his welcome.

This being his first official appearance since his success in the Derby appointment, the members received their President with a spontaneous and hearty ovation on his rising to respond.

The President thanked Alderman Wright for the very kind words he had addressed to him personally, and also on behalf of the Association for the cordial welcome he had offered to the members. He might say that he believed the meeting would be a pleasant and successful one; Alderman Wright having taken the greatest interest in the drawing up of the programme. Before visiting the gas and electric lighting works, he should like to propose a vote of thanks to the Chairman and members of the Committee for their kindness not only in inviting them to Stafford, but also in inviting them to visit the works.

Mr. T. Glover (West Bromwich) seconded the motion, which was carried by acclamation.

Alderman Wright, in pleasant terms, acknowledged the vote.

The Late Mr. Peter Simpson.

The President said that since the last meeting they had lost their respected Treasurer, Mr. Peter Simpson, who, as the members were aware, was honoured, and was probably one of the most honoured gas engineers in the country. He passed away on the 24th of April, at the ripe age of 75. It was a matter of sadness to all of them to know that the closing days of his life were filled with sorrow and anxiety. It was only on the day previous to his death he lost his only son, Mr. Robert Simpson, through pneumonia. Mr. Simpson was the esteemed Engineer of the Rugby Gas Company for upwards of 40 years; and how well he fulfilled that trust was known to all the members. He was also a typical English gentleman in goodness and kindness of heart, which was mirrored in his benevolent countenance. More than a quarter of a century ago, Mr. Simpson, with a few others, founded the Association; twice he was their President; and for a long number of years he acted as the Honorary Treasurer of the Association. The members were also aware of the veneration and regard in which Mr. Simpson was held by the people of Rugby. On his retirement from the Engineership of the Gas Company, whom he served so well, he devoted himself with energy to the affairs of the town. He took his place as a member of the District Council; and shortly before his death, they wanted to elect him Chairman of that body. He was also a member of the Management Committee of the Rugby Hospital; and there he endowed a bed in memory of his wife. Those members who attended the funeral knew how rich and poor alike were present to pay their last respects to Mr. Simpson. He (the President) thought it well they should enter on the minutes a vote of condolence with the relatives of their late friend; and he would propose that this be done.

Mr. W. R. Cooper (Banbury), in seconding the motion, said he had known Mr. Simpson for upwards of 40 years; and it was rather painful to him to be at the meeting joining in a vote of this kind upon his sudden withdrawal from among them. It was only at the last meeting that Mr. Simpson was anticipating being with them on this occasion—enjoying a pleasant day among friends, and honouring the President by his presence. But gas managers were not exempt from the experience of the rest of the world; and they found, as they went on, that they lost one by one; and their places had to be taken by fresh men. The good works of which the President had spoken were well known throughout the length and breadth of the country; and the gas profession generally looked upon Mr. Simpson as one of the great men of their number who had been taken from their midst. They felt they had lost in Mr. Simpson a friend and a father. The members of the Association would miss his presence, his genial face, and lively company, whenever they met for some long time to come. He (Mr. Cooper) was very glad that the President had referred to the good works Mr. Simpson had performed in the town with which he was associated. Kindness and nobility were two of the most prominent traits of his character. He would hold up Mr. Simpson's character as a pattern for the younger members, and say to one and all of them, "Go ye and do likewise"—feeling sure that, if they walked in the steps of him whose loss they now mourned, they would be honoured men in society and respected by their fellows.

Mr. J. Hepworth, in response to a call by the President, said he had no idea he should be asked to say a word in addition to what had been already so feelingly and justly said by the President and Mr. Cooper. Having known Mr. Simpson between 30 and 40 years, he was in thorough sympathy with the sentiments which had been expressed; and everyone who knew their late friend would share in them. Perhaps the simplest and best way left to them to give expression of their regard for his memory was in the way which Mr. Cooper had commended to them—to follow in his footsteps. The next best thing for them at this meeting was to rise solemnly and silently, and in that way testify to their great respect for his memory.

The motion was passed in the manner suggested.

Minutes and New Members.

The Hon. Secretary (Mr. Charles Meiklejohn, of Rugby) having read the minutes of the last meeting,

The President proposed, and Mr. A. Cooke (Oldbury) seconded, the election of Mr. C. F. Kent, of Kingswinford, and Mr. S. G. Askew, of Droitwich, as members.

The proposition was adopted.

Honour for Mr. Cooper.

Mr. Glover said they had now to elect a new Treasurer; and the name which he had to propose would, he was sure, commend itself to every member. It was that of Mr. Cooper, of Banbury, which was a name that many of them had esteemed from their youth up. He trusted Mr. Cooper would accept this invitation to take the office, and that it would be to him as great a pleasure as it was to their departed friend, Mr. Simpson.

Mr. R. King (Wolverton) seconded the motion, which was heartily agreed to.

Mr. Cooper remarked that he felt highly honoured by this mark of respect. He had ever received kindness from the members of the Association, and particularly during the time he was their Secretary, and during his year of office as President. Anything he could do for the Midland Association, he should do with the greatest pleasure.

This concluded the business portion of the proceedings.

The Gas and Electricity Works Visited.

The members next repaired to the gas and electricity works. In times past, they have had evidence of the strength of the

views of their President on professional matters; and here, there, and everywhere about the works on Thursday, they recognized the product of his brain. Good working and financial results, up-to-date plant, and clean gas afford incontestable proof of the soundness of a man's views; and all these things the members found in their visit to the works, and in the printed information distributed among them. It was noticed that the works have one great disadvantage, and that is that they are situated upon a bed of bog varying in thickness from 30 to 60 feet. This has been a matter of difficulty in times past, and is now so to some extent. It necessitated, as will be seen below, the substitution of the wire-rope system of guiding for columns in the case of one holder; and it is pleasing to learn that for eighteen months the holder, under its changed conditions, has been working to the satisfaction of Mr. Bell and without a hitch. A biennial painting of ironwork is proved by Mr. Bell to be an important feature in the economics of gas-works management. As already stated by Alderman Wright, it has been decided to adopt a carburetted water-gas plant; and in connection with this matter, a point of interest was mentioned by Mr. J. R. Frith, of Runcorn, who many years ago was connected with these works. On a spot where retort-settings are now being reconstructed, some 48 years ago, in Mr. Frith's time, stood one of White's water-gas plants, about which system Professor Lewes made some remarkable statements at the recent meeting of the Institution of Gas Engineers. In their inspection of the gas and electrical plant, the members were greatly assisted by the energetic attention of the Chairman, the President, Mr. R. Poulson (the Works Foreman), Mr. J. H. Clothier (the Chief Assistant in the Electrical Department), and Mr. S. Lee (the Draughtsman). With regard to the electrical works, it may be mentioned that Dr. John Hopkinson was the expert consulted; and only three weeks before his lamented death, he had an interview with the Committee at Stafford. Fuller particulars of both the gas and electrical works will be found in the following notes prepared by the President, and distributed among the members on Thursday.

Gas-Works.

These works were purchased by the Corporation from the Stafford Gas Company in 1878, for the sum of £77,022; being an average of £262 for £100 of share capital. Since the works have been transferred to the Corporation, they have been almost entirely rebuilt; and when the extensions and alterations now in progress are completed, they will have a productive capacity of 1½ million cubic feet of coal gas per diem, and ½ million cubic feet of carburetted water gas.

A short branch line, with bridge over the river, connects the works with the Great Northern Railway, over which the London and North-Western Railway have access; and the sidings in the works are cleared twice each day by the Great Northern or London and North-Western Railway shunting engines—nearly all trucks being shunted direct into position for loading or unloading, as may be required.

The retort-house is 65 feet wide inside by 156 feet long. On one side is a covered coal-store, and on the other side the coke-stores, both of which have railway sidings. The retort-house is a stage house; the cellar being used for cleaning, &c., the gas-producers. The stage-floor is used for drawing and charging the retorts.

There are three benches of retorts, each consisting of four arches; and in each of the arches of two of the benches are nine through retorts, oval ○ section, 16 in. by 22 in. by 20 ft. long—making 144 mouthpieces, which are being increased to 216—and each bench is easily capable of producing ½ million cubic feet of gas per diem. The retorts are heated by Bell's regenerator gas-furnaces; there being one producer to each arch of nine retorts, or eighteen mouthpieces. All the retorts are furnished with self-sealing mouthpieces and extra large ascension-pipes, which convey the gas from the retorts to the hydraulic mains. A separate main, with gas, tar, and liquor seal regulating valves, is fixed for each nine retorts, so that any bed of retorts can at once be shut off and disconnected.

The tar is automatically removed from the hydraulic mains into vertical tanks fixed at each end of the benches. It is replaced by water; the difference in gravity between tar and water being utilized to keep the hydraulic mains clear of tar, and the vertical tanks are periodically run off to the storage wells and the tanks refilled with water.

The retort-house is wide enough to allow of the introduction of mechanical stoking machinery; and the author's idea is to take the power from the electricity works to drive the drawing and charging machines by electric motors fixed on each machine, the current being taken from an overhead trolley wire running the length of the retort-house on each side of the benches.

The coke will be removed by a De Brouwer conveyor fixed on the floor of the retort-house just in front of the benches. This conveyor will be arranged so that the coke is elevated and loaded into an overhead storage hopper, from which carts or railway waggons may be loaded or coke conveyed to the coke-bank and stored to the height of 15 feet. Designs and tenders have already been obtained for this work.

The gas is drawn from the hydraulic main through a 15-inch main which runs round the retort-house, in order that the gas may be slowly and gradually cooled on its way to the exhauster, which is a rotatory one worked by a direct driven steam-engine. It passes through a set of atmospheric condensers consisting of a battery of cast-iron pipes, which are under cover; and this will be assisted by a water-cooled condenser capable of efficiently cooling 1 million cubic feet of gas per diem from 180° to 60° Fahr. The contract for this additional condenser has been placed.

From the exhauster, the gas is forced through a tar-extractor, which eliminates the tarry matters; and it is then passed through two vertical scrubbers (filled with thin boards, put in tiers), and afterwards through one of Walker's purifying machines. The author proposes to erect an additional Hunt washer, to finally eliminate the last trace of ammonia from the crude gas.

The gas, on leaving the scrubbers, is passed in all through ten purifiers. The first four boxes are each 20 ft. by 25 ft. by 6 ft. deep, are elevated so that they may be emptied by bottom discharge-doors, and are filled by a travelling conveyor and elevator. These are filled with lime to eliminate the carbonic acid; and the next two boxes are of the same size, and are filled with oxide of iron to eliminate the sulphuretted hydrogen. Afterwards are four smaller purifiers, which are filled with lime. In the first two of these series, the lime is always a sulphide, in order to eliminate the bisulphide of carbon, which is reduced from 10 to 12 grains per 100 cubic feet.

There are three gasholders. Their combined storage capacity is about 750,000 cubic feet. Each of the holders has two lifts and brick tanks.

No. 1 gasholder has now been in use for 46 years, and No. 2 holder for 32 years. The latter has recently been converted into a cable-guided holder, as the outside guide-framing was continually getting defective, owing to the sinking of the ground and consequent settling of the tank. An inspection of Nos. 1 and 2 gasholders, after 46 and 32 years' use, will indicate that ironwork, by careful attention and periodical repainting, may be preserved in good condition for a great number of years.

There are large and roomy workshops, general stores, meter repairing and testing shop, also general offices at the entrance to the works, adjoining which is the station-meter house and governor-house.

At the time the works were purchased by the Corporation, the price charged for gas was 4s. per 1000 cubic feet. The price now varies from 2s. 3d. to 2s. 9d. per 1000 cubic feet net; the average being 2s. 6d., and no meter-rents.

It is interesting to note that considerably over one-third the quantity of gas sold is now used for cooking, heating, and motor power; and notwithstanding the introduction of the electric light, the consumption keeps rapidly increasing—the increase in the gas consumption last year being over 8 per cent. The capital invested in the Gas Department is £107,583, from which £36,707 has been paid in reduction of capital account, leaving £70,876 now owing. In addition to this, £34,850 has been handed over in reduction of rates.

Electricity Works.

In 1890, the Corporation, on the advice of their Town Clerk, Mr. Blakiston, obtained a Provisional Order, empowering them to supply electric energy, for lighting and other purposes, within the borough of Stafford. The powers were not exercised until 1893, when the Corporation decided to erect a central electric supply station; and the late Dr. John Hopkinson, F.R.S., was engaged as Consulting Electrical Engineer, and was responsible for the electrical equipment.

The electric supply station adjoins the gas-works; and consists of a boiler-house 41 ft. wide by 56 ft. 6 in. long, which contains three Lancashire boilers, each being 7 ft. 6 in. diameter by 28 ft. long, with two flues in each 36 inches diameter. The boilers are all fitted with Meldrum's dust-fuel furnaces; and coke breeze is chiefly used for steam raising. At the back of the boilers is a set of Green's economizers, containing 192 tubes, each 4⅛ in. diameter by 9 ft. long; so that the furnace gases, after leaving the boilers, pass on their way to the chimney round the vertical tubes of the economizer, thereby very considerably reducing the outlet temperature of the gases, and the feed water enters the boilers at near boiling-point. Space is left in the boiler-house for a fourth boiler; and the house is arranged so that it can be easily doubled, the chimney being large enough for eight boilers, which work at a steam pressure of 125 lbs. per square inch. The water for steam raising is taken from the River Sow, but is first passed through canvas screens, and then softened and filtered by Maignen's water-softening apparatus.

The engine-house, which adjoins the boiler-house, is 45 ft. wide by 82 ft. long, and at present contains three coupled compound condensing steam-engines, each of 125-horse power, which drive three continuous current shunt wound dynamos (each of 66 units size) by means of seven 1¼ inches diameter cotton ropes from the engine fly-wheels, which are 12 feet in diameter.

The high-pressure cylinder in each engine is 11 inches diameter, and the low-pressure cylinder 19 inches diameter and 26-inch stroke. They run at about 125 revolutions per minute, and are fitted with Dr. Proel's valve gear and Körting's ejector condenser. The water for condensing purposes is pumped from the River Sow to a high-level cistern above the pump-house, by means of Gwynne's centrifugal electric motor pumps. Space is allowed in the engine-house for two more engines of double the size of the present ones. Tenders are being obtained for a 300-kilowatt direct-driven set.

Adjoining the engine-house is a mechanics' shop; and in the division wall is fixed the station switch-board, which is of the ordinary bus bar type, with regulating switches for cutting cells in and

out. It is also fitted with ampère and Kelvin standard voltmeters, and meters for registering charge and discharge from battery.

The accumulator room is above the mechanics' workshop, and contains 112 chloride 35 R plate cells. The capacity of the battery is 267 ampères for three hours.

The current is distributed on the three-wire system, the potential being 210 volts on the outers, so that consumers can be supplied at either 105 or 210 volts pressure; but steps are being taken to increase the pressure to 210 and 420 volts across the outers. The cables are of stranded tinned copper wire, 100 per cent. conductivity, vulcanized india-rubber covered, and drawn into earthenware pipes laid under the footpaths. The new cables lately laid down are upon Callender's solid system.

The central station was opened on Oct. 15, 1895. Since that date the supply has been continuous; and there are now 8600, or their equivalent, of 8-candle power lamps connected, and the lamp connections are rapidly increasing.

The charge for electric energy is 5d. per unit, and for motive and power 2½d. to 2d. There are no meter-rents. The total amount expended on capital account for the Electricity Department is just over £20,000.

A Much Appreciated Drive.

At the close of the inspection of the works, conveyances were in waiting to take the members on what will be a memorable drive to those who had the good fortune to participate in it. It commenced by a visit to Tillington Hall, the residence of Alderman Wright, where the visitors were generously regaled with refreshments. From thence they were conveyed through Ingestre Park, the seat of the Earl of Shrewsbury; and the lovely estate was much admired. The Mayor's beautiful home at Little Ingestre was also visited; and here again a liberal entertainment awaited the party. The drive took in Tixall, Milford, and Shugborough (the seat of the Earl of Lichfield); then back again through the Milford Hills, bordering on Cannock Chase, to Stafford. Picturesquely wooded and charming scenery and parks inadequately describe the fair country through which the visitors had the pleasure of passing. There were two or three heavy showers during the journey; but they were of short duration, and were as quickly forgotten as they came.

The President's Dinner—A Point for Consideration in the Amalgamation of the Gas Institute and Institution.

The pleasures of the day were brought to a close in a befitting manner. With extreme good-heartedness, the President invited the members, the Corporation Gas Committee, and several of his friends to dine with him at the Swan Hotel; and the repast was immensely enjoyed. Departing from our usual custom, a few matters of passing interest to which reference was made during the after speeches may be noticed. The President was the recipient of the heartiest good wishes for success in connection with his new appointment at Derby; and Mr. Charles Hunt congratulated the members of the Midland Association on the fact that three recent important appointments had been allotted to members of their body. He also hoped that the vacancy at Stafford would fall to the lot of a member of the Association. Upon this Alderman Wright remarked that he could promise that whoever was appointed would receive from the Committee their best assistance, but it would be a difficult task to follow Mr. Bell. Mr. Meiklejohn also intimated, amid much disapprobation, that his tenure of office as Secretary was drawing to a close. When he undertook the Secretaryship, eight years ago, the membership was 67, and the balance in hand was £75. He had then a desire to retain the position until the members numbered 100, the balance in hand was £100, and the Association had attained its majority. It was now 23 years old, they had a balance of £97, and the membership was 94; so that he was nearing the time when he could terminate his career as Hon. Secretary.

To Mr. D. Macfie was confided the proposing of the toast of "Kindred Associations;" and with it he coupled the name of Mr. Hepworth. He referred to the distinguished position which that gentleman has held in the gas profession; and he hoped that his services would not be lost to any Association. If, he observed, any effacements were to be made in the near future, he trusted that one of the names would not be that of Mr. Hepworth, who was distinctly an ornament to any body of gas men. In the course of his response, Mr. Hepworth said Mr. Macfie had referred to what was a burning topic just now, and would be for the next week or two—that was, the amalgamation of the Gas Institute and the Institution of Gas Engineers. He (Mr. Hepworth) did not hesitate to say frankly and outright that he very much wished that such an amalgamation might be brought about. He had had the privilege of serving as President of the Gas Institute, and had been Hon. Secretary for some years. Though he was not on the Council when the division took place years ago, he did what little was in his power to prevent the division. He was not now on the Council; and he would never be again. But he should do what he could, so long as he had the opportunity, of furthering in every way the union that had been suggested. He thought the time had come when they might afford—and he certainly spoke feelingly here—to sink any little personal advantage they might have in belonging to the Institute, as well as their personal opinions as to various points of detail in regard to administration and so on. They might afford to sink all these little differences if they could see, in place of two very excellent Institutions (both of which had done splendid work), one national institution, which could be looked up to as representative of the industry of the whole country. He did not mean for a moment to say that they had any great difficulties to contend with. But there was the electric light and other means of lighting to reckon with; and there was great need that there should be no time or opportunity lost in combining their forces, and doing everything they could to produce good and cheap gas, and to maintain the position of the gas industry, which had, indeed, been maintained and improved very largely. Therefore, he hoped they would see this combination. In the next few days, he supposed a vote on the subject would be taken in London; and he did hope that those who would discuss it would be able to keep tolerably cool, in order that the thing they all desired might come about. This was not the place for discussing details. But Mr. Macfie was exceedingly kind in making reference to himself (Mr. Hepworth) in regard to future membership; and he might say that he thought it should not pass the wit of man to devise some scheme whereby those who were reputed to possess technical ability (technical ability which had been devoted, and was being devoted now, to the furtherance of the gas industry), although not at present engaged in the management of gas-works, might at least have some place in the Institution in the future. He apologized for introducing these remarks; but he should cast the blame for them on his friend Mr. Macfie.

There were several other toasts and speeches, in the course of which were many expressions of appreciation of the handsome manner in which the visitors had been treated by the President, Alderman Wright, the Mayor, and the Gas Committee.

ASSOCIATION OF GAS ENGINEERS OF HOLLAND.

Forthcoming General Meeting.

The Twenty-Eighth Annual General Meeting of this Association will be held at Nijmegen on the 26th and 27th inst., under the Presidency of Heer D. J. Cramer, of Rotterdam. Members will assemble at a concert on the evening of the 25th inst.; and on the following morning the report of the Council will first be presented. Then the financial and other private business of the Association will be dealt with, including the appointment of two Editors of "Het Gas," the official organ of the Association, in succession to Heeren C. T. Salomons and P. Bolsius, whose period of office terminates with the present year. Next, the reports of Committees of the Association, dealing with photometry, sulphate of ammonia, &c., will be received; and officers for the ensuing year will be elected. Afterwards Herr Schöne, of Dessau, will give a lecture, with demonstration, on cooking by gas. He will be followed by Heer J. W. Molijn, of Gouda, who will deal with water-gas manufacture. A number of questions will then be discussed. Among them, we notice several connected with water gas—such as its use for mixing with coal gas, recent improvements in the water-gas process, the minimum output for which water-gas plant becomes remunerative, the use of the Pelouze tar-extractor with water gas, the practical significance of the iron carbonyl commonly present in water gas, the thoroughness with which the oil is distilled in the Humphreys and Glasgow plant, the relative advantages of American and Russian oils in respect of tar production and deposit in the carburetting chambers, the price of oil in bulk during the past year, the cost of 16-candle power water gas, oil storage tanks, and photometry as applied to water gas. After the discussion of these many important questions connected with water gas, the following subjects will, according to the programme we have received, be similarly dealt with: Substitutes for coal for carbonization in gas-retorts; prices of gas coal during the year; the use of inclined retorts with various kinds of coal; the use of gasholders at a considerable distance from gas-works; gas-engines for driving exhausters; the protection of exposed mains, with a view to avoiding deposition of naphthalene; the objections raised to the employment of wet meters on the services to gas-engines; different systems of coin-freed gas-meters; distribution of gas under high pressure; high-pressure incandescent gas-lighting; the cost price of gas; the relative advantages of coal gas, water gas, and electricity for extensions in Holland; eight-hour shifts for stokers; the effects produced by certain forms of incandescent burners on the enamel of street lantern reflectors; and types of exhausters. In conclusion, the gas and water works of Nijmegen will be visited by the members of the Association.

ASSOCIATION OF GAS AND WATER ENGINEERS OF AUSTRIA-HUNGARY.

The Nineteenth Annual General Meeting of this Association was held, as arranged, at Pressburg, on the 24th to the 27th ult. The central position of Pressburg and its charming surroundings attracted, as was to be expected, an unusually large number of members of the Association and friends to the meeting.

The President, Herr H. Nachtsheim, of Vienna, and the Vice-President, Herr Berthold, of Pressburg, held a reception on the evening of May 24; and on the following morning the business

of the meeting was formally opened with the customary exchange of civilities between the Association and the authorities of the city. The Inaugural Address of the President followed. It comprised a comprehensive retrospect of methods of illumination and their scope, and was received with applause. The private business of the Association was next dealt with; and the watering-place of Ischl was chosen for next year's meeting. Herr Berthold then gave an interesting account of the Pressburg Gas and Water Works. He was followed by Herr C. F. Schweickhart, of Vienna, with a paper on "Aërogene Gas." The art of cooking by gas was treated by Herr Schöne, of Dessau; and Dr. Kauer presented the meeting with a much appreciated description of new photometers.

The afternoon of the 25th was devoted to an excursion, and the evening to an entertainment. The proceedings on the morning of the 26th opened with highly interesting communications by Dr. W. Brix, of Vienna, on "Gas Apparatus" and the Salzenberg "Kugel" or "Ball Light," which was recently described in our columns. Dr. Alto Arche, of Vienna, then spoke on "The Smoke Nuisance," giving quite a modern treatment to this well-worn theme. He discussed the quantities of soot and unconsumed carbon which were wasted in the form of smoke—indicating that the substances which were recovered as bye-products on the gas-works were irretrievably lost as smoke in both household and industrial fires. The subject was discussed also by Herr Wobbe and Dr. Kauer; and then Herr H. Meuzel, of the Berlin-Anhalt Engineering Company, described a number of novel types of gas-works plant and apparatus.

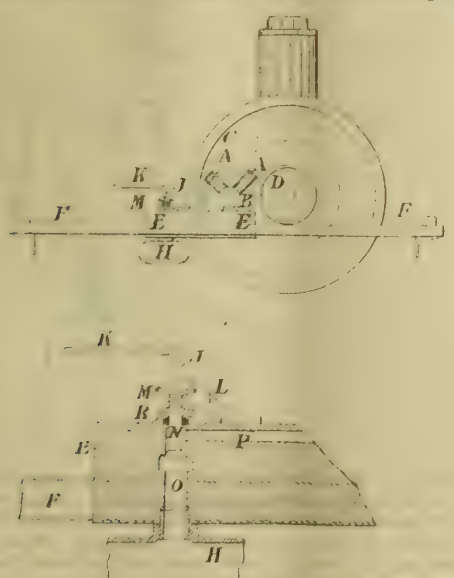
The business proceedings terminated with the customary votes of thanks to the officers of the Association. In the afternoon the members and visitors sat down to a grand banquet, and subsequently drove to the municipal water-works, which are of modern construction. We hope to give further particulars of some of the communications presented to the meeting as soon as they are published in "Der Gastechniker," which is the official organ of the Association.

REGISTER OF PATENTS.

Starting Arrangements for Gas-Motors.—Lanchester, F. W., of Birmingham. No. 12,245; June 12, 1899.

This invention is of the class in which compressed air is used for the purpose of starting; and it has for its object to provide for the automatic starting of the engine, without any preparation, no matter in what position the crank may be.

A represents the cylinders of a small compressed-air motor, of any suitable type. To the shaft of the motor is keyed a friction pulley B, adapted to gear alternatively with either the inside of the rim of the gas-engine fly-wheel C, or with the pulley D upon the engine-shaft. The fly-wheel rim is constructed so as to provide a gearing surface for the pulley. The air-motor is arranged upon a frame E, which is supported so as to be capable of longitudinal movement in either direction upon guides F, attached to the structure which carries the engine. The cylinders A communicate with a reservoir H, attached to the frame through passages O,



P, controlled by a valve N. The valve-stem passes up through a stuffing-box R, and is fitted with a strong spring M, which normally holds the valve upon its seat. The top of the stem is securely fastened to a disc, which comes under the end of the lever J, pivoted upon the bracket L, fixed to the frame E. The link K, which is attached to suitable operating gear (not shown), is provided for moving the frame E along the guides F in either direction, and for simultaneously actuating the valve N.

The operation of the arrangement is as follows: Assuming the reservoir H to be initially charged with compressed air, and that it is desired to start the engines, the frame E is moved to the left, so as to bring the pulley B and the fly-wheel C into gear. Sufficient force is applied to the rod K to cause the lever J to tilt (when the frame E has reached the limit of its travel) against the force of the spring M, thereby opening the valve N. The air-motor is thus put in motion, and starts the main engine. In order to recharge the reservoir H, the frame E is moved to the right, bringing the pulley B into gear with the wheel D; sufficient force being exerted to tilt the lever J, and open the valve N. The air-motor then acts as a pump; being driven backwards by the main engine. The valve N does not open till a sufficient pressure (determined by the strength of the spring M) is brought to bear on the pulley B. The pressure on the pulley is thus completely under control, and skidding at its friction surface is rendered impossible.

When the framework E is in the intermediate position shown, the valve N is shut; and the compressed-air charge stored in the reservoir H is retained for use as occasion requires it. In the event of the reservoir becoming empty, with the main engine stationary, the charge may be replenished by rotating the air-motor shaft by hand, or by pumping air into the reservoir.

Purifying Acetylene Gas.—Goodwin, R., of Dublin. No. 14,379; July 12, 1899.

This invention relates to a composition (to be used in any kind of gas-washing apparatus) for purifying acetylene gas, consisting of one part by weight of copper sulphate crystals, one part of kieselguhr or infusorial earth, and forty-eight parts of water. When applied to the washing of acetylene, the composition is said to "cause deposit of all the impurities suspended in the gas; the fouling of the burners is thus prevented, and the luminosity of the gas is greatly enhanced."

Incandescent Gas-Mantles.—Helmecke, H., of Hamburg. No. 3925 Feb. 28, 1900.

This is a modification of the inventor's former proposals, as contained in patent No. 8058 of 1899—see "Journal" for April 3, p. 871. He says that, in extensive trials of fabric-impregnating processes for the manufacture of incandescent mantles, made by improved means (and especially with substances chemically nearly absolutely pure), it has been proved that besides the mixtures and the mixture proportions enumerated in the former application, there are modifications which are in some cases better for the purpose. Among other matters, it has been found that the addition of a small quantity of cerium oxide or nitrate to calcium, zirconium, and lanthanum, or yttrium, or sometimes both lanthanum and yttrium-salts, has the effect of augmenting the lighting capacity in an essential degree. Also the salts of didymium (neodymium and praseodymium), of which traces occur nearly always in lanthanum salts, when used sometimes with calcium and lanthanum salts and the like, give a very useful incandescent mantle of orange yellow, mild, and agreeable light; but the addition of didymium salts must not overstep certain limits, as otherwise the light intensity would be diminished, and the incandescent mantle so produced is inclined to contract immediately above the burner. The same happens with incandescent mantles of beryllium oxide, besides calcium and zirconium oxide, and to which cerium oxide has been added for augmenting the light-emitting capacity. Such incandescent mantles give a reddish white light, and produce a proportionally very resistent mantle. But only the addition of a small percentage of beryllium salts is admissible; otherwise the incombustibility of the incandescent mantles made in this manner would be diminished, because the calcium oxide and beryllium oxide would act on each other as a flux (as would also calcium and aluminium oxide), and give them therefore more tendency to melt. The erbium salts, which can be separated from the yttrium salts only with difficulty, and which amount on the average to nearly 20 per cent. of the yttrium salts put on the market, produce in incandescent mantles a clearly visible greenish shade of colour, even if only a very small quantity is contained in the above mixtures.

The following formulæ show the proportions of cerium, didymium (neodymium and praseodymium), and beryllium in the composition of calcium, lanthunum, zirconium salts, and the like, which have been found to produce the best results, and furnish incandescent mantles with light-emitting capacity of the colours mentioned:

1.—Colour of the light bluish white.

		Parts.
Distilled water		100
Zirconium nitrate	$Zr(NO_3)4$ about	15
Calcium "	$Ca(\ ")2$ "	10
Lanthanum "	$La(\ ")3 + 6H_2O$ "	5
Cerium "	$Ce(\ ")3 + 6H_2O$ "	0·3–0·5

2.—Bluish white.

		Parts.
Distilled water		100
Calcium nitrate	$Ca(NO_3)2$ about	15
Zirconium "	$Zr(\ ")4$ "	15
Cerium "	$Ce(\ ")3 + 6H_2O$ "	0·3–0·7
Yttrium "	$Y(\ ")2 + 6H_2O$ "	0·02–0·05

3.—Pure white.

		Parts.
Distilled water		100
Zirconium nitrate	$Zr(NO_3)4$ about	11·5
Lanthanum "	$La(\ ")3 + 6H_2O$ "	11·5
Calcium "	$Ca(\ ")2$ "	7·0
Cerium "	$Ce(\ ")3 + 6H_2O$ "	0·1–0·5
Yttrium "	$Y(\ ")2 + 6H_2O$ "	0·015

4.—Gold white.

		Parts.
Distilled water		100
Lanthanum nitrate	$La(NO_3)3 + 6H_2O$ about	14
Zirconium "	$Zr(\ ")4$ "	9
Calcium "	$Ca(\ ")2$ "	7
Cerium "	$Ce(\ ")3 + 6H_2O$ "	0·3–0·5

5.—Slightly orange coloured.

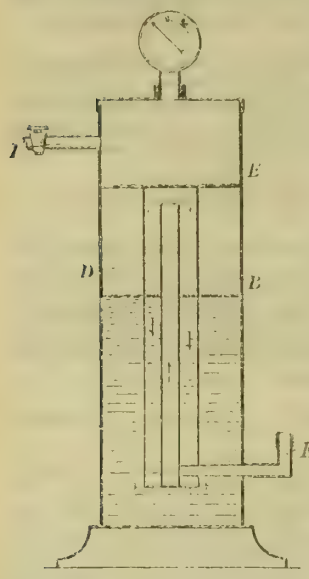
		Parts.
Distilled water		100
Calcium nitrate	$Ca(NO_3)2$ about	15
Lanthanum "	$La(\ ")3 + 6H_2O$ "	14
Didymium " / Neodymium 85% / Praseodymium 15%	$Di(NO_3)3 + 6H_2O$ "	1
Cerium nitrate	$Ce(NO_3)3 + 6H_2O$ "	0·1–0·5

6.—Reddish white.

		Parts.
Distilled water		100
Zirconium nitrate	$Zr(NO_3)4$ about	20
Calcium "	$Ca(\ ")2$ "	8·5
Beryllium "	$Be(\ ")2 + 3H_2O$ "	1·5
Cerium "	$Ce(\ ")3 + 6H_2O$ "	0·45–0·6

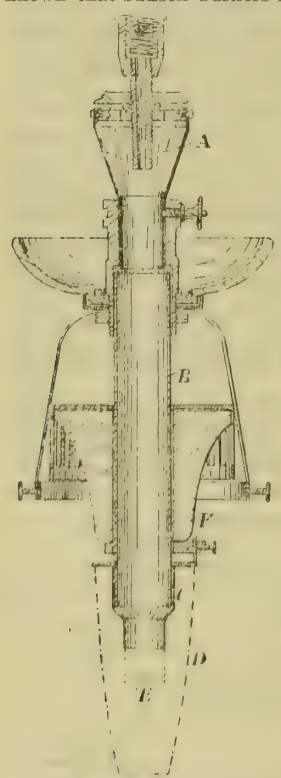
Testing Gas-Piping for Soundness.—Schuster, E., of Berlin. No. 4539; March 9, 1900.

The apparatus shown for the purpose of testing gas-pipe systems, to determine whether there is any leakage, consists of a receptacle fitted with a horizontal sieve E, arranged at the upper part, and having a full central portion from which is suspended a tube B, having its lower end open and the upper end closed. Within the tube B is mounted a second tube D, having a closed lower end and an open upper end; and it has a branch tube K at the lower part. Above the sieve is an inlet-pipe I, with a cock; and at the top is a pressure-gauge. The receptacle is filled with gasoline; and an air-pump is attached to the pipe K. Air is then forced into the apparatus, and passes upwards through the pipe D; then downwards through the pipe B; and again upwards through the liquid, and into the gas-pipe system, leaving the apparatus at I. Air is continually pumped into the apparatus, until the pressure in the whole system has reached the desired test pressure, when the cock I is closed, and the apparatus allowed to stand. If, on re-opening the cock, the pressure decreases, the gauge will indicate the decrease, and the pipe system will be shown to be defective. If, on the other hand, the pressure is substantially maintained, the pipe system will be tight and sound.



An Inverted Gas-Mantle Burner.—Bernt, J., and Cervenka, E., of Prague, Bohemia. No. 5769; March 27, 1900.

In explanation of their invention, the patentees say: "It is well known that bunsen burners are employed with great advantage for the production of incandescent gaslight; the gas issuing from the burner-head, when lit, rendering the incandescence material luminous. The light from such luminous body spreading out upwards at an angle of 45°, it becomes necessary to provide the burners with reflectors, in order to deflect the light rays downwards; but up to the present it has been impossible in many cases to do this without expensive reflectors, when required to have the light reflected downwards at an angle. Attempts have been made to suspend the mantle head downwards. The bunsen burner had, consequently, also to be reversed; and then it was found that the gas issuing downwards from the burner, when lighted, struck back to the open nozzle of the burner. The mantle, therefore, became incandescent only over part of its surface; while the greatest portion of it did not come in contact with the burning gas at all, and consequently gave no light. To avoid these drawbacks, gas has been used under considerable pressures—such as are not employed in normal gas supplies; and up to the present incandescent devices shedding their light downwards have only been obtained in combination with a method of gasifying suitable liquids under considerable pressure. In the case of such reversed bunsen burners, the drawbacks above described are caused owing to the burner becoming excessively hot, whereby a current of air is produced sufficiently strong to drive the flame back."



The illustration represents a reversed bunsen burner and mantle. To the burner A is attached an isolator B, made of a bad heat-conducting material—such as glass. The latter is provided with a burner-head C, projecting into the mantle D, and made of metal or suitable refractory material. The gas, which meets with no impediment whatever in the lamp (the orifice of the burner-head is wholly open), passes through the bunsen body, the isolator, and the burner-head into the open; and when lit it gives a flame projecting downwards, and confined to the mantle by the contrary air-currents produced. Striking back of the flame is prevented, since the isolator B protects the burner against becoming excessively heated; while a conical head F, on the isolator, deflects the hot air away from the burner sides.

With a view of increasing the incandescence effect of the mantle and its downward radiation of light, the burner-head C may, with advantage, be provided at the end with a perforated sleeve E of metallic netting. The gas issuing radially through the fine meshes is protected by the principal jet of the flame striking downwards against contrary air-currents—*i.e.*, against striking back, and, "reaching the adjacent parts of the mantle, causes the latter to become incandescent over a maximum extent of surface."

Making Incandescent Mantles.—De Léry, J. B., and Richardson, C. G., of New York. No. 5821; March 28, 1900.

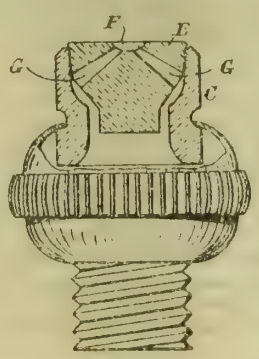
The patentees claim a process of making incandescing elements, consisting in forming a stocking of combustible fabric, and saturating it with a solution of incandescible mineral oxides, turning the stocking inside out, knotting a loop of asbestos or other incombustible material, inserting the loop into one end of the stocking with the knot outside, and securing the loop by winding the stocking with combustible filament which has been saturated with solution of incandescible oxides, and then reversing the stocking. It is said that this method greatly cheapens the cost of making the mantles; for the construction of the top of the mantle is such that it is very readily shaped by the user on the burner, without requiring any particular skill, and therefore the mantles can be sent out from the factory without being first burned out and treated with protective coatings as is now necessary.

A Double-Chimney Incandescent Gas-Burner.—Golby, F. G.; a communication from A. Müller, of Darmstadt, Germany. No. 6213; April 3, 1900.

This invention relates to an incandescence gas-burner having secured to its lower part a flattened cone, with a gallery carrying a second cylinder, so that the air for combustion passes down through the annular space between the two cylinders to the space enclosed by the flattened cone, and thence to the burner—becoming heated in its passage between the two cylinders.

Gas-Burners.—Bray, J. W., of Leeds. No. 6882; April 12, 1900.

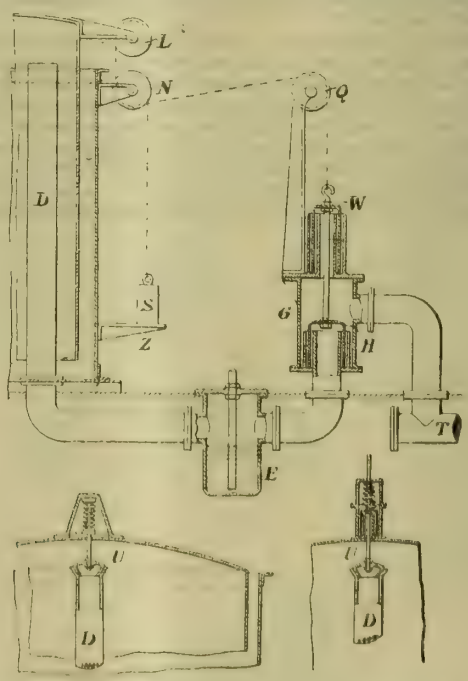
This invention in gas-burners has for its object their arrangement in such a manner that the upper surface of the burner, at the point of ignition, is elevated some distance above, and clear of, the socket; and to so construct the tip of the burner that it will withstand the necessary pressure of gas and produce "a satisfactory flame of such shape as to give a maximum amount of light" for the quantity of gas consumed.



As shown, the tip of the burner consists of two parts C and E connected together—the lower portion attached to the socket by which the burner is fixed to the fitting, and the upper portion arranged with holes G, extending from the interior of the burner, and terminating within the concave portion F.

Safety-Valves for Gasholders.—Thwaite, B. H., of Great George Street, S.W. No. 6730; April 10, 1900.

To emphasize the utility of his invention, the patentee remarks that a gasholder containing gas such as that from blast-furnaces, when employed for supplying gas-engines, is liable to be exhausted of its gaseous contents by the repeated suction strokes of the engine, when the supply of gas to the holder is cut off or not sufficient to satisfy the demands of the engine; and his invention relates to means of automatically preventing such complete exhaustion, which involves danger of collapse of the holder.



Referring to fig. 1, D is the outlet-pipe from the holder, having the usual water catch-box E, with its pump connection. Between the box E and the pipe T leading to the engine, is interposed a valve-box G, containing a bell-valve H having an annular water-seal. The stem of the valve has fixed on it a bell W, with water-seal, so that the valve can be freely moved without allowing any escape of gas. Attached to the roof of the holder is a pulley L; and a similar bracket with pulley N is attached to the side of the tank. A standard bolted on the top of the valve box G also carries a pulley Q. A chain passes over the pulley Q, under the pulley N, and over the pulley L, to a weight S, which rather more than counterbalances the valve H and its stem. The chain is of such length that, when the holder is quite down, the weight rests on a support Z, and the valve H is closed. As the holder rises, the chain is tightened raising the valve bell H until it meets the cover of the valve-box G, and the passage is opened to the pipe T. The holder, in rising further, merely raises the weight S. When the holder descends, the weight also descends until it reaches the support Z; and then the valve-bell H descends and closes the passage to the pipe T, shutting off the supply of gas to the engine.

According to the arrangement shown by fig. 2, a valve U is attached to the roof of the holder immediately over the gas outlet pipe D. When the holder is almost empty, the valve closes the pipe; but, as the holder

rises, the valve is lifted, allowing gas to flow to the engine. In order to permit of a certain elasticity of action, the valve is preferably suspended on a spring. The valve-stem Y may also be made to extend to the outside, as shown in fig. 3, in which case it has fixed on it a bell to form a hydraulic seal, preferably with mercury.

Gas and Like Fluid Meters.—Greenall, J., of Leeds. No. 6532; April 7, 1900.

This invention refers to the type of meter described in patent No. 4886 of 1899. The object of the present invention is to construct a meter acting in substantially the same manner, but in which the arrangement and construction of the parts are varied; and the method employed in the present invention to communicate motion from the pistons in the interior of the gas-measuring chambers to the exterior, is effected through the medium of a horizontally arranged shaft having a rocking action, in lieu of vertically reciprocating rods as in the previous invention.

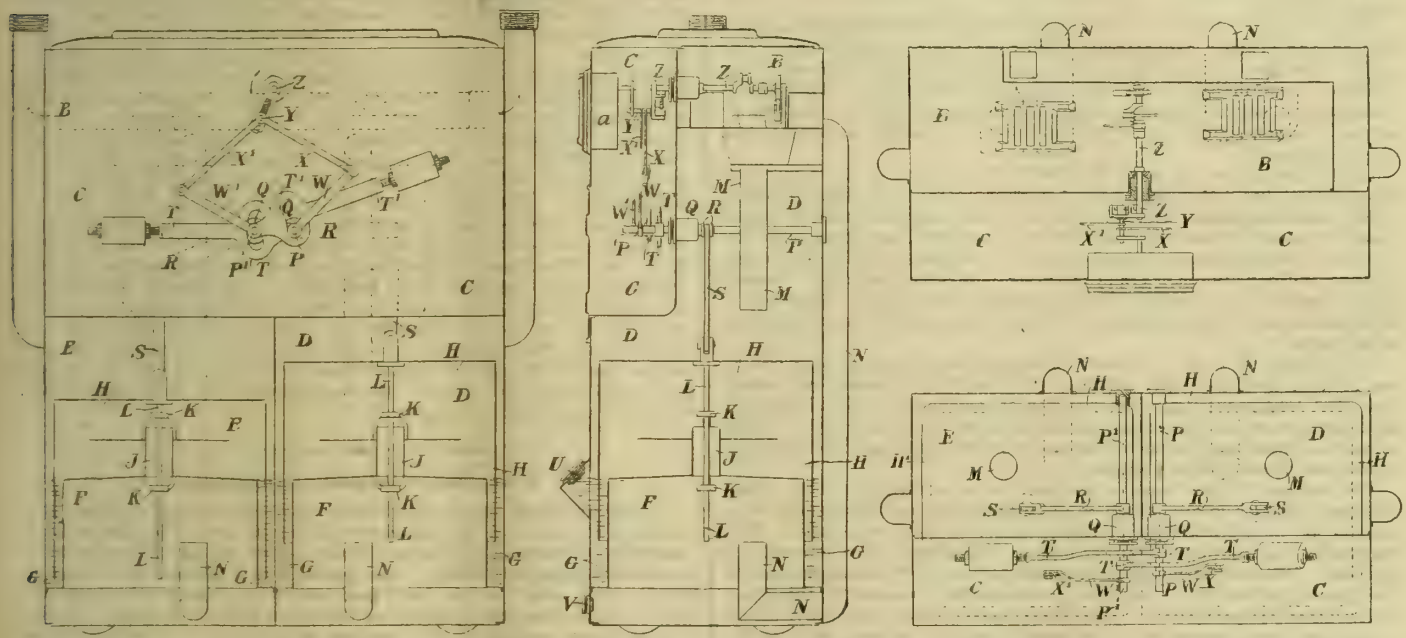
The illustrations show a vertical longitudinal section of the meter, a vertical transverse section, a horizontal section taken through the valve chamber, and a horizontal section taken below the valve-chamber.

The outer casing of the meter is divided, by suitable partition plates, into four chambers—the first chamber B containing the valves, and serving to receive the gas to be measured; the second chamber C being for the reception of the recording mechanism, the levers for counterbalancing the pistons, and mechanism for operating the valve-shaft; while the remaining two chambers D and E are the measuring chambers, and contain the vertically reciprocating sealed pistons. The arrangement of parts within each chamber D and E are similar. The base of each chamber is formed into a compartment F by having an up-rising part, the sides of which stand at a short distance from the interior vertical walls of the chamber, and thereby leave space for the reception of the liquid G, which forms a gas-seal for the piston H, which latter rises and falls in the chamber—its lower edge always being immersed in the sealing liquid. The upper surface of the compartment F communicates, by a tube J, with the interior of the piston H; and the tube is fitted with bridge-pieces K forming guides for a rod L fixed within the piston—the office of the rod L being to guide the piston in its reciprocations. M is a tube from the valve-chamber B, opening into the chamber D above the piston H, and by which gas is alternately supplied to, and exhausted from, above the piston at the proper times. A tube N admits gas from the valve-chamber B into the compartment F, by way of the tube J to the interior of the piston H, and exhausts it therefrom.

Mounted horizontally in the chamber D is a rock-shaft P, supported at one end in a bearing within the chamber, while its opposite end passes through a stuffing-box Q into the chamber C. Upon this shaft is fixed an arm R, to the end of which is pivoted a connecting rod or link S, the lower end of which is pivoted to the piston H. The weight of the piston and its connecting parts is counterbalanced by a weighted lever T, on the shaft P, and located within the chamber C.

The liquid G, which forms the gas-seal for the piston H, is inserted through the aperture U; and should it be necessary to reduce gas pressure which may at the time exist within the piston H, a screw-closed aperture V is provided in the compartment F for the purpose.

The rock-shafts P P^1 are fitted with crank-arms W W^1, connected by links X X^1 to an adjustable pin Y of a crank fixed upon a valve-actuating shaft Z, which latter extends through a stuffing-box into the chamber B, wherein slide-valves are located, which are actuated by suitable connections from the two cranks on the shaft Z. The slide-



valves govern the inlet and outlet of gas to and from the chambers D and E, and to and from the interior of the pistons H H^1, and to the outlet. The crank-pin Y directly operates the recording mechanism, which may be of any approved and well-known construction. Upon the shaft Z within the chamber B is a single toothed ratchet-wheel co-acting with a pawl, the office of which is to prevent the mechanism operating with a reverse action.

In action, the gas enters from the main, and passes into the chamber B (as shown by the arrow), and by the controlling action of the slide-valves is fed alternately both above and below each of the pistons H H^1, thus causing them to rise and fall in a similar manner to that of the pistons of a double-acting steam-engine. The gas, after leaving the measuring chambers, passes through the exhaust-ports of the valves to the outlet. The alternate reciprocating movement of the pistons H H^1 (one being half a stroke in advance of the other) imparts a rocking motion to the shafts P P^1, and thence by means of the crank-arms W W^1, connecting links X X^1, and pin Y, converts such rocking motion into a circular motion of the crank-shaft Z. The amount of gas displaced per stroke is regulated by the length of stroke given to the pistons H H^1, and the length of stroke may be varied as required by regulating the amount of movement of the rock-shafts P P^1, by adjusting the position of the pin Y.

APPLICATIONS FOR LETTERS PATENT.

9300.—Barr, J., "Liquid-meters." May 21.
9380.—Porritt, A., "Gas-producers." May 22.
9381.—Lucas, R., "Internal combustion engines." May 22.
9425.—Kaiser, R., "Incandescent gas-lamps." May 22.
9434.—Schleussner, H., "Acetylene and other gas-lamps." May 22.
9537.—Ross, J. H., "Acetylene generators." May 24.
9565.—Bachmeyer, A., "Gas-burners." May 24.
9585.—Wilson, A., "Gas-producers." May 24.
9609-10.—Fischer, G., Mestern, M. R. H., Woda, F., and Pallester, P., "Carburetted air producer." May 24.
9613.—Simmance, J. F., and Abady, J., "Street-lamp lighting torches." May 24.
9624.—Bever, A., "Internal combustion engines." May 25.
9631.—Bastian, C. O., "Detective lock or seal meters." May 25.
9657.—Davidson, S. C., "Illumination." May 25.
9689.—Chester, W. R., "Discharging retorts." May 26.
9710.—Kirkpatrick-Picard, H. F., "Manufacture of the haloid compounds of cyanogen." May 26.
9720.—Répécoud, L., and Brunier, J., "Burners for incandescent lighting or heating with acetylene or other rich gases." May 26.
9723.—Mackenzie, J. W., "Acetylene gas-generator." A communication from E. Landauer. May 26.
9734-5.—Dürr, F., "Gas-producer for hydrocarbon engines." May 26.
9745.—Beaumont, F. J., "Atmospheric gas-burners." May 26.
9769.—Hunt, C., "Conveyor and elevator chains." May 28.
9782.—Chisholm, J. W., "Manufacture of gas." May 28.
9785.—Nielsen, R. A., "Media for incandescence lighting." May 28.
9789.—Fuller, G. B., "Gas chandeliers and pendants." May 28.
9793.—Thompson, W. P., "Automatic gas-lighting devices." A communication from O. Alius. May 28.
9914.—Richmond, A. & E. W. T., and Richmond and Co., Ltd., "Gas-burners." May 29.
10,038.—House, H. A., "Gas or vapour burners." May 31.
10,049.—Talbot, B., "Gas-producers." May 31.
10,068.—Lake, W. R., "Manufacture of acetylene gas." A communication from R. Exley. May 31.
10,086.—Greenberg, M., "Water turbines, meters, and the like." May 31.
10,160.—Dowle, A. G., "Burners for coal or oil gases." June 1.
10,191.—Boerlage, T., "Gas-pipes." June 2.
10,211-4.—M'Mullen, J. A., "Internal combustion engines." June 2.

Batley Gas Profits.—At a meeting of the Batley Town Council last Thursday, a recommendation of the Gas Committee that £2000 be transferred from the gas profits in aid of the rates, and that £1718 be placed to the credit of the contingency fund, was approved.

The Profit-Making Undertakings of the Halifax Corporation.—At the last meeting of the Halifax Town Council, a statement prepared by the Finance Committee showed that the results of the past year's working represented a gain of £7060 on the estimates; being £6858 from the profit-making concerns of the Corporation, and £202 on the Council's ordinary expenditure. Alderman Smith explained that the water-works had yielded a profit of £3474, or an advance of £1984 on the estimate; and the electricity works had produced £5489, instead of £5725. While, however, the Gas Committee had been a little too sanguine as to their profits from this source, they had greatly under-estimated those from the gas-works, which amounted to £13,060, or an advance of £5132 on their anticipation. The growing profits from the gas undertaking, in face of the competition of electricity, were remarkable.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

Mr. Carpenter's Paper on Inclined Retorts.

SIR,—As a staunch supporter of Mr. Brackenbury, in his gallant attempt to show the London gas engineers that they are by no means what they would have us Provincial engineers believe them to be, allow me to express my surprise and disappointment that Mr. Carpenter should so far forget himself as to say, in a public letter, that Mr. Brackenbury "has no personal knowledge" of the subject upon which Mr. Carpenter so dismally failed recently to enlighten his professional brethren. Let him (Mr. Carpenter) be quite sure himself that he has a personal knowledge of what he is talking about, before he resorts to such tactics, which latter can only bring derision upon any person who uses them.

Rotherham, June 9, 1900. FRANK A. WINSTANLEY.

The Welsbach Company's New Prices, and their Effects.

SIR,—A little more than a year since, the Welsbach Company astounded the gas world by proposing considerable increases in their prices, and in your issue of April 4, 1899, you were good enough to publish a protest from me upon the matter. It was pointed out that such a retrograde step on the part of the Company would certainly have prejudicial effects upon their interests, as well as upon those of gas undertakings, whose objects should be identical. The indignant tone of my letter respecting the Company's methods was justifiable then. To-day a better state of things prevails.

In last week's "JOURNAL" you magnanimously review the Company's history, and heartily congratulate them upon their present businesslike policy. In these congratulations, you probably voice the opinions of gas engineers and managers all over the United Kingdom. That cheap incandescent burners are now obtainable, marks an epoch in the history of gas. As you rightly say, "it is an opening of which no living man can see the end."

In this connection the need is felt of an Institution of Gas Engineers representing the whole profession. A central organization at this juncture could render invaluable service. One does not want to distribute simple trade circulars so much as something to signalize and emphasize the enormous stride made, and the dawning of a brighter day for gas undertakings and consumers. Trade circulars and advertisements, if taken notice of at all, are naturally viewed cynically; but a strong authoritative representation at such a moment as the present would be most beneficial to all parties.

As you put it, "the Welsbach Company have turned over a new leaf;" and they are fairly entitled, therefore, to not merely consideration, but preference over the number of competitors in the market, apart altogether from the complicated question of patent rights. After numerous experiments with different mantles, I have found none superior to the one issued by that Company.

The subject of the various methods of extending the use of the Welsbach burner is one which might profitably form the topic of discussion at one of the District Associations, in lieu of a paper. The gratuitous distribution of burner-nibs to consumers is a commendable practice. Whether or not it is desirable to issue a Welsbach burner to the "penny-in-the-slot" customers is debateable. Generally, this class of consumer has provided a central sliding pendant working stiffly, which would involve the mantle being frequently broken. A cheap form of the "Surprise" pendant, with the counterbalance arms and weights, is particularly suitable for a living-room, the centre of the light being distributable over a circle of about 3 feet diameter, while the light itself can be regulated to the required height. The subject of suitable pendants is one intimately associated with the adoption of an incandescent burner.

Huddersfield, June 7, 1900. EDWARD A. HARMAN.

LEGAL INTELLIGENCE.

Wholesale Thieving by Boys from Slot Meters at Widnes.

At the Widnes Petty Sessions last Thursday, Nicholas Purcell, aged eleven, was charged with robbing the slot meters of occupied houses, on dates from Dec. 13 up to the present time, and taking therefrom the sums of 10s. 8d. and 4s. 10d. A meter-inspector stated that he visited the houses after the tenants left, and found the meters smashed and the contents missing. The boy pleaded guilty, and was ordered to be birched three times for each offence. Four other boys were charged with being concerned in robberies of the same nature, and pleaded guilty. On promises of reformation, they were dealt with under the First Offenders' Act, and ordered to find sureties of £5 each, to come up for judgment when called upon.

The Operation of Special and General Acts.

At the Thames Police Court on the 1st inst., Mr. Dickinson gave judgment in a summons taken out by Mr. Arthur Crow, District Surveyor, against the Whitechapel Board of Works for executing certain work in Great Prescott Street without serving a building notice respecting it, in accordance with the London Building Act. Mr. Horace Avory and Mr. Biron appeared in support of the summons; Mr. Dickens, Q.C., represented the defendants. Mr. Dickinson said the summons was taken out by the District Surveyor against the Whitechapel Board of Works for not having given him notice before they began certain works—viz., the construction of boxes or chambers under the street for the purposes of electric lighting. Mr. Dickens, for the defendants, had contended that it was not necessary for them to give such notice—first, because the London Building Act, 1894, did not apply, the boxes being constructed under the provisions of the Electric Lighting Orders Confirmation Act, 1892 (a Special Act, which, he said, was not consistent with the General Act, and therefore over-rode it); and, secondly, because, even if the General Act did apply, the boxes were not "buildings, structures, or works" within its meaning. The principle which, said his Worship, had to guide him in coming to a decision on the first point was: "Is there anything in the Special Act of 1892 so inconsistent with the General Act of 1894 that the two cannot stand together?" He was unable to see any such inconsistency. Upon the second point—whether these boxes and chambers were "buildings, structures, or works" within the meaning of the 145th section of the General Act—he was of opinion that they were. He therefore imposed a nominal penalty of 1s., and £10 10s. costs. He, however, agreed to state a case.

The Lighting of Private Streets.

At the Brighton Borough Police Court a few days since, William Garrett, jun., and Jasper L. Neale were summoned in respect to the lighting of certain houses in Russell Court. The Deputy Town Clerk (Mr. Talbot), who prosecuted on behalf of the Corporation, stated that the claim was for what was technically known as "new street expenses," and was merely to recover a civil debt which the Corporation alleged to be due to them from the defendants as owners of premises abutting upon the court in question, which was a private street within the definition of the Public Health Act, but not a street which had been dedicated to the public. A nuisance arose in consequence of the court being in darkness; and notice was served upon the owners to provide "means for lighting" it. He believed it would be contended that the words "means for lighting" did not include the illumination, although the defendants admitted that they might be charged for the erection of the lamp; and they said they were not liable for the cost. He submitted that proper "means for lighting" included the lamp, gas, and actual lighting. He understood that for the defendants it would be argued that the owners, being ratepayers, were entitled to lighting; but this was not so, as private streets were not entitled to watering or scavenging at the public expense. Mr. A. Weller, Deputy Borough Surveyor, produced a plan of the court, showing the houses owned by the defendants, whose apportionment of the cost for lighting was £1 3s. 7d. for the erection of the lamp and 16s. 3d. for lighting. Mr. Boxall, who defended, argued that section 150 of the Public Health Act, under which the proceedings were taken, referred to the execution of structural work only, not to the continuous provision of the lighting. They had tendered £1 3s. 7d. for the structural erection, so that the question was whether they were to be continually charged for the gas consumed. Mr. Talbot said he was entitled to interest on the £1 3s. 7d. The Deputy Stipendiary remarked that the section was one which was fairly arguable from both sides. The Magistrates thought the owners should only be called upon to pay the costs incurred in respect of structural work; and that the gas ought to be supplied by the Corporation. The action, so far as the 16s. 3d. was concerned, was dismissed, and £3 3s. allowed towards Counsel's fees. The £1 3s. 7d. was paid into Court by Mr. Boxall. On the application of Mr. Talbot, it was decided to state a case for appeal.

A Gas-Meter Dispute at Blackpool.

A case in which the registration of a gas-meter was in dispute was recently discussed in the Blackpool Police Court. The Corporation sued Robert Wiseman, a company house-keeper, for £12, the balance of a gas bill alleged to be owing. The period under dispute was June to Oct. 6, 1899; and £10 had been paid on account of the Corporation's bill for that time—the amount of the claim being still owing. *Primâ facie* evidence was given by a number of inspectors. It was admitted that a test of the meter had shown that it was 3 per cent. fast; but an allowance had been made for this. The hearing of the case lasted for three hours; and eventually the Magistrates reduced the claim to £10 12s. 5d.

The Assessment of Premises for Water-Rates.

At the Highgate Police Court, last Wednesday, the New River Company applied, under the Water-Works Clauses Act, for two Justices to fix the assessable value of No. 33, Broadway Parade, Crouch End. Mr. A. Debenham appeared for the applicants; Mr. A. Levi, for the respondent—a Miss Nokes, trading as E. & E. Nokes, boot and shoe dealers. Mr. Debenham said the premises were assessed at £100 per annum, and a demand was sent in for £6 1s.; being 5 per cent. on this sum, 9s. for two closets, 6s. for a bath, and 6s. for the high service. An extra 1 per cent. was charged because the premises were more than 160 feet above Trinity high-water mark. The rent was £120 a year, and a sum of £10 was allowed for the lessee's expenses, for repairs, insurance, &c. This brought the value down to £110; and he asked that this sum might be fixed. Respondent had requested to be supplied by meter, but was told that this could not be done for domestic purposes. Mr. F. Rex and Mr. Cuthbert Lake having given evidence in support of the application, Mr. Levi contended that, under the Dobbs case the value of premises for water-rate purposes was that fixed by the local rating authority. Here the Hornsey District Council assessed the value at £100, but reduced it to £92 owing to depreciation in value. The rent was grossly inflated. Miss Nokes took the premises without experience, and was losing money. Mr. P. Hodson, Mr. H. Lewis, and Mr. F. Durrant gave evidence as to the value of the premises; the latter expressing the opinion that £72 a year would be sufficient rental. Other evidence showed that neighbouring premises were assessed by the Company at £84, and the water rate, on the basis of a £92 assessment, had been refused by the Company for those in question. Sir John Glover said, having regard to the fact that the neighbourhood was only in the process of development, the Bench came to the conclusion that the value upon which the tenant offered to pay £92 ought to have been accepted. They fixed the value at this figure, and allowed the respondent five guineas costs.

The railway station of the city of Benares is to be lighted by acetylene gas. The system employed is the "Thorsen;" the contract having been given to Messrs. Lockerbie, Limited, of Birmingham. There will be a total of about 200 lights employed to illuminate the station and approaches.

MISCELLANEOUS NEWS.

WELSBACH INCANDESCENT GASLIGHT COMPANY, LIMITED.

The Directors' Report.

The Directors of the above-named Company have issued the report and accounts for the year ending the 31st of March, in view of the ordinary general meeting of shareholders next Friday.

The Directors open their report with the statement that the sales show an increase in amount over the previous year. There was an advance of 13 per cent. in the sale of mantles—the number sold being the largest yet reached in one year; while the burners decreased 9 per cent. for the year. The gross profit on the trading for the year amounted to £159,029. Certain charges which in previous years have been debited to profit and loss have this year been debited to trading. Had they been charged as hitherto, the gross profit would have been shown at £170,553, as compared with £155,915 last year. The dividend on the shares held in the Austrian Company was at the rate of 65 per cent. for the year, amounting to £76,555, which compares with an average as to rate of 85 per cent., and as to amount of £100,824 for the previous year. After charging all expenses, Directors' fees, depreciation of property, plant, fittings, &c., allowance for bad debts, and also a sum of £5470 transferred to the reserve account, the net profit carried to the balance-sheet amounts to £120,789. Some of the items in the accounts for the past year which differ disadvantageously from the apportioned figures of similar items for the corresponding period ending March 31, 1899, making a total of £42,559, are given in the report. The stock-in-trade amounted on March 31 last, to £144,151, after writing off £27,658 on the recommendation of the Managing-Director. To meet the sum to be provided, the Board decided to transfer the amount of £5470 from the profit for the year to the reserve account of £25,000, bringing the total up to £30,470. From this sum there has been deducted the amount written off stocks, as well as £2812 for anti-vibrator royalties. After adding the balance of £1707 brought from last year's account to the £120,789 of net profit for the year, the available total of the profit and loss account is £122,497. Out of this there has been paid an interim dividend on the preference stock for the half year to Sept. 30, 1899, at the rate of 5 per cent. per annum, £37,500, and an interim dividend on the ordinary stock for the same period at a like rate, £33,750. The balance remaining—viz., £51,247—it is proposed to apply as follows: In payment of a dividend on the preference stock, at the rate of 5 per cent. per annum for the half year ended March 31 last, £37,500; setting aside to reserve to meet the contingency of a further fall in value of materials in stock, consequent upon anticipated reduction in price of fluid, £10,000; and carrying forward £3747.

The Directors state that during the period covered by the report there has been paid the sum of £20,000 to the vendors of the Kern burner (British) patent under the terms of the agreement to purchase; leaving a balance of £40,000 due on this purchase on March 31 last, since which date this balance has been further reduced by a subsequent payment of £20,000. The adoption of the new Kern burner in England, referred to in the last report, has progressed, having been extensively used by numerous public lighting authorities. To facilitate the execution of orders for public lighting, a special department has been organized for this branch, with satisfactory results.

The reduction in the price of fluid by the Austrian Company, foreshadowed in last year's report, has been carried out, but has not resulted in an increased demand to the extent anticipated. The income realized from this section of the Austrian Company's business has consequently been less; but there has been a satisfactory increase in the installation department of that business, which has successfully carried out the contract for lighting the streets of Vienna with the Welsbach system. Out of the reserve funds of the Austrian Company, the Austrian Board have appropriated up to March 31 last, the sum of 604,647·66 kronen (say, £25,194), for the purpose of developing the new electrical undertaking, in the profits of which the shareholders of the "A" (Gas) undertaking are entitled to participate to the extent of three-sevenths, after the repayment of the advances taken from these reserve funds.

Referring to the position of the Company's patents, the Directors say: "The 1885 and 1886 patents, owned by the Company for the manufacture of incandescent mantles, expired on Dec. 12, 1899, and the 13th of March last respectively; but, as the shareholders have already been informed, the superiority of the Welsbach mantle was attained through the patent of 1893, which does not expire until 1907. The upholding of the Company's patents has for years entailed heavy expenditure, under the head of law charges, in proceedings against infringers; and an action is now being proceeded with against the New Sunlight Incandescent Company, Limited, for infringement of this Company's 1893 patent. Litigation with the New Sunlight Incandescent Company, Limited, is also pending on the subject of the Kern burner patents. The Directors, having been advised by eminent Counsel, have full confidence as to the result."

The concluding paragraphs of the report run as follows: "Considerable improvement has recently been made in the terms given by the Company to the trade, which will not only facilitate the increase of the Company's business, but the satisfaction with which these new terms have been received will create renewed interest on the part of the trade in the Company's various productions. In order to bring the advantages of the Welsbach system within the reach of the very large number of those who, on account of the initial expense of the installation of burners, &c., have hitherto been precluded from availing themselves of the benefits and economies of the system, the Directors have decided to make substantial reductions in the prices of both burners and mantles, so that the burners can in future be purchased by the public at from 1s. 6d. and upwards, and the mantles from 7½d. each. It may reasonably be anticipated that these reductions in prices (which took effect from the 1st of June) will result in the Welsbach light being largely adopted by small householders throughout the country, which should bring a considerable increase of business to the Company. This departure should go a long way towards popularizing, in a still further degree, the Welsbach system, the immense utility of which to the gas companies, as a means of increasing the light, even with gas of an inferior illuminating power, must open up still further the vast field for incandescent lighting which remains yet undeveloped, and tend to bring the Welsbach system into more general use."

During the past year Major-General G. de la Poer Beresford and Mr. J. T. Woolrych Perowne resigned their seats on the Board, and Messrs. W. Harris, H. L. Peters, and Chas. L. Samson were elected Directors of the Company; Mr. Peters being appointed Managing-Director on the 1st of January last. Mr. Julius Moeller and Mr. L. R. de Fonblanque have retired from the office of Joint General Managers. The former gentleman has resigned his seat at the Board, and is now Technical Adviser to the Company and the Managing-Director of the Kern Burner Company, Limited.

THE LABOUR DISPUTE AT THE NEWPORT (MON.) GAS-WORKS.

For more than a quarter-of-a-century, peace and goodwill existed between the Newport (Mon.) Gas Company and their workmen until last winter, when there appeared ominous signs that a section of the men were becoming dissatisfied. Besides paying high wages, the Company supported a flourishing Benefit Society, paid the men in addition half time during their illness, provided allotments, and guaranteed to every sober, industrious, and capable man permanent employment where possible, and his lawful turn where only temporary work could be given. During the autumn of 1899, the Bristol District Organizer of the Gas Workers' Union came upon the scene, established a branch of the Union, with a Committee, Chairman, Vice-Chairman, and Secretary on the works. At one of the stations of the Company (Mill Street), the Union did not seem to produce much effect; but at their Crindau station, clear evidence was quickly given of dissatisfaction and insubordination. It may be said that this was not the effect of the Union. Possibly not; but, at any rate, the state of things described did not exist before the Union was fully established.

In January of the present year a stoker was dismissed for drunkenness and insubordination. The Union has taken legal action to recover a week's wages in lieu of notice, and the matter is still under adjudication. The man, however, has not been reinstated. Later on, in February, an application was presented by the workmen for an increase of wages, shortened hours, and a general change in the usual conditions, amounting in all to £2541 per annum. Most of these demands were unreasonable; but the Company were quite willing to grant, and have in effect since granted, an all-round increase of wages satisfactory to the majority of the men. But this would not satisfy either the Union or its most ardent disciples at the Crindau works; and it was clearly evident that, sooner or later, the Company would have to face a strike, even if they attempted to grant the impossible—viz., an additional £2541 per annum. The expression "down with the tools" was now heard frequently as a threat from the retort-house at Crindau.

Matters were precipitated by the erection of one of the "Rapid" charging-machines of Messrs. Biggs, Wall, and Co. at the above-named station. The retort-house hands, stokers and wheelers, refused to work them, although they were promised the retention of every man in his place, an increase in wages, and the continuation of the eight-hour system. They insolently required assistance to the amount of £800 per annum for doing with a simple machine what had been previously done with the shovel. The Company could, in fact, well have claimed a reduction in labour, but they were content to take as their share the better working results obtained with the machines.

On the 20th of April, the Company's Engineer and Manager (Mr. T. Canning) gave a peremptory order that the machines were to be worked forthwith. No heed was taken of it. Mr. Canning at once made his Directors cognizant of the fact, and presented his recommendations for ensuring the working of the machines. The Board now saw clearly that a fight was inevitable; and their Chairman (Mr. R. Laybourne), with the unanimous support of his colleagues, desired Mr. Canning to dismiss the insubordinates, and proceed to fill their places with imported labour—in fact, to do all that was necessary under such circumstances. Accordingly, on Saturday, the 28th of April, the recalcitrant men were dismissed—being paid a week's money in lieu of notice. As they marched out of the works, a body of non-Union men to take their places marched in, followed by carts and waggons containing all things necessary for their food and lodging on the works.

On the following Monday, the real fight with the Union began; and the local papers have recorded particulars of it. Efforts were made to draw out the Mill Street hands; but they did not succeed. Still the Mill Street station alone could not keep up the supply of gas, owing to repairs and the erection of regenerative plant, &c., going on there. With respect to the new men, many of them were drawn out from time to time; but the Company filled up their places as rapidly as they were vacated. Picketing, intimidation, rioting, all followed. One man was summoned for intimidation, but he quickly decamped, and a warrant was issued against him. Another man was arrested under warrant, tried, and convicted of "intimidation" and "persistent following." Subsequently, three other men were all tried and convicted for intimidation, among them being the Secretary of the Union, Mr. Evan L. Jenkins, as already recorded in the "JOURNAL" (*ante*, p. 1454). The "gallant fight" went on during the whole of May, the Company winning evidently, day by day. The supply of gas was well kept up; and the dictation of the Union was broken down—especially when it was found that no dismissed men would be reinstated, out of about forty who went out, and when the Mill Street workmen, in a body, returned their cards to the Union.

In this struggle, Mr. Canning was ably assisted by his staff, as well as by Mr. Russell Wall; and he also received valuable assistance from Mr. C. C. Carpenter, and practical help from Mr. Ingram, of Truro. After a considerable expenditure of money, incessant and worrying labour, long hours, and intense anxiety on the part of the staff, the Company are once more the masters of their own works, besides having prevented an imposition to the extent of many hundreds of pounds a year in respect of demands which were excessive and intolerable. Some other advantages, indirect, but most important, result from this spirited and persistent resistance by the Company to a despotic thraldom, to owners of works in their own town, and not only to neighbouring gas-works, but to every gas undertaking in the United Kingdom.

ASSOCIATION OF MUNICIPAL CORPORATIONS.

Private Bill Legislation—The Supply of Water Gas—Municipal Trading.

The members of the above-named Association met in the Royal University Buildings, Dublin, on Saturday, the 2nd inst., under the presidency of Sir ALBERT ROLLIT, M.P.

In his introductory remarks in opening the proceedings, the President said he trusted there were some services the Association might be privileged to render to the municipalities of Ireland; and perhaps he might be allowed to allude to one Bill which was passing through the House of Commons, and which expressly included that country as it excluded Scotland. In the Borough Funds Bill, which, as an Association, they were promoting, and which it seemed likely would pass, they sought to relieve, not only England, but also Ireland, from the incubus of being saddled with delay in public matters, and cost and expense, owing to the cantankerous nature of a possible single ratepayer. He mentioned this in order to enable him to make an acknowledgment eminently due to a gentleman on the platform—the Parliamentary Secretary of the Local Government Board, Mr. T. W. Russell—for not only had he rendered the greatest aid in the various stages of the Bill, but when it was before the Standing Committee it was upon his motion and initiative that Ireland was included.

The Lord Mayor then moved—"That, in the opinion of this Association, the procedure in municipal Private Bill legislation should be shortened, and the expenses curtailed, and that the question of the best means of achieving this object be, and is hereby referred to the Council of the Association for consideration and report." He said the unnecessary doubling of the cost in submitting Bills to Parliament was, in his opinion, a great hardship, which they probably felt much more keenly in Ireland than in England. They were a greater distance from the House of Commons; and they had to take their Counsel and witnesses to London at very heavy cost. The Corporation of Dublin had at present before the House of Commons a Bill for the extension of the boundaries. This Bill, and also one for the amalgamation of the southern railways, had been referred to what might be termed a dual Committee. They recognized this as a step in the right direction, for it meant the reduction of expenses by one-half; and he failed to see how any interest could be prejudiced by it. Last year this Bill was promoted, and it cost the city and the surrounding townships (who were practically the city) £40,000. It passed the Committee of the House of Commons, and went to the House of Lords; but, after some weeks, they emasculated it, and it was sent back to the Commons, who refused to accept it and threw it out. This might be very pleasant for the lawyers in London and the expert witnesses who resided there, but it certainly was not for the citizens of Dublin, who had to bear the expense of it. Probably the solution of the difficulty would be the creation for Ireland, as had been done last session for Scotland, of a tribunal to settle such difficulties. This applied equally to English corporations. He knew a case in which a small Municipality promoting a main drainage scheme to cost £50,000 had to pay £10,000 to do so. A small town not a hundred miles from Dublin, with a rateable value of £30,000, promoted a water scheme, and the cost of obtaining power to carry it out amounted to £16,000. The Town Clerk of Wolverhampton (Mr. Horatio Brevitt) seconded the motion. Mr. T. W. Russell, M.P., said, with regard to the resolution before them, he was able to speak both as a citizen of Dublin and as a member of the Legislature. He thought this was one of the greatest grievances Ireland had. There were many things said about Ireland, but there was one on which they all agreed, and that was that Ireland was not a rich country as compared with either England or Scotland; and things which might do very well for those countries were perfectly fatal to one like Ireland and a city like Dublin. The citizens could not afford the £40,000 which the lawyers and expert witnesses took last year; for they really got nothing for it. Then they came to the remedy; and if they got a Committee of the two Houses of Parliament, the thing would be simplified so far. But this was not getting at the root of the matter at all. The truth was that these inquiries should be held at home. No matter what the political views of anybody might be, these investigations could be better conducted at home than elsewhere. Scotland generally got in front when there was anything good going; and where Scotland led in a matter of this kind, anybody might be content to follow. Now, Scotland had obtained a measure which would admit of their inquiries being held locally. The only difficulty that arose in the consideration of the Scotch case was the question of the tribunal; and it was not easily settled. It had been settled in a manner in Scotland, but he was loth to think finally. So far as Ireland was concerned, there could be no doubt that the Government were simply waiting to see the operation of this tentative scheme in Scotland before it was applied to Ireland. The principle of its application to Ireland was admitted by the Government and by Parliament. The real question in Ireland, as in Scotland, would be that of the tribunal to try things locally. Whatever might be the difficulties in Scotland, he was perfectly sure they would not be less in Ireland—probably they would be more; but he was certain the measure would be applied to Ireland before any great lapse of time. Alderman Sir James Slumper strongly advocated local inquiries in regard to Private Bills. The President also supported the resolution. He reminded Mr. Russell that a Bill for dealing with the matter for Ireland and Scotland was promised in 1897 or 1898 in the Queen's Speech, and expressed the hope that the time when the Bill would be passed for Ireland was not far distant. The resolution was adopted.

The Town Clerk of Longton (Mr. G. C. Kent), in the course of the proceedings, also moved (1) "That the Board of Trade be urged to promote legislation at the earliest moment to carry out the recommendations in the report of the Water-Gas Committee of 1899," and (2) "That the Local Government Board be asked to give some assurance that applications for loans by Local Authorities, who may, in the meantime, find it necessary to provide water-gas plant, will not be prejudiced by the fact that the expenditure has been incurred before the loans have been sanctioned, so long as such expenditure has been incurred under competent advice." He said he was not going into the merits of this matter, but the supply of water gas had now become an accomplished fact. In the United States coal gas was only supplied to a small extent, and in England at least 50 municipalities were supplying water gas, and a large number of companies were also doing so. The Town Clerk of Blackpool (Mr. T. Loftos) seconded the motions. Alderman Gibson (Manchester) said this should not be called water gas. It was carburetted water gas, which was a totally different thing, and was a most valuable auxiliary to gas-works. Alderman Burgess (Liverpool) said there was considerable difference of opinion as to whether or not water gas should be largely used. Under these circumstances, the meeting would, he thought, act wisely in not passing the resolutions proposed. The Mayor of Rochester (Mr. P. J. Neate) agreed with the last speaker. The price obtained at present for the coke resulting from the ordinary process of gas making was so high that there could be no possible profit in its use for the manufacture of water gas. The Town Clerk of Walsall (Mr. J. R. Cooper) supported the resolution. The Mayor of Ripon (Mr. R. Wilkinson) asked what tribunal was to decide what was "competent advice." Mr. T. W. Russell strongly deprecated the passing of the second resolution. It proposed to spend money first and ask for sanction afterwards. The Town Clerk of Longton thereupon withdrew this resolution. The Mayor of Southport (Alderman Griffiths) moved, as an amendment—"That the Board of Trade be urged to remove the deadlock as to water gas." The Mayor of Blackburn (Mr. E. Hamer) seconded the amendment, which was put and negatived, and the first resolution passed.

The President then proposed the following resolutions:—

1.—That enterprises which have hitherto been entrusted by Parliament to Municipal Corporations, such as gas, water, tramway, electric lighting and power, markets, docks, piers, and other similar undertakings, have been managed efficiently and economically, and for the general benefit of the inhabitants of the localities; and any abridgment or interference with such powers would, in the opinion of this meeting, be a misfortune to the communities served by such undertakings, and a retrograde step in the principles of local self-government.

2.—That, in the opinion of this meeting, all undertakings in the nature of a local monopoly or *quasi*-monopoly, in which the general body of the inhabitants of the locality is interested, should be entrusted to the municipal authority, as has, in effect, been recognized by the Tramways Act, 1870, the Gas and Water Works Facilities Act, 1870, the Electic Lighting Acts 1882 and 1888, and other Acts, which require the consent of the local authority to applications for powers under those Acts.

3.—That Municipal Corporations cannot exercise any trading or other powers beyond those authorized by the General or Local Acts; that it is inexpedient to fix any limit to the powers to be granted in future to Municipal Corporations; and that each case should be dealt with on its own merits.

4.—That, having regard to the fact that the Town Council is a representative body, and that manufacturers and traders are members of such Council, or are fully represented thereon, there is no fear that any undue interference with the trading interests of any town will be proposed or carried out.

5.—That the Secretary be requested to send a copy of the foregoing resolutions to the Joint Committee on Municipal Trading; and that evidence be submitted by representatives from cities and boroughs in support of such resolutions.

In doing so, he said he had already dealt with the subject in his place in Parliament, so that he had not much to add. The first resolution asserted that municipalities had efficiently and economically conducted certain operations for the general benefit of the community. The efficient management of these great undertakings was admitted. It was conceded by Mr. Balfour, in his motion for the appointment of the Committee, and was supported by the evidence of Sir Courtenay Boyle and by Sir Henry Fowler's return, which showed as the net profit of these undertakings for the previous three years the sum of £3,613,668. Sir Henry Fowler put the profit on municipal gas undertakings at £1,811,000, or 6·3 per cent. on the capital expenditure. These matters ought to be in the hands of the corporations, and not in those of speculative companies, who had temptations to prefer dividends to disease and death. He would not move the second resolution. On the third, he would ask, What had been the history of the evolution of these great undertakings? First, there had been tentative or even experimental legislation; and when it had proved successful—and it generally had done so—Parliament had adopted it, and then the Government took hold of it and embodied it, through General Acts, in the legislation of the country. They should resist being put into a strait-jacket, curtailing the operations which had hitherto been so successful. On the fourth resolution, he might say they repudiated the idea that they were going to curtail private enterprise. They wished to reconcile action for the community with legitimate private enterprise; and it was natural that, when they found the latter meant an obligation to be bought out in the end by the community, they doubted whether it was for their advantage. It was not the ratepayers, but the private companies, who challenged the action of the municipal corporations. The ratepayers, as a rule, were highly pleased with the administration of the corporations. Lastly, it was suggested that evidence should be given before the Committee. Their resolution had asked that the Committee should have on it members who had practical acquaintance with municipal affairs. Well, as far as he knew, there were only two who possessed this qualification—one was a gentleman who was formerly a member of the Corporation of Birmingham, and had some knowledge of local government; the other was one of the Peer members, who was at one time a Mayor of a borough. He would not discuss whether or not this secured adequate municipal representation. The Council would take care that evidence was carefully gathered for the Committee. He begged to move the resolutions on the *agenda*, with the exception of No. 2. The Town Clerk of Blackburn expressed the opinion that Nos. 1 and 3 represented the views of the meeting. The Lord Mayor of Dublin said he would take leave to move a rider to the resolutions—"That any legislation which imperils the principles contained in the above resolutions be opposed by this Association." He should frankly say they were now face to face with a House of Commons which was not in favour of municipal trading; and they were equally face to face with opposition to works which corporations were legitimately entitled to keep in their own hands. Therefore he thought they should do everything possible to prevent any interference with what were unquestionably their rights. He did not propose to justify the statement he had made; but if he put the facts before the Association, he was sure they would be impressed with the importance of the rider. Mr. Syme (Nottingham) seconded the rider. The resolutions, with the rider, and with the exception of No. 2, were adopted unanimously.

After the transaction of other business, the usual votes of thanks were passed, and the proceedings closed.

IRISH TRADE UNIONISTS AND THE SUPPLY OF CARBURETTED WATER GAS IN DUBLIN.

On Monday last week, the seventh annual congress of Irish Trade Unions was opened in the Council Chamber of the City Hall, Dublin, under the presidency of Mr. W. J. Leahy. The proceedings on the second day were marked by an incident which calls for notice in our columns. It was the proposal by Mr. Patrick Cassidy of the following resolution: "That the action of the Dublin Gas Company in manufacturing water gas from crude petroleum and supplying it to consumers in the city and township is a matter of the gravest consequence to nearly 1200 skilled and unskilled labourers in Dublin and Kingstown. That as the new water-gas plant has been only working for a short time, and scientific experiments unerringly show that already over 17 per cent. of it has been mixed with coal gas, it may be safely assumed that in the very near future the manufacture of gas from coal will unfortunately cease to be an important industry among our workers. That it is obvious the most disastrous consequences will result to a large community of workers in the event of a very considerable, if not total, falling off in the importation of gas coals, which gives large and constant employment to stevedores, fillers, and other labourers in the discharge from steamers and haulage to the works. That as petroleum is, and will be, discharged by the steamers' pumps, through a flexible tube laid across the wharf from the vessel to the works, the means of earning by quay labourers will cease. As it is claimed by experts that 681,000 feet per day of the new gas may be produced by the labour of four stokers, the entire quantity required for lighting Dublin and the surrounding district would be produced by less than 24, this reduction among the stokers alone would mean the disemployment of 80 men out of every 100 at present required for manufacturing coal gas. That as only enough coke will in future be produced to assist in transforming the oil into water gas, a large decrease of labour will result in that and every other labour-employing department in the Alliance and Dublin Consumers' works. From ascertained facts and figures, we have reluctantly been forced to the conclusion that in the course of the next few years four-fifths of the labour now required in producing coal gas will be dispensed with. That we call on the workers' representatives and friends in the Municipal Council to use their powers under the Public Health Act in preventing the manufacture and distribution of a deadly poisonous illuminant. That we emphatically declare that it is diametrically opposed to the interests of the working community and of the shopkeepers and traders of this city to have the Managing-Director of the gas-works as a civic representative in the Corporation, and a member of the Committee which is supposed to safeguard and protect the health of the community." Mr. John Simmons, in seconding the motion, said the question of water gas was one of importance, not alone to Dublin, but to all parts of the country. The motion was carried.

PUBLIC LIGHTING AT DEVONPORT.

Proposed Adoption of the Incandescent Gas System.

A deputation from the Devonport Corporation recently visited Liverpool to study incandescent gas lighting, with the view to ascertaining how far it should be applied in Devonport. At present some of the streets in the latter town are lighted by incandescent burners; but the system is not in general operation. As the Corporation are about to light some of the main thoroughfares by electricity, the opportunity was thought to be a good one for considering whether the whole system should not be revised. The deputation report at length on the experience of Liverpool, as to which Mr. C. R. Bellamy, the Superintendent of street lighting, supplied them with full information. Comparing the effectiveness of the ordinary gas-burners with the incandescent mantle, the deputation had no hesitation in saying that the incandescent lighting, with a suitable lantern and apparatus to reduce the vibration, was far better than the old system. In Liverpool, the consumption of gas per burner, on the basis of 3 cubic feet per hour, is 10,737 cubic feet per annum. The cost for gas is £1 6s. 3d.; while the whole cost is £2 11s. 2d. This burner will be sufficient for the general lighting of the streets of Devonport; double burners being used at street crossings and important corners. They recommend that seven of the streets in the centre of the town should be lighted by electricity, and that for this purpose 41 arc lamps should be installed, and that each of them should also be fitted with a pair of 16-candle power incandescent electric lamps to be brought into use at midnight when the arc lamps are switched off. The annual cost of the electric lighting is estimated at £19 per annum for each pillar. In order that effect may be given to their recommendations, and the whole system of lighting improved, the deputation recommend the Corporation to purchase from the Gas Company the lamps and pillars in use throughout the borough, and at the expiration of the existing contract, in October, 1901, to undertake the lighting and maintenance of the lamps. There are in the borough about 776 public lamps, of which 54 are fitted with incandescent burners. The annual charge of the Company for these lamps is £3 7s. 6d. for those fitted with batswing burners, and £3 12s. 6d. for each incandescent burner, and the total sum paid to the Company in 1899 was £2632 10s. The deputation estimate that at a consumption of 3 cubic feet of gas per burner, and the time averages 3600 hours per annum, the lighting of the same number of lamps on the incandescent system can be undertaken for £2357, or a reduction of £275 on the existing plan. This charge, which includes a proportion of the cost of the pillars and brackets, and the supply of new lanterns and burners, is equal to £3 per annum, as against £3 12s. 6d. now charged by the Company for incandescent lamps. The 41 electric lamps will displace 46 gas-lamps, and the number of public lamps will then be 730 gas-lamps of 30-candle power each, and 41 electric arc lamps of 500-candle power each; giving a total of 42,400 candles. The total cost of the lighting is thus estimated to be £3068, of which £887 will be for gas, £1012 for lighting, renewals, rent of depôt, and cost of gas testing, £390 for interest on, and repayment of, loans, and £790 for the supply and maintenance of the electric lamps. The report will be considered by the Town Council at their next meeting.

BOLTON CORPORATION GAS SUPPLY.

The Past Year's Working.

The annual report of the Gas and Lighting Committee of the Bolton Corporation, bearing the signature of Alderman Miles, the Chairman, has been issued. It deals with the working of the undertaking in the twelve months ending the 31st of March last, and opens with the following comparison with the figures of the preceding year:—

	1900.	1899.
Coal and cannel carbonized, in tons	98,477	91,256
Average cost per ton delivered on the works and trimmed	11s.	9s. 7d.
Percentage of cannel used	8·20	4·37
Gas made, in cubic feet	984,416,000	935,992,000
" " per ton carbonized	9,996	10,256
Gas accounted for " "	9,641	9,828
Gas unaccounted for per cent. through leakage and condensation	3·55	4·18
Maximum quantity of gas in cubic feet supplied in 24 hours during the year	6,356,000	5,378,000
Minimum quantity supplied per 24 hours	815,000	597,000

The Committee remark that the increase in the sale of gas over the preceding year is no less than 52½ million cubic feet, which is a record in the history of the undertaking. Notwithstanding the reduction in price of 3d. per 1000 cubic feet, which took place on April 1, 1899, and the extra amount paid for coals, the Committee are enabled, in consequence of the largely increased sales of gas and the augmented value of the residual products, to hand over the sum of £20,000 in aid of the rates. They will very shortly have to make contracts for the purchase of the major portion of the year's requirements of coal; and, in view of the present inflated value of this commodity, a very large additional expenditure will, in all probability, have to be incurred, which will unfortunately materially affect and reduce the available profits from the current year's working. The taking down of the old retort-house at the Lum Street works, and rebuilding it on improved lines, will have to be commenced during the current financial year. This necessarily costly undertaking has been somewhat unduly deferred, and it is intended to make a beginning in February next, and finish before the winter. In doing this, the overhead railway from the main line will be continued into the retort-house, so that the coals may be discharged close to the retorts. It is also contemplated to increase the capacity of the washing plant, and so reduce to a minimum any trace of ammonia present in the gas. The apparatus for stacking and loading coke at the Gas Street works has been erected, and has been successfully in operation for some time, with the result of bringing about considerable economy in the cost of handling this material, and also reducing the quantity of breeze. The scheme of enlarging the trunk mains, which has now been carried on for several years, is to be steadily proceeded with, so as to give full and ample supplies to the various portions of the area. The number of lamps throughout the borough on March 31 was 4464; and the number outside, 696—making a total of 5160, against 4874 on March 31, 1899. An improved system of incandescent street lighting with the Kern double burner has been adopted, and has been in operation for some time with very satisfactory results. The same system with single burners is also at work, and shows a marked improvement on the old style of street lighting. The large extension of incandescent lighting recently sanctioned by the Council is also well in hand, and will be proceeded with expeditiously during the summer, and will, it is hoped, be completed over most of the tramway routes for next winter. The very careful attention of the Committee has also been given to the good and efficient lighting of the secondary and the back streets of the borough. This policy will continue to be pursued, so as eventually to make the county borough of Bolton, as a whole, take rank in the near future as one of the best-lighted towns in the kingdom.

The accounts accompanying the report showed that the sale of 870,264,000 cubic feet of gas to private consumers and 71,569,000 cubic feet for public lighting produced, after allowing for discounts, £109,007; the sale of residual products yielded £39,354; and the sale and rental of meters, rents, &c., made up a total of £151,155, as compared with £143,397 in the preceding year. The manufacture of gas cost £78,649; distribution, £6841; management, £2068; and the total expenditure was £93,340, as compared with £80,090 before. The balance carried to the profit and loss account is £57,815, against £63,307. After meeting interest and sinking fund charges, &c., there is a balance of £20,000 transferred to the district fund account; being £5000 less than in the year 1898-9. The working statements show that the quantity of coal and cannel carbonized, under the supervision of the Gas Engineer (Mr. W. Smith), in the year covered by the accounts was 98,477 tons; the residuals produced being: Coke, 67,124 tons, of which 17,233 tons were used in manufacture; breeze, 4907 tons; tar, 6944 tons; sulphate of ammonia, 1186 tons. An interesting diagram shows the yearly sales of gas each fifth year from 1835, before which no record was kept. In 1840, the quantity sold was 21 millions; in 1860, it was 122 millions; in 1880, 412 millions; in 1885, 530 millions; in 1890, 644 millions; in 1895, 769 millions; and now, 941 millions. From 1873 to 1879, the amounts voted in aid of the rates ranged from £5922 up to £8099. In 1880 the sum was £10,000. It went back to four figures in 1885 and 1886; but since then it has gone on increasing. The total amount used in this way since 1873 has been £356,928. The capital expenditure per ton of coal carbonized and per 1000 cubic feet of gas sold in that year was £11 8s. 3d. and £1 3s. 9d.; whereas it is now £6 13s. and 13s. 10d. The price was then 3s. 4d. within, and 3s. 10d. and 4s. 4d. beyond the borough; but it is now 2s. 3d. and 2s. 9d.

At a recent meeting of the Gas Committee, the Borough Treasurer was authorized to estimate that a sum not exceeding £20,000, available as profits from their department, should be applied in aid of the district rates for the current financial year. By resolution, the undesirability was urged of placing inordinately large sums out of its profits in aid of the district rates, believing that such a course would "interfere with, and cripple the success and prosperity of, the Gas Department."

OLDHAM CORPORATION GAS DEPARTMENT.

Annual Report—Increase in Price.

The Gas Committee of the Oldham Corporation have held a Special Meeting to receive the annual statement of the Superintendent of the department (Mr. Arthur Andrew), referred to below. They also considered their position in regard to the price of gas during the coming year; and it was decided to recommend the Council to advance it by 3d. per 1000 cubic feet from June 25. It was mentioned that this, if brought into force, would not recoup the Committee for the increased expenditure they will be put to during the next twelve months; and some portion of the surplus profits of the past year would have to be applied to make up the deficiency estimated after the price has been increased.

The statistical statement of Mr. Andrew contained the following: The expenditure on capital account during the year ended March 25 was: Higginshaw station £4300, gas-mains £967, gas cooking-stoves £420—total £5687. The gross revenue for the year on gas-works account amounts to £159,614, and the gross expenditure to £125,590—the balance carried to profit and loss account being £34,023. Annuities during the year amounted to £3540, interest on loans and stock to £8345, and sums payable to sinking funds to £4313—total £16,198; this bringing the net profit on the year's working to £17,825. Adding a year's accrued interest from annuity redemption fund (£668), and the balance brought forward from the previous year (£6779), and deducting £9620, the amount to which the Corporation are entitled in aid of the borough fund, the credit balance to be carried forward is £15,652. The quantity of gas supplied to the Corporation street-lamps and municipal buildings free of cost during the year is 68,246,000 cubic feet. There has been an increase in the amount received from gas-rents of £5623, and in the receipts from residual products amounting to £13,634. Tar realized £3035 more than in the previous year; and ammoniacal liquor receipts also show an increase of £1191. Coke receipts are £20,174, compared with £10,662. The reserve fund now stands at £47,269; the amount of interest accrued during the year being £1447. The balance profit on fittings account is £310. The expenditure on street lighting account was £2629—a surplus of £303 being carried forward to next year's account. The price of gas per 1000 cubic feet, and also the discount allowed thereon, if paid within the stipulated period, during the past year have been as follows within the district of supply: When the consumption is under 2 million cubic feet, price 2s. 9d., discount 6d.; 2 million cubic feet, and under 5 million cubic feet, price 2s. 8d., discount 6d.; 5 million cubic feet and above, price 2s. 6d., and discount 6d. The quantity of gas manufactured at the different gas-stations during the year ending March 25 was: Oldham 186,226,000 cubic feet, Higginshaw 524,215,000 cubic feet, Hollinwood 470,032,000 cubic feet, Royton 59,454,000 cubic feet—making a total of 1,239,927,000 cubic feet, against 1,181,281,000 cubic feet in the preceding year. The quantity of cannel and coal carbonized in its production was 124,949 tons. The average quantity of gas made per ton of cannel and coal carbonized during the past year was 9923 cubic feet. The loss of gas from leakage, &c., during the year was 77,551,000 cubic feet, or 6·254 per cent. of the quantity made. The average illuminating power of the gas supplied during the year was equal to 19·23 candles. New meters fixed numbered 1009; and the total now fixed is 50,452. The number of consumers is 49,160.

THE PRICE OF GAS AT STOCKPORT.

At the Meeting of the Stockport Town Council last Wednesday, the subject of the price of gas was under consideration. The Gas Committee had resolved to recommend an increase in the price of gas of 7d. per 1000 cubic feet; but, on reconsideration, they decreased the amount of increase to 4d., to apply equally to consumers inside and outside the borough, subject to the usual discount for prompt payment—the increased charge to come into force after the June readings of the meters. In asking the Council to adopt an increase of 4d., Mr. W. Lister, the Vice-Chairman of the Committee, said the first calculations showed that next year the advanced prices of materials—chiefly coal, cannel, and oil—were likely to amount to £14,000 or £15,000; but, after communication with the contractors, they found that, by extending their contracts and making others more favourable to the Committee, and from the fact that oil, which went up 100 per cent. on the last contract, was likely to be somewhat easier, they might get through the year with an increased expenditure of £10,000 to £11,000, which meant a rise of 4d. per 1000 feet in the price of gas upon last year's rental. The Committee also expected to gain something, especially in the sale of coke. Mr. G. Burrows asked that the question of advancing the price be deferred until the Gas Engineer had presented his report on last year's working of the Gas Department. Dr. Barrie Taylor supported this request; adding that, in his opinion, gas should be sold at cost price, and should not be made to bear the expenses of other Committees. Alderman Lees pointed out that the advance in prices of materials used in the manufacture of gas had been phenomenal. He thought the Committee made a mistake in reducing the price some time ago. He considered the advance now proposed fairly reasonable. Other members expressed similar views, and the Committee's proposal was adopted unanimously.

WEST BROMWICH GAS UNDERTAKING.

The Annual Accounts—Proposed Extension of the Works.

The Gas Committee of the West Bromwich Corporation have lately issued a report on the undertaking. In the course thereof, they state that the accounts for the financial year ending the 31st of March last show a net surplus remaining, after making provision for interest and sinking fund, of £4679; and they recommend that £2000 be transferred in aid of the general district rate for the current year, as already promised; that £2600 be transferred to the depreciation fund account in reduction of the debit balance thereon; and that the balance of £79 be carried forward to the current year's accounts. The Committee have had under consideration the question of further extensions of the manufacturing plant. Those carried out last season, being on a comparatively small scale, were expected to meet the requirements for some two years only; and additional plant, it is anticipated, will be needed during the heavy stress of next winter. They therefore recommend the Council to approve of the following scheme of extensions: Alterations to railway siding, £2000; additional condensers, £900; two exhausters (one being additional), valves, and connections (less the cost of one to be replaced) £500; Dellwik water-gas plant, £3700; contingencies (say, 10 per cent.), £700—total, £7800. The Committee's borrowing powers being now exhausted, they recommend the Council to make application to the Local Government Board for sanction to borrow the amount required for carrying out this scheme, as well as £1024 for extensions of the stoking machinery and the coal-conveying plant; making in all a total of £8824, or (say) £9000.

The report came up for consideration at the meeting of the Town Council last Wednesday. In moving its adoption, Mr. Bushell drew attention to the application which the Committee recommended should be made to the Local Government Board for sanction to borrow £9000. This sum was, he said, necessary to enable them to provide increased carbonizing plant. They proposed to introduce the manufacture of carburetted water gas, which was the most expeditious and least expensive method of producing gas known at the present time. In view of their having very nearly reached the limit of their existing plant, it was highly desirable that the Committee should do something to enable them to provide against all emergencies which might arise. Out of the total contemplated outlay of £5000, they were only looking forward to spending £4000. Alderman Blades thought some explanation was due with regard to the spending of £2000 on alterations to the railway siding. Mr. Browne asked whether the improved plant would increase the illuminating power of the gas. Mr. Gill wished to know why the Committee were borrowing £9000 when they were handing over £2000 to the relief of the district rate. Mr. Bushell, in reply, said the £2000 to be spent on the railway siding was required to provide for the necessary growth of the works. The annual quantity of raw material dealt with at the works was double what it was at the time the siding accommodation was provided. The present scheme was part of a much larger one which would have to come before the Council later on; and when the time arrived they would ask for powers to lay down increased carbonizing plant. With reference to the question of Mr. Browne as to the illuminating power of the gas, he observed that the system of water-gas manufacture was the best yet introduced for rendering it uniform. Alluding to the annual accounts of the gas undertaking, he said he thought the substantial increase which had taken place in the quantity of gas sold was very satisfactory. It was hardly possible for them to expand quite as fast in the future; and he himself did not anticipate such good results in the years to come. He reminded the Council of the increase which had taken place in the price of coal, and said the probabilities were that it would continue to advance, and consequently he did not suppose the consumers would be much surprised if they were asked to pay a little more for their gas. The prepayment meter system, notwithstanding the large amount spent upon it, had been a success. Alderman Blades expressed his surprise at the remarks of Mr. Bushell, and also at his intimation of a probable increase in the price of gas. He expressed the hope that the Committee would not raise the charge with the view of making a large profit on the gas undertaking. The report was adopted.

On the above-named day, Mr. T. Hudson, the Secretary and Borough Accountant, issued his annual report on the gas undertaking. It showed that during the year ended March 31 the capital account had been increased to the extent of £4901; and the average capital expenditure per ton of coal now stands at £7 0s. 3d. The satisfactory increase in the sale of gas referred to in his previous report had continued throughout the year; the income being 9·16 per cent., and the quantity of gas consumed 8·66 per cent., more than in the preceding year. The principal increase, however, had occurred in the gas sold to prepayment meter consumers and for motive power purposes; the former having been from 5 to 6 per cent., while the latter was nearly 25 per cent.—the sales to works and manufactories for lighting purposes having increased by 10 per cent. The gas sold to the small ordinary consumers, as distinguished from the prepayment consumers, showed a decrease of over 14 per cent.—an evidence of the transfer from this class to the prepayment meter class. The income from gas sold was £3124 in excess of the previous year, of which £2497 was in respect of prepayment meter consumers. From these meters alone the income was £6887. At the end of the financial year, the total number of consumers was 9668; being an increase of 649. The total quantity of gas consumed was 295,874,800 cubic feet, against 272,272,700 cubic feet in the previous year—an increase of 23,602,100 cubic feet, or 8·66 per cent. The total income was £54,279, as compared with £46,456 in the previous year—a rise of £7823. The total expenditure was £40,955, against £34,153, or an increase of £6802. Manufacturing charges were £6986 over last year; and purification, maintenance and repairs of works and plant, and salaries and wages, were also in excess. During the year, 29,070 tons of coal and cannel had been carbonized an increase of 3157 tons. The cost of maintenance and repairs of mains and services was £661 9s. 9d. below the previous year. The gross profit on the trading account was £13,323, against £12,303 an increase of £1020. There was a balance of £10,732 on the depreciation fund account, which would be used as working capital. The debit balance at the end of the year stood at £18,750; and the total outlay on the prepayment meter account to March 31 was £19,260, which represented the cost of fitting 3208 houses.

Liverpool and the Wallasey Water Supply. At the meeting of the Wallasey District Council last Thursday, Mr. Greene, in moving the adoption of the minutes of the Water Committee, said they had practically completed an agreement with the Liverpool Corporation for a supply of water from Vyrnwy, and very soon the work would be entered upon. Unless parliamentary powers were needed—and they hoped to do without them—they would be receiving water from Vyrnwy within two years. One or two members raised objections, but Mr. Greene stated that Liverpool had to give them five years' notice before ceasing the supply, which he considered ample time for Wallasey to seek out another scheme.

MIDDLETON CORPORATION GAS AND ELECTRICITY SUPPLY.

At the last Meeting of the Middleton Corporation, the report of the Gas Engineer (Mr. Tim Duxbury) to the Gas and Electric Lighting Committee came up in the Committee's minutes. In the course thereof he stated that the capital outlay in the year ending March 31 had been £2567. The most striking points in his working statement were the large increase in the quantity of gas sold—viz., 8,985,700 cubic feet, or 9·13 per cent.; the reduction of the unaccounted-for gas by slightly more than 0·5 per cent., notwithstanding an increase in the day pressure to the extent of 33 per cent.; and the greater percentage of cannel carbonized and the lower make per ton, owing to the higher illuminating power of the gas, to using unscreened coal, and to its inferior quality due to the scarcity of supplies. Turning to the financial statement of accounts, the gross revenue for the year amounted to £20,398, and the gross expenditure (less annuities, interest, and sinking fund) to £13,180; leaving a gross profit of £7218. The net profit was £1970. The coal and cannel mixture had cost 1s. 9¾d. per ton more, which was equivalent to £1147, and was due to the advance in price last summer and to the increased illuminating power of the gas supplied; while the coke had only gone up by 6¼d. per ton of coal, or equivalent to £343. Tar had realized 6s. 7d. per ton more, and ammoniacal liquor 2s. 4d. per ton more; the latter being due to the advance of £1 9s. per ton in sulphate of ammonia. Carbonizing wages had been reduced by 9½d. per ton of coal over last year, or 1s. 4d. over 1898, with the old retorts, which was equivalent to £843 per annum, in addition to more than 1000 tons (£500) of coke saved per annum. This saving of £1343 was entirely due to the installation of inclined retorts and coke plant. Purification had cost £100 more, due principally to the use of lime. Repairs of works and plant had entailed an outlay of £519 more. Owing, however, to the maintenance having been kept well up, the cost per ton of coal was below the average of past years. Coal and working expenses, less residuals, were £1208 more; and the net revenue from gas showed an increase of £1197. While annuities and interest remained about the same, the sinking fund showed an increase of £332.

The adoption of the minutes was moved by Alderman Walker, who briefly referred to the particulars contained in the above statement. He said he regarded the increase in the quantity of gas sold as very satisfactory. He went on to say that the Committee asked the Council to pass a resolution authorizing them to apply to the Local Government Board to increase the total for which borrowing powers were sought, for the purpose of electric lighting, from £20,000 to £21,592; the extra money required being for an increase in the amount of the estimate for buildings. Mr. Mellalieu seconded the motion. Mr. Mills said he could not give his consent to the resolution. The estimate of the Engineer for the buildings was in the first instance £3500. Certain re-arrangements were made, and they then came to £4300—a very considerable increase. Then specifications were made and tenders sought which varied between £8000 and £10,000; and a Sub-Committee were appointed to see if the buildings could not be cut down. This had been done; but no plans of the proposed new buildings had been furnished to the Committee as yet. While they were in the present crude condition with regard to the scheme, he thought they had better defer their application to the Local Government Board until they knew exactly what they required. Mr. Roe was very pleased that the Gas Department had made a profit; it was most creditable to the Gas Manager and the Committee. He should have been very glad if the Committee had seen their way to reducing the meter hire, especially for the penny-in-the-slot meters, as people using them paid 25 per cent. more for their gas than ordinary consumers, besides paying for it in advance where others had three months' credit. Other councillors having spoken, Alderman Walker, in reply, said the extra expenditure as they were all aware, was under the rough estimate given about three years ago. Since then building prices had gone up considerably, and they were bound to follow them. Their idea in bringing down the size of the structures was to lessen the cost; and the Engineer advised them they would be large enough if brought down to the size proposed. The Alderman proceeded to describe the point raised by Mr. Roe as a "chestnut," and disposed of it by saying that gas supplied to penny-in-the-slot consumers was charged at a higher rate because the meters required a great deal more attention than those of the ordinary kind. The minutes were passed.

HINCKLEY URBAN DISTRICT COUNCIL GAS DEPARTMENT.

The Past Year's Working.

At the last Meeting of the Hinckley Urban District Council, the Gas Committee reported that they had had before them the statement by the Engineer and Manager (Mr. F. Lee) on the working of the gas undertaking during the year ending the 31st of March. It showed that the total receipts were £10,651, and the expenditure (exclusive of interest and sinking fund) was £6136; the gross profit being £4515. After deducting interest and sinking fund, amounting to £2037, there was a net profit of £2478. Coal and cannel cost 13s. 8·22d. per ton, as compared with 12s. 6·36d. per ton in the preceding twelve months; being an increase of 1s. 1·86d. per ton. The receipts for gas and meter and stove rents were £8493, against £7695, or £797 more. Residuals and fittings were £754 higher. The quantity of coal and cannel carbonized was 5097 tons, as compared with 4937 tons. The coke sold was 2688 tons; being 10½ cwt. per ton of coal carbonized, against 9 cwt. per ton before. This represented a saving of £200. The quantity of gas manufactured was 54,695,000 cubic feet, against 50,286,000 cubic feet in 1898-9; the amount sold being 48,350,000 cubic feet, against 43,864,600 cubic feet. The unaccounted-for gas was 8·82 per cent., as compared with 10·03 per cent. before. The number of ordinary meters in use was 1205, and of prepayment meters 75—being increases of 29 and 49. The number of stoves on hire was 150, or 32 more than in the previous year. Mr. Lee expressed his gratification on presenting so favourable a report. Had it not been for the abnormal increase in the price of coal and other materials, the Committee would, he said, have been in a position to make a substantial reduction in the charge for gas; but, in face of the very heavy expenditure to be incurred during the current year, he thought it must be satisfactory to them to be able to meet it without increasing the price.

In moving the adoption of the report, the Chairman of the Gas Committee (Mr. J. Abbott) said it was with great pleasure that he brought it before the Council. He did not like to say too much with regard to Mr. Lee's management; but the Council were more than satisfied with the year's working, which showed a profit of nearly £2500. This was double what it was last year; and the result had been achieved with obsolete appliances. It was true that new plant had been put down, but they had not felt the benefit of it this year; and yet out of this profit a sinking fund to cover £9500 had to be provided to pay for it, while this year they derived but little benefit. However, the additional works would soon be in going order; and this year the Committee would have the advantage. While feeling that a vote of thanks might not be appropriate to a paid servant, they thought that the Manager's services should be recognized in a practical manner. Mr. Lee had done his work well—indeed, if the concern had been his own he could not have done better. Mr. Kinton, in seconding the motion, said that last year he predicted that there were better times in store for them; and so it had proved to be. He was anxious that Mr. Lee should have his full share of the credit for the excellent report before them. However energetic the Committee might be, they were always in the hands of their Manager. The Chairman remarked that had it not been for the large increase in the cost of coal, they would have been able to reduce the price of gas; but for this year the coal would cost between £1200 and £1300 more than last year, and the men's wages had also gone up. The large profit realized had been due to the economical management of Mr. Lee. The report, which was accompanied by the accounts, was adopted.

THE GAS UNDERTAKING OF THE TEIGNMOUTH COUNCIL.

Extensions at the Works.

An inquiry was held at Teignmouth last Tuesday, by Mr. G. W. Willcocks, one of the Inspectors of the Local Government Board, on the subject of an application by the District Council for power to borrow £1015 for gas-works purposes and for consent to deviate from the plans in respect to which loans were authorized in April, 1898. The Board originally sanctioned a loan of £3000, and in November last another loan of £1250. With regard to the present application, it was explained that in preparing the foundations for the new holder, certain difficulties were met with which led to an increase of £515 in the expenditure. This sum and one of £500 which it was proposed to spend on coal-barges were the ground of the present application. Mr. Allen, a member of the District Council, objected to any further expenditure on the gas-works, and said that, although a large sum had been laid out, no improvement had been effected. In answer to a question by Mr. Jarvis, another member of the Council, the Surveyor said that certain defects had arisen in connection with the new holder; but these were not in the foundations, and were now being dealt with. As to the purchase of barges, Mr. Stormonth, the Gas Manager, said the Council at present paid 1s. 3d. a ton for the carriage of coal from the colliers to the gas-works, and great loss was occasioned by the bad condition of the barges they hired. He estimated that they would economize to the extent of £91 a year by having good barges of their own, and that, after deducting interest and sinking fund, a sum of £63 would be saved annually. Mr. Allen opposed this expenditure. Considerable time was occupied in the explanation of the proposed deviation from the original plans. Mr. Stormonth said he estimated that there would be a saving of £900 in the capital cost of the alterations by the adoption of his plans, and the more efficient working would result in a gain of £799 a year. Mr. Hutchings, a member of the Council, objected to the proposal to depart from the original plans; and he cross-examined the Manager at considerable length. Colonel Morrison, ex-Chairman of the Council, said the business of making gas had been a thorn in their side for many years. They had about the worst gas in England, and had been paying the highest price for it. The Manager assured the Council that great economy would be realized under his scheme, and that they would produce better and cheaper gas, and make a fair profit from the works. The Council were only too glad to adopt any suggestion for getting out of their difficulties.

THE HONLEY DISTRICT COUNCIL AND THE GAS-WORKS.

At the last Meeting of the Honley District Council, the Clerk (Mr. J. Sykes) read some correspondence which had passed between him and the Local Government Board with reference to the suggested purchase by the Council of the Honley Gas Company's works and rights. The first letter was from the Board, who pointed out that it did not appear that the sanction of the ratepayers in public meeting was necessary to enable the Council to purchase the works; further, that the Company were able to supply gas outside the urban district of Honley, and the Board would not be prepared to give their sanction to the Council undertaking such liability, which would require a Provisional Order. He (the Clerk) replied on the 25th of April, saying that the matter had been considered by the Council, and they observed with regret that the Board would not be prepared to give them power to supply gas outside their district, because it was so small a quantity—1038 cubic feet out of a production of 13,222,000 cubic feet—that was supplied in the Thurstonland and South Crosland districts, and emphasizing the fact that the Council were only desirous of acquiring the gas-works so as to be able to supply their own district. The reply to this letter had just come; and the Board stated that the Council could not be authorized to supply gas beyond the limits of their district by means of a clause in the Provisional Order; and that upon the information at present before them, they were not in a position to suggest any expedient by which the Council would be able to undertake such a supply. The Chairman (Mr. E. Crowther) remarked that the principle involved was similar to the question of tramways outside the borough. The Board did not state that they could not get the power by a Private Act. The Clerk said there was no question about that. Mr. Stansfield observed that, as there seemed to be some opposition in the district to their acquiring the tramways, he hoped they would obtain all the privileges possible, so as to make the scheme self-supporting. Many people thought that, as electric light was taking precedence of gas, they ought not to purchase the Company's works; and if they did intend

to buy them, he should like to have a ratepayers' meeting, because he thought too much publicity could not be given to the matter. The Chairman remarked that it had been pretty freely talked about by the Council, and was fairly well understood by the ratepayers. A public meeting would be attended by the opponents of the scheme, but not by its supporters. After some conversation, it was decided to call a ratepayers' meeting to consider the question.

THE WATH-UPON-DEARNE GAS ORDER.

Consents of Local Authorities Dispensed With.

Our readers may remember that one of the applications for Provisional Orders this session was from the Wath-upon-Dearne and District Gas Company, Limited, for power to maintain, construct, and continue gas-works, and to manufacture and supply gas in the urban districts of Wath-upon-Dearne and Bolton-upon-Dearne, the township or parish of Thurnscoe, and part of the township or parish of Brampton Bierlow, in the West Riding of the county of York. The Local and Road Authorities of the districts comprised within the proposed area of supply are the West Riding County Council, the Wath and Bolton Urban District Councils, the Doncaster and Rotherham Rural District Councils, and the Barnbrough, Brampton, Bierlow, Hickleton, and Thurnscoe Parish Councils. The promoters were unable to obtain all the necessary consents, and they asked the Board of Trade to exercise the powers conferred by section 4 of the Gas and Water Works Facilities Act, 1870, of dispensing therewith. The Board thereupon instructed Mr. Ingram B. Walker as Commissioner to hold a public inquiry at Wath-upon-Dearne with reference to the application for the Order, and to report to them on the matter. At the inquiry, the promoters stated that they no longer proposed to include the parishes of Hickleton and Barnbrough in the limits of supply; and the consent of the Parish Councils and of the Doncaster Rural District Council (the Road Authority in respect of these parishes), therefore, became unnecessary. The promoters also agreed to the insertion of clauses to meet the objections of the Brampton, Bierlow, and Thurnscoe Councils. The opposition of the Wath and Bolton Councils was, however, maintained; and, after hearing the parties, the Commissioner reported that, subject to certain conditions, the Order should be allowed to proceed. After considering his report, the Board decided to grant an Order, subject to certain modifications and amendments.

CAPE TOWN AND DISTRICT GAS COMPANY.

The Annual General Meeting of this Company was held on Thursday last, at the Offices, Winchester House, E.C.—Mr. John Boustead, J.P., in the chair.

The report of the Directors (which was taken as read) stated that the result of the working of the past year was a profit of £19,240, to which have to be added the balance of £474 brought forward from the previous year, and £1822 profit on the recent issue of preference shares—making a total of £21,536. After providing for the debenture interest to Dec. 31, and for the dividend on the preference shares, and after writing off the whole of the sum of £3970 standing at the debit of suspense account, there remained £10,066. Of this amount, £4000 had already been absorbed by an interim dividend on the ordinary shares at the rate of 8 per cent. per annum for the half year ended June 30; and the Directors recommended the payment of a final dividend on the ordinary shares at the rate of 10 per cent. per annum for the six months to Dec. 31. This would absorb a further sum of £5000, and leave £1066 to be carried forward. Previous to the very large advance in the price of coal, the Directors secured a contract for a supply sufficient to last the Company during the greater part of the present year. The Directors were also fortunate in obtaining during the past year very favourable freights for the transit of coal; but owing to the war in South Africa there was at present great delay in the unloading of vessels at Cape Town, and freights had materially advanced in consequence. In order to meet this advance, the Directors had increased the price of gas. The quantity of gas made in 1899 was 3,504,000 cubic feet in excess of the previous year; and the returns for the present year showed a very gratifying further increase.

The Chairman said he thought he was justified in stating that the result of the past year's working had been most satisfactory. They were in a position to declare a dividend for the second half of the year at the rate of 10 per cent. per annum; and they had, at the same time, the satisfaction of knowing that the result attained was not in any respect abnormal. Each department had contributed to the extra profit. The increase in the receipts from the sale of gas had amounted to £4100; from meter-rents, to upwards of £100; and from the sale of fittings, to £600. In addition to this, the leakage had been reduced from nearly 18 per cent. in 1898 to something like 12½ per cent. in the past year. This reduction was very important, because it represented a saving of about £2000 for the year. So far, therefore, the period under review had been most satisfactory. It was difficult—in fact, unsafe—to prophesy; but there was every reason to believe that in the present year, notwithstanding the drawbacks of the high price of coal and increased cost of chartering vessels, there would be no falling off in the prosperity of the Company. He did not think they were likely to have any diminution in the price of coal, because, though the war was practically at an end, all the troops would have to be brought home; and the amount of coal required for this and other purposes was so great that the price would no doubt be maintained during the year. But there was another direction in which they might hope to make a further saving—that was, in the leakage. Although this had, as already mentioned, been reduced to about 12½ per cent. in the past year, it ought to be brought down to 8 per cent., which was the recognized legitimate leakage at the time the Company took over the undertaking. The experts then reported that the leakage was excessive, and might be reduced to 8 per cent. If this further reduction was secured, it would go some way towards meeting the increase in the cost of coal during the present year. Then, of course, in the past year they had not the advantage of the rise in the price of gas which they had been compelled to make in consequence of the very great cost of coal. It was fair, therefore, to assume that in declaring the increased dividend of 10 per cent., the Directors had not in any way acted prematurely. Beyond this, it would be seen from the report that the whole of the sum of £3970 standing at the debit of suspense account had been written off. As this charge would not recur during the present year, they would probably be able to turn their attention to the formation of a substantial reserve fund, which, of course, must be provided. He concluded by moving the adoption of the report and accounts.

Mr. J. E. Lilley, J.P., in seconding the motion, said that in 1896 the leakage amounted to no less than 23 per cent.; it having gone up by leaps and bounds. The Directors were unable to account for this, because they believed that the Manager had given every attention to such matters. The Board therefore sent out instructions that everything should be thoroughly overhauled. Of course, this necessitated very considerable expenditure, the final instalment of which had been written off during the past year. However, time had proved that this expenditure was a wise step. Having regard to the growth of Cape Town, it was certain that the business would continue to increase in a satisfactory manner. The sale of gas since Jan. 1 of the present year had exceeded that in the corresponding period of the previous year, notwithstanding the large increase that took place then. In a progressive place like Cape Town, it was absolutely necessary for the Company to have money at disposal, to carry out the requisite extensions of the works; and the issue of the remaining £50,000 of preference share capital (completed last year) supplied this money, and enabled the Directors to pay off the debts against capital account.

The resolution was carried unanimously.

On the motion of Mr. H. R. Savory, seconded by Mr. R. A. Fairclough, the retiring Director (Mr. Boustead) and the Auditors (Messrs. C. F. Kemp, Sons, and Co.) were re-elected.

The proceedings then terminated.

SHANGHAI GAS COMPANY.

The Annual General Meeting of this Company was held on the 10th of April—Mr. E. Jenner Hogg in the chair.

The Secretary (Mr. G. R. Wingrove) having read the notice convening the meeting, the report of the Directors was presented. It showed that the profit for the twelve months ending Dec. 31 last was 73,992 taels (about £24,000), which amount had been transferred to the profit and loss account. The net profit for the year, after providing for interest on debentures and for the reserve fund, amounted to 61,564 taels, of which 10,335 taels had been written off for depreciation of plant and buildings. The balance at the credit of the profit and loss account on Dec. 31 was 71,794 taels, out of which 18,000 taels, the final dividend for the past year, was paid in January last, leaving a balance of 53,794 taels. Of this amount the Directors proposed to place 50,000 taels to the credit of the renewals and depreciation account; carrying forward the balance (3794 taels) to the credit of the profit and loss account. Private consumption of gas increased by 7,254,533 cubic feet, or 6·57 per cent., and public lighting by 75,176 cubic feet, or 1·17 per cent. At the close of the year there were 34 gas engines in use. Having made favourable contracts for the supply of coal this year, the Directors have been able to reduce the price of gas to $1·80 per 1000 cubic feet for lighting purposes, and proportionately for cooking, heating, and motive power. Accompanying the Directors' report was one by the Engineer (Mr. H. King Hiller). In the course thereof, it was stated that 13,657 tons of coal and shale were carbonized, and 138,066,300 cubic feet of gas manufactured last year; being 486 tons 17 cwt. more coal and 8,801,800 cubic feet more gas than in 1898. The yield per ton was 10,109 cubic feet. Of the total make, 124,469,110 cubic feet were sold (7,352,710 cubic feet more than in 1898), and 13,597,190 cubic feet were used on the works and unaccounted for.

The Chairman, in moving the adoption of the report and accounts, dealt at some length with the various items in the latter, and then passed on to refer to the general progress of the Company's affairs. The result of the working in 1899 had, he said, left a net balance of 53,794 taels to be carried forward, as compared with 38,565 taels at the close of 1898. As far as the present year was concerned, the business was going on most favourably; the consumption of gas having, so far, materially increased. Moreover, the coal supply for the year had been secured on satisfactory terms. At the Chinese New Year, which was always the Company's largest day's delivery, they sent out 721,400 cubic feet of gas, which exceeded by some 90,000 cubic feet any previous record. Following out the policy of the Company in times of prosperity, the public were made participators through the reduction in the price of gas to $1·80 per 1000 cubic feet. This meant a gain to the public of more than 20,000 taels in the course of the year. The Company had made an important stride in public lighting. The new incandescent gas-lights which had been placed were very satisfactory, and quite bore out the experience of important towns elsewhere. The Company were anxious to extend the use of this system of illumination; for some roads, being still lighted by the old-fashioned burners, were calculated to bring gas lighting into disrepute. They had therefore applied to the Municipal Council for permission to replace them by incandescent burners; their proposition being to supply lights giving 26,700-candle power per hour in place of the present 5000-candle power—or (say) an increase of 21,700-candle power for the increased cost of only 2600 taels per annum. He regretted to say that the proposal had not been accepted. While making this suggestion to the Council, the Directors thought it not inopportune to submit a proposal for improving the whole lighting of the Settlements by the adoption of the incandescent gas system. This they did on the basis of a saving to the ratepayers of about 15,000 taels a year for five years, or (say) about 75,000 taels altogether during that period; but unfortunately—for all parties, as he firmly believed—the proposal had not been entertained. Probably the thing most to be regretted, however, was the curt refusal to allow the Company to show—entirely at their own expense—what excellent lighting it was that they were offering to the public. The lamps which had already been fitted up were of 40-candle power and placed 70 yards apart, whereas the Directors' proposal was for lamps of 60-candle power placed 50 yards apart, which, of course, made a great difference. They had just exhibited alongside their town office a light of great brilliancy, produced, at considerable economy in cost, by the intensified system, by

which the gas was forced at high pressure into the burner, thereby increasing the intensity of the incandescence to such a degree that each burner gave a light of 350 candles for a consumption of 10 cubic feet of gas per hour, or a light of 35 candles per cubic foot per hour, against 2½ to 3 candles in a common flat-flame, and 16 candles in an ordinary Welsbach burner. In conclusion, the Chairman bore testimony to the excellent work of the staff, to whom the Company must, he said, always be indebted for their success. The Directors thought that on the occasion of so successful a year, a substantial recognition in the form of a bonus should be accorded.

Mr. J. M. Young seconded the motion, and it was carried unanimously.

A dividend of 6 per cent. for the half year ending the 30th of June, on the reserve fund of 100,000 taels, was then declared.

At the close of the ordinary business, a special meeting was held, at which it was resolved to increase the capital of the Company by the issue of 1000 new shares of 100 taels each, and to appropriate the sum of 100,000 taels now forming the reserve fund in payment for these shares, which were to be issued to the shareholders in the proportion of one new to three existing shares.

The proceedings then closed.

ELECTRIC LIGHTING NOTES.

At a meeting of the Finance and General Purposes Committee of the Heywood Town Council, on Monday last week, it was decided to apply to the Local Government Board for sanction to borrow £15,000 for the purpose of the electric light scheme.

The Local Government Board have approved of the plan for lighting Rhyl with electricity. The project will entail an expenditure in the first instance of £19,000, and will be worked in conjunction with a refuse-destructor and a new electric tramway along the sea-front.

The Swansea Corporation Electric and Tramways Committee have decided to charge for current used for lighting 6d. per unit for the first hour-and-a-half's daily consumption of the maximum demand, and for all subsequently used at the rate of 2d. per unit. For motive power the rate is to be 6d. per unit for the first hour's average daily consumption of the maximum demand, and for all consumed in excess of this at the rate of 1½d. per unit. As an alternative, users of electricity for motive power purposes may pay 3d. per unit. It has also been decided to adopt the slot meter system of supply; and to obtain power to extend the supply of electricity over the whole borough.

At the last meeting of the Belfast County Borough Council, the minutes of the Electric Lighting Committee contained a recommendation that the Council should authorize them to make application to the Local Government Board for power to borrow £95,000. This money was, he said, required to carry out works which would place the department in a position to adequately supply light up to the winter of 1902. Mr. Wheeler seconded the motion. Mr. J. Thompson, alluding to the price charged for the current, said it seemed to him that the Committee received more for it—in some cases 25 per cent., and in others 30 per cent.—than was charged throughout England and Scotland. He instanced Leicester in particular, and said he considered more economy should be exercised. Mr. Andrews said the price had been reduced at the beginning of the year, and he thought that probably when the last quarter's accounts were made up it would be found that the Belfast consumers were paying rather less than those in Leicester. The minutes were passed.

At the meeting of the Dorking Urban District Council last Thursday, a letter was read from Mr. W. T. Pressland, on behalf of the Edmundson Electricity Corporation, Limited, making the following offer for the transfer of the Council's Electric Lighting Order: (1) The Council to have the approval of the site for the station, and (2) the power of purchasing the undertaking at a period of ten years by paying the capital expended *plus* 15 per cent.; (3) the repayment of all expenses incurred under the Order; and (4) private lighting to be charged on the maximum demand system—viz., 7d. per unit for the first hour, and 4d. after. Mr. Chalcraft considered that the Council ought to do something with their Order, which, he said, cost them about £200 or £300. He learnt that the Leatherhead Council had sold their Order for nearly £300. Let them either use the Order or transfer it to someone who would do so. Mr. Shearburn hoped, after paying a large sum to ensure themselves against another monopoly in the town, they would not be unwise enough to give up the reins. The Provisional Order was a cheap insurance against further monopoly. If they parted with it in the way Leatherhead had done, he felt sure they would have reason to regret it. He suggested the letter should lie on the table, and this was agreed to. Mr. White moved that the subject be referred to the General Purposes Committee.

Mr. A. Billson, M.P., is a member of the Select Committee who are considering three or four of the large electricity supply schemes now before Parliament, and he is also a member of the Halifax Chamber of Commerce. Being present at a recent meeting of the latter body when a communication was read from the Yorkshire Electric Power Company to the effect that they were promoting a Bill to supply electricity at a low price to Councils and others in the West Riding, Mr. Billson remarked that he was sure the Chamber would consider the matter to be of much importance. There were numerous schemes all over the country for supplying electricity in bulk. As he was on the Select Committee appointed to consider some of the Bills, he could say nothing with respect to them. It had been deemed desirable by Parliament, seeing that they represented a new departure, that the whole of the Bills should be referred to a Special Committee; so that they might take cognizance of the facts connected with all, and try to make what was called a Model Bill, upon the fashion of which other Bills could be founded. When this question was before the House of Commons, there was considerable opposition to the Bills from municipal corporations, on the ground that they were an attempt to interfere with what was the legitimate province of municipal enterprise. Mr. Ritchie then gave a definite assurance that in no case would a Bill be allowed a second reading, unless a clause was inserted that the company concerned should not interfere in any borough or urban area without the consent of the local authority. If this was carried out, a local authority would have ample power to prevent a new

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1545.

Issue.	Share	When ex Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 11	10½	Alliance & Dublin 10 p. c.	20—21	..	5 0 0
100,000	10	,,	7½	Do. 7 p. c.	13½—14½	..	5 3 5
500,000	100	Jan. 2	5	Australian 5 p. c. Deb.	102—104	..	4 16 2
200,000	5	May 16	5	Bombay, Ltd.	6—6½	..	4 12 4
40,000	5	,,	6	Do. New, £4 paid	4—4½	..	5 6 8
840,000	Stk.	Feb. 23	12	Brentford Consolidated	250—260	..	4 12 4
270,000	,,	,,	9	Do. New	185—190	..	4 14 9
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	Dec. 14	4	Do. 4 p. c. Deb.	118—123	..	3 5 1
220,000	Stk.	Mar. 14	11½	Brighton & Hove Orig.	235—240	..	4 15 10
226,320	,,	,,	8½	Do. A. Ord. Stk.	175—180	..	4 14 5
999,500	Stk.	Feb. 23	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Mar. 29	10	British	39—41	+½	4 17 7
50,000	10	Feb. 23	12	Bromley, Ord. 10 p. c.	24—26	..	4 12 4
79,000	III	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	May 16	6	Buenos Ayres (New) Ltd.	9—9½	..	6 6 4
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	100—102	..	3 18 5
150,000	20	Mar. 14	8½	Cagliari, Ltd.	24—26	..	6 6 11
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	14—15	..	5 6 8
50,000	50	May 2	6	Do. 6 p. c. 1st Mort.	55—57	..	5 5 3
550,000	Stk.	Apl. 11	13½	Commercial Old Stock	275—285	..	4 14 9
236,425	,,	,,	10½	Do. New do.	210—220	..	4 15 5
238,237	,,	Dec. 14	4½	Do. 4½ p. c. Deb.	141—144	..	3 2 6
600,000	Stk.	May 31	9	Continental Union, Ltd.	155—165*	..	5 9 1
200,000	,,	,,	7	Do. 7 p. c. Pref.	170—175*	−3	4 0 0
51,600	Stk.	Feb. 23	14	Croydon A 10 p. c.	335—340	..	4 2 4
173,100	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
555,000	Stk.	Feb. 23	5½	Crystal Palace Ord. 5 p. c.	116—120	..	4 7 6
60,000	,,	,,	5	Do. 5 p. c. Pref.	130—135	..	3 14 1
486,000	10	Jan. 26	11	European, Ltd.	19½—20½	..	5 7 4
354,000	10	,,	11	Do. £7 10s. paid	14½—15½	..	5 6 5
14,993,975	Stk.	Feb. 9	4⅞	Gas-light and Coke	4 p. c. Ord.	100—103	+1	4 15 1
2,600,000	,,	,,	3½		3½ p. c. max.	96—98	..	3 11 5
3,799,735	,,	,,	4		4 p. c. Con. Pref.	116—118	..	3 7 10
3,993,975	,,	Dec. 14	3		3 p. c. Con. Deb.	96—99	..	3 0 7
70,000	15	May 31	8	Hongkong & China, Ltd.	13½—14½*	..	5 10 4
2,800,000	Stk.	May 16	10	Imperial Continental	205—208	+1	4 16 2
473,800	Stk.	Feb. 9	3½	Do. 3½ p. c. Deb. Red.	100—103	..	3 8 0
75,000	5	Dec. 14	6	Malta & Medn., Ltd.	4¾—5¼	..	5 14 3
560,000	100	Apl. 2	5	Met. of Melbourne	5 p. c. Deb.	107—110	..	4 10 11
250,000	100	,,	4½		4½ p. c. Deb.	106—108	..	4 3 4
541,920	20	May 31	3½	Monte Video, Ltd.		10½—11½*	..	6 1 8
667,946	Stk.	Feb. 23	9½	Newc'tle & Gatesh'd Con.		215—220	..	4 4 1
299,355	Stk.	Dec. 29	8½	Do. 5½ p. c. Deb.		104—107	..	3 5 5
150,000	5	May 16	8	Oriental, Ltd.		7—7½	..	5 6 8
135,000	5	,,	8	Do. New, £4 10s. pd.		6¾—6¾	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.		1½—1¾	..	4 11 5

* Ex. div.

Issue.	Share	When ex Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment
£			p. c.	GAS COMPANIES.			£ s. d.
60,000	5	Feb. 23	7	Ottoman, Ltd.	5—5½	..	6 7 3
500,000	100	June 1	6	People's Gas of Chicago 2nd Mtg. Bonds	102—106*	..	5 13 2
851,070	10	Apl. 27	7	River Plate Ord.	10½—10¾	..	6 10 3
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	101—103	..	3 17 8
250,000	10	Apl. 11	8	San Paulo, Ltd.	11½—12½	..	6 8 0
135,000	Stk.	Mar. 14	10	Sheffield A.	245—247	..	4 1 0
209,053	,,	,,	10	Do. B.	244—246	..	4 1 4
447,427	,,	,,	10	Do. C.	244—246	..	4 1 4
5,600,000	Stk.	Feb. 23	5½	South Metrop., 4 p. c. Ord.	129—132	+2	4 0 9
1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb.	98—100	..	3 0 0
380,940	Stk.	May 16	5	Southampton Ord.	115—120	..	4 3 4
70,825	,,	Dec. 29	4	Do. 4 p. c. Deb.	120—125	..	3 4 0
120,000	Stk.	Mar. 14	6	Tottenham A. 5 p. c. and B. 3½ p. c.	120—125	..	4 16 0
250,520	,,	,,	4½		93—98	..	4 11 10
55,100	,,	Dec. 14	4	Edmonton 4 p. c. Deb.	113—117	..	3 8 5
182,380	10	Jan. 12	5	Tuscan, Ltd.	7—8	..	6 5 0
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.	101—104	..	4 16 2
				WATER COMPANIES.			
780,399	Stk.	Dec. 29	11	Chelsea, Ord.	303—308	−2	3 11 5
150,000	,,	,,	5	Do. 5 p. c. Pref.	157—162	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	145—150	..	3 0 0
175,785	,,	Mar. 29	4½	Do. 4½ p. c. Deb.	145—150	..	3 0 0
1,720,560	Stk.	Apl. 11	7	East London, Ord.	190—195	..	3 11 10
654,740	,,	Dec. 29	4½	Do. 4½ p. c. Deb.	145—150	..	3 0 0
890,000	,,	,,	8	Do. 8 p. c. Deb.	99—101	..	2 19 5
700,000	50	Dec. 14	7½	Grand Junction 10 p. c. max.	104—107	..	3 10 1
310,000	Stk.	Mar. 29	4		4 p. c. Deb.	130—135	..	2 19 3
708,000	Stk.	Feb. 23	14	Kent	307—312	..	4 9 9
160,000	,,	,,	7	Do. New, 7 p. c. max.	200—210	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.	290—295	..	3 11 2
406,200	100	,,	8	Do. 7½ p. c. max.	207—212	..	3 15 6
850,000	Stk.	Mar. 29	4	Do. 4 p. c. Deb.	130—133	..	3 0 2
500,000	100	Feb. 23	13½	New River, New Shares	418—423	+1	3 3 10
1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb.	132—137	..	2 18 5
902,300	Stk.	Dec. 14	7½	South-wark and Vauxhall	Ord.	197—202	+2	3 14 3
126,500	100	,,	7½		7½ p. c. max.	185—190	..	3 18 11
489,200	Stk.	,,	5		5 p. c. Pref.	160—165	..	3 0 7
1,019,585	,,	Apl. 11	4		4 p. c. A Deb.	129—134	..	2 19 9
1,155,066	Stk.	Dec. 14	10	West Middlesex		285—290	..	3 9 0
200,000	,,	,,	4½	Do. 4½ p. c. Deb.		147—152	..	2 19 3
200,000	,,	Mar. 14	8	Do. 8 p. c. Deb.		99—101	..	2 19 5

*Ex div.

scheme from coming into existence, so far as they were concerned. On the other hand, it was urged with considerable force that the manufacture of a vast supply of electricity must, on the whole, be good for the country, just as, if they found some mechanical substitute for water, they would contend that they must adopt the manufacture of it to the greatest extent possible, so that, if towns were short of the natural supply, they might take up the artificial supply. It was argued that, if town authorities should fail to produce power as cheaply as it was produced outside, it would injure no one if, outside their own boundaries, there was a source from which they could take a cheap supply of electric power and furnish it to manufacturers to work their machinery. The matter was in the balance now, and he had no doubt that, before this Yorkshire Bill came on, both that Chamber and the Town Council would take pains to see the bearings of the subject and consider whether, on the one hand, the enterprise of the Corporation, which was so successfully working electricity, would be interfered with by a company coming in from outside, and whether, on the other hand, manufacturers were likely to have anything to complain of because the Corporation did not carry on the work with proper vigour. The communication was referred to the General Purposes Committee.

THE POSITION OF THE WATER SUPPLY OF MANCHESTER.

A report has been prepared by the Water Committee of the Manchester Corporation, in which they state that, in view of the large increase in the consumption of water during the last few years, they are somewhat alarmed at the possibility in the near future of the supply being short of the demand. They cannot, they say, put away from their minds the conviction that the public generally have the idea that Thirlmere will afford an exhaustless supply for all time; and this has led, if not to actual waste, at least to a very excessive increase in the consumption; and they desire, if possible, to remove this false impression. From every source, so far as they are at present aware, there is an available quantity of 25 million gallons per day from Longdendale, and there will be 50 million gallons per day from Thirlmere when the works are completed, though this is not absolutely certain, but simply the nearest estimate of the maximum supply that can be obtained, making 75 million gallons per day. Looking at the increase in the consumption during the last ten years, and then during the last five years, the question is how long the whole quantity of water at the Committee's disposal will last before it is overtaken by the consumption. The consumption at the present time is practically 32 million gallons per day; and the increase during the last ten years has been at the rate of above a million gallons per day per annum. Taking into consideration the progressive increase in the population supplied, and in the demand for water, upon the same basis as at present—that is, increase upon increase—the Committee are of opinion that, at the rate of consumption stated, the whole 75 million gallons per day is likely to be overtaken in about 35 years. They therefore feel it their duty to make this emphatic statement, so that all citizens and consumers may realize their personal responsibility for the proper and moderate use of the water. The Committee also suggest that the Council should authorize them to take immediate steps in reference to the laying of another pipe from Thirlmere.

OPENING OF NEW WATER-WORKS FOR PENMAENMAWR.

Last Wednesday, in the presence of a large number of spectators, the new water-works which have recently been completed for the Urban District Council of Penmaenmawr, from the designs of Messrs. Wood and Brodie, of Liverpool, and under the supervision of the present Chairman of the Council (Mr. Coverley) and the District Surveyor (Mr. E. Worrall), were formally opened by Mr. Charles H. Darbishire. It is some 33 years since Penmaenmawr entered upon a scheme of water supply. At that time the resident population was about 1000, while the visitors were few. The subsequent relatively large growth of population, and the increasing popularity of the town as a health and pleasure resort, have necessitated additions to the old storage capacity of about 100,000 gallons, which was gathered from Cwm Graiglwyd and two smaller subsidiary sources of supply. In the year 1891, an Act was obtained by the Dwygyfylchi Local Board to carry out a new water scheme; and out of several competitive plans, that now completed was decided upon. The carrying of this scheme into effect has involved the re-piping of the central and west portions of the district, the construction of a service reservoir of 100,000 gallons capacity, and an overflow-pipe therefrom to the old reservoir, mains from these to the source of supply, and the excavation and construction of the large reservoir, with its feeders and overflow. As the heights above the sea of the service-tank and the reservoir are respectively 540 and 1070 feet, it is obvious that the water will be distributed under a high and constant pressure. The tank is constructed of cement concrete, with local stone dressing, and covered with iron girders and concrete. It measures internally 30 feet square and 8 feet deep, and stores three days' supply. The large reservoir has a capacity of a million gallons. The varying water-level (7 feet) between the main reservoir and the higher feed reservoir is balanced by an automatic valve, so adjusted as to admit only as much water as is needed to keep the large reservoir full. Adequate precautions have been taken to cope with the heavy sudden rainfall which occurs sometimes in the winter season. Analysis shows that the water is of unsurpassed purity, and there is not a single habitation within the catchment area of the supply, which is the property and under the sole control of the District Council. The whole cost of the scheme is within £13,100.

A first installation of a Thwaite plant for the utilization of the waste gases of blast-furnaces for driving gas-engines has just been put in operation at the works of the Société des Fers et Aciers Robert, at Outreau, near Boulogne. It is stated that the Company intend to eventually extend the plant to a capacity equal to 2000-horse power.

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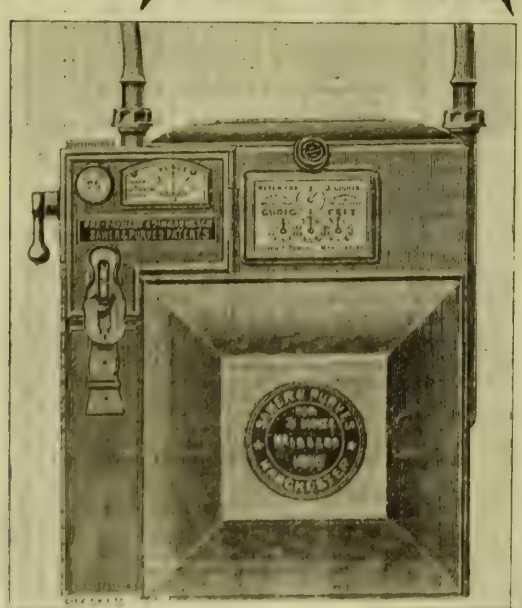
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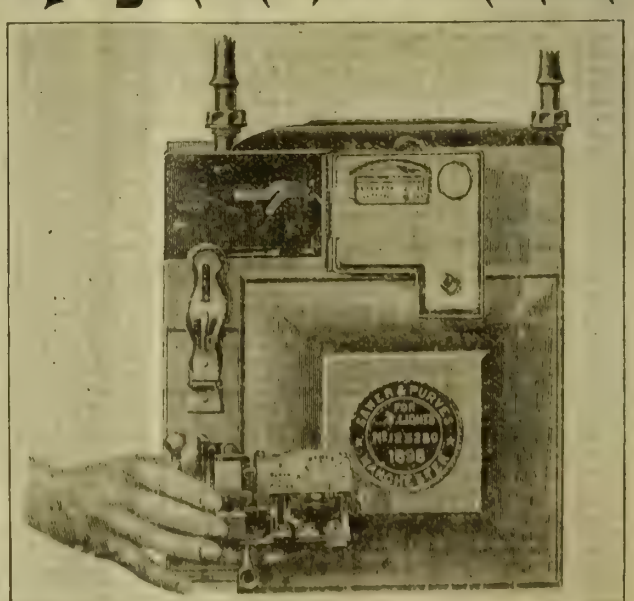
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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The contract for the first section of the new Provan gas-works has been let by the Gas Committee of the Glasgow Corporation to Messrs. Robert M'Alpine and Sons, of Glasgow—the well-known railway contractors. The work which has been let is for the erection of a retort-house, coal-stores, purifier-house, lime-stores, boiler-house, station-meter house, exhauster-house, offices, workshops, limekilns, railway works, and two tanks for gas-holders of 8½ million cubic feet capacity each. The contract price is £171,756 13s. 4d. All the work is to be completed within two years. The holders and other plant are estimated to cost a further sum of at least £150,000. No part of this has yet been contracted for. It will thus be about 1904 before the relief which the new works will afford to the gas undertaking will be available. That time will be eagerly looked forward to, because at the present rate of progress of the gas consumption Mr. Foulis and his assistants will be hard put to by then to meet the demand.

That which Mr. W. Ewing, of Hamilton, mentioned at the Informal Meeting in Glasgow in April as possible—viz., that he would be able to continue to sell gas at the same price—has happened. On Thursday, at a meeting of the Town Council, the Gas Committee's report, among other things, recommended that £1200 should be set aside for depreciation; that a balance of £36 should be carried forward; and that the price of gas be continued at 2s. 1d. per 1000 cubic feet. Mr. Ewing had recommended a reduction of 1½d. in the price of gas; but the Committee did not adopt his view. Bailie M'Hale, the Convener of the Gas Committee, in moving the adoption of the report, said he thought the Council would agree with him when he said that it was a very satisfactory state of affairs that the Gas Committee should be in a position to recommend the continuance of the present low price, in face of the great increase, not only in the cost of coal, but of all materials used in the gas-works. As they would observe from the report, the Gas Manager recommended a reduction, in his usual optimistic style, of 1½d. per 1000 cubic feet. Although he believed it would have been a mistake to make such a reduction, still he was of opinion that it could have been done with safety. Last year the Manager's forecast was higher; and that it was not realized was owing to two or three circumstances which were not likely to arise during the coming year. One of these circumstances was the fact that they had to pay rates for two years; and they had also what might be called a spring cleaning of all bad debts. These things were not likely to happen again during the present year. A question was put as to the basis upon which the £1200 for depreciation was fixed; and Bailie M'Hale replied that it was a more ample provision than was usually made. Treasurer Keith moved that the price of gas be raised by 2½d. per 1000 cubic feet. He did so, he said, as a protest against the bad financial management of the gas undertaking. The works belonged to the town; and they should be managed so as to produce a fat balance. He thought that £36 was sailing too near the wind. The Council, by ten votes to four, adopted the recommendations of the Committee. Mr. Keith apparently wants a fat balance in the gas undertaking in order that he may use it for other purposes. Those in charge of the works do well to resist any such attempt. As to depreciation, the total capital is only £35,500, for an annual output of 160 million cubic feet of gas. Taking this £1200 as being in reality sinking fund, it is sufficient to wipe off the whole of the capital in less than twenty years. I have not calculated the time; but on account of the interest charge getting less year by year, it must be so. The provision is thus quite ample. A balance of £36 is not much; but it is of the essence of good management to make as little profit as possible, after meeting all necessary charges. It would better become Mr. Keith if he were to give credit to the management of the gas undertaking, rather than to endeavour to depreciate it, for there are no works in the country where better results are obtained.

The accounts of the Dundee Gas Commission for the year ending April 30 have been issued. They show that the estimated revenue was £104,109; while the actual receipts amounted to £106,119—an excess of £2009 over the estimate. It was calculated that the expenditure would amount to £103,540; and the actual expenditure has been £107,598—an excess of £4058 over the estimate, and £1479 more than the income for the year. The details of the revenue are: Balance, £3006; gas, £90,279; chemical products, £10,424; coke, £2279; coal waggon revenue, £128; transfer fees (debenture stock), 12s. 6d. The expenditure was made up as follows: Coal, £58,811 (£3171 above the estimate); purifying, £1383; main-pipe repairs, £1514; service-pipe repairs, £971; repairs to buildings, £700; gas apparatus (tools, &c.), £1645; retorts and setting, £1664; meter repairs, £2405; fuel, £1288; refuse, £1302 (£750 over estimate); water, £437; interest account, £6162 (£637 under estimate); expense of loans, £56; annuities, £6825; assessments, £5341; rents, £482; salaries, £2958; stationery, £255; general expenses, £444; coal analysis, £444; sinking fund, £7500; contingent fund, £1000; suspense account, £4000. The sums paid into the sinking fund amounted to £179,128, applied as follows: In payment to the Dundee New Gas Company, beyond what the Commissioners were bound to pay on getting a corresponding deduction from the annuities, £6269; annuities redeemed, £1967 (the actual cost being £58,556); mortgages redeemed, £40,750; loans redeemed, £10,000; cash in bank, £63,552. The capital account shows the sum expended at last balance to be £233,819, and amount spent during the year £5794; making a total of £239,613. The quantity of gas delivered during the year ended April 30 was 622,304,000 cubic feet. The total quantity sold was 564,456,000 cubic feet, realizing £94,268, from which had to be deducted discount and bad debts, amounting to £4088, reducing the amount realized to about £90,200. At the works the amount of gas consumed was 7,109,900 cubic feet; leaving 50,738,100 feet, equal to 8·153 per cent., unaccounted for. The quantity of gas delivered was in excess of that in any previous year, and exceeded that of 1898 by 16,992,500 cubic feet. The gas-stove account shows the amount expended up to this year to be £5092, and the sum received from the sale of stoves to consumers £1832; leaving a balance of £2912. The Gas Committee have considered the report, and the estimates for the current year which have been prepared by the Engineer and Manager (Mr. W. M'Crae). A rise in the price of gas of 5d. or 6d. per 1000 cubic feet is spoken of; but no resolution on the subject has yet been arrived

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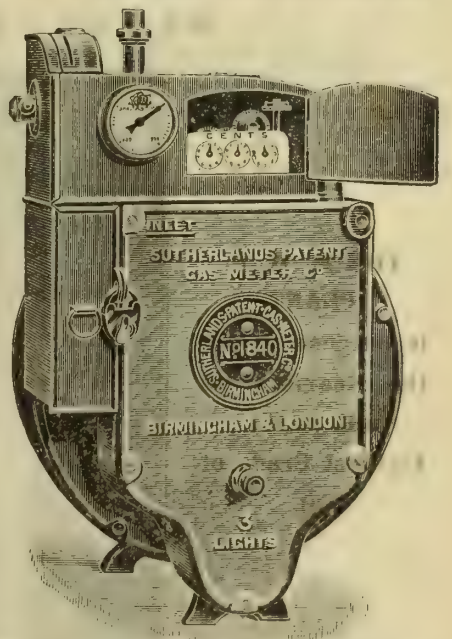
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at. The accounts are eminently satisfactory, and show an exceedingly prosperous business. No better management could be desired; but in this, as in the Water Department, the management is hampered by heavy financial liabilities, which have been handed down by a former generation of public men. Nothing helps a manager like a low capital account. I am afraid it will be a long time before that is reached in Dundee; and that, therefore, working results, although in every way most excellent, will not look so well as they appear in some places.

The Gas Commissioners of Dunfermline have closed their financial year better than was anticipated some time ago. At this time last year, under panic arising from the fact that the accounts for 1898-99 had closed with a deficit of about £60, the Commissioners raised the price of gas by 3d. per 1000 cubic feet. They have overdone the remedy, which is not an unusual experience; for the year just closed has ended with a surplus of £1500. It was feared, before the balance was struck, that owing to the increase in the price of coal, it would be necessary to raise the price of gas by 5d. or 6d. per 1000 cubic feet; and it is therefore a sort of relief to find that the increase which will be necessary is only 2d. per 1000 cubic feet. This information is conveyed by a letter from Mr. H. Pooley, the Engineer, to the Convener of his Committee. In it he estimates that, with gas at the same prices as at present—3s. 2d. per 1000 cubic feet to ordinary, and 3s. 9d. to differential consumers—allowing for an increase of 4 per cent. in the quantity made, and also allowing a fair value for residuals, there would be a loss of £555 upon the current year. He proposes to raise both classes by 2d.; and as regards consumers who have prepayment meters, seeing that the price to them was not raised last year, he proposes to make an increase of 5d. —making the price 4s. 7d. per 1000 cubic feet. In order to effect this, his suggestion is that the mechanism of the meters be altered so as to give 17 cubic feet for a penny; but as this gives a yield of 4s. 11d., the difference between that sum and 4s. 7d. is to be returned to the consumers. These increases will, he estimates, produce £754; and there should then be a surplus of about £200. The Committee have agreed to recommend the adoption of Mr. Pooley's proposals.

The Stevenston (Ayrshire) Gas Company, Limited, during the past year sold 2,933,400 cubic feet of gas, and had a revenue of £806, of which £263 was profit. Adding the balance brought forward, the sum at the credit of profit and loss account was £281. A dividend at the rate of 5 per cent. has been paid, and £161 carried forwad. The output of gas showed a considerable increase, and unaccounted-for gas is getting less; but it is still higher than is desirable, being 21·68 per cent. In regions where coal working exists, it is difficult to keep down this figure in the balance-sheet; and I have no doubt but that the Manager (Mr. W. Ward) has his eye upon it. That the Company is in good hands is shown by the fact that the price of gas is retained at 5s. per 1000 cubic feet.

Mr. W. Blair, since he was appointed Manager of the Helensburgh Corporation gas undertaking, has made it vibrate with increased vitality. The first annual statement of accounts was submitted at a meeting of the Corporation last Saturday, by Bailie Bryden, the Treasurer. He said that the capital expenditure amounted to £32,885. The experience of the works and working during the past year had amply justified the price (£31,115) which had been paid for the undertaking. It was believed to be the cheapest transfer on record within recent years, and worked out at 18s. 1½d. per 1000 cubic feet of gas sold. The revenue receipts amounted to £10,255, and the expenditure to £6807, leaving a surplus of £3446. This balance had exceeded their expectations. The gas sold amounted to 37 million cubic feet, being 3 millions in excess of the previous year. The make was only 1½ millions extra; but they had reduced the waste from 19 to 15 per cent., which represented another 1½ millions. The net cost per 1000 cubic feet of gas, inclusive of sinking fund and interest, was 3s. 8¾d. The Committee recommended that the old rates for gas be continued—viz., general consumers 4s. 7d. per 1000 cubic feet, stoves and public lamps 3s. 9d. Provost Anderson moved the approval of the reports and recommendations, which were unanimously agreed to.

On the 31st ult., the new gasholder which has been for some time in course of construction at the works of the Saltcoats Gas Company was formally completed, and the ceremony of turning the gas on to the town was performed. This is the fifth holder erected by the Company; the first—a very small one—having been put up when the works started in 1836. The second was constructed in 1849, and had a capacity of 10,884 cubic feet; the annual make of gas being then 843,000 cubic feet. The third was completed in 1874; its capacity being 22,000 cubic feet, and the annual make of gas about 3½ millions. The fourth, for 50,000 cubic feet, was put up in 1884, when the make had risen to 9 millions. The latest addition to the holders will contain 133,000 cubic feet of gas; and the annual make is now about 20¾ millions. The tank is 70 feet in diameter and 20 ft. 6 in. deep; and the holder rises nearly twice that height. When fully inflated, it will weigh about 46 tons. It has been constructed by the Barrowfield Iron-Works, Limited, under the superintendence of Mr. J. Napier Myers, the Gas Company's Manager. The inaugural ceremony was performed by the Chairman of the Company (Mr. R. L. M'Alpine), in the presence of the Directors and officers; Mr. Laidlaw, of Stevenston, and his brother, Mr. Porteous Laidlaw, being in attendance as representatives of the Contractors.

Kelso is badly off for water, notwithstanding that it stands on the banks of the Tweed. The Burgh Commissioners have been engaged for years in searching for an augmentation of the supply, and have met with more than one disappointment. The latest is announced this week. They were in hopes that they would get water from the farm of Ladyrig, situated on the property of George Watson's Hospital, of Edinburgh. They had even gone the length of receiving estimates for the work; but it is now announced that, in consequence of the attitude taken up by certain interested parties, the trustees of the Hospital have declined to conclude an agreement for the supply of the water. The Commissioners are to apply to the Sheriff for powers to put in force the Lands Clauses Acts with a view to compulsory purchase of the necessary lands.

An installation of the Kitson light is now to be seen at the premises of Mr. J. D. Wilson, of Richmond Road, Bradford, who is the agent for the Kitson Lighting and Heating Syndicate, Limited, in that district.

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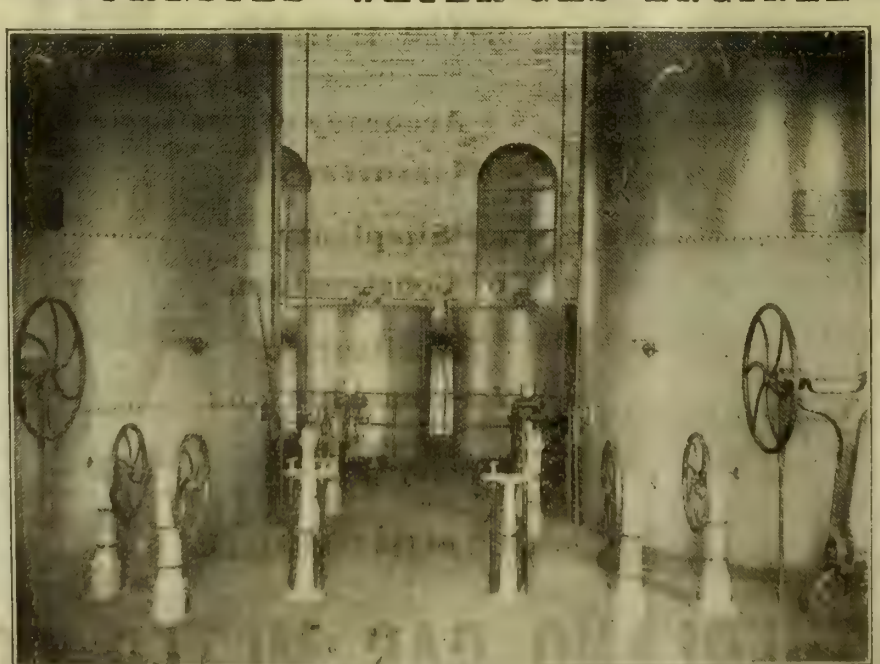
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CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *June* 9.

Sulphate of Ammonia.—There has been a very quiet market throughout the week; and prices have again declined slightly—the closing quotations being £11 3s. 9d. to £11 6s. 3d. per ton, delivered f.o.b. at the ports. There is nowhere any great pressure to sell; stocks being light, and production nearing its minimum. But buyers are, as far as possible, delaying further purchasing, with the object of depressing values; and they are finding some encouragement in speculative quotations below makers' prices. Exports are well sustained; but deliveries are largely against contracts made in advance. There is good inquiry for July-August delivery; but in this position makers still quote £11 10s. per ton, whereas buyers' views are about 5s. per ton less. There is practically no interest in later deliveries.

Nitrate of Soda is again easier; the spot quotations being 8s. per cwt. for ordinary, and 8s. 4½d. for fine, quality. The forward position is neglected.

LONDON, *June* 9.

Tar Products.—Contrary to expectations, creosote and tar oils continue to fall in value as the season advances; and the position is made worse by dealers having sold contracts which they are now endeavouring to cover by offering low prices. Ordinary benzol is dull; but for qualities suitable for gas enrichment, there is more inquiry, especially for next season's delivery. There is no change for the better in naphthas, which remain about the same value. Carbolic acid is steady, notwithstanding the efforts to bring the price down. Makers hold no stocks; and so long as crystals command 1s. per lb., there is no reason for crude selling at less than the price quoted below. Some business is being done in anthracene; and the reported formation of an Alizarine Convention is much discussed, especially in respect to its bearing on anthracene.

The week's values are (about): Tar, 17s. 6d. to 28s. Pitch, east coast, 37s.; west coast, 34s. Benzols, 90's, 7½d.; special qualities for gas, 9½d.; 50's, 11d. Toluol, 1s. 2½d. Solvent naphtha, 1s. 1½d. Crude naphtha, 3¾d. Heavy naphtha, 1s. Creosote, 2¼d. Heavy oils, 3d. Carbolic acid, 50's, 2s. 2d.; 60's, 2s. 8d. Naphthalene salts, drained, 33s.; pressed, 70s. Anthracene, "A," 4d.; "B," 2¾d.

Sulphate of Ammonia is very inactive. Inquiries appear to have died off; and although many makers sold considerable quantities during the late spurt, there are still some pressing sellers. Fortunately, the make is slacking off; and production is nearly at its minimum. To-day's average value is £11 2s. 6d. to £11 5s. per ton, less 3½ per cent.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—During the past week there has been very little business stirring here, owing to the holiday stoppages at works and mills; and with regard to the general position, it can only be said that a strong tone is maintained for all descriptions of fuel. On further gas coal contracts that have been placed, the full advance of 5s. per ton over last year's rates has been secured. For house coals the demand, which has so far been pretty brisk for the time of the year, will necessarily show a falling off; but stocks are so low that collieries would be glad to be able to put something down to meet next winter's requirements, and there is little probability of any giving way in prices, which are firm at recent best rates. Steam and forge coals continue in pressing request, and strong in price; and the demand for slack shows no diminution, with the position of local collieries strengthened owing to the lessened competition from some of the outside districts, and their prices well maintained on the recent basis. The shipping trade has shown signs of increased animation, both in steam and house-fire qualities. Coke is strong at the full rates last given. At the pit, house coal ranges from 13s. and 13s. 6d. per ton for common to 14s. 6d. and 15s. 6d. for the better qualities, steam and forge coal is about 13s., and slack from 10s. 6d. to 11s. 6d. according to quality. Delivered at the Mersey ports, unscreened steam coal is quoted at 14s. 6d. per ton, and screened qualities at 15s. 3d., with house-fire coals from about 15s. 6d. for seconds to 16s. and 16s. 6d. for the better descriptions.

Northern Coal Trade.—The holidays last week were protracted, so that there has been rather a stiffening of the prices of some kinds of coal, though the demand is now at its summer level. The normal production has now been returned to; and there is a more regular shipment. Best Northumbrian steam coals are quoted at from 17s. 6d. to 18s. per ton f.o.b., second-class steam coals are about 9d. per ton below the prices just quoted, and steam smalls are 12s. 6d. to 13s. The gas coal trade shows that the summer low consumption has now been reached in the local demand; but there is a large export of gas coals, and the quantity that is being sent to the South is very full for the present season. For occasional cargoes of gas coals, the price is steady at 16s. 6d. to 17s. per ton f.o.b.; and for contracts, best Durham gas coals are still about equal to 16s. In coke, the demand is full, and the supplies are well taken up. Best Durham coke commands 33s. to 35s. per ton f.o.b. Gas coke shows no change of moment.

Scotch Coal Trade.—The market continues very strong. It is reported that the miners and their employers are likely to come to terms as regards working hours, on the basis of the masters conceding an eight-hour day and the men agreeing to work eleven days a fortnight. Should this be realized, the output will be assured; and this will be the most effective check upon prices. Of late, there has been some restriction of the output, and the tendency in the meantime is to slightly higher prices. The quotations are: Main 14s. to 14s. 3d. per ton f.o.b. Glasgow, ell 16s. to 17s., and splint 15s. 9d. to 16s. The shipments for the week amounted to 228,367 tons—a decrease of 3550 tons upon the previous week, but an increase of 54,934 tons upon the corresponding week of last year. For the year to date, the total shipments have been 4,245,752 tons—an increase of 851,390 tons upon the same period of last year.

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SULPHATE OF AMMONIA PLANTS.

The Danger of Blowing Out the Gas.—A Devonshire farmer named Robert Chaning, who lived near Tiverton, went to Bath on the 1st inst. to take the waters. Next morning he was found nearly suffocated by gas—the burner in his bedroom being turned on; and he died last Tuesday. His relatives say that he was unaccustomed to gas, and there is every reason to suppose that he blew it out. At the inquest, a verdict of "Death from gas poisoning" was returned.

Three Persons Injured in a Gas Explosion.—A serious gas explosion occurred at the Sunbeam Hotel, Crook, yesterday week. One room was wrecked; and Mrs. Sherrington, the landlady, and her daughter, were buried in the *débris*. They were quickly rescued, when it was found that Mrs. Sherrington had one leg broken and an ankle dislocated, while her daughter sustained a severe shock to the system. A young man named James West, who was standing in the doorway, had his right arm severely hurt. How the explosion occurred is a mystery, for the hotel is lighted by oil lamps. The road was being mended close at hand; and it is surmised that the gas escaping here found entrance through the foundations of the hotel.

Sales of Shares.—Last Wednesday, at Consett, Mr. John S. Murray offered for sale £6000 of new ordinary £10 shares in the Shotley Bridge and Consett District Gas Company. The shares, which are limited to a 5 per cent. dividend, realized £10 5s. to £10 10s. each; and the whole parcel was sold in less than half-an-hour. On the following day, Mr. Wilson Tickle sold 400 £10 shares in the Bognor Water Company; being a portion of the additional capital authorized by the Bognor Water Act, 1891, to provide means for the extension of the Company's works. The prices realized ranged from £11 2s. 6d. to £11 15s. each. At a recent sale at Norwich, 18 new ordinary shares of £10 each in the Yarmouth Water Company were sold for £11 15s. each.

Tonbridge Water-Works Company, Limited.—The 48th annual meeting of this Company was held at the Central Hall, Tonbridge, last Thursday—Mr. J. Fagg in the chair. The Directors' report showed that the financial position of the Company was very satisfactory; and dividends at the rates of 9 and 6½ per cent. per annum on the original and additional shares were recommended. The Chairman, in moving the adoption of the report, said the past year had been an eventful one in the history of the Company. The Directors felt they needed further powers, more land and water, and additional capital, in order to meet the demands made upon them, as all their capital had been expended and their borrowing powers exhausted. This necessitated an application to the Board of Trade; and, in consequence of the opposition of the Urban District Council, an inquiry was held with very satisfactory results for the Company. The Directors had arranged for the purchase of the "Race-course" meadows, adjoining the pumping-station, which would not only be a protective zone, but would also yield an increased supply of water. A new bridge had been constructed over the Medway; the steam-boilers had been replaced by two new steel (Galloway) boilers of increased power; and all the pumping plant was in excellent working order. The report was adopted. A very hearty vote of thanks was accorded to the Chairman and Directors, as well as to the Engineer and Manager (Mr. James Lees), for their services.

Exeter Water Supply.—A statement of the accounts of the water-works presented to the Exeter City Council last Wednesday showed that with an increasing revenue there is a decreasing balance of profit available for distribution. After payment of all the charges, including interest and sinking fund, a balance of £948 was shown on the year's working. The Water Committee recommended that £100 be set aside for depreciation, and the balance paid to the district fund account towards the reduction of the rates. This balance is £213 lower than the sum available in aid of the rates last year, and that was £464 less than was paid in 1898. There has thus been a decrease in two years of 44 per cent. in the net profit, which, it was explained, is due to the extra amount paid for coal for pumping. The works were reported to be in good order, and the quality and quantity of the water supplied have been uniformly satisfactory.

Cockermouth Gas Supply.—At the last meeting of the Cockermouth District Council, the report of the Gas Committee was presented. The balance-sheet showed that, after paying £569 interest, and providing £369 for the reduction of the debt, the surplus profit for the year was £31; and the Committee recommended that this should be carried forward. The Manager (Mr. H. Baker) reported that, though the profits were small, the year had been a perfectly satisfactory one. New consumers had been supplied, and the works improved and kept in good repair. Mr. Mitchell, in moving the adoption of the report, said that, in addition to the reserve fund, amounting to a little over £800, there was a balance of £1611. The estimated expenditure for the ensuing year on repairs, &c., would exceed £250; and this would come out of the balance. They expected that the expenditure for coal would amount to £200 more this year than it did last; and it looked to him very much as if the balance would be reduced to £1150 or £1200. They had not, however, thought about making any difference in the price of gas. The report was adopted.

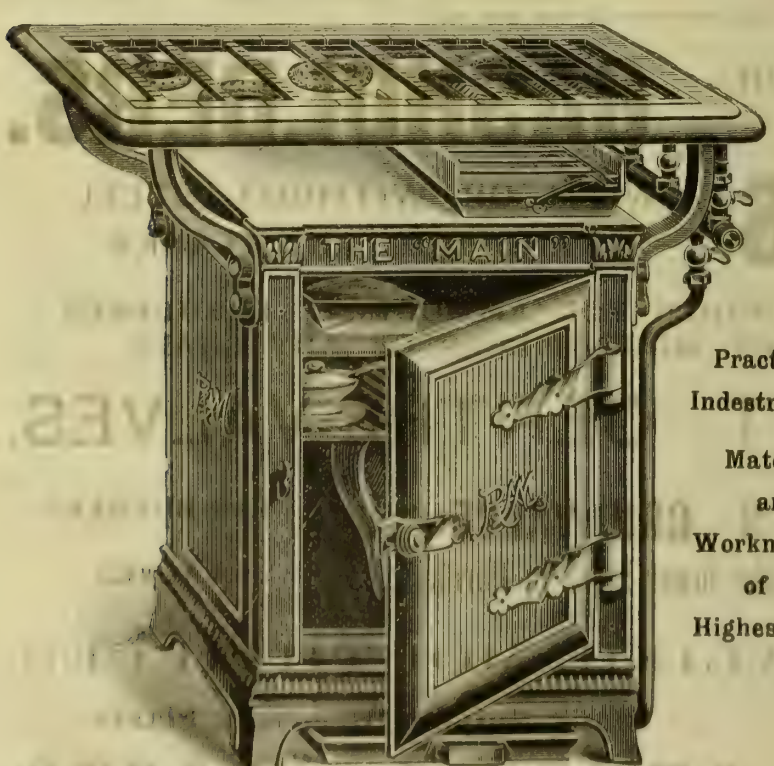
The Quality of the West Surrey Water Company's Supply.—A conference of delegates from various public bodies in the district was recently held in the Council Room, Weybridge, to consider the question of the quality of the water supplied by the West Surrey Water Company. The report of the proceedings was submitted at the meeting of the Weybridge District Council last Wednesday. In the course thereof, it was stated that Dr. Graham gave a review of the chemical and bacteriological examinations of the water supplied by the Company, and particulars of the steps taken by the Weybridge Council to secure a pure supply, and proposed "That, in the opinion of this conference, the water supplied by the West Surrey Water Company is not at all times of the purity demanded by section 35 of the Water-Works Clauses Act, 1847; and the necessity of continuous purity should be impressed upon the Water Company." The resolution was carried unanimously. It was also proposed by Dr. Graham that a request be sent to the Directors that they should receive a deputation from the conference to point out the views held by the Councils of the district supplied by the Company as to the necessity of improvement in the quality of the water. This motion was also carried unanimously. The Council proceeded to consider the report, and eventually it was accepted, with thanks to the delegates.

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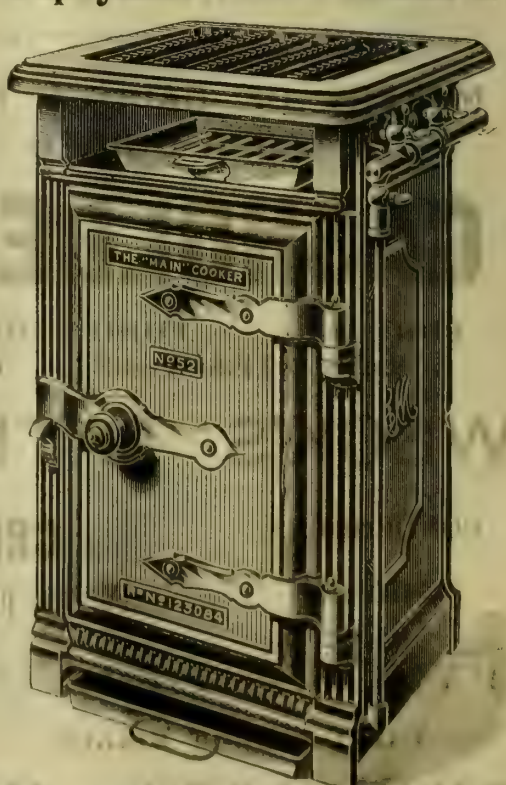


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Failure of the Gas Supply at Hungerford.—On the night of the 2nd inst., the tradesmen and residents of Hungerford were subjected to much inconvenience owing to the supply of gas failing, and lamps and candles had to be resorted to. It was found that water had got into the main in Bridge Street, and men were set to work to remedy the trouble; but when matters were put right, it was too late to be of much service to tradesmen.

The Grouping of Gas Accounts at Bradford.—Last Friday, the Gas Committee of the Bradford Corporation discussed at some length the question of the grouping of gas accounts, which (as already noticed) has given rise to a mild agitation among the property owners. As a result of the discussion, it was decided that the resolution passed by the Sub-Committee proposing to abolish the grouping of gas accounts, should be rescinded, and that the Chairman of the Committee (Alderman Aykroyd) should be asked to withdraw the matter at the Council meeting to-day.

Darlington Town Council and Carburetted Water Gas.—The Darlington Town Council last Thursday authorized a deputation from the Gas Committee to visit several towns in the South of England, with a view to gaining all the information they could regarding carburetted water gas prior to its introduction to the town. Alderman T. M. Barron said the Committee, before committing the town to a cost of £30,000 for a new gasholder, which was needed, should ascertain if they could secure carburetted water-gas plant for (say) £7000, which would be a great saving to the town.

Breaking Public Lamps at Lancaster.—At the last meeting of the Lancaster Town Council, Mr. Jackson, in moving the confirmation of the minutes of the Lighting Committee, stated that the report of the Chief Constable was of great importance. During the quarter no less than 166 lamps had been reported broken. This was a very serious matter for the Corporation. Recently some sixteen boys and young men had been proceeded against for breaking lamps, and the Magistrates had inflicted fines amounting to £8 10s. Therefore it looked as though the Bench considered it a serious matter. The police were looking sharply after offenders, and he believed the Magistrates would deal severely with them. Alderman Smith suggested that if, instead of fining the lads, the Bench ordered them to be thrashed, the mischief would be all the sooner stopped.

Proposed Purchase of the Hartlepool Gas and Water Works by the Corporation.—At the meeting of the Hartlepool Town Council last Wednesday, a proposal was submitted by the Mayor (Alderman Horsley) for the appointment of a Committee to confer with the West Hartlepool Corporation as to the advisability of purchasing the undertakings of the Hartlepool Gas and Water Company. The West Hartlepool Corporation, he remarked, were preparing a Bill with the view of purchasing the works; and it was only fair that Hartlepool should have some voice in the matter. If they could obtain the undertaking at a fair price, he thought it would be a good paying investment so far as the Corporation were concerned. The gas and water supply should be under their own control. The West Hartlepool Corporation, he explained, were contemplating the appointment of a similar Committee to confer with them. The motion was adopted.

The Belfast Corporation's Gas Coal Contracts.—At the last monthly meeting of the Belfast County Borough Council, the minutes presented by the Gas Committee contained the offers received for the coal supply. In moving their adoption, Mr. Young remarked that, owing to the rise in the price of coal, the result of the orders given would be an additional expenditure of some £25,000, while the increase in the price of oil would mean an additional £15,000 or £17,000. The reason for mentioning the matter was that he was afraid, unless something turned up in the meantime, it would be necessary to do what had been done in a great many cities across the water—viz., increase the price of gas. The Gas Committee would endeavour to prevent this taking place; but they hoped the other Committees who were spending Committees would assist them, and not ask them to supply money out of the surplus, so that the public might have the benefit of cheap gas. Alderman Dempsey said he did not think the present was a judicious time to enter into another large coal contract. It was said that the war was over, and war prices, of course, would fall. Yet the Committee had bought as much coal as would last for eighteen months. Mr. Young said the Committee had done the best they could, acting under advice, not only from their own officials, but those of other cities and towns, as to the purchase of coal, even at the increased price of 5s. per ton. He pointed out that other corporations had paid higher prices than they had. The minutes were passed.

The Price of Gas at Fenton.—The minutes presented by the Gas Committee at the last meeting of the Fenton District Council recorded the fact that a proposal had been made in Committee that the price of gas should be 3s. 6d. per 1000 cubic feet, with 2d. per 1000 cubic feet discount, and for prepayment meters 3s. 4d. as from July 1 next. However, an amendment was passed deferring the consideration of the matter until the September quarter. On the minutes being submitted, Mr. Hopwood said he had heard that there had been a difference of opinion in Committee; and he believed it would be acceptable if the date in the original motion was altered to Oct. 1. Mr. J. Shenton said he regretted the advance should have to be recommended; but the fact was they could not do without it. With the proposed increase, the extra income estimated would be £1571; but they would have extra expenditure amounting to £1666, and still be £100 on the wrong side. Circumstances had also transpired which made it quite possible, indeed probable—that the existing contracts for the supply of 5000 tons of coal might be determined at any time. There were difficulties ahead of the colliery companies, which might prevent them fulfilling their contracts; and if they did, the extra expenditure would be almost £2200. It was a fact that for nearly two years they had been selling each 1000 cubic feet of gas to large consumers at absolutely less than it cost to produce; and if the price remained at 3s., they would still be disposing of gas at a loss. Why should they go on selling an article belonging to the ratepayers at less than its market value? In his opinion, it was most unjust to do this; and while he was indifferent whether he retained the chairmanship of the Committee or not, if the Committee would agree to a fair price for gas, he was willing to stick to the boat. But if not, he would not be a party to continuing a system which was manifestly unfair and unjust. The Chairman said the matter would have to be determined by the Committee.

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Belfast Corporation Gas Supply.—At the meeting of the Gas Committee of the Belfast Corporation last Friday, a good deal of discussion took place in regard to whether meters should be allowed to remain on premises where the occupiers are not taking a supply of gas; and, if so, on what terms. This applies especially to mills and places of business where the electric light is employed as the illuminant, and where the meters are consequently not used. In other cities a small charge is made in such cases; and it was decided to adopt this course in Belfast. The Chairman stated that the accounts for the period ending the 31st of March, to bring the Gas Committee's finances into line with the other Corporation accounts, showed, after all the necessary deductions, a profit of £32,000. It was explained that this large sum would be almost entirely swallowed up during the current year by the great increase in the price of coal and oil; so that if the consumers escape an advance in the price of gas they may be very much gratified. It is not the intention of the Committee to make any change at present.

The Gas Workers and General Labourers' Union.—The biennial conference of this Union was opened at Sunderland yesterday week. Mr. Pete Curran (General Organizer) presided, and in his address said that in the eleven years of the existence of the Union, they had been called upon to defend almost every one of the 75 classes of workers embraced within their amalgamation; and while it could not be said that they had been absolutely successful on each of these occasions, in the great majority of cases they had won, while their absolute defeats had been very few. He expressed the opinion that the time was approaching when there would be one labour amalgamation, in which the semi-skilled and the lesser skilled workers would be merged under one banner, and have one general trade union ticket. Referring to the Federation of Trades and Labour Unions, he said that up to now they had received only three-quarters of the contributions from the 400,000 in the Federation; but nevertheless they had in the bank a balance of over £16,000. If they could proceed in a peaceful way, still bringing in more societies to the Federation, and without any big industrial war for two or three years, he thought they would have—quite apart from their sectional funds—such a purse as would cause the employers to hesitate before forcing on any national struggle with the men, who were endeavouring to obtain what they considered to be their legitimate due. Mr. W. Thorne (General Secretary) read the report for the past two years. The contributions during that period amounted to £36,306; the total income being £37,325. At the end of 1899 the membership had risen to 48,030. The payments made in connection with various labour disputes had been £35,487; and Mr. Thorne expressed the opinion that the increase in the wages obtained would amount to something like £100,000.

The Eccleshill and Bolton Gas Company have placed an order with Messrs. R. Dempster and Sons, Limited, of Elland, for four 15-feet square purifiers.

Messrs. J. Abbott and Co., Limited, of Gateshead, have obtained the contract for the supply of retort-house requirements to the Halifax Corporation Gas Committee.

An artesian tube well, 13 inches in diameter and 200 feet deep, has been bored in Dunstable by Messrs. C. Isler and Co., of London, for the local Gas and Water Company.

The Corporation of Halifax have entrusted Messrs. W. J. Jenkins and Co., Limited, of Retford, with the contract for the supply of coke conveyors, screens, &c., for their new retort-house.

The Rotherham Corporation Gas Committee have just entered into contracts for their supplies of coal for the ensuing twelve months at from 15s. 3d. to 16s. per ton, and of Yorkshire cannel at 24s. per ton.

The Economy Gas Cooking-Stoves Company, Limited, has been formed with a capital amounting to £1000, in £1 shares, with the object of carrying on the business of gas cooking and other stove manufacturers, merchants, engineers, &c.

The Leeds Fire-Clay Company have received orders for installations of deep regenerator settings and ironwork from the Sutton, Southcoates, and Drypool Gas Company, the Vancouver Gas Company, British Columbia, and the Yeovil Corporation.

The Gas Committee of the Halifax Corporation have recommended, and it has been agreed to accept, a tender of the Chain Belt Engineering Company, of Derby, for the supply and erection of a horizontal conveyor and elevator for the sum of £849 19s. 6d.

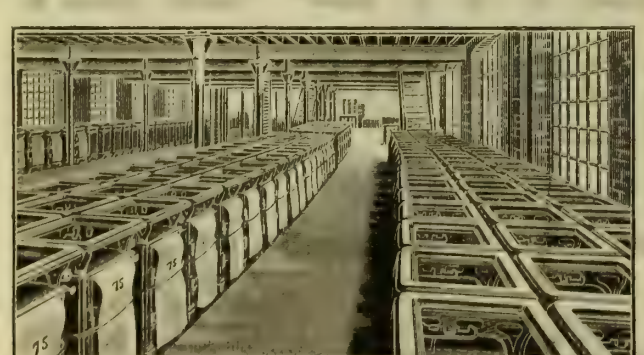
As notified elsewhere, the South Metropolitan Gas Company are inviting tenders for £30,000 of 3 per cent. perpetual debenture stock, at a minimum price of £97 per cent., in accordance with their Acts of 1882 and 1896. Tenders must be in by the 10th prox.

The Killarney Electric Light Company, Limited, have lately had to appear in answer to 28 summonses charging them with having made default in the supply of electric current on this number of occasions during March. The defence was that the failure was due to an accident to a steam alternator, and to inability to get contractors to deliver plant which had been on order for some time. A fine of 5s., with 5s. costs, was inflicted on each summons.

As will be seen by an intimation which appears elsewhere, the Southwark and Vauxhall Water Company are about to make a further issue of their 3 per cent. debenture stock, redeemable at par 25 years from the date of issue. The population at present supplied by the Company exceeds 800,000; and the gross revenue accrued from water-rents, &c., for the year ended September last was £289,700, against £214,397 ten years previously. The stock, as our readers are aware, is a lawful investment for trustees.

Exhibitions of gas appliances have lately been held by the following five firms: Messrs. Fletcher, Russell, and Co., Limited, at Broughty Ferry; Messrs. R. & A. Main, Limited, at Carluke and Stirling; Messrs. Richmond and Co., Limited, at Derby, Matlock, and Ripley; Messrs. Wilsons and Mathiesons, Limited, at Leeds; and Messrs. John Wright and Co., Limited, in Edinburgh. Lectures and demonstrations in cooking were given for the above-named firms by Miss S. Barker, Miss Holroyd, Miss Parker, Miss L. Richmond, Miss M. B. Terrace, and Mrs. Young.

"Noble stock, I'd wish no better choice."—Pericles V., 1.



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[For Illustrated Advertisement, See June 5, p. 1524.]

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SECRETARY and Manager wanted for the above Works. He will be required to take and fix Meters and Fittings, keep and collect the Accounts of the Company, and superintend and assist in the working generally. Commencing Salary £100 per year, with Cottage, Gas, and Coal.

Applications, with Testimonials, endorsed "Manager," to the Secretary, Westerham Gas and Coke Company, Limited, Kent.

BOROUGH OF STAFFORD.
(Gas and Electricity Department.)

THE Corporation of Stafford invite applications for the appointment of ENGINEER and MANAGER to take entire charge of their Gas and Electricity Works.

Applicants must possess a thorough knowledge of Gas Engineering, and be capable of Designing, Superintending, and carrying out any Alterations or Extensions that may be required at the Gas-Works, and undertake the General Management of the Electricity Department.

Salary to commence at £350 per annum, with a prospect of being raised to £400 in eighteen months.

Candidates' Age to be between 30 and 45.

Applications, stating Age, Qualifications, and Particulars of Experience (with *copies* of not more than three recent Testimonials), to be sent to me on or before Saturday, the 16th of June, 1900.

Matt. F. Blakiston,
Town Clerk.

June 1, 1900.

TIPTON URBAN DISTRICT COUNCIL.

TO GAS MANAGERS.

THE Tipton Urban District Council require the services of a competent and experienced MANAGER, to take charge of their Gas-Works—the present Annual Make of Gas being 110 Million cubic feet. He will be required to reside in the Parish, and to devote the whole of his time to the services of the Council. He must be able to design and carry out all Extensions, and have had experience in all Departments. Salary £170 per annum.

Applications, stating Age (which must not exceed 45), present position, Experience, and Training, accompanied by *copies* of not more than three recent Testimonials, and endorsed "Gas Manager," must be sent to the undersigned not later than Ten a.m. on Saturday, the 16th inst.

Canvassing the Members directly or indirectly will be considered a disqualification.

By order,
Jno. W. Waring,
Clerk to the Council.

Public Offices, Tipton,
June 1, 1900.

WANTED, to Hire for a week or two, for Experimental purposes, a PORTABLE PHOTOMETER.

Address No. 3510, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

ENGINES and Exhausters combined "Waller," to pass 30,000 cubic feet per hour. DITTO to pass 7000 feet per hour, overhauled and complete. Cheap to clear. Also BOILERS.
J. FIRTH BLAKELEY AND Co., Thornhill, DEWSBURY.

SECOND-HAND PURIFIERS.

WANTED, Two Second-hand Purifiers, 12 ft. by 10 ft. by 4 ft,
State Condition and Price to J. MACBEAN, Gas Manager, Abertillery, MON.

FOR SALE—Two Lancashire Boilers, each 6 ft. diameter by 20 ft. long, with Mountings. Been in use only a short time. Made by the Yorkshire Engine Company, Limited, Sheffield.
Apply to NEWTON, CHAMBERS, & Co., LIMITED, Thorncliffe Iron-Works, near SHEFFIELD, where the Boilers may be seen.

GASHOLDER, 50 ft. by 18 ft., with Six Columns, 15 inches diameter, Wrought Lattice Girders, &c., complete and perfect. About Fourteen Years old.
Price, erected, on application to J. FIRTH BLAKELEY AND Co., Thornhill, DEWSBURY.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

HYDE GAS COMPANY.

FOR SALE—A Vertical Exhauster and ENGINE, with Two Plunge Pumps, 12-inch Valves and Connections, made by George Anderson. Can be seen working.
For further Information, apply to CHARLES POTTS, Secretary and Manager, Gas-Works, Raglan Street, Hyde, near MANCHESTER.

CONDENSERS, Washer-Scrubbers, "Cutler" patent CONDENSERS (14) 6 in. to 12 in. PIPE CONDENSERS, Patent WASHERS by "Livesey," "Holmes," and "Cockey," EXHAUSTERS up to 60,000 Cubic Feet per hour. ENGINES, BOILERS, &c. Several TOWER SCRUBBERS, PURIFIERS, METERS, GOVERNORS, PUMPS, TANKS, VALVES, &c.
J. FIRTH BLAKELEY AND Co., Gas Engineers, DEWSBURY.

PURIFIERS FOR SALE.

THE Eccleshill and Bolton Gas Company have FOR SALE four PURIFIERS, 8 feet square, with Centre-Valve, and 8-inch Connections, Lifting Gear, &c.
The Purifiers are in good condition, and can be seen working.
For further Particulars apply to
JAMES LEE,
Manager.
Gas-Works, Eccleshill, Bradford,
May 30, 1900.

RUGBY GAS COMPANY.

FOR SALE—One 20,000 cubic feet per hour WALLER THREE-BLADE EXHAUSTER, with Engine Combined, with Disc Valves, Governor, &c., complete.
One 30,000 cubic feet per hour DONKIN COMBINED ENGINE and EXHAUSTER, with Valves, Governor, &c., complete, and Bye-Pass Valve and Connections.
Both Exhausters have been working until May, and are now replaced by larger ones.
Permission to view, and any further Particulars required, to be obtained from the undersigned.
C. MEIKLEJOHN,
Engineer and Manager.

BOROUGH OF DUKINFIELD.

TENDERS FOR GAS COAL.

THE Gas Committee require Tenders for 8500 Tons of screened GAS COAL, one-half to be delivered before the end of September next, and the remainder by the end of June, 1901, by Road, Rail, or Canal (Peak Forest).
For Forms of Tender apply to the undersigned.
Tenders to be delivered at the Gas Offices, not later than the first post on Monday, the 25th inst., addressed to Mr. Councillor Stafford, Chairman of Gas Committee.
HARRISON VLEVERS, C.E.,
Engineer and Secretary.
Gas Offices, Dukinfield,
June 1, 1900.

THE Directors of the Huyton and Roby Gas Company invite TENDERS for the supply of GAS COAL, CANNEL, and STEAM SLACK.
The quantities required are as follows—
2000 Tons of GAS COAL in the form of either Nuts or Slack.
300 Tons of best round CANNEL.
220 Tons of STEAM SLACK.
To be delivered during the Year ending the 30th of June, 1901, into the Company's private Siding at Huyton Quarry (L. & N. W. Rly.), in such quantities, and at such times, as may be required by the Company.
The material to be Clean, Dry, and Fresh Worked.
The Company will provide their own Waggons for the transit of the greater portion of the material.
Tender, specifying the description of the Coals, the name of the Pit from which they are to be raised, and endorsed "Coals," may be sent in to me not later than Saturday, the 16th inst.
FRED. PRITCHARD,
Secretary and Manager.
Gas Office, Huyton,
June 6, 1900.

CITY OF LEEDS.
(GAS DEPARTMENT.)

TENDERS FOR COAL AND CANNEL.

THE Gas Committee of the Leeds Cor- poration are prepared to receive TENDERS for the supply of best GAS COAL, COBBLES, NUTS, and CANNEL.
Forms of Tender may be had on application to the undersigned.
Sealed Tenders, endorsed "Tender for Coal," will be received not later than Monday, the 25th of June, addressed to the Chairman of the Gas Committee, Municipal Buildings, Calverley Street, Leeds.
The lowest or any Tender will not necessarily be accepted.
R. H. TOWNSLEY,
General Manager.

FILEY URBAN DISTRICT COUNCIL.

TENDERS FOR COAL.

THE Council invite Tenders for the supply of 1400 Tons of GAS COAL, COBBLES, or NUTS in the Twelve Months ending the 30th of June, 1901. Delivery to be made at the Coal Depôt, N.E. Rly., Filey.
Monthly payments.
The Council do not bind themselves to accept the lowest or any Tender.
To comply with the Public Health Act, the party whose Tender is accepted will be required to enter into the usual Contract and find Sureties.
Tenders, addressed to the Chairman, Council Offices, Filey, to be sent in by Wednesday, the 29th of June inst.
HENRY TOBEY,
Engineer.
Malton, June 11, 1900.

NEWARK GAS COMPANY.

TO MANUFACTURING CHEMISTS AND OTHERS.

THE Directors of the above Company are prepared to receive TENDERS for the purchase of the AMMONIACAL LIQUOR produced at their Works for One Year from the 1st day of July, 1900, at per degree Twaddel (Temperature 60° Fahr.).
The Liquor to be not less than 5° in strength.
Terms: Cash monthly.
Further Particulars can be had on application to the undersigned, to whom sealed Tenders, marked on the outside "Tender for Liquor," are to be sent on or before the 20th inst.
The highest Tender will not be necessarily accepted.
F. B. FOOTTIT,
Secretary.
Newark, June 2, 1900.

NEWARK GAS COMPANY.

TO TAR DISTILLERS AND OTHERS.

THE Directors of the Newark Gas Com- pany are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Works, free on rail, G.N. Rly. or M. Rly. in Purchaser's Tanks, for One Year from the 1st day of July, 1900.
Terms: Cash monthly.
Further Particulars can be obtained on application to the undersigned, to whom sealed Tenders are to be sent on or before the 20th inst., marked on the outside "Tender for Tar."
The Directors do not bind themselves to accept the highest or any Tender.
By order,
F. B. FOOTTIT,
Secretary.
Newark, June 2, 1900.

URBAN DISTRICT COUNCIL OF LYMM.

THE above Council are prepared to receive TENDERS for the supply of CANNEL and best screened GAS COAL, to be delivered at their Gas-Works in Lymm, for a term of Nine Months from the 1st day of July, 1900.
The probable quantities required will be about 130 Tons of Cannel, and about 1200 Tons of Gas Coal, which must be freshly wrought, well screened, and free from Sulphurous Pyrites or other objectionable matter; but the Council reserve the right of increasing or decreasing the quantities named.
The person whose Tender is accepted will be required to enter into an Agreement with the Council for the due performance of his Contract.
Sealed Tenders, stating Price per Ton delivered alongside the Works, to be sent to the undersigned, on or before the 21st day of June, 1900, and endorsed "Coal Tender."
The Council do not bind themselves to accept the lowest or any Tender.
Forms of Tender are not supplied.
Further Particulars may be had on application to the Gas Manager, Mr. Donaldson.
W. MULLARD,
Clerk.
Council Offices, Lymm, Cheshire,
June 1, 1900.

URBAN DISTRICT COUNCIL OF LYMM.

THE above Council are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR made at their Gas-Works, for a term of One Year from the 1st day of July, 1900.
The Tar and Liquor will be delivered free into Contractor's Boat on the Bridgewater Canal.
The Purchaser will have to enter into an Agreement with the Council for the due performance of his Contract.
Sealed Tenders, stating Price per Ton for Tar and Price per Ton for Liquor (by Twaddel), to be sent to the undersigned on or before the 21st day of June, 1900, endorsed "Tar Tender."
The Council do not bind themselves to accept the highest or any Tender.
Further Particulars may be had on application to the Manager, Mr. Donaldson.
W. MULLARD,
Clerk.
Council Offices, Lymm, Cheshire,
June 1, 1900.

TO COAL CONTRACTORS AND OTHERS.

THE Sedgley Urban District Council invite TENDERS for supplying 800 to 1000 Tons of GAS COAL, the deliveries to be made at the Shut End Siding at such times and in such quantities as may be directed.
Sealed Tenders marked "Coal," must reach me on or before the 26th of June.
The Council do not bind themselves to accept the lowest or any Tender.
By order,
JOSEPH SMITH,
Clerk to the Council.
Offices: High Holborn,
Sedgley, June 8, 1900.

SUTTON, SOUTHCOATES, AND DRYPOOL GAS COMPANY, HULL.

THE Directors of the above Company invite TENDERS for the surplus TAR and AMMONIACAL LIQUOR produced at their Works during the Twelve Months ending the 30th of June, 1901.
Probable quantity of Tar, 1000 Tons.
Probable quantity of Ammoniacal Liquor, 1200 Tons.
Tenders for Liquor must state price per Ton, per degree Twaddel's Hydrometer from 4° to 8°.
Tenders to be sent to the undersigned on or before the 25th of June, 1900, marked "Tender for Tar" or "Liquor."
The Directors do not bind themselves to accept the highest or any Tender.
DAVID WOOD,
Secretary.
Offices: St. Mark's Street, Hull,
June 6, 1900.

BOROUGH OF SMETHWICK.

TENDERS FOR GAS COAL.

THE Gas Committee invite Tenders for the supply of about 30,000 Tons of screened and unscreened GAS COAL, and screened and washed GAS NUTS for delivery during the Year ending June 30, 1901.
Form of Tender and further Information may be obtained of the undersigned.
Sealed Tenders, endorsed "Tender for Coal," and addressed to the Chairman of the Gas Committee, Town Hall, Smethwick, to be sent in not later than the 28th of June next.
The Committee do not bind themselves to accept the lowest or any Tender.
By order,
W. J. STURGES,
Secretary.
Gas Offices, Town Hall,
Smethwick, June 6, 1900.

BAKEWELL URBAN DISTRICT COUNCIL.

COAL.

TENDERS are invited for the supply of 1200 to 1400 Tons of GAS COAL and 150 Tons of CANNEL during Twelve Months from July 1 next delivered at Bakewell Station.
Forms of Tender on application to the undersigned, to whom they must be returned before the 23rd of June.

TAR AND LIQUOR.

Tenders are invited for the purchase of the surplus TAR and AMMONIACAL LIQUOR during Twelve Months from July 1 next. Delivery free in Purchaser's Tanks at Bakewell Station (Midland).
Endorsed Tenders to reach the undersigned before the 23rd of June.
The Council reserve the right of rejecting any Tender above invited.
V. R. COCKERTON,
Clerk.
Bakewell.

BOROUGH OF BURTON-UPON-TRENT.

TAR.

THE Mayor, Aldermen, and Burgesses of the Borough of Burton-upon-Trent, acting by the Council, invite TENDERS for the purchase of the surplus TAR to be produced at their Works during Twelve Months from the end of July next.
Probable quantity of Coal carbonized during the Twelve Months, 35,000 Tons.
The Tar will be delivered free into Contractor's Tank-Trucks, on the Gas-Works Railway Siding.
Payments: Net Cash Monthly.
Tenders, sealed, and endorsed "Tender for Tar," are to be delivered to me, at or before Ten a.m., on Thursday, the 28th of June inst.
The highest or any Tender will not necessarily be accepted.
F. L. RAMSDEN,
Manager and Engineer.
Gas and Electric Light Works,
Burton-upon-Trent, June 1, 1900.

COUNTY BOROUGH OF BURY.
(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Gas Committee are prepared to receive TENDERS for the supply of
37,000 Tons of GAS COAL,
600 Tons of BURGY,
300 Tons of HOUSE COAL.
The same to be delivered in such quantities as stated in Schedule for Gas Coal, but with respect to Burgy and House Coal as from time to time ordered.
Forms of Tender and Conditions of Contract may be obtained on application to Mr. H. Simmonds, Engineer and Manager, Gas-Works, Bury.
Tenders, which must be on the printed forms, and addressed to the Chairman of the Gas Committee, Town Clerk's Office, Bank Street, Bury, endorsed "Tender for Gas Coal," to be delivered not later than Friday, the 15th inst.
JOHN HASLAM,
Town Clerk.
Corporation Offices: Bank Street, Bury,
June 1, 1900.

CONTENTS.

EDITORIAL NOTES:—

GAS, LIGHTING, &c.— PAGE.

The Position of the Gas Institute . . . 1605
Pronouncements on the Coal Difficulty . . . 1606
The Welsbach Company's Annual Meeting . . . 1607
An Abortive Agitation . . . 1607
The Problem of Coal Again . . . 1608

WATER AND SANITARY AFFAIRS—

Two London Water Companies' Meetings . . . 1608
Manchester Water Supply—New Pipe from Thirlmere; Water-Closets *v.* the Pail System . . . 1608

THE INCORPORATED GAS INSTITUTE—

ANNUAL MEETING IN LONDON—

Review of Proceedings . . . 1609
The Proceedings Summarized . . . 1611
General Report—
Confirmation of Minutes; The Report and Accounts; Awards of Premiums . . . 1616
Presentation to Mr. Dougall; President's Address; The Proposed Amalgamation . . . 1617
The Benevolent Fund; Papers and Lecture; Report of the Scrutineers; New Members and Transferences; Honorary Members; The Amalgamation Question Again . . . 1624
Place of Next Meeting . . . 1625
Votes of Thanks . . . 1626
Lecture—"The New Gas." By W. H. Y. Webber . . . 1627
The Visit to Paris . . . 1632

ESSAYS, COMMENTARIES, AND REVIEWS:—

Gas and Water Companies in the Stock Market . . . 1636
Electric Lighting Memoranda . . . 1636
Law of London Gas Companies; and Fancies about Some . . . 1636
The Origin and Potentiality of Coal . . . 1638
The Water Supply of Liverpool . . . 1638

NOTES:—

A Cyanogen Gas Identical with Argon . . . 1640
Large Gas-Engines for Blast-Furnace Work . . . 1640
Some Points of a Contractor's Business . . . 1640

TECHNICAL RECORD:—

German Association of Gas and Water Engineers—Inaugural Address of Herr W. von Oechelhaeuser . . . 1640
Repairing a Submerged Main . . . 1643

REGISTER OF PATENTS:—

Treating Earthy Oxides in the Manufacture of Incandescent Mantles—Daix, V. . . . 1644
Circular Flame Gas-Burners—Darby, H. W. & I., and Punchard, J. H. & W. C. . . . 1644
Compressing Gases for Lighting Purposes—Sugg, W. T. . . . 1644
Cement for Caulking Retorts, Pipes, &c.—Woodhouse, S. J. . . . 1645
Illuminating Media for Incandescence Gas Lighting—Apt, J. . . . 1645
Combustion Chambers of Internal Combustion Motors—Lindemann, O. (Körting, E.) . . . 1645
Purifying Gases—Lindemann, O. (Körting, E.) . . . 1646
Patent Notices . . . 1646

CORRESPONDENCE:—

The Carpenter-Brackenbury-Winstanley Controversy . . . 1646

LEGAL INTELLIGENCE:—

A Disputed Gas Bill . . . 1646
Claims Against the Newport Gas Company for Wages . . . 1646

MISCELLANEOUS:—

Meeting of the Welsbach Incandescent Gas-Light Company . . . 1647
Meeting of the Malta and Mediterranean Gas Company . . . 1648
Meeting of the Southwark and Vauxhall Water Company . . . 1649
Meeting of the Grand Junction Water Company . . . 1650
Professor Lewes and the City Corporation . . . 1651
Statutory Prices for Public Lighting in North and South London—The City Corporation and the South Metropolitan Gas Bill . . . 1651
The Dublin Corporation and the Supply of Carburetted Water Gas . . . 1652
The Proposed Purchase of the Leamington Priors Gas-Works by the Corporation—Rejection of the Corporation's Offer . . . 1652
The Price of Gas at Leeds—Radical Opposition to an Increase . . . 1652
St. Helens Corporation Gas Supply . . . 1653
Manchester Corporation Gas and Water Supply . . . 1653
The Price of Gas and Water at Bradford . . . 1654
Wigan Corporation Gas Supply—The Past Year's Working . . . 1654
Bury Corporation Gas Supply—The Past Year's Working . . . 1655
Rochdale Corporation Gas and Water Supply . . . 1655
Sale of the Crawley Gas-Works . . . 1655
The Whitwick and Coalville Gas-Works Arbitration . . . 1655
Burton-on-Trent Gas and Electricity Supply—The Past Year's Working; The Price of Gas . . . 1655
Loughborough Corporation Gas Supply—The Outlook for the First Year's Trading . . . 1656
Electric Lighting Notes . . . 1656
The Abortive Newhaven and Seaford Water Bills—The Effect on the General District Rate . . . 1657
The Falmouth Corporation and the Water-Works . . . 1657
Gas and Water Companies' Stock and Share List . . . 1657
Notes from Scotland . . . 1658
Current Sales of Gas Products . . . 1660
Coal Trade Reports . . . 1660

PARAGRAPHS:—

OBITUARY: Mr. Adolphus F. Waller . . . 1639
PERSONAL: Mr. W. Lister; Mr. C. Sheppard; Mr. W. Pooles; Mr. R. M. Couper; Mr. David Easson; Mr. B. W. Smith; Mr. W. J. Fuller; Mr. Harold W. Woodall . . . 1639
Coal in the United States . . . 1639
Utilization of Water Power in Italy and Spain—Electric Traction . . . 1644
Sequel to the Brigg Gas-Works Transfer . . . 1652
Southport Corporation Gas Supply . . . 1658
East-End Consumers and the Price of Gas—The St. Mary Church Gas-Works—The Water Supply of Llangollen—The Rating of Reservoirs—Braunton Water Supply . . . 1661
Barry Gas and Water Supply—Regenerator Settings for Small Gas-Works—Reduction in the Price of Gas at Silsden—The Delights of Gas Managership—Profit-Sharing at Stafford—Stourbridge Gas Undertaking—New Retort-House and Station Meter at the Market Harborough Gas-Works—Birmingham Corporation Finances . . . 1662
Sale of the Clifton Water-Works to the Halifax Rural District Council—Gas Explosion Caused by Lightning—Tiverton Corporation Gas Supply—Shrewsbury Water Supply—The Yorkshire Coal Trade—Increase in the Price of Gas in North London—Sales of Stocks and Shares—Water Supply Scheme for East Shropshire . . . 1663

EDITORIAL NOTES.

The Position of the Gas Institute.

THE meeting of the Incorporated Gas Institute last week presents to an impartial observer of the whole proceedings the appearance of a mingled yarn, good and bad together. The technical fare provided by the endeavours of the Honorary Secretary and the Council, in the shape of papers and communications, was, with but one or two exceptions, scanty in quantity and of small actual interest. There were, of course, several powerful reasons for this, which no pains of the governing body, nor any amount of goodwill on the part of the members generally, could contend against. Some of these blighting influences were particular and temporary—such as the necessity for sacrificing a good deal of what would have entered into an ordinary programme for the sake of the Paris trip—but others, and probably the more serious, were constitutional, and referable to a state of things in the profession which must be described later. Apart from the technical portion of the transactions, members had enough to think about in the question of the formal union of the membership of the two national professional organizations; and the fashion in which they handled this all-important matter on the two days of the meeting was decidedly "mixed" in grain. Before discussing the subject on the merits, which will be the chief purpose of this article, it is due to the President (Mr. E. H. Stevenson) to record the devotion which he has admittedly shown during his year of office to the difficult and delicate task of realizing, in the shape of a scheme of amalgamation, the feeling in favour of union in the profession so clearly manifested in the course of last year's meeting. As a very active professional man, Mr. Stevenson must have made many irksome sacrifices of time and attention to this special affair of the Institute. The Honorary Secretary and the members of the Council, too, must have passed through an anxious and laborious year, in the discharge of responsibilities differing wholly in kind, and vastly surpassing in weight the ordinary routine work of office.

This being said, it is a painful reflection to make that, when the fruit of all this labour was submitted to the members assembled this day week, as much as anything for the express purpose of taking cognizance of and considering it on the merits, it was rejected. The business went off, partly through mismanagement, partly through the intemperate language of some and the injudicious acts of others, and partly through confusion and lack of understanding of the issues submitted to the vote. The pity of it was that up to a point all went well; and while the conduct of the business by the President was excellent, the Chair enjoyed the confidence and support of the preponderating party of union on the lines suggested by the Council. The abstract resolution in favour of union was carried unanimously. One amendment after another was defeated by large majorities; the voting revealing the existence of a clearly defined, and not unexpected, element of opposition to the particular course of action recommended by the Council. Then came the surprise. Upon the executive resolution authorizing the governing body of the Institute to take the necessary steps for liquidating the Company, the vote failed (by four) of the requisite three-fourths majority. An attempt to repair the mischief by means of a poll had an even more unfortunate fate; and the members separated for the day with the uncomfortable feeling that somehow they had blundered into an altogether false position. It is a significant indication of the real state of mind of the members, as a whole, that the announcement of the result of the poll was received in dead silence; the gathering forthwith dissolving as glumly as if everybody had been to a funeral.

It is desirable to place these significant facts on record, because otherwise those who were not present on the occasion might misunderstand the report of what happened; and there have been too many regrettable misunderstandings about the whole affair to render endurable the prospect of an addition to the number in this connection. If there was a voting member taking part in these critical divisions who was gratified with the result, he was most careful to keep his feelings to himself. There may have been a small party of Irreconcilables present; but they found no encouragement to crow over the stultification of the Institute. The great majority were heartily sorry, and many not a little ashamed, as business men, of the condition to which the outbreak of the poor old game of cross-purposes, and petulancy of temper, had reduced all the elaborate edifice which was intended to

shelter a re-united profession. This feeling grew until it found adequate expression on the following day in a resolution, carried without a dissentient voice, that the new President and Council should pick up the dropped threads of the diplomacy and statesmanship that had already brought union within reach, and should resume the endeavour to attain the heartily desired end at the earliest possible moment. No worthy member of the profession will disparage this frank, cordial, and eminently sensible arrangement.

Members of the Institution of Gas Engineers certainly will not wonder at, or put an unkind construction upon, the failure of the party of union within the Institute to carry their agreement through at the first attempt. It is conceded on all hands that the first approaches towards union are more difficult for the Institute than for the Institution to take. While the best opinion of both Societies agrees that the good of the profession and of the industry demands that any possible professional organization of the future shall not include members whose connection with the industry is merely mercantile, it is the fact that the Institute actually contains members of this description, while the Institution does not. While the members of the Institution are bound by their own corporate principles to make the preservation of this distinction between different orders of followers of the industry a fundamental rule of any new technical society they may substitute for the present companionship, and are quite free to act up to their principles, the like-minded members of the Institute find themselves under the painful obligation to impose their will in this regard upon a numerous body of their fellow-members whose corporate rights in the Institute are equal to their own. The old Council accepted the necessity of dealing with the whole body of the members of the Institute whose major interest in gas is purely commercial, without respect to persons; and accordingly the President was directed to "take the bull by the "horns," and ask these members in writing to consent to their own demission from the roll of the Institute. Now that no mischief can be wrought by the criticism, one is free to express a doubt whether the President was altogether so happy in his function of "the complete letter-writer" as was desirable for the attainment of the object in view. His notions of strategy seem to have partaken of the character of those of the British Generals who did not at first invariably command success in South Africa.

The real source of weakness in these preliminary proceedings, however, was precisely the same as that which in a less degree troubled the other President and Council. It was that the whole transaction was *ultra vires*. There had been no regular reference of the matter to the Council, with instructions to act; and consequently, when the Council tabled the provisional agreement into which they had entered with the other side, they were open to attack for having gone too far, promised too much, and acted too exclusively in accordance with the conditions of union laid down on behalf of the Institution, and without consulting with their own people. Here was the chance of the malcontents, and they took it. Here, also, was the opportunity for the manipulation of the velvet-gloved hand; and it was missed. There was little real weight in the opposition; but, such as it was, it sufficed to wreck the Council's scheme, assisted by the tremendous force which the necessity for a three-fourths majority on the executive resolution for winding up lent to the minority.

Now it has all to be gone through again, but with the difference that the thunderstorm has cleared the air. There would have been a fresh, and perhaps a more serious split in the Institute than ever, if an expedient for keeping the matter in action had not been adopted at the last moment. An unknown number of members of the Council and others would certainly have withdrawn from the Institute as soon as the meeting was over; and there would have been thrown upon those responsible for the rebuff of Tuesday the task of keeping the organization going. As it is, however, the threatened breach is only put off; it is by no means averted. The new governing authorities and all the members will have to make up their minds definitely on the plain issue of whether they wish to retain the trading members or to let them go. It is mere shirking the issue to put it behind certain well-known and honoured names, and lash up a fine fervour of Indignation at the suggestion that the bearers of these names should be asked to retire in order that a new technical society may be formed on a fresh basis, and without them. It is as unjust as it is impolitic to thus confound the question of principle with the claims, real or imaginary, of individuals; and if it were either polite or legally safe to do so, a black could be found to set off every white. Hard cases must not be allowed to make bad law. It must be a question of yea or nay, all or none. What may be done later, cannot be taken into consideration. Of course, if any ordinary members of the Institute prefer to everything the corporate companionship of their mercantile friends, they have a perfect right to give constitutional effect to their wishes. Only, they must do so with full knowledge of the consequences. They and their friends must be prepared to run the Institute.

The late Council, with their supporters, who showed themselves to be the majority at the last meeting, must be taken for serious-minded persons, and men with the courage of their opinions. They would never have put their hands to the scheme they recommended unless they had been convinced of its necessity and propriety. They will not go back upon their deliberate judgment. They will at the most wait a reasonable time, and see what use is made of the open door which the meeting so carefully set ajar again. It is those men who have had recent experience of the difficulty and have felt the drawbacks of the existing unhappy division of the ranks of the profession, who realize that the plea for unity is no sentimental aspiration. On the other hand, the cry for the retention at all costs of a particular order of members who have never been distinguished for helpfulness in the work of the Institute, and whose room would, in general, be far preferable to their company, is either sentiment or it is something much worse. If these gentlemen, as a class, wish for the advantages of association on their own account and for the good of the industry of gas lighting, they are at liberty to form themselves into a society of their own. The judgment of the majority of gas engineers and managers is that they can get on with their technical education better in the absence of those who have, or hope to have, trade dealings with their employers. The argument for the inclusion of traders with gas managers, on the asserted analogy of the Institution of Civil Engineers, which does not expel a member because of his opening a shop, is radically unsound. As a rule, the members of the Institution of Civil Engineers are men who are their own masters. Nine-tenths of the possible constituency of a gas industry society are not their own masters. This makes all the difference. Besides, there is the ample answer to all merely sentimental pleas for the retention of commercial men in a society chiefly composed of salaried officials and professional men, who form a little world of their own—and no bad world either, if it comes to a question of honest work or hearty play—that it has been tried; and it is not so satisfactory as the alternative, modern, and improved arrangement.

Pronouncements on the Coal Difficulty.

The coal question naturally continues the topic of prime interest in industrial circles generally, as well as in the gas world in particular; and pronouncements thereon are the order of the day. Some—such as that of Mr. Thomas Burt, M.P., whose monthly circular to the Northumberland Miners' Association has been given considerable prominence in the Press, as if it were a valuable contribution to the discussion of the problem—consist of little but the barest of platitudes, and general statements unsupported by argument or fact. What earthly use is it for Mr. Burt, or anyone else, to state (as if the statement were obviously incontestable and needed no proof) that "it is quite cer-"tain that any benefit which might accrue from a device "of this kind [the checking of coal exports by artificial "arrangements] would bring greater evils than it would "remove"? Very likely; we are not disputing it. The statement is in accordance with truth; but there is far too great a tendency in these days towards mistaking *obiter dicta* for reasoned and proved facts.

Other contributions to the consideration of the situation—such as those of Mr. E. H. Stevenson, in his Inaugural Address to the meeting of the Gas Institute, and Mr. Norton H. Humphrys, in the columns of the "Journal" last week—really help towards a clearer and cooler judgment than, as Mr. Stevenson remarked, has been evinced in some quarters in the Press, or displayed in the public utterances of our leading men. The "Journal" has never taken an alarmist view of the future. We hold that the present difficulty is, if very serious and vexatious, but a passing one; and that history, as well as a careful consideration of the originating causes of the existing state of affairs, points to the certainty of a not far distant

reaction, with a return to more reasonable prices, if not actually to the low level of two or three years back.

The foreshadowings of that inevitable reaction are, indeed, becoming daily more numerous and unmistakable. The exportation of coal, it is true, shows no abatement; for the quantity shipped during the month of May is returned at 4,170,220 tons, as against 3,942,121 tons in the same month last year—when already the upward movement was in full swing. The quantity exported then was nearly 50 per cent. higher than in 1898, in May of which year it was 2,691,020 tons. Yet a careful examination of the situation abroad, as well as of the detailed figures published by the Board of Trade, tends to the opinion that we are not far from the time when the upward movement in coal shipments will cease—the increase being confined to Russia, Germany (with Denmark and Holland), France, and Spain; while other countries are taking less than in 1899, and some even less than in 1898. There is reason to believe that industrial activity in the first-named countries has reached or passed its zenith, as orders are not now coming to hand from those quarters with anything like the recent freedom and frequency. Looking at home, rather than abroad, the signs of a reaction in demand—and after that, of course, in price—are more marked, especially in Scotland, where both shipbuilders and iron and steel manufacturers are beginning to feel very anxious as regards future business. They are busy at present, but new orders do not come to replace those completed; the fact being present prices are simply killing trade.

Mr. Humphrys discusses the question as to whether it is the best policy to meet the higher cost of coal by an increase in the price of gas. It is, of course, impossible to express any opinion one way or the other as regards the industry as a whole; for every individual case must be considered on its facts and merits. But it is at least possible to strongly endorse the opinion expressed by Mr. Humphrys that trying to stave off the evil day by starving the works, and overworking and underpaying the staff, is shortsighted policy, fraught with far-reaching evils. There is, moreover, a good deal in his remark that fair-minded and reasonable men would not greatly resent an increase in price, while they might even think there was something of mystery about the company that could go on charging the same price whether coal were dear or cheap. It must, however, be said that, so far as the second point is concerned, there would be little fear of an agitation against such a company, the accounts of all being open to the inspection of the said reasonable man, who would certainly find that the shareholders were only receiving the benefit of previous reservations of dividend, and the consumers that of an average instead of a fluctuating price.

The present time is undoubtedly by no means cheerful for those interested in gas undertakings; but, to quote Mr. Stevenson's conclusion in regard to the coal difficulty: "If "companies and consumers will only fairly share the "extra burden put on the industry, it will soon pass away, "and only be remembered as a bad sort of dream." In the meantime, for those able to look at the situation dispassionately, we are making very interesting history; and in business, as in private life, times of difficulty are not without instruction, and, if only faced aright, not without ultimate benefit.

The Welsbach Company's Annual Meeting.

There was a very large audience indeed when Sir Henry C. Burdett, K.C.B., rose to address the proprietors at the meeting of the Welsbach Company on Friday last. We have often heard it remarked at company meetings that when everything is going well, it is impossible to induce the shareholders to attend; and the crowded state of the Great Hall of the Cannon Street Hotel on this occasion seemed, therefore, to indicate a spirit of unrest. And, indeed, in the course of the proceedings (which, by the way, lasted two-and-a-half hours) much disappointment was expressed by the proprietors at the result of the Company's operations. The Chairman explained that there was great difficulty in comparing the accounts under review with those previously submitted, because the latter covered a period of about sixteen months. So far, however, as they could be compared, it seemed that the net profits of the past year showed a decrease of £42,000. It was pointed out that one of the chief causes of this falling off was the reduced dividend upon the shares held by the Company in the Austrian undertaking. Much, however, is hoped from the new policy which the Board have adopted since the appointment of Mr. H. L. Peters as Managing-Director. This policy consists, as has already been notified in our pages, of a large reduction in the price of the Company's specialities, together with a vigorous endeavour to effect economies in the somewhat heavy expenditure. Time, of course, will be necessary to prove the wisdom of the reductions in price which came into force on the 1st inst.; but it seems only reasonable to assume that they will lead to a very large increase in the Company's business. Sir Henry, at the conclusion of his address, offered, if the shareholders wished it, to resign his position as Chairman of the Company; but the meeting was strongly in favour of his continuing at the head of affairs. General Russell, M.P., moved, and the Hon. Philip Stanhope, M.P., seconded, an amendment to the effect that a Committee of Shareholders be appointed to investigate the present position of the Company's affairs; but as the feeling of the proprietors appeared to be against the adoption of such a course, the amendment was ultimately withdrawn. It was, however, clearly intimated by General Russell that a Committee of Investigation would be again proposed at the next meeting of the Company, unless meanwhile things took a more favourable turn. We venture to hope that by the time the shareholders next assemble, matters will have so far improved as to render the moving of an amendment of this character altogether unnecessary. The system of the Company has enormously benefited the gas industry; and surely there is no reason why it should not prove equally beneficial to the shareholders. Perhaps one of the most hopeful signs is the fact that, under their new policy, the Directors intend to turn their attention to placing the business on an ordinary commercial basis, rather than treat it in the light of a monopoly, as they have hitherto done. There is also Dr. Auer's osmium electric lamp, a sample of which was on view at the meeting. It was stated that this lamp will be ready to be placed on the market in the autumn; and if the results obtained from its general use prove equal to that shown on Friday last, the lamp should prove a valuable asset to the Company.

An Abortive Agitation.

It is very remarkable how uncommonly fond the latter-day Radical is of compulsory legislation. We are led to make this by no means novel observation by the desperate efforts lately put forth by the "Daily News" to work up a grievance against the present Government in regard to the new Factory and Workshop Regulation Bill. This measure is intended to enlarge the power of the Home Office over dangerous trades. It being very difficult to define this qualification, and many important modern industries being divisible into processes of different degrees of danger, the Government Bill contains a provision to enable the Home Secretary to exercise a discriminating and dispensing power where the circumstances are such as to require it. This elasticity is abhorrent to the Trade Unions. They want hard-and-fast laws and cast-iron regulations. Accordingly, that not very important body, the London Trades Council, memorialized the Home Secretary in this sense. With almost excessive courtesy Sir M. White Ridley directed that the memorial should be answered, and the true intent of the Bill explained; and for this he has been hysterically abused by the "Daily News," which so far forgot its manners as to call the official communication an "almost whining apology." The usual routine of modern newspaper agitation—which so seldom agitates anybody—duly followed. Several Trade Union officials were "interviewed;" and they all formulated their "sound and reasonable objections" to the Government Bill, in terms suspiciously resembling the language previously used by the newspaper writer. This was all very capital. A large and representative body of working-class opinion denounced the central idea of the Bill—the substitution of the Home Secretary's discretion for the express provisions of statute law—and there the matter dropped. Nobody really cared two straws for the ravings of the demagogues of the London Trades Council; and the Home Office was not "one penny the worse" for the onslaught so suddenly made by an Opposition journal in sore need of a Party cry. It would scarcely be suspected, having regard to the terms in which the factitious opposition to the Bill was expressed, that its whole purpose is the better prevention of industrial accidents, and the suppression of those deadly processes which supply the popular

Press with the material for its periodical outbursts against the "Moloch of Capital." An attempt is to be made to attain this object in the most direct way, and the work-people likely to be affected by any new regulations are to be heard on an equality with the employers. Ample protection is thus secured for every interest. This is the dreadful measure which the Trade Unions do not like, probably because of its very practical character, and the precautions taken to avoid grounds upon which grievances might be manufactured. We agree with the opinion of "Engineering," in regard to the reservation of discretionary power to the Home Secretary, that a cast-iron uniformity of rules and regulations for factories and workshops is not within the range of practical politics. But what is that to a set of "Labour" politicians? Of course, of the political aspect of these sporadic outbreaks of Radicalism in association with the Socialists who live by the Trade Union movement, we have nothing to say. The prospect, however, that if this coalition were to attain to any real power in the Legislature, Acts of Parliament would be passed thick and fast for binding national industries in subservience to the Trade Union sentiment of the hour, is not to be overlooked. Mr. Steadman would see to it that the manufacture of carburetted water gas was made felony. Gas manufacture generally is not a dangerous trade; but electric lighting is, in some respects. What a happy, prosperous, and free country England would be, if the Party of Progress had their way!

The Problem of Coal Again.

Once more the problem as to the extent and probable duration of the coal deposits of the United Kingdom has been descanted upon by a President of the Institution of Mining Engineers. Mr. H. C. Peake this year took up the subject where his predecessor in the chair of the Institution, Mr. J. A. Longdon, had left it. He declared himself as not possessed by such gloomy views of the situation, and looked to the enhanced price of coal as likely to influence consumers in the direction of economy, and coalowners in that of putting fresh supplies upon the market. Meanwhile, he agreed that the coalowners are now making up for past losses. It was explained that during the years of poor profit there is no inducement for coalowners to spend money on the improvement of their property. They do just what is necessary to keep the pits open, and no more. Consequently, when times of higher demand come, as at present, the colliery proprietors are not prepared to meet the demand by the aid of mechanical appliances for facilitating an increased output. And, of course, the men will not bring much, if any, more coal to bank. It has been asserted elsewhere that if the colliers would only work steadily for five days a week, the present abnormal prices would soon drop to reasonable proportions. To say this, however, is obviously to convince the men of the folly of their doing anything of the kind. Whether the colliery proprietors can and will do what is indicated as possible to increase the output by mechanical treatment of the coal in and out of the pits is doubtful. Mr. Peake puts the shorter and longer limits of the duration of the British coalfields, as at present worked, at 150 and 350 years. There is not much use in making these calculations. They are liable to be upset by a hundred unforeseen influences. He also mentioned the suggestion that a 5s. export duty should be put upon British coal; but he seems to have shirked the responsibility of treating the proposal magisterially. The general impression left by his remarks on the price of coal, which is the all-important matter, was that the trade will keep rates up as long as they can. More than this rather obvious induction cannot very well be drawn from any of his observations.

WATER AND SANITARY AFFAIRS.

The proceedings at the meetings held last week of the Southwark and Vauxhall and Grand Junction Water Companies, reports of which will be found elsewhere, were not marked by any very striking incidents. Both Companies have, unfortunately, lately been in trouble with Mr. Allen Stoneham, the Official Auditor under the Metropolis Water Act, 1871, over certain matters connected with the accounts; but in one case the objection raised was met without affecting to the extent of a penny the amount available for distribution, and in the other the difficulty will probably be satisfactorily arranged. Both Companies have done very well in the half year covered by their accounts. The Southwark and Vauxhall Company received £137,561 for water supplied, or £3614 more than in the corresponding period of 1898-9; but as the first-named amount included an item of revenue from the East London Company £1995 less than it was in the six months ending March, 1899, the legitimate increase was £5609. The result of the working was a sum of £72,142 to be transferred to the dividend and interest account, as compared with £68,085 a year ago. The Directors recommended a dividend at the rate of 7½ per cent., after payment of which there would be £8732 to be carried forward. The Chairman (Alderman Sir Henry E. Knight) explained that they might have proposed an additional half per cent.; but they thought it scarcely wise to do so in view of the advance in the prices of coal and iron. Mr. F. Tendron told the proprietors of the Grand Junction Company much the same story; but both gentlemen held out the promise of an increase of dividend on the next occasion. The severe frost of a few years ago entailed very considerable expense upon each Company; and this, of course, affected the dividends. In the case of the Grand Junction, an average of 8½ per cent. had been paid for thirteen years up to 1895; but since then the shareholders have received 1 per cent. less. But during this time the Directors have set aside £21,000 as the nucleus of a reserve to meet the extra expense which will come upon the Company when they begin to take water from Staines; and they entertain the confident hope that the normal increase in the rental, without any serious addition to the maintenance and other charges, will enable them to recommend next December the payment of an extra half per cent. dividend. Satisfaction was expressed by both Chairmen at the report of the Royal Commission. As to the London County Council and their doings, Mr. Tendron and his colleagues have come to the conclusion that the more they attend to their own affairs, and the less they trouble about the County Council, except to defend the Company from attack, the better it will be. This is a judicious resolution; but, unfortunately, the exception entails upon the Company, as well as all the others, the expenditure of a great deal of money which might be much more usefully employed.

Sir John Harwood, the Chairman of the Water Committee of the Manchester Corporation, is evidently a man who believes in taking Time by the forelock. Though he acknowledges that Manchester has not arrived at utilizing half of the water which will eventually be furnished from Thirlmere, the consumption is increasing at such a rate that in a very few years the supply at present available will be insufficient for the wants of the city. He therefore asked the Council last Wednesday to sanction the laying of an additional pipe from the above-named lake, to bring in an extra 10 million gallons of water, at a cost of £500,000. The matter is urgent, as the work will require three years for its execution, and there is now a margin of only 2½ million gallons per day. Possibly if Sir John's request had gone no farther than asking for the new pipe—though it seems that it would be much more economical to lay all the four extra pipes contemplated in the scheme while the work is in hand—there would not have been much discussion upon the proposal. But in their report the Committee had the temerity to call special attention to the fact that the supply from Thirlmere is "not inexhaustible for all "time," and that disregard of this circumstance has led, "if not to actual waste, at all events to a very excessive "increase in the consumption." While asking for his new pipe, therefore, Sir John emphasized the remarks of the Committee just quoted, and pointed out the advisability of a more judicious use of water. For this he and his Committee were stigmatized by certain councillors as "alarmists," more especially as they had referred to the increasing number of water-closets in the city, and questioned whether, if this went on, the service would be able to bear the strain. The discussion then turned upon the relative merits of the closet and the pail system. The former conveniences are increasing at the rate of close upon a thousand a year in Manchester, and they cause the use of 64,000 gallons of water daily which was not contemplated when the Thirlmere scheme was devised; and the point which the Council discussed was practically whether or not the order made in 1891 as to the adoption of water-closets should be revised in favour of the pail system. The course suggested was adopted on both sides.

THE INCORPORATED GAS INSTITUTE.

PROCEEDINGS AT THE THIRTY-SEVENTH ANNUAL GENERAL MEETING,

HELD AT THE

ROYAL UNITED SERVICE INSTITUTION, WHITEHALL,

JUNE 12 AND 13, 1900.

Mr. E. HERBERT STEVENSON, M.Inst.C.E., President.

REVIEW OF PROCEEDINGS.

In the height of the strongest heat-wave of the summer and in the midst of a pelting thunderstorm, a numerous company of members of the Incorporated Gas Institute assembled this day week at the Royal United Service Institution, Whitehall, for what must be classified as one of the most momentous meetings in the records of the Society. The President (Mr. E. Herbert Stevenson) took the chair with commendable punctuality, and began the business with an air of good humour and urbanity which augured well for the smoothness of the subsequent proceedings. The subject of amalgamation of the two national organizations was first broached by Mr. W. R. Chester, in moving the adoption of the report of the Council. The accounts revealed a healthy condition of the Institute finances, and were passed without comment.

The President's Medal and first premium for last year's papers went to Mr. T. O. Paterson, of Birkenhead; the second premium, to Mr. T. Newbigging; and the third, to Mr. J. P. Leather.

During the presentation of the awards, Mr. J. W. Helps, the President of the Institution of Gas Engineers, entered the hall, and took a seat on the platform beside the President, amid general applause. Another exceptional incident was the voting of a complimentary presentation of a piece of plate to the Honorary Secretary (Mr. Andrew Dougall), on the termination of his period of five years' service in this responsible and difficult office. This was an exceedingly popular interlude; Mr. Dougall being as well and widely appreciated by the members as he deserves to be, which is saying much. The President then began the delivery of his Inaugural Address.

It commenced very frankly with an admission that the speaker could not claim to have had much prior acquaintanceship with the bulk of the members of the Institute to the chair of which he was called, by circumstances and a somewhat ironical Fate, at a critical period of the history of the organization. It was just as well that Mr. Stevenson should have made this voluntary confession of not being a strong Institute man; because if he had not done so, others might have found occasion to twit him with the fact. As it was, the President threw himself upon his Council and the Honorary Secretary; and by freely ascribing to them most of the credit for whatever benefit to the Institute may be referable to his tenure of the chair, he disarmed the easiest and most obvious criticism on what might be found amiss. It is indeed remarkable that the task of conducting, in the name of the Institute, the most difficult and delicate foreign and domestic diplomatic negotiations that have ever been entrusted to a President of this body, should have fallen to so detached a personality as that of Mr. Stevenson. But possibly there was a gain in this. The President was able to play the part of an *amicus curiæ* to the two national Societies which had shown a strong desire to sink their differences and unite their forces. His experience of parliamentary bargaining and arbitration proceedings must have prepared him for the similar kind of work he had to do for the Institute during his year of office. He was in this respect much better fitted than a strong partisan for the shaping of the external policy of the Institute, although his lack of familiarity with individuals inside the organization was a source of awkwardness in the treatment of particular cases. Still, "there's always a something" in earthly concerns which calls for pardon and speedy forgetfulness.

The President was fain to confess that the technical fare provided for the days of meeting was spare, but cheerfully opined that it would hold out for the allotted time, especially as the question of amalgamation with the Institution would probably excite a good deal of discussion. With this passing reference, the address went on to describe the actual crisis through which the gas industry is passing. This naturally suggested a reference to the circumstances of the industry in 1873, when the then existing system of maximum dividends, with power of revision, so signally broke down. There was a so-called "coal famine" in the land in those days; and it passed away. The President holds the cheerful belief that what has been will be again; and he sees in the present dearness of coal only a transient pinch, which gas consumers and companies must bear together while it lasts. As for the municipalized gas undertakings of the country, the President had little thought or care for them in this emergency. He merely remarked that they could raise the price of gas, and added the cryptic utterance that the long-suffering ratepayer "will now possibly find out how very useful he may be." What did he mean by this? So far as observation yet extends, it looks rather as though it is the poor gas consumer who, as usual, is to be made to bear the burdens of the ratepayer.

It is possible to agree with much that the President advanced to show that the general position of gas undertakings to-day, and their ability to bear the coalowners' "nip," are superior to the state of the same concerns thirty years ago. Probably, however, some may think that this line of argument was not sufficiently worked out. It would have been more convincing had it been supported by some reference to a particular instance, instead of being allowed to rest only upon general principles. The sliding-scale, for instance, looks very different, from the public standpoint, according to whether it is working up or down. The President left the subject open for fuller treatment by himself or somebody else later, and finished this part of his address with a generous laudation of those who, in the present session of Parliament, have succeeded in breaking through the hide-bound prescriptions of statutes regulating the illuminating power of London gas. He is not one of those who are unable to see the significance of the new movement inaugurated at enormous cost and pains by the South Metropolitan Gas Company.

From this matter, the President passed to the subject of the proposed union of the Institute and the Institution. He showed how, in negotiating to this end, he and the Council felt themselves to be acting upon a mandate of last year's meeting. He remarked upon the striking coincidence of his late father, Mr. G. W. Stevenson, having been the first President of the Gas Institute after the reconstruction, and of the likelihood of himself being the last, if the suggested fusion were to take place. These considerations led up to the crucial point, which was the question whether the membership of the Institute, as a body, would support the tentatives of the Council in respect of the reconstruction of a single new technical companionship upon the remains of two abandoned organizations. This question, again, was shown to wholly turn upon the possibility of procuring the acceptance by the members generally of the Fourth Clause of the Memorandum of Association of the proposed new Association. The President did not at all trifle with the point. There was the clause. He read it, commended it, and reminded the meeting that the question was practically passed upon by last year's assemblage. As soon as the Council had agreed upon the clause themselves, they directed the President to bring it under the notice of everybody who might be regarded as likely to be touched by it. This was a peculiarly ungrateful task to impose upon any official personage. Nobody likes disfranchising measures; but they are necessary at times. It is nobody's fault that this is so, least of all those who find themselves under the painful duty of working the guillotine.

This was the position: The existence in the Institute of a particular order of members was recognized on all hands as an insuperable bar to the formation of a new Society. They were invited to consider the situation, and to subordinate any personal desire they might entertain to keep their standing, to the general aspiration towards unity which unquestionably inspires the majority of members of the profession. Many—indeed, most of them, and the best esteemed—saw the expediency of the sacrifice, and they made it. Not gladly, of course. It would have been impossible for Mr. Hepworth and Mr. John West, who have filled the chair of the Institute, and enjoy universal respect and much individual affection, to contemplate the severance

of the tie that bound them to the body they had served so well. But these magnanimous Past-Presidents were equal to the occasion, and gave the highest meed of approbation to the action of the Council by conforming to the spirit of the movement. They did more—they certainly saved the position, so far as safety could be ensured in anticipation of the event.

This part of the address was its culmination. The rest was matter of detail. The proposed title of the new Society was mentioned; and it was explained that the scale of subscriptions for non-elective members will remain the same as of yore. New members coming up for election would be expected to pay more. This explanation brought the brief address to its conclusion. It therefore remains one of the shortest of presidential utterances in the records of the Institute. Nor were the circumstances favourable to the pronouncement of any long discourse upon technicalities. The meeting had but the one subject in mind; and the President was in no way inclined to stand in the way of the discussion. His cue obviously was to put the question of the conduct of these negotiations and deliberations to the test of a vote, without occupying much time in preliminaries. Time pressed; and he had no desire to appropriate the precious moments for a display of his rhetorical powers. It was a wise course in the circumstances—leaving it impossible for any member to fairly complain of a stinted opportunity for debating the points of the proposed settlement. Mr. Stevenson has the satisfaction of feeling that he effaced himself as far as possible, and left the fairest and fullest field for the discussion of the plan of union from every point of interest.

"The Society of Gas Engineers and Managers," as the provisional title for the new companionship, came out for the first time in the course of the address, which was fairly well received.

The vote of thanks for the address was moved by Mr. W. A. Valon, who laid stress upon its businesslike quality. The vote was seconded by Mr. C. S. Ellery, of Bath, who specially acknowledged the public spirit of the President and members of the Council in giving up so much valuable time to, and taking such pains over, the arduous work of the year. The President's acknowledgment of the vote was particularly well inspired and gracefully expressed.

The first motion in favour of amalgamation, as a general principle, was put from the chair, and seconded by Mr. Porter, of Elland. It was supported by Mr. Chester, and passed by a show of hands without a dissentient.

The second resolution was prefaced by the reading of letters from Mr. Hepworth and Mr. West. It was afterwards stated that only three gentlemen still refused to retire from membership in order to facilitate the reunion of the profession. The executive resolution was moved in unexceptionable language by the President, and seconded by Mr. Valon in a highly politic speech, terminating in an almost impassioned plea for unity irrespective of personal considerations.

Mr. C. E. Jones opposed the liquidation of the Institute, as a preliminary to union; holding that the Institute was quite well adapted to fulfil all the requirements of a peripatetic technical society, and should be preserved. He argued for the alternative procedure of the members of the Institution coming to the Institute; and he moved wordily an amendment to the resolution in this sense. All Mr. Jones's supporters avowed their desire for reunion, but objected to the programme of the Council. Mr. W. Carr argued that the price asked for amalgamation was too high. The Solicitor at this point intervened with an explanation that the proposed method of procedure was the only one practicable; and the President ruled that the carrying of any such amendment would quash the whole thing. These strong rulings served to keep the meeting in hand; and the discussion accordingly went forward in order on Mr. Jones's amendment. The President showed firmness and skill in keeping the debate to the point, and refusing to admit disturbing matter. He proved to be a strong Chairman; and he had his reward in a good majority for the recommendation of the Council and against Mr. Jones's amendment, declared to be a direct negative to the original resolution.

This vote being taken after one o'clock, the President insisted on going on with the discussion to a finish. Mr. Chester accordingly moved the delaying amendment recorded against his name, which he supported in an admirable speech. The amendment was seconded by Mr. Isaac Carr; and there was no desire manifested to prolong the discussion. The President accordingly deprecated hanging up the issue for an indefinite period; and the amendment was defeated by a vote of 70 to 60.

Mr. Miles had a further amendment to offer, relating to clause 4, and making its operation prospective. This was supported by Mr. Chester, but opposed by Mr. Valon, who wished the question to be left to the Council. Mr. Ford, of Stockton, speaking as a member of the Council, here gave valuable support to the Chair. This amendment shared the fate of the others, only more so; the figures being 62 for, and 81 against.

The vote was immediately taken on the substantive motion, resulting in its being carried by 82 to 18. This apparently ended a momentous crisis. It only remained to take the vote upon the constitutional question—"That "this Institute be wound up voluntarily." A three-fourths majority was declared to be necessary to carry this resolution; and it was not obtained by four votes. The motion was therefore lost; and the matter fell through. Not absolutely, however, for Mr. D. Irving stepped into the breach, and demanded a poll, which was appointed to be taken in the afternoon, at four o'clock. Thus the business of the morning ended in a thoroughly unsatisfactory deadlock; the last vote being contradictory of the sense of those that preceded it. The meeting adjourned for the luncheon interval with the uncomfortable feeling that it had not comported itself with any conspicuous wisdom.

In the afternoon, Mr. Chester's paper was taken. It is a very useful contribution to the technical literature of coal carbonization, and, in other circumstances, would have made a deeper impression. It nevertheless elicited a good discussion, and was decidedly the most important paper submitted to the meeting.

The discussion was interrupted by the inexorable sounding of the hour of four, at which the ballot on the constitutional question of liquidation was to be taken. There was considerable confusion at the moment; a large contingent of members having so delayed their return as to incur great risk of being shut out from the division. But, eventually, the papers were duly distributed, filled up, and collected; Mr. Martin and Mr. C. E. Jones being appointed Scrutineers to announce the result, which was: For the dissolution, 86; against, 64—26 votes short of the requisite three-fourths majority.

The result was naturally awaited with great interest, as it was understood to mark an era in the history of the Institute. The hall presented a very animated aspect at this crisis; the members all conversing anxiously on the prospects of the division. On the announcement of the figures by the President, there was a dead silence; the discrepancy between the various polls of the day being felt to be anything but creditable to the Institute. So much for the dream of unity!

The conclusion of the discussion on Mr. Chester's paper occupied the first half hour of Wednesday's meeting, and was immediately followed by Mr. Webber's lecture, which proved to be a development of the thesis that the permanent success of the incandescent system of gas lighting reacts upon the manufacture of the gas used, and practically makes it all fuel gas. It was on the lines of the evidence offered in support of the South Metropolitan Gas Bill in Parliament recently.

Mr. Walmisley's paper on "Iron Roofs" was next taken, and was a very instructive statement of the best practice in this line of construction. Mr. Wilkinson's spicy paper completed the work of a busy and profitable morning.

Mr. Young's paper on "Naphthalene" was read after the luncheon interval. Then followed the regular constitutional business of the meeting, which, in view of the circumstances, was of unusual interest. The new President is Mr. T. O. Paterson, of Birkenhead; and Mr. A. Dougall is succeeded in the important office of Honorary Secretary by Mr. J. Davis, of Gravesend. An important variation on the usual order of business was the moving by Mr. Jas. Stelfox of a resolution intended to restore the opening for union of the two Societies which the unhappy vote of the previous day seemed to shut. This endeavour to mend a bad business was warmly received, and cordially supported upon all sides. It was carried without a single dissentient, and with every sign of satisfaction. This was the best that could have been done; and it is to be hoped that everybody concerned will so regard it. Next year's meeting will again be held in London, which will be by far

the most convenient place of assembly in the conditions of the present and coming year.

So the meeting ended with coruscating votes of thanks and also the presentation to Mr. A. Dougall—some of the members to go to Paris the same night, and others to spend the next day at Stonehenge. Both excursions were successful and enjoyable in an eminent degree; and the experiment of dividing the party into two or even more groups, for the general convenience, may possibly be repeated.

THE PROCEEDINGS SUMMARIZED.

[*The usual full Report Commences on p.* 1616.]

Under oppressive atmospherical conditions (which even a heavy storm at the time fixed for the commencement of the proceedings did not mitigate), the members of the Gas Institute assembled in the Lecture Theatre of the Royal United Service Institution on Tuesday morning last. The hall, too, was uncomfortably crowded in anticipation of the sitting being a lively and eventful one. This it proved to be; and in the excitement and interest of the occasion, personal discomfort was a secondary consideration. The President (Mr. E. H. Stevenson) took the chair shortly after 10.30; and a little later he was joined on the daïs by Mr. J. W. Helps, the President of the Institution of Gas Engineers, whose reception attested his popularity among the members of the old Institute.

Formal Business and Presentations.

The preliminary business was quickly disposed of. The minutes of the last meeting were confirmed; and then the annual report of the Council was presented. The adoption of the report (the principal portions of which have already been published) was moved by Mr. W. R. Chester, who made reference to the long list of deceased members, and alluded with particular regret to the loss of the former Secretary (Mr. F. G. Burfield), whom the members held in great regard. He also congratulated the Council upon the advance of the amalgamation question, and the efforts they had made in this direction. Following the adoption of the report, came the awards for papers read at the last meeting. Mr. T. O. Paterson was the recipient of the President's Medal and a cheque for £10 for his paper on "Gas for Motor Purposes." Mr. Thomas Newbigging was awarded a cheque for his paper on "Differential Rates;" but he was not present to receive it. Mr. J. P. Leather also received a similar recognition of his valuable contribution on "Naphthalene Deposits." An announcement by the President that, the term of Mr. A. Dougall's office as Hon. Secretary being about to close, the Council had decided to make a presentation of plate to him, was marked by the warmest approbation.

The President's Address.

The formal business completed, the President delivered his Inaugural Address. The full text was published last week; and some comments upon it appear in the preceding "Review." Therefore it is unnecessary to make mention of its contents here. It was well received, and was characterized by Mr. W. A. Valon, in proposing a vote of thanks to the President, as a very business-like composition. The members' appreciation for it was testified with their accustomed vigour.

The Amalgamation Question—Unity Approved, but the Price too Heavy.

Then the great topic of the day—the amalgamation scheme—was introduced by the President; and the pent-up excitement of some of the members soon found vent. On the whole, it must be said the matter was discussed by the bulk of the speakers with great moderation; but a few little indiscretions were committed in the heat of the moment—and not only in the body of the hall. The principle of amalgamation was approved without hesitation; but the one vital condition was objectionable to a minority of sufficient strength to sacrifice the whole scheme. That condition was the disqualifying clause, which excluded from membership persons "actively engaged in or about the management of business, either as principal, managing director of a joint-stock company, or as agent, or traveller of any trading company, firm, or concern doing business with gas undertakings, whether as vendor or as purchaser." And it was the thought of losing, under this rule, such men as Mr. John West and Mr. J. Hepworth that was the moving and paramount influence. At the outset, the President moved a resolution expressing the desirability of amalgamation; and seconded by Mr. Robert Porter, and supported by Mr. W. R. Chester, it was carried without dissent. The second resolution recorded that it was desirable that amalgamation should be effected by the voluntary liquidation of the Institute and Institution, and by the transfer of all property and assets of the two bodies to a new Society, having a Memorandum and Articles of Association in the form of the draft issued to the members. Before the discussion was opened, the President read letters from Mr. Hepworth and Mr. West. In terms which showed how keenly he would regret his severance from the Institute, Mr. Hepworth declined to allow his personal feelings to bar the way of amalgamation. Mr. West also was unwilling that his membership should be an obstruction; but at the same time he thought some rule might have been framed whereby technically trained men could have been admitted to the new organization. Of the associate members, there were only three, the President stated, who had absolutely declined to resign. He commented on the difficulty of differentiating between gentlemen who were in any way connected with firms trading with gas undertakings; and he also stated the necessities for dissolution and reconstruction. He formally moved the resolution, which Mr. W. A. Valon seconded. While he did not want the rules to be framed in such a way as to exclude for all time such men as Mr. West and Mr. Hepworth, Mr. Valon admitted that the gas profession ought not to suffer because of individual disqualifications. However, he could not see any impossibility in meeting this matter. He finished a well-pointed speech with a stirring appeal to the members not to let differences of opinion stand in the path of re-union. In a speech, in which power and humour were blended in the old, well-known style of Mr. C. E. Jones, that gentleman declared that he yielded to none in his wish to further the best interests of the profession. Yet he could not see the necessity for liquidation; the Institute being well adapted for the reception of their "erring brethren" of the Institution. He argued that the Institution of Civil Engineers would never have been what it is if the great engineers who were, and had been, identified with trade had not been admitted to its ranks. He moved that it be an instruction to the Council to effect the proposed union without dissolving the Institute. Prefacing his remarks by a statement that he was agreed as to amalgamation, Mr. William Carr thought the point they had to consider was the price they had to pay as the parent Institute. There were 518 members in the Institute; and he ventured to say that amalgamation would not raise the number to 600, while 109 gentlemen would be severed from them. He described the circular which had been sent by the President to the associate members as an injudicious one; and he told the President that the 57 assents obtained were given more or less under compulsion. Those gentlemen were willing to retire; but it would be to the everlasting disgrace of the Institute if it were made necessary that day. He failed to see any just reason whatever why the Institute should be dissolved, or the associate members banished at the behest of the Institution. The necessity for the dissolution having been explained by the Solicitor, Mr. W. W. Hutchinson gave it as his opinion that it was an unfair thing to ask the associate members to resign, though he would like to see the re-union accomplished. Mr. W. Hardie, hoped the members would hesitate before nullifying the whole of the Council's labours in this matter. Mr. Robert Fish was sorry separation had ever come about; and a reason for the obnoxious rule being made retrospective was sought by Mr. J. P. Leather. One noteworthy remark of Mr. J. Stelfox was that the trade element should keep in their own place, and that place was not at the meetings of the Institute. In Alderman Miles's judgment, the terms of amalgamation were not equitable. Mr. D. T. Livesey saw nothing in the way of amalgamation that was insurmountable. A most effective and really polished speech was made by Mr. J. Carter, who traced in Mr. Jones's amendment something that was not consistent with the resolution already carried. On the other hand, in the proposal under discussion, there was such a ruthless violation of existing rights as should not be found in any scheme of amalgamation. They should not allow the union to be shattered; but he was extremely anxious that

the interests of the present associate members should be recognized in the amalgamated Society. That some means of reconciliation would be found was the earnest hope of Mr. W. Prince. It was explained by the President that there were 240 members in the Institution, under 40 per cent. of whom were also members of the Institute. An unfortunate incident, causing as it did considerable irritation, was his reference to the difference in position between the men who would be gained and lost. The voting resulted in the rejection of the amendment.

In the hope that the labours of the Council would not be lost, Mr. Chester moved a further amendment composed of the first part of the second resolution, but referring back for the further consideration of the Council the draft Memorandum and Articles of Association. He remarked that he did not believe the members were prepared to pay the price required under Rule 4; and he thought a proviso might be inserted to meet the election of such eminent gentlemen as Messrs. West, Hepworth, and Sugg. The members did not wish to emasculate the Institute by depriving it of its manhood as proposed by the rule mentioned. Mr. Isaac Carr seconded the amendment; but it was also negatived.

Another effort to pour oil on the troubled waters was made by Alderman Miles, who proposed a modification of Rule 4 which would have had the effect of making it prospective instead of retrospective. Mr. Chester seconded; but after a few observations by Messrs. Valon, Ford, and Herbert Lees, this proposal was likewise rejected.

The original motion was then carried by 82 votes against 18. Thus far the scheme had gone through; but it was wrecked on the smallest rock in its course. The final resolution was, "That the Institute be wound up voluntarily," and 95 voted in its favour, and 37 against. The requisite majority in favour not being obtained, it was declared lost. One last struggle to save the situation was made by Mr. D. Irving, who, supported by other members, demanded a ballot. This it was decreed by the President should be taken at four o'clock in the afternoon; and just before that hour arrived, a large number of members flocked into the hall who had absented themselves during the previous portion of the afternoon sitting. Sharp to the hour, the President ordered the doors to be closed; and this instruction bid fair to create a little disorder—in fact, one member charged the President with trying to take a snatch vote. However, the ballot was eventually accomplished; and the voting was 86 in favour of the resolution and 64 against. This was a far worse result than before; and it means that the century will now probably end with the gas profession still in a state of division.

The lengthened time occupied in the discussion of the above momentous question left but a small portion of the day's sitting for the consideration of technical matter—in fact, it only permitted of the reading of Mr. Chester's paper, in which he champions the cause of inclined retorts, and the commencement of the discussion. The paper was entitled

Automatic Stoking and Inclined Retorts.

In the opening paragraphs, a rapid survey was made of the evolution of mechanical stoking to the point at which the West and Arrol-Foulis machines were made commercially successful. Inclined retorts, however, in the author's view, have an economical limit much lower than the power stoker, and are therefore applicable to smaller works. The utmost economical limit of the power stoker is 500,000 cubic feet of gas per day, as against (say) 100,000 cubic feet in the case of inclined retorts at the time of the minimum output. Where the installation is of suitable magnitude, there is not much real difference in the cost of mechanical stoking between inclined and horizontal retorts; but the inclined system has this advantage, that it can be successfully worked when the power stoker cannot enter into competition on account of the smallness of the works. So far, the author's remarks (of which the foregoing is the purport) are preliminary to the main object of the paper, which is to describe an installation of inclined retorts at the Eastcroft works at Nottingham, and also the mechanical contrivances for dealing with the coal and coke, which, he states, "make the installation the most complete of its kind in existence, and render the process of carbonizing in gas-works as nearly automatic as it can be." The house to which the system has been applied is an old one; and the means adopted to effect the conversion from horizontal regenerator settings are explained. The division walls of the settings being only 8 ft. 6 in. apart, it was not possible to get more than seven retorts in a bed; and they were set at an angle of 32°. They are 21 ft. 10 in. long, measured on the incline, and taper from 20 inches wide at the top to 22 inches at the bottom, by 16 inches deep. The charge of coal is 8 cwt. for the through retort, or 180 tons for the whole house when on six-hour charges. The method of breaking, elevating, and distributing the coal in the house is described. Broadly, the arrangement is similar to that ordinarily applied in new installations; and the author does not claim any particular merit for it. The principal novelty of the installation lies in the method of dealing with the coke. In front of the discharging end of the retorts, are two push-plate conveyors, each moving towards the centre of the house, with the return chain carried overhead. Upon the edges of the conveyor trough, a portable hopper and shoot has been devised, to traverse the whole length of the retorts on wheels. The charges of coke are received into this hopper, and are lowered on to the conveyor through a pair of hinged doors in the bottom of the hopper. Without some such arrangement as this, the rapid discharge of the coke from the retorts causes it to fall in a heap and block the conveyor, besides which the coke cannot be properly quenched. When, by the way, the lids of the retorts are opened, the tar falls on to an inclined plate attached to one side of the hopper, and runs down the plate into a bucket provided for its reception. Another feature of the portable hopper is that, if required, it will transmit the coke while hot to the furnaces. From both ends of the house, the conveyor delivers the coke into an elevator fixed in the centre, and it is raised into storage hoppers having a total capacity of 280 tons. From these hoppers, the coke is screened and delivered into trucks as required. The net expenditure for the conversion of sixteen beds of horizontal regenerator settings into a like number of beds of inclined retorts, with all the necessary coal and coke machinery for automatic working, was £20,000. The total saving the author estimates at fully 2s. per ton of coal carbonized, or sufficient to recoup the whole outlay in about four-and-a-half years of 250 working days each.

In inviting discussion, the President complimented Mr. Chester upon having eliminated hand labour so far as was possible in the process of carbonization. Mr. Shoubridge opened by disagreeing that power machinery could be economically used in gas-works with such a small output as 500,000 cubic feet per day. His own experience led him to say that not less than twelve beds could be economically worked by power machinery. It was very gratifying to him that Mr. Chester had adopted the same inclined retorts and charging machinery that he (Mr. Shoubridge) had put down at Salford. The statement of the author that his was the only installation in existence where the whole of the carbonizing from the reception of coal to the transmission of the coke from the works was automatically accomplished, was hardly correct. The same thing was done at Birmingham ten years ago, and in a good many instances in Germany, Denmark, Austria, and Belgium. The portable hopper was the novelty of the installation; and he could quite understand that some such hopper shoot was necessary with the form of conveyor used by the author. But such a hopper was not a necessity in the works under his own control. It was stated by Mr. Tim Duxbury that at Middleton they had in each oven eight retorts, 20 feet long; and when they had three ovens working, it cost them 1s. 2d. per ton for carbonization, six the same, and he thought with twelve it would be the same. Mr. W. A. Padfield inquired whether there was any creeping of the coal in Mr. Chester's installation, and also whether he used a variety of coal. Mr. T. O. Paterson asked the amount the author provided for wear and tear of his plant. Mr. W. Whatmough, referring to the saving of 2s. claimed by Mr. Chester, asked for the cost of labour before this installation was put down. At this point, the discussion was interrupted to take the ballot on the amalgamation question; and, consequently, the discussion suffered. The next morning the only speaker was Mr. C. A. Craven, who remarked that he found with inclined retorts a considerable saving, even with his minimum production, compared with hand labour. Frequently the total cost of labour was only 1s. 2d. or 1s. 2½d. per ton. In the summer time, the cost might get up to 1s. 6d. or 1s. 7d., but the average throughout the year was about

1s. 4d. He had worked inclined retorts three years with very satisfactory results. In his reply, Mr. Chester made some very complimentary remarks with reference to Mr. Shoubridge's work in connection with inclined retorts. He also gave further information as to the screening of the coke. Regarding Mr. Duxbury's statement that he did not find a decrease in the average cost on increasing the number of retorts, he observed that this was contrary to general experience. He (Mr. Chester) used something like thirty to forty different varieties of coal, and he was prepared to deal with any kind likely to come into the works. On his own works, he had not met with the creeping of coal. The apparatus had not been in use sufficiently long to determine the wear and tear; but he was sure it would be less than with power stoking. With hand labour the cost from point to point dealt with by the apparatus described was 3s. per ton of coal carbonized, as against 1s. under the new conditions.

The President next called upon Mr. W. H. Y. Webber for his lecture, to which he had given the obscure title

The New Gas.

As the title stood in the programme, it attracted attention and occasioned some wonder. And the title of any lecture, essay, or paper which does this is a title to be admired; for frequently upon the title depends the extent and depth of interest taken in the discourse or matter which follows. In this instance, nothing in the three monosyllabic words employed indicated the character of the gas upon which Mr. Webber proposed to expatiate; and consequently until Wednesday last the lecture was veiled in a little pleasant mystification. But now that it has been delivered, many would, without Mr. Webber's explanation as to the manner in which he applied the descriptive word "new," be inclined to say that its use was inappropriate; for the gas of which he spoke is that common coal gas which our predecessors made and used. In a sentence, however, he cleared away all ambiguity. "I mean to say," said Mr. Webber, "that while the gas is old, being none other than the honest, unsophisticated coal gas of our fathers, as a resource of the material civilization of the coming century, the gas is new; because it will be produced according to a reformed principle of manufacture, and will be used for a totally new service." His position stated, he reminded his hearers of the aspiration of scientific workers that something which they vaguely qualified as "cheap fuel gas" should be made available for general consumption, as coal gas was for lighting; but he refrained from wearying his audience, and padding his subject, by going over the old ground as to the constitution of the great variety of gaseous fuel proposals to which those aspirations have given birth. He, however, stopped to recall something which had almost, by the passing of time, faded from memory—that was, the advocacy by Sir William Siemens, in an address to the parent Association at Birmingham twenty years ago, of a system of duplex coal carbonization, in which two-thirds of the make should be reserved for sale as illuminating gas, and the remaining one-third be diverted for sale separately as heating gas, and his words (now the more remarkable) as to the heating value of a gas of low illuminating power. In the historic debate which followed, much was said about the desirability of cheapening town's gas; but the discussion proceeded on the tacit assumption that if there was to be such a public service as that of fuel gas, it must necessarily be something totally different from the ordinary town's gas of high illuminating power. Consequently, the idea of a heating-gas branch for gas undertakings fell flat; and for some years it became usual to increase the illuminating power of town's gas, with the idea of giving people good value for their money. This era the lecturer called the Dark Age of the British gas industry. At the commencement of the eighties, the gas industry was really at a perilous pass. Electric lighting was then coming in; and there was nothing in gas-burners to meet the incandescent light on its own ground. The electricians declared that the only proper employment for gas was as a fuel; and events have justified this judgment, albeit in a manner that those who pronounced it neither expected nor desired. Then came the "Otto" gas-engine; and gas cooking-ranges were tentatively taken up by the most progressive gas companies. But they looked very blankly at this small department of their business, and could not see their accustomed dividends in it. Five years later came Dr. Auer von Welsbach's invention. It was this which turned all town's gas into fuel gas without for some time anybody marking the change; and it is scarcely yet realized that its appearance practically made a new gas. To Dr. Auer the gas industry owes the simple, easy, and natural solution of the puzzle that discomfited all the wise and skilful experts at the Birmingham meeting who heard Dr. Siemens hold forth. Passing on, the lecturer directed the minds of his auditors to Germany, where he showed them things "that shall be here in due course." In Germany, there is no patent monopoly whatever in the Welsbach system; and the result has been that for years it has been worked there strictly on the commercial system. The gas companies there, he explained, are able to buy mantles at from a penny to twopence apiece; and the burners cost ninepence. They have also a system of cleaning and maintenance, from the gallery upwards, at a uniform charge of about 6d. a burner. Broadly speaking, wherever the gas companies do their work in a businesslike style, there is now in Germany nothing but incandescent gas lighting. Berlin will have only incandescent gas-burners in the streets; and last year's increase of burners on the books of the German Continental Gas Company was divided thus: Incandescent burners 21,842, flat flame 1895, and argand 98. The replacement of old luminous flame burners by incandescents is going on everywhere with similar rapidity. This being the state of the case, the practical German mind has already realized that the gas manufacturer has for the future to sell fuel gas only. Experiments instituted by Herr W. von Oechelhaeuser, to clear up the question of what relation the conventional illuminating power of town's gas has to its fuel value, with special reference to the performance of the incandescent thorium-cerium mantle, revealed the fact that, as the gas was unloaded of its benzol enrichment, and the normal illuminating power fell, the duty of the incandescent burner actually rose, while the calorific value dropped but very slightly. Almost non-luminous gas was found to be capable of activating the Auer mantle to the tune of 73·668 candles illuminating effect for a consumption of 3·673 cubic feet per hour. Dr. Bunte has corroborated this important record; and so in Germany, the lecturer told his audience, the age of heavy, loaded town's gas is over. To Herr Dieckmann, the Manager of the Municipal gas undertaking of Magdeburg, he accords the honour of being the first to declare for light gas; and now Magdeburg gets gas of no more than 10½-candle power. Although he sets no store by the illuminating power, Herr Dieckmann pays particular heed to the calorimeter testing of the gas. The records supplied by the lecturer of the tests both of illuminating power and of calorific value disclosed two things: First, what a vacillating quality the normal illuminating power of town's gas is; and, secondly, what a good, steady fuel any common coal gas is. Strikes and coal owners' rings not being unknown even in the happy fatherland, Herr Dieckmann proposes to adopt a carburetted water-gas plant, with which, by the aid of a native schist oil, he will make gas of, as near as possible, 8 Hefner power. He has satisfied himself that this gas will possess exactly equal calorific power with that now supplied to the town; and this is all he cares about. "Thus at last," said the lecturer with emphasis, "the photometer has come to play hand-maid to the calorimeter." "If," he added, "this simple circumstance does not prove the completeness of the revolution in gas manufacture I have attempted to describe, I should like to know where to find a better symbol of the change." Another example the lecturer gave in support of the main argument was Bremen. There it has been decided that the new gas-works shall inaugurate the new *régime* of light gas; and, under the new dispensation, there will be no standard of illuminating power. Town after town is actually consenting to be supplied at this moment with gas indicating from 7 to 10 (English) candle power; and they are the most brilliantly lit towns in Europe. In the concluding sentences of his ardent plea for a reformed gas supply, Mr. Webber made the piquant remark: "We poor red-tape bound English will be left in the lurch by the Germans in gas making as in some other things, unless we take a leaf out of their book, and free ourselves from everything that operates in restraint of trade, and to the discouragement of industrial enterprise."

The lecture was received with a very gratifying manifestation of approval. It was described by the President as most interesting and edifying; and by Mr. Stelfox, in

proposing a vote of thanks, as an extremely valuable contribution to the literature of the gas industry. Mr. Hardie, in seconding, made use of similar kindly expressions; but Mr. Isaac Carr regretted that the subject had not been presented in the form of a paper, as it bristled with controversial matter. The President mentioned that Mr. Webber had intimated that he was quite prepared for the matter to be discussed; but time was too short. A grateful acknowledgment by Mr. Webber concluded a very interesting feature of the proceedings.

Retort-House Roofs.

The paper which followed was by Mr. A. T. Walmisley; and it will be found valuable for reference by engineers when engaged in the design of retort-house roofs, as it brings within convenient limits the characteristics and measurements of several types planned by representative engineers. The first few paragraphs of the paper are devoted to some of the general principles followed in retort-house roof construction. Primary importance is given to ample ventilation above the eaves. Then, as a rule, the author states, no glass is introduced in the covering; and very little sunlight is admitted. In the stage-floor house, a greater amount of clear headway is required than in the ground-floor type. A ridge ventilator is generally made to extend from end to end of the building. Ventilating tubes or towers are sometimes added; and every effort is made, in a well-considered design, to provide roof ventilation free from wind currents at the sides of the building. Retort-houses are, as a rule, placed in sheltered positions; and the strains produced in a truss fixed on the side exposed to the wind are greater than the strains produced in a truss fixed on the lee-side only. Mechanical stoking has created a necessity for wider spans than formerly. With inclined retorts, the intermediate hopper causes the height of the building to be greater than in the case of hand stoking; and the span, as compared with horizontal retorts, is not reduced, since, with the double arrangement of benches usually introduced, space is left in the middle for the charging machinery. The chief characteristic of a roof is its principals, which may be triangular, quadrilateral, segmental, or a combined outline. As a rule, retort-house roofs have a straight inclined surface suitable for slate covering. The approximate weights and the kinds of slating used are cited by the author. The slates can be fixed directly on angle-iron laths or Z iron bars, without the introduction of woodwork, by lead pegs or copper or zinc clips. The angle usually given to the rafters averages about 1 in $1\frac{1}{2}$, having a rise of one-third of the span; and this inclination gives an angle of 33° to 34° with the horizontal. Then follow descriptions of several types of roofs; and the author draws attention to their distinguishing features. He incidentally gives the useful rule that a weight of 8 cwt. per square is ample to allow for a roof of 60 feet span, or 10 cwt. for a span of 100 feet, if intended to carry slates on boarding. In roofs of 100 feet or less span, there is no economy in making the parts of steel. The author also comments upon the necessity for having the lengths of the various elements of a roof truss perfectly accurate, in order to ensure satisfactory results. The roofs dealt with include samples of construction from the gas-works at East Greenwich, Bow Common, Newcastle, Folkestone, Sheffield, Luton, Sydenham, Ramsgate, Tottenham, Dublin, Derby, Beckton, and Hartlepool. The measurements and other information which the author has brought together form a serviceable compendium of the latest and best practice in connection with the subject. A large collection of diagrams illustrating the paper were exhibited at the meeting, and we purpose publishing several of them with the text of the communication.

There was an excellent discussion on the paper. It was opened by the President, who, while complimenting the author, thought that some of the examples of roofs illustrated were old, and would not be adopted now. He also related certain of his own experiences bearing on the question. It was considered by Mr. C. E. Jones that cast-iron was a source of weakness in a roof, and should be eliminated; and he asked for the author's views on the point. He also stated that the life of corrugated roofs was very short; and there was no economy in using them. There were many situations on gas-works where light roofs were required; and it seemed to him that uniform types for specified spans would be very useful. Mr. F. W. Cross asked the author whether he could give the members some idea of the strain upon the walls—the outward thrust—of the different types of straight and curved roofs. Mr. F. W. Stevenson would have been pleased if the author had criticized, or called attention to, the weak points in the examples of roofs shown. He objected to the use of copper fastenings in retort-house roofs, as they would be destroyed, while good lead would stand in that position for many years. As to the "dead weight" mentioned by the author, he asked whether it included everything complete. Corrugated galvanized sheeting for gas-works was not suitable for retort-houses or places exposed to fumes; but there were many places where it was useful. For instance, in coal-sheds, where there was a good deal of vibration, nothing could be better than galvanized roofs. By tarring them every other year, they would last for a great length of time. At Sheffield, they had had them in use twenty years. In Mr. G. R. Hislop's opinion, in exposed situations galvanized iron was preferable to slating, on account of the liability to accident by the wind blowing down the slates. He took the precaution of coating corrugated roofs with oxide paint both inside and outside. He believed the use of cast iron in roofs was a thing of the past. Mr. William Carr thought the paper would be of more value to gas engineers for reference in time to come than as a paper to discuss. He had been thinking of adopting a galvanized iron roof, but on hearing the author's remarks, he felt he would have to hesitate; but from what they had heard from Mr. Fletcher Stevenson, he thought the galvanized roof would have to go on. Several criticisms were made by Mr. J. H. Crowther, who considered it most desirable to use a suspension rod to keep up the tie-bars in the centre of the roofs. A very light one was all that was necessary. Nothing had been said about wind-ties in connection with the bracing of these roofs. Slated roofs could be constructed so that there need be no fear of danger, no matter how much exposed. Mr. T. O. Paterson said he had slated retort-house and purifying-house roofs which had been in use fifteen years; and he had not had a slater on them since they were erected. Mr. S. W. Durkin next recounted his experiences, in roof construction, and added that he had a galvanized roof which had been in use now some years; and it did not cost him a penny except for an occasional coat of paint outside. In working out weights and strains, Mr. Ellery was of opinion that they should not draw the matter too fine. He also advocated the putting of a little more weight in roofs, rather than multiplying the members and joints. He was now erecting roofs on girders; and the question had occurred to him as to how far—in connection with expansion and contraction—they should tie up the roofs to the walls and girders, and how far they should give them play. The usefulness of papers of this kind to the younger members of the profession was borne witness to by Mr. Arthur Valon. Replying to the discussion, Mr. Walmisley said the question of the use of wind-ties was mainly effected by the situation of the roof. Cast iron should not be introduced in any member which was likely to be subjected to tensile strain. The "dead weight" which he had mentioned was simply the framework, and did not include the covering. The question of the strength of roofs depended much upon the requirements of the situation. Speaking generally, it did not do to cut down the sections too fine; and he thought it best to allow an excess of metal for deterioration. He did not care for galvanized iron; and he would sooner use corrugated iron, and give it two coats of iron paint. A good designer always took care that every part was available to the painter's brush. He also agreed as to the advisability of reducing the number of members in a roof. Arched roofs were suitable for large spans; but it must not be supposed that, even with the adoption of a semicircle, they could avoid outside thrust entirely.

The next paper was submitted by Mr. John Wilkinson, and it dealt with

Some Disputed Points among Gas and Water Experts.

From beginning to end the paper is an impeachment, from the point of view of an outsider, of the present system of expert evidence in connection with parliamentary and arbitration proceedings. The author finds it impossible to account for, or to reconcile in any way, with any degree of satisfaction, the wide differences in the opinions of professional experts. In parliamentary contests, the points upon which the main differences arise are too well known to

readers to need recapitulation. As the author points out, a company's experts are called to prove by figures that their requests are most reasonable, and that they cannot carry out their obligations with anything less; while the local authority's experts stoutly deny this, and urge considerable reductions. There is finally such a juggling of figures and facts that the majority of Parliamentary Committees must, he thinks, really feel bewildered by them. In his opinion, the heavy expenses involved in these proceedings are dissipated without any benefit whatever either to the consumers or the ratepayers; and the liability for this he deliberately sets at the doors of the local authority experts. Dealing presumably with a hypothetical case, in which a Company's Bill has passed a Committee with modifications, he says: "In all probability, the Gas Company's experts would have advised them to accept similar terms to those which the Parliamentary Committee had granted; but knowing full well the procedure adopted by experts engaged for local authorities, they were bound to protect themselves by asking for a good deal more than they desired, or expected." The author discusses at some length parliamentary and arbitration proceedings for the transfer of gas and water works. He calls attention to the contradictory evidence as to the so-called precedents of compulsory expropriation; but as "JOURNAL" readers have time and again been told, there are no cases of compulsory purchase of gas-works which have received the confirmation of both Houses of Parliament. The questions as to a company being willing sellers, the amount due for compulsory purchase, the number of years' purchase, prospective value, surplus plant, and other matters were all cited by the author as points upon which the most diverse views exist among experts. A table which he has collated showing actual differences of opinion under seventeen different heads should, he thought, be sufficient to convince experts of the error of their ways; but it did not convince those at the meeting. The real object of the paper, he said, was to elicit the opinions of the "experienced members of the Institute as to whether or not they consider as satisfactory the present basis upon which experts are compelled [?] to give evidence." Notwithstanding all he previously says, he asks, "Whenever recourse is made to Parliament or arbitration, do experts give their evidence on the basis of justice or equity to all parties concerned?" He does not directly reply to the inquiry; but he is fully convinced that the whole system needs quick and drastic reformation. He further inquires, "What is there to prevent" the experts "from meeting together and fixing standard facts and precedents, and firmly adhering to them no matter which side they represent?" The reply to this is simple enough; but the author thinks, if it could be done, the experts would gain the confidence of all parties. The author was also desirous of eliciting an explanation of why the costs incurred in parliamentary proceedings did not follow the event, as in legal proceedings. The paper presented quite a sheaf of points for comment of a very engaging character.

If Mr. Wilkinson did not instruct, he certainly amused his audience by his pointed statements. There was much laughter when the President opened the discussion with the remark that the paper had been exceedingly interesting to him. He showed that the author did not understand what local authorities were like. In his (the President's) own practice, he always tried to make people agree if possible, as better terms were obtained than by fighting. He did not think the poor experts were so bad as they were painted. They must represent their clients, and do the best they could for them. Circumstances varied in every case; and it was these circumstances which caused the differences. "Now, Mr. Valon!" called the President; and Mr. Valon responded by saying, among other things, that the paper was no doubt honestly written from the point of view of the writer; but it was erroneous from beginning to end. There were no two works in the country that could be said to be of the same value unless they were on all-fours. Admitting that the conclusions of Mr. Wilkinson were wrong, Mr. Leather said there was at the same time a good deal of truth underlying the paper. What troubled the author was that two experts dealing with the same company did not come to anything like the same decision. The only remedy was for the tribunal who were considering a Bill or other matter to call in expert witnesses to advise them, and to consider the question without either side calling witnesses. Mr. Herbert Lees did not think the author had been quite fair to the experts. Alderman Miles failed to understand some of the statements in the table supplied by the author. Mr. R. G. Shadbolt congratulated the author upon bringing the paper forward. As to the great divergencies of opinion which were often found, they were no doubt due to the point of view the experts took, and quite honourably. As to the costs of parliamentary applications, it did seem a great hardship that a comparatively small concern should be mulct in costs of perhaps the same amount as a large concern. The reason why the author had arrived at some of his conclusions was, in Mr. Chester's opinion, that he had not followed the cases far enough. If he had looked into the cross-examination of the witnesses, he would have found that many of the points were perfectly understandable. He explained how some of the divergencies arose. Replying, Mr. Wilkinson observed that the experts who had spoken had not explained why one expert valued an undertaking at £55,000, and another engineer at £22,000. There was no doubt the experts did give their evidence honestly in the circumstances under which they were compelled to give it at present—that was, that each had to do the best he could for his clients.

At a length which defies the abstracter to give within reasonable compass a fair indication of the vast amount of information imparted, Mr. William Young discussed in the succeeding paper the subject of

NAPHTHALENE FROM RETORT TO POINT OF DEPOSITION.

In Mr. Young's absence, Mr. T. Glover kindly read the communication. Introducing his subject, the author mentions the generally accepted view as to the reason why naphthalene causes such a large amount of trouble during the manufacture and distribution of gas—viz., that, at all ordinary temperatures, it passes directly from the state of vapour diffused through the gas to that of a crystalline solid. The difficulties are further accentuated by the naphthalene being deposited in thin laminated or feathery crystals, a small weight of which will occupy a large space, and on account of their lightness are liable to be drifted or blown forward until they become entangled in the narrower passages of the service-pipes. It is not so well known and recognized that the same cause—the direct assumption of the crystalline form from the vapour, and *vice versâ*—to a a very considerable extent accounts for the naphthalene vapour being present in the gas so as to produce the trouble. To get a clear conception of how such results are brought about, the author minutely examines certain conditions which prevail, and some of the physical and chemical forces brought into play, during the processes of condensation, purification, and distribution. The interested reader will turn to the full text of the paper (when published) for Mr. Young's studied views on these questions. Sufficient is said to show the important part which the crystalline condition of naphthalene plays in producing the troubles experienced from the presence of the napthalene vapours in the gas, and also to show that the apparent eccentricities of the behaviour of naphthalene are in perfect harmony with well-known physical laws. The naphthalene which is the source of trouble may, the author asserts, have been produced at the works weeks or even months before; and it may during the interval have been travelling forward by a series of successive crystalline depositions from, and evaporations into, the gas until it reaches the place where it is finally deposited, and occasions trouble. The remedies for these troubles are: (1) The removal of the naphthalene vapour from the gas, or at least such a quantity of the vapours as would prevent them from being deposited during the subsequent distribution of the gas; (2) the addition to the gas of something that will prevent the naphthalene vapours in the gas from being distributed in the crystalline form. The dense oils obtained by the distillation of the condenser tars, and freed from naphthalene, furnish an excellent solvent for naphthalene, as well as for the other hydrocarbons diffused through the gas. If, however, the benzols and other high-tension vapours obtained from the distillation of the tars are returned to the dense oil, the solvent power of the dense oil for the benzol and other high-tension vapours present in the gas is balanced, and the solvent power of the oil is thus restricted to dissolving out naphthalene. The application of dense oil so prepared to the naphthalene-charged gas (after the fashion of the prepared ammoniacal liquor or solvent water in the case of

ammonia) would, the author says, perfectly remove the naphthalene vapour from the gas. The second remedy or preventative is to evaporate into the naphthalene-charged gas such a quantity of liquid hydrocarbon vapours (having vapour tensions approximately the same as that of naphthalene) that, when the temperature of the gas falls so low as to cause the vapour of the naphthalene to be precipitated, there will simultaneously be condensed such a quantity of the vapours of these liquid hydrocarbons as will take up the precipitated naphthalene in solution. The author suggests as a ready means of obtaining a supply of hydrocarbon liquid the carbonization of a portion of the gas coal at such a low temperature as will produce liquid tars comparatively free from naphthalene, but rich in vapours having vapour tensions similar to that of naphthalene. The naphthalene-charged gas, when mixed with the hot gas and products from the coal carbonized at the lower temperature, has the major part of the naphthalene vapour dissolved out by the liquid tars as these are precipitated; while at the same time, the gas takes up in diffusion the vapours of hydrocarbons which have tensions approximating to that of naphthalene. These are present in large quantities in the low-temperature products; and, during the distribution of the gas so treated, they prevent any naphthalene which may remain from being deposited in the crystalline form, for these vapours condense along with it, and take it up in solution. Where it is desired to effect the removal of naphthalene and at the same time raise the illuminating power, the use of benzol is advocated, or the carbonization of cannels at a lower temperature than that employed for gas coal. (The latter suggestion, it will be remembered, formed the subject of a paper and discussion at the recent meeting of the Institution of Gas Engineers.)

Contrary to the general rule when the subject of naphthalene is brought up, there was little discussion on the paper. Mr. J. P. Leather informed the members that the experience which he gave them in his paper last year had been confirmed since. It was possible to take naphthalene very thoroughly out of gas without deteriorating its quality. Mr. J. W. Morrison gave his experiences at Sheffield. There they were practically free from naphthalene. They had been using at all the stations the test brought out by Dr. Colman; and they had found no trace of naphthalene from the works. When they did get trouble, it was generally worse in the hilly districts, or where the mains ran to an end. He had been conducting experiments in passing gas containing naphthalene through the lighter tars—the tars taken from the foul main and condensers; and, so far, the results had been very satisfactory. Mr. Glover, in reply, was glad Mr. Leather's further experience confirmed that laid before the members last year. Mr. Morrison, by his experiments in washing gas with thin tars, would eventually find he could cure all trouble from naphthalene.

This concluded the technical matters before the members.

The New Office-Bearers.

The report of the scrutineers was next read; and the names of the gentlemen who will hold the reins of the Institute during the coming year were received with marked approval. Mr. T. O. Paterson will be the President; and Messrs. S. W. Durkin and A. Dougall, the Vice-Presidents. Messrs. T. Bower, W. Carr, W. S. Haddock, and T. P. Travers are to be the new members of Council; and the Honorary Secretary is now Mr. J. Davis, of Gravesend. The nomination of the President of the Société Technique and Mr. Alfred Lass as Honorary Members was heartily acquiesced in.

The Union Question not Dead.

After the commotion at the previous day's meeting, Mr. Stelfox had a surprise in store for the members. At this juncture, he rose, and stated that, as the result of conversation with a number of members, he found what the general feeling was (as it undoubtedly was the previous day) that union should be carried out; and he thought it would be unfortunate if they left the matter where it then was. He therefore proposed a resolution placing on record the members' appreciation of the labours of the Council in endeavouring to bring about amalgamation, and earnestly requesting them to continue their efforts to secure a satisfactory agreement, and to call another meeting of the Institute to consider and vote upon their proposals at the earliest possible moment. Mr. W. A. Valon seconded the motion; and speeches in support of it were made by Messrs. Chester, Ellery, William Carr, Paterson, Miles, Hutchinson, Durkin, Carter, and A. Dougall. Their remarks will be found fully reported elsewhere. It was generally felt, using the words of Mr. Carter, that the resolution was one that the circumstances of the moment rendered absolutely necessary, seeing that the position as it was left the previous day misrepresented the actual feelings of the members. The resolution was carried without dissent, and with much enthusiasm.

Concluding Matters.

London was again selected as the place for the holding of the next annual meeting. Among several formal votes of thanks was one acknowledging the considerate arrangements made by the Société Technique and the Paris Gas Company for the reception of the members who were about to visit Paris. The most pleasing event of the final proceedings, however, was the presentation to the retiring Honorary Secretary (Mr. A. Dougall) of a silver salver and a case of dessert knives and forks, in recognition of his services during the past five years.

In this peaceful way, a meeting which had been prolific of incident was brought to a close; and the members separated—some with the view of preparing for the Paris trip, and others to amuse themselves, or to depart to their homes. Many of those who remained in town participated in the excursion to Stonehenge on Thursday.

GENERAL REPORT.

The Thirty-Seventh Annual General Meeting of the Institute was held on Tuesday and Wednesday last week, in the theatre of the Royal United Service Institution, Whitehall—Mr. E. Herbert Stevenson, M.Inst.C.E., in the chair.

Confirmation of Minutes.

The President opened the proceedings with a few brief words of welcome to the members, and expressed the hope that they would be as unanimous as possible in dealing with the matters coming before them. He then suggested that the minutes of the last meeting be taken as read; and this was agreed to.

Mr. J. P. Leather (Burnley) moved, and Mr. R. Watson (Hertford) seconded, the confirmation of the minutes; and the motion was at once carried.

The Report and Accounts.

Mr. W. R. Chester (Nottingham) moved that the annual report, which had already been circulated (see *ante*, p. 1435), be received and adopted. He expressed his regret to see that the list of deceased members was longer than usual, and his sorrow at the death of Mr. Frederick G. Burfield, of Tunbridge Wells, their former Secretary, whose kindness and urbanity were known to all. The financial position of the Institute appeared to be very satisfactory, there being a balance of £252 14s. 10d. on the revenue account, which was a pleasant change from the state of affairs which prevailed for so many years, when they had great difficulty in making both ends meet. He saw that there was a cash balance at the bank of £501; and he thought it would be well if the Council took steps to invest at any rate a portion of this amount, so as to add something to the income of the Institute. The Council were also to be congratulated on the efforts they had made towards effecting an amalgamation of the two Institutes, in which, he held, they had rightly interpreted the feeling evinced at the last annual meeting, when the two chief agents in the disruption shook hands over the Presidential chair.

Mr. W. Ewing (Hamilton) seconded the motion.

Mr. C. E. Jones asked where the property of the Institute was located. Was it quite safe from risk of fire?

The President replied that it was in the strong-room at the bank, and was about as safe as it could be.

The motion was carried unanimously, as was also one for the adoption of the accounts.

Awards of Premiums.

The President then presented the premiums awarded by the Council for papers read at the last meeting, as follows:—

First Prize (£10 and the President's Medal).—To Mr. T. O.

Paterson, of Birkenhead, for his paper on "Gas for Motor Purposes."

Second Prize.—To Mr. T. Newbigging, of Manchester, for his paper on "Differential Rates as between Consumers of Gas for Lighting and for Purposes other than Lighting."

Third Prize.—To Mr. J. Petty Leather, of Burnley, for his paper on "Naphthalene Deposits: Their Cause and Prevention."

Mr. PATERSON and Mr. LEATHER briefly acknowledged the honour conferred upon them. Mr. Newbigging was not able to attend the meeting.

PRESENTATION TO MR. DOUGALL.

The PRESIDENT said Mr. Dougall, the Hon. Secretary of the Institute, had now completed his five years of office, during which time he had advised the Presidents and Council with great ability and courtesy. He was known and respected by all; and the Council felt that, after such a period of work, they ought to show their appreciation of his services. They had therefore decided to ask the sanction of the members to the presentation of a piece of plate to Mr. Dougall. The matter had been left in his hands; and, feeling sure that the members would heartily fall in with the suggestion, he had communicated with Mr. Dougall, and a piece of plate (a silver salver) and box of knives and forks had been selected by that gentleman and Mrs. Dougall. He was sorry to say that, owing to the intervention of the holidays, the manufacturers had not been able to send the testimonial, properly inscribed, that morning; but he hoped it would be there in the course of the day or on the morrow, when it would be formally presented, and when Mr. Dougall would have an opportunity of expressing his thanks. In the meantime, he would ask the members to express their approval of the action of the Council.

A unanimous round of applause showed that the members present cordially endorsed Mr. Stevenson's remarks.

PRESIDENT'S ADDRESS.

The PRESIDENT then delivered his Inaugural Address, which was given in the "JOURNAL" last week (p. 1542).

Mr. W. A. VALON (Ramsgate) moved a vote of thanks to the President for his address, which he said was one of the most businesslike addresses he had ever listened to. It seemed to him quite natural that someone of the name of Stevenson should occupy the chair of the Institute. His father had done so before him, and the President was a worthy successor. Being a comparatively young man, they might hope that for many years to come they would have his benefit of his advice and assistance, either for the new Institute, if it was formed, or, if unfortunately the scheme for amalgamation fell through, for the old one. There was no need to say anything in support of the motion; but he might add that they not only thanked the President for his address, but also sympathized with him in the difficult work he had had to perform during the year, as shadowed forth therein. They knew there was no more arduous task than that of framing rules for the guidance of men, not only in the present, but in the distant future.

Mr. C. S. ELLERY (Bath), in seconding the motion, said it was very gratifying to listen to the hopeful anticipations set forth in the address as to the prospects of the gas industry; but certainly the existing condition of the markets afforded a strong reason why the industry should present a united front against—he would not say its enemies, but those who were certainly not doing their best to aid it. They must all remember that a great deal of the President's time must have been occupied during the year in bringing forward the scheme of amalgamation now before them; and he (Mr. Ellery) should like to assure him that, whatever difference of opinion might be manifested later on with regard to matters of detail, they all appreciated the pains and trouble he had taken over this matter.

The motion was carried by acclamation.

The PRESIDENT, in responding, said his year of office, with all its hard work, had been well rewarded by the vote of thanks, and the way in which it had been passed. He had done his best for the good of the Institute and the profession; and he hoped he had not altogether failed. He was glad to find that his efforts were appreciated; and he thanked the members very warmly for their confidence and sympathy.

THE PROPOSED AMALGAMATION.

The PRESIDENT said they had now to discuss the matter with which he had dealt at some length in his address. As the first resolution was one with which he thought all would agree, he would simply move it without further remark: "That it is desirable that the Incorporated Gas Institute and the Incorporated Institution of Gas Engineers be amalgamated."

Mr. R. PORTER (Elland) seconded the motion.

Mr. W. R. CHESTER (Nottingham), in supporting it, said he felt sure there would not be a single dissentient voice with regard to this resolution, though there might be some difference of opinion as to the terms on which the amalgamation should take place.

The resolution was then put and carried *nem. con.*

The PRESIDENT said before putting the next resolution he would read two letters which had been sent to him from Mr. Hepworth and Mr. West—the latter being accompanied by a request that it should be read to the meeting. Considering the position Mr. West occupied, it was only right that his letter should be read. He would first, however, read Mr. Hepworth's:—

WHITEHALL CLUB, S. W.,
11th April, 1900.

My dear Mr. President,—I have, as you rightly say in your letter of the 9th inst., which has been forwarded me here, already expressed my readiness to resign my position as member of the Gas Institute if such a step would in any way promote the interests of the Institute, or facilitate the movement in favour of the amalgamation of the two Institutions now representing the gas industry.

I have always regretted the division which took place some years since, and did what I could to prevent it; and I trust that anything that can be done honourably to bring about a re-union may now be done.

I shall naturally regret my severance from an Institute with which it has been my pleasure to be so closely identified in the past; but I should not for a moment allow my personal feelings to prevent my taking any step in the interests of the Institute. Therefore I shall gladly forward my resignation whenever required—on the grounds above stated.

I am, Yours faithfully,
J. HEPWORTH.

The letter from Mr. West was in the following terms:—

BARFIELD HOUSE, WEST DIDSBURY,
MANCHESTER, *31st May*, 1900.

To the President and Council of the Gas Institute.

Gentlemen,—With reference to the correspondence I have had with your President asking me to resign my position as a member of the Gas Institute in order to facilitate the amalgamation of the Gas Institute and Institution of Gas Engineers, I have given the matter more careful consideration, and, in the first place, wish to lay before you my reasons for declining to resign, as indicated in my letters.

1.—I was articled to a gas engineer, and have been connected with the profession for 45 years, during which time I have filled several important positions to gas companies and corporations, and at the present time am acting as consulting engineer.

2.—I have been a member of the Gas Institute for 31 years, having occupied the position of President, and am at the present time one of your Trustees.

3.—I am a member of the Institution of Civil Engineers.

For these reasons, I considered it was very uncomplimentary to myself and the Institution of Civil Engineers in asking me to resign my membership; but, after very careful reconsideration of the matter, I lay before you the following suggestion:—

I consider that in framing the rules of the proposed new Institution a rule should have been arranged to include men who have been technically trained and have similar qualifications to myself, inasmuch as there are a number of engineers who are eligible to become members of the new Institution presumably occupying the positions of gas engineers to corporations and companies, but who are connected with trade quite as much as myself; the only difference being that, while I devote the majority of my time to a trading concern, they have sufficient time at their disposal to attend to their duties as engineers to corporations or companies, and arrange for other contractors to manufacture and introduce their inventions; and I would suggest that a rule could still be framed which would allow of those gas engineers connected with trade who are members of the Institution of Civil Engineers to become members of the new Institution.

I am, as most of you are aware, not opposed to amalgamation—in fact, it has always been my great desire that this should take place, and while President of the Gas Institute, I endeavoured to further this object. At the same time, if the fact of my being a member of the Gas Institute stands in any way as an obstruction to the amalgamation of the two bodies, I am quite willing to resign, and you can accept my resignation; in

which case I should like you to lay this letter before the meeting of the Gas Institute next month.

Wishing you and the Council every success with the proposed amalgamation,

Yours faithfully,

JOHN WEST.

After reading these letters, he might say there were only three gentlemen left who absolutely declined to resign. It was true that one of them was a man of very great ability, who had rendered important service to the gas world in the past, and yet he was, and always had been, engaged in trade. It was not that he looked down for a moment on trade, which was the backbone of this country, and without it those present would not occupy the position they now did. The men in trade were as honoured as men anywhere, and stood as high in the opinion of the country and in the affection of the people. But it came to this—they could not ask one man to retire, or exclude one man, from an association when they did not ask another to do so who was in exactly the same position as to his occupation, and in almost the same position as to his ability. They could not differentiate between men of this character; and they had therefore been compelled to take the step mentioned in the next resolution, that of liquidation—dissolving the Institute, and reconstructing it and the Institution of Gas Engineers in another Institute which it was proposed to call "The Society of Gas Engineers and Managers." He had a letter in his pocket from Mr. Helps to the effect that the question of title was absolutely left to the Institute to determine. There were legal difficulties about keeping either of the existing titles. The Board of Trade would be pretty sure to cause trouble if an attempt were made to register a new Institute, having either of the existing titles, while the old body was in existence; but the new Society must be formed before the old one was dissolved, so as to hand over the property to it. The chief point in the new rules was clause 4, which he had mentioned in his address; but, after having read the letters from two of the most eminent men who would be excluded under the rule, and who said they were desirous of retiring rather than that the amalgamation which had been brought so nearly to a conclusion should be wrecked, he thought they would all see that there was no one who would really be injured by the dissolution of the Institute, and the incorporation of a new Society. He would therefore move: "That it is desirable that such amalgamation be effected by the voluntary liquidation of the Incorporated Gas Institute and the Incorporated Institution of Gas Engineers, and by the transfer of all the property and assets of these two Societies to a new Society, to be registered under the 23rd section of the Companies Act, 1867, by the name of 'The Society of Gas Engineers and Managers (Incorporated 1900),' having a Memorandum and Articles of Association in the form of the draft issued to the members, and produced to, and approved by, this meeting, and identified by the signature of the President, subject to such alteration (if any) as may be approved by the Council."

Mr. VALON said he had great pleasure in seconding the motion. He had been somewhat relieved by hearing the letters from Mr. Hepworth and Mr. West read. In seconding the proposition, he must say he did not wish the rules of the Society to be formed in such a way that for all time men like John West and Joseph Hepworth should be excluded from it. If the difficulties were too great to be overcome, and if no arrangement could be made by which these gentlemen might be admitted into the new Society as members, then, as the lesser of two evils, they must leave them outside, because the body of the industry must not suffer because of individual disqualification. It was from this point of view that he should like to approach the consideration of the subject. If it were not possible to admit them, and only in that event, should they be obliged to leave outside the names and persons of these gentlemen, who had now been associated with them as Presidents and members for so many years past. He could not conceive that it was impossible. He could, of course, perfectly understand, by the terms of the clause to which the President had referred, that it would be impossible; but he certainly did think some modification of it might be made by which these gentlemen should be included. They all knew the action he took when this unfortunate split occurred. But if counsel, if solicitors, if all the information they could get, showed that there was no way of including these gentlemen, it was their duty to the profession, however painful it might be, to leave them outside—still to be always honoured by invitations to attend the meetings, so that the position they all deeply regretted might as far as possible be ameliorated. There was a provision in clause 8, under which, if a member ceased to hold a qualification, he was, or might be, removed; and he (Mr. Valon) thought the word "may" in that clause should be "shall." But if a man had a qualification to be elected a member of the Society, he did not see how his entering into any other profession affected his qualification as a member of the gas profession. A member of the Institution of Civil Engineers might go into any other business—he might keep a grocer's shop—but he was still a member of the Institution; and there was no reason that he could see why, if he had the qualification, he should be expelled. There again, however, he bowed to the decision of the Council and their advisers. If it were necessary that such a clause should remain, let it remain rather than the good of the profession should be prejudiced. There was one other small matter; and that was the question of students. He noticed that, quite rightly, there were to be students. But he could not help thinking that the clause relating to this matter was very badly drawn. It said first of all "any person being or having been a pupil of a living member;" and then, further, he was to be recommended by that member. If the member was not living, he (Mr. Valon) could not understand how he was to recommend the student. But what he found fault with most was that there should be no qualification for the student. He did not know of any Society of importance that did not demand of all its students some kind of qualification. It appeared to him that before a student could be accepted by the Council, or recommended by a member, he should be possessed of some educational qualification, such as it would be necessary for him to possess, otherwise his studentship would be a farce; and he (Mr. Valon) would suggest the insertion of some words to carry this out. He sincerely hoped that no difference of opinion would prevent the reunion of the two Institutes; that no feeling, however strong, would run high enough to induce members to vote in such a way that there should still be two bodies representing one industry. Let them unite, and when united, if the members wanted alterations in the rules or regulations, it should be in their power to make them. The only point to be careful about was that the articles were such as left them perfect freedom for the future; and he was sure that, after the experience of the past, they would be too cautious in admitting members to ever have to go again through the farce they were now engaged in. He sincerely urged upon everyone to make this a personal question, and see that nothing interfered with the amalgamation of the two Institutions.

Mr. C. W. HASTINGS (London) said it seemed to him that there was a way out of the difficulty with regard to gentlemen like Mr. West and Mr. Hepworth; for among the old rules there was one which allowed the election of honorary members, and if ever two gentlemen deserved to be honorary members of the Institute, they were the two whose letters had been read that morning. The Articles of Association (clause 7) provided for the election as honorary members of the Society of any persons who were eminent in science, combined with experience in pursuits connected with the gas industry; and it seemed to him these two gentlemen fully complied with this clause. He thought there was no reason why either the old Institute or the new one should not elect them as honorary members.

Mr. VALON thought Mr. Hastings had not read clause 4, which would exclude these gentlemen, as being traders.

Mr. HASTINGS said there was one distinguished honorary member at present, Mr. William Sugg. Were they going to turn him out? (SEVERAL VOICES: "Yes.") He was sorry to hear it.

Mr. J. KEEN (Wigan) asked if it were permissible for him, as an associate, to speak on this question.

The PRESIDENT was afraid that they could not depart from the rule that only members might take part in the discussion.

Mr. KEEN said in that case he would only ask to be allowed to state that, although he had been an associate for twenty years, he was quite willing to resign, though he had not written in reply to the application which had been sent to him.

Mr. C. E. JONES (Leyton) congratulated the mover and

seconder of the motion on the extreme courtesy and goodwill which clothed their remarks, and the evident anxiety they felt to bring about an amalgamation between what were now called the two rival Societies. He claimed that he was quite as sincere in his desire to bring about this re-union as anyone; and he yielded to none in his wish to further the best interests of the gas industry. It was not a pleasant thing at any time to find oneself in conflict with the constituted authorities; and as he had voted for the former resolution, he should hope for a little consideration while he discussed the liquidation of the Institute as now proposed. He saw no necessity whatever for liquidation, and could not imagine what they would gain by it. They were actually asked to assist at their own obsequies—to commit collective suicide—and glory in the event. He rather objected to assist at his own obsequies before the proper time; and he did not believe the time was yet. He thought, further, that the present body of the Gas Institute was admirably suited in its constitution for the requirements of a peripatetic society such as this was. They had various classes of members; and the rules were necessarily elastic, in order that the circumstances of those respective classes and individual members might be provided for. It cost them considerable labour, and some little expense, anxiety, and trouble, to provide the Code of Regulations which was adopted some ten years ago; and it had worked admirably since. This code was drawn up with the assistance of one of the ablest men of the legal profession connected with Institutions of this nature—the Solicitor to the Institution of Civil Engineers—and that being so, he was loth to acknowledge any necessity for departing from the rules which had served them so well. Why they should be asked to commit suicide, he could not understand. He complimented the President on the clear manner in which he had pointed out the advantages of amalgamation; but he had failed to convince him that anything whatever was to be gained by liquidation. In the first place, it was a sign of weakness. But were they weak? Had the interest of the members in the transactions of the Society during the last ten years been relaxed or diminished? Quite the reverse. They possessed more vitality to-day than ever in the history of the Institute; and this vitality he feared would not be encouraged by a continual change of name, or by going into liquidation. He knew it was to be a voluntary and silent operation; and there was a consolation in knowing that they were solvent. Notwithstanding this, however, it was a liquidation; and he believed a great deal of good resulted to a Society like that in continuity of policy, and in the perpetuation of a name. He trusted that the amendment he was about to propose would be accepted, and would remove the necessity for liquidation. They were asked to adopt the title "The Society of Gas Engineers and Managers;" but what about the secretaries? They had a Society of their own; but they had secretaries in the Institute, and they had never caused any trouble that he knew of. Again, anyone who was a managing director of a public company, if its business was trade (and most companies' business was), would have to be expelled; but he thought they ought to save those gentlemen from such a disgrace, and not ask them to resign a position which they adorned. They did not exclude chairmen of gas committees—men elected by the *vox populi*, who held their office for a very short time. It appeared to him that the amalgamation could be brought about without dissolution. He trusted it would be, and that they would welcome their erring brethren into the fold again. They would be very proud indeed to welcome their friends; and it was a fact showing the kindness of heart which animated the gas profession that, notwithstanding this unfortunate difference of opinion about trade, they were all friends in both Institutes, and some of the members belonged to both. He hoped this feeling would be long perpetuated. They were asked to show a united front, which was a very good thing on the field of battle; but they were not a combative Society. A united front would not delay for one moment the march of science, or arrest the development of invention. Where would they have been, as a profession, as a business, or as a trade, without the inventive ability of outsiders? What about Welsbach, and his new lamp? And what about a hundred other things which he could not stay to enumerate, which had brought about progress in all branches, if trade was to be excluded? The Institution of Civil Engineers would never have had an Armstrong, a Whitworth, or a hundred other able princes of trade, had it not been that they were allowed to follow their own vocation. It was quite true, unfortunately, that a few gentlemen who were associated with the Institute had been guilty of some slight acts of indiscretion; but it must not be forgotten that to err is human, to forgive divine. It should also be remembered that the extraordinary members of the old British Association of Gas Managers had paid a very high entrance fee to come into the Society; and he very much questioned if they could be expelled, or if the Society could be dissolved without their consent. They had had an unfortunate illustration of the difficulties of expulsion some ten years ago; and it was not for the majority, in all cases, to assume that they were right, and could do what they liked in opposition to the rights of individuals and the law of the country. He thought the extraordinary members should be called upon to state their views; and if they went to the Court for an injunction, he believed they would have a very good case. He was in the presence of a gentleman connected with the legal profession; and he would put that point to him—whether it was possible to exclude from the Society compulsorily, without consideration or compensation, people who had paid a heavy entrance fee, had subscribed to it for years, and had behaved themselves as English gentlemen should do. The amendment he begged to move was this—"That the liquidation of the Incorporated Gas Institute is not called for in effecting amalgamation with the Incorporated Institution of Gas Engineers; and that it be an instruction to the Council to effect the proposed union without dissolving the Institute." If it were the will of the Institute that they should commit suicide, he had no more to say, except he was sorry for it; and as one of the assentors to the Articles of Association, he desired to say to those who would have the direction of affairs in future, in the words of the dying gladiators of Rome, "*Ave Cæsar! Morituri te salutant.*"

Mr. H. Lees (Hexham) seconded the amendment. He said many would remember the very grave circumstances which occurred some years ago, when the late Mr. George Garnet was President, and when they had to contend with a similar arrangement very ably put forward by the Council at that time. He was rather surprised to hear Mr. Valon use the word "cannot." He did not believe in that word himself; and he would leave it out altogether. Those gentlemen who were on the books as extraordinary members numbered 48 in 1890; and they had now been reduced by the arrangement then made that no other extraordinary members were to be admitted. They were allowed to die off in their own quiet way. He thought it would be very well to take a leaf out of the former experience, when acting under the advice of Mr. Radcliffe, and say that members who shall be elected subsequently to the re-incorporation of the Institute should be so-and-so, but to still allow members who were on the books at present, one and all, to be carried forward as members of the new Society.

Mr. W. Carr (Stalybridge) supported the amendment. He quite agreed with the first resolution that it was desirable that, if possible, there should be only one body representing the gas industry; but the parent Institute—possessing the members and the funds—ought to consider very thoroughly the price they were asked to pay in order to get united with the people who certainly represented the *élite* of the gas engineering profession. In the report sent out by the Secretary, the number of ordinary members of the Institute was put down at 518. If they were to absorb the Institution of Gas Engineers, he ventured to say it would not raise the number really to 600, and they would lose 109. They were thus going to ask 109 people to retire in order to get what was not more than an ordinary year's addition to their membership roll. This was a big price to be asked to pay; and, considering the nature and character of some of the gentlemen who were requested to retire, which had been so eloquently spoken to by the seconder of the resolution, he was hoping, all the time Mr. Valon was speaking, that he was going to renounce the duty he had undertaken. If anything could have convinced him (Mr. Carr) that it was impolitic to pass the resolution, it would have been the speech of Mr. Valon. Why should they stop at Mr. West and Mr. Hepworth? There were other gentlemen, who had been perhaps less fortunately situated than they, but who had been quite as earnest in smaller matters in their helpfulness and single-heartedness, who were on the same roll, and had been

asked by the President, in a most injudicious circular, as he thought, to resign—a circular which intimated that if they did not gracefully retire they would be kicked out. He could here tell the President of a circumstance which perhaps he did not know—that out of the 57 assents he got, there were a great many more or less under compulsion, because they assented after the fashion of Mr. West and Mr. Hepworth; they were willing to retire if it was necessary. He thought it would be to the everlasting disgrace of the Institute if it were made necessary. He saw no reason whatever, and there had been no argument advanced by the President or by anybody else, why they should dissolve the Institute or expel these people, except that it had been made an explicit stipulation by the Institution. This was the one point upon which they made an absolute stand. They would not go on if the Institute would not do that. If this was the one point on which they made a stand, he was prepared to go on as they were; and he trusted the meeting would endorse the action he was taking by supporting the amendment. He was quite prepared, if the majority of the Institute decided to annihilate all these people for the sake of the gas industry, to support any resolution which was come to; but, in the meantime, he should do his best to prevent it being passed. He should like to go back to the time when they were what was called a united Institute. He did not think such a thing as being a united body ever occurred when they were all together before. They were divided into sets, cliques, and parties; and the wire-pullers in those days nominated their own successors. Very often there was a great under-current of feeling among the members which was not pleasant, and he was not at all certain that the same thing would not come about again if they effected what they were pleased to refer to as a united front. At the meeting last year, though he took part in what had been described as the "noteworthy incident," when Mr. Livesey, Mr. Bray, and Mr. Sellers made their appearance —and no doubt the feeling was unanimous among them all that it was a pleasant thing to see the lion and the lamb lying down together—and though the little bit of sentiment given expression to at the time was perfectly unanimous, he could not agree that the President and Council should have regarded it as a mandate that they were at once to take proceedings to bring about a union, and to put all other things aside until this was done. He did not think this was at all implied by that little bit of hand-clapping. With regard to the question of clause 4, under which all these gentlemen were to be excluded, he did not agree that it was an undesirable thing to have people connected with them who were interested in trade, nor did he see where they were going to draw a hard-and-fast line. There were members of the Institution who could not come into the new body under that clause; and they were pretty numerous. And if they were to go into the question of trade, what was trade? Was a man who was a shareholder in a concern interested in trade, or had he only to be the actual seller or director? He (Mr. Carr) thought the President himself was more or less a trader. He did not see any difference between a lawyer and a grocer in that respect; he had to pay them both. He was not against traders, but was rather of opinion that when they got men eminent in mechanics and engineering to become members, and join in their discussions, they were adding to their strength and to the interest of the proceedings. He was as much opposed to the little traveller who dodged about the lobbies outside, trying to button-hole the members and secure an order, as any member could be; and he should encourage the Council to do their utmost to exclude these people, and keep them out of the meetings altogether. He thought the action of the Council during the past ten years clearly showed that they had been careful on this point, and that a great improvement had come over the proceedings in that time. Seeing that they were at present working so well together, he did not think it advisable to change. A good deal was said about the name. Some people argued that the Institution had a better name than their own. In 1881, when they considered an alteration of title, the Council proposed that it should be called the Institution of Gas Engineers. The meeting at that time over-ruled the Council, and voted that it should be an Institute, which they said was an infinitely better title than Institution. It only showed how fashions changed. For himself, though at first he preferred "Institution," he had got to like the word "Institute;" and for a short title he thought "The Gas Institute" could not be beaten. There was another point in the rules to which he should like to call attention, which perhaps had not been noticed, for they were very voluminous. In his early days, when he was on the Council in 1879 and 1880, he had a great struggle to make it possible for individual members to have an opportunity of nominating a member of that body. Previously to that, the Council nominated their own successors, though they were always obliged to nominate twelve, whereas only four could be elected. Nobody else, however, could make a nomination. This was reformed, and it was so arranged that any two members could nominate a third; and it was the duty of the Council only to nominate when the members outside failed to do so. But he saw by the draft rules that they were going back again partly to the old system. Instead of two members being able to nominate, it required three; and they must have the candidate's consent in writing, which must be sent to the Secretary two months before the annual meeting. No one individual could put his name to more than one nomination. All this was hedging about, and depriving the members of their privileges, and increasing the difficulties of members in nominating, in order that the Council, once getting the power into their own hands, could practically appoint their successors, and have the management within the circle they thought most fitting. This was a backward movement which he felt he could not endorse; and he trusted that the rules would not be passed. He therefore supported the amendment.

Mr. Chester said he desired to put another amendment before the meeting, but he did not know whether he could do so until the first was disposed of.

The President said one amendment only could be dealt with at a time.

The Solicitor (who was present at the President's right hand) said he would answer the question which had been raised by Mr. Jones, who seemed not unnaturally to look forward with some dismay to his early dissolution. It was necessary, in order to carry out this amalgamation at all, that not only the Gas Institute, but also the Institution of Gas Engineers, should go into voluntary liquidation and be wound up. The articles of the Institute, which were drafted by Mr. Radcliffe, were so framed that the Institute might be amalgamated with any other institution or institute having similar objects; but the articles of the Institution were so worded that that body could not part with their assets to an existing body such as the Gas Institute. All that they could do would be to open their mouths and swallow up the Institute.

Mr. Jones said he, too, had taken legal opinion upon this question.

The President said they could not have a contest on a legal matter. It was much better to take the *ipse dixit* of their Solicitor. They certainly could not enter into a legal argument.

The Solicitor said under the Articles of the Institution they had, as a matter of fact and law, no power whatever to amalgamate, except by going into liquidation.

Mr. Jones: Then let them liquidate.

The Solicitor said both Societies must liquidate in order to carry out the amalgamation, as he wrote and informed the President two months ago. This was the reason why the amalgamation was being carried out by means of the liquidation of both Societies, and the regeneration of the two Societies in the form of one Society.

Mr. D. Irving (Bristol) suggested that it would be of assistance to the meeting if they knew what the amendment was which Mr. Chester proposed to move.

The President said that would be out of order. If any amendment were passed to the resolution, the whole matter would be at an end; and, in his opinion, it would be at an end for the next generation, if not for longer.

Mr. W. W. Hutchinson (Barnsley) said he was present at the last annual meeting, when he heard it said by several honourable gentlemen that they were "burying the hatchet." Then he came to the present meeting, and, instead of burying the hatchet, it appeared to him they had practically got hold of it to knock down at least 89 men. This was what he could not quite understand. He very much wished the two Institutions to be amalgamated; and he desired to favour this all he could. He earnestly hoped that Mr. Livesey in particular would rise to the occasion, and, in his happy way, as he had heard him do before (for instance, on one occasion when he read

a paper on "Gasholder Tanks"), facilitate this matter, and go on the lines of letting the Institutions be fused—retaining the present associates only on the distinct understanding that no others should be added, but letting the existing ones gradually die out. During the discussion, he could not help feeling that the associates had no voice; and even if they had, they would have a natural reluctance to speak. But he thought it an unfair position to put them in, to ask them to resign after paying their money and conforming to the rules for so many years.

Mr. W. Hardie (North Shields) supported the resolution. He said they must all be grateful to Mr. Valon for giving them so able a view of the situation. Mr. Valon and Mr. Hepworth had taken a very great part in making the Institute what it was; and when they had the views of these two gentlemen pressing them to accept the union as a desirable thing, they should be very careful before adopting an amendment which would tend to throw aside everything the Council of the Institute and the other body had been trying to bring to a successful issue during the past twelve months. It was agreed on all hands that it was desirable that union should take place. It was all very well to pooh-pooh the other Institution, and to say how much stronger the Institute was; but it was highly desirable that they should show a united front. He could testify, being a member of both Institutions, how very undesirable it was that there should be two. He knew many gentlemen at the present time—young engineers rising in their profession—to whom the question arose which of the two Institutions they should join; and with many gas companies and committees it was a difficulty, when their managers and engineers asked to be away to attend these meetings, and they wanted to know whether they were going to a meeting of a body who really represented the national industry or not. When they had two Societies, neither of them could be said to be entirely representative of the gas industry of England, Scotland, and Ireland, because it left outside some of the best names in the profession. He hoped the members that day would endeavour to throw out some of these smaller matters for the purpose of accomplishing this much-desired object. With Mr. Valon he certainly did regret that some means could not be found to retain in the Institute, somehow or other, the services of gentlemen such as Mr. Hepworth, Mr. West, and others who might be mentioned; but at the same time he thought, if necessary for the good of the gas industry, they should sink one or two little personal matters, so that the thing might go on. The Articles might be left in such a way that the rules of the new Society could be amended if they were not found suitable.

Mr. J. Carter (Lincoln) thought that the issue might be much cleared if the President could see his way to allow Mr. Chester to mention the terms of his amendment.

The President said he was advised that he ought not to have a further amendment read until the first had been disposed of.

Mr. Valon asked if it was the opinion of the Solicitor that Mr. Jones's amendment was a direct negative to the proposition before the meeting.

The President said certainly it was a direct negative.

Mr. R. Fish (East Cowes) said he was strongly in favour of amalgamation, and was very sorry there had ever been a separation. Still, as it had occurred, if they could do anything to facilitate an arrangement for reunion, it was their duty to do it. He was greatly surprised that Mr. Jones had proposed an amendment which would be fatal to the amalgamation, and was very pleased that the Solicitor should have stated, in so clear a manner, the position of the two Societies. He understood him to say it was impossible, under the present condition of the Institute rules, to amalgamate with any other institution or society.

The Solicitor said the Institution of Gas Engineers could not amalgamate with the Gas Institute except it opened its mouth and swallowed them up, unless they also went into liquidation.

Mr. Fish said the result was that, if they desired to have amalgamation, they must voluntarily liquidate; and he hoped, therefore, that the members would reject the amendment. They had already passed a resolution approving amalgamation; and he trusted they would now show their practical wisdom by voting against the amendment.

Mr. J. P. Leather (Burnley) said they had already passed a resolution that they were in favour of amalgamation, if it were managed in a proper way; but it appeared to him that the only real question arose with regard to clause 4, which was the principal thing Mr. Jones had spoken upon, particularly one word in it—the word "remain" as it affected the question of present membership. This was the point on which they were all thinking. They were willing to agree to the rule if it were not retrospective; and he felt that they had had no arguments as to why it should be. They could not call it an argument to say the other side had made it a condition. The question was why they had made it a condition; and if this could be made clear—and no doubt it must have come forward in the discussions of the Joint Committee—it would be a great help to members in voting. With regard to the amendment, he felt very strongly with Mr. Jones against liquidation, and thought it would be far better to keep the present name. There was a great deal in a name; and none they could agree upon would be so good as that of "The Gas Institute." He was therefore very sorry that re-union could not be managed in some way without liquidation and change of name. He would not enter into the legal question, but he rather gathered that it was on the part of the Institution that the difficulty lay; and the only reason why they were called upon to liquidate was in order that both should be on the same footing. As far as the law was concerned, however, it would be sufficient if the Institution liquidated.

Mr. J. Stelfox (Belfast) said he had always regretted the split, and never could see any reason why it should have occurred; and from that time to the present he had always hoped to see some method suggested for bringing about re-union. It was on the trading question that the split took place, though the trading element was introduced very largely by some who now expressed their intention to vote for the resolution. So that it was evident their views had changed since that time. But whatever they thought in the past, they were all agreed now that, on the whole, it would be better to let the trading element have its own place, and that not in the meetings of the Institute. Therefore, if they could not get all they wanted, they must take all they could get; and though probably there might be no occasion to dissolve, if they were going to form a new Institution they ought both to start on the same footing. Their Solicitor told them that this was the best and the safest way; and he thought they should accept that opinion, and go straight forward. They were not liquidating because they were insolvent, for they could pay 20s. in the pound; so that they could not be disgraced in any way. Nor were they liquidating from weakness, or anything of that sort. There were one or two matters in the draft rules to which he took some exception; but one had been rectified. He understood that, in future, members were to pay two guineas subscription; but this did not apply to present members.

The President remarked that this should have been in the rules.

Mr. Stelfox said he understood, in other words, that the members of the Institute would join the amalgamated Society on exactly the same footing as that they now held.

The President: Exactly the same.

Mr. Stelfox said he thought it would be a great injustice to tell members who had been connected with them for many years that they could only come forward in the new Society as associates.

The President said they would go in exactly in the same position, and as of right.

Mr. Stelfox said, with regard to the name, he was sorry it was going to be changed, and it was a matter of more importance than might at first sight appear. It was like giving a child a long ugly name which it had to bear all through life; and he must say he did not like it. If it were absolutely necessary to change the name (and he understood the Institution would not object to carrying on the old name), why could it not be called the United, or the Amalgamated, Gas Institute? "The Society of Gas Engineers and Managers" was long and troublesome; but he understood that passing the resolution would not prevent the Council thinking that matter over.

The President: Certainly not.

Alderman Miles (Bolton) asked if he understood the President to say that, if the amendment were carried, the amalgamation would be absolutely at an end.

The President said that was so.

Alderman Miles expressed his regret at hearing it. He always thought it was possible, if one amendment were

carried, to move another, which might bridge over any difficulty.

The PRESIDENT said the point was this: It was not an amendment which the Council could carry into effect. It was one which another party had to agree to; and the other party said they would not agree to a certain course of action to which this amendment would bind them.

Alderman MILES said, after this authoritative statement, the members would know their position, and would vote accordingly; and this he should feel bound to do. Nobody desired more ardently than he did the amalgamation of these two bodies. But it should be done upon equitable and just terms; and he did say, with the greatest possible respect to the Institution of Gas Engineers, that, in his humble judgment, these terms were not just or equitable. After the President's statement, it was of no use saying any more, though he greatly hoped that another amendment might have been moved later on, which would have bridged over the present difficulty.

Mr. D. T. LIVESEY (East Grinstead) said that this was a matter for conciliation. The body with whom they were anxious to unite had already passed a resolution saying that it was very desirable that the Institute and the Institution should become one organization. The Institution, he understood, could not possibly unite with the Institute without annulling itself; and, therefore, in order that they might start on the same basis, they should also annul themselves—or "commit suicide," as Mr. Jones had called it—in order to start together as one body. It did seem to him that this was the only possible ground on which they could start on fair lines, or, as Alderman Miles had said, in a position of equality. If the Institution must, on account of its rules, annul itself in order to become amalgamated, it did not seem to him it should be very difficult for them to do likewise, and to join on the same lines. He did not think it should be beyond the power of a body of gentlemen like the Council to bring the matter to an issue in a way which would be creditable to themselves as well as to the other Association. If they wished to bring about amalgamation, which they all said was desirable, surely they should discuss the subject in a conciliatory spirit. There seemed to be a tendency in some quarters to suggest that the Institution had thrown down the gauntlet—that it would only do certain things on certain conditions, and that they must necessarily accept them. He thought the members were entitled to say now what was their view of this matter, and leave it to the Council to carry out their wishes as far as possible. As to the amendment, it was a direct negative to the resolution suggested by the Council. They proposed that the Institute should be dissolved; and the amendment suggested that they should not do so. Was it not desirable, if the amalgamation was to take place, that it should be done in an honourable manner, and with credit to themselves? Was their anything in the way of doing it which was insurmountable? If they were now to accept the resolution, surely there was sufficient ability in the Council to carry out the wishes of the members; and these little difficulties, which all admitted, might perhaps be got over. They all regretted losing the gentlemen whose names had been mentioned, and a number of others; but it occurred to him that they might have another paragraph added to the rules, providing for the election of extraordinary members because of their association with the profession. He hoped they would carry the resolution, and go on with the amalgamation.

Mr. CARTER said he was quite sure the meeting was not in anything like a fit condition to give a distinctive and positive vote upon such an important matter as the passing of Mr. Jones's amendment would involve. No doubt there was a large consensus of opinion that, in the formulation of the Articles of Association, there had been such a ruthless violation of existing rights as one would scarcely find in any scheme of amalgamation of any character whatever. The hundred associate members surely had some rights which were entitled to respect; and among the Council there should be enough moderation and ordinary English common sense to evolve some scheme by which everything which was desired with regard to these members might be largely met, and that the anxious and earnest labours of the two Councils should not be rendered altogether futile. There was something in the amendment not at all consistent with the first resolution, if the view that it was desirable to amalgamate was anything more than an abstract idea or pious opinion. It seemed to him that, by adopting the amendment, they were simply wrecking the scheme on the merest matter of form. The first thing to settle was, Was amalgamation desirable? If they agreed to this, he took it that, as men of sense, they ought not to allow their opinion to be shattered, or a mere matter of form to stand in the way of its being carried out. He was anxious to preserve the rights of those gentlemen who were sometimes rather disdainfully referred to as "traders," but who had rendered distinguished service to the gas industry. He was, however, also anxious that the labour of the Council should not be thrown away, and that all the hopes which had been centred on the progress of these negotiations should not be shattered by one rude blow at this juncture. The object was to maintain the position of the associate members in the amalgamated Society; but if the amendment were adopted, the die would be cast—the whole thing would be decisively settled, and there would not be the smallest door open for further negotiation, or any future possible agreement between the two Associations.

Mr. JONES: Then it is a shame if there is not a door open.

Mr. CARTER said that, to his mind, the only way to keep the gate open was by defeating the amendment, and then possibly some other amendment might be put forward which would make the position more plain with regard to the associate members.

Mr. W. PRINCE (Stoke-upon-Trent) said he should like to know whether, if the amendment were negatived, the members were pledged to amalgamate on exactly the lines laid down in the draft rules which had been circulated. It appeared to him that the President and the members of the Council were in a very responsible position—in fact, upon the President's generalship the amalgamation of the two bodies now depended; and he (Mr. Prince) hoped that the amount of power he possessed would be brought to bear on the question, and that there would be some way found to solve the difficulty which had been referred to. He felt sure it must have been patent to the President that there was a strong current of feeling antagonistic to the amalgamation under the clauses as set forth; and he (Mr. Prince) wanted to make an appeal, on behalf of the younger men, that every consideration should be given to it. He felt that there was a great principle at stake; and he thought it would redound to the honour of the President and the Council, if this amalgamation should take place, if it could be done in a way satisfactory to everyone, and without loss of dignity to either side.

The PRESIDENT, before putting the amendment, said as far as he was personally concerned, he did not mind whether the amalgamation would redound to his honour or not. They had been asked whether or not any alteration could be made in clause 4. He did not know that it could. It was possible that there might be some alteration; but he did not know. This, however, was not the final vote which the members would be able to give on the matter. A month hence they would be called together again to record their final vote; and if they were not satisfied then, all they would have to do would be to simply say "No," and they would revert to their old position—in fact, no steps could be taken with regard to winding up till the confirmatory resolution had been passed between a fortnight and a month hence. But in respect to the amendment, it was a direct negative to the resolution, because it said "the liquidation of the Incorporated Gas Institute is not called for." It was absolutely called for, if they were to amalgamate, for two reasons. There were several men—some of them mere traders, absolute traders—who either did not intend to resign, or, as in the case of one man who was a mere trader, absolutely objected to do so. How could they ask others to go if they retained these? Therefore, if it were only to get rid of that one man, it would be necessary to dissolve. They must also do so in order to start on the same footing as their brethren in the Institution. They knew they were by far the larger number; but to say by this resolution or by the dissolution that they would turn out 100 and take in 50 or 60 was altogether wrong. They would take in more than they would turn out; and if, instead of counting them, they weighed them by the position they occupied in the profession, they would take in infinitely more than they would be turning out.

Mr. W. CARR: How many?

The PRESIDENT: Probably 150.

Mr. CARR: Half of them are members of the Institute already.

The PRESIDENT said there were nearly 240 members in the Institution, and not 40 per cent. were members of the Institute—only 50. Therefore they would take in nearly 200. Then they should look at the difference of the men, with the exception of one or two, who had expressed their willingness to resign, when comparing them with men like Mr. Livesey—(murmurs)—he would not mention names; but many of those others were not comparable with him as a leading man in the profession. It was for the meeting to decide whether or not the amalgamation should take place. He trusted it would; but it could only do so on certain terms, and these were more or less shadowed out in the resolution. He would remind the meeting that the resolution said that the rules were subject to alteration by the Council; and if the alteration did not suit the members, a month hence they could negative the whole thing. He concluded by reading the amendment through and putting it to the meeting.

Mr. JONES said that under Rule 53 he claimed a vote by ballot.

The PRESIDENT asked the members entitled to vote, who were in favour of the amendment, to hold up their hands. This having been done, he stated that the members voting in favour of it were 31. On putting the contrary, he declared the amendment lost.

Mr. JONES: I take it, Sir, that you refuse a poll?

The PRESIDENT said he did, as it required a demand by six members.

Mr. CHESTER said he was quite sure there was but one feeling among the members, and that was that the labours of the Council should not come to nought for any frivolous reason. It was the desire of all that amalgamation should take place, and the only question was as to the price they were to be asked to pay for it. He did not believe the members would be willing to pay the price asked in clause 4 of the Articles of Association.

The PRESIDENT asked Mr. Chester whether, if a proviso were put in allowing eminent gentlemen to be elected at the will of the Council, this would meet his view.

Mr. CHESTER said he thought the members would want some clearer definition than this. He feared there was no possibility of getting over the difficulty in that manner; but, in order to keep the door open for amalgamation, he begged to move a further amendment. He should adopt the resolution down to the words "Memorandum and Articles of Association," and then delete the remainder of the paragraph, and add: "But that the draft Memorandum and Articles of Association now presented do not meet with the approval of the members, and that they be referred back for the further consideration of the Council." This left the gate entirely open. The Council would have gathered, from the expressions of the members, that there was a very strong consensus of opinion that those whom the Association proposed to eject from membership should not be sacrificed in the manner suggested in clause 4. They were all desirous of amalgamation; but to expel men like Mr. West and Mr. Hepworth, and also Mr. Sugg, than whom there was no more honoured member of the Institute, who had spent a whole life in promoting the welfare of the gas industry, and who was at all times ready to lay his experience and knowledge before the members, to say nothing of younger engineers like Mr. Pease, who was the inventor, to a certain extent, of an epoch-making device—to deprive themselves of any individual who came out with new schemes and new inventions in connection with the manufacture of coal gas, would be to narrow the lines of the Institute in a manner which was very undesirable. They wanted to broaden the basis rather than to exclude such members; and he should be glad to see the gates opened wider to receive men of all kinds of eminence who were associated with the welfare of the gas industry. They did not want to emasculate the industry by depriving it of manhood, as was proposed by clause 4, but to keep the basis as wide as possible, and to increase rather than decrease its usefulness. For this purpose he moved the amendment.

Mr. ISAAC CARR (Widnes) seconded the amendment, which he said would provide a way for dealing fairly with those gentlemen whom it was proposed to expel, and for doing not only what was just to those gentlemen themselves, but also greatly to the advantage of the Institute.

The PRESIDENT said he did not think it was necessary to discuss the amendment at much length, after what had taken place; but he would ask the members to consider the matter carefully before adopting it. If it were passed, it would hang up the matter indefinitely; and they all wished to have it decided. Those who were in favour of any such alterations in the rules or the Memorandum of Association as had been suggested, had only to formulate them for the two Councils to consider, and, if possible, they would be adopted. He did not say that any alterations would be made; but they would be if possible. They would then register the new Society; and when they were called together again to pass the confirmatory resolution, if they were not satisfied, they would simply have to say "No." Then the matter would be decided. The passing of the amendment before them simply meant hanging the question up for another twelve months at least; and this would give opportunity for a great deal of dissension and trouble. All these matters were open for the revision of the Council; and therefore, if members would send in their views, the Council would consider them when meeting the members of the Institution, and try in all ways to adopt them.

The amendment was then put; and the voting was 60 for and 70 against it. It was therefore lost.

Alderman MILES said he had another amendment to propose. He would accept practically the whole of the resolution down to the words "subject to such alteration," and then he would insert, in clause 4, which was the clause affecting the whole of this position, "no person shall be qualified to become a member of the Institution, after the date of the amalgamation, who shall be actively engaged in or about the management and business," and so forth—deleting the words "be or remain," and putting in the words "become a member after the date of amalgamation." The effect of this would be, to his mind, to let the members as they at present existed, remain intact; and in the election of any future members to allow the principle of clause 4 to come into operation. He knew this would meet the views of a great many members; and it was the *crux* of the whole question.

Mr. CHESTER said he had great pleasure in seconding the amendment, as it exactly fitted in, he believed, with the feelings of the meeting; and if it were carried it would have the effect of doing what he desired to do perhaps in a more gentle way, by allowing the Council themselves an opportunity of carrying out what Mr. Miles suggested. He could not help feeling that it was a little curious that they had heard no expression of opinion from any member of the Council. He hoped they were all so absolutely unanimous that there was but one feeling to be expressed.

The PRESIDENT said that was the position.

Mr. JONES supported the amendment, as it would carry out exactly what Mr. Chester and he had been wishing, and would prevent the expulsion of some of their earliest and best members. A breach of faith, either on the part of an individual or a public body, was a most dishonourable thing.

Mr. VALON said the President had already stated that any suggestion coming from individual members would receive every possible attention, and would be represented to the other side. When it came, as it would do here, from the meeting—showing the very strong feeling that something should be done in the way of modifying clause 4—might they not leave it for the present in the hands of the Council, without passing the amendment? If they would leave it in this way, the Council would have the power, if they were not able to do all they wished, to do all they could; and he would appeal to members not to tie the hands of the Council except by an expression of opinion.

Mr. W. FORD (Stockton) said he should like, as a retiring member of the Council, to support the suggestion of Mr. Valon. He felt very strongly on the question of sending some of his oldest and most esteemed friends out of the pale of the Institute. Having been an original member of the British Association of Gas Managers, and being also a member of the Institute, he should not like to condemn these men entirely; but he should assure them that every member of the Council, whether opposed to their inclusion or not, would give the most earnest consideration to the matter.

Mr. H. LEES (Hexham) said he had given this matter a great deal of consideration. He could speak thereon with much feeling for those who went through the trouble of fourteen or fifteen years ago, and could sympathize with the position some members might take up that morning. He hoped, however, the feelings then generated would not

be allowed to influence the voting. To postpone this question for another twelve months would be a serious blow to it; and he feared that, if it were postponed, there would be no amalgamation. He considered that all who voted on the first resolution had committed themselves to amalgamation; and the passing of the amendment would be fatal to it. He was sorry for those who would have to retire; but if they consented to it—if 99½ per cent. were willing—why should they make further trouble about it? Consideration had been given to them. They had been asked if they were willing to retire, and those who took any interest at all in the Institute said they were. He knew that some of them were giving up a great deal; but they did not mind making the sacrifice at this juncture in order to bring about an amalgamation which should help forward the gas industry in future generations. There were certain points in the draft rules upon which he might have made some remarks; but perhaps this was not the proper time to do so. He trusted the resolution would be passed without the amendment. Could they not trust the Council, who, he believed, had carried out the wishes expressed at the last annual meeting? He was not present then, and was not committed to amalgamation; but he trusted that they would support the Council, and not wreck the scheme for the sake of sentiment.

The PRESIDENT then put the amendment, with the following result: For, 62; against, 81.

The original resolution was then put and carried by 82 votes to 18.

The PRESIDENT said there was one other resolution which did not require any further debate—viz.: "That the Institute be wound up voluntarily." There could be no amendment to this resolution; it must be simply "Yes" or "No."

Mr. CHESTER asked what was the requisite majority for the passing of the resolution.

The PRESIDENT said a majority of three-fourths.

The resolution was then put, and the votes were: For, 95; against, 37.

The PRESIDENT announced that the resolution was lost by four votes.

A MEMBER asked if it would be in order to demand a poll.

The PRESIDENT said yes, if six members demanded it.

After some discussion, it was decided that a poll should be taken at four o'clock that afternoon.

It being then two o'clock, the meeting adjourned for luncheon.

On re-assembling in the afternoon, the reading and discussion of papers commenced; the first taken being that by Mr. Chester, on "Automatic Stoking and Inclined Retorts." The discussion of the paper was in progress at four o'clock, when the poll was taken; Mr. T. H. Martin (Barnet) and Mr. C. E. Jones being appointed tellers. At half-past four,

The PRESIDENT said a great many people who did not vote in the morning appeared to have done so now; the votes being 86 in favour and 64 against the resolution. It appeared that those who had not sufficient confidence in themselves earlier in the day had voted differently now. The matter was entirely lost; and he would just say that, as far as amalgamation was concerned, it might be relegated for many years.

The meeting was then adjourned till the following morning.

THE BENEVOLENT FUND.

The Annual Meeting of the Donors and Subscribers to the Benevolent Fund was held at the conclusion of the sitting on Tuesday—Mr. W. R. CHESTER in the chair.

The minutes of the previous meeting were read and confirmed, and the report and accounts, as circulated, were adopted. No discussion ensued; and the proceedings terminated with an invitation from the Chairman to any members to send to the Committee, for their consideration, particulars of deserving cases with which they were acquainted.

THE PAPERS AND LECTURE.

On the resumption of the proceedings on Wednesday, the discussion on Mr. Chester's paper, interrupted on the previous afternoon, was finished; and the lecture and the other papers followed. The order was—

Tuesday.—(1) "Automatic Stoking and Inclined Retorts." By W. R. CHESTER, of Nottingham.

Wednesday.—(2) "The New Gas." A Lecture by W. H. Y. WEBBER. (3) "Roofs for Retort-Houses." By A. T. WALMISLEY, of London. (4) "Some Disputed Points among Gas and Water Experts." By J. WILKINSON, of Drighlington. (5) "Naphthalene, from the Retort to the Point of Deposition." By W. YOUNG, of Peebles.

To-day we give (p. 1627) the lecture; and the papers, with the report of the discussions thereon, will appear in the next issue of the "JOURNAL."

REPORT OF THE SCRUTINEERS.

At the close of the technical business, the report of the Scrutineers was presented. It showed that the following gentlemen had been elected office-bearers of the Institute for the ensuing year:—

President.—T. O. Paterson, of Birkenhead.

Vice-Presidents.—S. W. Durkin, of Southampton; and A. Dougall, of Tunbridge Wells.

New Members of Council.—T. Bower, of West Hartlepool; W. Carr, of Stalybridge; W. S. Haddock, of Warrington; and T. P. Travers, of Cork.

Auditors.—W. D. Child, of Romford, and Samuel Wood.

Honorary Secretary.—J. Davis, of Gravesend.

MEMBERS.

Birch, H., Wellington (N.Z.).
Braithwaite, J., Wrexham.
Brown, J. H., Ilford.
Buckley, J. H., Formby.
Cobban, A. M., Scunthorpe.
Currie, W., Alexandria (N.B.).
Dixon, J., North Walsham.
Falkner, F. J., Romsey.
Garlick, D. E., Barnoldswick.
Goodson, A. F., Heckmondwike.
Hole, W., Leeds.
Jenkins, C., Portsea.
Newbigging, E. L., Macclesfield.
Schofield, F. L., Barnstaple.
Shadbolt, T. E., Grays.
Spier, W., Rockhampton (Queensland).
Stevenson, G. E., Long Eaton.
Theobald, J., Henley-on-Thames.
Turner, J. W., Torrington.

ASSOCIATE MEMBERS.

Bury, A. N., Wrexham.
Gandon, H., Lower Sydenham.
Hunter, R. W., Chester.
Lewis, G. P., Lower Sydenham.
Williams, H. R. S, Lancaster.

TRANSFERENCES.

The following were reported to have been transferred from the class of associate members to that of members:—

Airth, G., Dundalk.
Buckland, W., Chesterfield.
Duxbury, Thos. H., Bradford.
Hutchinson, Harold, Barnsley.

The report of the Scrutineers was adopted.

HONORARY MEMBERS.

On the recommendation of the Council, the President of the Société Technique du Gaz en France was elected an honorary member of the Institute, as was also Mr. Alfred Lass, late an Auditor of the Institute.

THE AMALGAMATION QUESTION AGAIN.

Mr. J. STELFOX (Belfast) said that, as the result of conversation with a number of members, and finding that the general feeling of the Institute, as was apparent on the previous day, was that the proposed union, which seemed for the moment to have been frustrated, should be carried out, he had been asked to propose a resolution. In doing so, he did not intend to occupy more than a few moments, as, of course, the subject was well known, and had been well ventilated. They had on Tuesday discussed the subject for more than three hours, and were unanimously of opinion that amalgamation should take place. But, subsequently, in a few moments, they did away with all the good they seemed to have done, and finally left matters in a very unsatisfactory state. The Council—not only last year's, but that of the previous year—had worked in the direction of securing this union between the two Societies; and they had seemed almost to have got to that point where the success due to their efforts was assured. It was quite clear that it was the opinion of the members universally that amalgamation was desirable—(hear, hear)—and he thought it would be extremely unfortunate if they were to break up now, and leave the matter as it rested at the moment. He begged, therefore, to propose the following resolution: "That, as the desirability of

the union of the Incorporated Institution of Gas Engineers and the Incorporated Gas Institute was unanimously resolved by the members of the Institute, as shown by the voting yesterday, we desire to place on record our appreciation of the labours of the President and Council in endeavouring to bring about the amalgamation, and earnestly request them to continue their efforts to secure a satisfactory amalgamation, and to call another meeting of the Instituteto consider and vote on their proposals at the earliest possible opportunity." (Applause.)

Mr. VALON said that, after a conference with some of his friends, he had undertaken to second this motion. He intended to do so with all the earnestness it was possible to put into it; but, hearing the reception the resolution had met with, he felt certain that all he need do was to second it, and that it would be carried unanimously. As the matter at present stood, it certainly did not represent the feeling of the meeting; and if the resolution were to drop, the Institute would be in a false position. He therefore hoped that the resolution would be carried absolutely unanimously.

Mr. CHESTER, as the mover of one of the amendments which brought about the present condition of affairs, said he had very great pleasure in supporting the resolution. He believed the majority of the members of the Institute, and also of the Institution, wanted amalgamation, and did not wish for the exclusion of a great number of those gentlemen whom clause 4 of the Articles shut out. He believed they all desired that the two Institutions should amalgamate, and that those gentlemen should remain members. On these grounds, he could not help feeling that the conclusion arrived at by the final vote on the previous day left the Institute to some extent in a false position. He believed it was within the powers of the Council to draw up such a scheme as would enable them to bring their past efforts to a successful conclusion.

Mr. ELLERY said he was more than pleased that this resolution had been brought forward, because he believed that on the preceding day they went away with a consciousness that what had been done did not represent exactly the feelings of the members. The present resolution brought them somewhat nearer to what they needed. It was a great matter; and in great matters it was not easy always to make the position plain, even to themselves. But he thought they were doing so now; and the Council might go away with a feeling that they had a solid vote behind them, at least on the point that the gas industry should be represented by one front. Ever since he had had the honour of being President of the Institute, he had been convinced that all gas engineers—or, at any rate, with very few exceptions—desired to be together in one body; and he could not help feeling that there were enough business men on both Councils to see a way by which this desirable end could be attained. He was satisfied that, however diverse their opinions might be on matters of detail, on the general desirability of amalgamation there was only one opinion; and if the President and Council went away with a feeling that the Gas Institute desired to find a way, as he believed the Institution of Gas Engineers did, towards this desired end, a way would be found.

Mr. W. CARR said he was one who opposed the efforts of the Council on the previous day. He subscribed to the first resolution—or, rather, did not vote against it—and certainly desired the amalgamation to come about; and as he now heard he was a member of the Council, his efforts would be in this direction. If some slight amendment could have been accepted on Tuesday, possibly they might have come to a very different conclusion; but he did not think that any harm was done. It was not wise to do these things in a hurry. Probably if the President would help them in the days to come, they might arrive at a much wiser and better conclusion in the end than they would have done on the previous day. He trusted it might be so—at any rate, he would do all he could to bring about an amalgamation.

Mr. T. O. PATERSON said the members might rely upon it that he would do all he could to bring about an amalgamation of the two Societies. There appeared to be very little between them; and he should say that what difference there was could be overcome without much giving way on either side. It seemed to have been narrowed to a very small gap; and he had no doubt the matter might be brought to a successful issue.

Alderman MILES said, as the mover of a somewhat hostile amendment on the previous day, he was thoroughly in accord with the sentiments now expressed. As he had said, no one was more ardently desirous to see the two bodies amalgamated than he; it was only a question of just and equitable terms. Now that the Institute had expressed itself in the manner it had done that afternoon, and they had just heard that the new President and new member of Council were going to use their best efforts towards bringing the amalgamation about, he had the most perfect confidence in leaving it in their hands, believing they would do all they could to re-unite the Institutions. There was only one difficulty that occurred to him. It was suggested that a meeting should be called as soon as possible to ratify this. But the trouble would, he thought, be to get members from all parts of the kingdom to attend the meeting. He trusted they would all do their best to bring about an amicable settlement.

Mr. W. W. HUTCHINSON supported the resolution, which, he said, met with his cordial approbation. He expressed the belief that the two Councils would have no difficulty in arriving at a satisfactory conclusion. A feeling of disappointment was certainly present among the majority of the members on the previous night; but he hoped this would be changed to one of satisfaction.

Mr. S. W. DURKIN desired to express his satisfaction that the olive-branch had been thrown out. On Tuesday, he made up his mind to resign his position on the Council, as he took the vote then passed as one of want of confidence in the President and Council. (No, no.) He should be very pleased to work with the new President and Council for the object they all had at heart; and he trusted that in due time they would see the fruition of their hopes, and the two Institutions working together for the good of the industry in which they were all engaged.

Mr. J. CARTER remarked that it seemed superfluous to say that the resolution was one which they should support. He would put it rather more strongly, and say that the circumstances of the moment rendered such a resolution absolutely necessary. As the position was left on the previous afternoon, he was quite certain everyone must have felt that it misrepresented the actual sentiments of the members; and it would have been an absolute calamity if they had been allowed to separate without an opportunity of revising their position, and correcting, it might be, the series of mistakes they had made. He felt on the previous evening that probably the cardinal mistake was in rejecting the amendment which Mr. Chester moved. If the gate had been left open, as that amendment rendered possible, the position would have been vastly more favourable than that which was eventually reached. At any rate, the resolution now before them would correct the mistake; and he was quite certain that the real feeling of the Institute was in favour of the door for negotiation being re-opened, and a strong desire that a promising movement should not be wrecked by a moment's inconsiderateness.

Mr. CHESTER remarked that they would like to hear the views of the Junior Vice-President on the question.

Mr. A. DOUGALL (who had only just entered the room) said he was at some disadvantage in not having heard the resolution; but he understood the question was the desirability of re-union. This subject he had had before his mind for five years—in fact, all the time he had been Honorary Secretary; and, in his humble way, he had tried not only to maintain the position of the Institute, but to do everything in his power to bring about the amalgamation. He felt the difficulty of carrying on the two Societies; and it was quite true that the members of both had a very keen desire to unite and form one strong body. He could assure the meeting that he would do his best to effect this. He was very glad this matter had been brought forward, because he certainly did feel that the action of the previous day amounted to a vote of want of confidence in the Council, but he presumed the members had somewhat altered their minds in this respect.

The PRESIDENT said he would now put the resolution, on which he would not say a word, except that everyone knew that he had done his best to bring about union. He hoped the motion would be carried unanimously.

The resolution was then put to the meeting, and carried *nem. con.*

PLACE OF NEXT MEETING.

Mr. T. H. MARTIN (Barnet) moved that the Institute hold the meeting next year in Liverpool, which he thought would be a convenient place, seeing that the new President

came from the North, and there was plenty of hotel and other accommodation.

Mr. T. Bower (West Hartlepool) seconded the motion.

Mr. Valon suggested that, under the present circumstances, it would be better to meet again in London. He said this after consulting the new President (Mr. Paterson); and he would therefore move, as an amendment, that the meeting in 1901 be held in London.

Mr. J. M'Gilchrist (Dumbarton) seconded the amendment.

Mr. Chester supported Mr. Valon's suggestion, understanding that it would meet with the approval of the new President. He thought if they were to "commit suicide" next year, they had better do it in London.

Mr. Martin said, if this were the feeling of the meeting, he would withdraw his motion.

The President said it would be just as well to take the opinion of the members, whether they preferred to meet in the country or in London.

On a show of hands, the majority were in favour of London.

Votes of Thanks.

The President then proposed a vote of thanks to the Société Technique de l'Industrie du Gaz en France for their kind invitation in connection with the Institute's visit to the Paris Exhibition, and the arrangement so courteously made for the reception of the members; also to the Compagnie Parisienne du Gaz for their very acceptable invitation to the members to visit the Company's station at Clichy, and for the facilities they were kindly providing in connection therewith. It was very good of them to receive the Institute so cordially; and as he knew one of the gentlemen who were going to meet them on Saturday—M. Lebon—he was quite sure they would be received exceedingly well.

Mr. Ellery said he was looking forward with pleasure to this visit; and as he had been for some years in the habit of receiving copies of the French Society's proceedings, he had very great pleasure in seconding the vote of thanks.

The motion was carried unanimously.

Mr. J. P. Leather (Burnley) then proposed a vote of thanks to the authors of papers.

Mr. J. Braddock (Radcliffe) seconded the motion, and it was carried.

Mr. T. Hands (Enniskillen) proposed a vote of thanks to the Scrutineers.

Mr. J. Booth (Southport) seconded the proposition; and it was carried unanimously.

Alderman Miles said he had great pleasure in asking the members to accord a hearty vote of thanks to the Council for their services during the past year. It would, he thought, be admitted on all hands that the work of the past year had been unusually heavy and difficult; and though the thing on which they had set their hearts did not immediately come to pass, he thought they could compliment them on the fact that at last they were in a fair way to its accomplishment. He was sure the members heartily appreciated their services.

Mr. Irving, in seconding the motion, said he could assure the President and Council that the members deeply sympathized with the position in which the vote of the previous day had placed them. It was all very well to make speeches; but he much regretted that they were unable to endorse the arrangements the Council had made. However, they had been invited to take the matter up again; and he trusted they would forget all about the resolutions of Tuesday, and keep in mind the unanimous request now made to them, and endeavour to bring about some settlement. They might depend upon it that, whatever conclusions they arrived at, the members of the Institute would support them to the end. The members must clearly understand that, when they appointed a Council who entered into negotiations on their behalf, they were bound by all that was honourable to support them; and he wished to pledge himself, and many others who agreed with him, to this. The Council should have their support, not only in votes of thanks, but right to the end.

Mr. W. W. Hutchinson concurred with the motion.

The President said he was not now a member of the Council, and was not included in the resolution. He might therefore say to the members that if they were not grateful to the Council they ought to be, for they had done well.

The motion was carried by acclamation.

Mr. Martin being called upon to respond, thanked the members on behalf of the Council for their cordial vote of thanks, and said that he should certainly do his best to carry out the proposition contained in the resolution passed that afternoon.

Mr. C. E. Jones said they had thanked the Council for their labours, but they must not forget that the Council had a head who was not included in the resolution—viz., the President. Of course, the anxieties and responsibilities of the President of an Association like theirs were very trying and onerous, and frequently very thankless. That the President had had a trying time they would all admit. But he had not only had it in the conduct of the business in that room, but for the whole of the previous twelve months; and he (Mr. Jones) thought his services were deserving of their special recognition. It had been said on the previous day by Mr. Valon, that the President sat in the chair which had once been honoured by his father; and it was his (Mr. Jones's) privilege many years ago to stand up and move a vote of thanks to that gentleman. He thought, therefore, it was only appropriate that he should be allowed the privilege of doing it on the present occasion. In the freedom of debate and the warmth of discussion, expressions were made use of which would possibly be somewhat toned down if they had more time for consideration; and he hoped the President would forget the hard knock which had been given him in any discussion which had taken place, and that speakers and movers of resolutions, wise or unwise, would also adopt the suggestion, and forget all these things, and go on again with a fervent desire to carry out the best interests of the Institute. He did not remember, in his experience of something like 26 years, any President having such contention and such diversity of opinion to deal with as Mr. Stevenson had had. He had their sympathy, and he deserved it; and he (Mr. Jones) had no doubt whatever that they would agree that he merited an unusually cordial vote of thanks on this occasion. He had no doubt his proposition would be carried unanimously by acclamation.

Mr. Hepworth seconded the motion. He said he was not present on the previous day, because he felt some delicacy about attending; but he had heard a great deal about the difficulties the President had had, not only at the meeting, but during the year. He could quite imagine the amount of anxiety he must have had to bear on behalf of the Institute, in carrying out these complicated and important negotiations, which resulted in the resolution proposed on Tuesday. They all knew Mr. Stevenson's great ability; and he was perfectly sure that in everything he had done he had sought to further the interests of the Institute, and had done it with a dignity which became the name of Stevenson. He (Mr. Hepworth) could only say that the strongest support the resolution could have had been already given by the extraordinarily hearty way in which the motion of Mr. Stelfox was received.

The vote of thanks was carried by acclamation.

The President, in responding, said he had not thought that his services would be regarded so highly as they seemed to be by so many gentlemen, even those who opposed what was suggested the previous day. He might say distinctly that he did not object to "hard knocks" from anybody, for he was accustomed to them. He got them every day of his life in the session, if not from other people, from his own old evidence, which was brought up against him. He had not felt hurt on account of any of the hard knocks, which he considered had been legitimately made; but he must say that more than once during the progress of the discussion, like Mark Twain, he made many vows, and like him he should perhaps find that, although there was great pleasure in so doing, there was greater pleasure in breaking them. It was said that second thoughts were best; and perhaps his second thoughts might be different from what they were on Tuesday. He felt that the Institute did wish, generally speaking, to amalgamate with the Institution; and he only regretted, and deeply regretted, that the motion now carried could not have been made on the previous day. He was very sorry, too, that more members did not attend. Out of the 600 who had the right to vote, only 150 came to exercise it on a momentous question like the one they had had before them; and he hoped that, the next time it came forward—and doubtless there would be a next time—every member who possibly could, whether he was in favour of the motion or deadly

opposed to it, would come up and vote, so that they might get the real mind of the Institute upon it. They did not want to effect amalgamation simply because the large majority did not attend; for this would simply mean trouble hereafter. They wanted the majority to show that they did desire amalgamation; and they should come and do this by their votes. He begged to thank them with all his heart for the way in which they had carried this vote of thanks.

Mr. W. W. Hutchinson then proposed a vote of thanks to the Auditors.

Mr. H. Wimhurst (Sleaford) seconded the proposition, and it was carried.

The President said he had next to propose a vote of thanks to their Honorary Secretary, which he knew would be accorded to him as heartily as possible. Mr. Dougall had served them well for five years, and had had his vote of thanks each year; but this year he was going to have it, and something more. The little present referred to on the previous day had now arrived; and as it had been chosen by Mr. and Mrs. Dougall, the members might be sure that it would be acceptable to them. It consisted of a silver salver upon which was the following inscription: "Presented to Andrew Dougall, Esq., by the members of the Incorporated Gas Institute, in recognition of his valuable services as Honorary Secretary during the years 1896-1900." With this there was a box of fruit knives and forks, also in silver. In the name of the Institute, he had much pleasure in presenting Mr. Dougall with these articles, which he did not doubt he would often use. It was only a small recognition of the services he had rendered.

The vote of thanks was carried by acclamation.

Mr. Dougall, in reply, said he could not find words to thank the members for this expression of their appreciation of his services. It had been a very pleasant time to him; and he was glad to think he had had the loyal support of the Council throughout his term of office. He had formed many friendships, and had felt amply repaid without any such recognition as that which he had just received; but he should highly appreciate the present, and round it would cluster many pleasant memories of the time when he had such close contact with the members of the Incorporated Gas Institute. He had now to propose a vote of thanks to Mr. Dunn, the Secretary, who really did the work of the Institute—the Honorary Secretary being only an ornament.

Mr. T. N. Ritson (Kendal) seconded the motion, which was carried unanimously.

Mr. Dunn briefly acknowledged the vote, and the proceedings terminated.

THE LECTURE.

"THE NEW GAS."

By W. H. Y. Webber.

I feel that an explanation is due to such an audience as I have the honour of addressing on the present occasion for the application to my discourse of what must to many of you have been a puzzling title. Those members of the Institute whose recollections run back, like my own, over a considerable period of time, will remember having had their attention called to more than one "New" gas. Indeed, this brood has been a numerous one; but although they all claimed to be different from everything else of the same name, they shared the congenital weakness which invariably carried them off before they had struggled far on in the world. No "New" gas ever grew old. Latterly, the strain of this brood has sadly degenerated. The last I saw was a callow bantling hatched in Lombard Street, which professed to make gas sufficient for lighting a large country house for six months from twopennyworth of some mystery poured into a tin box. You then struck a light, and the patentee did the rest. I fear that this particular brand of new gas perished in the shell.

It is hardly necessary for me to assure you that I do not propose to waste your time on anything so preposterously novel, so lamentably stale, as this kind of new gas. I will own at once that there is no novelty at all about my so-called new gas. Perhaps the best illustration of the sense in which I use the term in this particular connection is to be found in that supremely beautiful phrase of Tennyson, in which he describes how the awakened Princess and her lover departed—when

> "Far across the hills they went
> In that new world which is the old."

For it is truly of a very old gas indeed that I propose to speak: Of that common coal gas which your predecessors made, because they could do no other, by methods and means to which those actually in use preserve so strong a family likeness. A gas which they and their employers went on making and selling through good and through evil report; because they believed in it. A gas which has kept its market, and done good service to civilization, despite the sneers of the superior scientific person and the adventures of the perfervid inventor. A gas which now, only now, years after its supersession as a staple manufacture has been proclaimed from lecture platforms and in the Press throughout all lands, is being awakened to a new destiny and an inheritance widely differing from, and greater than, anything that either its friends in the past or its enemies of the present have ever suspected to be in store for it.

I mean to say that while the gas is old, being none other than the honest, unsophisticated coal gas of our fathers, as a resource of the material civilization of the coming century the gas is new; because it will be produced according to a reformed principle of manufacture, and will be used for a totally new service. I am aware that this declaration is not news. You who are gas makers and vendors can read the signs of the times as well as I can. But although every man carries his own watch nowadays, and does not really need anybody to tell him the time, we still erect and keep in action town clocks for all to see. So it has commended itself to your Council that I should call the time of day for the British gas industry at this meeting, and so enable the Institute to place upon its records the fact that it took cognizance betimes of the coming of that industrial revolution which is certain within a few years to put a different face upon British gas undertakings, public and private, and the consequences of which no man can venture to predict.

It has long been the aspiration of scientific workers that something which they vaguely qualified as "cheap fuel gas" should be made available for general consumption, as coal gas was for lighting. More than once it has been fondly imagined that the *desideratum* was supplied. In turn, water gas, Siemens gas, and the blend of the two now called Dowson gas promised to be suitable for the purpose. Not long ago, all these varieties of gaseous fuel, and everything else of the kind that could be made to order, were exhaustively tested by the Westinghouse Company with a view to distribution for fuel purposes, when the natural oil-gas supply of Philadelphia should give out; and the result was to demonstrate that only coal gas and carburetted water gas could be economically generated at manufacturing stations and distributed. I need not go over this old ground. The literature of the subject is vast; and knowledge of the facts is part of the regular professional equipment of gas engineers. It is worthy of note, however, that on the occasion of the meeting of this Institute in the city of Birmingham, in 1881, the late Sir W. Siemens delivered a suggestive address advocating a system of duplex coal carbonization, in which two-thirds of the make should be reserved for sale as "illuminating gas," while the remaining one-third would be diverted into another channel for sale separately as "heating gas." This portion of the make he distinguished as "light gas," because it was not overloaded with the heavier hydrocarbons.

This arrangement was defended in these remarkable words, to which later experience has given deeper significance than the eminent speaker could have anticipated. He said that "the heating gas, although possessed of an illuminating power of only 11·05 candles, would be preferable to the mixed gas for heating purposes, in being less liable in its combustion to deposit soot upon heat-absorbing surfaces, and in giving, weight for weight, a calorific power superior to olefiant gas." At the same time, although Sir W. Siemens had no idea of the possibility of burning gas for illuminating purposes otherwise than with the self-luminous flame, he admitted that this was an extravagantly wasteful way of procuring light, as not more than about 1 per cent. of the calorific energy developed in the combustion of the gas was really utilized in the production of luminous rays. How gladly, therefore, would he have seen the system superseded by something more economical!

At the meeting, the late Mr. F. W. Hartley, Mr. Sugg, and other practical-minded persons, duly poured a large

quantity of cold water upon Sir W. Siemens's duplex-carbonizing suggestion; but Mr. W. Foulis was already free to admit that, although he "still had his doubts about it," his experiments "seemed to indicate" that "gases of low illuminating power were better suited for heating purposes than gases of high illuminating power." I am sure, gentlemen, that nobody could expect a Scottish gentleman to express himself upon the subject more positively than this, at the period to which I refer!

It is very impressive, as one reads up the record of men's thoughts of bygone times in the light of later events, to mark how they have fumbled round a locked door without ever finding the key, although it lay near at hand. Nineteen years is not so very long to look back over. Most of those who listened to Dr. Siemens, as he then was, are happily still with us, only a thought grayer; but their speeches on that occasion ring strangely archaic. Something has happened since then to put a different face upon the use of gas for lighting. We can, however, applaud the strong good sense of the then President, Mr. Charles Hunt, who was convinced that a duplex supply was not the right way to bring in fuel gas. Mr. Hunt, by the way, was the only speaker on this occasion who was blessed with a bit of the prophet's mantle, for he observed that "he very much questioned whether, if a consumer had the choice between 18-candle gas at a high figure and 11-candle gas at a low one, he would not choose the latter."

In the course of this historic debate, moreover, much was said about the desirability of cheapening town's gas; and the familiar question arose of when such gas might be regarded as "cheap enough" for this or for that use—a most important problem, which is not susceptible of a general solution, although such a way of regarding it has been much favoured by municipalities who ought to have been better inspired. This view of town's gas, as to its being cheap enough at 2s. per 1000 cubic feet or thereabouts (or even when it is as cheap as the same product in the next town) is, in fact, a superstition descending from the period, before 1881, when illuminating gas was conventionally regarded as dispensed wholly for one principal use—that of giving light by its luminous flame; and was a luxury for the well-to-do. The trail of this superstition is all over the Birmingham discussion, which proceeded on the tacit assumption that if there were to be such a public service as that of fuel gas, this must necessarily be something totally different from the ordinary town's gas. The suggestion was contemplated as foreshadowing a new and distinct branch of a gas company's business; and this view was sustained by the belief that the illuminating power of the luminous flame of the lighting gas must be maintained at a high photometric standard.

Consequently, the idea of a heating-gas branch for gas undertakings fell flat. It could not be worked; and there the matter rested for awhile. Professional opinion, the Legislature, and public wishes tended to assign importance to the conventionally-measured luminosity of town's gas. For some years it became usual to increase the illuminating power of town's gas from 12 to 14, 15, and 17 candle power, with the idea of giving the people good value for their money. Local authorities everywhere insisted upon screwing up the statutory illuminating power of the gas supplied by companies; and when they had the supply in their own hands they, in many instances, voluntarily gave their public the same imagined advantage.

The Board of Trade returns exhibit the effect of this usage in gas manufacture by the number of gas undertakings which claim to supply gas of a much higher illuminating power than their legal requirements. I call this era—the era of enhanced conventional illuminating power of town's gas—the Dark Age of the British gas industry. It was the period when the good folks of Edinburgh and Glasgow groped about grumbling in the semi-darkness of their high-candle power gas; and when it was the fashion of those who knew no better to envy them this splendid privilege.

Looking back at this period, one can now perceive that the gas industry at the commencement of the eighties was really at a perilous pass. Electric lighting was coming in, and to this charming novelty gas could only oppose a time-worn face, destitute of any pretence to that indefinable but irresistible attraction which we call "the fashion." When it was decided to hold a Gas Apparatus Exhibition at the Crystal Palace in 1882-83, although something had been done in the way of improving burners, I had the best means of knowing that more than one prominent member of this body was in despair of making anything like an attractive or novel show of gas lighting. What was eventually done was imposing rather than truly convincing. All the improved gas-lights were large burners, vieing with the arc lights; and the Nave of the Palace was as a huge gas-stove. There was nothing in gas-burners to meet the incandescent electric light on its own ground. The gas people were like those who, finding themselves in the company of persons speaking a strange tongue, try to make themselves better understood by shouting.

Consequently, it is no wonder the new comers into the lighting industry contemptuously bade the gas people cultivate a kitchen and factory trade, as their lighting connection would certainly depart from them. The electricians declared that the only proper employment for gas was as a fuel; and events have justified this judgment, albeit in a manner that those who pronounced it neither expected nor desired.

The defenders of the gas industry about 1880 warmly objected to be dismissed from the streets, the shops, and the parlours; and they had reason. What are generically called the daylight uses of gas were then only beginning to assume commercial importance. The Otto gas-engine had just come into the market; gas cooking-ranges were being tentatively taken up by the most progressive gas companies, but the manufacture was in few hands; and gas heating was practically unknown. Gas companies looked very blankly at this small department of their business, and could not see their accustomed dividends in it. They clung to their lighting trade; and, very fortunately for them, the provisional system of lighting by regenerative burners came into being just in the nick of time to save this market.

All this time, nothing occurred to disturb the belief of experts in conventional illuminating power as a necessary quality of town's gas. If the gas found a subsidiary market as fuel, so much the better; but the lighting was the mainstay of the business, and lighting could only be satisfactorily done by the aid of illuminating power. In America, one of the reasons assigned for the substitution of 25 and 26 candle carburetted water gas for the older and cheaper 16-candle coal gas was the pressure of competition with the electric light. In the United Kingdom, the systematic enrichment of common coal gas to an artificial brilliancy was tacitly accepted everywhere as a necessity.

I am unable to ascertain when the practice of deliberate, systematic enrichment, or carburetting, of common town's gas became a settled thing in English gas-works. There is no mention of either of these familiar words in the index of "King's Treatise on Coal Gas." The occasional use of a sprinkling of cannel in ordinary gas making came in with clay retorts, high makes, and exhausters; and there were always many grades of gas between the product of sea-borne North Country coal, and the article which made darkness dimly visible in Scotland. But enrichment or carburetting, strictly so called, only came into vogue when the stand-by cannel pile disappeared from its old conspicuous position in the gas-works yard.

Curiously enough, contemporaneously with the professional acceptance of the practice of common coal gas enrichment as a concession to the requirements of the public, and the endorsement of the higher standard by Acts of Parliament and the resolutions of gas-supplying English municipalities—signalized by the increase of the statutory illuminating power of London gas from 12 to 16 candles, and the general "screwing-up" already mentioned—Glasgow and other places grew sick of supplying too rich and heavy a gas, which they had learnt by painful experience was—

> "A creature far too bright and good
> For human nature's daily food."

And in 1892 the Gaslight and Coke Company ceased to supply their so-called cannel gas, of 20-candle power, in the West-end of London.

It was still held in England as an article of professional belief that no respectable gas undertaking ought to send out gas of less than 15-candle power, although it gradually came to be understood, even in Scotland, that gas of much more than 20-candle power is a thing of the past. Great credit is due to Mr. Foulis for his single-handed victory over ancient prejudice, won in the face of bitter opposition, in the interest of the people and city of Glasgow. I am speaking now, be it observed, from the point of view of the gas manufacturer. This partial levelling-down of the standard of conventional illuminating power proceeded on purely industrial grounds; so that, even if it were open to be argued that the future of

the British gas industry depended on the restoration of the old Scottish standard of illuminating power all over the country, this contention would not alter the unfavourable industrial facts. People would have to go without cannel gas of the old style, however badly they might think they needed it, for the same reason that they have to dispense with many other things classed as luxuries, generally with little reason.

Into a technical world so diversely influenced by conflicting currents of wishes and economic considerations, Dr. Auer von Welsbach, five years later than the era of the "perilous pass" to which I have already drawn your attention—to wit, in 1885—dropped an invention which had the astonishing effect of solving, in a wholly unattended manner, the old problem of establishing a town's supply of fuel gas as distinguished from lighting gas. His incandescent burner it was which turned all town's gas into fuel gas, without for some time anybody marking the change. People soon began to take stock of the new burner; but it is scarcely yet realized that its appearance practically made a new gas.

Yet this, Mr. President and gentlemen, is the very pith and point of my address. This is the time of day which has struck, and which this Institute is going to register on the town clock of the gas industry, sounding here, and now, for the enlightenment of the technical world.

Dr. Auer von Welsbach wrought better than he knew, although no inventor ever more richly deserved all the rewards he has received for an invention which was no mere happy thought—no chance hit—but represents profound knowledge of the means, painfully brought to bear upon the attainment of a desired object, and guided by native genius. Whatever share others may rightly claim in perfecting the incandescent gas-light, let it never be forgotten that the whole luxuriant crop of these burners and their accessories is from seed which Dr. Auer supplied, as this Institute fitly recognized by making him a Birmingham Medallist. Dr. Auer is, indeed, *the* Birmingham Medallist; for it is to him that the gas industry owes the simple, easy, and natural solution of the puzzle that discomfited all the wise and skilful experts at the Birmingham meeting who heard Dr. Siemens, and also, during the same meeting, established the medal which was to signalize the unknown Œdipus whom the Fates were reserving to answer this riddle of the Sphinx.

For such it was, as we can now see. Something had to be done to put new life into the old industry. The riddle was to be answered, on pain of death. The answer came. Scarcely had the enemies of gas lighting begun to cry, "See! it is dying—it dies!" than Dr. Auer was able to answer, "Not so! It lives again, brighter, fairer, stronger than ever! You bade the gas makers turn their attention to heating applications. Here is one you thought not and will like less to see!"

I do not propose to discuss the Welsbach invention as such; but only to elucidate its reaction on the gas industry. The chief result of the permanent success of the new method of obtaining light from gas is, as I have already remarked, that it has turned town's gas into fuel gas pure and simple, thus superseding the convention of illuminating power of the luminous flame, and all that this entails—enrichment, photometry, and all the squabbling and local unpleasantness about "bad gas." There need never be any more of these familiar grumblings—most frequent, be it observed, in places where the standard of illuminating power was highest. Not only so—the very price of gas ceases to be felt as a check to those who like the most brilliant lighting and plenty of it. Possibly I may hear somebody say "Not so fast! The incandescent gas-light is all very nice, so far as it goes; but I have yet to see that it is likely to become universally popular, to the exclusion of the luminous flame, or that even so it will cause any radical change in the method of gas manufacture such as will materially cheapen the product."

To such an objector I would reply, "Come to Germany, where I will show you things that shall be here, in due course." It so happens that Germany did not give the Welsbach, or the Auer system as they call it on the Continent, any patent monopoly whatsoever. The result has been that the system has for years been worked there on all hands strictly on the commercial basis. The manufacture of mantles, burners, and all the accessories has progressed enormously; and the whole trade is far more advanced and improved than it is in any country where the patent monopoly has kept it in one proprietorship. There are half-a-dozen well-reputed makers of incandescent mantles for the German market. The gas companies, who are the largest buyers, get them at from a penny to twopence apiece; and the burners cost ninepence. A good incandescent lighting fixture, complete with burner, mantle, reflector shade, and Jena chimney, can be had, fixed, for about 2s. 3d. Of course, there are better qualities. Consequently, German towns are brilliant with the brightest and cheapest light known to science.

I have counted 15 and 17 incandescent lights in a half-front shop window, all good and in perfect order. This is how they do it: The gas company, or sometimes a big gas-fitting firm in the town—for there is perfect free trade in the matter—have a system of replacing defective mantles, &c., at a uniform charge of about 6d. apiece. This includes everything from the "gallery" upwards—clean burner, new mantle, mantle carrier, and new chimney. The old fitting is taken in exchange. When a consumer sees a light going wrong, he telephones word to the proper quarter, and all the rest is done for him. There are never any complaints of "bad gas." The gas administration see that the service-pipes, the meters, and the internal fittings are of ample size. They also keep up an adequate gas pressure, and make sure that the mantles are good. Poor mantles, which lose their lighting power quickly, and get out of shape, have no sale in Germany.

Broadly speaking, in the most advanced of German cities, and wherever the gas company do their duty and work in a businesslike style, there is now nothing else but incandescent gas lighting. Berlin has gone past electric lighting, and will have nothing but incandescent gas in the streets. All over the wide region covered by the German Continental Gas Company, of which Herr W. von Oechelhaeuser is the go-ahead President, the last year's *increase* of burners on the Company's books was divided as follows:—

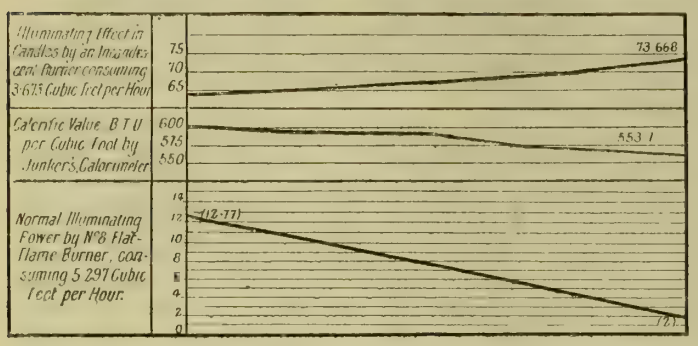
Incandescent burners	21,842	= 91·64	per cent.
Flat-flame ,,	1,895	= 7·95	,, ,,
Argand ,,	98	= 0·41	,, ,,

And the replacement of old luminous-flame burners by incandescents is going on everywhere with similar rapidity. The regenerative lamps have gone utterly. Indeed, one has to hunt for a luminous-flame gas-burner in Dessau or Magdeburg. The Gas Company aver they cannot afford to use them. Incandescents are in all the retort-houses and workshops—the "Gem" pattern, with air holes in the side of the chimney, being preferred for this use. Moreover, with 50 per cent. of the daily output sold for cooking, heating, and motive power generation—as in many cases here—the element of illuminating power dwindles into insignificance on all sides.

This being the state of the case, the practical German mind has already realized that the gas manufacturer has for the future to sell fuel gas only. The next point to be determined is, what obligation this entails upon the manufacturer. Will he have to change his methods? This raises the question of what relation the conventional illuminating power of town's gas has to its fuel value, with special reference to the performance of the incandescent thorium-cerium mantle. In order to settle this query, Herr W. von Oechelhaeuser arranged for a crucial experiment, which was carried out by his Secretary, Herr Schaefer, at Dessau, who was good enough to tell me all about it. The results of the experiment are shown on the diagram (p. 1630). They can be checked by any of you—the more the merrier!

What was done was to fill an experimental gasholder with ordinary Dessau gas, which indicated an illuminating power of 14·7 Hefner units (12·77 English candles) at starting, burnt at the rate of 150 litres (5·297 cubic feet) per hour in a No. 8 flat-flame burner. It was then deprived of its benzol by filtration through a box containing wool steeped in "green" or creosote oil. The calorific power of the same sample at the start, by the Junkers calorimeter, was 5320 calories per cubic metre. This is about 600 British thermal units per cubic foot. The diagram referred to is an exact copy of the one submitted by Herr W. von Oechelhaeuser to the German Gas and Water Works Managers' Association at Cassel last year, converted to the ordinary English equivalents of the metric measurements. What Herr von Oechelhaeuser wanted to learn was, whether the public who buy gas would suffer if the ordinary quality of town's gas, which in Dessau has to be carburetted even to make it read about 13 English parliamentary standard candles, were sent out uncarburetted, just as it comes from the usual run of German gas coal. This coal, which is mined in Westphalia, only makes from 7 to 9 candle gas,

Lighting-Effect by the Incandescent Burner and Fuel Value of Coal Gas deprived of its Normal Illuminating Power.



These experiments were made at Dessau, in May, 1899, by Herr Schaefer, under the direction of Herr W. von Oechelhaeuser, with an Auer mantle previously used for 300 hours. The gas was progressively deprived of its benzol by being passed through "green oil." The results have been converted into English equivalents by the Author.

when thoroughly worked off at the rate of about 10,700 cubic feet per ton; but the coke is good.

You will see by the diagram that as the gas was unloaded of its benzol enrichment, and the normal illuminating power fell, the duty of the incandescent burner used actually rose, so that users of these burners would get better value for their money; while the calorific value dropped very slightly—too little to be noticeable in the working of gas stoves or engines. This result was confirmed by pushing the experiment to the extreme limit, when the illuminating power of the gas went down to 2 candles. At this point, I expect, an ordinary London gas examiner would have a fit at the appearance of the test flame; but Herr Schaefer was in search of cold, hard facts, and he found that this almost non-luminous gas was capable of activating the Auer mantle to the tune of 73·668 candles illuminating effect for a consumption of 3·673 cubic feet per hour.

Dr. Bunte corroborates this most important record, which I take the liberty of styling the "Magna Charta" of the "new" light gas industry, by an independent demonstration that methane and the heavy hydrocarbons of lighting gas, although possessing a high calorific value, do not activate the Welsbach mantle so effectively as hydrogen. Hydrogen, moreover, is the only gas that will act upon the self-igniting preparations now being introduced for use with incandescent burners. The facts being as stated, and the scientific and practical German intellect being singularly devoid of prejudices, it naturally follows that in Germany the age of heavy, loaded, unnecessarily costly town's gas is over.

The best examples of the beginning of this silent revolution in German scientific gas manufacture must be sought for the present among the emancipated municipal works; the gas companies being still bound by the terms of their concessions to sell gas which must be enriched to the by no means elevated standard of 13-candle power English. The municipal gas undertakings, however, no longer buy benzol in quantity; and they confine their purchases of coal to the cheapest and most serviceable native products.

The first Gas Manager of Germany to declare for light gas was Herr Dieckmann, the far-sighted Engineer and Manager—the Herr-Director as he is called, which means this and something more—of the municipal gas undertaking of Magdeburg, a city of 250,000 inhabitants, the capital of Prussian Saxony, and a very rising, flourishing centre of trade and manufactures. Magdeburg town's gas is supposed by a legal fiction to be of 13 Hefner units illuminating power; and the official Examiner duly tests it daily. I was there in the middle of March; and the following are the official returns of the illuminating power of Magdeburg gas for the first part of the month:—

1900.	Hefners.
March 1	12·1
,, 2	11·2
,, 3	10·9
,, 4 (Sunday)	8·5
,, 6	11·3
,, 8	12·0
,, 9	11·7
,, 10	11·0
,, 11	10·7
,, 12	11·4
,, 13	11·9

On Sunday, March 4, there was something wrong at the works, and the gas was sent out of the low illuminating power of 8½ Hefners, or 7·45 candles; but nobody in the town noticed it. The above figures should convince those who prefer the ounce of fact to the pound of theory. Oechelhaeuser, Bunte, and Schaefer arrived experimentally at the conclusion which the gas consumers and the Municipality of Magdeburg have reached by experience—that, with modern methods of gas lighting, normal illuminating power is nothing. Magdeburg never gets gas of more than 10½-candle power. This matter of normal illuminating power does not interest Herr Dieckmann at all. He makes gas as well as he knows how from the ordinary run of Westphalian coal which his Committee buy for his use; and he knows that so long as the consumers get gas enough, and the incandescent mantles are good, the public will be satisfied. This state of things has gone on for over a year.

Although he sets no store by illuminating power, Herr Dieckmann pays particular heed to the calorimeter testing of his gas, which is done at least once a week, by Junkers' instrument. I give the official records for the month of December last:—

1899.	Calories per Cubic Metre.
Dec. 4	5417
,, 12	5376
,, 19	5359
,, 23	5258
,, 27	5426
Average	5367

I ask your attention to two things revealed by this record. First, that the amount of variation of the fuel value of the gas for the whole month of December, when the works were busiest, is remarkably small; being only 168 calories per cubic metre, or 3·2 per cent. on the lowest figure. The range of illuminating power for the same time, if one may take the March testings as an illustration, would be at least 12½ per cent. on the minimum. This shows what a vacillating quality the normal illuminating power of town's gas is, and also what good, steady fuel any common coal gas is.

The second important point is that the uncarburetted Magdeburg gas, with its mean of 10-candle power, averages 5367 calories per cubic metre, or, as I make it, about 606 British thermal units per cubic foot; whereas the carburetted Dessau gas is shown by Herr Schaefer to give no more than 5320 calories, or 601 British thermal units per cubic foot. Evidently, therefore, the added benzol in the latter gas does not count for much as fuel.

An interesting development of the teachings of the calorimeter, as a guide to gas making, is announced by Herr Dieckmann. Although the cheap and serviceable Westphalian coal—the common gas coal of his native land—suits him well enough, he is rather uneasy under the reflection that in depending wholly upon this material he has all his eggs in the one basket. Strikes and coalowners' rings are not unknown even in the happy Fatherland; and for this reason Herr Dieckmann proposes to get a Humphreys and Glasgow carburetted water-gas plant, with which, by the aid of a native schist oil, he will make a gas of as near as possible 8-Hefner power. He has satisfied himself that this gas will possess exactly equal calorific power with that now supplied to the town; and this is all he cares about. *Thus at last the photometer has come to play hand-maid to the calorimeter.* If this simple circumstance does not prove the completeness of the revolution in gas manufacture I have attempted to describe, I should like to know where to find a better symbol of the change.

One word as to the character of this instrument, a specimen of the latest form of which I have on the table before me. Its use is extremely easy; and the result is positive and unconditional. We all know that the photometry of gas is very much the opposite of this; it is conditional to the last degree. The standard of light; the construction of the test burner; the rate at which the gas is consumed; the quality of the photometric screen; the personal equation of the operator; his carefulness in seeing that all the circumstances are normal and in making all the necessary corrections to arrive at an approximately true result; the temperature of the room; the humidity of the air—all these factors affect the operation, some of them to an unknown and undeterminable extent. On the other hand, the measure of the calorific power of gas is simply the number of degrees of the thermometric scale by which the temperature of a certain weight of water is raised by the heat of burning a certain quantity of gas. There is little chance of error here; and I am able to cite Dr. Harold G. Colman as testifying to the Institution of Gas Engineers last month, from several years' experience, not only that the Junkers calorimeter is a satis-

factory instrument, but also that it is a far more satisfactory instrument than any photometer.

I should like to remind you here that the first practical gas calorimeter was made nearly 20 years ago by our late good friend Mr. F. W. Hartley. His instrument was used to ascertain the fuel value of the gas burnt for the various experiments on gas cooking and heating appliances carried out for the Committee of this Institute on the Gas Section of the Gas and Electrical Exhibition, 1882. This work of Mr. Hartley's was in advance of the times; but those who compare the Hartley calorimeter, illustrated and described in the Report on the Gas Section of this Exhibition, with the later instrument now in the market, will do justice to the pioneer work of our old friend, and join with me in regretting that it received so poor a welcome in this country.

Since I undertook to deliver this lecture, another ounce of fact has come into my possession to support the main argument. This is the example of Bremen, the Liverpool of Germany. The Director of the municipal gas-works of this thriving North German port, Herr Salzenberg, has advised his Committee, and the Committee have agreed, that the splendid new gas-works which the growth of the town has necessitated shall inaugurate the new *régime* of light gas. Hitherto Bremen, like Liverpool, has had one of the highest illuminating power town's gas in all Europe—20 English candles per 5 cubic feet, or, to be more exact, 12 candles for a consumption of 91·6 litres per hour. This gas was made from a blend of two-thirds high-grade English or Scotch gas coal with one-third German coal. At the old works, a carburetted water-gas plant by Humphreys and Glasgow was also installed, and helped to cocker-up the make to the approved standard.

The local prices of gas have been—

	Per Cubic Metre.		
For private lighting . . .	20 pfs.	=	(5s. 8d. per 1000 c. ft.)
,, heating and cooking . .	15 ,,	=	(4s. 3d. ,, ,, ,,)
,, power	12 ,,	=	(3s. 4d. ,, ,, ,,)

The Gas Committee have decided to make a big cut in these rates, as they can well afford to do by reason of the abandonment of their highly carburetted gas manufacture.

The new scale of prices is:—

	Per Cubic Metre.		Per 1000 Cubic Feet.
Private lighting gas . .	16 pfs.	=	4s. 6d., decrease 20 per cent.
,, heating . . .	12 ,,	=	3s. 4d., ,, 20 ,,
,, power . . .	11 ,,	=	3s. 1d., ,, 9 ,,

There will be *no standard of illuminating power* under the new dispensation. Herr Salzenberg confines himself to the general declaration that the gas will be such as will come out of the ordinary run of Westphalian (Ruhr basin) coal without cannel or other enrichment. The calorific value of the new gas, he admits, will be somewhat less than that of the costly article hitherto made, which he states at about 700 British thermal units. This is probably about right for such a heavy gas. The light gas, he expects, will show a calorimetric reduction of about 10 per cent.

As the selling price is to be reduced by 20 per cent., this exchange means a bonus of 10 per cent. to the consumers. As to the effect of the change on the performance of the incandescent burners, Herr Salzenberg pins himself to the promise that there shall be no falling off in the lighting value per unit of consumption. On the contrary, he thinks the duty of the incandescent burners will be improved. So Bremen joins the procession of the enlightened German cities whose frugal citizens know how to get the most value for their money spent on gas; and declines to spend another pfennig for an enrichment of its gas which is so only in name. Town after town is actually consenting to be supplied at this moment with gas indicating from 7 to 10 candle power English; and they are the most brilliantly lit towns in Europe. Moreover, gas from being a luxury of the well-to-do, and burnt chiefly by the commercial classes—which accounts for its being hitherto about double the English prices—is being taken to eagerly by the mass of the population, through the prepayment meter. From being a slowly-growing industry, annual increases of as much as 20 per cent. of the output are being recorded by German gas undertakings.

Hitherto no universal reduction of price has signalized the revolution in German gas manufacture, because the change has nowhere been so great as in Bremen; but those concerned in it are thankful that they have not had to face serious increases of price in consequence of the dearness of English coal and the colliery-labour troubles in Bohemia, whence they used to obtain their cannel. They find that the nominal price of lighting gas has become of small moment; having been reduced in effect to one-sixth, or thereabouts, by the incandescent burner. Light-gas making may not immediately cheapen the product everywhere, at the consumers' meters; but it is bound to prove economical in the long run. Coals and other hydrocarbons hitherto unsuitable for gas manufacture are now open to the gas manager; and the new business that is crowding in upon him will have the natural result. Not least of all these considerations is the relief of English coal deposits of the best quality from a large foreign drain for gas making.

Before concluding this lecture, I ask your indulgence for a quotation from the Third Volume of "King's Treatise," which was published in 1882. In the chapter on "The Production of Illuminating Gas from Materials other than Coal," the author discussed the question of gas enrichment, or carburetting, by mixing the materials of manufacture, together with the contrary practice of reducing a rich gas to a manageable power by the addition of air or a non-luminous gas. He said "there is no doubt that, so far as they extend on similar lines, both processes are equally wrong. When the gas from any material is sold in the highest condition, as regards illuminating power, at which it can be taken out of the material, without the addition of anything else, it may be laid down as an incontestable rule that the most favourable conditions of manufacture are fulfilled . . . it will be a safeguard against error of the gravest kind if the fundamental truth here laid down is always borne in mind when cases in which it is involved are considered."

I found myself, in 1900, so thoroughly in agreement with this strong pronouncement of 1882, that it was with quite an agreeable shock that I found myself reminded, in the preface to this volume, that the writer of the chapter was a certain W. H. Y. Webber. I at least had forgotten that the law of economical gas manufacture had ever been laid down at so early a date, when the gas-maker was very much more closely "cabin'd, cribb'd, and confined" as to his coal, cannel, or oil resources than he need be to-day.

Germany, ever a foe to superstitions, has initiated for the industrial world another reformation. Dr. Auer gave the seed; Herr von Oechelhaeuser, Dr. Bunte, Herr Dieckmann, and others have planted and watered it; and we poor red-tape bound English shall be left in the lurch by the Germans in gas-making as in some other things, unless we take a leaf out of their book, and free ourselves from everything that operates in restraint of trade, and to the discouragement of industrial enterprise. Gentlemen! It is a magnificent, a boundless Land of Promise which lies before our industry. I invite you to disabuse yourselves of all prejudices and preconceived ideas regarding the public interest in the illuminating power of town's gas, as the photometer shows it. You already provide, through the agency of the incandescent system of gas lighting, the cheapest and most brilliant commercial artificial light in the world. You have already secured an enormous bulk of business in the way of distributed motive power, and of fuel for cooking, warming, and performing an infinity of industrial operations. You light the homes of the poor with economy and safety to life and property. Do not let any conventions stand in the way of your industrial expansion along all these lines, which are really one! I do not presume to promise what the result of the universal adoption of the new guiding principle in gas manufacture will be in individual instances. I do not offer you, who know your own affairs and circumstances so very much better than anyone else can tell you, any quack nostrum for making the old goose lay more golden eggs than ever. But I do claim that a new hour has struck for our common interest, a new page of technical history is about to be turned, and a new principle, or way of regarding and treating old elements, has been evolved; and I ask you to ponder the matter very seriously after you have gone home from this gathering, and I also pray your forbearance if in the endeavour to strike the hour, in the name of the Gas Institute, I have failed to rise to the importance and interest of the occasion and the subject.

The PRESIDENT observed that Mr. Webber's lecture was extremely interesting and edifying, and would give them a great deal of matter for thought.

Mr. J. STELFOX (Belfast), in proposing a vote of thanks to the lecturer, observed that Mr. Webber had undertaken the duties of the town clock; and he thought they would none of them be disposed to question his time, the distinctness of the dials, or his illumination of them. He regarded the

subject as most interesting. For a long time back it had occurred to him that it was no use adding another candle and another candle to the gas supply of towns, while probably two-thirds of the illuminating power was lost through the burners. Mr. Webber had shown them a way out of the difficulty; and he thought the lecture went to prove that public feeling was changing, and that they were within measurable distance of the German system. He did not think they would be left so far behind if the South Metropolitan legislation was to be looked upon as likely to set the fashion in the near future. Mr. Webber had given them all the information that it was possible to give on this interesting subject, and had placed it before them in a very interesting way.

Mr. W. Hardie (North Shields) seconded the vote of thanks, and remarked that they must all have thought, on hearing the lecture, what a happy place Germany is. In England, they had not reached the stage when they could send out 7-candle gas into a town without being found out. If all that Mr. Webber had told them was correct, it would seem that the sooner they could get incandescent burners reduced to the low figures they had in Germany, and could supply the same quality of gas with the gratifying results obtained in that country, the better it would be for them. Mr. Webber had given them some facts which would be very useful; and he thought he had conferred a benefit on the Gas Institute by giving them this *résumé* of the position in which they stood to-day.

Mr. Isaac Carr (Widnes), in supporting the vote of thanks, expressed regret on his own behalf, and said he thought that many gentlemen present would also regret, that this subject had not been brought before them in the form of a paper. The lecture was most interesting, and everybody must feel much indebted to Mr. Webber for having so ably placed the subject before them; but it was one which bristled with controversial matter. When they had a lecture, it was usually upon a special subject by a gentleman who had made it a special study; but this, he would submit, was a subject with which they were all equally familiar with Mr. Webber. Mr. Webber called the subject of his lecture the "New Gas;" but, according to the statement of a gentleman who had recently made a pilgrimage to Widnes to make investigations as to their gas, instead of being new gas it was very old gas. However, he was sure that the subject introduced by Mr. Webber would not be lost sight of, and that the excellent effect would be to bring the subject forward again—next time not in the form of a lecture.

The President said he would apologize if they liked, on behalf of the Council, for not bringing this subject forward in the form of a paper. Mr. Webber, however, was quite prepared to have the matter discussed, and would no doubt have enjoyed it; but their time being short this year, the Council had thought it better that the subject should be brought forward in the form of a paper at another meeting, when it could be discussed thoroughly.

The vote of thanks having been carried by acclamation,

Mr. Webber thanked the meeting for the extremely cordial way in which they had received the vote of thanks, and for the strained attention with which they had listened to what he had had to say. He was under the impression that he had made a special study of the subject, and fondly imagined that he was as competent to bring it before the Institute as anybody else. If he was wrong in that, he apologized; and if there were any weak points in the lecture he would doubtless hear of it. As the President had told them, he was asked if he had any objection to having the lecture discussed, and, of course, he had not the least. He would be glad to have it discussed as much as possible. He did not think there was anything controversial in the lecture. It might be controversial if he had told Mr. Carr how to make 14-candle gas in Widnes; but he did not tell any gas manufacturer how to improve his own business. The lecture was a record of facts that he had collected; and he had to express his gratitude to Mr. George Livesey for giving him the opportunity of collecting them, because he could assure them they had opened his eyes. When they went to Germany last September, they had an idea that gas was being made somewhat differently from what it was in England, and they were all glad to see that the most enlightened municipality in Germany, and probably in the world—that of Berlin—had done away with the electric light all over the city, and used nothing but incandescent gas. But, still he was not prepared to find that over 90 per cent. of all the new burners were incandescent, and that it was impossible to find a flat flame, except in a lavatory or a draughty passage where little light was really wanted. If they wished to see what a gas company could do when it was absolutely free from all red tape, let them go to Dessau, where they had the most magnificent gas company's factory he ever saw, and where they used nothing but gas-engines, and for lighting nothing but "gem" burners. They might depend upon it that the facts he had brought before them were facts which must in the long run operate deeply and widely in radically changing the point of view from which the technician and the public would regard common town's gas.

THE VISIT TO PARIS.

The number of members and visitors who signified their intention of joining in the excursion to Paris was unfortunately not so large as had been anticipated; but still, all told, they made a goodly number. Writing with a knowledge derived from a personal participation in the kindness the members received at the hands of their French *confrères*, we can say that those members who did not care to visit Paris, or who were unable to do so, were distinctly the losers. The company numbered a little less than 100; and, under the arrangements made, they had the choice of the two principal routes. About fifty ladies and gentlemen, or perhaps rather more, travelled by the Dover-Calais route; and the remainder *viâ* Newhaven and Dieppe. Those comprising the party who had selected the former route left Charing Cross at nine p.m.; the passengers including the President (Mr. E. H. Stevenson) and one of the Vice-Presidents, Mr. A. Dougall. The second party left Victoria by the 8.50 train for Newhaven. In both cases, special saloons and compartments were reserved; and on the steamers, thanks mainly to the attentions of the "man from Cook's," a fair number secured berths on the long-sea route. The night, however, was clear, the moon bright, and the sea smooth; and the temptation to remain on deck the greater part of the passage was strong. Under these favourable circumstances, Calais and Dieppe, and finally Paris, were reached early on Thursday with surprising nearness to the stated time. Both parties set out from London with a determination to enjoy themselves; and this they certainly have done to the full. It is difficult to see how, given fair weather, they could have done otherwise; for very complete arrangements were made by the Secretary and Excursion Committee, consisting of the President, the former Hon. Secretary (Mr. A. Dougall), Mr. J. Davis, Mr. R. G. Shadbolt, and Mr. T. H. Martin. Messrs. Davis and Shadbolt and the Secretary particularly deserve mention for the thoroughness with which they devoted themselves to the work of organization. Nor must we omit to prominently record the very graceful and generous aid rendered by the Paris Gas Company and the Société Technique du Gaz en France, to make the visit of their English friends a happy, pleasant, and memorable one.

Most of the members and their lady friends devoted the morning of Thursday to rest; but luncheon had to be taken early in order to keep an engagement with the Chairman and Directors of the Paris Gas Company, who had invited the visitors to journey by special steamer down the Seine to visit the Clichy station of the Company. On board, the members were received with exceeding warmth and graciousness by a large number of gentlemen connected with the Company—in fact, the greater number of the Directors and Engineers had assembled to honour their friends from across the Channel, and to testify their friendship and regard. We are afraid we did not secure the names of the whole of the gentlemen associated with the Company who took part in this event. But we may mention that of the party who, with much cordiality, received the visitors were M. Troost (the Chairman), M. Camus (the Governor), MM. de Gayffier and de Raynal (Directors), M. Godot (the General Manager), and MM. Euchène, Gigot, Audouin, Louvel, Brisac, Sainte-Claire Deville, Bertrand, and Supplisson. There were also present many members of the Société Technique—among them being the President, M. Th. Vautier, and MM. Thibaudet, Foucart, P. Mallet, Villeneuve, Ad. Bouvier, Chamon, Foiret, Foucart, Heeley, Hedde, and M. Raveau, the General Manager for MM. Lebon et Cie. And this does not by

any means exhaust the names of the gentlemen present. The trip down the river was immensely enjoyed, as it afforded an opportunity for viewing some of the most picturesque and lovely environs of Paris, including Meudon, St. Cloud, the Bois de Boulogne, Suresnes, &c. After about an hour's journey, which was pleasantly passed in conversation, exchange of courtesies, and sightseeing, the Clichy Gas-Works were reached; and there the members found that their comfort had been studied even to the extent of constructing a special landing-stage and steps in order to reach the entrance to the works with the greatest convenience and minimum of fatigue.

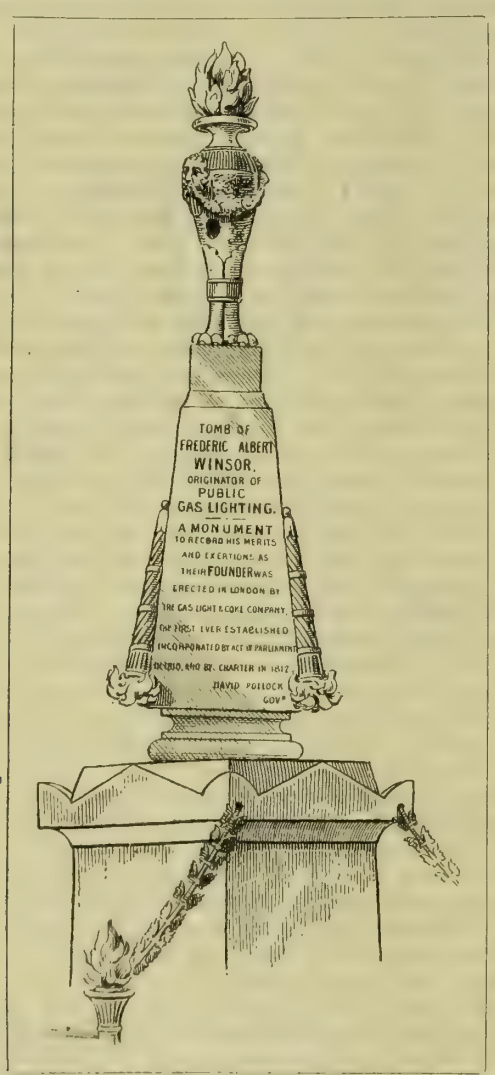
The works were found to be very expansive; and as they now stand, so they were originally planned and constructed, there having been no extensions since. The members were greatly interested in all they were privileged to see; and differences in practice and details of working were discussed with the utmost amicability and freedom. The first important part of the plant that they were taken to inspect was the pier, with overhead railway and means for elevating the coal from barges in the river and delivering it alongside the large retort-houses. The coal is raised by means of a 12-horse power gas-engine from the barges, in large buckets, having a capacity of about 1200 kilos. It is then transferred to small waggons on the overhead railway, and deposited at different convenient points near the retort-houses, into which it is delivered as required by means of hand trucks. The whole cost of transferring the coal from the barges to the point of consumption is placed at 7d. per ton. In and about the retort-houses, the greatest interest centred. It was found that what are called the Siemens-Clichy settings are employed. In England, the Siemens settings have been found wanting in many ways; but here they are successful to a degree which surprised many of the English engineers. In all, the houses contain 1500 retorts, 9 feet long, 26½ inches wide, and 14 inches high. They are of ⏀ section, corrugated, and set eight in a bed. The coal comes from the North of France. It is cheaper than English coal, but does not produce so much gas. It is also found that by its use the unpleasantness of stopped pipes has to be less frequently encountered. The make at this station is approximately one-fifth of the Company's entire output, which is about 325 million cubic metres, or (roughly) 11,500 million cubic feet. Perhaps the most attractive part of the operations on these works is the method of dealing with the coke. In the first place, the attention of the members was called to a drying plant for coke. The Company have to deliver a large quantity to the railway companies for locomotive purposes; and they are compelled to use it in a perfectly dry condition. Consequently, the Company have put down this drying plant for the purpose. It consists of a hot-air chamber about 77 yards long; and the coke is carried through it by means of conveyors. As it leaves the chamber, the coke is quite warm, and practically absolutely dry. Of course, for this service the Company charge the buyers an additional price. The operations in the house in which the screening, measuring, and sacking of the coke are performed were watched and examined with much interest. The coke is classified by its passage through a revolving screen; and the different grades fall directly through shoots into 2¾-bushel hand tips, from which the sacks are filled direct. Then by means of conveyors, it is despatched, in the sacks, either to railway waggons or to the coke heap. An interesting piece of mechanism is a mechanically operated lift, which is constantly working, and which raises sacks of coke to the height of the shoulders of the men who have to remove them and send them on their way to their different destinations. The conveyor for the sacked coke is constructed of a Dodge chain running on wheels; and those sacks of coke which are not immediately required are raised by an inclined elevator to the top of the coke heap, and there they are emptied by hand. The heap can be carried to a height of 22 yards. Aërial cables are also employed in the distribution of the coke to various points. At the foot of the heap is another machine for measuring and bagging the coke again when required; and it is capable of filling 400 sacks an hour. The bagging of the coke appears to be responsible for a good deal of hand labour at the different points of the system; but the whole of the work is accomplished with remarkable cleanness and despatch, which are matters worth consideration in a large works. By the Company's engineers, this installation of coke plant is regarded as an imposing feature of the works. It was designed by M. Louvel, the Constructing Engineer; and it is operated electrically. The washers are also driven electrically; and, benzol being used on the works for enrichment, the electrical plant is used for lighting various parts of the works at night. The time at the disposal of the visitors only permitted of a hasty survey of other portions of the plant. The purifying-houses occasioned some little astonishment, on account of the smallness of the boxes. There are four houses; each containing 32 vessels measuring about 15 ft. by 10 ft. Prepared oxide and sawdust only are used in the purifying process. Eight Pelouze and Audouin condensers were reported to work well, and give every satisfaction. They relieve the gas of all tar, and consequently keep the upper part of the purifiers clean in this respect. Another feature of interest was the system of passing the gas into the tops of the holders by means of mains with knuckle joints. The day pressure of the gas was stated to be 3½ inches, and the night nearly 5 inches. These are a few of the interesting points gathered during a walk through the works, made under most pleasant circumstances, and the guidance of the most courteous and distinguished of French gas engineers.

Meanwhile, the ladies, who had remained on board, had been taken to view a further stretch of the river, and were also entertained in one of the saloons with light refreshments in the most charming manner possible by the hosts for the day. On the gentlemen re-embarking, they were the happy recipients of similar civilities and favours. A little later during the passage, when all were on deck, there was a courteous exchange of compliments between the President and M. Troost, the Chairman of the Company, and M. Godot, the General Manager. Addressing these gentlemen, the President said: Gentlemen,—On behalf of the Gas Institute as a body, of the gentlemen who have come over here, and, I am asked to say also, on behalf of the ladies whom you have so hospitably treated, I have to thank you exceedingly for the way in which we have all been received. When the invitation came to us to visit one of your works, and we accepted that invitation, we did so thinking that we were simply going to view a works of one of the leading cities of the world, in the usual manner; that we should be received by the works manager, shown round the works, and be allowed to form our own conclusions; and that we should find our own way there and back. The way you have treated us, we know, is not because we are so many gentlemen, but because we represent the same industry as yourselves in a neighbouring country, and in a very friendly country too. (Cheers.) I must say, on behalf of all my friends and colleagues who have been here to-day, that we had no idea we should be received in so magnificent and princely a style as that in which we have been received. I can assure you, we greatly appreciate it; and I only trust that, sooner or later, it may be our privilege, either as a body or as individuals, to receive you over in England in a similar way. I can assure you that you will be received just as hospitably—just as warmly. I ought to add also, and I ought to have said it sooner, that we are indebted very much to you for the exceedingly kind way in which we have been shown round the Clichy works by MM. Euchène and his colleagues; and we appreciate it as professional brethren one to the other. We feel sure, whenever you may come over to England on a professional or friendly visit, you will always be shown what you want to see. We shall be only too glad to show you all we can, and perhaps [humorously added the President] on one or two points we may give you a little bit of advice. The sentiments conveyed in the President's words were very heartily received.

The tenor of M. Troost's response (which was uttered in French, with great vivacity and politeness of expression) was that the Paris Gas Company were very delighted to show the works at Clichy to their English colleagues. This station was the most complete of all the Company's works; and, as had been seen, there they had tried to economize labour in many ways—chiefly in respect of the methods employed for dealing with the coke. In the transport of the coal from the barges, they had also done all they could in the same direction. They had seen the derrick and the crane, driven by a gas-engine, raising the coal from the barges, and the manner in which it was transferred to the retort-houses. The Directors were glad to have had this opportunity for showing their regard to their English colleagues, as well as to the ladies; and he hoped one and all would have a long remembrance of their

hospitality and goodwill. Returning to the saloon, the President proposed the toast of "Health and long life to the Paris Gas Company. May it live long, and may we again be allowed to enjoy its hospitality at a later date." The toast was honoured by the visitors, and supplemented by three ringing cheers. M. Euchène then reciprocated with "Here's to the English gas engineers, and our English friends." The toast was drunk by the French gentlemen present with equal enthusiasm. With hearty handshakings, and mutual assurances of esteem, hosts and guests separated at a landing-stage almost immediately opposite the Exhibition Hotel, where the company were staying.

The next day was given up entirely to sight-seeing; and many of the party saw something of the grandeur and marvels of Paris for the first time. Driven in vehicles supplied by Messrs. T. Cook and Sons, and accompanied by one of the most courteous and intelligent of guides, they visited or passed the new French Opera House, Madeleine Church, Place de la Concorde and Obelisk of Luxor, Palace of the Elysée, Champs Elysées, Arc de Triomphe de l'Étoile, Trocadéro Palace, École Militaire, Invalides and Tomb of Napoleon I., Ministry of Foreign Affairs,



TOMB OF WINSOR
IN THE CEMETERY OF PERE LACHAISE, PARIS.
From a Pencil Sketch made by Mr. W. J. TENNANT.

Palais Bourbon, Chambre des Députés, Pont de la Concorde, and the Palace of the Legion of Honour. Here a break was made for luncheon at the Palais Royal. Again boarding the brakes, they continued their tour, and visited the Palais de Justice, the Conciergerie, Sainte Chapelle, Notre Dame, Place de la République and Statue of the République, Place de la Bastille and Column of July, and the Prison de la Roquette. The last place visited was the Cemetery of Père Lachaise; and there they had pointed out many of the tombs of the departed great. One of them, which had a peculiar interest for the members, was that of Winsor; and very kindly one of the company (Mr. W. J. Tennant, Fel. C.I.P.A.) made on the spot the accompanying rough sketch of this monument to the memory of a man who was so intimately connected with the inception of our great industry. Inscriptions appear on the two front sides of the triangular column of the monument. One is reproduced on the sketch; the other is in French, and runs: "Ici repose Winsor, Fondateur de l'Éclairage des Villes par le Gaz. Mort à Paris, le 11 Mai, 1830. Agé de 68 ans. L'application qu'il fit à Londres de cet éclairage en grand remonte à 1803, il l'importa à Paris en 1815, et de ces époques date la propagation de ce Systême.—Ex fumo dare lucem." The day being fine and refreshingly cool, the outing was immensely enjoyed.

The reception by M. Th. Vautier, the President of the Société Technique de l'Industrie du Gaz en France, and M. Eugène Lebon, the President of the Gas Section of the Exhibition, on Saturday, in the Gas Pavilion, was a decided success. It was really a grand *réunion*, in which gas engineers of France, Germany, England, and America mixed and fraternized, and also showed and expressed, individually and collectively, their great regard for each other. May that regard long continue! The representatives of the Société Technique, of the Gas Institute, and of the German Association of Gas and Water Engineers, with friends and a few visitors from America, began to assemble about two o'clock. A little later they were invited to the reception-room, where M. Lebon presided—on his right hand being M. Th. Vautier and Herr Wunder (in the absence of the President of the German Association, Herr von Oechaelhaeuser), and on his left, Mr. E. H. Stevenson, the President of the Gas Institute.

The visitors having all assembled, M. Lebon briefly, but heartily, welcomed them; remarking that he had the honour of doing this first because he was the oldest man on the platform. He then called upon M. Vautier to address the visitors.

Speaking in French, M. Vautier said: Gentlemen, and dear colleagues, I have the honour to wish you welcome in the name of the Société Technique de l'Industrie du Gaz and of the Organization Committee of the International Congress, 1900. We congratulate you that your visit to the Exhibition has permitted us to meet together and to exchange with you proofs of cordial fraternity. It is the desire to know better our foreign *confrères*, to show in common our works, and to exchange our views, that has prompted us to arrange in Paris for the commencement of September an international congress of the gas industry. We have the pleasure to announce that we have already received 1150 promises of attendance, of which at least one-half will come from foreign countries. The congress will last for several days—a fact which will permit us to make a better acquaintance with our *confrères*, and to receive them more completely than we have been able to do in the few hours at our disposal to-day. We are very pleased and very happy that most of you are coming to our Congress; and we hope that, in any case, you will follow the proceedings with interest. I have now to indicate to you the organization of the visit we are going to make. We shall commence with the Gas Pavilion, where we are now gathered together, and which has been constructed, on the initiative of our Société Technique, with the help of the Paris Gas Company and of various other Gas Companies. It is M. Eugène Lebon who undertook its supervision and organization. I shall leave it to him to do the honours to you. We shall request you to divide yourselves into four groups, each of which will be conducted by one of our colleagues to and in the sections of the Exhibition connected with the industry. Permit me, in concluding, to give you the toast of "Prosperity to all the Foreign Technical Societies, and particularly of the Gas Institute and of the German Association of Gas and Water Engineers," of which you are the representatives. Gentlemen, I drink to the union and prosperity of your Societies.

M. Vautier also announced that he had received from Dr. Bunte a telegram thus worded: "We address to the Gas Engineers of France, of England, and of Germany, gathered together in Paris, our cordial greetings, and our best wishes for the continuance of friendly relations between colleagues, in order to promote the prosperity of the gas industry in the Twentieth Century." The message was received with loud applause, and M. Vautier proposed that the assembly thank Dr. Bunte, and address to him a unanimous concurrence in the sentiments he had expressed.

The honour of responding first fell to Mr. E. H. Stevenson, for the Gas Institute; and this honour as the youngest President present, he sincerely appreciated. Proceeding, he remarked: I must say for the English gas engineers that we have felt throughout our visit here how very kind and hospitably we have

been received by our French colleagues. We were told that there was trouble between the French and the English in many ways. We have seen nothing of it; we certainly shall not see anything of it, I know. Why there should be any trouble, I do not know. We wish to be friends with France and with the inhabitants of France; and I think they want to be friends with us as well. It is to our mutual interest; and the way in which we have been received here proves that in every respect you desire our friendship. It is the first time I have been over to France in any official capacity; and I must say that the warm manner in which we have been received, not only here, but also on Thursday afternoon, Sir, is very greatly appreciated by us. We have been received and treated in the most handsome way; and we have enjoyed ourselves immensely. I do not believe there is one among us who is not surprised at what we have seen here; and the surprise has brought enjoyment with it. I do not think in our country we quite understand how to do these things, just in the same way that we poor Englishmen do not understand how to use our tongues in any other language but our own. It is our misfortune; it is our stupidity, probably. But we do not; and so we miss a very great deal which we should otherwise enjoy exceedingly. In so far as we have been able to understand, there is one thing that has impressed itself upon every member of the Gas Institute—that you, representing the French gas industry, welcome us, not as enemies, but as friends and *confrères*. We, in a similar manner, reciprocate your kindness; and we hope that we shall have the opportunity of doing so officially. At any rate, we can do so individually; and to me, for one, it would be a matter of very great happiness to have the opportunity. We thank you for your kindness and reception, and for all you have done to make our visit so happy. We wish France every prosperity.

Herr Wunder, in a speech which raised to great enthusiasm the German gentlemen present, expressed the pleasure which he felt at seeing the gas engineers of great nationalities fraternizing in the manner they were doing that day. He concluded by asking both the German ladies and gentlemen to give a hearty *hoch* three times—one for the Société Technique and the Paris Gas Company, for M. Vautier, and for M. Lebon. This they did with very great heartiness.

Refreshments of a luxurious character were then served; the hosts intermingling with their visitors, and showing them attentions in the most charming manner. Afterwards, the whole company were divided into four parties, and conducted round the Pavilion and to the different sections of the Exhibition which possessed the greatest interest for them as engineers. For the English party, M. G. Chamon was the kindly and courteous guide; and he addressed himself with the greatest possible interest to the pointing out of special objects, and to answering the thousand-and-one questions with which his inquisitive following plied him. About the gas exhibits, there is one thing to be regretted, and that is that they are not concentrated. What there are are good of their kind. But the variety is not great; and there is a very small representation from foreign sources. In the Gas Pavilion, the use of incandescent lighting for domestic purposes is finely demonstrated; and gas cooking and heating stoves and other household conveniences are also shown. In the centre of the main building is a splendid statue of Philippe Lebon. Various interesting manuscripts and books are also to be seen. The Pavilion has been so fully described recently, that there is no need to make further reference to it. In other parts of the Exhibition, but widely separated, are to be seen fittings used for old and new methods of lighting; in another quarter there is a small photometrical room, apparatus for the verification of gas-meters, a collection of meters, and some handsome street lanterns fitted with incandescent burners. Elsewhere may be found some good examples of the work of the Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz, including a Pelouze and Audouin condenser, and extractors for benzol and cyanogen. Again some little distance away are to be seen exhibits of Messrs. Graham, Morton, and Co.'s inclined-retort system, and of the Berlin-Anhalt settings. The latter is a very interesting and complete model. In the Mechanical Electrical Section, a number of English gas-engines were noticed—the exhibitors being Messrs. Crossley, Tangyes, the National Gas-Engine Company, and the Dudridge Iron-Works.

If the gas exhibits are scanty, high and normal pressure gas lighting in the Exhibition and grounds more than compensates. In intensity, perfect diffusion, and effectiveness, it eclipses the electric light altogether; and, with the engineers who saw it on Saturday, we can say that it is the best piece of gas illumination on a large scale that we have ever seen. For giving such prominence to what can be done with gas, and in a way which must carry conviction to visitors from all parts of the globe, the Paris Gas Company have done a service to the gas industry in all countries; and they deserve the best thanks of all. We are glad to have had the opportunity of seeing this lighting and to publish our appreciation of it. In a pamphlet distributed among the visitors by the Paris Gas Company, it was remarked: The principal exhibit of the Company consists in the lighting of the parks of the Champ-de-Mars and the Trocadéro. The Company desire to put in evidence the progress realized in the lighting by gas, and to demonstrate that, in illuminating power and price, other systems of lighting are incomparable with this, even in the space so difficult to light as the gardens situated under the Eiffel Tower, 300 metres high. The Company have employed, for the lighting of the Champ-de-Mars, Auer mantles and Bandsept burners supplied to them by the Auer Society; and for the Trocadéro they have employed the "Model" Denayrouze burners, furnished to them by the Denayrouze Company. One part of the apparatus is supplied with gas compressed to 200 mm. This compression is obtained by means of compressors installed in the Pavilion of the Company on the Quai d'Orsay, near the Pont d'Iéna. The intensity of the lanterns varies from 22 to 360 carcels. The importance of this lighting is shown in the table below:—

—	Number of			Total Intensity. Carcels.
	Lamp-posts	Lanterns.	Burners (or mantles)	
Gas under normal pressure—				
Champ-de-Mars . . .	495	800	1,900	60,000
Trocadéro	455	610	1,400	
Gas under compression of 200 mm.—				
Champ-de-Mars. . . .	140	240	1,200	40,000
Trocadéro	50	100	500	
Total . . .	1,140	1,750	5,000	100,000*

* Equal to 1,000,000 candles.

The total surface which is lighted up, not including the basements, is 200,000 square metres; and the daily consumption of gas is 1340 cubic metres. This does not exhaust by any means what the Company have accomplished at the Exhibition for the general benefit of the industry. The inspection over, the visitors returned to their hotels.

In the evening, the majority of the *voyageurs* left Paris by their chosen routes; and it is safe to say that not any of them felt a whit the less patriotic or loyal to their Sovereign than when they left the shores of England the previous Wednesday. But this they did feel—that their visit to the great city of our neighbours, and to the grand Exhibition on the banks of the Seine (the like of which Exhibition they had never seen before, nor in such collective form may never see again), had been an intellectual revelation to many of them. The short visit was sufficient to take them out of the narrowness of their every-day life. In the multitude of things they saw, there was much which impressed them—more, perhaps, than anything had ever done before—of the infinity of the workings and products of men's brains; and however great and marvellous the inventions of their own country had appeared to them, they learned that of such also were the inventions of other countries, and equally worthy of respect and admiration. With so much to ponder over and to talk about, they were richer than when they left home. And, moreover, the thorough kindness and good-fellowship which they met with from their professional compeers on the other side have knitted tighter their sympathies and bonds; and any little uncertainty which recent events may have engendered in the minds of some of the members has been cleared away by a closer contact than can be secured through the medium of the Press. Would that representatives of all industries common to both countries could be brought into personal communion in the same way; and a better understanding would ensue which would benefit both nations.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1637.)

THERE was hardly any improvement to be discerned in the general condition of business on the Stock Exchange last week. The persistent quietude which has settled down upon it ruled steadily all through the week. This was the more disappointing, as it was clear that there was abundance of money on the look out for good investment. The London County Council, Bristol, and Nottingham loans were eagerly taken up; and it is believed that the subscriptions exceeded twenty-five millions. But very little money came in the direction of Capel Court. This slackness naturally had a weakening effect; and prices for the most part are lower, though the shrinkage does not amount to much. The settlement was a light one, and was easily adjusted with the aid of cheap money. In the Money Market, the continuing and increasing ease brought about another reduction in the Bank rate; the Directors on Thursday lowering it to 3 per cent. from the 3½ per cent. at which it had been fixed on the 24th of May. Business in the Gas Market was not particularly active; and it was decidedly colourless and devoid of feature. By far the lion's share of transactions was done in Gaslight and Coke issues. Indeed, if they were eliminated, the total of business marked in all the rest would scarcely make up a moderate day's work. Their movements in value were almost conspicuous by their absence. If we except the alterations which proceeded from *ex div.* adjustment, the direct changes are reduced to two in number, and they are unimportant. In Gaslights, there was good, steady business in the ordinary all through the week at unswerving prices; stock changing hands every day at 101½, and occasionally touching 102½, while the quotation was advanced half-a-point. A moderate amount of business was done in the secured issues; but they did not move at all. Only three transactions were marked in South Metropolitan; but the price was firm and steady. Commercials were quieter still, and unchanged. Next to nothing was done in the Suburban and Provincial group; but a bargain was marked at a low figure in Brighton original, and the quotation dropped. The Continental division were extremely quiet, and what little was done in them did not point in the direction of increased strength. None of the rest presented any feature to record. In the Water Companies, there was rather more activity; and the tendency was in favour of higher prices, though there were not many actual changes effected.

The week's operations were so limited in their scope, and so monotonously level in point of price, that they do not call for daily notice, which would be mere repetition. Suffice it to say that on Tuesday Gaslight ordinary rose ½. In Water, New River rose 2, and East London 1½. On Thursday, New River rose 2 more. On Friday, Brighton and Hove original fell 2½; and Grand Junction Water rose 1.

ELECTRIC LIGHTING MEMORANDA.

The Analysis of Electricity Works Accounts—Unaccounted-for Electricity in London—The Costliness of Electricity in London—The Latest Electric Railway.

THE leading electrical journals show a praiseworthy solicitude for the establishment of a high standard of rectitude in the statement of electricity works accounts. The necessity of candid bookkeeping is not universally appreciated among those who are responsible for the administration of electric lighting undertakings; and therefore the electrical press, in insisting upon its observance, is performing one of the most elevated of the duties of specialized journalism. The current and previous issues of the "Electrician" contain some peculiarly instructive examples of analyzed electricity works accounts, including those of the Metropolitan Electric Supply Company, the St. Pancras Vestry, and the City of London Company. The first-named undertaking is one of the largest in existence. It has been the first among the London Electric Lighting Companies to feel the need for an extra-mural generating station supplying current on the scale which is commonly described by the term "in bulk;" and it experienced much trouble last winter through having taken on more lamp connections than it could satisfactorily serve. Our contemporary has now done so much of this analytical work upon electricity supply accounts, that it has arrived at the point of being able to criticize the results of its analyses in particular instances by average data ascertained from examination of the working results of the generality of undertakings of the same class or locality. This, of course, is the purpose of analyses of works accounts. Perhaps in a few years consulting electricians who advise local authorities to spend the money of ratepayers on electric lighting schemes will also use data of this kind for the bases of their estimates.

It is one thing to exercise the imagination upon presentments of what electricity supply ought to be done for, and quite another to correct these fancies by reference to accomplished facts. Many of the results ascertained by analyzing electricity works accounts never do find their way into preliminary estimates, although the supply of material is ample. On the other hand, scarcely two undertakings keep their accounts in such a way that all the critical data can be extracted from them in a strictly comparable way. As regards the working of the Metropolitan Company, the "Electrican" observes that the aggregate costs of production are at least 0·4d. per unit more than they should be. The same criticism is applied to the St. Pancras Vestry results, only more so, inasmuch as the costs here are stated to be 0·5d. per unit too high. Singularly enough, the latter is exactly the figure applied in a like sense to the City of London Company; so that we have the remarkable coincidence of these three big Metropolitan concerns all taking a halfpenny per unit too much to work their stations. This is a serious amount. The Metropolitan Company do not mind owning up to an output of 12,891,250 units, of which only 8,327,939 units are entered as sold. These analyses do not give the proportion of electricity unaccounted for, as is usual in gas-works statistics. Evidently this proportion would be a very large one. The City of London Company avoid any impeachment of their performance in this regard by omitting to give the number of units generated. The Metropolitan Company are shy in other respects. They do not state the total capacity of their plant, which omission knocks out numerous consequential figures from the "Electrician's" statistical table.

In discussing the St. Pancras Vestry undertaking, our contemporary expresses satisfaction at the appearance of indications of a resumption of progress towards more economical working, after a rather bad year. These Metropolitan electric lighting undertakings are mostly enjoying rates of increase of from 15 to 25 per cent. in the number of lamp connections. For this reason, they ought to be able to put their finances upon a sound basis; and some of the companies are profiting by the opportunity for doing so. The St. Pancras Vestry, however, are not making any provision for depreciation; but this is the same old story that has so often been told. The position of the City of London Company naturally exhibits the effects of the stress of circumstances. Yet, notwithstanding everything, the amount of business done has increased for the year by nearly 20 per cent. The dividend fell from 6 to 4 per cent.; the profits having been seriously diminished by the forced reduction in price. None of these Metropolitan undertakings accounts can be understood as indicating that the business of central station electric lighting even in London is a gold mine. The cost of the unit is not what can reasonably be characterized as low, considering the large scale of power generation and the excellent class of machinery employed in the work. Nor do the statistics encourage the hope that generation in bulk would materially modify matters in this regard. Cheap electricity for lighting is not yet in sight from these parts; and cheap electric power is still farther off.

Most of the London newspapers last week had special notices of the practical completion of the Central London Electric Railway. It does not appear to have been mentioned anywhere that there is considerable risk of confusion being made between the names Great Central Railway and the Central London Railway. Not for the first time, we have, in our national haphazard way of doing these things, permitted two utterly different and unconnected objects to be designated by very similar names; and consequently telegrams, letters, parcels, and passengers will occasionally be gloriously muddled up with the two. Although so short a time has elapsed between the making and equipping of the various Metropolitan underground electric railways, considerable differences appear between the successive realizations of the same idea. Electric railway practice has not yet become standardized. The newest plant for generating the current is on a very extensive scale; and the twin stocks of the Shepherd's Bush power station are already conspicuous landmarks of this region. The arrangements for distributing the driving current over the railway system are all novel. They include the use of rotary converters of the largest size ever made for railway work; and the most elaborate provisions exist to ensure the service against interruption. Still, we are left in ignorance of the margin allowed for wasted power; and therefore no fresh information is forthcoming as to the efficiency of the electric transmission and utilization of energy in the latest form of electric railway.

THE LAW OF LONDON GAS COMPANIES; AND FANCIES ABOUT SOME OF THEM.*

THIS is a curious little book. It strikes an amused, and occasionally amazed, reader as representing in its composition that fusion of the two limbs of the legal profession which has been so much and so long talked about; for one half of it is advocacy, and the rest is law. The author is a barrister, and he has a happy knack of writing blithely on so stodgy a matter as the general and statutory history of the gas supply of London. Thus, in his so-called Introduction, he leads his interested reader on until, before the innocent suspects his fate, he is in the thick of a Chartered brief against Mr. George Livesey! It will be the kindest service we can do Mr. Barnes to mention his law book first, and postpone further comment upon the facetious pamphlet of 39 pages with which he introduces it.

The serious part of the work—that which will alone give it any permanent value as a collection of the London Gas Acts

* A Synopsis of the Statutes, Public and Private, affecting the Metropolitan Gas Companies. With Comments and a Short History. By Thos. J. Barnes, of the Middle Temple, Barrister-at-Law. London: Walter King.

before the present year—fills 63 pages. It begins by setting out the names of the three London Companies, with the titles of their Acts. The statutory history of the Commercial Company, being the simplest, is related first. Then comes the South Metropolitan record, which gives the author a little more trouble. He takes considerable pains to set out the true capital account of this Company, which is admittedly a complex matter. In stating the capital powers and conditions of the Gaslight and Coke Company, the author makes out that there is an amount of £1,088,694 available to meet capital demands, with the addition of whatever premiums may be obtained on the sale of the remaining £250,000 of ordinary stock, and of the remaining £200,000 of 3 per cent. consolidated debenture stock. Against this (at the end of last year) there was a temporary loan of £125,000. There is nothing to be said by way of comment on the author's collection of the statutory requirements applying to the ordinary work of the Companies. His method is to take a specific matter, such as "streets," for example, and state the general, public, and private enactments applying to the subject, with brief explanatory remarks and the rules laid down in leading cases. This plan is more informing to the student than complimentary to the system of gas legislation, which is exhibited as a thing of shreds and patches, there being differences of statutory powers among the three Companies on very many points. Mr. Barnes appears to be careful to verify his references; but he has omitted to insert the date of the abandonment of the supply of cannel gas by the Chartered Company.

It is difficult to test the instructional value of a book of this kind without reference to some particular question. It has been reported that the Portable Photometer Bill of this session, promoted by the London County Council for the purpose of making the London Gas Companies liable to surprise and peripatetic penalty testing for illuminating power, has been pronounced superfluous by the Law Officers of the Crown, who are of opinion that the Gas Referees already possess the very power which this Bill would have conferred upon them. We cannot vouch for the accuracy of the report, and, of course, have no intention of discussing its substance as a pure hypothesis. But one suggestion will serve as well as another for testing Mr. Barnes in his capacity as a guide to the statute law of this matter. All that can be gathered from him on this head is the information that the Referees "shall prescribe and certify the mode of testing and recording the power and purity, the situation of the places for testing, and the apparatus and materials therein." It may be a nice question whether such a direction is broad enough to cover the scheme contemplated in the Portable Photometer Bill, or anything like it. But an affirmative answer to the query would seem to be barred by the wording of ancillary provisions, which refer to testing-places in terms that imply "a local habitation and a name" in this connection.

It will be understood that we have no criticism to offer on that part of Mr. Barnes's book which is a synopsis of the London gas statutes, public and private. So far as this goes, it is a useful guide to the Acts themselves, and gives many good hints as to how their various and anything but uniform provisions may be studied. As the author only puts forward his compilation as a section of a more comprehensive work which he is keeping back to see what Parliament means to do this session, it would be unfair to criticize the little book for what it is not. The question that naturally arises is whether the whole thing had not better have been kept back; and this probably would have been the wiser course. There is no valid reason why the book should have been rushed out while the South Metropolitan Bill is in course of passing through the Houses, more especially as the Act, if it passes, will render the book partially obsolete. And can there be anything more hopelessly obsolete than a law book which is out of date?

But the reason which may have induced Mr. Barnes to get out his booklet in the middle of the session is perhaps to be found in what we have styled the pamphlet part of it, which the author prefers to call his "Introduction." This is a bright and brisk piece of writing, which amply fulfils the first purpose of an introduction, by introducing the reader to the foundation of the main portion of the work. For a certain distance, students of statutory and of technical origins must travel over the same ground. For this reason it is quite correct for Mr. Barnes, barrister-at-law, to introduce his readers to Winsor and Murdoch. But it is an unhappy weakness in specialists to forget their speciality; and Mr. Barnes is as bad in this respect as many engineers who will talk law, and many chemists who have a fondness for social science. Thus he relates that the Gaslight and Coke Company "obtained an Act in 1810," without telling why or wherefore. Yet this was his proper business as a lawyer. Why did the Company want an Act of Parliament? Mr. Barnes goes out of his way to record the fact that "Science, though less unfriendly than Commerce, had chill misgivings" about the proceedings of the first incorporated Gas Company. But the attitude of science, or commerce, is no concern of his, as a barrister-at-law. What was the legal position, and why should an English Gas Company need an Act of Parliament, which is not wanted by an American or Continental gas company?

An adequate answer to this natural question would have served nicely to introduce us to the statutory aspect of the gas supply of London; but this Mr. Barnes does not provide. Surely, he is not ignorant of the circumstance that many scores, even hundreds of gas undertakings still exist in the United Kingdom without statutory privileges, protection, or obligations at all? He would have worked a much fresher vein if he had expounded as fully as possible what may be called the natural history of gas legislation, which is a great mystery to Continental and American gas specialists. How is it that we have nothing like the Continental "concession," or the American "franchise"? These are legal and constitutional queries, which a barrister might be expected to know something about.

In justice to our author, we must admit that he occasionally drops into law, as Silas Wegg did into poetry. For example, he discusses the Clauses Consolidation Acts in an informing manner, showing how much needless trouble, uncertainty, and expense may be caused both by the similarity and the difference of what should be common clauses. But after a few pages of explanation as to General and Special Gas Acts, Mr. Barnes grows tired of studying comparative gas legislation, and fastens joyfully upon the "somewhat peculiar" position of the South Metropolitan Company under their latest and previous Acts. This is on the eighteenth page of his pamphlet, and throughout the remaining eighteen pages he enjoys himself hugely at the expense of the Company's doubtfully-worded Acts, their cloudy accounts, and the vagaries of the Chairman, Mr. George Livesey. This is not exactly what one is prepared to find in a law book. But it is very fair journalism; and inasmuch as it would be likely to rest unseen in the decent obscurity of an "Introduction" to a study of statute law unless we disinterred it, we make no excuses for dragging it to light before it goes wholly out of date. Mr. Barnes is laudably desirous of having the South Metropolitan accounts straightened out, so as to show what the amounts are on which dividend and interest are paid. Singularly enough, the Chairman of the Company has anticipated Mr. Barnes in this desire; and the object will be attained by the Company's Bill of this year. Why, then, should Mr. Barnes complain of the "anagogic utterance"—whatever this means—of Mr. Livesey in anticipating his criticism of the old statutory form of accounts?

Nobody except the author will be interested in the various exercises he indulges in to prove how admirably he could have kept the Company's books, if he had been their Accountant. This, again, is not law writing. It serves, however, for a stick wherewith to chastise Mr. Livesey for having indulged in "an arrogant, unkempt criticism" on "the administration and administrators of a neighbour Company." So there we are at last! Mr. Barnes takes his seat in his chosen galley, and thenceforward tugs at the labouring oar to make it go safely through the deep waters in which the report of the Powers of Charge Committee left it wallowing. He does not make her go very lightly. He exaggerates the effect of the old London amalgamation "entanglement," on the price of gas north of the Thames, as to which, he says: "The Gaslight Company cannot, *for admitted reasons*, sell gas as cheaply as the South Metropolitan can." Where are these reasons, and who has "admitted" them? This is pretty fair for a writer who elsewhere remarks that "this little book must be kept free from all controversy." Why, this Introduction, or the better part of it, is nothing if not controversial! Take the following observations: "No blow aimed at the gas interest from the outside has done it such permanent injury as that struck from the inside, at the management of a particular Company" . . . . "the agitation triumphantly flourished against price yesterday, to-morrow will direct itself against profits." . . . . "Belgravia and Piccadilly pay for most things more than is paid in the distant settlements of Peckham and the Old Kent Road." This, as we have already admitted, is all very amusing; but it is not judicial, nor judicious. Mr. Barnes lays himself open to retorts so obvious that it were superfluous to give them; but if he imagines that Londoners and the Legislature will ever be pacified while there is a difference of a shilling per 1000 cubic feet, or thereabouts, between the prices of gas in Clapham and in Kentish Town, he is grievously mistaken. His attack on Mr. Livesey is instigated by the circumstance that Mr. Livesey alone, seeing how things were going, exercised his legal rights as a shareholder of the Gaslight and Coke Company and said some unpalatable things of the administration.

If Mr. Barnes were a true friend of the Gaslight and Coke Company, he would apply his talents and his interest in some more helpful manner than in the forging of cheap sneers against those critics of the Company's administration who are only too safely on the laughing side, if that were any satisfaction. "So far-reaching are his (the consumer's) interests that one Company, when he is not their customer, may feel moved in their generous sympathy to urge that the alien company who light his house should forego their profit for his further good." This is Mr. Barnes's idea of the correct style of treating—without controversy—the actual situation. He can hardly think that it will help his chosen side to get a penny of fresh capital from Parliament, or will reconcile a single northern gas consumer, or even inflict a passing pang upon that dreadfully unkind person, the Chairman of the South Metropolitan Gas Company. What, then, is the good of it? And why put it into a law book? These be mysteries, indeed; but unhappily the painful facts remain, one of which is the loss of the Chartered Bill while Mr. Barnes's book was passing through the press. This single circumstance unhinges a good deal of his arguments. In any case, he will scarcely reprint his pamphlet as the introduction to his promised larger volume.

THE ORIGIN AND POTENTIALITY OF COAL.

It would probably be unjust to say that, as a rule, gas managers do not trouble themselves much about the origin in a remote age of the raw material with which they have to deal; but we think it will not be denied that during the past eight months their thoughts have been directed rather to the pits which would be most likely to furnish their supplies than to the geological changes which produced the much-needed mineral. Further, their business from day to day has been directed to getting as much gas as possible from it; and the necessity has not arisen for very serious consideration of the general question of the potentiality of coal. Our stores have been freely drawn upon, and their product used in many cases with a recklessness betokening indifference to the eventuality of the supplies becoming some day exhausted. The recent very serious advance in the price of coal, taken in conjunction with the development of the branches of industry for which coal supplies the motive power, invests with more than ordinary importance the question of the rational utilization of its stored-up energy. It was doubtless with the view of directing serious attention to this subject that M. Gaston Kern, the Manager of the Strasburg Gas-Works, lately brought it under the notice of the members of the Société des Sciences, Agriculture et Arts de la Basse-Alsace, and appealed subsequently to a larger auditory by circulating his communication in pamphlet form, a copy of which has been forwarded to us.*

In his introductory remarks the author reminds his readers that the extraction of coal from the bowels of the earth requires much concentration of effort; and he says the fact has been too long ignored that coal can be much more economically employed as a fuel by previous gasification—a process which is applicable to every variety of coal, and is equally suitable for the production of motive power, heat, and light. He explains that it is his purpose to look generally at the problem as it now presents itself. What, he asks, has the future in store for us? In what form shall we burn coal a hundred years hence? Will sluggish Europe imitate go-ahead America? Shall we some day see rivalry between the old-fashioned works for making illuminating gas to which we are accustomed, and the modern plant for the production of "poor"—or should we not call it "new"—gas? M. Kern emphasizes the fact, which has lately been brought so prominently to the notice of gas engineers, that the invention of the Auer burner has completely revolutionized the gas industry. Before Dr. Auer von Welsbach appeared, he remarks, "rich" gas was necessary for lighting purposes. Now, however, illuminating gas is no longer indispensable, inasmuch as the Auer burner requires only gas which possesses calorific properties. Heating gas is power gas—the gas to which the generic name of "poor" has been given; and, moreover, it is cheap, and serviceable all round. In its production, no costly "fat" coal is required. It may be made with any kind, or even with peat; and the process does not yield residuals, such as coke and tar, the possession of which, according to M. Kern, only causes people to continue their wasteful use of solid fuel. He thinks that a gas which can be economically used instead of steam and as a substitute for heating by coke, coal, or wood, has assuredly a great future before it, and will be the medium by which the balance between the production of coal and the growing needs of its consumers will be re-established.

With this introduction, M. Kern proceeds with the subject-matter of his book, which is divided into two parts—the origin of coal, and the development of its potentiality. He tells us that a hundred years ago no reliable data existed as to the origin of what are familiarly known as "black diamonds," and much less as to the carbon forming their principal constituent. It has been left to the nineteenth century to furnish these particulars. The author deals concisely with the genealogy and morphology of coal, and with the geology and climatology of the carboniferous period; and he gives a plate representing an antediluvian carboniferous forest, with the gigantic lepidodendron in the foreground. He next considers the hypotheses brought forward to account for the covering up of this mass of vegetation, and explains the chemical action by which it is converted into coal. Having traced its origin so far, he proceeds to classify the different varieties, and to indicate on a map the coal basins of Central Europe and the number of persons engaged in mining. The production and employment of coal are next dealt with; but the statistics are not the latest obtainable—the different uses to which coal is put in England being for 1887, and the stocks in different countries being for 1890. The writer favours 500 or 600 years as the probable duration of the coalfields; but he consoles us with the assurance that the unused force of Niagara would be sufficient to replace the actual production of the mines.

In the second part of his book, the author deals with the development of the potential energy of coal. He considers first its utilization by means of the steam-boiler, and next by recuperative furnaces, by gasification, and by distillation. With regard to boilers, he shows that in practice the yield is only 54 per cent. of what theory says it should be; and he quotes the experiments of Messrs. Bryan Donkin and Kennedy, made with a number of boilers of different types, in support of this figure. Moreover, the steam-engine utilizes only a small proportion of the heat conveyed to it from the boiler. Passing on to deal with recuperative furnaces, M. Kern remarks that theoretically they do not furnish a larger number of calories than ordinary grate furnaces; but, in practice, a temperature of 2200° C. is obtained with generators, while simple furnaces rarely furnish more than 1600°. An interesting chapter follows on the treatment of coal for producing Dowson, Mond, coke-oven, blast-furnace, and water gas; and the author gives a table (after Pfeifer) showing the comparative values of these heating gases—the highest duty being assigned to Dowson gas (89 per cent.), mixed generator and water gas coming next with 84·4 per cent., and illuminating gas figuring at 20 per cent. We next come to the distillation of coal in gas-works. The author shows that the distillation of 100 kilos. of coal will produce 30 cubic metres of gas, 70 kilos. of coke, and 5 kilos. of tar—the whole having a heating value of some 704,000 calories, as compared with the 750,000 calories of the coal. We therefore get 90 per cent. of the original calorific power of the coal after its distillation. In practice, however, from 10 to 20 kilos. of coke have to be deducted for the heating of the ovens; but, on the other hand, the value of the non-combustible residual products have to be added to the balance-sheet. As a matter of fact, therefore, the 30 cubic metres of gas are produced at the cost of 50 kilos. of coal. Given good gas-engines, consuming at the outside 500 litres (17½ cubic feet) per horse power per hour, the author shows that a horse power could be produced at gas-works with the consumption of 0·83 kilo. (1¾ lbs.) of coal—a result attained by only the most improved steam-engines.

In his concluding remarks, M. Kern points out that 100 kilos. of coal occupy in bulk only 0·15 cubic metre, which furnishes by distillation 30 cubic metres of gas, or 200 times the original volume of the coal. Furthermore, the 70 kilos. of coke form a mass 0·2 cubic metre in bulk, which by the Dowson process, for example, could be transformed into 300 cubic metres of mixed gas, equivalent to 1500 times the original volume of the coke. It is clear, therefore, that the admixture of air necessary to support combustion is more easily effected in the case of a combustible thus expanded than it is in that of a compact fuel such as coal. In the production of this gas with the minimum of thermic loss and the maximum economy of fuel, and in its complete combustion with the exact quantity of oxygen necessary for the operation, lies the whole secret of economic heating. The figures obtained up to the present time, however, show that the art of transforming into useful work the energy stored up in coal is still in its infancy. The steam-engine, notwithstanding all the improvements which have been made in it, utilizes only one-tenth of the latent force contained in the fuel, and the gas-engine only about one-fifth; whereas acetylene has stored up in it 2700 calories, and, according to Pictet, produces by its combustion about 4800° C.—a temperature which is unique in the history of chemistry—the author thinks that probably some day we shall obtain this result from carbonate of lime, which, like coal, owes its existence to the carbonic acid of the atmosphere, and forms mountains which are much less likely to be exhausted than coal mines. But whether it is a question of the carbon in the lime or that in the coal, there is this certain fact about them—that they were both stored up thousands of centuries ago, and that we give them back to the atmosphere after having utilized them in a more or less satisfactory manner.

It only remains to say that the text of M. Kern's book is illustrated by several diagrams, as well as by 28 plates showing various kinds of plant, including that employed in the manufacture of blast-furnace, producer, coal, and water gas; the system selected for the latter being that of Messrs. Humphreys and Glasgow. The book is a useful addition to the literature of a subject of special importance at the present time.

* "Le Potentiel de la Houille et ses Origines." Par Gaston Kern, Ingénieur, Directeur de l'Usine a Gaz de Strasbourg. Strasbourg: Imprimerie Alsacienne; 1900.

THE WATER SUPPLY OF LIVERPOOL.

The Water Engineer to the Corporation of Liverpool (Mr. J. Parry, M.Inst.C.E.) has just issued, in accordance with the instructions of the Water Committee, an elaborate report on the undertaking which is subject to his supervision. It is divided into two parts—the first being historical and descriptive, while the second deals with the present state of the works.

It appears that in the early days of the city's history the only sources of water supply were shallow wells bored into the new red sandstone. As the population increased, carts were employed for the distribution of the water; and at the close of the eighteenth century there were 60 of them in use, distributing about 100,000 gallons a day. The first Water Act was passed in 1709; its object being to enable the Corporation to grant to Sir Cleave Moore, Bart., "liberty to bring fresh water into the town, and serve the inhabitants therewith from springs in the village of Bootle-cum-Linacre." The powers thus obtained were, however, allowed to remain dormant for nearly a century. In the year 1786, an Act was passed for, among other objects, "supplying the town of Liverpool with fresh and wholesome water." A sum of £95,324 was subscribed, and works were commenced in 1799 by sinking wells and laying pipes. In that year, a Company was formed under the title of "The Company of Proprietors of the Liverpool Water-Works," for "better supplying the town and port of Liverpool with water from

certain streams in the parish of Bootle." In 1822, an Act was passed to repeal the provisions of the Act of 1786, and to incorporate a Company, subsequently known as the Liverpool and Harrington Company, to take over the powers thereby conferred, and to construct works for the supply of the town and port with water. Thus competition was introduced, which, as in many other cases, resulted in an arrangement being come to for the two Companies to confine their operations within certain specified limits.

The supply furnished by the above-named Companies being inadequate, an agitation for a better service was commenced; and three Engineers—Mr. Hawksley, Mr. Cubitt, and Mr. Rendall—were engaged to investigate and report upon the various schemes proposed. Eventually, Mr. Hawksley prepared what was afterwards known as the Rivington Pike scheme, for impounding the upper waters of the Douglas and Roddlesworth, in Lancashire. This was adopted by the Town Council; and in 1847 the Corporation obtained an Act of Parliament (10 and 11 Vict., cap. 261) by which they were empowered to carry out the Rivington works and to purchase by arbitration the undertakings of the two Companies. Mr. George Stephenson was appointed Arbitrator; and he awarded them £537,392. After the passing of the Act of 1847, the advocates of wells in the new red sandstone continued the strenuous opposition they had previously raised to the Rivington scheme. Public feeling was greatly excited on this subject; and at length, on Nov. 9, 1849, all the questions at issue were referred by the Council to Mr. Robert Stephenson, who reported in March, 1850, in favour of proceeding with the Rivington works and adversely to the new red sandstone as a sufficient and permanent source of supply. The construction of the Rivington reservoirs was commenced in 1852, and the water was first delivered into Liverpool in 1857. The works have been extended from time to time to meet the requirements of the city.

Towards the end of 1876, the attention of the Water Committee was called to the advantages of the River Vyrnwy, in Montgomeryshire, as a source of water supply for Liverpool; and Mr. G. F. Deacon, who was then the Borough and Water Engineer, was instructed to report upon the subject, and also as to a proposal to procure a supply from Lake Haweswater. The conclusion at which Mr. Deacon arrived was that a reservoir to be constructed upon a particular portion of the Vyrnwy possessed all the more important advantages of the lake scheme, together with some which were wanting in the latter. The Vyrnwy scheme met with the favourable opinion of Mr. Bateman and Mr. Hawksley, and it was finally adopted by the Water Committee on June 4, 1879, and by the Council on the 29th of the following month. The Act of Parliament conferring the necessary powers for carrying out the project was passed on Aug. 6, 1880 (43 and 44 Vict., cap. 143); and the works were commenced in 1881. Mr. Hawksley and Mr. Deacon were appointed Engineers; but the former relinquished the position on Sept. 1, 1886, and the scheme was completed under the sole direction of Mr. Deacon. The works were formally opened by H.R.H. the Duke of Connaught on July 14, 1892.

In addition to the sources of supply mentioned above, Liverpool has three wells: The Windsor well, sunk in 1846, with a daily yield of 1,260,000 gallons; the Green Lane well, with a yield of 2,750,000 gallons; and the Dudlow Lane well, with a yield of 1,207,000 gallons. Geologically, the wells are all in the pebble beds of the new red sandstone formation. The Rivington watershed comprises about 10,000 acres of thinly-populated hill and moorland on the millstone grit. There are seven reservoirs, besides filter-beds; and they will hold 4105 million gallons of water. The Rivington aqueduct works comprise five reservoirs, which contain when full 103½ million gallons. The total area of the gathering-ground from which the Corporation can impound water at Vyrnwy is 22,742 acres. This includes two streams, the Cowny and the Marchnant, tributaries of the Vyrnwy, which have not yet been utilized. To convey the waters of the former into Lake Vyrnwy, a tunnel 5 feet in diameter is now being driven. The length of the conduit will be 2272 yards; and a similar tunnel 2442 yards long will be required in the case of the Marchnant. The area of the lake is 1121 acres; its length, 4¾ miles; and its available contents amount to 12,131 million gallons. The dam across the valley is 1172 feet long, 84 feet high, and 127 feet thick at the base; and its foundations are 60 feet below the natural surface. Its total weight in solid masonry is 510,000 tons; and the amount of excavation for the foundations was 220,890 cubic feet. The total length of the aqueduct is 67 miles. It consists of a tunnel 4⅛ miles in length to convey 40 million gallons of water per day, and pipes for 63¾ miles for the first instalment of 13⅓ million gallons. The quantity of water now delivered through the Vyrnwy pipes into Prescot from Oswestry is at the rate of 15,400,000 gallons daily. With regard to the quality of the supply, the monthly analyses show that the Vyrnwy water taken at Prescot contains 38 bacteria per cubic centimetre; the Rivington water, 34; the Dudlow Lane well water, 48; the Green Lane well water, 95; and the Windsor well water, 57. Professor Boyce, who makes systematic bacteriological examinations of the water, describes the result of his observations as most satisfactory; and shows that of five great Continental cities Liverpool is much below all except one (Munich) in the bacteria per cubic centimetre. Liverpool averages 24, against 50 for Berlin, 70 for Hamburg, 100 for Buda-Pesth, and no less than 1125 for Paris.

The total quantity of water distributed from the Liverpool works during the past year was 9,900,306,000 gallons, or an average of 27,199,000 gallons daily. It was obtained from the different sources of supply in the following proportions: Wells, 1,190,863,000 gallons; Rivington, 3,821,281,000 gallons; Vyrnwy, 4,773,530,000 gallons; sea, 114,632,000 gallons. The average daily consumption within the compulsory limit was 25,522,000 gallons, which works out to 31·154 gallons per day per head of the population. In 1846, it was 8·24 gallons; and in 1851, 10·75 gallons. The average consumption of water for the extinction of fires represents very inadequately the occasional demands for this service. At the largest fire which occurred in Liverpool last year, the quantity of water used was 1,750,000 gallons. Particulars are given of the measures adopted to prevent waste by the introduction of the Deacon meter. The capital expenditure on the Liverpool Water-Works to the end of 1899, including £2,203,855 on the Vyrnwy works, was £4,985,501.

The remainder of Mr. Parry's interesting book, which is exceedingly well printed, and is illustrated by reproductions of photographs, diagrams, and maps—raising it far above the category of an ordinary report—is devoted to observations on the present state of the works.

OBITUARY.

We regret to learn of the death of Mr. Adolphus F. Waller, who was for many years Manager and Secretary of the Sherborne Gas Company, and subsequently Sub-Manager of the Croydon Gas-Works. Deceased was a pupil of the late Mr. Bellows, the first Engineer of the Oriental Gas Company. He died on the 8th inst., at the age of 78, after a long illness, and was buried in Tooting Cemetery on the 13th inst.

PERSONAL.

Mr. W. Lister has been appointed Manager of the Aberavon Gas-Works, in succession to Mr. W. G. Owen.

Mr. C. Sheppard has been elected Chairman of the Battle Gas Company, in succession to Mr. J. P. Woolgar, resigned.

Mr. W. Pooles, the Mayor of Boston (Lincs.), has been elected Chairman of the Boston Gas Company, in succession to the late Mr. S. Sherwin.

Mr. R. M. Couper, formerly Manager of the Newbury Corporation Gas-Works, has been appointed to a similar position under the Brentwood Gas Company.

Mr. David Easson, of Maybole, has been appointed Manager of the Selkirk Gas Company, in succession to Mr. W. B. M'Lusky, who is going to Perth. Mr. Easson was for seventeen years in the Perth Gas-Works, rising to the position of Assistant-Manager. In that capacity he showed much ability, and his friends were greatly disappointed that his services could not be retained in Perth. Three years ago Mr. Easson was appointed Manager of the Maybole Gas Company. The output of gas at Selkirk is about three times that at Maybole; and so the change is an upward one for Mr. Easson.

Last Friday, an interesting ceremony took place in the stokers room at the Smethwick Gas-Works, when the employees of the Gas Department of the Corporation presented Mr. B. W. Smith, the Manager, who, as already announced, has obtained the appointment of Gas Engineer to the Walsall Corporation, with a handsome marble timepiece, bearing a suitable inscription. Mr. Bullock made the presentation, and referred to the pleasant relations existing between the employees and Mr. Smith during the latter's nineteen years' connection with the works. Mr. Smith suitably acknowledged the gift. His successor (Mr. Vincent Hughes) took up his duties on Saturday.

We regret to learn that Mr. W. J. Fuller, Engineer and Manager of the Bournemouth Gas and Water Company, has been compelled to resign his position on account of ill-health, and Mr. Harold W. Woodall has been appointed his successor. Mr. Woodall finished his education under Professor Beare and Dr. James Fleming at University College, was a pupil in the shops of Messrs. Bryan Donkin and Co., and was for four years Assistant-Engineer to the Westminster and City of London Electric Light Companies. For twelve months he was Assistant to Mr. G. F. L. Foulger, the Distributing Engineer of the Gaslight and Coke Company; and he has since been in the service of the South Metropolitan Gas Company under Mr. C. C. Carpenter—first at Vauxhall, and latterly in charge of the Old Kent Road station. Mr. Fuller is leaving the Bournemouth Company with the entire sympathy and good wishes of the Board, who have granted him a retiring allowance.

Coal in the United States.—The production of coal in the United States last year was 258,539,650 tons, as compared with 219,974,667 tons in 1898—being an increase of 38,564,983 tons. The largest coal-producing States in the American Union are Alabama, Illinois, Ohio, Pennsylvania, and West Virginia. The output of Alabama in 1899 was 7,234,758 tons, as compared with 6,535,283 tons in 1898; of Illinois, 23,435,445 tons, as compared with 18,599,299 tons; of Ohio, 16,679,880 tons, as compared with 14,516,867 tons; of Pennsylvania, 75,591,554 tons, as compared with 65,165,133 tons; and of West Virginia, 11,755,222 tons, as compared with 16,700,999 tons.

NOTES.

A Cyanogen Gas Identical with Argon.

Dr. T. L. Phipson, in the "Chemical News," points out that when dry cyanogen is passed into a glass tube heated to redness, and full of iron nails (*points de Paris*), devoid of rust, a gas is obtained which can be collected over water, in which it is only slightly soluble. This gas is colourless, and almost odourless; it extinguishes a lighted match without taking fire itself; it is not absorbed by potash; and when mixed with oxygen and submitted to the electric spark, it does not detonate. A quantity measuring 1000 c.c. weighed in two experiments 1·8 and 1·81 grammes at 0° C. and 30 inches barometrical pressure. These weighings were made with the best balance in Dr. Phipson's laboratory. The gas, therefore, was not nitrogen (of which 1000 c.c. in the same circumstances weigh 1·267 grammes), nor, *à fortiori*, cyanogen. It therefore contained carbon, and from these two determinations its atomic weight, or equivalent, would have the half of the quantity of carbon contained in cyanogen. Dr. Phipson thought it was perhaps identical with argon, of which about 1 per cent. had been found in atmospheric air, and which would therefore be a carbide of nitrogen, containing half the carbon contained in cyanogen.

Large Gas-Engines for Blast-Furnace Work.

Mr. Adolphe Greiner has reported to the Iron and Steel Institute on the results obtained at the Cockerill Works with the first blowing engine worked by blast-furnace gas ever employed in any iron-works (see *ante*, p. 1359). The problem, which is of great economic interest, has been completely solved by the engineers of the works, with the engine made by Delamare-Debouteville. This is a 600-horse power engine; and it has now been running continuously since Nov. 20, 1899, with unpurified gas taken from the Seraing blast-furnaces. The performance of this pioneer plant has been exhaustively tested by Professor Hubert, of the Liège School of Mines, in the presence of Mr. Bryan Donkin and other witnesses. On March 20 the engine was tested simply as a gas-motor, when it was found to be giving a mean of 575 brake horse power. The calorific power of the gas used, tested by the Junkers calorimeter, varied between 798 and 937, or a mean of 860 calories per cubic metre. The consumption of this gas per effective horse power was after the rate of 111·4 cubic feet. The thermal efficiency, or ratio between the power developed and the mechanical equivalent of the heat of the fuel consumed, was about 30 per cent. About 50 per cent. more was accounted for by the cylinder water-jacket; and the remaining 20 per cent. went off in the exhaust gases. This efficiency is highly remarkable; and the Seraing blowing engine marks an era in the construction of gas-motors. Several engines of 1200-horse power are in process of building for various Continental iron-works. Not the least interesting consequence of the success of these blast-furnace gas-engines is the possibility of establishing iron-works in localities where the large water supply necessary for steam-power plant does not exist. Thus blast-furnaces have been erected at Toula, near Moscow, and on the island of Elba—water being absent in both cases. The Crossley Company are working successfully in the same direction.

Some Points of a Contractor's Business.

A highly instructive paper on working methods of carrying out engineering structures was contributed during the last session of the Glasgow Association of Students of the Institution of Civil Engineers by Mr. James Brand. The paper was a valuable compendium of information upon most of the practical considerations that enter into the calculations of engineering contractors' agents. It tells the student much that it behoves him to know about excavations, timbering, rock cutting, blasting, pumping, and so forth. After passing in review old and modern practices in these all-important matters, Mr. Brand observed that the doubling of the rates of wages of the work-people employed in this line of business during the last 40 years might, on the face of it, be supposed to entail a corresponding increase of the cost of works. But this is not, in point of fact, the result. The improvement of appliances and in modes of working have practically kept the cost of earthwork—whether in hard ground or in soft—at very little advance upon the prices of that period. No doubt, said Mr. Brand, in light cuttings in sand or in gravel with short leads, prices were rather better than at present; but they were never below 7d. or 8d. per cubic yard. On the other hand, where there were long leads or soft material, the prices were never under 1s., and often a good deal more. Rock was never under 2s. 6d. for the lightest and easiest qualities; and it frequently went up to 5s. These prices are pretty much the same still; and the extra cost of wages has been met by the improvement in drills and the introduction of the more powerful explosives. Masonry under the same conditions certainly costs more; but although the wages have likewise doubled, Mr. Brand does not consider the prices for dressing and building greater than 30 to 50 per cent. above those obtainable 40 years ago. In concluding his paper, the author laid stress upon the desirability of encouraging people in very subordinate positions to communicate their ideas concerning possible improvements in the working to those in more authority.

TECHNICAL RECORD.

ASSOCIATION OF GERMAN GAS AND WATER ENGINEERS.

Inaugural Address of Herr W. von Oechelhaeuser.

The following is a translation (somewhat summarized towards its close, where it dealt chiefly with affairs of purely German interest) of the Inaugural Address delivered by Herr W. von Oechelhaeuser, the General Manager of the German Continental Gas Company, at the meeting of the above-named Association at Mayence on the 9th inst.:—

The President of an Association, in inaugurating its annual meeting with a retrospect of the progress of that industry with which the Association is concerned during the preceding year, is nowadays confronted with the dilemma which is often presented to the promoters of art exhibitions. In spite of the immense number of pictures from which these gentlemen have to make a selection, they cannot every year offer to the pampered public works which will live in history. Similarly, though we trust that this year's general meeting will bear testimony to the activity which pervades the gas and water industries in all directions, and though we see some improvements attained, and others in course of development, yet we may fitly extend our glance this year to a more distant horizon, and review the general technical and social conditions which lie at the root of our engineering activity.

Since the last general meeting at Cassel, we have passed the turn of the century; and in this eventful age it already seems far behind us. The light which was directed at that time on all our national affairs would make any retrospect of them now appear commonplace. Nevertheless, amid the multitude of ideas and impressions which the turn of the century presented to us, one ever-green fact recurs to the mind of every German engineer who has at heart the love of his profession; and its value to him cannot be over-estimated. I refer to the promotion of the study, and the recognition of the services, of technical science and practice by the Emperor of Germany.

After the great festival of the Berlin Technical College last autumn, the principals of the three technical colleges of Prussia, expressed through Privy Councillor Riedler, who has been the leader in the technical education movement, their acknowledgments to the Emperor. In reply, His Majesty made an improvised speech which betrayed the depth of his views and intentions, and filled all who were present with a deep sense of gratification. It should lead every association of German engineers to revise its programme, and to act hereafter in accordance with the spirit of the Emperor's words. These were as follows: "It has given me much pleasure to have the opportunity of conferring distinction on the technical colleges. Very great obstacles had to be overcome; but they have now been set aside. It was my desire to give a foremost position to the technical colleges; for very great problems, social as well as technical, have to be solved through their agency. Hitherto, these problems have not been solved as I should desire. You, of the technical colleges, are in a position to exercise widespread influence on social and moral relations; for your many associations with labour, workmen, and industry in general, present great opportunities for stimulating and influencing others. Therefore in the future great tasks await you."

The programme presented by the Emperor in these pithy sentences is one which applies not merely to the technical colleges and educational bodies, but also to the present generation of engineers, who are already engaged in the practical business of life. By example and authority, they can most effectively aid in the solution of the social problems which appertain to their calling. Especially is this the case with the associations of managing engineers, which have to regard the ideal as well as the material problems of their industry. And precisely as in this our Association we have always kept up our knowledge of such high technical problems, intimately dependent on science, as come before us, so should we consider how we have fulfilled the second chief issue of the Emperor's programme—viz., the carrying out of our social duties towards our workmen. I would include among the workmen in this sense the lower orders of officials, who, often enough, in these times of solicitude for the working classes, are passed over and unrequited, though their wages frequently do not exceed those of the better paid of the workmen.

In order to obtain a knowledge of what is already being performed in social matters in our industry, and thus to learn the proper starting-point for further efforts, a paper of questions has been addressed to the members and associates of the Association, both at home and abroad. The questions are directed to ascertaining the existing arrangements for the welfare of workmen, apart from the ordinances and requirements of the law in this respect. So large a number of my colleagues and of managing bodies have responded with highly interesting communications, that I take this opportunity of rendering to them, in the name of the Association, most grateful thanks. Shortness of time, however, has made it impossible to review the whole of the materials, and especially to deal with the many different special clauses in the rules of benefit and pension funds and workmen's clubs. These will not now be considered in detail,

though plans of many benefit schemes, and the rules of numerous workmen's funds, are exhibited on the walls of this theatre. The result of the inquiries has, however, justified us in our view that, though much still remains to be done for the social welfare of those engaged in both municipal and private works, yet, in the gas and water industries, there are already many distinct and admirable arrangements which are deserving of wider recognition and adoption.

The directions in which we must work in carrying out the Emperor's admonition—that we must fulfil our social and moral obligations to workmen and other employees—can only be briefly indicated here. Whatever arrangements we make may involve some of the following matters—viz., the hygienic conditions of the workpeople, the technical methods adopted in working, the representation of the workmen, their wages, their benefit funds, their savings banks, their pension funds, and the means adopted for training foremen and officials.

No one, of course, would expect all these matters to be brought forward everywhere; for we know how different are the local conditions as regards our industry. Particular details of a scheme which have proved their worth in one place cannot forthwith be adopted without modification at another works. Certain general arrangements which are feasible everywhere can be defined, and they may be specified here: (1) The hygienic conditions under which the workman is engaged must be made as favourable to him as practicable. (2) The technical methods adopted in the industry must be such as will lighten as much as possible bodily toil.

With regard to the first question, of the hygienic conditions of the men, labour on gas and water works ranks among the most healthy and least dangerous. Our retort-houses and apparatus buildings are well ventilated and guarded. Proof of the favourableness of the conditions is afforded by the long service of many of the men and officials, especially of such as reside upon the works. As regards also the technical arrangements, these are in all new works directed to the employment of mechanical means to as great an extent as possible. Especially is this so with respect to the very arduous toil of stoking, which drawing and charging machinery, inclined retorts, and the vertical chambers of water-gas plant, have greatly minimized. There appears, however, to be one hygienic requirement which has been by no means universally conceded. I refer to baths and detached rooms for the use of the stokers. At every works this accommodation should be provided without question. Of course, every works cannot provide luxurious bath and eating rooms for the men. In many cases, works are on too small a scale—especially as, in comparison with large works in other industries, few workpeople are employed thereon; yet, if the desire exists, a bath room and workmen's room can in almost every instance be partitioned off or built. Among the exhibits in this theatre are whole series of examples taken from medium-sized or small works. The arrangements at the Zurich Gas-Works are also shown by drawings; and the Manager, Herr Weiss, rightly says: "The capital expended on these arrangements, will not only benefit the workmen and the gas-works, but also the families of the men, as the habits of cleanliness acquired on the works will be imported into the family life. Consequently, the claims on the sick and benefit funds will be correspondingly diminished."

On large works, special eating rooms for the men should scarcely be dispensed with; and the new gas-works at Charlottenburg affords a fine example of an erection of this kind. Those gentlemen who, together with their English *confrères*, accepted the hospitality of the Municipality of Charlottenburg, will recall with pleasure the model accommodation erected there on technical lines. For large works also must be mentioned, as worthy of imitation elsewhere, the drying-rooms and ventilated drying-cupboards for the wet clothes of workmen arriving at their work, such as are provided at Strasburg, Winterthur, and Copenhagen.

It seems that workmen's dwellings have been found necessary at a few works only, probably because, as already stated, the men employed are comparatively few, and dwellings can readily be found for them. Some large installations of workmen's abodes have, however, been projected—for instance, by Herr Joly for the municipal gas-works at Cologne.

Workmen's representative organizations of a permanent character appear to exist only comparatively rarely. Opinion in our industry is much divided as to their value and serviceableness. Much must depend on the character of the working classes of the place. The circular issued has revealed the existence of only seventeen of these organizations in addition to those of the German Continental Gas Company. This peculiarly social establishment, however, in all cases where its working has been carefully observed, is much appreciated, notably by Herr Joly, of Cologne. I am also able to confirm this from experience of the senior delegates, who have been in existence for 12 years in my own Company. In critical times, when other speakers besides these have turned up, we believe we have avoided many a crisis by knowing, on the first symptoms of discontent, with whom we had to deal. When demands were made, we were in a position to treat with a representative elected by the workmen themselves in untroubled times. The more extreme elements are found in the van only in times of excitement, elections, and so forth. The rules of some workmen's organizations are here.

Many means are adopted in different works to secure a capable and reliable staff of workmen. In this connection, wages are of great significance. Apart from wages, which rise steadily, bonuses are recommended at many places. They are regulated by scale according to the duration of service. For instance, after five years' service, a single payment of 50 to 80 shillings; after ten years' service, one of £5; after fifteen years' service, one of £7 10s.; and after each five years over and above this, £2 10s. more. At some works also the workmen are entirely relieved of their obligation to contribute to the sick fund and invalid insurance. Personally, I think this arrangement a questionable one, as all lawmakers contend, and most social politicians also recommend, that charity should not be bestowed on the workmen, but that they should be required to contribute to their own insurance funds, &c. It is highly desirable, and in most works appears practicable, that workmen and officials retain their full pay during military exercises. In many works, including those of my own Company, there is a desire to secure a staff of distinctly good workmen, and to grant them a short period of leave in the summer according to the length of their service. For instance, after one year's service, two days' leave each summer; after five years' service, three days each summer; and after ten years' service, four days each summer. Of course, full wages must be paid during this leave-time.

The pension funds are of the utmost importance to the officials of gas and water works. In this matter the municipal undertakings have a great advantage over private works, as they can grant similiar pensions to those given to officials in other branches of the municipal service. Private companies, however, have not the same continuity and permanency as local authorities; and in their case a pension fund must be endowed with a very large capital in order to make sure that the obligations can be met. The obtaining of large capital is made difficult owing to the fact that when the fund is started, the older officials object to paying up contributions for the period of their service which has already expired. Consequently, the capital in respect of these expired periods of service must often be provided by the works in full. The German Continental Gas Company have endeavoured to solve this difficulty by making contributions to the fund out of the profits of specially good years. A professional actuary should be called in from time to time to ascertain the position of the fund in the case of private companies. The rules of some such funds are exhibited here. Provision for widows is covered by the regulations of these funds in most instances. The bulk of the pension funds only make provision for the officials; but some are for both officials and workmen. Two cases exist where the funds are for workmen only. How much the precaution is felt to be needed, however, in the case of officials and many other classes of workmen, is shown by the fact that, to the question in the circular as to whether pension funds existed, not unfrequently the laconic reply "*unfortunately* they do not" was given. The provision of pension funds should be demanded in the case of municipal works; but for private works, which are not in a position to start them, it is desirable that, so far as the health and age of the officials allows, they should be provided for by life insurance. The firm of Messrs. Julius Pintsch, among others, has introduced this system. Similarly, Messrs. Körting Brothers grant an insurance policy after four years' service. Also it is well known that a fixed sum can, by agreement, be made payable on such a policy at the 60th, or some later, year of life. Benefit and relief funds to meet those cases which are not covered by the State sick, accident, and incapacity insurance, are much to be commended. They can be administered either by the Sick Fund Committee, where one exists for any particular works, or by the senior delegates, in which case the influence of the workmen's representative body over the workmen is considerably increased.

Finally, the consideration of the thrift funds or savings banks, which are unfortunately little esteemed on our works, must not be omitted. The circular has revealed only eight works in which these exist, in addition to the works of the German Continental Gas Company. Two of those works grant interest at 5 per cent. on the deposits of officials and men; others let the age bonus, which generally commences with five years' service, be wholly, or as to one-half, entered in the thrift fund books. The system introduced by the German Continental Gas Company appears to answer excellently. It has now been in existence for four years. The deposit can be made in any selected public savings bank. The Company then make an addition, the amount of which is determined from year to year, to the interest allowed by such outside banks. This addition was raised, in consequence of the favourable circumstances of the last few years, from 5 to 7 per cent., so that the depositors now receive 10 per cent. in all. To avoid abuse of the system, the maximum deposit is fixed at 10 per cent. of the year's earnings of the official or workman, and these earnings for the most part need never be reckoned to exceed £225. The savings in the first year amounted to about £950, and have risen to something like £4900 in the fourth year. A cursory calculation will show that the grant to meet the interest allowance could easily be made by most works.

Among other arrangements for the welfare of the workmen and officials, there is to be greatly recommended the provision of instructive and amusing, and especially illustrated, papers in the workmen's lobbies. Also officials' clubs, and even skittle alleys, where officials and foremen could meet, would contribute to making pleasant the personal relations of officials and workmen to their superiors. In addition, social evenings for the families

of officials and men have been arranged—in St. Gall, for instance—with excellent results.

This fleeting review presents a cheerful picture of social efforts which can nowhere be introduced as a whole, but which should stimulate us to put them into practice as far as possible in our respective spheres of action. The efforts must be made having regard to the particular class of works and the management. In any case, the Emperor's appeal—"You have great problems to solve, social no less than technical"—should be made to us with good results, because the majority of our works are under municipal control. Arrangements for the welfare of workmen can more readily be introduced in these than in small private works, because of the permanency of the corporation and the existence of similar arrangements in other branches of municipal enterprise. In addition to the words already quoted, the Emperor said further: "Our technical education has already achieved great results. We need very much technical knowledge throughout the country." Assuredly it is of far greater use to the German people than many imagine. The achievements of German technology in the last three decades have certainly affected the technical knowledge throughout the country but very little, and by no means to the extent which is necessary for the continued development of the Empire. For though we in Germany believe that at the present time we possess an advantage in the scientific training of our engineers, yet a comparison of the *average* technical knowledge throughout the country with that found in other cultured nations is certainly not favourable to Germany. The average technical knowledge among educated people in general, apart from the professional men, is smaller with us than with, for instance, the greater of the cultivated nations, England and America. This fact can be observed in the course of any journey abroad. The educated man, more especially one who has received the usual classical training, with us has assimilated incredibly little of the great practical and scientific attainments of the time, although they are constantly brought before him. Electrical technology alone, in virtue of State patronage and the energy of those exploiting it, has at last succeeded in arousing general interest. But whoever has had occasion to be present at the sittings of English Parliamentary Committees, for instance, will have been astonished at the average technical knowledge of the members, as displayed in the questions which they ask, the results of their inquiries, and their decisions. These Committees have to deal with the granting of monopolies in the gas and water industries, as well as with tramways, &c. The same remark will apply to the hearing of patent cases in the English Courts by Judges who have had no special technical training.

The extent of the technical knowledge and practical experience of English and American men has been brought home to the German nation on several occasions lately in connection with many economical questions of political importance, and in their representation by ministers, consuls, and colonial officials. For the benefit of those who have not gained such an impression from their personal experience abroad, I may relate a little incident which should serve to remind them of many similar occurrences. At the time of the Chicago Exhibition, I was driving along the bank of the river from the Falls of Niagara to the rapids lower down, and I entered into conversation with my driver on the subject of a hurricane which had raged during the night. He supported a remark as to the force of the hurricane with a statement, which he had evidently culled from a morning paper, that the wind had possessed a velocity of so many feet. This driver was a simple man of the country, not an educated European. To my inquiry as to the velocity of ordinary high winds in that locality, he gave me a quite intelligent reply. Again, when interruptions occur in the tramway services, instead of the customary energetic expressions of annoyance which are all we hear in Germany, you find in America intelligent conjectures made as to the probable cause and nature of the interruption, and how it is being grappled with. I am surely not the only European engineer who has been struck on such occasions by the high average degree of intelligence of Americans and Englishmen. On the contrary, to take one instance out of many, I recollect not long ago an educated German gentleman who was dining in a room in which were burning many incandescent *gas* lights, remarking, when the conversation turned on them, "Oh, I thought the incandescent *gas* light was worked by *electricity*." This cultured countryman of mine and the American driver have often come to my mind as typical examples.

How astounding, too, is the ignorance of technical matters often displayed at the present time in the mandates of public authorities. In our own industries we have every year to be on our guard against such misconceptions. I will pass over the full details of the most recent instance of this nature—I refer to the great increase in the number of fires which have of late years occurred at electrical stations, and the works of leading firms of electricians. Among these may be enumerated fires at central electrical stations, exhibitions, theatres (*e.g.*, the Comédie Française), Krupp's Germania wharf, and at least eight large shops or warehouses. Of the latter, those at Munich, Frankfort-on-the-Maine, Brunswick, and Rixdorf excited special notice. [Since the above was written, two more large warehouses have been burnt out at Solingen and Brunswick, and the newspapers give "short-circuiting" as the origin of the outbreaks.] Even the ladies who patronize these establishments have of late been asking what this dreadful short-circuiting is. Yet there has just appeared an order of a German police authority, which permits the use of electricity *only* in the warehouses, and prohibits gas entirely. In this case, the question which the Landgraf puts to Tannhäuser, in Richard Wagner's opera, after he had been away a long time for well-known reasons: "Tell me, where have you been tarrying so long?" could quite appropriately be asked the technical adviser of the police authority.

We need scarcely look among the upper and lower classes of our people for proof of the truth of the Emperor's words, "We need very much technical knowledge throughout the country." But how is this better technical knowledge to be secured? The technical colleges can only provide one factor in the problem, even though they are yet further moulded and supported according to their own wishes. The starting-point for an extension of technical knowledge must be reform in the upper schools and of the disability Acts. Thanks to the opportune action of the Emperor, these are now down on the "Orders of the Day," and will not easily be struck off, however great may be the opposition, which, according to him, will be directed against them with redoubled force. The Association of German Engineers has, moreover, done a special service in this direction by its pronouncement on behalf of the body of scientific engineers. We need here only direct attention to the valuable speeches made at the meeting on the 5th of May in Berlin, without repeating the views expressed there and elsewhere on the classical and practical scientific training. It is specially the duty of our Association, which is concerned with such important public interests and functions, to take up a position on some at least of the main issues of the question, and endeavour to wipe out the greatest of the prejudices which have always involved it.

We engineers cannot reiterate too frequently how deeply we respect, and are grateful for the past and present work of, the classical grammar schools and universities, and how we look to these schools for great results in the future. We cannot overemphasize how far are we from wishing that classical studies should be made to play a quite subordinate part. But classical training has served in the past as the only equipment for all the higher professional callings—just as the monasteries in still earlier times were responsible for all deep learning and not merely for the study of divinity. Modern times, with their manifold problems requiring educational training, undoubtedly demand a more far-reaching distribution of work in the teaching of our subsequent special scientific studies. Such is the consequence of the continually increasing number of subjects of scientific education, and the impossibility of extending further the time spent at school. At one time, the courses of instruction of the technical colleges could be framed so that the first two terms were devoted to making up for the defects in mathematical and physical training of those who had just left the grammar-schools. At an earlier period, when our international commerce was in its infancy, a knowledge of foreign languages could be acquired incidently as occasion might demand. To-day, however, international competition has become so keen, that a much more profitable use must be made of time; and, owing to the greatly increased number of fields of scientific knowledge, sound, but not one-sided, instruction in mathematical science and languages must be given in practical lower and upper schools.

I cannot, however, make it my business now to do more than glance at the rich field for discussion which this disability or qualification question presents. But I would refer you in particular to the speeches and writings of Privy Councillors Riedler and Slaby, who have championed this cause. There is one point, however, which has been passed over lightly in the discussions of this question, which I consider of great importance. It has not failed to escape the keen observation of the Emperor, who has expressed a wish, in the course of the speech already quoted, that the best families of the country would train up their sons for technical pursuits. While we all heartily endorse this wish, we are aware that its fulfilment is practically out of the question so long as the qualification rules give privileged positions only to those who have passed through the grammar school curriculum. Thus, certain old families traditionally retain great influence, and secure important positions, which are not accessible to engineers or others who have had a technical or business training. Yet at the present time, when the commercial development of Germany is becoming of so great importance, and our foreign commerce is assuming immense significance, it is highly desirable that these technical men also should have their share in the affairs of the State. Moreover, in consequence of the privileges accorded to those who have passed through the grammar schools, not only do the sons of families in the upper ranks of society receive their education there in order to be in a position to occupy the higher positions in the State, but even those of us who are in the less exalted ranks of society are constrained to select the same schools in order that our sons may not be under any disability. Thus it comes about that the more practical and commercial schools do not secure the best material in the first instance. People send their most promising sons to the grammar schools, in order that they may not be restricted in the choice of a career, and that the higher public and social positions may be open to them. It therefore comes about that the raw material with which the grammar schools and the practical and commercial schools have to deal, is by no means of the same quality.

In place, therefore, of technical knowledge being promoted

in the country according to the Emperor's wishes, the leaders in technology are drawn from an inferior grade of men. Those who have passed through the science schools often are noticeably lacking in general education and address. Their faults must not, however, be laid at the door of science, as such accomplishments are to be acquired from no school or college, but only in the social atmosphere of the old families of the land. And as those who are naturally favoured by high position and birth proceed to the grammar schools as a matter of course, it is small wonder that those who have succeeded in attaining good positions in technical spheres frequently do not appear well fitted to fulfil the duties of leaders and rulers. If, however, the best families would follow the Emperor's behest, and devote their sons to technical pursuits, matters would be otherwise. Before this can happen, the upper science schools must be given an equal position with the grammar schools of the country.

It is frequently alleged that if all the professions were opened freely to those trained in other schools than the grammar schools, the learned professions, especially those of medicine and law, would be overcrowded. But, on the other hand, if the stamp of inferiority were removed from the practical and science schools, many of those who now betake themselves to the grammar schools would instead apply themselves to practical technical pursuits; and the older professions would, in reality, be less overcrowded. Indeed, the number of grammar schools, especially in the smaller towns, would probably decrease; and there would be fewer anxious to join the older professions.

When the relative advantages of the classical and scientific education are being considered, we can point to the fact that those who have raised themselves to the foremost positions in industry or commerce have shown themselves anxious to fulfil not only their statutory, but their ideal moral obligations to the people. The intelligence and insight which they have acquired in practical affairs especially adapt them to give practical effect to plans of idealists for the welfare of the people. And especially to indicate how the vocation of engineer is in no sense antipathetic to the comprehension and elaboration of the ideal in life, I may call attention to one of the best known and appreciated of our modern poets—viz., H. Seidel. Only a few of those who enter the great station of the Anhalt Railway in Berlin, which in its time was the largest on the Continent, guess that it was constructed by this poet, who was for over seven years a very active and capable engineer. He afterwards became a poet. He has himself recorded that only those who have no conception of the creative and fertile activity of the engineer would suppose that when his mind and imagination were afterwards turned in search of the ideal, they were cut off entirely from his earlier professional pursuits.

As further illustrations of the truth that the higher technical knowledge and intelligence rise, the more naturally do men turn to the embodiment of the ideal in life, I may mention that a deceased honorary member of our Association was a dramatist, and another honorary member and engineer founded the German Shakespeare Society. It is my opinion that in all circles, whether the training be classical or otherwise, individual temperament and upbringing play a far larger part than does the training adopted.

The present Gutenberg festival celebrates, as Count Posadowski pointed out when he opened the Gutenberg Hall, the far reaching intellectual benefits which have sprung from the one technical advance of the invention of moveable type by Johann Gutenberg more than four-and-a-half centuries ago. But as Privy Councillor Riedler has pointed out, printing is but *one* of the technical agencies for disseminating culture. The printing press, the telegraph, and means of communication are some of the agencies by which technical advances have facilitated the spread of civilization to the common good. The last five decades have witnessed greater intellectual advance, due to technical collaboration, than did probably the whole period from Homer to the nineteenth century. Goethe also expressed to Eckermann his opinion that the good roads and railways of Germany would effectually prevent her disruption! For the sake of her intellectual advance, and her position in international commerce and affairs, we may hope that the deep-rooted opposition in Germany to the movement for placing all the higher schools on an equality will be supported, even by the privileged classes. At the present time, the success of this movement is more than ever essential to the country's welfare. Absolute freedom for every superior calling is a necessity of the age; and we must bestir ourselves in our own sphere of influence to place this question uppermost—not merely for the sake of our engineering profession, but for the general intellectual and cultural advance of the German nation.

It is of supreme moment to us, and our very position in the world is wrapped up in it. We must not confine our attention to abstract principles and theories, but above all dutifully perform the social tasks which the Emperor deems to be equally important with our advances in science and practical affairs. In aiding in the solution of social problems, in disseminating technical knowledge throughout the country, and in making provision for the welfare of the people, we shall find a worthy ideal in and about our life's vocation. By such means we shall help to stem the flood of materialism. Arm in arm with science, we may thus obey the mandate of the Emperor that we should apply ourselves with all our strength to the great economical and social problems of the age.

REPAIRING A SUBMERGED WATER-MAIN.

In the course of a paper read by Mr. D. W. French at the last meeting of the American Water-Works Association, he gave the following account of the repair of a 30-inch submerged water-main:—

The 30-inch main which forms the subject of this paper is one of three force mains which connect the principal pumping-station of the Hackensack Water Company (reorganized) with their reservoirs at Weehawken (N.J.); the distance between the two points being practically 14 miles. The main in question is not laid the entire distance between the pumping-station and reservoirs, but is connected to a 20 and 24 inch main at Ridgefield, 10 miles from the pumping-station. The main was laid during the season of 1897-8; and after being carefully tested between each gate as the work progressed, was brought into use in April, 1898, and continued in service without any interruption until the afternoon of Aug. 19, 1898. Then the pressure of 102 lbs. at the pumping-station, against which the engines were working, suddenly dropped so low that it was evident that a serious break had taken place somewhere on one of the force mains. These extend over a distance of practically 40 miles, and at several intersections are connected with each other. At the time the break occurred, the engines were running with these connections all open, in order to reduce as much as possible the working pressure, and consequently the cost of operation. As the distance to be covered was so great, considerable time was taken up by the men in getting to the gates which had to be shut; but as soon as the connections were closed, which enabled us to prove each main separately, the difficulty was found to be with the 30-inch main, and the break was finally located at a river crossing, on the bed of which the main lies, and over which there was 11 feet of water at low tide.

With the 30-inch main out of commission, and crippled in a place which made its repair a question of weeks rather than days, with the daily consumption over a million gallons greater than what could be delivered through the 20 and 24 inch mains, even after raising the pressure to 120 lbs., and with a stock on hand of 20 million gallons, it was decidedly too evident for comfort that more water must be delivered into the reservoirs at Weehawken than it was then possible to send, that we must run at the pressure named on the 20 and 24 inch mains, or else prepare for a water famine as gracefully as possible.

About 2500 feet north from where the break occurred, the street in which the 30-inch main is laid intersects a turnpike road, along which the 20-inch main lies; and from this point south the mains are parallel with each other for practically a mile. About 300 feet north from this point of intersection there is a gate on the 30-inch main, which is the first gate north of the break, and consequently closed. I felt positive that, if the 20-inch main was connected to a point on the 30-inch main above the closed gate, and water delivered through the latter from the pumping-station into the former at this point, the advantage would be the loss of friction between these two places, and would result in an increased delivery of from 2½ to 3 million gallons per day.

As we were fortunate enough to have sufficient material on hand to make this connection, which required 300 feet of 20-inch pipe, a 30 in. by 30 in. by 20 in. branch, a 20 in. by 20 in. by 20 in. branch, a 20-inch gate, bends, &c., work was commenced early the next morning, and, by working continuously with alternate gangs, was completed late in the night of the following day. After this connection was opened, we were able to deliver 12½ million gallons per day at 120 lbs. pressure, which showed the effective value of the bye-pass to be 3,150,000 gallons per day. This was also emphasized a week later, when, due to the exceedingly warm and dry weather, the daily consumption exceeded 13 million gallons.

The method adopted in making the repair to the 30-inch main is not based upon any established precedent, so far as I know, but upon what seemed to be the best, quickest, and cheapest way to accomplish the result. It seemed practicable to make the repair in two ways—either by sinking a caisson in the usual manner, or by raising the pipe from the bed of the river high enough above low tide to permit the removal of the broken length and the substitution of a new one. After looking at the case from all sides, it seemed that the latter method was practicable, and that it could be done more quickly and for less money than the former.

After engaging a pile driver, scow, tackle, and diver and his apparatus, and making provisions for such other requirements as were needed, the work was commenced. On the first examination, the diver reported that he had found the broken pipe, which was of the Ward joint type, cracked on the bell end, parallel with the axis of the pipe, and very near the top, and that the slit followed along the pipe for about 3 feet, then turned at an angle of about 90°, and passed round for a distance of about 3 feet. He reported that the opening was 1½ to 2 inches wide.

The river across which the pipe lies is practically 500 feet wide, but the location of the broken pipe was about 100 feet from the north shore at low tide, and exactly in front of a draw in a bridge which crosses the river at this point. In general, the method of operation decided upon was to drive piles in bents, in the centre of each length of pipe, from the shore out to the break, cap the piles with 12 in. by 12 in. yellow pine, break out a length on the

shore above the tide, and raise the pipe gradually and intact about 3 feet above low water, and hold it suspended while the broken length was removed and a new one substituted.

In order to facilitate the work, it was first necessary that the pipe should be free to move endwise on the shore end, otherwise, in raising it from its bed, we should be lifting against an inverted arch. Some difficulty was experienced in breaking the shore pipe, which is 1⅛ inches thick, and weighs 550 lbs. per foot; but it was finally accomplished, after several unsuccessful attempts, by the use of dynamite.

As soon as the piles were driven and capped, the diver passed round the centre of each length a heavy chain, to which was hooked a three-sheave block and fall, which was hung from an eye-bolt in the cap-piece on top of the piles. When everything was in readiness, the process of lifting was commenced, which required a considerable time, as only a short lift could be taken at any one time, and every change from one tackle to another involved the moving of the pile driver from which power was obtained. Measurements were taken almost continuously from the surface of the water, which served as a good level, in order to guide the work, and to make sure that the joints were not being unequally strained.

Some difficulty was experienced in starting the pipe from the bed of the river; but after it was started, the lifting continued until the pipe was several feet above the bed, and the weight, which represented 60,000 lbs., was supported by the piles and capping. By rigging up another block and fall from the shore end of the pipe, which was now suspended, to the mainland, very little difficulty was met with in separating the two lengths, as the crack in the bell was about 2 inches wide, and did not therefore offer much resistance.

After this was done, the broken pipe was raised until it was about 3 feet above low tide, which enabled us to cut off the broken pipe and remove the spigot from the adjoining bell. With this part of the work done, it now remained to raise the end still lying on the bed of the river to the same level as the first section, which was accomplished by driving fourteen more piles in seven bents, capping them as in the previous case, and repeating the operation of lifting.

After the pipe was raised to the proper level, a new length was put in place and the joints run; and the work was then ready for the final lowering. As the pipe when ready to lower formed an arch, the radius of which was about 100 feet, and in its descent the arch must necessarily be reversed, it was absolutely necessary to keep the pipe, from the break inshore, suspended so that it would be free to travel endwise, until the balance of the section picked up was down on the bed of the river, after which the inshore end was lowered into its place. Before making the final connection on shore, the end of the pipe was plugged, and the section in the river tested for leakage.

After the pressure had remained full on for an hour or more, it was turned off, and the falling of the pressure, as shown by the gauge, was satisfactory evidence that there was some leakage at the joints, due to their movements in raising and lowering. These leaks, which were several in number and all small, were found, and made tight by the driver. After the testing was completed, the final connection was made, and the main again put into commission; the repairs having been made in 15 days, at an actual cost of $2258. The cost of material and labour for making the bye-pass connection was $1300; so that the total cost amounted to $3558. When the break in the river took place, it was accompanied by an effect which, in my experience, was unusual. The distance, as already stated, between the pumping-station and the break is practically 10 miles south, and yet about a mile north of the pumping-station a 12-inch main, and 1½ miles south two 6-inch mains, were broken simultaneously.

Utilization of Water Power in Italy and Spain.—We learn from the "Electrician" that plant is to be put down, by La Società Ferrovie e Tramvie Elettriche Varesine, to utilize the water power of the Giona stream for the generation of electric energy. At first three large 500-horse power alternators driven by turbines are to be provided; electric energy being utilized in the operation of the Luino-Varese electric tramway and for lighting and power purposes generally. It is proposed to instal a plant to utilize the water power of the River Ottaven, in Galicia, for the generation of electric energy, and to distribute it to a number of small towns in the district.

Electric Traction.—At the meeting of the Society of Engineers on Monday last week, Mr. Algernon H. Binyon read a paper on "Electric Traction." He said that in London tramways—horse and cable—carried 309,000,000 passengers, or 45 per cent. of the total traffic; the underground railways 128,400,000, or 19 per cent.; and the omnibuses, 248,600,000, or 36 per cent. The whole population of London—5½ millions—travelled 124 times in a year; while the New York population of 3¼ millions travelled 210 times yearly. He favoured the overhead trolley system, used in nearly all English towns, as being the most efficient and economical, especially the form known as the side trolley system, which obviated the unsightliness of very long brackets. In combining lighting and tramway plant, Mr. Binyon advocated the use of completely separate dynamos and mains. He recommended the use of meters in cars, and said that from 30 to 40 per cent. of the waste caused by the careless handling of controllers could be saved.

REGISTER OF PATENTS.

Treating Earthy Oxides in the Manufacture of Incandescent Mantles.—Daix, V., of Paris. No. 10,083; May 12, 1899.

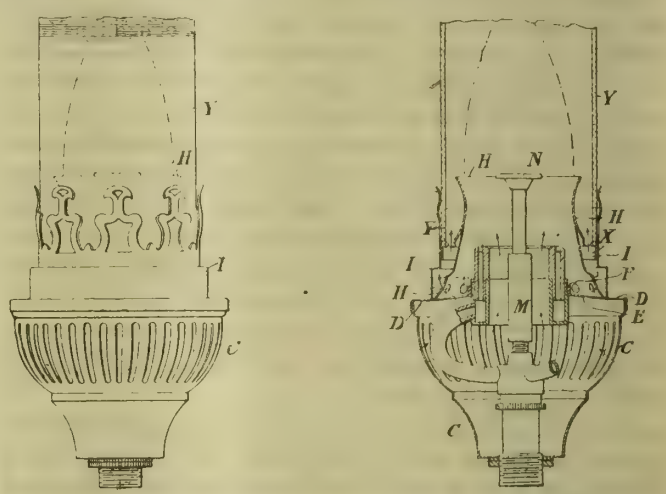
This invention relates to the treatment of ordinary earthy oxides—such as lime, magnesia, baryta, strontia, &c.—with a view to their employment in incandescent gas lighting.

The treatment consists in combining the oxides with sugar, glucose, or other combinations containing carbon, to form "sucrates, glucates, or other similar combinations," which, after being burnt, leave a carbonaceous residue that preserves the oxides from the action of gases and the moisture of the atmosphere. Under the action of heat, the sugar, glucose, and the like entering the salt, loses its moisture, becomes decomposed, and nothing remains but a carbonaceous residue, in the pores of which the oxide is lodged, whereby it is rendered insensible to the action of the moisture and atmospheric vapour produced by the combustion of gas. To the sucrates of ordinary earths, may be added oxides of rare earths—yttrium, thorium, zirconium, &c.—according to the colouring desired for the incandescent body.

In order to further strengthen the incandescent body, the patentee proposes to cover wires made of platinum or aluminium, with the salts, or with asbestos in a naked state, or wrapped in cotton, flax, or hemp fibres.

Circular Flame Gas-Burners.—Darby, H., W., & I., and Punchard, J. H. & W. C., of Cannon Street, E.C. No. 10,616; May 19, 1899.

It is claimed that, by the use of this invention, "novel and striking effects" are produced—"the flame having very much the appearance of the present well-known incandescent gas-burner with mantle, although no bunsen burner is employed, and no mantle is used or intended to be used."



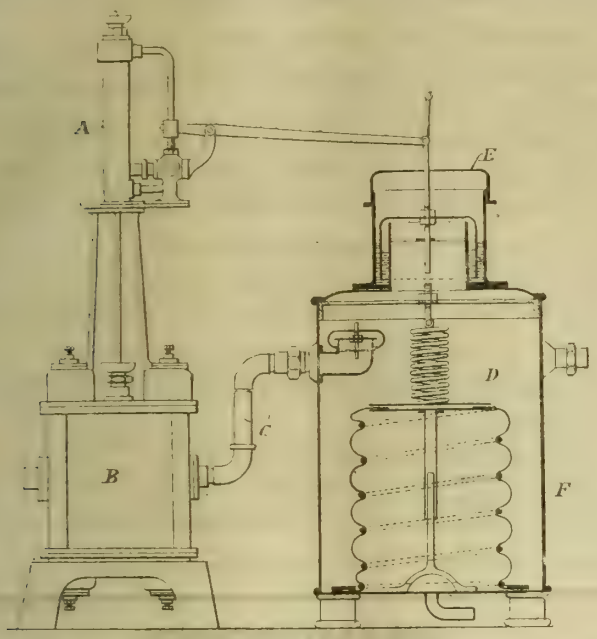
D is a horizontal flat rim or ring with downwardly-extending flange, within which latter the basket C is held in position. E are inwardly-extending arms which carry the central collar or burner-mount F. H is a cone or hood mounted concentrically with the burner, and secured to the upper side of D—at a point a little outside its projecting inner edge. As the hood extends upwards, it contracts until above the top edge of the burner, and then is widened out and terminates at a point about ⅜ inch above the top of the burner. At the lower part of the hood H there is a clear annular space between the exterior of the burner and the inside of the hood, which latter, near its bottom edge, is provided with a series of apertures leading into an annular enclosed air-heating chamber X, formed between the outer side of the lower part of the hood and the jacket I. This latter is provided with a series of outlet-apertures within the interior diameter of the chimney Y, so that, when the chimney is in position, a supply of heated air will be led through the outlets from the annular chamber X, in between the inside wall of the chimney Y and the exterior of the upper part of the hood; and such supply of heated air is caused to impinge on the exterior of the flame just as it rises above the top edge of the hood. M is a vertical central post fixed to the burner; and mounted on it is the button or flame "spreader" N, supported level with the top edge of the hood.

The air supply entering through the basket or restrictor C is led to the flame by three separate annular passages—namely, (1) through the central annular passage formed inside the burner, between the post M and the inside wall of the burner; (2) through the annular passage formed between the outside of the burner and the inside of the lower part of the hood; and (3) air (coming from the annular heating chamber X) is led through the annular space formed between the outside of the upper part of the hood and the inside of the lower part of the chimney Y, and impinges on the outside of the flame as the latter emerges above the top of the hood. Upon lighting the gas coming from the burner, these several air-currents, "acting in conjunction with the special arrangement and construction of the burner, cause the flame to produce a brilliant light, while the spreader acting in conjunction with the hood and arrangement of air-currents causes the flame to assume a somewhat conoidal or conical form, as indicated by the dotted lines."

Compressing Gases for Lighting Purposes.—Sugg, W. T., of Westminster. No. 12,870; June 20, 1899.

The patentee remarks that in incandescent gas lighting (as is well known) the heating medium—a mixture of gas and air—must be under a certain amount of pressure to produce any result at all, and the greater the pressure, within reasonable limits, the better the light. In places where the pressure is not sufficient, it has been proposed to increase the pressure in an installation by mechanical means—water or other suitable power. In such apparatus, it has been found desirable to have an arrange-

ment to cut off the supply of motor fluid when the pressure in the apparatus exceeds that required for the gas-burner. It has also been found that the light fluctuates: First, when the pressure-increasing apparatus is changing its direction; and, secondly, when the cut-off acts too rapidly, which it is liable to do. The object of the present invention, therefore, is to combine a cut-off with means whereby this fluctuation will be prevented.



A is a water or other motor, and B is a gas compressor of any approved type. C is the pipe leading gas from the compressor to a receiver D—a valve being provided for preventing back-pressure against the compressor. On the summit of the receiver, is arranged the automatic cut-off for the motor. This preferably consists of a gas-bell dipping into a mercury well, and supporting a vertical rod adapted to operate a lever connected with the supply-valve of the motor. E is a casing enclosing the gas-bell and other parts connected therewith—all of which are described in patent No. 21,144 of 1898.

The action of the automatic cut-off (as is well understood) depends on the rise and fall of the bell weighted to the desired extent, according to the pressure within the receiver D. Co-operating with this cut-off, is what the inventor proposes to term a flexible piston F, which is capable of collapsing under undue pressure of gas, and of expanding again when the pressure is reduced. This piston is situated within the receiver D, and is attached to the bottom of it, through which there is communication with the air to the interior of the piston. The piston is supported, either from above or below, by an adjustable tension-spring attached, in the former case, to a fixed cross bar, and provided circumferentially with a coiled spring, as shown.

The employment of the flexible piston F has the effect of neutralizing the fluctuations which arise from the action of the compressor, by relieving the cut-off from the shocks and irregularities incidental thereto. "Regularity of pressure in the receiver is thus maintained, and a maximum efficiency as regards gas pressure is assured."

Cement for Caulking Retorts, Pipes, &c.—Woodhouse, S. J., of Leeds. No. 13,573; June 30, 1899.

This "non-porous and non-shrinkable cement" is composed of fire-clay (raw or burnt), cast iron (or cast iron and steel) borings, glass (or pottery) refuse, and lime (or forge slag); the whole being ground to a fine powder and thoroughly mixed, preferably in about the following proportions: Fire-clay, 50 per cent.; cast-iron borings or steel borings, 25 per cent.; glass refuse, 12½ per cent.; and forge slag, 12½ per cent. The proportions are slightly varied, according to the degree of heat to be sustained. Thus the proportions given are suitable for joints or parts which are to be worked at a white heat, while for hydraulic and steam joints, or any joints worked at comparatively low temperatures, the amount of fire-clay and borings would be slightly increased—the glass refuse and forge slag being correspondingly decreased.

When required for use, the cement "is mixed with water to form a paste of suitable consistency, which, when applied, sets into an absolutely non-porous, non-shrinking, and non-expanding mass."

Illuminating Media for Incandescence Gas Lighting.—Apt, J., of Berlin. No. 16,053; Aug. 5, 1899.

The process of manufacturing incandescent bodies or illuminants by means of such compounds of thorium and cerium as will withstand high temperatures, and are not liable to change into oxides during the combustion of the fabric, but remain undecomposed, has already been described (the patentee remarks) in patents No. 2000 and No. 14,448 of 1896—the arsenates and antimonates having, according to these patents, proved especially suitable for this purpose. It has, however, been found that incandescent bodies thus manufactured can only be kept in good condition for a very limited period, as the commercial nitrates of the rare earths are highly acid; and, moreover, under the action of arsenic acid, &c., upon such earths, nitric acid is disengaged, according to the following reaction:—

$$2H_2O + Th(NO_3)_4 + 2As_2O_5 = Th(AsO_3)_4 + 4HNO_3.$$

This nitric acid very rapidly destroys the threads or fibres of the support, and renders them unfit for the further operation upon the incandescent body—the "burning off." Incandescent bodies produced in accordance with the processes have the further disadvantage of being highly hygroscopic. Consequently, the insoluble arsenates will react with the disengaged nitric acid according to the following formula:—

$$Th(AsO_3) + 4HNO_3 = Th(NO_3)_4 + 2As_2O_5 + 2H_2O.$$

Hence the soluble constituents are gradually dissolved out of the fabric, and the quality becomes impaired. This defect is specially noticeable in factories where the incandescent bodies are not "burnt off," but which only supply the impregnated fabrics ready for being "burnt off."

To neutralize the nitrate solution by ammonia is, under the circumstances, inadmissible, seeing that even on adding only a single drop of it, oxides will be precipitated. It is equally impossible to subsequently treat the impregnated fabrics with ammonia; since, instead of the desired arsenates, only oxides will again be obtained. Attempts have, however, been made to obviate this disadvantage by employing the borates, arsenates, and antimonates in a highly basic state; but this again has the great disadvantage that the bodies are entirely insoluble, and it is consequently only possible to cause them to deposit from a state of suspension upon the fabric, or to rub them in a solid state. Incandescent bodies manufactured in this manner are quite useless, as it is impossible to obtain an even distribution of the material applied, and the latter during transport, &c., is liable to fall off, owing to it adhering to the fibre only externally, and not penetrating it. The fabrics thus impregnated are, moreover, useless, for the reason that, since the substance adheres but loosely to the outside, it is neither admissible for the fabric to be "burnt off" nor to be acted upon with compressed gas.

The object of the present invention is to produce incandescent bodies by soaking the fabric in special solutions, suitable for this purpose, so that within the fabric itself insoluble neutral compounds of the rare earths are produced, such that a decomposition due to disengagement of acid is entirely impossible; and hence these incandescent bodies are "distinguished by an extraordinary durability and light-emitting power."

To employ those basic arsenates and antimonates indicated in the patents already referred to, is not possible in the case of the present invention, because actual solutions must be operated with, and not substances merely in suspension. The patentee has, however, discovered that it is possible to produce fabrics which contain only insoluble salts—arsenates and antimonates—besides neutral nitrates, and which are entirely free from acid, so that any corrosion of the fabric by the intensely hygroscopic property, in view of the re-forming of the soluble salts in connection therewith, as well as any deterioration in the quality, are avoided.

For this purpose, the fabric is not soaked in a mixture of the nitrates and arsenic or antimonic acid, but is first soaked in a solution of basic nitrates of the rare earths, and subsequently in so much arsenic acid or antimonic acid as to correspond in quantity to the free oxide contained in the basic nitrate. The manufacture of the solution of the basic salts, which forms an integral part of this process, is effected by mixing, in the proportion of one to two, an aqueous solution of commercial nitrate with freshly precipitated and well lixiviated thorium hydroxide; the mixture being then heated (preferably in tubes closed by sealing or fusion), to a temperature varying between 140° and 150° C. In this operation, the hydroxide combines with the nitrate to form a basic compound, which cannot be obtained in a solid and soluble form, but which at the same time does not precipitate even on cooling.

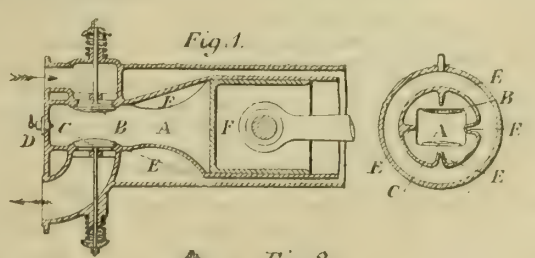
In this manner, basic nitrates can be obtained which (dried at 100° C.) contain as much as 70 per cent. of oxide, while in ordinary nitrate only 48 to 49 per cent. is contained. These basic nitrates correspond to the formula: $Th(NO_3)_4 - 2ThO_2$. The fabrics are first impregnated with this solution, and then, while still moist, are impregnated with a solution of arsenic acid or antimonic acid, and dried; insoluble arsenates or antimonates being formed during this process without any nitric acid being set free. Thus:—

$$3\{Th(NO_3)_4 - 2ThO_2\} + 8H_3AsO_4 = 3Th(NO_3)_4 + 2Th_3AsO_4 + 12H_2O.$$

The concentration of the solution of arsenic acid should be such that the amount of arsenic acid corresponds to that of the oxide contained in the basic nitrate.

Combustion Chambers of Internal Combustion Motors.—Lindemann, O.; a communication from E. Körting, of Hanover. No. 7208; April 18, 1900.

In internal combustion motors in which the charge is compressed before ignition, it is necessary (the patentee remarks) to cool the charge while it is being compressed, if it is desired to avoid the objections dependent on such high compression and temperature of combustion. By this invention, the cooling is effected by enlarging the cooling surfaces in the combustion chamber, for which purpose either the walls themselves are provided with folds or ribs, or a specially cooled body of metal is placed in the chamber.



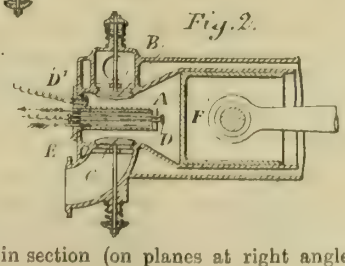


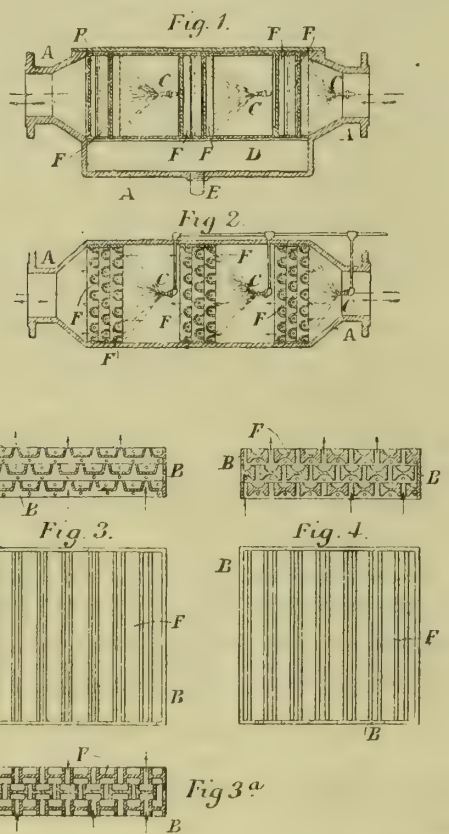
Fig. 1 shows in section (on planes at right angles to each other) a combustion chamber provided with folds or ribs. A is the chamber,

with its valves B and C, for admission and exhaust. E are the ribs and folds, by means of which the cooling effect of the water-cooled walls is carried near to the middle of the chamber. F is the piston, and D the igniter. The number of folds or ribs and their surface are determined by the degree of compression and the capacity of the chamber; also by the ignition and dissociation temperature of the gases—the general rule being that the cooling surface is larger in proportion as the capacity of the chamber or degree of compression is increased, and as the dissociation or ignition temperature is lower.

Fig. 2 is a section of a combustion chamber A, provided with a cooled metal tube E projecting into it. On the end of the tube is an electrical igniter D; and another such igniter D^1 is placed at the bottom or end of the chamber. This arrangement of igniters renders the combustion of the charge "quick and certain."

Purifying Gases.—Lindemann, O.; a communication from E. Körting, of Hanover. No. 7209; April 18, 1900.

Gases which contain impurities consisting of fine dust or smoke particles (it is pointed out by the patentee in his specification) cannot, except with great difficulty, be completely freed from these while they are dry. The present invention relates to purifying apparatus in which the gases, before arriving at the place of purification proper, are artificially moistened with a liquid spray. The separation of the dust particles is then effected at the same time as the drops or vesicles (and the liquid formed from these) serve to carry off the dirt. The accompanying drawings illustrate a purifying apparatus of this kind.



In figs. 1 and 2, A is a covered box in which are arranged (behind one another, and separated by intervening spaces) three sets of frames F, each consisting of three rows arranged close together, in such a manner that they nearly touch the walls and the cover. The bottoms of the intervening spaces are covered with plates. Under the frames and the cover-plates there is a space D. Between each set of frames there is arranged a spray-nozzle C or several of these, which fill the intervening space between the sets of impact frames with a fine liquid spray, which mixes with the gas and flows with it through the next set of impact frames, where the moisture is precipitated along with the dust, and drips down into the space D, whence it flows away by the pipe E.

The frames in which the impact surfaces are arranged (constructed according to known principles), in general, are provided with vertical rods, between which are slots through which the gas flows. The rods and slots in each of two successive frames are so arranged that the rods of one frame are opposite to the slots in the next frame; so that the gas which flows through the slots of the one frame strikes against, and is deflected by, the rods of the other frame, and the particles of dirt remain attached to the impact surfaces.

Fig. 3 illustrates frames constructed in this manner, which are provided with straight impact surfaces. B are the frames, with rods of U-shape in cross section. The two vertical edges of two adjacent rods form between them the slot for the passage of the gas. At the foot of the rods holes are provided in the frames which allow the precipitated matters to flow off. Fig. 3a illustrates a similar frame in which the rods are H shaped in cross section, instead of U shaped; so that the gas is compelled, after flowing through the slots between the bars, to return to the rearward hollows of the same bars before it passes into the slots of the next row of bars. Thus a powerful eddying action is produced "that promotes considerably the aggregations and precipitation of the non gaseous particles."

Fig. 4 shows a construction of the impact surfaces which is similar to that of fig. 3a, but with the difference that these surfaces are made concave on both sides, so that there in a constant deflection of the current of gas on its way from the slots of one row of bars to the slots of the next row, combined with a correspondingly powerful centrifugal pressure of the heavier particles of moisture and dirt against the bars, "increasing their adhesion, and the consequent dripping or trickling down."

APPLICATIONS FOR LETTERS PATENT.

10,238.—Swain, A. C., "Gas-generating apparatus." June 5.
10,255.—Edgeworth, T. F., "Gas heating-stove." June 5.
10,300.—Whittle, A., "Illuminant appliances for gas-burners." June 5.
10,329.—Gans, P. F., "Igniting apparatus for explosion engines." June 5.
10,354.—Evans, W., "Globe-holders for incandescent gas-burners." June 6.
10,358.—Clark, A. M., "Pumps for exhausting or compressing gas or air." A communication from Pokorny and Wittekind. June 6.
10,431.—Davis, H., "Incandescent burners and fittings." June 7.
10,432.—Bower, G., "Mixing and burning inflammable gas and hydrocarbon vapours and air for the production of light, heat, and power." June 7.
10,433.—Bower, A. S., "Generating illuminating gas from metallic carbides." June 7.
10,442.—Grabowski, G., "Igniting device for lamp-burners." June 7.
10,461.—Wright, J. W. B., and Darwin, H., "Gas boiling-burners.' June 8.
10,467.—Prunell, T. L., "Operating the taps of gas-lights." June 8.
10,514.—Bower, A. S., "Carburating and increasing the pressure of combustible or incombustible aeriform fluids for the purposes of heat, light, or power." June 8.
10,515.—Glover, J. G., "Gas-lighting torches." June 8.
10,574.—Wünsche, R., "Generating gasoline gas." June 9.
10,583-4.—Green, W. O., "Gas and other meters." June 9.
10,588.—Schniewind, F. W. C., "Enrichment of gas." June 9.
10,589.—Schniewind, F. W. C., "Treatment and utilization of gases." June 9.
10,591.—Sieverts, W. H. A., "Incandescent gas-burners." June 9.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Carpenter-Brackenbury-Winstanley Controversy.

Sir,—I hope the accident of following one's vocation in London is not generally considered a disqualification for forming an independent judgment upon any particular process—especially after trying it. I do, however, protest against the suggestion of the existence of a geographical delimitation of area within the pale of which honest convictions do not flourish, or are incapable of formation.

I feel sure your correspondent will be the first to withdraw such an implication when he knows more of those against whom it is levelled.

Charles Carpenter.

June 16, 1900.

LEGAL INTELLIGENCE.

A Disputed Gas Bill.

At the Westminster County Court last Thursday, the Gaslight and Coke Company sought to recover £7 5s. 10d. from Thomas William Everard, a laundryman, for gas supplied to premises in Worship Street, E.C. The defendant signed the usual contract, and gas was supplied and paid for for some years. No notice of discontinuance was given; but when the above-named amount was demanded, defendant said a Receiver in Chancery was in possession, and as he had paid the rent and all other charges, and took all the profits, he must pay this. His Honour, in giving judgment for the plaintiffs, said the agreement was binding; and until notice was given defendant must pay.

Claims Against the Newport Gas Company for Wages.

At the Newport County Court last Thursday, his Honour Judge Owen had before him a series of actions arising out of the recent dispute between the Newport Gas Company and their employees (*ante*, p. 1559). In the first case taken, Mr. Maney, a yardsman, sought to recover 19s. 6d., a week's wages, in lieu of notice. The evidence showed that on the 13th of April, and some days after, 24 men, members of the Gas Workers' Union, had been discharged. The plaintiff was asked, after he had done a day and a quarter's work—from 6 a.m. to 7 p.m.—to go and wheel coal in the retort-house. He said he could not wheel coal in such a hot place, and would not try it, especially after the long day he had done. Thereupon the foreman said they had had enough of him, and told him to go. Next morning, by direction, he received 3¼ days' pay, and now claimed the full week in lieu of notice. Mr. Whitfield, the Superintendent, said plaintiff was engaged as a general labourer, not as a yardsman. The plaintiff had often been very stubborn, and he and 26 more had to be discharged. Plaintiff and others were having meals on the premises, and plaintiff absolutely refused to help with the newly-imported men. Next morning he pressed plaintiff to return to his work; but he demanded his money. Witness did not tell plaintiff to go into the retort-house to work, but to return so as to be ready to help in case he was wanted. Another action to recover 21s. for a week's wages in lieu of notice was brought by Albert Smith, service layer's labourer, engaged in outside work, who on the 1st of May was asked after his day's work to unload coal and load coke inside the works. This plaintiff had, however, signed a discharge in full for 16s. 8d. Ivor Jeffries, a yard hand, also claimed a week's wages. He returned to work on the Saturday evening (April 14), and worked several hours; but on being asked to wheel hot coke in the retort-house he declined. He was one of the men fined for intimidation by the Newport County Magistrates (*ante*, p. 1454). His Honour held that Smith and Jeffries had discharged themselves; and he gave judgment against them. He allowed Manley's claim, and also one for a guinea to a fourth complainant, John Colen, who was called to work in the yard, and was afterwards ordered into the retort house.

MISCELLANEOUS NEWS.

WELSBACH INCANDESCENT GAS-LIGHT COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held on Friday last, at the Cannon Street Hotel—Sir Henry Burdett, K.C.B., in the chair.

The Secretary (Mr. W. R. Few) read the notice convening the meeting; and the report of the Directors (which was noticed at length in last week's "Journal," p. 1559) was taken as read.

The Chairman said it was a great pleasure to him to meet the shareholders, because he always felt that, whatever else might be uncertain, there was no doubt but that every director, and every chairman, must regard himself as being the servant of his shareholders, whose interests it was his duty to use his utmost powers to protect and further. He was very glad to see so many shareholders present; for it showed the great interest they took in the affairs of the Company. He could quite understand there might be questions to answer; and possibly there might be amendments to move. The business before the meeting was very important; and first of all he would take the report a little in detail. They would observe that the gross profit on the trading of the year to March 31 last, on the plan previously adopted in preparing the accounts, was £170,553, as compared with £155,914 in the previous year. The gross profit, however, instead of appearing in the balance-sheet as £170,553, was shown as £159,029 only, owing to certain re-arrangements of the accounts made at the suggestion of Mr. Peters, who commenced his duties as Managing-Director on the 1st of January last. The object of these re-arrangements had been that the accounts in future should show more precisely the trading results, and therefore be more satisfactory to the shareholders. The alteration, however, did not affect the result shown by the accounts—namely, an increase in the gross profit as compared with the previous year. These figures, whatever else they might show, proved the progressive character of the business done by the English Company; and they could not, therefore, fail to be satisfactory to all possessing any knowledge of the true interpretation to be placed upon the figures of a commercial business of such an extensive character as their own. The net profits for the year amounted to £120,789. It was unfortunate that the net profits shown in the accounts previously issued were for a period of about sixteen months, so that it was impossible to give corresponding figures from those accounts which were exactly comparable. So far as they were applicable, it would seem that the net profits of the past year showed a decrease of about £42,000; and the cause of this falling off was made clear in the report. He would specially emphasize the diminished dividend in Austria, which represented a shrinkage of no less a sum than £24,269 on the dividends. He wished further to impress upon the shareholders that the net profit brought into the balance-sheet presented to the meeting last June not only dealt with a longer period, but included exceptional profits, arising out of the necessary adjustments owing to the accounts covering a period prior to the date of the incorporation of the Company. Passing to the expenses charged against profit and loss for the year, he said that, as compared with those charged for the previous year, they showed a total of £101,724, against £93,498, or an increase of £8226. This increase was covered by three items—advertising, &c., £498 increase, law charges £4071, and anti-vibrator royalties £3750; making a total of £8319. There were decreases in the items shown under salaries, rents, and audit and accountancy charges, which were counterbalanced by increases in depreciation, reserve for bad and doubtful debts, and interest. Last year he referred specifically to the Auditors' certificates. In view of the criticisms passed upon it, the Board decided to submit the accounts and a case to eminent Counsel, asking him whether it was necessary for the Directors, before arriving at profits, to make any provision for depreciation of patents and patent-rights, goodwill, and shares in the Austrian Company. Counsel advised that "it is clear that the Directors are not bound to take into consideration, before declaring dividends, any possible depreciation in goodwill, patents, and patent-rights; shares acquired in the Austrian Company which were paid for out of the capital subscribed by the shareholders of the Welsbach Company; shares in the Austrian Company since acquired; the benefit of the contracts securing continuity of service; and the benefits of the contracts for the acquisition and satisfaction of the local Austrian interests." Counsel further advised as to the proper wording of the first item on the credit side of the balance-sheet. The Managing-Director and the Auditors had taken great pains to issue the statement of accounts in a form so clear as to be readily understood by everybody. They were all anxious to give the shareholders a plain, unvarnished statement. In a great enterprise like theirs, the trading policy was all-important. A cardinal fact to be borne in mind was that the first paragraph of the report proved that the trading of the Company was of a progressive character. Shareholders would observe that there had been an increase in the number of mantles sold; though the sale of burners showed a falling off. Possibly they might be aware of the attacks that had been made on the new Welsbach burner by competitive undertakings. These attacks had been of the most mischievous character, because they had thrown doubts upon patent-rights, created feelings of indecision in the minds of the trade, and made them hesitate to take up or supply the new burner to the public. Such circumstances must retard the business done in new burners. The Board looked forward, however, to an early settlement of the legal position regarding the burner patent, which would remove, once and for all, the bad effect of these attacks. He ventured to hope that the shareholders would not form any false impression from a decrease in one section of the business, seeing that the combined output of the Company's productions reached enormous figures, counted by millions of articles, and that the business on the whole exhibited not only stability, but also vitality. This vitality there was every reason to hope would largely increase by the forward policy which the Board had decided to adopt. Dealing with the question of trading policy, they had to consider it from three points—the trade, the public, and the Company. It had been represented by their rivals that the Company had not met the trade in a liberal spirit; but the Managing-Director would inform them that the terms and conditions had been so improved that the rate of profit the trade generally could make upon the Company's products was greater now than formerly. Letters had been received from the trade in all parts of the country, expressing unqualified gratification at the reduction in prices, and predicting a large increase in business therefrom. This reduction must have far-reaching effects as regarded the public. A large number of people anxious to adopt the light had been precluded from doing so on account of their relatively small means, which made them unwilling to face the expense necessary to start an installation of the burners at the old price; and a further impediment arose from the cost of mantles for renewals at the higher price. The great majority of the people in this country lived in houses of £12 to £50 per annum rental; and most of these householders had been precluded, on account of the cost, from using the Welsbach system. But now the light had been brought within the reach of this class of people; and these new consumers should so add to the output of the Company's wares as to compensate the shareholders for any deficiency in revenue that might be involved in the reduction of price. The effect of the reduction was to give the public the opportunity of purchasing for a small house a complete installation of (say) six "York" burners for 15s., which would formerly have cost 24s. Again, the charge for the upkeep of the system in such a house was now less than two-thirds of what it was on last year's price list. It was his duty to point out to the shareholders that the criticisms which had been passed in regard to the legal expenses during the year were marked by an absence of knowledge of the matter. Critics pointed to the fact that the legal expenses were £4000 more than last year; and they implied that this increase was due to the litigation with the Sunlight Company. Nothing wider of the mark could be imagined. Although the legal expenses were £4000 more than last year, they were nearly £5000 less than in the year 1897-98, and were materially under the average of the last four years. The actual expenditure upon the Sunlight actions during the past year was considerably less than £5000; and against this had to be placed any damages which their Company might recover from the Sunlight Company when the matter was finally settled by the Law Courts. The balance of the legal expenditure had been due to the enforcement of an active protective policy for the prosecution of infringers throughout the country. To make this system effective, a large staff of travelling inspectors had been employed, who had been able to promptly detect and suppress infringements which might otherwise have made inroads upon the Company's revenue. The reduction in the price of their goods must have a direct bearing upon the legal expenditure, by rendering this policy of infringement less remunerative to those engaging in it. The Board thought that the reduction in prices should be accompanied by a reduction of the heavy charges in all possible directions. Personally, he had felt the necessity for this change very strongly; and his feeling was shared by the entire Board. With a view, therefore, of decreasing the expenses, the Board had unanimously agreed that the present Directors, other than himself and Mr. Peters, out of the sum of £4000 fixed by the shareholders as the remuneration of the Board, should accept £300 each for the year 1900-1901, instead of £500 apiece. He (the Chairman) agreed, on the Directors adopting this proposal, to voluntarily reduce his own remuneration from £3000 to £1500 for the same period; the other moiety under his agreement to be received by him at such time as the Company paid a dividend upon the deferred shares. He wished to prove by this act that nothing he could do should be left undone to make the new policy a complete success. In addition to this, from the commencement of the present year steps had been taken to reduce the legal expenses to a material extent. Mr. Peters had devoted his attention to the general charges, with the object of reducing them whenever possible. Steps had further been taken to lower the cost of manufacture; and great care had been exercised in regard to the stocks—the large sum of £27,658 having been taken from reserve in order to write down the stock to a basis which was fully explained in the report. Besides this, a sum of £10,000 had been set aside to reserve to meet the contingency of a further fall in value of materials in stock. To meet the wishes of a large number of householders, a system of maintenance had been elaborated, whereby everyone who possessed an installation of incandescent gas-lights could have it maintained for a reasonable and inclusive annual charge. The introduction of the Kern burner had been most satisfactory. These patents had enabled the Company to give a very decided impetus to incandescent street lighting. In the use of the Kern burner for ordinary lighting the increase was less marked; but it was progressive. The prices of the Kern burners had been much higher than those of the others; but the reductions in price which took effect on June 1 would doubtless lead to their more general adoption. Substantial improvements had been made in the Kern burner; and further important improvements were contemplated, which it was anticipated would greatly increase its popularity and utility. During the year under review, the Company's 1885 and 1886 patents expired; but the mantles were now, and had for some years been, manufactured under the patent of 1893, which would remain operative until 1907. It was expected that the action against the Sunlight Company for infringement of this patent would have been decided before the expiry of the 1886 patent. The management had done their best to meet the situation by increasing the amount of advertising. In regard to the future, he desired to again point out that the Company had settled their policy upon a commercial basis, as opposed to a monopoly; and in this way they hoped to be in a position to meet all possible competition. If they succeeded in the establishment of their 1893 patent, they would be placed in a condition of supremacy. The policy of the past year had been necessarily one of transition, notwithstanding which the trading results exhibited by the statement of accounts testified to the vitality of the business. Mr. Moeller resigned his seat at the Board in April last, having accepted the responsible post of Managing-Director to the Kern Burner Company, Limited, where his great knowledge should render his services invaluable. Mr. Moeller would also act as Technical Adviser to the Welsbach Company. On the retirement of Mr. de Fonblanque from the office of Joint-Manager, the Board took the opportunity to place on record their sense of his devotion to the interests of the shareholders and his high integrity on all occasions. As a Director of the Company, they hoped for many years to come to have the benefit of his wide experience. It was important that the shareholders should understand the position of the Austrian Company. The dividends paid by this Company during the last three years had been respectively 100, 80, and 65 per cent. This serious decrease in the dividend

on the Austrian shares was mainly owing to reductions made in the price of fluid. These reductions had not been accompanied in certain countries by a corresponding reduction in the price of mantles, which would have resulted in larger mantle sales and consequent increased consumption of fluid. This was important, because the factory in Vienna was large enough to face any increase in the output of fluid, and would yield a greater profit on a larger sale at the lower price than on a smaller sale at the higher price. As a consequence, shareholders of the Austrian Company had suffered from the effects of the transition period through which the enterprise was now passing, owing to the reduction in the price of fluid. Having explained at some length the position of Dr. Auer and the Austrian Company, with regard to any new electrical inventions of the former, the Chairman went on to say that he was sure the shareholders would desire to hear something of the new electric lamp. He could well understand that they were all anxious to learn the present position of this matter. At his (the Chairman's) earnest request, Dr. Auer had sent over one of the lamps for exhibition at the meeting; and he had also written saying that the osmium lamp would be available as a commercial commodity in the autumn. It was not possible for him, or for anybody else, to forecast with exactitude the future of the Company. It was not even possible to say that day what would be the effect of the present policy of the Board. Experience might show modifications to be necessary in various directions; and for this reason he asked for the Board the confidence of the shareholders, who he was sure would exercise patience. The future of the Company must largely depend upon their keeping abreast of technical developments. Before sitting down, he wished to say a few words in regard to himself personally. The reason he became Chairman of the Company, and had a large salary given him, was that he promised to give a great deal of attention to the enterprise. Now, to occupy his position properly, it seemed to him that he ought to have a considerable stake in the undertaking. His holding that day in the different shares of the Company amounted to £20,235, all of which had been acquired for cash. Further than that, on joint account he held £10,000 more ordinary stock. So that altogether his holding was upwards of £30,000; and he was one of the largest shareholders in the Company. One or two shareholders had expressed the view that he should resign his position as Chairman. The chairmanship of the Company was not sought by him. It was pressed upon him; but having accepted the post and the responsibility, he had made great sacrifices, and had worked hard to overcome the difficulties due to the transition period at which the business had arrived. For these reasons, he did not suppose that the shareholders to whom he had referred represented anyone but themselves; but he should decline to hold office one minute longer than the shareholders wished. He concluded by moving the adoption of the report and accounts.

Mr. C. L. Samson, in seconding the motion, explained that he had joined the Board, in conjunction with Mr. Peters and Mr. Harris, in July of last year. He did this at the request of holders of a very considerable proportion of the stock of the Company, who thought it desirable that new blood should be introduced on the Board. Their object since their election had been to endeavour to put the Company on a sound commercial basis; and the first thing they did was to bring about the appointment of Mr. Peters as Managing-Director. Mr. Peters was a man who had a splendid record for past achievements; and he hoped he would beat this record in what he would do for the Welsbach Company. Under Mr. Peters's guidance, the Company had taken what he considered was a very bold step—they had greatly reduced the prices of the burners and mantles. The Company's output had doubled since 1897; but even now it was nothing to what it might be. They were only supplying a very small percentage of the gas consumers of the country; but he believed that now they would rapidly make up the leeway,

General Russell, M.P., said he could not congratulate the Board on the clearness of the report. He took exception to the amount set apart for Directors' fees, and also to the legal expenses. Patents, he knew, must be supported; but the question was whether it was necessary to enter into these expensive lawsuits in regard to patents on the point of expiry. The decision on appeal concerning the 1886 patent was not given until the patent had actually expired. He also had great fault to find with the conditions on which the Kern burner patent had been purchased. He wished to move as an amendment—"That a Committee of seven members be appointed from amongst the shareholders, to make a full investigation into the affairs of the Company, and to make recommendations as to the future management and the constitution of the Company; and that the present meeting stand adjourned for one month to receive the report of the special Committee."

The Hon. Philip Stanhope, M.P., in rising to second the amendment, said he would confine himself to what he might call the striking features of the situation. Here was a great Company, with no less than £3,400,000 of capital, launched only two or three years ago under most flaming auspices and the most specious promises. At the end of this time, they found themselves in a position that was lamentable. There could not be one single shareholder who regarded the present position of the Company as a satisfactory one. He certainly thought it was a case—and an urgent case—for searching investigation. If the Committee were appointed, one thing they should do would be to consider whether or not the present very large capital was justified by the assets. He would sooner have his property in the Company represented by what it was really worth than by an inflated paper value.

Mr. M. Prael thought there was certainly great cause for complaint against the original members of the Board. These gentlemen would never have made the reduction in the price of the mantles and burners on their own initiative. Mr. Peters was alone responsible for the great advance that had been made. He appealed to General Russell and the Hon. Philip Stanhope to withdraw their amendment, because his experience was that Committees of Investigation did an enormous amount of mischief in a trading concern of this kind.

Mr. R. H. Green thought there was not a concern in the whole of the country that had been more grossly mismanaged than the Welsbach Company. The trade previous to Mr. Peters's appointment had held meetings for the purpose of boycotting the Company, owing to the treatment they had received at their hands. It only remained for them to get in good odour with the trade to be made a great success.

Some six or seven other shareholders having taken part in the discussion,

Mr. H. L. Peters said he joined the Board as an ordinary Director last July; and after acting in this capacity for some months, he was asked whether he would accept the post of Manager, which he agreed to do. The shareholders must have patience, because great changes in policy such as they had recently made took time to develop. The Company were strong enough to face any competition, quite regardless of the question of patents. He mentioned, as showing the extent of the Company's business, that it was necessary to send out from the office 28,000 parcels of circulars announcing the reductions in price.

General Russell, at this stage, said that as there seemed to be a general feeling that it would be only fair to give the Board another chance, he would ask permission to withdraw his amendment. He would, however, remark that, unless a more satisfactory report was presented at their next meeting, he and others with money invested in the Company would think it their duty to canvass the shareholders beforehand and endeavour to get a Committee of Investigation appointed.

The Chairman, in reply to various questions that had been put, said the reason why the 1886 patent appeal was pursued when the patent was about to lapse was that they were advised by Counsel that it was the best course that could be taken; the appeal being necessary to secure damages. As to the English Kern patents, these had been of most material assistance to the Company in reference to street lighting. The £80,000 given was for the British patents, with which the Kern Burner Company had nothing to do—they had only the Continental patents. The guarantee of the Welsbach Company in regard to the £100,000 of debentures of the Kern Burner Company was to run for ten years; and the Company was incorporated only last November. The Era Lamp and Kern Burner Company ordinary shares had not been taken into account in profit and loss.

The motion for the adoption of the report was then carried unanimously.

The dividends recommended were declared; and the retiring Directors (Lieut.-Col. W. Treslove Ellis and Mr. L. R. de Fonblanque) and the Auditors (Messrs. Deloitte, Dever, Griffiths, and Co.) were re-elected.

The proceedings closed with a vote of thanks to the Chairman and Directors.

MALTA AND MEDITERRANEAN GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Tuesday, at the London Offices, No. 60, Gracechurch Street, E.C.—Colonel J. Le Geyt Daniell in the chair.

The Secretary (Mr. A. W. Cooper) read the notice convening the meeting; and the report and accounts (which were noticed in the "Journal" for the 29th ult., p. 1462) were then presented.

The Chairman said it fell to his lot to preside at the meeting in the absence of the Chairman (Mr. J. Birch Paddon) through indisposition—an absence which they would all regret (not only for its cause), and perhaps none more than himself. Though absent in person, he was present in a degree that the shareholders might not be aware of, for, notwithstanding his illness, he had devoted his attention to the affairs of the Company—at a time, too, and under conditions of pain and weariness, which they would all know did not predispose a person to bring his brains to bear upon abstracts and figures. As a result, Mr. Paddon had given him (Col. Daniell) his views; and he could not do better than give expression, as far as he was able, to some of the particulars which, had Mr. Paddon been present, he would have commended to the attention of the shareholders. The incidents of the past year were chiefly of a commonplace character, excepting those connected with the supply of coal. The great increase in the price of coal had, of course, a disturbing influence on the Company's affairs, in common with others; and it had somewhat rudely interrupted a progress which was decidedly satisfactory. They were fast repairing the breach in the Company's business made by the establishment of the electric light in Malta, and the loss of sale of 30 million cubic feet of gas caused thereby. Of this, they had recovered two-thirds without decreasing the dividends. The increase in the price of coal had a direct effect on profits. It was, as the shareholders were aware, only within limits that the price of their gas could be raised; and there was no doubt that some of the contemplated loss must fall on the Company. Of course, they were encouraged in the hope that the present high price of coal was merely artificial, and might not last long; but there was no immediate prospect of a return to moderate prices. All they could set against it was such an increase in the price of gas as they might be able to make, and the increase in the value of residuals. With these things, and possibly some little help from the reserve fund, they might fairly hope to maintain the present rates of dividend. There was a somewhat serious increase to be seen in the accounts under the heading of rates and taxes. This increase amounted to £596, and represented an impost levied upon the Company by the Italian Government in respect of their Sicilian station. Apparently the necessities of that Government rather blinded them to the consequences of an action of this kind; but as the Company did not stand alone, they could not help themselves. They resisted for a long time, and obtained the best of legal opinions. Short of going into Court—which was a bad thing for Companies situated as they were to do—they did all in their power to avoid this impost; but in the end they had to submit. The £596 in question was for back licences, for which the Directors never thought the Company were liable. Apart from disturbing things of this kind, the accounts showed much that was satisfactory, and which to a great extent qualified the adverse factor to which he had called attention. The receipts and expenditure presented much the same figures as before. Their investments had, however, been increased by an amount of £3744, which appeared under the heading of Consols. This sum consisted of arrears received from the Municipality of Marsala. Strictly speaking, it was revenue; but it was placed in the general balance-sheet and invested in Consols, because it was intended to utilize it for the provision of new works, &c. The capital account had not been altered in any way since it was last presented. In the general revenue account, the only difference was a small decrease in the debenture interest and the interest on the reserve fund. The items in the profit and loss account were more interesting. In the first place, coal had cost £1235 more. Certainly, they had used 419 tons, or equal to 4·38 per cent. more than in the preceding year; but even allowing for this, there would remain an increase of £840 in price. The item

of maintenance was £233 more; and this increase was caused chiefly by repairs to gasholders and by efforts to still further reduce the leakage. There was an increase in the item of rents, rates, and taxes of £648, to £596 of which he had already referred. The remaining items were collectively a little less than last year. The total revenue expenditure had been £19,759, or £2161 more than last year. This excess was practically accounted for by the increase in the price of coal, the extra Sicilian taxation, and the heavier charge for maintenance. The manufacturing operations of the year had been comparatively satisfactory. They had used 9982 tons of coal, and made 104 million cubic feet of gas, which was equal to more than 10,415 cubic feet per ton. Of this amount they had sold 91 million cubic feet, which left a difference of 12·46 per cent. between the make and the sale. This was an improvement; but they had reason to expect a still further decrease in the amount of unaccounted-for gas. The receipts side of the profit and loss account revealed an increase of £1056 in gas-rental. Coke showed an increased return of £307; tar and pitch was £30 less; and fittings £255, or 13½ per cent., more. The total receipts were £28,596, or £1617 more than last year. With reference to Malta, he (the Chairman) had paid a visit of inspection to the works last winter. Besides this, Mr. Basil Makins had visited the works early in the year. Their impression of things there was that matters were by no means discouraging. The rate of increase at Malta was over 8 per cent.; and there was a satisfactory addition to the number of consumers. At Sliema, there was an increase of 19 per cent.; and the improvements being made there by the Government would lead to the development of the land for building and other purposes, of which the Company would not be slow to take advantage. He must say that, when he was at Malta, he was received with the greatest possible courtesy by the heads of all the departments; and the relations of the Company with the governing bodies generally he considered to be of a very agreeable character. The resulting profit from the whole of the business was of necessity a little less than last year; but they were nevertheless able to pay their usual dividends, and to carry £312 forward to the next account. The several works of the Company were well maintained; and with regard to both works and mains, it might be said that they were never in better order than now. The accounts showed no receipts from Corfu; and this matter remained in much the same condition as in the previous year. The Directors had, however, received repeated assurances that the Municipality would pay as soon as ever they were in a position to do so—that was, as soon as they could succeed in raising a loan. He (the Chairman) had received every assurance personally on the subject. He saw the British Minister at Athens, who gave him to understand that he had no doubt whatever that the Company would be paid at the first opportunity. At Corfu, he (the Chairman) saw the present President of the Council; and he thought that in him they had an honest man. The Directors, notwithstanding the very great delay, still looked upon the account as good. At Trapani, there had been an increase of 2½ per cent.; but at Marsala there was a decrease of about the same amount. These two stations produced an amount which the Company would be very sorry indeed to lose. Regarding the coal difficulty as a passing one, the Directors were inclined to look hopefully upon the future; and they did not anticipate that it would be necessary to diminish or vary in any way the dividends they had hitherto been able to recommend to the shareholders. He concluded by moving that the report of the Directors, together with the balance-sheet and accounts, be approved and adopted.

Mr. Basil T. Makins seconded the motion.

Mr. A. M. Paddon hoped he might be permitted to congratulate the Directors and proprietors on the very able statement which had been presented. He ventured to say that these results could not possibly have been achieved without very considerable administrative skill on the part of the Board, and very great tact on the part of the executive abroad. The Board themselves had an intimate knowledge of the condition of things which prevailed where the different stations of the Company were situated. The difficulties and the embarrassments attached to the conduct of a Company like theirs were very different to what was experienced in the administration of a statutory Gas Company in England. A very high degree of diplomatic skill was required of the management. They had not, of course, to deal with the predatory instincts of local authorities which were so often in evidence in this country; but they had an arbitrary Government in Malta, and an equally arbitrary Government in Italy. Another thing was that the places from which their revenue was derived were scattered. This in itself constituted a very considerable demand upon their representatives abroad; but in Mr. Starkey they certainly had a very able Manager. His (Mr. Paddon's) sole object was to show that the duties of the Directors of such a Company as theirs were of an exceptional character, and that therefore success should meet with exceptional praise on the part of the proprietors. He thanked the Chairman most sincerely for his kind remarks about his (Mr. Paddon's) father. His father was extremely gratified to know that he was so well thought of by his colleagues.

Mr. A. W. Oke asked if the Board had well considered the question of the new contract for coal. They all knew of the crisis through which Gas Companies were now passing; and it would be comforting to be assured that their Company had been able to secure a satisfactory contract for coal. He would also like to know whether it would be necessary for the Directors to increase the price of gas—it seemed a very general experience in England. It was a relief to find that the extra amount of £596 for taxes was not likely to be permanent. He was also glad to see that the item of bad debts was so small, and that there was a satisfactory increase in the sale of gas, considering the great competition of the electric light. Though the balance carried forward was smaller than in the previous year, they had a large reserve on which they could, if necessary, fall back to make up the dividends. The price of the Company's shares in the market showed that the proprietors were not afraid to hold them, but looked upon them as good security for their money.

The Chairman said the Board thought the Company's contract for coal was of a satisfactory character; and he trusted that they would next year be supported by the shareholders in that view. They had raised the price of gas as much as they were able to do under their contracts. They would have liked to have increased it a little more, but this was not in their power.

The resolution was then put to the meeting, and carried unanimously.

On the proposition of the Chairman, seconded by Mr. Stephenson R. Clarke, dividends were declared at the rates of 7 per cent. per annum on the first preference shares, 7½ per cent. on the second preference shares, and 4 per cent. on the ordinary shares (making with the interim dividend of 2 per cent., 6 per cent. for the year).

Mr. Clarke proposed, and Mr. Joseph Cash seconded, the re-election of Colonel Daniell as a Director of the Company; and this was unanimously agreed to.

On the motion of Mr. Cash, seconded by Mr. A. M. Paddon, the Auditors (Messrs. R. Hesketh Jones and Thomas Guyatt) were re-appointed.

The Chairman said before they separated he wished to propose a vote of thanks to Mr. Cooper, Mr. Starkey, and the other officers of the Company. He could endorse what Mr. Paddon had said about Mr. Starkey's ability. He (the Chairman) was very much impressed at seeing the difficulties their Manager had to contend with—the class of people he had to meet, and the trouble with which he held his own against such absolute authority among the Government departments as existed, and must exist, in places of the kind in which their works were situated.

Mr. T. Guyatt seconded the resolution, and it was carried unanimously.

Mr. Cooper having briefly acknowledged the resolution,

The proceedings terminated with a vote of thanks to the Chairman and Directors.

SOUTHWARK AND VAUXHALL WATER COMPANY.

The Half-Yearly General Meeting of this Company was held at the Offices, Southwark Bridge Road, on Tuesday last—Alderman Sir H. E. Knight presiding.

The Secretary (Mr. Montague Watts) having read the notice calling the meeting, the report of the Directors for the six months ending March 31 was presented. In the course thereof they stated that the number of new domestic supplies taken into charge in that period was 646, estimated to produce an increased annual rental from this source alone of £1642, and, in addition, the income derived from meter-rates and other sources showed a satisfactory increase on the corresponding period of past years. They recommended a dividend at the rate of 5 per cent. per annum on the preference stock, and of 7½ per cent. per annum on the ordinary stock and "D" shares.

The Chairman observed that the proprietors would recollect that the accounts for the half years to March 31 and Sept. 30 last year were certified by the Company's Auditors, but not by the Government Auditor. He (the Chairman) explained at the time that there was no objection as regarded the accounts themselves on the part of Mr. Stoneham, but that that gentleman thought an alteration was required in the form in which they were presented. The Directors could not at first come to an agreement with the Government Auditor; and they were only able to do so in the past half year after a good deal of negotiation and several conferences with him. The adjustment of the accounts which Mr. Stoneham required was exceedingly simple; and as far as he (the Chairman) was concerned, he could not see that it made any difference one way or the other. The Government Auditor, however, in his capacity, seemed to think that he would prefer the accounts made out in the form in which he now certified them; and it therefore became necessary for the proprietors to accept and approve the adjustment. The only difference was in the dividend and interest account, on the debtor side of which, as it had been drawn up for some years, the interest on temporary loans was entered, thus reducing the balance applicable to dividend. Mr. Stoneham required that the item in question should be taken from the debtor and put on the creditor side of the account. The money applicable to dividend was not reduced by this amount; but it was paid out of the balance applicable to dividend. The alteration made not a penny difference in the amount available for dividend; but the change was more satisfactory to Mr. Stoneham. He then moved a resolution approving and adopting the amended accounts for the half years in question, "as adjusted to the satisfaction of the Government Auditor, and certified and signed by him."

Mr. C. M. Vialls seconded the motion, which was at once unanimously carried.

The Chairman afterwards proposed the adoption of the report and accounts submitted to the meeting. After pointing out that the latter had been approved by the Government Auditor, he stated that in the revenue account for the half year ended March 31 last, on the debtor side, the amount expended on maintenance appeared as having been £55,525, showing an increase of £2314 as compared with the figures of the corresponding period of 1899. If, however, the proprietors took the figures in this bald manner, they would be deceiving themselves, and would not arrive at a correct appreciation of the result. For example, the item of maintenance and repair of mains, &c., showed that the amount expended in the past half year had been £11,774, as against £14,000 in the March half of 1899. This would look as if a great deal less had been expended on this item in the past half year, whereas the outlay had been greater. In the March half of last year, there was included in the £14,000 expended £4200 for the cost of strengthening and additional work to the 42-inch main, whereas in the past half year the extra outlay on this main was only £600. This made a difference of £3600, which ought to be deducted from the expenditure of the March half of 1899 in order to come on an equal footing with the outlay in the past half year under this heading. The £14,000 would then be reduced to £10,444, which was the proper amount for the proprietors to compare with the £11,774 in the half-year's accounts now submitted. An increase was then shown under the heading of maintenance and repair of mains of £1330; and the proprietors would wish to have an explanation of this excess. More money had been expended on the lowering of those mains which had been laid at too shallow a depth, and which were therefore liable to be affected by frost. There had also been an enormous advance in the price of iron; and therefore all the pipes that had been laid in the past half year had cost a good deal more. Further, there had been a considerable advance in wages. These three items accounted for the increase. The only regrettable point in regard to the matter—if it was regrettable at all—was that the increase in wages was an item which they were still likely to have to meet; but he had no doubt that after a time the Company would obtain some relief as regarded the increase in the cost of iron pipes, and that they would also not be at

the extra expense of lowering the mains. With respect to this item, therefore, matters were pretty well in a normal condition, and would continue so. The pumping and engine charges had been £16,890, showing an increase of £3471 over the figures of the March half of 1899. This increase was entirely under the head of pumping, and was solely accounted for by the higher price of coal. The proprietors would therefore understand what an important effect this increase in the cost of a material which the Company must consume in order to perform their duties had upon them. Rates and taxes had cost £16,592, as compared with £15,110 for the corresponding period of the previous year. He was glad to state that a decrease was shown in the management expenses; the figures being £8572 last half year, or £1888 less than those of the March half of 1899. This was practically accounted for by the reduction in the law and parliamentary expenses, which in the past half year had amounted to £977, as against £3097 a year previously. On account of the sinking fund, £423 had been paid to the City Chamberlain, against nothing in the March half of 1899. Allowing for the decrease of £1888 in the management expenses, against the increase of £2314 in those under the head of maintenance, an advance of £426 was shown, taking the two items together; and adding this to the payment to the City Chamberlain, £849 appeared as the increase on the debtor side of the account, as compared with the figures for the corresponding period of 1899. The credit side of the account he approached with very great pleasure; and he could assure the proprietors that it was a great satisfaction to the Directors to find that they were able to come before them half year after half year, and to show a continual improvement in the Company's position. The water-rents accrued to the date of the present accounts amounted to £137,561, showing an improvement of £3614 as compared with the corresponding period of the previous year. But again an outside element had to be taken into consideration, or the proprietors might think that £3614 represented the entire increase under this heading in the past half year, whereas this was not so. The Company received from the East London Company last half year £1995 less than in the March half of 1899; and to arrive at the legitimate increase in the water-rents accrued, this £1995 had to be added to the £3614, making an improvement altogether of £5609 in the past half year. This must be exceedingly satisfactory to the proprietors, as it was to the Directors—showing as it did the innate vitality of their undertaking, and that it still continued to be progressively prosperous. As he had said, £5609 represented the legitimate increase in the water-rents last half year over the corresponding period of 1899; but as he had to deal with actual figures, he should only take the £3614. The rentals also showed an advance of £1133, which was accounted for by the interest paid to them by the East London Company, in respect of the communicating main laid by this Company, which cost them £47,000, and also by increased lettings of some portions of their surplus lands at Battersea. Adding this £1133 to the £3614, they arrived at £4747 as the actual increase of cash from these sources which had to be dealt with this half year. In the item of surcharges, £82 had been saved, while £89 less had had to be allowed for bad debts; and, on the other hand, a sum of £12 had to be taken off for something else. Dealing with these different amounts together, the sum of £4906 was arrived at as the extra earnings of the concern in the past half year, as compared with the corresponding period of 1899; but from this increase, the £849 of excess on the debtor side of the account had to be deducted, leaving £4057 as the actual additional profit to be taken to their dividend and interest account for the half year under review. They therefore had £72,142 to carry to the dividend and interest account this time, as compared with £68,085 a year ago. Passing to this account, it would be seen that, after paying the dividend last half year, a balance of £14,535 was left; and adding this to the amount brought down, £86,678 was shown as the sum that had to be dealt with. Deducting the interest accrued to March 31 last on the debenture stock, the dividend paid on the preference stock to Dec. 31 last, and the interest accrued on this stock to March 31 last, £47,306 remained, which the Government Auditor certified as the amount applicable to dividend. Out of this, the Directors proposed a dividend at the rate of 7½ per cent.; leaving £8732 to be carried forward. They might have proposed 8 per cent.; but they had not thought it wise to do so in view of the advance in the price of coal and iron. They had had great difficulty in arranging the Company's coal contracts; and they thought that the proprietors would agree with them that it was better to be on the safe side, and only pay the dividend at the rate recommended. The past six months, it should be remembered, was what was called their bad half year, while the next would be their good half year; and the Directors hoped to be able to advise the proprietors to take a little larger share then in the profits. Turning to the Directors' report, he did not suppose that any of the proprietors had read, as the Directors had been obliged to do, the evidence given before the Royal Commission on the Metropolitan Water Supply, or that they had watched the inquiry as the Directors had done; but they had no doubt read the summaries which had appeared in the Press. He did not think that the Water Companies had any reason to be dissatisfied with the result of the Commission. It had no doubt cost an immense amount of money to place before the Commission the real facts, and to put the Companies' case before them in such a way as to enable them to come to the decision at which they had arrived. The result showed that the Companies had been well advised, and that they had been ably represented before the Commission; and, further, that they had been able to convince the Commissioners of the correctness of the views held by the Companies. The proprietors gave their permission, at the Wharncliffe meeting held last February, to a Bill being introduced by the Company into Parliament; and it was duly pressed forward in the House of Commons. It was for carrying out a certain principle, enabling the Companies to combine for the construction of reservoirs and for other purposes, in order that the water supply of the whole of the Metropolis might be placed beyond any doubt. In face of the report of the Royal Commission, and for other reasons, it was, however, felt that such an object as this ought to be brought forward as a Government measure. The Directors were therefore advised that it would be well to withdraw the Bill; and this course was taken after the Bills of the London County Council had also been withdrawn. The Company were getting on very well with the other works which Parliament had directed them to carry out. He believed that his colleagues on the Board thoroughly agreed with him that the undertaking was never in a better or more prosperous condition, and that it had never had better prospects than at the present time. They were about to offer another £100,000 of debenture stock; and he only hoped that this would meet with the same success as that which attended the last issue in March, when the same amount was offered and was applied for four times over.

Mr. Vialls seconded the motion, which was carried unanimously.

The Chairman afterwards proposed, and Mr. Vialls seconded, the payment of the dividends recommended; and this was carried.

A resolution was next passed contributing ten guineas towards the completion of the New Victoria Schools, at Teddington.

The Chairman said he ought to have mentioned that the debenture stock which they were about to issue would carry three months' dividend up to September next, when the interest would go on in the usual way. Anyone, therefore, who subscribed for the debentures would not be out of pocket as regarded income, which would immediately begin to accumulate.

An extraordinary general meeting was subsequently held.

The Chairman stated that under the Act of 1899 the Water Companies were authorized to spend money in constructing works for the purpose of intercommunication between their systems. The Company were empowered, with the consent of the Local Government Board, to raise a certain sum by debenture stock to represent the expenditure thus incurred, and the stock was not to be subject to the sinking-fund clauses. It would rank *pari passu* with their "B" debenture stock, but it would be different in the point just mentioned. The Company had laid out £47,000 on the works in question, and they would have to spend a little more, making perhaps £50,000 altogether. He concluded by moving the following resolution: "That the sum of £47,000, being the amount authorized by the Metropolis Water Act, 1899, and sanctioned by the Local Government Board at an inquiry held on the 10th of May, 1900, be, in exercise of the powers conferred by the said Act, raised by the Directors by the creation and issue of such debenture stock 'B' as will produce the said sum, on such terms and conditions, and at such times and in such manner consistent with the said Act, as the Directors may deem expedient."

Mr. Vialls seconded the motion, and it was carried unanimously.

A vote of thanks to the Chairman, Directors, and staff brought the meeting to a close.

GRAND JUNCTION WATER-WORKS COMPANY.

The Half-Yearly General Meeting of this Company was held at the Office, South Molton Street, last Wednesday—Mr. F. Tendron, F.G.S., in the chair.

The Secretary (Mr. J. Goodwin) having read the notice convening the meeting, and other formal business having been disposed of,

The Chairman moved the adoption of the report and the statement of accounts (*ante*, p. 1515). He said the proprietors would notice that in the revenue account there was a charge for the Staines reservoirs of £3000, and that in the balance-sheet this item had not been paid, as it was deducted from the amount which stood for intercommunication works, and was put in suspense. The reason for not paying it was that Mr. Stoneham, the Official Auditor, refused to sign the accounts of the Staines Reservoirs Joint Committee to June 30, 1899, for two reasons. One was because the Committee had allowed a brokerage of ½ per cent. to all tenders which had been accepted from members of the Stock Exchange for their issue of £500,000 of the stock. The Act of Parliament authorized the Committee to issue the stock either by tender or by sale. If issued by sale, the Committee would have had to pay much more for commission and advertising than by this brokerage, and if they had endeavoured to issue it by public tender, they would in all probability have been unsuccessful; whereas a good price was obtained by them, and the amount was over-applied for. At present he need say nothing further on this point, although it might be necessary at a future time for him to ask the proprietors to allow the payment out of the Company's funds of the proportion for which they were liable on this account. As to the other point objected to by Mr. Stoneham, where the Committee bought lands and were unable to get a settlement—where they had had considerable legal difficulties—they had had to pay interest in the terms of purchase; and they were advised by their Solicitor, who was a leading authority on all these points, that this was a capital charge. They consequently took Counsel's opinion, which was that the whole of their expenditure, whether for interest on the debenture stock or the expenses of management, should go simply to a cash account, and so be charged to capital until the respective Companies received water from the reservoirs. This opinion was one of immense importance to the Grand Junction Company; and it was with much satisfaction that he informed the proprietors that the Staines Reservoirs Committee had given instructions that the accounts submitted to June 30, 1899, were to be made out on the basis of Counsel's opinion. The Directors calculated that probably 3½ years from the date he had mentioned would elapse before the Companies were receiving water from the reservoirs, and that during this time the Company would have had to pay out of their present earnings no less than £40,000, which would now be capitalized, and instead of having to provide £40,000 in 3½ years, they would have to pay for interest and sinking fund about £2000 a year for an indefinite period. The proprietors could see how much this strengthened the position of the Company, and what a large reserve they would have to meet the heavy expenditure they would have to incur when once water was delivered from Staines, not only for interest on debenture stock, but also for sinking-fund and pumping charges, rates and taxes, and the supply of water. Dealing with the accounts generally, he said he would leave out of consideration the supply of water to East London, and only deal with the Company's normal receipts and expenditure. He found that, as compared with 1894, their rental earnings had increased by no less than £28,600. This was a most satisfactory feature in the accounts of a Water Company; but, on the other side, he found that rates and taxes and the rental they paid to the Thames Conservancy had increased £7000, leaving to the good £21,600. Their Engineering Director (Mr. Walter Hunter, M.Inst.C.E.) had managed, in the way of interest and dividends on additional capital, and by various improvements of the works, to dispose of the whole of this increase. The expenditure, however, had been very wise, and the position

of the Company now was much stronger than it formerly was. The terrible frost of 1895 called their attention to many shortcomings which existed; and the Company now had engine power and filtration works capable of dealing with no less than 30 million gallons a day, although their normal requirements only averaged about 20 millions. They had the power of distribution to this extent—that in times of pressure they could give their own district fully 25 million gallons, and help the East London Company to the extent of 5 million gallons a day, if needed. This position was so strong that they might fairly conclude that, although the rental of the Company would in all probability rise by the average of £6000 a year, as for the last five years, there would be hardly any increase in the ordinary outlay for the maintenance of their works. It was true that coal and iron were dear; but this increased expenditure was exceptional. Taking all these matters into consideration, and reviewing the past five years, during which the shareholders had only received a dividend at the rate of 7½ per cent., whereas for thirteen years before the frost they had a dividend averaging 8½ per cent., they might probably ask what had become of the difference of 1 per cent. during this period. The answer was that a number of the mains in the country district had been relaid, and the proportionate cost of the work had been met out of revenue; and during this time the Directors had also put by about £21,000, which was now carried forward in reserve, to meet the heavy expenses he had referred to which would come upon them when once they were receiving water from Staines. Taking into consideration the normal increase in the Company's rental and the fact that there would no longer be the abnormal increase in the charges for maintenance, or for interest and dividend on fresh capital to be raised, the Directors had come to the conclusion that the time had arrived when some consideration could be shown to the shareholders; and they had authorized him to say that at the meeting next December they would be prepared to recommend a dividend at the rate of 8 per cent. He looked forward to the time when the Company, who had now for five years, on their normal receipts and expenditure, earned a dividend of 9 per cent., would reach the 10 per cent. maximum to which the shareholders were entitled. The only other matter to which he need refer was very fully dealt with in the report—the parliamentary proceedings and the action of the London County Council. Some years since, that body pressed to have a Royal Commission on the Metropolitan Water Supply. It was granted them, and most eminent men constituted it. They came to a conclusion favourable to the Water Companies, and not to the Council. Ever since then that body had called in question the conclusion to which the Commission came. Another Commission were appointed three years ago, consisting of very able men, and presided over by a man of the greatest talent and penetration, who devoted—he could not say how many days, and the full power of his mind, to investigating the subject. That Commission came to a unanimous conclusion; and they no sooner reported it than the County Council went in a diametrically opposite direction. The experience of the Directors therefore was that the more they attended to the Company's work, and the less they troubled themselves about the County Council, except to defend the Company from attack, the better.

Viscount Knutsford, G.C.M.G., seconded the motion.

Mr. Bellewes expressed the proprietors' indebtedness to the Directors for the skilful way in which they had placed the Company's case before the Royal Commission, and for the triumphant result which had been secured. There were rumours as to proposals for the amalgamation of some of the Water Companies—their own being possibly one of them. He did not know whether the Directors would be prepared to entertain such a proposal; but he felt quite confident that they would not do so unless the full value of the Company's prospective as well as of their actual rights was taken into consideration.

The Chairman, in reply, said that the shareholders might rely upon it that their interests would not suffer at the Directors' hands.

The motion was carried unanimously, and resolutions were afterwards passed declaring the dividends recommended and re-electing the retiring Directors (Viscount Knutsford, the Hon. Sydney Holland, and Sir John Colomb, M.P.) and Auditor (Mr. R. A. M'Lean).

An extraordinary general meeting was held subsequently.

The Chairman stated that all matters in connection with the intercommunication scheme had been so frequently referred to that it was unnecessary for him to go into any details. The Grand Junction Company was one of the first who were required to carry out their portion of the works; and it had cost them as nearly as possible £70,000. They had already been of immense service to the East London Company, and might be again this year. Further works in connection with intercommunication would have to be carried out by other Companies. All these matters were under the consideration of the Local Government Board. So far as the Grand Junction Company were concerned, they had made the works and borrowed the money, and they now wished to get it in the permanent form of debenture stock. He concluded by moving the following resolution: "That the sum of £69,744 cash be raised by the creation and issue of sufficient debenture stock for the purpose under the provisions of the Metropolis Water Act, 1899, and of the consent of the Local Government Board given on the 17th of May, 1900; and that the Directors be authorized to issue such stock—to be called 'three per cent. debenture stock'—on such terms and conditions, at such times, and in such manner, consistent with such provisions and consent, as they may deem expedient.

Viscount Knutsford seconded the motion.

The Chairman said that Mr. Hunter had suggested to him to mention that the interest on this sum, although paid by the Company, was recouped by the other Companies in the proportion of their respective rentals, and that the charge to their own Company was at present very small.

The resolution was carried unanimously.

Dr. Leeson, in proposing a cordial vote of thanks to the Chairman, Directors, and staff, expressed his opinion that had it not been for the scheme of storage which was initiated by Mr. Hunter and the late Mr. Fraser, the Company's position would have been totally different, and their shares would not have been worth half their present value, while the scheme for bringing water from Wales would have been very far advanced.

Mr. Lathbury seconded the motion, which was carried unanimously.

The Chairman acknowledged the vote, and the proceedings terminated.

PROFESSOR LEWES AND THE CITY CORPORATION.

At last Thursday's Meeting of the Court of Common Council of the City of London, Mr. A. C. Morton was successful in getting the following resolution passed: "That it be referred to the Officers and Clerks' Committee to consider the conduct of the Gas Examiner in giving evidence before the House of Commons Committees for the Gaslight and Coke Company and the South Metropolitan Gas Company without the consent of the Corporation, as defined by the Court in the terms of his appointment—'To undertake not to act for any Gas Company supplying the City without the consent of the Corporation.'"

It will be remembered that Professor Lewes gave technical evidence as to the luminosity of various flames before Mr. Oldroyd's Committee that sat, with regard to the various Metropolitan Gas Bills, this session—he being summoned to the House by the Speaker's Order to appear and give information. The Chairman of the County Purposes Committee stated this in the Common Council on Thursday; also that he, the Chairman, had wired to Professor Lewes telling him to obey the Speaker's warrant, in reply to the Gas Examiner's request as to what he was to do. In spite of this statement, however, Mr. Morton's resolution was carried.

STATUTORY PRICES FOR PUBLIC LIGHTING IN NORTH AND SOUTH LONDON.

The City Corporation and the South Metropolitan Gas Bill.

It may be remembered that, at the Meeting of the Court of Common Council of the City of London, on the 31st ult. (*ante*, p. 1508), a resolution was passed—"That it be an instruction to the Town Clerk to direct attention of the Local Authorities on the northern side of the River Thames to the South Metropolitan Gas Company's Bill in Parliament, and to request them to present petitions to the House of Lords against the proposal of the Company to purchase the portion of the district of the Gaslight and Coke Company on the southern side of the river, as this proposal, unless the Bill be amended, would have the effect of largely increasing the price of gas to the authorities on the north side of the river beyond the rate fixed by the Amalgamation Scheme of 1883 of the Gaslight and Coke Company and the London Gas Company." Pursuant to the resolution, the following "Memorandum" has been circulated among the Local Authorities referred to in it:—

The Bill is in several separate parts dealing with different objects. Part IV. authorizes the sale to the South Metropolitan Gas Company of that portion of the Gaslight and Coke Company's undertaking which is situated on the south side of the River Thames, if and when the two Companies can mutually agree. The effect of this proposed sale will, if carried out, be to annul the existing statutory provisions under which gas is supplied to public lamps at the lowest rate charged to private consumers south of the river, where gas is the cheapest in London.

Between the years 1859 and 1876 amalgamations of the many Gas Companies who then supplied the Metropolis were authorized by different Acts of Parliament. In the discussions that took place before the Select Committees to whom the Bills were referred, the Corporation, acting in the interests of all the local authorities and private consumers, contended that the fullest protection should be afforded against the establishment of a monopoly, and a consequent increase in the price of gas. The present well-known sliding-scale, and what are known as the auction clauses, were among the provisions inserted with this object.

Under certain Acts, the Gaslight and Coke Company were authorized to acquire the district of the London Gaslight Company south of the Thames; but under those Acts a scheme had first to be prepared and submitted to the Board of Trade for approval. Such a scheme was submitted and approved; and it provides, *inter alia*, for the charges for public lamps.

Shortly, the position with regard to the charge for public lamps is as follows: The Gaslight and Coke Company cannot charge more for public lamps than the lowest charge to private consumers *in any part of their district*. The lowest charge to private consumers in any part of their district is that in their district south of the Thames, which is not to exceed the amount for the time being charged by the South Metropolitan Company, which is the lowest in London; so that the cost of gas for public lamps over the whole district is brought down to that level. If, therefore, the southern district is sold off under Part IV., the lowest charge to private consumers in any part of the Gaslight and Coke Company's district will then be the price charged on the north side; and the cost of public lamps will automatically rise to that level.

To-day, the difference between the Gaslight and Coke Company's charge to private consumers north of the river and the South Metropolitan Company's charge south of the river is 7d., but was, three months ago, 11d. It was given in evidence last session, that the aggregate quantity of gas consumed by public authorities for street lamps on the north side of the river was about 1000 million cubic feet. Upon this quantity, every penny of difference in price amounts to somewhat over £4000. The present difference therefore amounts to nearly £30,000 per annum, in favour of the public authorities. Last year it was nearly £50,000. This difference, or its capitalized value, is, in fact, the value to the public on the north side of the Thames, of the statutory enactments, and is too large a sum to be parted with without some equivalent. Unless Part IV. of the Bill be rejected, or considerably amended, the whole of this will be bargained away between the two Companies.

It is submitted that, in this case (as in the case of all previous gas amalgamations), the terms and conditions of the agreement between the two Companies should be subject to parliamentary criticism and approval in the public interest before being authorized. The Select Committee in the Commons rejected the Bill the Gaslight and Coke Company had introduced to enable them to raise £2,500,000 of debenture stock, because the Bill did not comply with the conditions laid down by Sir James Rankin's Select Committee of last year; but by authorizing (as the South Metropolitan Bill does) the Gaslight and Coke Company to sell their southern district, Parliament is putting an enormous amount of capital at the Company's disposal without a single one of those conditions.

The Bill will be in the House of Lords soon after the Whitsuntide recess; and it is hoped that all the Local Authorities in the Gaslight and Coke Company's area will co-operate with the view of obtaining either the rejection of Part IV. of the Bill altogether—and no urgency is claimed for it—or at all events in obtaining such an amendment as may protect the public from loss. In conclusion, the Corporation ask the co-operation of the various Boards in the matter.

On the receipt of the above communication by the Holborn District Board of Works at their meeting on Monday of last week, it was resolved that the Corporation be informed that the Board would accede to their request.

THE DUBLIN CORPORATION AND THE SUPPLY OF CARBURETTED WATER GAS.

At the Meeting of the Dublin Corporation on Monday last week, a report was presented by the Special Gas Committee with reference to the manufacture and supply of carburetted water gas by the Alliance and Dublin Gas Company. Mr. M'Call, in moving the adoption of the report, said he understood that the Company had put down plant by which they would be enabled to produce 4 million cubic feet of gas per day, which he thought exceeded their present supply by a million feet. In other cities where this gas was used, the quantity was confined to 20 per cent. He suggested that a somewhat similar agreement should be come to here, and that the people should be advised to see that the gas-pipes in their houses were in good condition, and that there were no leakages in them. The City Analyst should also be instructed to make analyses from time to time of the exact proportions of carburetted water gas distributed in the city. Mr. Irwin, in seconding the motion, said they had no power to prevent the manufacture of water gas and its supply to the citizens; but what they claimed was that the percentage of it should be limited. Mr. Murray thought they should be slow to interfere with the Gas Company in this matter. Mr. Joynt expressed the opinion that the Company should be called upon to give a guarantee on the line suggested by the Committee. Alderman Meade thought the House had not sufficient information to enable them to come to a fitting conclusion. The Committee should obtain expert opinion as to this new gas, and also legal advice as to the position of the Council in the matter. For this purpose the report should be referred back to the Committee. Alderman Cotton thought the House would be doing the proper thing in sending the report back for the fullest information. Dublin was about the last city to adopt the use of carburetted water gas. As to the question of labour in the works, its manufacture would make very little difference in the number of men employed. Mr. Clancy said there was great anxiety in the city as to the danger attending the use of this new gas, and Professor Reynolds had stated that, as at present supplied to the citizens, the gas was poisonous, and was a menace to health. The Council must do something to allay this anxiety. There was another view of the matter to be considered, and that was that the labourers at present employed by the Company would be reduced by 80 per cent. Alderman Cotton said the plant now being put down at the gas-works was in duplicate, and was only for the manufacture of 2 million cubic feet per day. It was eventually resolved to instruct the Gas Committee to obtain expert advice and also legal opinion as to their power; and what they advised the Council should do. The Committee were also instructed to ascertain where, and in what proportion, the admixture was used in the United Kingdom and elsewhere.

THE PROPOSED PURCHASE OF THE LEAMINGTON PRIORS GAS-WORKS BY THE CORPORATION.

Rejection by the Company of the Corporation's Offer.

Our readers may remember that, at a Meeting of the Leamington Town Council on the 14th ult., a resolution was passed that an offer should be made to purchase the undertaking of the Leamington Priors Gas Company for the sum of £140,000, and that Mr. Thomas Newbigging should be appointed Arbitrator (*ante*, p. 1390). The exact terms of the resolution were as follows: "That an offer be made to the Gas Company to purchase their undertaking at a sum of £140,000; the Corporation taking over all liabilities (excepting loans of £11,790, which the Company must discharge), and assets, including the surplus revenue of £7394, as per published balance-sheet at Dec. 31, 1899." This resolution was forwarded by the Town Clerk (Mr. H. C. Passman) to Mr. Edward Wright, the Chairman of the Company; and a special meeting was called to consider it. In sending a copy of the resolution to the proprietors, the Secretary (Mr. T. Berridge) stated that he had been instructed by his Directors to say that, in view of the estimate of the value of the works made by Mr. Livesey, who had been called in to advise upon the matter, they did not feel justified in recommending the acceptance of the offer. The meeting was held last Tuesday, when resolutions were passed rejecting the offer, and authorizing the Directors to appoint an Arbitrator, in accordance with the provisions of section 62 of the Leamington Corporation Act, 1896, and the Lands Clauses Acts therein referred to, and to take such steps, by the employment of Counsel, the retention of expert witnesses, and other means, as they deem necessary for protecting the interests of the shareholders, and properly representing their case before the Arbitrators and the Umpire to be appointed in accordance with the above-named Acts.

Sequel to the Brigg Gas-Works Transfer.—In connection with the transfer of the Brigg Gas Company's undertaking to the Brigg Urban District Council, Mr. George Jack, the Manager of the works, claimed as compensation £1721, and Mr. G. Clarke, the Company's Collector, claimed £735. With a view of effecting a compromise, the Council offered Mr. Jack £400, and Mr. Clarke £135. These amounts the claimants, however, declined to accept; and therefore the matter was referred to arbitration. Mr. George Livesey being the Umpire agreed to. The award just received gives Mr. Jack £600, and Mr. Clarke £135. The costs in Mr. Jack's case are to be paid by the Council; while Mr. Clarke has to pay his own expenses.

THE PRICE OF GAS AT LEEDS.

Radical Opposition to an Increase.

At the Meeting of the Leeds City Council last Wednesday, the proposal of the Gas Committee to advance the price of gas gave rise to a warm discussion; the proposition being strongly opposed by the Radical members.

The Lord Mayor (the Right Hon. Alderman Gordon), in the temporary absence of Alderman Lowden, the Chairman of the Gas Committee, moved—"That on and after the 1st of July next the price of gas supplied by the Corporation be as follows: To consumers within the city of Leeds, 2s. 3d. per 1000 cubic feet; to consumers outside the city, 3s. 1d.; and to consumers by means of automatic meters, 2s. 7d. That the resolution of the Council of Oct. 4, 1898, and also the resolution of the Gas Committee of April 17, 1896, on the subject, with the resolution of the Council of May 6, 1896, approving the same, be and the same are hereby varied accordingly."

Mr. Clarke seconded the motion.

Mr. Ratcliffe moved, as an amendment, that the matter be referred back to the Gas Committee. He said it would be a barefaced imposture upon the people of the city if the price were advanced as suggested. So late as the 23rd of April, the Chairman of the Committee had told them that no increase would be necessary. They had still 275,119 tons of coal in stock and on order. This would supply their needs until March next year. Upon what ground were the Gas Committee desirous of raising the figure? It might be said that the purifiers and yardmen had received an advance of wages. This would mean £1000 or £1500. But, on the other hand, the works were receiving 5s. 10d. a ton more for their coke than last year, which alone would give an increased revenue of something like £30,000.

Mr. Brown seconded the amendment. Halifax, he said, had decided for the present not to raise the price of gas, and he could not understand why Leeds was not in such a favourable position, in the matter of gas supply, as that borough.

Mr. Wilson severely criticized what he termed the hollow arguments of Messrs. Ratcliffe and Brown. He supported the proposal to increase the price of gas, but reserved his right of action in regard to automatic meters.

Alderman Lowden (who arrived during the discussion) said the financial statement for the year ended March 25 last, was not so satisfactory as he had anticipated. If his expectations had been realized, he should not have been disposed to ask for as great an advance as was now proposed. Analyzing the accounts for the financial year ended March 25 last, and comparing them with those of the previous year, Alderman Lowden said the profits for 1898-9 were £22,771 11s. 9d.; and for 1899-1900, 14s. 5d. only. The total increased expenditure for the past year was £41,307 11s., and the increased income £18,536 13s. 8d.; a difference of £22,770 17s. 4d. Though the profit was so small, it was satisfactory there was no deficit; and as long as he was Chairman of the Gas Committee, he did not intend to have one, or to sell gas at less than cost price, nor was he disposed to leave his successors with a large deficit. He now asked for an advance in the price of gas; but with regard to automatic meters, he was prepared to accept an amendment that no change should take place. The suggested increase of 1d. would only yield £320, while the cost of alterations in the automatic meters, which numbered 10,000, would be £310, besides requiring six months in which to make them. There was scarcely a town in the country which was not making an advance in the price of gas. The increase in 25 cases was the same as that recommended by the Committee, and in 28 instances it was 6d. It should be borne in mind that last year a reduction of 2d. was made in Leeds at a time when no other town lowered its charges. The present suggested advance, therefore, only meant 1d., as compared with other towns. If it were not for the favourable position of Leeds as regarded coal, an increase of 3d. would not suffice. Alderman Lowden criticized at some length the objections raised by the Radical members to the Committee's proposal, and concluded by stating that in the Gas Department there had been invested capital to the amount of £1,500,000; and it was their duty to see that this money was used in the interests of the city. If the Council wished the department to remain in a proper financial position, they would have to grant the application for the advance in the price of gas.

Mr. T. Walker did not see that they were warranted in assuming that coal would be 5s. per ton higher on the 25th of March next. That being so, they were not justified in raising the price of gas 3d. per 1000 cubic feet in anticipation of what might not happen. Neither in Committee nor in the Council had it been shown that an increase in price was necessary.

Mr. Henry protested that there was no necessity for an advance in the price of gas at present. It was evident that there was sufficient coal for this year, as some 275,000 tons had yet to be delivered; and, in addition, there were the surpluses from month to month. There were consequently nearly 300,000 tons available for the next six months. This being the case, it was not necessary to raise the price of gas. The design was apparent, however. Money was required; and the Conservative majority had pledged themselves that, no matter what the expenditure was, the rates should not be raised—that money should be got in some other way. The proposed advance in the price of gas was merely part of a system of extraction which was absolutely unnecessary.

Mr. Kinder complained that the gas profits were taken, and that the moment money was required by the Gas Department the price of gas was raised. He agreed with Sir Albert Rollit that, in conducting municipal trading concerns, all that was required was to safeguard the ratepayers against loss; but at the same time he held that some regard should be paid to the rights of the gas consumer.

After some further remarks in a similar strain, the amendment was put and lost.

Mr. Jessop then brought forward an amendment to the effect that the price charged for gas to customers using prepayment meters and cookers should not be advanced. This, he urged, would relieve the poorer class of consumers.

This amendment was carried; and eventually the Gas Committee's minutes, as amended in accordance with Mr. Jessop's proposition, were confirmed by 21 votes to 17.

ST. HELENS CORPORATION GAS SUPPLY.

The Past Year's Working and the Progress of the Undertaking.

At the last Monthly Meeting of the St. Helens County Borough Council—Alderman J. L. Gamble (in the absence of the Mayor) in the chair—the minutes of the Gas and Lighting Committee were presented. They set forth that the balance-sheet for the year ended the 31st of March last, showed that a net profit of £8855 had been made; and that the Committee had resolved that such profit should be appropriated as follows: £2500 to the borough fund, or as the Finance Committee might direct; £500 to the borough fund, to be expended in improving the street lighting; and the balance (£5855) to the reserve fund. The Committee further resolved to continue the price of gas, both for lighting and power, as at present.

Alderman Cook, in moving the adoption of the minutes, said that during the past financial year the total quantity of gas produced was 327,332,000 cubic feet, as compared with 298,000,000 cubic feet in 1898-9; being an increase of 9·82 per cent. The quantity of gas sold had been 306,126,000 cubic feet; being 10·47 more than in the previous year. The coin meters passed 51,772,000 cubic feet, against 33,000,000 cubic feet—an increase of 36 per cent. The amount in cash taken from the coin meters was £7135, against £5236. The gas used for motive power was 9,524,000 cubic feet, as compared with 7,487,000 cubic feet in the previous year; being 27 per cent. more. The unaccounted-for gas was 5½ per cent., against 6 per cent. in the previous year. The extra cost of coal during the year had been equal to 2·68d. per 1000 cubic feet. There had been received for residuals and sundries 2·29d. per 1000 cubic feet more than in the previous year. Financially the results were as follows: The gross profits for the year were £21,157, out of which there had been paid for interest and sinking fund £10,718. The depreciation of meters and stoves came to £1564, and there was a new item of £20 for the superannuation account. These sums deducted from the gross profits left a net profit of £8855. Having explained how the Committee proposed to appropriate this amount, he went on to say that the reserve fund stood at £17,119. But there was a debit, or sort of suspended account, against that fund of the amount lost on account of the explosion, £3461; so that if they did not receive any damages, the reserve fund would stand at about £13,658. With regard to the price of gas, the Committee did not purpose raising it. During the year there had been added 621 new consumers; and they had now 7658—being an increase of 8·8 per cent. They had fixed 1056 cooking and heating stoves and boiling burners, as compared with 610 in the previous year. There were erected during the year 23 additional public lamps; making a total of 1637 now in use. As the end of the century was approaching, he had been curious and interested enough to review the accounts of the Gas Department since the undertaking was acquired in 1878. He had done this to see what benefits had accrued to the community of St. Helens by that purchase, as well as to ascertain if the expectations of the Council of that day had been realized by the results. The total quantity of gas sold in 1878 was 99,451,000 cubic feet; the quantity sold last year was 306,126,000 cubic feet—being an increase of 207·8 per cent. The unaccounted-for gas in 1878 amounted to 13·22 per cent.; whereas last year it was 5½ per cent. The net profits which had been realized were £96,101. There had been ten reductions in price, amounting to £22,359; and there had been discounts allowed since 1882 of £36,052. In 1891, meter-rents were abolished; and in 1895, the charges for the hire of cooking and heating stoves. These sums made altogether £163,532, which represented the benefits which had accrued to the whole community of St. Helens by the acquisition of the gas-works. Some few years ago, he had an extract made from the books of the Corporation to see the amount of rates paid by the consumers and the non-consumers of gas. At that time the consumers paid 55·6 per cent. of the rates, and the ratepayers who were not consumers paid 44·4 per cent.; consequently, of whatever was paid into the borough fund out of the gas-works profits, 55·6 per cent. went back again to the consumers in the relief of their rates. This aspect of the question was not often noticed. Dividing the sum of £46,531 paid to the borough fund, he found that the gas consumers received £25,870 back in reduction of rates, and that the ratepayers who were not gas consumers only got back £20,620. To sum up all the benefits that had been conferred upon the gas consumers, there were ten reductions in price, amounting to £22,359; discounts were allowed of £36,052; and meter and stove rents were abolished to the amount of £9020. There was another aspect of the accounts to which he must refer, and that was the soundness of the concern. The capital expenditure in the year 1880 stood at £157,159, and there had been an outlay on capital account since that date of £111,986; making a total of £269,145. There had since been reductions—to the amount of £88,000; so that the balance at the present time was £181,145. It would be well to see how they stood with respect to the quantity of gas made in 1880. The capital then was £157,159, or at the rate of £1 10s. 4d. per 1000 cubic feet of gas. Now the capital expenditure account was £181,145, or 11s. 10d. per 1000 cubic feet—a reduction of 61 per cent. on 1880. He thought he had said sufficient to show that the accounts were very satisfactory, and testified to the sagacity of the Council in 1878, who carried through the negotiations which resulted in the purchase of the gas-works.

Mr. Leach said he thought the thanks of the Council were due to Alderman Cook, Mr. Glover (the Gas Engineer), and the members of the Committee, for the excellent way in which they had managed the gas undertaking. In distributing the profits, £5855 would go to the reserve fund. He thought if the Committee had seen their way to have dealt a little more generously with the rates out of the amount, they would have completed better than they had done their splendid work for the benefit of the town.

Alderman Cook said he thought every Committee, when they were spending money, ought to be perfectly aware of the effect it would have on the rates. It was a bad precedent to apply to his Committee in time of financial difficulty; and he could not agree to make any further grant. If the Council chose to say it should be so, he must submit; but it would be a wrong policy, because coal would cost £5000 more than last year. In view of this, he thought they could not ask him to give more, because it was not improbable they might have to draw upon the reserve fund in future years.

The minutes were passed.

MANCHESTER CORPORATION GAS AND WATER SUPPLY.

Gas-Meter Tests—The New Pipe from Thirlmere—The Water-Closet System.

At the Meeting of the Manchester City Council last Wednesday, one or two matters of special interest in connection with the Gas and Water Departments were discussed.

Alderman Gibson moved the adoption of the Gas Committee's minutes. They included the acceptance of tenders for the construction of a new boiler-house at the Bradford Road works, and for the supply of the coal and cannel required by the department for the ensuing year. It was also recommended, in accordance with the revised estimates agreed to at the previous meeting of the Council, to make an advance of 3d. per 1000 cubic feet in the price of gas, as from the 24th inst.

Mr. Shuttleworth said that a report from the Gas-Meter Testing Office showed that no less than 425 of the gas-meters which had been tested had proved deficient—telling either against the consumer or the Corporation. He also found that some of the meters put under what was called the "double" test had proved from 33 to more than 55 per cent. against the consumer. No wonder the latter protested. He knew very well that the Gas Committee did not want to charge for something they did not supply; but he would like to have an undertaking that in future, when a dispute arose between the consumer and the Committee, the meter should be put under the double test, and justice done.

Alderman Gibson remarked that the Committee were so desirous of having their meters absolutely correct, that they paid 6d. for every one in order to have it tested; and he was rather pleased to hear that there were only 425 deficient out of 125,000. He did not think this was extraordinary. He could assure Mr. Shuttleworth that the Committee were making inquiries as to this special test. They paid 6d. now, and were prepared to pay more if necessary, so that the test should be correct.

The Committee's recommendations were agreed to.

Alderman Sir John Harwood moved the adoption of the report of the Water Committee noticed last week (*ante*, p. 1566), in which the Council were asked to authorize them to take immediate steps in relation to the laying of another pipe from Thirlmere. The report, he thought, told the Council all they wished to know. They had a great luxury, but it would be wrong to suppose they could not exhaust the supply. They had a good service of pure water, and had been indulging its use to excess. If they employed it reasonably, they had enough water for the next 30 or 35 years. He did not advocate selling their water. They must keep Thirlmere as free as they could, as they would want it. The new pipe would bring 10 million gallons more water daily to the city.

Alderman Sir B. T. Leech seconded the motion.

Mr. Fildes proposed, as an amendment, that the report be referred back to the Committee for further consideration; making special reference to a paragraph in which it was stated that there had been a large increase in the number of water-closets, and the question was whether the Committee had such quantity of water at their disposal as to be able to bear this strain. The Committee seemed fearful lest the demand on this account would affect the general supply of the city. The average number of conversions of old property to the water-closet system during the last four years was 674; constructed in new houses, 2412; and in new buildings, 366—making a total of 3452. On a fair and equitable basis, this meant an extra 64,000 gallons per day of water consumed in closets. He asked anybody if there was anything to fear from this amount of increase. Practically all the important cities in England had adopted the water-closet system; and yet the Water Committee wished to restrict the work. They no doubt desired to furnish a good supply to the city; but it seemed passing strange that they should ask the consumers to be careful now because 32 years hence they might be short of water. Let them do their duty to the city now by providing it with water. In 20 years' time there would be another Committee, who would see that the right thing was done under the circumstances. Sir John Harwood and his Committee had no need to look after posterity, which would look after itself.

Mr. Plummer, in seconding the amendment, said he had read the report with considerable surprise; and he could not altogether absolve Sir John Harwood and his Committee from taking up the position of alarmists. It seemed an unheard-of proceeding that, while admitting that they had 75 million gallons of available water, that they had not got to half of it, and that the contingency of possible failure would not arise for 22 or 23 years, the Committee should wish to limit the supply. Previously, when they had come to within measurable distance of the exhaustion of supplies, they rendered homage to the men who saw the difficulty, and remedied it. They were now getting into a state of panic as to a possible failure in the next generation. The same energy which opened up the Thirlmere supply would no doubt be available again when the necessity arose. He hoped members of the Council would agree that they should not be prevented from doing anything necessary for the good of the city because of the contingency of possible failure in the next generation. They had brought water from remote hills in Cumberland; there was another lake not far away; and if any of the Committee were in a state of apprehension, let them at once start and make provision for an increased supply. They were justly proud of the financial management which had brought Thirlmere water to Manchester, not only without putting an additional burden on the city, but enabling them to reduce the price of water. If the contingency feared did arise, by that time one-half of the debt at present existing on the water-works would have been paid off. They had heard nothing from Sir John to justify this report; and he would urge the Council to adopt an uncompromising attitude, and not ask any citizen to stint himself in the reasonable use of water. He hoped the broader view of the Council would prevail over the narrow one of the Committee.

Sir B. T. Leech observed that Mr. Fildes and Mr. Plummer seemed to labour under serious misapprehensions. He did not think the report dealt at all with the question of putting an end to the use of water-closets. It simply drew attention to the fact that a large consumption was going on, and, as sensible people, they must take care there was no waste. That was all it said. It was stated that they were alarming people because they pointed out that in 35 years they would be short of water. He was not an alarmist, but he did say that the consumption of water had increased to an extent which had never been anticipated—one chief cause being that people had the idea that there was

any quantity to be got, and were using it in a way that was not at all desirable. He disliked waste, and he was thoroughly convinced that it was going on to a large extent. Their position was rather serious. They had a pipe from Thirlmere from which they had expected to get 10 million gallons; but they found that a certain proportion of it escaped, and they only had 8½ millions. They had done all they could to deal with this difficulty. The report simply asked the Council to let the Committee go on taking steps to put down a second pipe. He could not conceive—knowing that they were likely to be short of water—that they could get the pipe; and until it was laid they must be careful. What would refuse permission to do this. Some years would pass before they the Committee wanted to do was not to cause alarm, but to point out that if proper care was not exercised there was a possibility that necessity would compel the Committee to curtail the supply. They should not regard the water supply as inexhaustible, but make it last as long as it would.

Alderman Southern observed that the mover and seconder of the amendment were in a state of unnecessary perturbation and alarm. Mr. Fildes imagined that some one was going to propose that the Sanitary Committee should be hampered in their operations with respect to the water-closet system. It would have been better if he had heard what was to be proposed, and then he would have found a great deal of his alarm altogether unnecessary. Mr. Plummer had evidently not studied the diagram showing the increase which had taken place in the consumption. The amount consumed had reached 32,439,893 gallons per day. They had thought they could rely on 25,000,000 gallons from Longdendale, and 10,000,000 gallons from Thirlmere; but, whether owing to leakage or not it was difficult to say, they did not get the anticipated amount. They were nearing to the limit of the available supply, and they must exercise caution. Sir John Harwoood, showing the same foresight which he had exercised before, called attention to the fact that they were getting nearly up to the full supply of the present pipes. It would take three years to put down another pipe. In the meantime, what was going on? With regard to water-closets, the consumption was 2,260,850 gallons per day, and they had 49,439 of these closets. There was a rapid increase in the supply of water to meet these changes. He did not want to stop the Sanitary or Buildings Committee in introducing water-closets where they could, but if they could, with equal advantage, apply pail closets, they should do so. He hoped the Council would adopt the report as it stood.

Mr. Simpson supported the amendment, on the ground that the paragraph in the report to which reference had been made was alarmist, and that the remedy suggested or implied was one which ought to be the last to be considered.

Sir John Harwood remarked that those who had been opposing the report were the very people who he should have thought would support the policy of the Committee. The Committee said their descendants would be in a dilemma if care were not exercised now. Those who opposed the report said: "Don't regard it at all." He might further remark that it could not be proved that there had been any diminution in the death-rate where water-closets had been established. They could, however, discuss the other parts of the report as long as they pleased, so long as they gave the Committee the power they sought to lay the extra pipe. He personally had no objection to dropping the paragraph about the water-closets, so long as the Council passed the recommendation about the new pipe.

Ultimately the report was adopted in accordance with Sir John Harwood's suggestion as to the withdrawal of the paragraph respecting the water-closet system.

THE PRICE OF GAS AND WATER AT BRADFORD.

At the Meeting of the Bradford City Council last Tuesday, the prices charged for gas and water were under consideration.

The minutes presented by the Gas Committee contained a resolution that, in view of the increased cost of coal, the price of gas be advanced from the 1st of July next, from 2s. 3d. to 2s. 6d. per 1000 cubic feet; also the resolution of a Sub-Committee "that the gas discounts at present in force be continued, but that the account for each separate property owner or occupier, be kept and reckoned separately, with the proviso that the grouping of accounts for gas supplied to cottages or dwelling-houses, with accounts for gas supplied to business premises, be prohibited." The latter resolution was afterwards rescinded by the General Committee. Alderman W. E. Aykroyd, Chairman of the Committee, in moving the adoption of the minutes, stated, in reference to the proposed increase in the price of gas, that the extra cost of the coal required in the year ending March 31, 1901, was estimated at £36,000. This sum would have been £10,000 more if the Committee were not receiving 40,000 tons on last year's contracts. The prices of all materials and the rates of wages had gone up; so that repair and maintenance of works would this year cost about £8000 more than last. The alteration of the public lamps for the incandescent system would cost nearly £7000; while the cost of the public lighting in the recently added districts would be £4800. The reduction in the price of gas in North Bierley would cost £2700. Altogether, the additional expenditure for the year was estimated at £58,000; while the increased revenue due to better prices for coke and residuals was estimated to produce only £16,000—leaving a difference against the Committee of £42,000. The profit last year was £20,500; so that unless the price of gas was advanced, or the Committee were paid something towards the cost of street lighting, which this year would come to £29,000, there would be an actual loss of £21,500. The unappropriated gas profits on the 1st of April were £39,700. An advance of 3d. per 1000 cubic feet in the price of gas would produce £18,000; leaving a deficit of £3000, which would have to come out of the profits. Mr. S. Smith drew attention to the question of gas discounts, on which the Committee had withdrawn a resolution. On one account, the total income was £152 11s. 11d., and the discount allowed was £19 1s. 6d. The number of accounts included in that amount which ought to have no discount according to the scale was 200. The number of accounts represented was 233. They were lumped together, and it was looked upon as a wholesale order. Another account—as to public houses—was for £126 8s. 1d. The discount allowed was £15 16s. The number of accounts in this name which ought to have no discount was 60; those which should have 2½ per cent. 24, and only one should have 5 per cent. There were 85 meters represented, and not one of them ought to have 7½, 10, or 12½ per cent. The minutes were passed.

The Chairman of the Water Committee (Alderman Holdsworth) moved the adoption of the minutes of that body. At a meeting of the Contracts and Works Sub-Committee held on the 23rd ult., a deputation from the Woolcombers' Association attended, in reference to the proposal to increase the charge for water when more than 400,000 gallons were taken, and urged that the price should not be increased, as it would, in their opinion, have a tendency to make consumers search for other means of supply, and thus reduce the quantity of water required from the Corporation. The Sub-Committee discussed the subject, and resolved to recommend that the same charges as at present be continued up to 400,000 gallons, and that above this quantity the rate be 7½d. per 1000 gallons. Alderman Holdsworth, in moving the adoption of the minutes, referred to the increased charge for water supplied for trade purposes, and said that for a great many years the trades of Bradford using water in large quantities had been receiving it very much under cost price. This could not continue. The Committee had been put to enormous expense to keep pace with the consumption of water, and the works had been carried on at a loss for years past. There was also no probability of the Committee being able to get assistance from the Gas Committee. In view of these facts, they had felt it necessary that the advance in the price of water should be made. The revenue from water-works sources had been very elastic. It was continually increasing; but the expenditure was also continually increasing. Taking the revenue of the last fourteen or fifteen years, there had been a continual loss of £10,000 or £11,000 per annum. The advance in the price of water was, he admitted, a serious step to take. For his own part, he did not desire to raise the price to the large consumers; but the Committee must have money to enable them to pay their way, and the only remedy was to put the charge upon the people who, as a matter of commercial fairness, ought to bear it. The demands upon the high-level service were now just double the real storage capacity of the high-level reservoirs, and but for the assistance of the new conduit the Committee would have been in a far less advantageous position. It was only honest and fair that those who received the water should pay for it at its commercial value. There was no profit upon it even at the increased price to be charged, nor did it pay anything for interest or sinking fund on the new works. Alderman D. Milner seconded the motion. Alderman Hustler moved, as an amendment, that the minutes be adopted with the exception of the resolution advancing the price of water to large consumers, and that this be referred back for further consideration. He contended that it was very unfair to raise the price of water. In Leeds, Batley, Dewsbury, and Halifax the price charged for trade purposes and for supplies in large quantities was less than in Bradford. Mr. J. Triffitt seconded the amendment. Mr. E. R. Hartley said the large consumers, who were now getting supplies of water at less than cost price, were chiefly responsible for the fact that Bradford was spending £1,500,000 for new works in the Nidd Valley; and yet they threatened that, unless they were still allowed to have their water below cost, they would make that expenditure useless. Alderman Holdsworth contended that it was not fair to compare the cost of Bradford water with that of some other towns which had been more fortunately situated, either in being in close proximity to large drainage areas, or in not having to supply water of the peculiar quality required by the Bradford trade. The amendment was lost by 41 votes to 26; and the minutes were then passed.

WIGAN CORPORATION GAS SUPPLY.

The Past Year's Working.

The Engineer and Manager of the Wigan Corporation Gas Department (Mr. Joseph Timmins) has lately presented his thirteenth annual report, dealing with the twelve months ending the 31st of March last. After specifying the nature of the extensions made to the works and plant, which included the renewal of two sections of retorts (56 mouthpieces), the erection of two new purifiers, each 30 ft. by 20 ft., and 5 ft. 6 in. deep, and the lengthening of the mains by 2 miles 126 yards, Mr. Timmins says the increase in the number of consumers in the year was 667, and of gas cooking-stoves 86. The quantity of coal and cannel carbonized was 32,462 tons, against 30,319 tons in 1898-9—an increase of 2143 tons, or 7·06 per cent.; of gas made, 369,465,000 cubic feet, against 353,964,000 cubic feet, a rise of 15,501,000 cubic feet, or 4·38 per cent.; of gas sold, 343,809,300 cubic feet, against 327,267,300 cubic feet, being 16,542,000 cubic feet, or 5·05 per cent. The gross and net profits for the year 1898-9 were £26,889 and £13,258; whereas for the past year they were £27,987 and £14,078. The total amount of net profit for the past thirteen years is £124,599. Mr. Timmins calls the attention of his Committee to the fact that practically the whole of this has been handed over to the district fund, and applied in relief of the rates, without any very clear definition of the source of application. He therefore ventures to suggest that the Committee should take into their consideration the desirability of supplying gas for "public lighting" free; new pillars, brackets, and lamps, and the maintenance of those existing, to be made a charge against the Streets Committee. The public lighting has for a number of years been done practically free of charge, as, whether the cost of doing so was made a first or a second charge against the amount handed over to the district fund out of the gas profits, the final result was precisely the same, though indirect in the channel through which it was passed, and indefinite in its issue. Mr. Timmins expresses the hope that the Committee may see the desirability of determining a clearly defined application of at least a portion of the profits made by this department as suggested.

Accompanying Mr. Timmins's report is an abstract of the accounts of the Gas Department for the past two years. It shows that the receipts from the sale of gas, residual products, fittings, &c., amounted last year to £66,322, and the expenditure to £38,335, as compared with £60,043 and £33,154 in 1898-9. The balance is now £27,987; whereas last year it was £26,889. The amount brought forward is £14,271, making a total of £42,258; last year it was £11,813, making £38,202. From the £48,258 there has been paid interest amounting to £9564; placed to the sinking fund, £4245; to the general district fund, £12,500; and to the bad debts

account, £99—leaving a balance of £15,850 to be carried forward. Out of the amount available last year after payment of interest (£28,834), £10,300 was placed to the general district fund; and the balance carried forward was £14,271. The total capital expended on the works up to the close of the past financial year was £340,136, of which £4895 was laid out in the preceding twelve months.

The foregoing accounts came before the Borough Council at their last meeting. In moving the adoption of the Gas Committee's minutes, Alderman Holmes referred with satisfaction to the increase in the quantity of gas sold, which, he pointed out, amounted to 5 per cent. The profits were £820 more than they had ever been before, and represented on the gross capital invested in the undertaking a little more than 4 per cent. He looked with no little trepidation at the prospect of a very serious increase in the price of coal during the current year; for should the advance of 5s. a ton, which had been accepted by many railway companies and gas-supplying corporations, be demanded from the Wigan Corporation, there would be a reduction of something like £8000 in the profits of the undertaking. The minutes were passed.

BURY CORPORATION GAS SUPPLY.

The Past Year's Working.

At the last Meeting of the Bury Town Council, the minutes presented by the Gas Committee contained the annual report of the Engineer and Manager (Mr. H. Simmonds), covering the period ending the 31st of March last. He stated therein that the quantity of gas made was 355,646,000 cubic feet (229,000 cubic feet having been made from benzol), and that sold and used on the works 349,088,150 cubic feet; leaving 6,557,850 cubic feet unaccounted for, or 1·87 per cent. In the preceding year, the loss was 7,434,750 cubic feet, or equal to 2·2 per cent. The cost of manufacture, distribution, management, &c., per 1000 cubic feet of gas sold was 2s. 1·35d. Allowing for tar, sulphate, coke, sundries, 10·02d., the net cost was 1s. 3·33d. Adding interest on loans, stock, and sinking fund, 6·45d., the total cost was 1s. 9·78d. The income being 2s. 3·15d., the profit (£7675) was 5·37d. The estimated cost for the current year is: Total gross cost per 1000 cubic feet of gas sold, 2s. 6·27d.; less residuals, 10·79d.; net cost of gas, 1s. 7·48d.; add interest on loans, 6·33d.; total cost of gas, 2s. 1·81d. Revenue, 2s. 3·48d.; estimated profit (£2300), 1·67d. There was an increase of 30 stoves and 269 grillers, 97 prepayment meters, and 477 new meters during the year; and the total length of mains in use at its close was 77 miles 690 yards. Alderman Collinge, in moving the confirmation of the minutes, called attention to the Manager's report, from which he said it would be seen that there was a profit of £7675. The Committee proposed to divide this sum—one moiety going to the general district rate, the other to the consumer. Last year they charged for gas 2s. 3d. per 1000 cubic feet, less 1d. for prompt payment, which, with 2d. from the profits (which was also deducted), brought the cost down to 2s. Now they proposed to charge 2s. 4d., less 1d. for prompt payment and 3d. profit; so that it came to 2s., as before. They all knew that there had been a great advance in the price of coal, which had cost about £3000 more than they thought it would do; and they anticipated it would cost them several thousand pounds additional during the current year. This was the reason why they put up the price from 2s. 3d. to 2s. 4d. The minutes were passed.

ROCHDALE CORPORATION GAS AND WATER SUPPLY.

According to the recently issued annual report of the Gas Committee of the Rochdale Corporation, there was an increase of 6½ per cent. in the consumption of gas in the twelve months covered by it; while the revenue from residual products showed a still more marked advance—being 69·7 per cent. of the cost of coal, as against 50·5 per cent. in the previous year. The use of gas for purposes other than lighting steadily extends; the quantity so used last year amounting to about 83 million cubic feet—an increase of nearly 19 per cent. Prepayment meters increased in numbers during the year; but the income per meter was rather less than before, and scarcely provided an adequate return on the outlay incurred. The balance of net profit at the close of the year, after strengthening the reserve fund by the addition of £6000, instead of the usual contribution of £3000, amounted to £13,061. Owing to the rise in the cost of coal, the Committee notified that the question of raising the price of gas must early engage attention. At the meeting of the Town Council on the 7th inst., the Committee brought up a resolution they had passed on the previous day, recommending the Council to order that after the next quarterly inspection of meters the price of all the gas supplied within or beyond the borough should be raised 3d. per 1000 cubic feet, and that the consumers using prepayment meters be charged 1d. for each 20 feet of gas supplied to them. It was explained that the Engineer and Manager (Mr. T. Banbury Ball) had stated that the probable increase in the Committee's expenditure this year was £14,250, £12,000 being for coal. The gross profits last year were £19,060, and the 3d. increase would realize £4750; making a total of £23,810. Deducting the extra expenditure which had to be met, there was left a profit of £9560, which was the sum the Manager thought they might fairly look forward to, independently of any increase in the consumption of gas. The resolution was confirmed.

The Water Committee have also issued their annual report. It shows that during the past year there was an increase of 570 in the number of tenants; the total being 28,390 for 1899-1900, against 27,820 for 1898-99. The ordinary water-rental payments now amount to £27,257, against £26,696 twelve months ago; showing an increase of £561. Payments for supplies by meter total up to £7307, against £6688 in 1898-99—an increase of £619. The total increase for the year is therefore £1180. These amounts do not include the rentals for water supplied from the Ramsden Woods reservoir and works recently acquired from the Todmorden Water Company, which are as follows: Domestic water-rentals, 1900, £1429; supplies per meter, £522—total £1951. The Committee say the above figures show that the demand for water in the town and districts require the supply available from the Ramsden Wood reservoir to be at once connected with the present service.

SALE OF THE CRAWLEY GAS-WORKS.

In accordance with the announcement which had appeared in the "JOURNAL," Mr. Alfred Richards carried out last Tuesday the instructions he had received from the Crawley Gas Company, Limited, and offered for sale, at the Mart, Tokenhouse Yard, E.C., the Company's freehold gas-works, which stand about half a mile from Crawley Station, on the London, Brighton, and South Coast Railway. They comprise a retort-house, containing in one arch three 21 inch by 15 inch retorts, 8 ft. 3 in. long; in a second arch six 16-inch round retorts 9 feet long—a third arch affording space for two additional retorts; a brick-built and slated coal-store; a vertical condenser and a scrubber, a tar well, with hand pump; a brick-built and slated purifier-house, containing two purifiers, each 7 feet square by 4 feet deep, with lime-shed adjacent; two gasholders, one 48 feet diameter and 12 feet deep, the other 26 feet diameter and 10 feet deep, both in brick and puddle tanks; a 250-light station meter, and a 6-inch governor and connections; a Manager's house, containing three bed-rooms, sitting-room, and washhouse; a lean-to workshop adjoining, fitted with bench, &c.; and an open store about 20 feet long and 12 feet wide. Mains to a total length of about 3½ miles have been laid in, and there are about 160 house services and meters, and 78 street-lamps and columns, belonging to the Company. The output of gas in 1899 amounted to 5,678,600 cubic feet; and the price charged to ordinary consumers was 4s. 9d. per 1000 cubic feet. The districts at present supplied by the Company are Crawley and that part of the parish of Ifield which is situate in Crawley, which together possess a total population of about 3000. There was a good deal of competition for the property, and the biddings, which started at £3000, eventually reached £5000, at which it was sold. The buyer enters into possession on the completion of the purchase on the 29th of September next. All fittings, tools, stock, &c., were included in the sale, with the exception of the coal, coke, and tar, which the purchaser will take at a valuation.

THE WHITWICK AND COALVILLE GAS-WORKS ARBITRATION

At last Tuesday's Meeting of the Coalville Urban District Council, the Chairman (Mr. T. H. Heward) referred to the recently published award in the arbitration in connection with the acquiring of the gas-works, and thanked the members of the Council for the confidence they had reposed in the Gas Committee. He briefly reviewed the negotiations which led to the decision to abide by arbitration. At a conference held with representatives of the Company, they made an offer of £30,000; but were told that the representatives of the Company had not been empowered to accept less than £42,500, and the matter was referred to arbitration. After hearing the whole of the evidence, the Arbitrators had failed to agree; and therefore the award was made absolutely by the Umpire, who had heard the whole of the evidence. Their Engineer's estimate, as put before the Arbitrators, amounted to £22,911. The decision arrived at amounted to practically £35,000, as the purchase price of the gas undertaking, which amount, with other details, would be increased to £40,000. He thought that, under the circumstances, they had done as well as could be expected, and as well as other urban authorities who had been compelled to purchase gas-works. In the face of the increase in the price of coal, however, the Council would not be able to begin its career in the control of the gas undertaking by reducing the price of gas. The arbitration with reference to the compensation to officers of the Company resulted in claims of £2709 being reduced to £600. Mr. Lindley supported the Chairman's statement; and Mr. M'Carthy said that, although no immediate benefits might result from the acquiring of the gas-works, there was no doubt the benefit would be felt in future years. Mr. W. Sheffield also expressed satisfaction at the result of the arbitration, and thought the ratepayers ought to be satisfied with the Council's effort.

BURTON-ON-TRENT GAS AND ELECTRICITY SUPPLY.

The Past Year's Working—The Price of Gas.

At the Meeting of the Burton-on-Trent Town Council last Wednesday, the minutes presented by the Gas and Electric Light Committee contained particulars of the working of their undertakings (of which Mr. F. L. Ramsden is Manager and Engineer) in the year ending the 31st of March last. In moving the adoption of the minutes, Alderman Lowe, after referring to the increased price of coal, which is now 5s. per ton more than it was twelve months ago, said he thought the Council would agree that they had made substantial progress during the past year in their electric light undertaking; and he ventured to hope the time was not far distant when the department would not only cease to be a charge on the rates of the borough, but would become remunerative. He was glad to inform the Council that the sales had increased in the past twelve months from £2751 14s. 9d. to £3503 3s. 8d. The total receipts were £3732 10s. 6d., against £2851 4s. 8d., or an advance of nearly 33 per cent. He could not but regard this as highly satisfactory; and should they increase in anything like the same proportion during the current year, the Committee would not find it necessary to ask the Council for assistance in discharging their liabilities. The expenditure had remained nearly stationary; amounting to £3738, as against £3621 3s. 10d. in 1899—an increase of £116 16s. 2d. Of this amount, £172 2s. 7d. was for interest on an overdraft at the bank. After paying £1867 13s. 1d. in stock and dividend contributions, they had a deficiency of only £5 9s. 6d. to meet. He felt sure the Council would regard as most gratifying the progress thus made. It was only fair to remind the Council that they had spent £1825 in replacing the old rubber mains with new cables. This had cost them altogether £2359, and had been paid for out of the reserve fund of the gas undertaking. Turning to the gas-works, the Committee were glad to be able to report another successful year's operations. Their business had maintained that steady increase which it had shown during the past. Their sales during the year had increased from £29,786 to £32,322; being equal to an advance of more than 8½ per cent. They had, however, to set against this the increased cost of coal, stokers' wages, and other items involved in the manufacture of gas, which augmented the expenditure

by £4012, in addition to which they had a very heavy year in renewals and repairs to works, plant, and mains, and other establishment charges. They had, however, succeeded in increasing their profit from £6105 to £6521. It was only about three years since the first prepayment meter was fixed in Burton; but now they had no fewer than 1500 of this class of customers, and they were increasing every day. It was a very striking fact that 25 per cent. of the gas consumers preferred this meter to the ordinary one. Then, in addition to the small grillers provided with the prepayment meters, they had nearly 800 gas-stoves out on hire, and had also supplied 90 gas-engines in the town. Perhaps the most noticeable fact about the year's trading was the extraordinary advance in the price of coke, for which the Committee had no difficulty in getting prices varying from 16s. 8d. to 19s. 2d. per ton. This was an advance of 6s. per ton on the average obtained last year. How long these high figures would be maintained, it was impossible to say; but at present the demand exceeded the supply. Taking all things into consideration, the Committee thought the gas and electric light undertakings had worked most satisfactorily. The minutes were passed.

Subsequently, Mr. Lowe brought forward a motion to increase the price of gas 5d. per 1000 cubic feet. He acknowledged that such a proposal was unpopular, and said the Committee had been most reluctant to come to the conclusion that they were bound to take the course they had done. But either the charge for gas must be raised considerably, or they would fail to make any contribution to the rates, which would in consequence go up 6d. in the pound at the very least. They hoped and believed that the rise would be only temporary. They had paid an advance of 5s. per ton on their coal, or equal to 43 per cent. rise. They carbonized 35,000 tons annually, on which they were paying the extra 5s. per ton, which would involve them in an additional expense of £8750; this being the amount they had to provide for. Now, 1d. per 1000 cubic feet of gas was estimated to produce about £1250; therefore an advance of 5d. should bring in £6250, leaving £2500 to be met by the increased price of residuals. It was not proposed to increase the price to prepayment meter consumers. After all 3s. was not a high price for gas, under the circumstances. When the charge was raised in 1894 from 2s. 9d. to 3s., the price paid for coal was 13s. per ton. Now they were entering into contracts at an average price of 16s. 8d. per ton, or 3s. 8d. more than it was six years ago, when gas was at a similar price. There was one other way in which the Committee might have partly met the difficulty, and that was by trying to reduce the illuminating power of the gas. For many years this had been equal to 18 candles, which was higher than many towns, and considerably higher than London; and 16-candle gas, though it would cost less to manufacture, would be just as efficient for power and heating purposes. Though the time might come when this would again have to be considered, the Committee were of the opinion that it was better to keep the quality as at present than to reduce its brilliancy. Mr. Hutchinson contended that, as the price of electricity was not to be raised, the consumer of this illuminant had an unfair advantage over his neighbour who used gas. Moreover, the Committee proposed to tax the gas consumers for the benefit of the general public; and he did not consider this was a proper course to pursue. He moved an amendment to the effect that the increase should be only 2d. all round. After some discussion, in the course of which the Mayor (Mr. G. L. Blackhall) supported the Committee's proposition, the amendment was lost by 16 votes to 3; and the motion was then put, and declared carried.

LOUGHBOROUGH CORPORATION GAS SUPPLY.

The Outlook for the First Year's Trading.

At the Meeting of the Loughborough Town Council yesterday week, the Parliamentary Committee reported that various matters, in regard to which it was necessary to make arrangements for the carrying on of the gas undertaking after it becomes vested in the Corporation on the 30th inst. have been under their consideration. The Committee have decided to recommend the Council to continue the services of Mr. Edward Onions as Engineer and Manager, at the salary now paid by the Company, the amount of salary attached to the office to be reconsidered after twelve months' service. With respect to the provision of additional carbonizing plant, the Committee have approved of the Company undertaking the erection of two additional benches of retorts at the gas-works, and for that purpose to accept the tender of Messrs. Gibbons Bros., for the sum of £1547. The Committee have considered the question as to how applications for additional gas-mains or extensions of mains should be dealt with. A number of such applications have already been received. They have decided to continue the policy of the Company—namely, to make such extensions only in cases where, in the opinion of the Committee, they will become remunerative in the immediate future. The Company have been requested to enter into contracts for the supply of coal and lime required at the gas-works for the next twelve months. The Manager of the gas-works has reported that the average price per ton for coal on the tenders accepted is 18s. 4d., compared with 13s. 4d. last year; and he estimates that the increase in the cost of coal for the year would amount to £2750, lime to £70, and wages £213—total increase in the working expenditure £3033. On the other side, he estimates that there will be an increase of receipts from coke sold of £896; and a saving on other items of £200. So that it would be necessary to increase the price of gas 6d. per 1000 cubic feet to meet the deficiency. The Committee, acting on this advice, "have been reluctantly compelled to direct that the price of gas be increased 6d. per 1000 feet, and have ordered notices to be given for this purpose."

Alderman Bumpus, in proposing the adoption of the report, said this was the first report since the Committee had been occupied in the preliminary stages of taking over the gas-works; and it showed the chief points they had had to deal with. It was absolutely necessary that the plant should be extended, inasmuch as the Manager was unable to guarantee an adequate supply of gas during the coming winter. Had the Company remained in charge of the undertaking, they would some time ago have extended the plant. It was with reluctance that they increased the heavy capital charge; but the rapid increase in gas consumption (the satisfactory factor in the situation) had made compulsory some further capital expenditure. The principal point in the report was the decision to raise the price of gas 6d. per 1000 cubic feet. This certainly was an unfortunate step just as the gas-works were being taken over by the Town Council. But if the Company had remained in charge, they would have had to take the same step. The 6d. increase would only barely cover the actual increased cost of production; and the Company might also have charged a profit upon the increased cost of production. The rise in the price of coal was the cause of the increase. The price of gas had been raised in other towns; and in none less than 6d., except in cases where the gas-works were owned by the Municipalities, and where large surplus profits had hitherto been given in relief of the rates. In such instances, where the increase had been less than 6d. there had been a diminished surplus to hand over for the benefit of the rates. Loughborough had no reserve of this kind to fall back upon; and consequently they had to raise the price of gas to meet the increased cost of production. Speaking generally, he was afraid the financial outlook was not very favourable. Their charges on capital account for the next five years would be exceptionally heavy; and it would only be by an increased consumption of gas that they could hope to equalize their balance-sheet. If the present rate of consumption continued during the next few years, it would put a satisfactory aspect on their accounts. Although for the present the gas undertaking would be expensive and burdensome, he was sanguine that before very long it would be beneficial to the ratepayers. There was one other item that interested some people a good deal; and that was the course the Committee had resolved to take in respect of new streets. They had to look at the gas-works as a commercial undertaking on behalf of the ratepayers. They had, therefore, decided to continue the policy of the Company, and only lay down mains where in their judgment they would prove remunerative. On the other hand, the Committee were anxious to meet the convenience of those who were developing building land, and of would-be consumers of gas in unfinished streets, and also the Highway and Estates Committee, so that streets should not be unnecessarily broken up for the laying of mains. They would give developers of building land an opportunity of ensuring a remunerative return, by offering to receive a guarantee from such developers that for a period of five years the income from the gas consumed through the laying of mains should not be less than 5 per cent. on the outlay. That would enable those who were projecting new streets to have mains laid forthwith. It would be an advantage in the development of the land, consumers would be able to have the gas at once, and it would enable the Highway Committee to be set at rest, inasmuch as they would see their streets more reasonably treated than they had been in the past by the mains being put down before the surface was finished. The Gas Company would be in possession till the 30th inst.; but they had allowed the Committee to proceed with the extension of the plant before they actually entered into possession. Otherwise they would not be able to get the work completed before the stress of the winter consumption came upon them.

Alderman Tidd, seconding the motion, thought the statement made by Alderman Bumpus was satisfactory to all parties concerned.

The report was adopted.

ELECTRIC LIGHTING NOTES.

The Electricity Committee of the Manchester City Council have written to the Local Government Board asking for an early inquiry to be held as to the borrowing of £189,890 for electricity purposes.

At the monthly meeting of the Whitby District Council last Tuesday, the Clerk read a letter from the Local Government Board to the effect that they had decided to accede to the Council's application for sanction to borrow £26,000 for the purposes of electric lighting; and they enclosed their formal sanction.

The financial statement of the Electric Lighting Committee of the Morecambe District Council, just issued, shows that the gross profits on the revenue account this year are £1764, against £775 last year. The total cost of the works and plant is £39,700; and the amount of principal repaid is £2500. The current sold during the year amounted to £3900, as compared with £1800 last year.

The Lighting Committee of the Leeds Corporation intend making application to the Local Government Board for sanction to borrow a further sum of £27,573 for electricity purposes. At the Council meeting last Wednesday, sanction was given to the formation of a reserve fund, to be called the electric lighting equalizing fund; and the payment into it of £8287 from the surplus profit of the electric lighting undertaking was ordered.

The Local Government Board have approved of the scheme for lighting Rhyl by electricity. The scheme will entail an expenditure in the first instance of £19,000, and will be worked in conjunction with a refuse destructor and a new electric tramway along the sea-front. In 1892 the Town Council purchased the gas and water undertakings, but, owing to the rapid development of the town, it has been considered advisable to instal the electric light. The loan is granted for 25 years.

The Lighting Committee of the Wolverhampton Corporation have issued their report for the year ending the 31st of March last. The net result is that, after payment of interest and sinking-fund charges, there is a profit of £402. In addition to this, the sum of £911 was expended during the year out of revenue, to suit the increased pressure at which the current is now being supplied. The amount in hand on account of the working of previous years is £416; and it is proposed to add the profit made last year—making £818—and to set aside this amount to form a reserve fund.

The Electricity Committee reported to the Newport County Council last Tuesday that a surplus of £403 had been made during the past year on the electricity undertaking. Mr. Llewellyn, the Chairman of the Committee, explained that the gross profit during the year amounted to £4092, and that provision had been made for all loans sanctioned, but not for the new ones. He hoped this small profit was an indication and a beginning of better times. Several gentlemen followed with a suggestion that the opportunity afforded by the Gas Company raising their prices should be taken the greatest advantage of, and that at the earliest opportunity the price of electricity should be reduced from 6d. to 4d. per unit. Alderman Moses hoped the Council would not be too hasty in reducing the price; and Mr. White followed with the observation that

comparatively few ratepayers used electricity, while the general body of the townspeople had had to contribute their share towards the cost of the installation.

At a meeting of the Halifax Board of Guardians, held last Wednesday, Mr. R. Thornton presented a report comparing the respective cost of gas and electric light. For the quarter ending March last the cost of gas was £37 12s. 5d., and of electric light £151 2s. 2d.—together £188 14s. 7d. The cost of gas in the corresponding quarter last year was £100 11s. 11d.; showing that, owing to the installation of the electric light, the quarter's lighting bill had increased by £88 2s. 8d. Mr. J. W. Hodgson said that when the installation was decided upon, the Committee were of opinion that there would be a considerable saving of painting, cleaning, &c.; and they were looking forward to a saving there. Moreover, the whole of the premises were more healthy. They ought not to look at the question solely from the pounds, shillings, and pence point of view. In reply to a question, he said that, unless the Halifax Corporation dealt with them liberally, they would at once consider the question of starting electric lighting plant of their own.

An inquiry was held last week at Wolverhampton into the deaths of Samuel Clulow and Daniel Trawford, who died on the 31st ult. from the effects of an electric shock received at the Mars Iron-Works, Ettingshall. A witness named Meredith stated that on the night of the accident he noticed Clulow lying on his back in the weighing-cabin, his left hand being in contact with a wire used for raising and lowering an arc lamp. When witness went to his assistance, his hand touched the wire, and he received a shock. Another witness stated that he saw the two men lying in the cabin. He caught hold of Clulow, and received a shock which drew his arms up. Mr. W. J. Baker, in the employ of the owners of the works, deposed to installing the electric light in November last. The lamps were second-hand, and all the repairs he did himself. He could not explain how the current got down the wire touched by deceased. He had had no special electrical training, and what he knew he had learned from books and by serving with an electrical engineer. Mr. W. H. Thornbury, Consulting Electrical Engineer, of Birmingham, said the wire was no part of the electrical system, and ought to have been completely isolated. He thought that at the time of the accident there was electrical connection between the lamp and the pulley-wire, which thus became a "live" wire; and if there was a leakage of electricity to earth at a distant part of the system a man standing on the ground, and touching the pulley-wire, would receive a shock. When the tests were made, no such leakage could be discovered; but he thought that at the time of the accident there was a leakage from another lamp through a suspension wire to the earth some distance away. He recommended that the plant be reconstructed for a low-voltage system; but with the exception of the electrical connection between the lamp and the suspending wire, there was nothing wrong with the plant. The Jury found that deceased met their deaths from an electric shock, accidentally received, and recommended that a low-voltage system be introduced into the works, or that suspension wires should be out of reach. It was stated on behalf of the owners of the works that the suggestion should have attention, and that all claims for compensation would be satisfied.

THE ABORTIVE NEWHAVEN AND SEAFORD WATER BILLS.

The Effect on the General District Rate.

Yesterday week at the Meeting of the Seaford Urban District Council, the General Purposes Committee reported that a letter had been received from the Local Government Board stating that they had no power to authorize the Council to temporarily appropriate the money now invested in Consols for the purpose of defraying the expenses incurred in promoting and opposing Water Bills in Parliament. They had also received a letter from their Solicitor, enclosing the amount of the taxed bill of costs for promoting and opposing the Bills. The amount payable by the Council was £2435 7s. 2d.; and the Solicitor requested the Council to make some definite arrangement as to the time of payment, and to pay interest on the payments. The Committee recommended that he be informed that the Council will arrange to pay half the amount on or before Sept. 30 next, and the balance within six months of that date; but that they had no power under the Public Health Act, 1875, to pay interest thereon.

It was subsequently proposed that the Chairman be empowered to affix the seal to a general district rate of 1s. 6d. in the pound. The mover of the resolution remarked that, as the Council were aware, they were unfortunately bound to pay the expenses incurred in connection with the Water Bills out of special rates. They might borrow money for the purchase of apparatus to clean out sewers or for the purchase of any "tiny pokey thing," they might borrow to develop landowners' property by providing main drainage, &c., thereby adding increased value to all the sites abutting on the main drain; but they must not do anything for the benefit of the town out of a loan. They were allowed to sink any amount of money on sea-walls and those sort of things; but they could not spend money on anything that would bring a quick return to the ratepayers, to relieve their burdens in the near future as well as give them a pure supply of water. He thought it was a scandal that the law remained as it was at present. They were recommended to go forward with these water questions; and if they had succeeded, they would have been granted a loan, but as they lost no loan was granted. The attempt was right in either case, whether they succeeded or failed; and he was unable to see the line that was drawn between success and failure.

THE FALMOUTH CORPORATION AND THE WATER-WORKS.

The question of the water supply was again under the consideration of the Falmouth Town Council at their meeting on the 7th inst. One of the members had given notice to move that steps should at once be taken for the purchase of the water-works. Before the motion was reached, however, Dr. Banks proposed, with a view to obtaining definite information as to the purchase of the works, that Mr. Mansergh should be asked his fee for reporting on their condition, on the work necessary to bring them up to date, and the present value of the undertaking. The majority of the Council, he said, were in favour of

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1636.

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment
£			p. c.	GAS COMPANIES.			£ s. d.
500,000	10	Apl. 11	10½	Alliance & Dublin 10 p. c.	20—21	..	5 0 0
100,000	10	,,	7½	Do. 7 p. c.	13½—14½	..	5 3 5
300,000	100	Jan. 2	5	Australian 5 p. c. Deb.	102—104	..	4 16 2
200,000	5	May 16	6	Bombay, Ltd.	6—6½	..	4 12 4
40,000	5	,,	6	Do. New, £4 paid	4—4½	..	5 6 8
350,000	Stk.	Feb. 23	12	Brentford Consolidated	250—260	..	4 12 4
270,000	,,	,,	5	Do. New	185—190	..	4 14 9
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	June 14	4	Do. 4 p. c. Deb.	116—120*	..	3 6 8
220,000	Stk.	Mar. 14	11½	Brighton & Hove Orig.	230—240	−2½	4 15 10
226,320	,,	,,	8½	Do. A. Ord. Stk.	175—180	..	4 14 5
999,500	Stk.	Feb. 23	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Mar. 29	10	British	39—41	..	4 17 7
80,000	10	Feb. 23	12	Bromley, Ord. 10 p. c.	24—26	..	4 12 4
79,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	May 16	6	Buenos Ayres (New) Ltd.	9—9½	..	6 6 4
220,000	Stk.	June 14	4	Do. 4 p. c. Deb.	99—101*	+1	3 19 3
150,000	20	Mar. 14	8½	Cagliari, Ltd.	24—26	..	6 6 11
100,000	10	June 14	8	Cape Town & Dis., Ltd.	14—15*	+½	5 6 8
50,000	50	May 2	6	Do. 6 p. c. 1st Mort.	55—57	..	5 5 3
550,000	Stk.	Apl. 11	13½	Commercial Old Stock	275—285	..	4 14 9
235,425	,,	,,	10½	Do. New do.	210—220	..	4 15 5
287,237	,,	June 14	4½	Do. 4½ p. c. Deb.	137—141*	−1	3 3 10
900,000	Stk.	May 31	9	Continental Union, Ltd.	155—165	..	5 9 1
200,000	,,	,,	7	Do. 7 p. c. Pref.	170—175	..	4 0 0
51,000	Stk.	Feb. 23	14	Croydon A 10 p. c.	335—340	..	4 2 4
173,400	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
555,000	Stk.	Feb. 23	5½	Crystal Palace Ord. 5 p. c.	116—120	..	4 7 6
60,000	,,	,,	5	Do. 5 p. c. Pref.	130—135	..	3 14 1
486,090	10	Jan. 26	11	European, Ltd.	19½—20½	..	5 7 4
234,660	10	,,	11	Do. £7 10s. paid	14½—15½	..	5 6 5
14,993,075	Stk.	Feb. 9	4½	Gas- 4 p. c. Ord.	101—103	+½	4 15 1
2,600,000	,,	,,	8½	light 8½ p. c. max.	96—98	..	3 11 5
3,799,735	,,	,,	4	and 4 p. c. Con. Pref.	116—118	..	3 7 10
3,993,975	,,	June 14	8	Coke 8 p. c. Con. Deb.	95—98*	..	3 1 3
70,000	10	May 31	8	Hongkong & China, Ltd.	13½—14½	..	5 10 4
2,900,000	Stk.	May 16	10	Imperial Continental	205—208	..	4 16 2
473,600	Stk.	Feb. 9	8½	Do. 8½ p. c. Deb. Red.	100—103	..	3 8 0
75,000	5	June 14	6	Malta & Medn., Ltd.	4½—5*	..	6 0 0
560,000	100	Apl. 2	5	Met. of 5 p. c. Deb.	107—110	..	4 10 11
250,000	100	,,	4½	Melbourne 4½ p. c. Deb.	106—108	..	4 3 4
541,920	20	May 31	8½	Monte Video, Ltd.	10½—11½	..	6 1 8
667,946	Stk.	Feb. 23	9½	Newc'tle & Gatesh'd Con.	215—220	..	4 4 1
299,855	Stk.	Dec. 29	8½	Do. 8½ p. c. Deb.	104—107	..	3 5 5
180,000	5	May 16	8	Oriental, Ltd.	7—7½	..	5 6 8
135,000	5	,,	8	Do. New, £4 10s. pd.	6½—6¾	..	5 6 8
15,000	5	,,	8	Do. do. 1879, £1 pd.	1½—1¾	..	4 11 5
				* Ex. div.			

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
60,000	5	Feb. 23	7	Ottoman, Ltd.	5—5½	..	6 7 3
500,000	100	June 1	6	People's Gas of Chicago 2nd Mtg. Bonds	102—106	..	5 13 2
851,070	10	Apl. 27	7	River Plate Ord.	10¼—10¾	..	6 10 3
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb.	101—103	..	3 17 8
250,000	10	Apl. 11	8	San Paulo, Ltd.	11½—12½	..	6 8 0
185,000	Stk.	Mar. 14	10	Sheffield A.	245—247	..	4 1 0
209,053	,,	,,	10	Do. B.	244—246	..	4 1 4
447,427	,,	,,	10	Do. C.	244—246	..	4 1 4
5,600,000	Stk.	Feb. 23	5⅓	South Metrop., 4 p. c. Ord.	129—132	..	4 0 9
1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb.	98—100	..	3 0 0
380,940	Stk.	May 16	5	Southampton Ord.	115—120	..	4 3 4
70,825	,,	Dec. 29	4	Do. 4 p. c. Deb.	120—125	..	3 4 0
120,000	Stk.	Mar. 14	6	Tottenham A. 5 p. c.	120—125	..	4 16 0
250,520	,,	,,	4½	and B. 3½ p. c.	93—98	..	4 11 10
55,100	,,	June 14	4	Edmonton 4 p. c. Deb.	111—115†	..	3 9 7
182,380	10	Jan. 12	5	Tuscan, Ltd.	7—8	..	6 5 0
149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.	101—104	..	4 16 2
				WATER COMPANIES.			
780,399	Stk.	Dec. 29	11	Chelsea, Ord.	303—308	..	3 11 5
150,000	,,	,,	5	Do. 5 p. c. Pref.	157—162	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	145—150	..	3 0 0
175,785	,,	Mar. 29	4½	Do. 4½ p. c. Deb.	145—150	..	3 0 0
1,720,560	Stk.	Apl. 11	7	East London, Ord.	192—196	+1½	3 11 5
654,740	,,	June 14	4½	Do. 4½ p. c. Deb.	142—147*	..	3 1 3
390,000	,,	,,	3	Do. 3 p. c. Deb.	97—99*	..	3 0 7
700,000	50	June 14	7½	Grand 10 p. c. max.	103—106*	+2½	3 10 9
310,000	Stk.	Mar. 29	4	Junction 4 p. c. Deb.	130—135	..	2 19 3
708,000	Stk.	Feb. 23	14	Kent	307—312	..	4 9 9
160,000	,,	,,	7	Do. New, 7 p. c. max.	200—210	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max.	290—295	..	3 11 2
406,200	100	,,	8	Do. 7½ p. c. max.	207—212	..	3 15 6
850,000	Stk.	Mar. 29	4	Do. 4 p. c. Deb.	130—133	..	3 0 2
500,000	100	Feb. 23	13½	New River, New Shares	422—427	+4	3 3 2
1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb.	132—137	..	2 18 5
902,300	Stk.	June 14	7½	South- Ord.	193—197*	..	3 16 2
126,500	100	,,	7½	wark 7½ p. c. max.	182—187*	..	4 0 3
489,200	Stk.	,,	5	and 5 p. c. Pref.	157—162*	..	3 1 9
1,019,585	,,	Apl. 11	4	Vauxhall 4 p. c. A Deb.	129—134	..	2 19 9
1,155,066	Stk.	June 14	10	West Middlesex	280—285*	..	3 10 2
200,000	,,	,,	4½	Do. 4½ p. c. Deb.	145—150*	..	3 0 0
200,000	,,	Mar. 14	8	Do. 8 p. c. Deb.	99—101	..	2 19 5
				*Ex div.			

the principle of purchase; but before they could decide anything they must have some detailed information from an engineer. After considerable discussion, it was decided that application should be made not only to Mr. Mansergh, but to Mr. A. Phillips and Mr. C. Hawksley; and in this altered form the motion was carried by the casting vote of the Mayor. The opponents of the proposition suggested that the object of the mover of the resolution was to obtain a high price for the water-works. Mr. T. J. Thuell, who had given notice of the resolution in favour of immediate purchase, decided to postpone it. The Mayor remarked that the Corporation had often expressed a wish to become possessed of the water-works. It was desirable that they should own them, but he by no means committed himself to compulsory purchase. At all events, they ought to have advice before they moved in the matter. A further discussion took place on the subject of a notice from the Water Company of their intention to commence the laying of new mains. Mr. H. Liddicoat, a representative of the town on the Cornwall County Council, wrote protesting against the opening of the streets during the summer, when the town would, or should, be full of visitors, and said that if this were done he should oppose any further grant from the County Council towards the maintenance of the roads. The Town Clerk pointed out that the Company could please themselves, as they were legally entitled to open the streets. Mr. J. Grose thought they need not be apprehensive of any energetic action on the part of the Company. The Mayor said that in the winter they urged the Company to leave the work until the summer. The Surveyor would watch the matter with a view to reducing the inconvenience to a minimum; but, having regard to the pressure put on the Company to improve the supply, and to Dr. Buchanan's report to the Local Government Board on the need of improvements in the distribution, he should feel sorry to delay these important measures. The Surveyor said the work would completely block the main streets. It was decided to ask the Company to do the work by night, and to hurry it forward as quickly as possible when it was commenced. Mr. J. W. Buckley expressed the fear that their representations would have no effect.

Southport Corporation Gas Supply.—At the meeting of the Southport Town Council last Tuesday, Dr. Isherwood, in moving the adoption of the minutes of the Gas Committee, stated that in the past financial year they had made a gross profit of £20,672, and a net profit, after paying interest and sinking fund, of £10,323, which had enabled them to hand over to the Council £9000 for the reduction of the rates—carrying forward £1323. They would have made as large a profit as they did in the previous year but for the fact that they had paid £4143 more for coal, cannel, and oil; £250 more as their proportion of the salaries at the Town Hall; £338 more for income-tax; £659 for repairs which ought to have appeared in the previous year's accounts; and £1170 more for interest and sinking fund. Last year, the cost of gas was 2s. 2¼d. per 1000 cubic feet; but in the current year the increased price of raw material would add 3¼d. to it. Alderman Fisher wished to move an amendment to sanction the placing of £500 out of the £1323 to the reserve. But he could not find a seconder; and the minutes were passed.

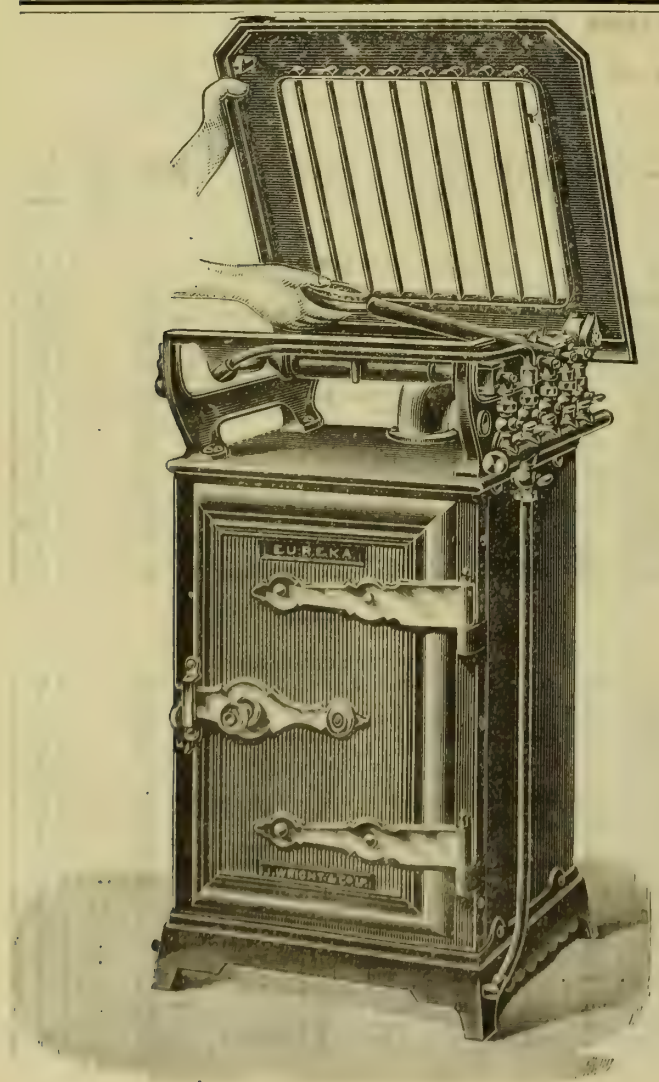
NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Perth Gas Commissioners had their annual accounts before them on Monday. Mr. W. Watson, the Convener of the Works Committee, who presented them, said that the total receipts were £27,247, and the expenditure was £22,042, which left a surplus of £5205 on the year's working. The receipts for gas sold amounted, less £537 of discounts, to £23,836, gas-stove rentals produced £537, secondary products £2299, coke and tar £1355, and property £50. The principal item on the expenditure side was £14,130 for coal; and the next largest were men's wages £3650, and salaries £926. Including £857 brought forward, the balance at credit of the profit and loss account was £6062, which was applicable to the payment of annuities, interest on debt, sinking and contingency funds, and depreciation of works fund. These required £6676, so that there was a debit on the year's working of £614. The Auditor (Mr. R. Morrison) had reported that the debt of the Commission had been increased by £52,500, less £23,500 of temporary loans paid therefrom and £1500 of bonds paid off at Whitsunday, 1899. For the year, an exceptional amount of £771 had been allowed for depreciation of works. There was an average increase of 10 per cent. in the quantity of gas manufactured, as compared with an increase of 7 per cent. in the previous year. There were 8376 consumers, as against 7966. Many things, Mr. Watson said, had occurred during the year to upset the estimate; but they were not any worse than in many parts of the country. In dealing with the estimates for the current year, an increased output of gas to the extent of 10 per cent. had been allowed. Mr. M'Lusky had gone over the coal account; and it had been agreed to estimate for 16,050 tons, at an average price of 20s. 6d., which meant an increase on the coal account of £3120. The increased expenditure required them to raise the price of gas from 3s. 2d. to 3s. 6d. per 1000 cubic feet. The revenue from gas was thus estimated to be £26,412. After some discussion, the report was adopted. It may truly be said that, notwithstanding the small deficit on the year's working, the Commissioners have no reason to be otherwise than satisfied. They have a splendid business in their hands; and if they give good heed to the advice of their Manager, and keep to business principles, there is every reason to anticipate continued prosperity. They are "swopping" Managers in the meantime; but it is not being done in "mid-stream," because Mr. M'Lusky is taking up the duties practically at the commencement of a year—a circumstance which must be agreeable to all parties. While we welcome the coming, we must not forget to speed the parting Manager. Mr. Wilson, on leaving Perth, has the sympathy of his brethren, and their hearty good wishes for his welfare.

On Monday, the Dunfermline Gas Commissioners had before them the fourth annual report by Mr. Hubert Pooley, their Engineer and Manager. It stated that during the year 8592 tons of coal were carbonized, yielding 82,900,300 cubic feet of gas. This was an increase of 5,778,400 cubic feet, and an average of 9649 cubic feet per ton. The gas sold amounted to 77,475,700 cubic feet, or an average of 9017 cubic feet per ton. The balance of 5,424,600 cubic feet, or 6·54 per cent. of the manufacture, was



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due to leakage, condensation, &c. With one exception, this was the lowest amount of loss for many years; and he believed it was the smallest percentage of unaccounted-for gas in the history of the undertaking. In the preceding year, the figures were 6,071,300 cubic feet, or 7·87 per cent. The demand for coke during the year was heavy, and good prices were obtained. Tar and liquor sold under contract had also produced a better price. The net revenue from them was £2054, as against £1298 in the preceding year. The number of gas accounts on the books at May 15 was 5462, as compared with 5060 last year. Prepayment meters had increased from 832 to 1040; and there were 450 persons deriving benefit from the differential rate, as compared with 323. During the year, there had been 39 gas-engines and 560 cookers in use, which included 277 cookers given free of hire to consumers with prepayment meters. In the previous year, the figures were 33 gas-engines and 374 cookers, inclusive of 192 cookers for prepayment meters. Coal contracts had been entered into at an average of 4s. 0¾d. per ton in advance of last year's price; and there had been a further increase in the cost of nearly all materials under annual contract. As stated in these "Notes" last week, Mr. Pooley recommended that the price of gas should be increased by 2d. per 1000 cubic feet to ordinary and differential consumers, and by 5d. to prepayment consumers. There was a difference of opinion in the Commission as to whether there should be an increase in the price of gas or not; and the matter was sent back to the Committee to consider. The Committee have since met, and, by the casting vote of the Chairman, have adhered to Mr. Pooley's recommendation. This resolution will be submitted to the July meeting of the Commissioners. One of the proposals before the Commission was that the price of gas should be increased by a penny. I should say that the Commissioners are scarcely in a position to purposely estimate for a deficit, taking the risk of adverse circumstances making the deficit much more than anticipated. They are almost shut up to an increase in price; and if there is to be an increase, seeing that 2d. is so moderate a sum when compared with what has been found necessary in many other places, it will be more satisfactory for the working of the undertaking if this figure is agreed to. The business can easily stand it.

On Monday, Sir John Cheyne, Q.C., Sheriff of Renfrew and Bute, held an inquiry at Paisley under an application by the Corporation of that burgh to the Secretary for Scotland, for the issue of a Provisional Order authorizing £200,000 to be borrowed for water-works extensions. Mr. Jas. Lee, the Master of Works, stated in evidence that the total cost of the extensions which they desired to make was estimated at £205,000. The work would be divided into three sections. Pipes of larger capacity would be laid between the Camphill and Rowbank reservoirs at a cost of £88,500, and between Rowbank reservoir and the Stanley high-level filters at a cost of £51,000. The Commissioners would also require to make extensions at Glenburn. At present, Glenburn water was discharged into the low-level system by an open conduit. They had, of course, plenty of water in the low level. It was on the high-level system that they wanted to get as much water as possible. They proposed to bring the water down from Glenburn by a pipe to the high-level filters, so as to increase the amount of water at that point as much as possible. This pipe would form a valuable reserve in case of a breakdown. The cost of this section would be £6200. The supply to Johnstone, which had been found to be insufficient, they also desired to augment, at an outlay of £6800. They further proposed to increase the storage capacity at the clear-water tanks, at a cost of £30,000. The existing mains would require alterations, which he estimated to cost about £8000. Wayleaves for the proposed extensions would amount to £15,000. Sheriff Cheyne is to consider the evidence before giving his recommendation. There was no opposition to the application.

The Glasgow Corporation Gas Committee have agreed to the proposal to have the first sod of the new gas-works at Provan cut on an early day. The date of the ceremony will probably be the 4th prox.—American Independence Day; and the Lord Provost will be the presiding genius—Bailie Mitchell, Convener of the Works Sub-Committee, taking a prominent part in the day's work.

The Corporation of Port Glasgow have just settled their coal contracts, at an average price of 20s. 2½d. per ton. This makes the Gas Committee's coal bill upwards of £1400 heavier than it was last year. In all, 4500 tons have been contracted for, and the selection of the coal is estimated by the Manager (Mr. W. Mackie) to yield per ton an average of 9577 cubic feet of gas having an illuminating power of 26·21 standard candles.

The Dundee Water Commissioners held their annual meeting on Thursday, and heard Treasurer Ritchie's explanation of the accounts for the past year. Their estimated revenue, he said, including a surplus from the preceding year of £1026, was £48,971; and the actual revenue was £50,294. Their estimated expenditure was £48,820, and the actual expenditure was £49,056. The revenue was thus £1323 more than the estimate, and the expenditure was £236 over the estimate. The net result was that, instead of closing the year with a surplus of £151 as estimated, they had a surplus of £1238. The sinking fund required £6397, and nearly the whole of it had already been applied in the reduction of debt. The capital expenditure during the year amounted to £3295, of which £2212 was upon extensions of piping. The accounts were approved; and the hope was expressed that the Treasurer might be able to recommend a reduction in the domestic rate.

The financial statement of the Edinburgh and District Water Trust for the year ending May 15 has been issued. It shows that the estimated expenditure was £107,444, and the actual expenditure £103,559, or £3885 below the estimate. The estimated income was £107,392, while the actual income had been £110,620, or £3228 over the estimate. The surplus upon the year's working is £7061.

The Town Council of Port Glasgow have recently made their annual inspection of the gas and water works belonging to them. At the gas-works, it was stated that there had been an increased output of gas during the year to the extent of 2 million cubic feet. The water supply is felt to be now inadequate; and the Council have in mind the extension of the works.

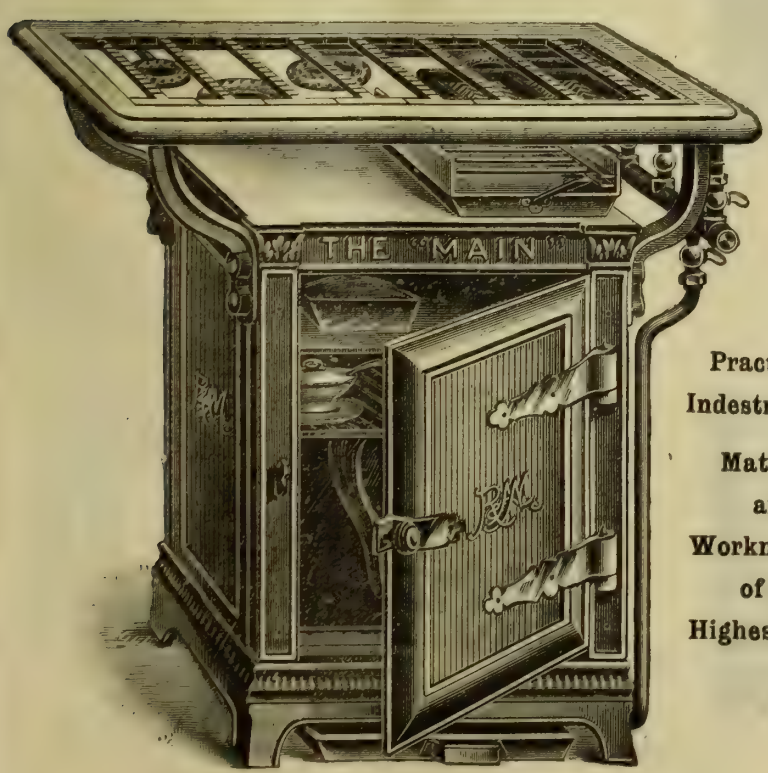
A Committee of the Dalkeith Town Council have prepared a report upon the subject of lighting the town by means of electricity. The Committee recommend the Council to accept an offer by Messrs. Crompton and Co., Limited, of London, and to authorize the firm to apply for a Provisional Order. The cost for street lighting would be at the rate of 3d.

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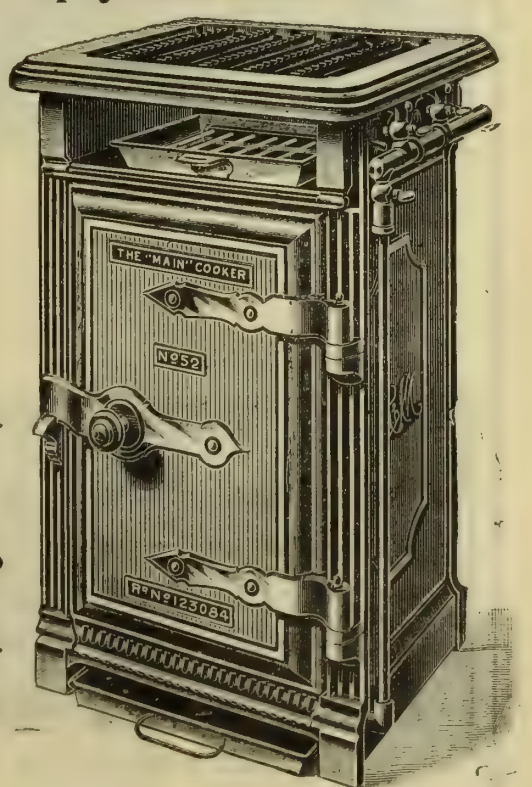


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per unit, which the Committee think would be much cheaper than gas, the charge for which is 4s. per 1000 cubic feet, with a discount of 5d. to the burgh. They consider that at 3d. the charge would be equivalent to gas at 2s. per 1000 cubic feet. Thus are the toils laid for an unsuspecting public, who will always find that, no matter what the rate charged, the cost of lighting by electricity is invariably considerably greater than that of lighting by gas, and that the light is not so satisfactory for working by. In a newspaper office I know, where electricity is laid on, but gas is retained, to be used in emergencies, the men would light the gas, to supplement the electric light, were it not for the most peremptory orders to the contrary by the proprietors.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *June* 16.

Sulphate of Ammonia.—The market continues to droop; and closing quotations are £11 per ton f.o.b. Hull, and £11 2s. 6d. f.o.b. Leith and Liverpool. Buyers find in declining prices encouragement to hope for still lower values rather than temptation to operate; and there has been a marked absence of direct business. Available supplies, however, continue limited; and any important demand would probably result in a sharp recovery. Concurrently with the decline in spot values, the forward position has also given way; and a premium for July-August delivery would hardly now be obtainable.

Nitrate of Soda is weak at 7s. 10½d. per cwt. for ordinary, and 8s. 3d. for fine, quality on spot.

LONDON, *June* 16.

Tar Products.—Benzol shows a little more firmness, although considerable variation in prices exists at the several points of production, arising from the heavy railway carriage on it and the difficulty with railway companies and carriers in taking it at all. There is a difference between the lowest and the highest prices quoted in various positions of at least 2d. per gallon. There is more inquiry for creosote and heavy oils; but prices mentioned are low as compared with recent rates. Carbolic acid is a steady market; and the same may be said of pitch, although very little new business is reported for next season. Makers are demanding at least equal to to-day's prices. There is nothing special doing in anthracene, which continues to be marked at a low figure. Average prices are as follows: Tar, 17s. 6d. to 28s. Pitch, east coast, 37s.; west coast, 34s. Benzols, 90's, 6d. to 8d.; special qualities for gas, 9½d.; 50's, 11d. Toluol, 1s. 2½d. Solvent naphtha, 1s. 1½d. Crude naphtha, 3¾d. Heavy naphtha, 1s. Creosote, 2¼d. Heavy oils, 3d. Carbolic acid, 50's, 2s. 2d.; 60's, 2s. 8d. Naphthalene salts, drained, 33s.; pressed, 70s. Anthracene, "A," 4d.; "B," 2¾d.

Sulphate of Ammonia.—This market is extremely dull. Very little business is being done; and for forward delivery inquiries have seriously fallen off. Much of the shipments now going on are on old contracts. The make is small; and there are but few urgent sellers. £11 to £11 2s. 6d. per ton, less 3½ per cent., is the average value.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—With the settlement by the Salford Corporation for the quantity of gas coal they will require for the ensuing year, amounting to 99,000 tons, in addition to 48,500 tons of cannel, the last important contract in this district has now been concluded. Of course, neither with regard to the Salford nor the Manchester Corporation contracts have the actual prices been allowed to transpire; but from inquiries, it can be gathered that on all new contracts for the ensuing year the advance has been about 5s. over 1899 rates. The Manchester Corporation, however, have been in the satisfactory position that in 1899 they bought a good deal of coal for delivery over the ensuing two years, with the result that a considerable quantity of this has to come in. It is stated that they have not this year been under the necessity of buying at the advanced prices more than about one-third of their full ordinary supply; while it is also affirmed that they have not been compelled in all cases to accept the special conditions which collieries have this year laid down with regard to their contracts, to which reference has previously been made in these reports. The result is that the Manchester Corporation have been in rather an independent position; and averaging the price of the coal they have had to buy this year, and the prices on the deliveries that have still to come in on contracts placed twelve months ago, the advance is much below what they would otherwise have had to pay. At the pit, the average basis on which coal has been bought for the ensuing twelve months may be given as about 13s. 6d. to 14s. per ton for the commoner qualities, up to 14s. 6d. and 15s. for the best screened Arley gas coal. The better qualities of round coal are now beginning to hang at collieries, and some fair quantities are accumulating on the pit-banks, or at the wharves and yards; but as these are more than required to replenish the depleted stocks, in view of the ensuing winter's requirements, there is no pressure to sell. Prices remain firm at the full basis of 13s. 6d. to 14s. per ton for common, and 14s. 6d. to 15s. 6d. for the better qualities at the pit; while it is even contemplated that as early as next September there may be some further advance upon present rates—the amount mentioned being generally about 1s. 8d. per ton. As to the lower qualities of round coal and engine classes of fuel, it would almost seem that prices have reached the top, so far as forward contracts are concerned, although there may possibly be some stiffening on the rates quoted for current sales. The demand for these continues active, and is taking away all the Lancashire collieries are raising; but slack is coming in more plentifully from outside districts, and consumers are in the position that they have now no difficulty in covering all their requirements either for steam and forge coal or engine fuel. At the pit, steam and forge coal remains at about 13s. per ton, with Lancashire slack ranging from 10s. 6d. to 11s. 6d., according to quality. The shipping demand is moderate, with the official list rates steady at 14s. 6d. per ton for unscreened to 15s. 3d. for screened steam coal, delivered at the Mersey ports. Coke continues in brisk request, with prices firm at from 24s. 6d. to 25s. for furnace, to 31s. and 32s. for foundry qualities, at the ovens.



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"Fetch forth the stocks, ho!" —*Lear II.*, 2.

Northern Coal Trade.—There is a full demand for coals, because of the lessened shipments expected for the rest of the month, through the effect of the coming local holidays. The collieries are well employed; and this week's output will be heavy. Best Northumbrian steam coals vary from 17s. 9d. to 18s. per ton f.o.b., second-class steam are about 17s., and steam smalls 13s. Household coals are in much lower demand; but there is little or no change in the prices. Manufacturing coals are very firm; and the demand is good. There is little change in smithy coals. In the gas coal trade, the demand is very heavy for this season of the year, both for export and for home use; and with full work there is a large production which is readily taken up. For occasional cargoes of best Durham gas coals, the quotation is 17s. per ton f.o.b.; while the contracts are based on about 16s. per ton. One of the chief of the Tees-side towns has just decided not to buy for a year, but to try to obtain supplies for a shorter period—a rather significant circumstance for consumers so near to the northern coal field. Best Durham coke is firm at 35s. per ton for export. There is no alteration in the position of gas coke; but the output is now at its lowest point. Prices are unaltered this week.

Scotch Coal Trade.—The market is reported strong; the forward demand being particularly active, at prices still higher. The miners are not working as regularly as they might, which has something to do with the present advance in prices. The quotations are: Main 14s. 3d. to 14s. 6d. per ton f.o.b. Glasgow, ell 15s. 6d. to 16s. 6d., and splint 15s. 9d. to 16s. The shipments for the week amounted to 201,116 tons—a decrease of 25,252 tons upon the previous week, but an increase of 25,657 tons upon the corresponding week of last year. For the year to date, the total shipments have been 4,443,949 tons—an increase of 872,079 tons upon the same period.

East-End Consumers and the Price of Gas.—Last Thursday afternoon an influential deputation of East London gas consumers waited upon the Directors of the Commercial Gas Company for the purpose of asking them to reconsider their action in raising the price of gas from 2s. 6d. to 3s. per 1000 cubic feet. Mr. Spencer Charrington, M.P., speaking on behalf of the deputation, said it was thought the price of gas had been raised disproportionately high, after taking into consideration the increase in the price of coal. Mr. H. H. Marks, M.P., said the people of St. George's-in-the-East felt that a hardship was being imposed upon them, especially in view of the fact that for about seventeen years the maximum charge by the Company was 2s. 9d. per 1000 cubic feet. Mr. Steadman, M.P., said it seemed strange that when the Company were able to pay a dividend of 13½ per cent. they raised the price so substantially. The action of the Directors inflicted a severe hardship upon the tradespeople of East London; and he considered the increased cost in the price of coal might be equally borne by shareholders and consumers. Mr. J. Blacket Gill, in reply, said he could not hold out any hope of a reduction in the charge for gas at present. Owing to the advance in the price of coal, and other expenses connected with the manufacture of gas, it was impossible for his Board to adopt any other measure.

The St. Mary Church Gas-Works.—It has been decided bythe St. Mary Church District Council to apply to the Local Government Board for power to borrow £10,000 for gas-works purposes. Messrs. Willey and Co., of Exeter, are to report upon what is necessary to make the works efficient, as well as present an estimate of the cost of carrying out the work.

The Water Supply of Llangollen.—As a result of a recent inquiry by the Local Government Board, permission has been granted to the Llangollen Urban District Council to raise a loan to cover the expenses of £2120 16s. 3d. incurred in law costs in defending the rights of the town to draw its water supply from the Vivod Valley. Sanction has also been given to the cost of relaying the mains (which have become defective) to the reservoirs in the Valley.

The Rating of Reservoirs.—At the last monthly meeting of the Middlesex County Council, a letter addressed to the General Purposes Committee by Sir F. Dixon-Hartland, Chairman of the Thames Conservancy Board, with reference to the rating of reservoirs, was read. In the course thereof, Sir Frederick referred to "the great injustice" of reservoirs being rated to the general district rate in urban districts, and to special district rates in rural districts at one-fourth only of their rateable value. He said: "These reservoirs are constructed for trade purposes, and contribute to the Water Companies' profits, and there is no reason why they should be rated on the same basis as natural ponds on agricultural land. The effect of this reduction in the assessment is very important in many of the Middlesex parishes, and will, when the whole system of reservoirs foreshadowed in the report of the Royal Commission on Water Supply is carried out, be an increasingly burning question, to show the importance of which it is only necessary to state that there is a reduction in the rates of £800 a year in one Middlesex parish alone—that of Sunbury-on-Thames." He considered the time was ripe for the question to be taken up by the County Councils' Association.

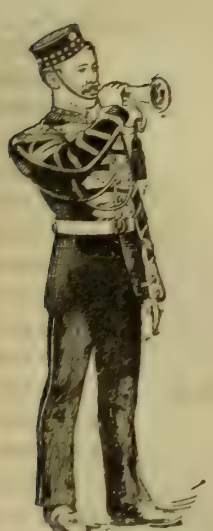
Braunton Water Supply.—An inquiry was held at Braunton last week respecting an application by the Barnstaple Rural District Council for power to borrow £3500 for works of water supply. The population of the village is 2170, and the supply is estimated to be equal to about 14½ gallons per head of the population. The Clerk to the District Council (Mr. W. H. Toller) said many difficulties had to be encountered in obtaining water. Some plans had been abandoned because of the exorbitant demands of the landowners. They had no power to acquire water compulsorily without having recourse to an Act of Parliament; and this was too expensive a procedure for a village water supply. There was urgent need for legislation to make it easier for local authorities to carry out such schemes. Mr. H. D. Nichols (Messrs. Beesley, Son, and Nichols, of Westminster) gave evidence as to the plans, and a number of witnesses testified to the need of a better supply than that afforded by the wells in the village. Some opposition was offered by farmers, who said that their interests would suffer by the impounding of the water. Mr. Toller said that these persons had no legal claim to compensation; but if any were substantiated, the amount would have to be settled by arbitration.

Charge of The Richmond Brigade.

(By an ABERDONIAN GAS OFFICIAL.)

(*With profuse apologies to the Shades of Tennyson.*)

[At the Aberdeen Trades Exhibition (June, 1900) Messrs. Richmond & Co. said they meant to book orders for 600 Cookers.]



Half a league, half a league,
Half a league onward,
All through the town they went
In search of six hundred
"Forward Richmond's Brigade!
Charge!" and the charge was made.
Straight from the Hall they sped
To get that Six hundred.

"Forward, Richmond's Brigade!"
Was there a man dismayed?
Not though canvassers knew
'Twas a large order:
Their's not to make reply,
Their's not to reason why,
Their's but to have a try,
So round the town they go,
Their watchword "Six hundred."

Cookers to right of them,
Cookers to left of them,
Cookers in front of them
Need it be wondered;
With canvassers East and West,
Each of them doing his best,
That at the three weeks' end,
Heaven with this shout they rend
"We've booked that Six hundred."

"Forty's" and "Sixty's" there,
One Hundred and Twenty's" (120) where,
Rivals in grim despair,
Often were heard to swear
There were no orders;
Booking them fast as smoke
Previous records broke,
Orders still coming.
Rivals who tried "a small stroke"
Shattered and sundered,
Richmond's Brigade came back
And shouted "Six hundred."

Cookers to right of them,
Cookers to left of them,
Cookers in front of them,
People had wondered;
Why! with the coal so dear,
They should have any fear,
To book for at least a year,
Now they had seen them here,
One of Six hundred.

When can their glory fade?
There was the record made.
People in wonder.
Honour the charge they made!
Honour Richmond's Brigade,
Their motto "Six Hundred."

Barry Gas and Water Supply.—The Barry District Council secured the gas and water joint undertakings a few years ago at a net cost of £200,000. The accounts of the undertakings for the past financial year have just been presented to the Gas and Water Committee, and show that on the supply of gas a net profit of £1860 was made, while there was a net loss of £3358 on the water supply; the net deficiency on the joint undertakings being £1498.

Regenerator Settings for Small Gas-Works.—An instructive instance of the application of regenerative heating to gas-retorts will shortly be presented at the works of the Sileby Gas Company, which are to be practically rebuilt, in accordance with plans prepared by Mr. A. T. Harris, of Market Harborough, at a cost of £4000. The retort-house will contain a bench, consisting of three settings on the regenerator principle, erected by Messrs. Jonas Drake and Son; and as the output is less than 4 million cubic feet per annum, a good test will be afforded as to whether or not this system pays in very small works. Messrs. R. & J. Dempster, Limited, have the contract for the retort-house roof, condensers, engine and exhauster, scrubber, purifiers, and gasholder.

Reduction in the Price of Gas at Silsden.—At the meeting last Tuesday of the Silsden District Council, they discussed at some length the price charged for gas and the discounts allowed. Hitherto the price has been 5s. per 1000 cubic feet gross, and 3s. 9d. if accounts are paid by the first day of the month following the delivery of the account. The new arrangement is that the price will be 3s. 9d. and 3s. 4d. A letter was received from the Kildwick Parish Gas Company intimating that the price of gas from the 1st of July would be raised for lighting purposes to 4s. 2d., less 5d. discount (3s. 9d.), and for heating purposes to 4s. 2d., less 1s. 0½d. discount (3s. 1½d.). The Clerk (Mr. J. Driver) said this would not affect Silsden, as the Gas Company were under a contract.

The Delights of Gas Managership.—At the monthly meeting of the Tow Law District Council last Thursday—Mr. R. Sproates presiding—Mr. Hillary, the Surveyor, complained of the refusal of the Gas Manager, Mr. Kemp, to carry out certain requests in regard to appliances and material for the Pretoria celebrations, and a breach of instructions from the Council. The complaints were specified as refusals to supply the Surveyor with a bucket of tar and a ladder for the celebration referred to. It was also reported that Mr. Kemp had allowed a chimney sweep to sleep on the gas-works, contrary to instructions. Mr. Brewer moved that the Manager receive three months' notice; but he subsequently spoke in favour of a month. They would, he said, be able to get another man at the present time without much difficulty. The Chairman asked if this was not an extreme step. Mr. Brewer did not think it was. This was not the first time the Manager had acted contrary to the wishes of the Council. Mr. Hillary suggested that the best way would be to visit the next act of insubordination with discharge. Mr. Robson seconded the motion. Mr. Harrison moved, as an amendment, that the Manager be instructed that he must obey Mr. Hillary or send in his resignation. After some further remarks, Mr. Blenkiron seconded the amendment. The voting being equal, the Chairman gave his casting vote in favour of the amendment.

Profit-Sharing at Stafford.—On the recommendation of the Gas and Electricity Committee, the Stafford Town Council last Tuesday adopted the bonus system for the employees at the works, with the view of giving them a direct interest in the prosperity of the undertakings. The resignation of the Engineer and Manager (Mr. J. Ferguson Bell) was accepted, and the Committee were authorized to advertise for a successor.

Stourbridge Gas Undertaking.—The statement of accounts of the Gas Department of the Stourbridge District Council for the year ending March 31 has been issued. The total expenditure has been £123,574, of which £98,454 was for the purchase of the undertaking, and the remainder for new plant, &c. The gas made was 153,269,500 cubic feet; and deducting the gas sold and used on the works, no less than 14,758,400 cubic feet were unaccounted for. But the Council have 40 miles of mains. They made £8460 profit on gas and £293 on the fittings account last year.

New Retort-House and Station Meter at the Market Harborough Gas-Works.—In order to meet the increased demand for gas, the Market Harborough District Council, acting upon the recommendation of their Gas Engineer and Manager (Mr. A. T. Harris) have unanimously decided to build a new retort-house, and to erect therein a retort-bench comprised of six settings of regenerator furnaces. The contract for the bench, including all the ironwork, has been placed with Messrs. Jonas Drake and Son. This work, together with the supply of a new station meter by Messrs. W. Parkinson and Co., to pass 20,000 cubic feet of gas per hour, will cost about £3800.

Birmingham Corporation Finances.—The Birmingham City Council went into Committee last Tuesday in order to consider the estimates. Before they were put to the vote, Alderman Clayton, the Chairman of the Finance Committee, made a few introductory explanations. He said the capital expenditure had been higher during the past year than for the last quarter-of-a-century. The total increase, after allowing for the redemption set aside, was £1,300,000; but, fortunately, a great deal of this was of a reproductive character. The Elan water supply, upon which £707,000 was spent during the year, it was hoped would never be charged on the rates. Then there was £95,000 for the Gas Department; and the Council knew the profits obtained from this undertaking. Another large item was £483,000 upon the Electricity Supply Department, which was not likely to ever increase the rates. The expenditure out of the rates had been higher than in the previous year by £22,900; but, looking at the industrial work of the Corporation, they found that the income of the Gas Department was £98,000 more than in the previous twelve months, and that of the Water Department £7000 more. After reference to the continued rise in the rates, Alderman Clayton gave, as one good point in connection with the capital expenditure last year, that the Committee spent £19,000 less than they had estimated. Having reminded the Council that the rates would be 5s. 5d. instead of 5s. 3d. in the pound, Alderman Clayton concluded by pointing to the rate of interest on loans, which had risen from 2¾ per cent. last year to 3¼ per cent. now. The various estimates were approved, and subsequently sanctioned by the Council.

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	Cubic Feet Daily.
BLACKBURN	1,250,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000
SALTLEY WORKS, BIRMINGHAM	2,000,000
COLCHESTER	300,000
BIRKENHEAD	2,250,000
SWINDON (New Swindon Gas Co.)	120,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000
WINDSOR ST., BIRMINGHAM (Second Cont.)	2,000,000
HALIFAX	1,000,000
TORONTO	250,000
OTTAWA	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
TORONTO (Second Contract; Remodelled)	2,000,000
BELLEVILLE	250,000
OTTAWA (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000

	Cubic Feet Daily.
BUFFALO, N.Y.	2,000,000
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.,	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
LEICESTER	2,000,000
ENSCHEDE (HOLLAND)	150,000
BUENOS AYRES (RIVER PLATE CO.)	700,000
BURNLEY	1,500,000
KINGSTON-ON-THAMES	1,750,000
ACCRINGTON	500,000
TONBRIDGE	300,000
STRETFORD	500,000
OLDBURY	300,000
TODMORDEN	500,000
SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
YORK (Second Contract)	750,000
ROCHESTER (Second Contract)	500,000
NEWPORT (MON)	250,000

Sale of the Clifton Water-Works to the Halifax Rural District Council.—At the meeting of the Halifax Rural District Council last Wednesday, it was reported that an agreement had been entered into with the Clifton Water Company for the purchase of their undertaking by the Council for £6000.

Gas Explosion Caused by Lightning.—Late on Monday night last week, Highfield House, Elland, the residence of Mr. Jonathan Dodgson, was struck by lightning. The chimney was badly damaged, and a gas-pipe leading into the house was broken. The gas was ignited, and a slight explosion ensued. Happily no serious damage was done, and the family escaped without injury.

Tiverton Corporation Gas Supply.—The Tiverton Borough Accountant has submitted his fifth annual report on the working of the Corporation gas undertaking. The revenue account shows a balance of £1734. After providing for interest and income-tax and the annual payment to the sinking fund, the balance amounts to £256, which has been placed to the reserve fund account; making a total of £2583. There were 220 cooking-stoves in use—an increase of 42 on the previous year. The quantity of gas made and consumed during the year was 30,322,000 cubic feet.

Shrewsbury Water Supply.—An unusual condition of things has arisen between the Shrewsbury Corporation and the Local Government Board. Some time ago the Board called the attention of the Corporation to the water supply of the borough, and suggested that a fresh one should be obtained from Batchcott. The cost of such a scheme was put down at £155,000; and the Corporation have informed the Board that they are unable to bear the expense. At present, the Council are carrying out a system of sewerage, which has already cost £75,952; and other improvements in the existing drainage were required. The debt of the borough amounts to £151,273; and the Council are of opinion that the Batchcott scheme would "result in rates which would be hardly endurable."

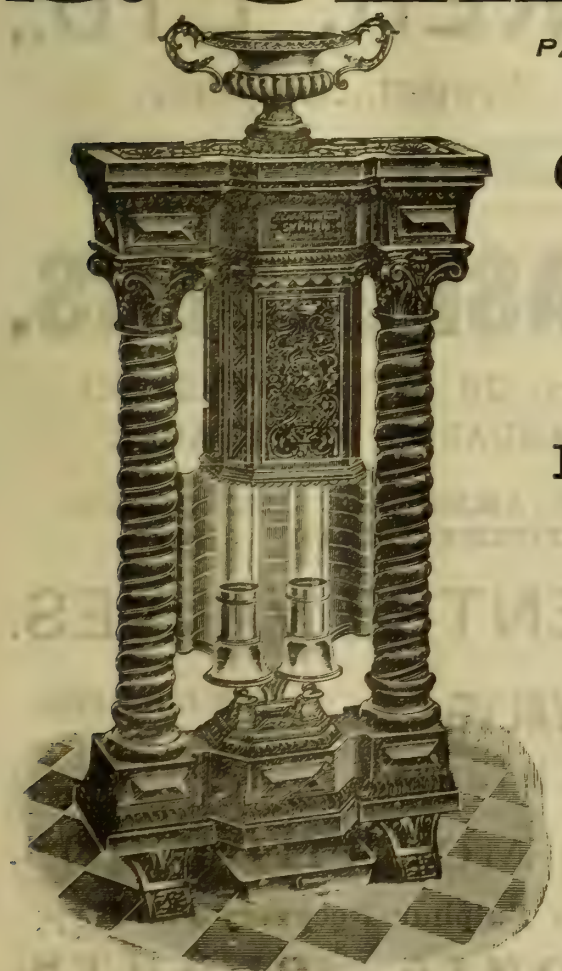
The Yorkshire Coal Trade.—The Sheffield correspondent of "The Times" states that never before in the history of the port of Hull has such a condition of the coal trade been shown as that which is revealed by the return of the Hull Incorporated Chamber of Commerce and Shipping issued on the 9th inst. An expanding trade has been reported, and a great pressure for supplies for export; but the actual figures show a pressure on the Yorkshire coal supply greater than had been realized by any but a few largely interested in the business. The total tonnage forwarded to the port last month—381,872 tons—was 54,736 tons, or 16·7 per cent., more than was forwarded in May, 1899, which was itself a busy month. In the five months of the present year, 1,458,944 tons were sent; being an increase of 215,392 tons, or 17·3 per cent. The quantity of coal exported coastwise last month—61,761 tons—was 114·6 per cent. more than was despatched in the previous corresponding month, most of it going to London; while on the five months' trading the increase amounted to 81·6 per cent. The exports to foreign countries last month totalled 199,628 tons—an increase of 95,618 tons, or 91·9 per cent.; the five months' total amounting to 666,748 tons, being 351,344 tons, or 89·8 per cent.

Increase in the Price of Gas in North London.—The Gaslight and Coke Company have given notice that after the current quarter the price of gas will be 3s. 5d. per 1000 cubic feet.

Sales of Stocks and Shares.—At the Mart, Tokenhouse Yard, E.C., last Tuesday, Mr. Alfred Richards sold, by order of the Directors, shares and stock of the Herne Bay, Walton-on-Thames and Weybridge, and Southend Gas Companies. Some additional £5 shares in the first-named Company (dividend on similar shares £4 4s. per cent. per annum) were sold at par; "B" shares in the Walton Company (7 per cent.) fetched from £14 12s. 6d. to £15 apiece; and £100 of new ordinary 5 per cent. stock of the Southend Company (last dividend 5½ per cent.) realized £110. On Wednesday, at the same place, Messrs. Fox and Bousfield sold fractional parts of King's shares in the New River Company at the rate of from £108,000 to £112,000 per share, and £100 new shares at £420 and £421 each, *ex div.* They also sold some £10 ordinary shares in the Gas-Meter Company at £29 to £30 5s. each. On Thursday, Messrs. Nichols, Howes, Young, Alder, and Co. sold £10,000 of general debenture stock and some new 4 per cent. debenture stock of the Bristol Gas Company. The former produced £12,028 10s., or an average of £120 5s. 9d. per cent., and the latter £115 per cent. Last Tuesday, Messrs. Woods and Co. sold 580 additional "E" shares of £20 each in the Northampton Gas Company, at an average of £32 3s. 4d. each; the total realized being £18,657 11s.

Water Supply Scheme for East Shropshire.—For some time past difficulties have been experienced in adopting a scheme for supplying the towns and villages in East Shropshire with water. Proposals were made by the East Shropshire Water Company, but the Bill was thrown out by a Committee of the House of Lords. The Shropshire Council have since taken the matter up; and a conference of delegates from the Local Authorities concerned was recently held at Shrewsbury. It was resolved to form an area, including Shifnal, Oakengates, Dawley, Lilleshall, Stirchley, Sheriffhales, and portions of Wellington (rural) and Hadley. The population of this area is put at 27,833; but for Shifnal, Stirchley, and Sheriffhales there is already a scheme under consideration by which these parishes may be supplied with water belonging to the Wenlock Corporation. Leaving out those places, the population to be supplied would be 23,311; and allowing for an increase of 15 per cent., provision should be made for about 27,000 people. At 20 gallons per head, the quantity would be 540,000 gallons per day. The estimate for the scheme, including engineering and contingencies, is £72,000. If the three districts named were included, the cost would be £9000 more. A further provision of 500,000 gallons of water daily for trade purposes would make the cost £110,000; or for 1,000,000 gallons, £125,000. It was recommended that works should be erected sufficient to meet the requirements of the second estimate, with 500,000 gallons of trade water, which might be readily added to should this quantity be exceeded. The working expenses, it is estimated, of a domestic scheme would be £1100 a year; with 500,000 gallons of trade water added, £1550; and with 1,000,000 gallons, £2000. Before further steps are taken, the scheme will be considered by the Local Authorities affected.

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Oldham Corporation Water Undertaking.—In his statistical statement for the past year in connection with the Water Department of the Oldham Corporation, Mr. Arthur Andrew shôws that the gross revenue for the year on water account amounted to £62,952; and the gross expenditure to £19,653; the balance carried to profit and loss account being £43,298. After meeting the charges for annuities, interest, and sinking fund, a surplus remains of £4982. The credit balance brought forward from the previous year was £4982, which now left a credit balance of £9762. The income during the past year was £62,952, against £60,426 in the previous year; and the expenditure was £19,653, as against £16,670.

Plympton St. Mary Water Supply.—An application by the Plympton St. Mary District Council for permission to borrow £500 for works of water supply was the subject of a Local Government Board inquiry last Wednesday week. It was explained that the supply was from old mine workings, and that recent investigation had shown that what was supposed to be a spring was, in reality, the overflow of an adit which had fallen in. In order to protect the water from risk of pollution, it was proposed by Mr. H. Francis, the Engineer of the works, to construct a concrete receiving-tank, and to make a brick culvert from the entrance to the adit to the tank. The water was described as of exceptional purity and abundant in quantity.

Taunton Water Supply.—At the meeting of the Taunton Town Council last Tuesday, the Water Committee reported that the Local Government Board had sanctioned a loan of £20,000 for the construction of a new reservoir. Application was made for a loan of £21,500, the estimated cost of the work; but the Board declined to grant the full amount owing to the present position of the borough with regard to its borrowing powers, and the £20,000 would bring the amount up to the extreme limit. The Town Clerk had since communicated with the Board, informing them that during the month a further payment would be made to the loans account; and they hoped to receive sanction to borrow the whole amount required.

Widnes Corporation Gas Supply.—At the meeting of the Widnes Town Council last Tuesday, the Gas and Water Committee submitted the profit and loss account for the past financial year, showing a net profit on the gas account, after providing the sum of £1601 for the cost of public lighting, of £3814. Mr. Davies, in proposing the adoption of the Committee's minutes, said he believed this was the greatest profit they had ever made. This result had been achieved notwithstanding that the price of gas had been reduced to 1s. 5d. per 1000 cubic feet to ordinary consumers, 1s. 3d. to consumers of more than 3 million cubic feet per annum, and 1s. 1d. for gas supplied for motive power, and that they had to spend for coal £2000 more than in the previous year. With regard to the future, he was afraid they would have to face a difficulty. The tenders they had received for coal would amount in the aggregate to upwards of £6000 more than the cost last year. Under these circumstances, they might have to increase the price of gas; but the Committee would certainly do all they possibly could to avoid it. The minutes were adopted.

The Austrian Welsbach Incandescent Light Company.—The recently issued report of this Company shows that the profit earned during the year 1899-1900 is proportionally considerably less than that of the preceding working period, which comprised only nine months. The loss is largely due to increased taxation, whereby the amount paid by the Company was nearly quadrupled. A dividend of 65 per cent., in place of 80 per cent. in the preceding period, is recommended. It is reported that good progress is being made with the manufacture of the Welsbach electric lamp, for which works have recently been established.

New Water-Works for Glastonbury.—The completion of the first and most important part of a scheme which is to cost about £12,000, and involving the extension of the present water-works at Glastonbury, was signalized last Wednesday by the Mayor and Corporation and a number of the principal inhabitants journeying to West Compton, where the water from a recently-acquired spring was turned into the new mains. Besides the scheme referred to, the Council have decided on another, known as the high-level scheme, to supply the higher parts of the town, and this will cost a further £2000. Mr. Hawkins, who was Mayor in 1897-8, performed the ceremony of turning on the water into the main at Edgarley; and the Mayor (Alderman Baily) turned on the water into the reservoir. Mr. Newton (the Engineer) presented each gentleman with a handsome gold key. In the evening, there was a banquet in celebration of the event.

The Gas Manager to the Oldbury District Council (Mr. A. Cooke) has been voted an addition of £50 a year to his salary.

The tender of Messrs. C. & W. Walker, Limited, for the supply of a condenser at the Stafford Corporation Gas-Works, has been accepted.

A party of five members of the Darlington Corporation have been on a deputation "to inquire into the mysterious manifestations of water gas"—visiting London, Rochester, Southall, and Croydon.

The Bishop's Stortford Gas Company, Limited, has been registered with a capital of £20,000, in £10 shares, to acquire the business of a Company of the same name (incorporated in 1871), and to carry on the business of a gas company generally.

A project is on foot for laying down a line of water-pipes for the supply of Coolgardie. It is an enterprise of the first magnitude, and involves the construction and placing of 328 miles of 30-inch steel pipes, which will deliver 5 million gallons of water daily.

The surrender of Pretoria was celebrated at Reading by general rejoicings, including a great procession and carnival, on the night of the 6th inst. From the account of the show given in the "Reading Observer," we learn that the Reading Gas Company had a procession on their own account, marshalled by Mr. A. H. Cane. The tableau was a reproduction of an advertisement which has from time to time appeared in the "Journal." It represented Kruger carrying a goose to the Colonial Secretary to be cooked. Behind Mr. Chamberlain floated the Union Jack, and behind Kruger was the Boer flag, hung half-mast high. The tableau was preceded and followed by patriots carrying lanterns, torches, &c.

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PURIFIERS. PURIFYING-MACHINES FOR AMMONIA. SCRUBBERS.
TAR-EXTRACTORS. RETORT MOUTHPIECES OF ANY SHAPE.

WECK'S PATENT CENTRE-VALVES.

CONDENSERS. **CRIPPS'S GRID-VALVE** TAR-BURNERS.

SIEVES. For bye-passing the lower layer in Purifiers. VALVES.

TYSOE'S SELF-SEALING MOUTHPIECES.

Tar-Distilling Plants. Claus' Sulphur-Recovery Plants.

SULPHATE OF AMMONIA PLANTS.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at th Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale than all other Oxides combined. Purity and uniformity of quality guaranteed.
JOHN WM. O'NEILL, Managing Director,
160, 161, & 162, PALMERSTON BUILDINGS,
OLD BROAD STREET,
LONDON, E.C.

ANDREW STEPHENSON, AGENT. All communications re Oxide to the Company as above.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for use in GAS-WORKS.
ANDREW STEPHENSON,
182, Palmerston Buildings,
Old Broad Street,
"Volcanism, London." London, E.C.

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS. Correspondence invited.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

AMMONIACAL LIQUOR wanted.
BROTHERTON AND CO., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

TO GAS AND WATER OFFICIALS.
HIGH-CLASS Cycles at reasonable and low Prices. Guaranteed for Twelve Months. Sent on approval. For Cash or Gradual Payment System. Send for Catalogue, Post Free.
MELROSE CYCLE COMPANY, COVENTRY.

SULPHURIC ACID for Sale.
BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

BENZOL, specially made for the Enrichment of Gas.
ELLISON AND MITCHELL, LIMITED, Kilnhurst, near ROTHERHAM.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

SPECIAL PAINT FOR GAS-WORKS.
JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."
[For Illustrated Advertisement, See p. 1674.]

PATENTS FOR INVENTIONS.
Messrs. J. C. CHAPMAN & CO., Chartered Patent Agents, ADVISE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

ENRICH your Gas with cheap Benzol.
Specially prepared, free from sulphur. At to-day's Price of Benzol, ILLUMINATING POWER costs less than ONE-THIRD OF A PENNY PER CANDLE.
Apply to SADLER AND CO., MIDDLESBROUGH.

PRACTICAL RETORT SETTERS.
GEORGE NUTTALL & CO., 32, Havelock Road, Saltley, Birmingham.
Regenerator or other Furnaces erected to Engineers' own Designs. Best Work Guaranteed. Please write for Estimates.

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c., CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special attention to Repairs.
Before placing Orders, please write for Estimate.
Telegraphic Address: "SATURATORS, BOLTON."

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM; and 45 & 47, Westminster Bridge Road, LONDON, S.E.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Addresses:
"Braddock, Oldham." "Metrique, London."

SULPHURIC ACID.
JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

GAS TAR wanted.
BROTHERTON AND CO., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

CANNEL, COAL, ETC.
JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application
No. 30, ST. ANDREW SQUARE, EDINBURGH, } SCOTLAND.
NEWTON GRANGE, NEWBATTLE, DALKEITH, }

WANTED, all kinds of Pipe Laying, on very reasonable terms. Gas or Water. Over twenty years' experience. Day-work or piece-work.
Apply to W. LOWE, 15, Brompton Row, Dewsbury Road, Leeds.

THE Advertiser wishes to place his son at a Gas-Works in England under an Engineer. Make per annum not less than 100 million cubic feet. Terms by arrangement.
Address No. 3515, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ADVERTISER wants Situation as ASSISTANT SECRETARY or CHIEF CLERK in Gas Company's Office. Nine years' experience of Gas Office work; and six years in Accountant's Office. Thirty years of age. Excellent testimonials.
Apply to No. 3517, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TWO Stokers, used to Shovel charging, wanted at once.
Apply, WYVER, Gas-Works, WHITSTABLE.

WANTED, Two experienced Retort SETTERS. Good wages to competent men.
Apply, by letter, to No. 3516, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a competent, reliable man, to take charge of a small private Gas-Works. Single man preferred.
Apply, by letter, giving References, to J. BEVAN, Clerk of Works Office, Elveden, near THETFORD.

WANTED, Retort Setters. Must be capable men, and able to take charge and work from drawings.
Apply, stating Experience and Wages required, to JONAS DRAKE AND SON, Ovenden, HALIFAX.

WANTED, a Good, Reliable, Experienced DRAUGHTSMAN in a Gas Engineering Firm.
Apply, with full Particulars, Character, Salary, and Experience, to No. 3514, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS Man Wanted for an American Gas-Works, making at present 50 million cubic feet per annum. One who has also had experience as Secretary of such a Company preferred.
Apply, in writing, to J. A. KELMAN, 251, Winchester House, OLD BROAD STREET, E.C.

MANAGER Wanted for a Foreign Gas-Works, capable of large increase upon its present output. Commencing Salary about £300 per annum.
Address, "DIRECTOR," care of Burbidge, Wilcox, and Co., Advertising Agents, 62, MOORGATE STREET, E.C.

THE RAUNDS GASLIGHT AND COKE COMPANY LIMITED.
WANTED, at once a Mainlayer and FITTER.
Apply, on or before Thursday, June 21, to E. J. WHITNEY, Secretary, Raunds Gas Company, Raunds, NORTHAMPTONSHIRE.

WANTED, a Working Manager for a Gas-Works. Practical man who can Superintend and do anything that is required on a Works with a make of 4 million cubic feet per annum. Salary 20s. per week, with House, Coal, Gas, and a Bonus on results.
Apply, with Testimonials, to the CHAIRMAN, Gas Company, Seaton, DEVON.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.
BALE & CO.'S Oxide of uniform quality. SPECIAL FIRE CEMENT, OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

SADLER & CO., Ltd., Middlesbrough, Tar Distillers and Tar Colour Manufacturers. BENZOL specially prepared for Gas Enrichment free from Sulphur. Pure Hydrated OXIDE OF IRON for Purifying Gas either for Sale or Lent on Hire. Always Buyers of GAS TAR and AMMONIACAL LIQUOR.

WANTED, one or two steady Men as STOKERS. Used to Shovel Charging. Good Wages given, and Permanency to good Men.
Apply to H. HAMILTON, Gas-Works, CHERTSEY.

WANTED, a Foreman Gas-Fitter, capable of superintending Service Laying and all Outdoor Work in connection with a Gas Company, including the Fixing, &c., of Gas-Stoves and Fitting up Houses under the Prepayment Meter System.
Address, in writing, stating Age, Wages required, and References, to No. 3518, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

YOUGHAL (CO. CORK) URBAN DISTRICT COUNCIL.
WANTED, a Manager for the Youghal Gas-Works. Make about 6 millions. Must be a mechanic and understand carbonizing. From 25 to 35 years of age. Wages, 45s. weekly, with free House, Garden, Light, and Firing.
Apply, in own handwriting, with *copies* of Two recent Testimonials, to the Council's Engineer, Mr. R. BRUCE ANDERSON, 35A, Great George Street, LONDON, S.W.

WANTED, new or second-hand, a Steel TANK, of the capacity of 400 gallons, mounted on strong Wheels and Frame.
State Price, with or without Valves, to the MANAGER, Gas-Works, FORMBY.

ALTON GAS AND COKE COMPANY.
WANTED, by the above Company, two good PURIFIERS, from 20 to 25 feet square, with or without Lifting Gear.
Full particulars to F. BARNLEY, Manager, Gas-Works, Alton, Hants.

ENGINES and Exhausters combined "Waller," to pass 30,000 cubic feet per hour. DITTO to pass 7000 feet per hour, overhauled and complete. Cheap to clear. Also BOILERS.
J. FIRTH BLAKELEY AND CO., Thornhill, DEWSBURY.

FOR SALE, a No. 1 Thorscar Acetylene GENERATOR, for Fourteen Burners, with guarantee from the manufacturers. Never been used. What offers?
Apply to No. 3513, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—Two Lancashire Boilers, each 6 ft. diameter by 20 ft. long, with Mountings. Been in use only a short time. Made by the Yorkshire Engine Company, Limited, Sheffield.
Apply to NEWTON, CHAMBERS, & CO., LIMITED, Thorncliffe Iron-Works, near SHEFFIELD, where the Boilers may be seen.

GASHOLDER, 50 ft. by 20 ft., with Six Columns, 15 inches diameter, Wrought Lattice Girders, &c., complete and perfect. About Fourteen Years old.
Price, erected, on application to J. FIRTH BLAKELEY AND CO., Thornhill, DEWSBURY.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

CONDENSERS, Washer-Scrubbers, "Cutler" patent CONDENSERS (14) 6 in. to 12 in. PIPE CONDENSERS, Patent WASHERS by "Livesey," "Holmes," and "Cockey," EXHAUSTERS up to 60,000 Cubic Feet per hour. ENGINES, BOILERS, &c. Several TOWER SCRUBBERS, PURIFIERS, METERS, GOVERNORS, PUMPS, TANKS, VALVES, &c.
J. FIRTH BLAKELEY AND CO., Gas Engineers, DEWSBURY.

FOR SALE—Two small Boilers, 6 feet long, 3 feet diameter, each fitted with two 9-inch Flue Tubes. Equal to new, with Fittings and Furnace Doors and Frames. Price £12 10s. each, or £22 the pair.
Also two 8-inch FLANGED T-PIECES and ELBOW CONNECTIONS, for Exhauster Bye-Pass, with Cockey and Smith's Patent Bye-Pass Valve, 4-inch Branch, and Throttle Valve and Compensator.
For further Particulars apply to the MANAGER, Gas-Works, Sandown, ISLE OF WIGHT.

THE Calne Gas and Coke Company, Limited, have FOR SALE the following APPARATUS. Offers to be sent to the Secretary at Church Street, Calne, Wilts.

All necessary CONNECTIONS for three Purifiers by Cockey and Sons, comprising:—

One Lift for 8-feet Purifier.
Four 6-inch Rack and Pinion Valves.
One 6-inch Centre-Valve with Column.
One 6-inch Bye-Pass Valve with Column.
Nineteen 6-inch Bends and Springs.
One 6-inch T-Piece.
Thirteen Caps and Clips.

RUGBY GAS COMPANY.

FOR SALE—One 20,000 cubic feet per hour WALLER THREE-BLADE EXHAUSTER, with Engine Combined, with Disc Valves, Governor, &c., complete.

One 30,000 cubic feet per hour DONKIN COMBINED ENGINE and EXHAUSTER, with Valves, Governor, &c., complete, and Bye-Pass Valve and Connections.

Both Exhausters have been working until May, and are now replaced by larger ones.

Permission to view, and any further Particulars required, to be obtained from the undersigned.

C. MEIKLEJOHN,
Engineer and Manager.

SUTTON, SOUTHCOATES, AND DRYPOOL GAS COMPANY, HULL.

THE Directors of the above Company invite TENDERS for the surplus TAR and AMMONIACAL LIQUOR produced at their Works during the Twelve Months ending the 30th of June, 1901.

Probable quantity of Tar, 1000 Tons.

Probable quantity of Ammoniacal Liquor, 1200 Tons.

Tenders for Liquor must state price per Ton, per degree Twaddel's Hydrometer from 4° to 8°.

Tenders to be sent to the undersigned on or before the 25th of June, 1900, marked "Tender for Tar" or "Liquor."

The Directors do not bind themselves to accept the highest or any Tender.

DAVID WOOD,
Secretary.

Offices: St. Mark's Street, Hull,
June 6, 1900.

NEWARK GAS COMPANY.

TO MANUFACTURING CHEMISTS AND OTHERS.

THE Directors of the above Company are prepared to receive TENDERS for the purchase of the AMMONIACAL LIQUOR produced at their Works for One Year from the 1st day of July, 1900, at per degree Twaddel (Temperature 60° Fahr.).

The Liquor to be not less than 5° in strength.

Terms: Cash monthly.

Further Particulars can be had on application to the undersigned, to whom sealed Tenders, marked on the outside "Tender for Liquor," are to be sent on or before the 20th inst.

The highest Tender will not be necessarily accepted.

F. B. FOOTTIT,
Secretary.

Newark, June 2, 1900.

NEWARK GAS COMPANY.

TO TAR DISTILLERS AND OTHERS.

THE Directors of the Newark Gas Com- pany are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Works, free on rail, G.N. Rly. or M. Rly. in Purchaser's Tanks, for One Year from the 1st day of July, 1900.

Terms: Cash monthly.

Further Particulars can be obtained on application to the undersigned, to whom sealed Tenders are to be sent on or before the 20th inst., marked on the outside "Tender for Tar."

The Directors do not bind themselves to accept the highest or any Tender.

By order,
F. B. FOOTTIT,
Secretary.

Newark, June 2, 1900.

CITY OF NOTTINGHAM.

(WATER DEPARTMENT.)

TENDERS FOR THE SUPPLY OF VALVES AND HYDRANTS, PIPES, LEAD, COAL, TAPS, AND FITTINGS.

THE Water Committee of the Corpora- tion are prepared to receive TENDERS from competent Ironfounders, Brassfounders, Valve Manufacturers, Lead Merchants, and Colliery Proprietors and Coal Merchants for the Supply of the undermentioned goods for the ensuing year:—

1. CAST-IRON DOUBLE-FACED SLUICE VALVES and HYDRANTS.
2. CAST-IRON MAIN PIPES.
   CAST-IRON SPECIAL PIPES.
3. LEAD PIPING.
   LEAD INGOTS.
4. GUN METAL TAPS and FERRULE FITTINGS.
5. STEAM COAL and OTHER FUEL.

Specifications and Drawings, together with Samples, Weights, &c., may be seen, and other Information obtained, at the Office of the Water Manager, Mr. Stephen Moore, St. Peter's Church Side; and Forms of Tender may be obtained at that Office on payment of One Guinea, which sum will be returned on receipt of a *bona fide* Tender.

Tenders, endorsed "Tender for Valves," "Tender for Pipes," "Tender for Lead," "Tender for Taps," or "Tender for Coal," to be delivered to me at the Guildhall, Nottingham, on or before the 30th of June inst.

The Committee do not bind themselves to accept the lowest or any Tender.

By order of the Water Committee,
SAMUEL G. JOHNSON,
Town Clerk.

Guildhall, Nottingham,
June 13, 1900.

GLYNCORRWG URBAN DISTRICT COUNCIL.

CONSTRUCTION OF GAS-WORKS.

THE above Council invite Tenders for the erection and completion of a new GAS-WORKS, MANAGER'S DWELLING-HOUSE, and TRUNK MAIN, on a site situate at Cymmer, in the County of Glamorgan, on the Rhondda and Swansea Bay Railway, in accordance with Drawings and Specification prepared by Mr. R. A. Browning, A.M.Inst.C.E., Engineer, Neath.

The Drawings and Specification can be inspected, and all Information obtained, from the Engineer, at his Offices, Gas-Works, Neath.

Tenders, under seal, to be delivered to the undersigned, on or before the 27th inst.

CUTHBERTSON AND POWELL,
Clerks to the Council.

58, Water Street,
June 11, 1900.

COUNTY BOROUGH OF BURNLEY.

TO TAR DISTILLERS.

THE Gas Committee of the Corporation of Burnley are prepared to receive TENDERS for the surplus TAR produced at their Gas-Works during the period of Twelve Months ending March 31, 1901.

The Tar will be delivered by the Corporation into boats provided by the purchaser at the Gas-Works Wharf, on the Leeds and Liverpool Canal. The quantity will be approximately 2000 tons.

Tenders, under seal, endorsed "Tender for Tar," and addressed to the Chairman of the Gas Committee, Town Clerk's Office, Town Hall, Burnley, to be delivered not later than Wednesday, the 27th of June, 1900.

JOHN P. LEATHER,
Gas Engineer.

Gas-Works, Burnley,
June 9, 1900.

MOUNTAIN ASH URBAN DISTRICT COUNCIL.

TO CONTRACTORS.

THE Council invite Tenders for the supply and erection at their Gas-Works, Penrhiwceiber, of one CORNISH BOILER, 16 by 4½ feet, and a 20,000 cubic feet per hour ROTARY EXHAUSTER and ENGINE.

Drawings and Specification may be seen, and Forms of Tender obtained on application to, Mr. J. Williams, Town Hall, Mountain Ash, on and after Monday, the 25th inst.

Sealed Tenders, prepaid and endorsed "Boiler, Exhauster, &c.," to be sent to me at or before 1 o'clock on Tuesday, the 10th of July.

The Council do not bind themselves to accept the lowest or any Tender.

It is particularly requested that all Tenders be endorsed.

By order,
H. P. LINTON,
Clerk to the Council.

Town Hall, Mountain Ash,
June 13, 1900.

COUNTY BOROUGH OF HALIFAX.

THE Gas-Works Committee invite TENDERS for the supply of:—

1. OILS, PAINTS, &c.
2. BRUSHES.
3. BRASS MAIN COCKS and UNIONS.
4. WROUGHT-IRON TUBES and FITTINGS.
5. CAST-IRON PIPES.
6. INDIA-RUBBER GOODS.
7. BRASS LAMP FITTINGS.
8. SULPHURIC ACID.
9. OXIDE OF IRON.

And for the purchase of—

1. SPENT OXIDE OF IRON.
2. GAS CARBON.
3. BRIMSTONE.

For the Twelve Months ending June 30, 1901.

Forms of Tender and further Information may be obtained on application to Mr. Thomas Holgate, M.Inst.C.E., Engineer, Gas-Works, Halifax.

Tenders properly endorsed, to be sent to the undersigned, before Two o'clock p.m. on Wednesday, the 27th of June, 1900.

The persons whose Tenders are accepted will be required to observe the Fair Contract Clauses adopted by the Corporation.

By order,
KEIGHLEY WALTON,
Town Clerk.

Halifax, June 16, 1900.

KENT WATER-WORKS.

TENDERS FOR COAL.

THE Directors of the Kent Water-Works Company invite TENDERS for the supply of SCREENINGS from the best Durham COAL, at their Pumping-Stations at Crayford, Orpington, and Wilmington, Kent, for One Year. Approximate weekly quantities: Crayford, 50 to 65 Tons; Orpington, 45 to 55 Tons; Wilmington, 70 to 90 Tons; or, alternatively, for the supply of such Coal in Cargoes, f.o.b. or alongside in the River Thames, in a bulk supply of 10,000 Tons.

The Coal must be delivered in good and proper condition, and must evaporate not less than 7 lbs. of water for each pound of Coal, and be perfectly free from slag or other mineral or earthy matter. The percentage of ash and clinker to be adopted as the agreed limit will be specified.

Payments monthly, upon Engineer's certificate.

The Directors do not bind themselves to accept the lowest or any Tender.

The Draft Contract can be inspected, and other Particulars obtained, at the Company's Offices, Mill Lane, Deptford.

Tenders, marked "Tender for Coal," to be transmitted under seal on or before Saturday, June 30, to

A. DICKSON, Junr.,
Secretary of the Company.

June 16, 1900.

TENDERS FOR GAS COAL.

THE Gas Committee of Limerick are prepared to receive TENDERS for a supply of GAS COAL, according to Specifications to be had on application at the Gas Offices, 34 and 35, William Street.

Limerick, June 14, 1900.

ALTON GAS AND COKE COMPANY.

THE Directors of the above Company invite TENDERS for their surplus TAR and LIQUOR. Coals carbonized, 2000 tons.

All persons tendering must supply casks delivered at Alton Station.

Particulars from F. BARNLEY, Manager, Gas-Works, Alton, HANTS.

THE Northallerton Consumers' Gas Company, Limited, invite Tenders, Plans, and Specifications for a new or a good second-hand EXHAUSTER, with Steam-Engine combined, to pass 5000 cubic feet per hour, with Valves, Governor, Bye-Pass Valves, and all Connections complete.

Tenders to be received not later than the 5th day of July next.

J. A. SQUINCE,
Secretary.

BOROUGH OF CONGLETON.

THE Gas Committee invite Tenders for the supply of 4000 Tons of best screened GAS COAL, BURGY, or WASHED NUTS, to be delivered between July 1, 1900, and June 30, 1901.

Sealed and endorsed Tenders, addressed to the Chairman of the Gas Committee, to be delivered at the Town Clerk's Office, not later than Monday, the 25th inst.

Further Particulars may be obtained from the undersigned.

WM. ORME,
Engineer and Manager.

BOROUGH OF CONGLETON.

THE Gas Committee are prepared to receive TENDERS for the purchase of the surplus TAR and LIQUOR to be produced at their Gas-Works between July 1, 1900, and June 30, 1901.

Sealed and endorsed Tenders, addressed to the Chairman of the Gas Committee, to be delivered at the Town Clerk's Office, not later than Monday, the 25th inst.

Information may be obtained from the undersigned.

WM. ORME,
Engineer and Manager.

CITY OF CARLISLE.

THE Carlisle Gas Committee invite TENDERS for the supply and erection of PLANT for the manufacture of CARBURETTED WATER GAS.

Particulars to be obtained from the undersigned, to whom Tenders are to be forwarded not later than June 30.

The Committee do not bind themselves to accept the lowest or any Tender.

C. B. NEWTON,
Engineer and General Manager.

Gas-Works, Carlisle,
June 12, 1900.

TO COAL CONTRACTORS AND OTHERS.

THE Sedgley Urban District Council invite TENDERS for supplying 800 to 1000 Tons of GAS COAL, the deliveries to be made at the Shut End Siding at such times and in such quantities as may be directed.

Sealed Tenders marked "Coal," must reach me on or before the 26th of June.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
JOSEPH SMITH
Clerk to the Council.

Offices: High Holborn,
Sedgley, June 8, 1900.

BOROUGH OF SMETHWICK.

TENDERS FOR GAS COAL.

THE Gas Committee invite Tenders for the supply of about 30,000 Tons of screened and unscreened GAS COAL, and screened and washed GAS NUTS for delivery during the Year ending June 30, 1901.

Form of Tender and further Information may be obtained of the undersigned.

Sealed Tenders, endorsed "Tender for Coal," and addressed to the Chairman of the Gas Committee, Town Hall, Smethwick, to be sent in not later than the 28th of June next.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
W. J. STURGES,
Secretary.

Gas Offices, Town Hall,
Smethwick, June 6, 1900.

NEWCASTLE-UPON-TYNE AND GATESHEAD GAS COMPANY.

SALE OF ORDINARY STOCK.

THE Directors have instructed Mr. ROBERT MACK to SELL BY AUCTION, at the Offices of the Company, Newcastle-upon-Tyne, on Wednesday, the 11th day of July, 1900, at 12 o'clock noon,

£25,000 ORDINARY STOCK

of the Company, to be issued under the Powers of the Company's Act of 1896.

For Conditions of Sale and further Particulars apply to the undersigned.

THOMAS WADDOM,
Secretary.

Offices: 85, Grainger Street West,
Newcastle-upon-Tyne, 1900.

HORNSEY GAS COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, relating to DEBENTURE STOCK only, WILL BE CLOSED on the 16th, and RE-OPENED on the 30th inst.

S. J. WILLIAMS,
Secretary.

63, Chancery Lane,
June 12, 1900.

SOUTH METROPOLITAN GAS COMPANY.

SALE BY TENDER OF £30,000 THREE PER CENT. PERPETUAL DEBENTURE STOCK.

MINIMUM PRICE, £97 PER CENT.

NOTICE is Hereby Given, that it is the intention of the Directors of this Company to SELL BY TENDER £30,000 of THREE PER CENT. PERPETUAL DEBENTURE STOCK, in accordance with the Provisions of the South Metropolitan Gas Acts, 1882 and 1896.

Particulars of same, with Form of Tender, can be obtained at this Office on application to the undersigned; and Tenders must be sent in on or before Tuesday, the 10th day of July next.

The Stock will be allotted to the highest bidders; but no Tender will be accepted at a lower price than at the rate of £97 money for each £100 Debenture Stock.

By order,
FRANK BUSH,
Secretary.

Offices: 709A, Old Kent Road,
London, S.E., June 9, 1900.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
SOUTHEND WATER-WORKS COMPANY.

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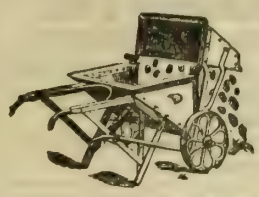
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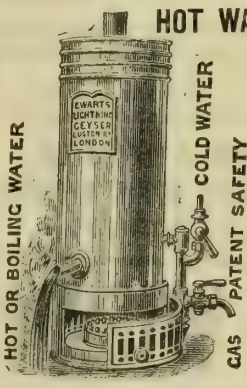
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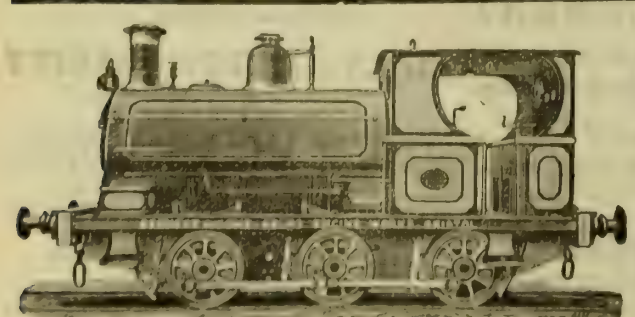
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CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE.
Rise of Price by the Gaslight and Coke Company 1695
The Passing of the Morecambe Gas Bill 1696
The Sapiency of the "London Correspondent" 1696
Municipal Loans and Fixed Prices 1697
The Latest Dockers' Strike 1697
The Cost of Accident Insurance 1697
Municipal Electricians and "Hospitalities" of Trading Firms . 1697
WATER AND SANITARY AFFAIRS—
Meeting of the British Association of Water Engineers—The President's Address 1698
THE INCORPORATED GAS INSTITUTE—
ANNUAL MEETING IN LONDON—
Papers and Discussions—
Automatic Stoking and Inclined Retorts. By W. R. Chester, of Nottingham 1699
Roofs for Retort-Houses. By A. T. Walmisley, of London. . 1703
Some Disputed Points among Gas and Water Experts. By J. Wilkinson, of Drighlington 1708
Naphthalene from Retort to Point of Deposition. By W. Young, of Peebles 1712
ESSAYS, COMMENTARIES, AND REVIEWS —
Gas and Water Companies in the Stock Market 1719
Electric Lighting Memoranda 1719
Sir H. H. Fowler on Municipal Trading 1719
Gas Undertakings and the Supply of Acetylene 1720
NOTES:—
Tests of the Pohlé Water-Raiser 1722
The Prospects of Cheap Coal from Alabama 1722
Recent Developments in the Acetylene Industry 1722
A Combination Power Plant 1722
Coke-Breeze Concrete Slabs 1722
TECHNICAL RECORD:—
Western Gas Association—Annual Meeting in Chicago . . . 1723
British Association of Water-Works Engineers—Annual Meeting at Cardiff—
General Business 1725
Inaugural Address of Mr. C. H. Priestley, Assoc.M.Inst.C.E. . 1725
REGISTER OF PATENTS:—
Manufacturing Gas for Motive, Heating, and Lighting Purposes —Stewart-Wallace, J. S., Cowell, W. B, Paisley, J. R., and Kemp-Welch, J. S. 1728
Coin-Freed Gas-Meters—Beechey, C. G., and Wright, A. T. . . 1728
Burners for Incandescence Gas Lighting—Grautoff, A. H., and Fritz, F. 1728
Internal Combustion Motors—Buchet, E. V. 1728
Automatically Opening a Valve at a Predetermined Time—Marks, C. C. (Stenhouse, A., and Atkinson, E.) 1729
Water-Meters—Duncan, W. 1729
Patent Notices 1729
CORRESPONDENCE:—
The Carpenter-Brackenbury-Winstanley Controversy 1729
The Gas Institute Amalgamation Discussion. 1729
Mr. Edwards's Paper on Artificial Light 1729
PARLIAMENTARY INTELLIGENCE:—
Gleanings from the Committee Rooms. 1730
House of Lords—Progress of Bills 1730
House of Commons—Progress of Bills; The Chartered Company's Increase in Price 1730
House of Lords Committee—Morecambe Urban District Council Gas Bill 1730
The Parliamentary Committee on Municipal Trading 1732
LEGAL INTELLIGENCE:—
Court of Appeal (Ireland)—Alliance and Dublin Consumers' Gas Company *v.* County Council of Dublin; Damage to Gas-Pipes by Steam-Rollers 1733
Chancery Court of Lancashire—Taylor *v.* Oldham Corporation . 1733
Monazite Sand for the Manufacture of Incandescent Mantles . 1733
Liability for Water-Rate 1733
A Workman's Claim Against the Birmingham Corporation for Injuries Received 1733
Robbing a Prepayment Meter at Rotherham 1733
MISCELLANEOUS:—
This Year's Examinations in Gas Manufacture—The Pass List . 1734
The Gas and Water Orders of the Present Session 1734
The Increased Price of Gas in the Metropolis 1734
Edinburgh and Leith Gas Commissioners—The Annual Accounts 1735
Southport Corporation Gas Supply—Engineer's Annual Report . 1735
Ramsgate Corporation Gas and Water Supply 1736
Oldham Corporation Gas Supply—The Increased Price of Gas—Adoption of Water Gas 1736
Bolton Corporation Gas Supply—The Past Year's Working . . 1736
Coventry Corporation Gas Supply—Annual Report. 1737
Selby Gas Undertaking—A Successful Result for the Past Year . 1737
Neath Corporation Gas Supply—The Past Year's Working . . 1738
Gas *v.* Electric Lighting at Hastings 1738
Chelsea Water-Works Company 1738
Gas and Water Companies' Stock and Share List 1739
New York Water Supply—An Important Report. 1740
Notes from Scotland 1743
Current Sales of Gas Products 1745
Coal Trade Reports 1745
PARAGRAPHS:—
PERSONAL: Mr. H. Hanan; Mr. E. Mason; Mr. M'Farlane; Mr. G. H. Roberts; Mr. Thomas Smith; Mr. E. P. Tarratt; Mr. Andrew Wilson; Mr. P. C. Holmes Hunt; Mr. Frank Howarth, M.Inst.C.E.; Mr. E. Sandeman 1721
OBITUARY: Mr. James Robb; Mr. G. Sumner; Mrs. George R. Hislop; Mr. J. Steel Johnson 1721
Post Office Delays—The Composition and Determination of Cerium Oxalate 1698
The Behaviour of Acetylene towards Hypochlorites. 1718
Glass-Lined Water-Pipes—The Maintenance of Vitrified Clay Water-Mains 1722
The Committee on Patent Office Reform 1724
American Society of Civil Engineers—Scraping Water-Mains . 1727
Closing of the Kimbolton (Hunts.) Gas-Works 1729
Discontinuance of Oil Lighting at Stoke-sub-Hamdon—The Leamington Corporation and the Gas-Works 1732
The Price of Gas at Paignton—Sales of Shares 1742
Brigg and its Gas Supply—Increase in the Amount Paid on a Contract—Manchester Water Supply—The Position of the Aberavon Gas-Works 1746

EDITORIAL NOTES.

Rise of Price by the Gaslight and Coke Company.

THE announcement, of which we were able to give an early notice in last week's "JOURNAL," of an increase of 6d. per 1000 cubic feet in the price of gas to private consumers north of the River Thames of the Gaslight and Coke Company, cannot be said to have been unexpected. It nevertheless has created a considerable commotion in the London newspapers, which forthwith began to look into the matter. So little attention does the London newspaper press usually bestow upon Metropolitan affairs, that several of the leading journals were unable, on the spur of the moment, to tell an accurate story about the London Gas Companies and their doings. They mixed up the names and prices charged by the different Companies, and only agreed upon the point that the rise of price ordered by the Directors of the Gaslight and Coke Company, from 2s. 11d. to 3s. 5d. per 1000 cubic feet, is "scandalous," and not to be endured. The more sober-minded newspapers recalled the fact that the Commercial Company had previously raised their price by 6d. per 1000 cubic feet; while the South Metropolitan Gas Company had advanced theirs by 3d., making the selling price 2s. 4d. per 1000 cubic feet. Still, the patent fact that the net result of all these increases was to show more glaringly than ever the disparity of treatment of the consumers of the three Companies, could not escape acrimonious mention. The consideration that the high cost of gas coal may have had something to do with the increased price of gas, was not overlooked; and one London newspaper even admitted that the Metropolitan Gas Companies were doing no more than 150 Gas Companies and Gas Committees of Municipal Corporations throughout the country had been constrained to do before them. As will be seen by a report which we reproduce elsewhere, one newspaper promptly sent and "interviewed" Mr. George Livesey on the subject, and received the enlightenment which some others conspicuously lacked.

Notwithstanding all the uproar that the Metropolitan Local Authorities and the newspaper writers may raise over these increases, it is difficult to believe that the people of London, knowing that there are no "summer prices" for house coal this year, will be so unreasonable as to expect their gas to be made as cheaply as ever. As men of business, the majority of householders must realize that gas cannot, and ought not, to be kept at the same price while coal has risen about 7s. 6d. per ton in the last two years. Any Gas Company who could so disregard the cost of the raw material of manufacture, must have charged too much before—that is, of course, assuming that there is no specially advantageous contract in the case. In at least one important instance—Preston—the Company have actually been able to reduce the price of gas; for the simple reason that they are enjoying the benefit of a contract for coals made before the general rise, besides participating in the enhanced value of coke. Many other gas undertakings, for the same reason, are under no necessity to raise their price, and are not doing so. It is as well that the public should be early reminded of these facts.

At the same time, it is desirable to expose the fallacy of the argument, very popular just now in the newspapers, that the value of residuals will rise so high that the enhanced cost of coal will be set-off thereby, so that no increase of the price of gas is necessary. Apart from the obvious remark that no sliding-scale Gas Company, at any rate, would be so foolish as to sacrifice dividend needlessly, it should not be difficult to show even "the man in the street" that, while coke rises in sympathy with coal for comparatively small increments of value, it cannot, and does not, rise sufficiently to compensate for great advances, as of 5s. per ton and upwards, in the price of coal. Besides, all the expenses of gas making have increased enormously of late years, as every man in business must perceive from his own experience; so that when a sharp rise of the raw material of gas manufacture comes on the top of other swollen charges, there is no help for it but dearer gas. As it is, in no instance that we know of have Companies put up the price of gas to the full figure deducible from the actual rise in the cost of coal into the works. They have invariably given the public the benefit of the uncertainty as to how far the residuals markets will respond to the pressure on the coal supply; and if the pinch lasts any considerable time, further advances of price may be expected.

This is not the time to discuss the peculiar circumstances

that have brought the Administration of the Gaslight and Coke Company into such a pass that they have now to face much more than the ordinary amount of obloquy that might be expected to attach to a Company for merely putting up the price of gas 6d. per 1000 cubic feet. Their old enemies in and out of Parliament will rage more furiously than ever; and the official optimism of the Horseferry Road will ring more falsely than usual, on this "higher scale." A difference of 5d. as compared with the Commercial, and of 1s. 1d. per 1000 cubic feet as contrasted with the South Metropolitan Company, is not to be lightly passed over as forming part of the natural order of things sublunary. It is a very grave matter indeed, from whatsoever standpoint regarded; and it is difficult to forecast the course that will be taken with the object of correcting the inequality from without, as there is no sign of its reduction from within. One can only trust that injustice may not be done in the endeavour to deal with a hard case.

The Passing of the Morecambe Gas Bill.

The Morecambe Gas Bill has passed through the Lords' Committee without further modification, and will therefore become law in the terms in which it left the Lower House. The only opposition offered to it in the Lords was in the interest of the outlying district of Heysham. The transfer of the Company's undertaking to the Morecambe Urban District Council is to be on terms which have been agreed upon by both parties; and, in accordance with established usage, a clause appears in the Bill enabling any outlying Local Authority supplied with gas to purchase their portion of the concern. In this case, however, Heysham desired to be empowered to sever from the Morecambe proprietary at a price calculated on the structural value of the plant taken over. Morecambe naturally objected to this proposal; contending that if Heysham were to be severed, it could only in fairness be on similar terms to those upon which they have agreed to purchase the undertaking as a whole. Heysham rejoined that, if Morecambe chose to pay an exorbitant price for the property, they should not be prejudiced thereby. The first question that arose before the Committee was as to the reasonableness or otherwise of the price that Morecambe had agreed to pay. Strong evidence was offered to the effect that the agreed price was fair. On the other hand, it was contended that the price was so high—throwing such a heavy capital burden on the undertaking—that the consumers of gas, especially in Heysham, would be worse off in future than they would have been if the Company had been left in possession. Still, the opposition failed to show cause why what is good enough for Morecambe is not equally good for Heysham; and the Committee declined to modify the severance clause in the sense asked for. Falling back on a second line of defence, Heysham asked for a clause similar to that inserted in the Glastonbury Bill for the protection of Street, which would give the outlying district the benefit of their rateable contributions to the sinking fund. Again the Committee declined to entertain the proposal. A last appeal for a direction that the gas profits should be applied to reduce the price of gas was also refused; so that, as above stated, the Bill went forward unaltered.

This precedent may be strongly commended to the careful study of municipalizers "on principle." Morecambe buys its gas-works, an admittedly fine property of the kind, at a very fine price. This is doubtless good business for Morecambe, which thus goes into a trade that is fast growing and extending. It so happens, however, that a good deal of this extension is in the outlying area of Heysham, which feels that it may be called upon to pay dearly for its gas in order that its neighbour may make a profit on the enormously inflated capital cost at which the undertaking has necessarily been acquired. Heysham may even consider that, but for the prospect of its compulsory assistance, Morecambe would never have consented to buy the gas-works at all. This shows the two sides of municipal trading for profit. Without going the length of approving of the original suggestion offered on behalf of the outlying district—that the Council should have the option of buying the local gas distributing plant, and severing themselves, at the "old-iron" value of the former—it is possible to hold that in such cases as the present the "outlanders" are somewhat hardly done by. The formal reservation to them of powers of purchase and severance is not enough protection. If they put them in force, in the majority of instances this means all the difference between supply by a small works and by a large one—that is to say, dearer gas. Many an outlying gas district has been constrained either to "cut off its nose to "spite its face," or to be exploited by another local authority. The rivalry, sometimes running to "bad blood," between neighbouring local authorities, is keen enough when they have no business relations with one another. Naturally, too; because it is usually a question of comparative rating. When to an existing cause of soreness which is perhaps congenital and unavoidable, is superadded a statutory right of one authority to relieve its rates partly at the expense of the other—and that the poorer suburban one—there is no wonder in these cases the "principle" of municipalization is differently esteemed in the two localities.

The Sapiency of the "London Correspondent."

If that journalistic personage the "London Correspondent" of the "provincial daily" were only to write upon subjects with which he possessed some acquaintance, how often would he fail to send off the expected quantum of "copy"! Certainly anyone whose enlightenment upon the inwardness of metropolitan affairs was derived solely from the aforesaid personage's daily budget would, in not a few cases, be a blind follower of the blind. We are moved to these remarks by a paragraph which appeared in the "Western Morning News" last Friday, wherein the London Correspondent of that journal embodied such information as he possessed in regard to the increased price of gas in the Metropolis and elsewhere. We congratulate him heartily upon having succeeded in as completely demonstrating his ignorance of gas affairs as it would be possible for anyone to do in the space of something under thirty lines of print. After remarking that notices have been sent round intimating that the price of gas will be raised by amounts varying from 1d. to 13d. per 1000 cubic feet, the correspondent proceeds: "Most gas companies have fixed upon 6d. or "7d., it being alleged that this is the exact increase consequent upon the advanced price of coal. That is, fuel "has gone up 5s. a ton, which, it is contended"—mark this evidence of complete ignorance as to whether a ton of coal produces 10,000 or 50,000 cubic feet of gas—"is "equal to 6d. per thousand feet. This," continues the correspondent, as if to emphasize his want of knowledge, "may or may not be the case. But even if it "is, the Companies are evidently bent upon making "an additional profit to their already large surplus; for if "coal has advanced by that amount, coke and the products "of coal"—we might inquire if the writer imagines coke not to be a product of coal—"will increase, and therefore "the Companies will charge the consumers for the entire "addition to the price of coal, and pocket the increase on "the residuary products." We hesitate to put into print the only language in which it is possible to justly describe such a piece of unwarrantable misrepresentation, but will merely advise the proprietors of the journal in question to obtain from some Londoner of average information a statement of the true facts of the case, when they will certainly require their correspondent to withdraw an absolutely unfounded charge against the gas undertakings of the country. They will also probably give him some wholesome advice as to the dangerous character of a very little knowledge.

The conclusion of this precious paragraph is, we were going to say, more inaccurate and unfair than its commencement, but that would be unjust to the quotations we have already made. This is what we read: "In one part "of London the addition is deeply resented, because, some "time ago, in order to obtain new powers from Parliament, "the price of gas was reduced 1d., in consequence of the "protest against this Company charging about 50 per cent. "more than the other London Companies. *Having got its* "*powers*, it now increases the price by 7d." How anyone could obtain the one grain of accurate information contained in these grossly inaccurate sentences without learning sufficient of London gas affairs to prevent the writing of such an utterly misleading paragraph, we are at a loss to imagine. We venture to inform the proprietors of the "Western Morning News" that the Gaslight and Coke Company's Bill for new capital powers was rejected by the Committee of the House of Commons to which it was referred, and that the Company have given notice to increase the price of their gas by 6d. per 1000 cubic feet. For information upon such matters as the actual increase

in the price of coal, and the operation of the sliding-scale, we would refer them to the files of "The Times," and to the various Acts of Parliament relating to the supply of gas in the Metropolis. We should hope it will be long before they again allow their London Correspondent to allude to questions requiring for their treatment an elementary knowledge of the gas industry.

Municipal Loans and Fixed Prices.

The London County Council are understood to be immensely proud of the success of their new financial policy, in issuing five millions of stock at a fixed price. Of course, the result will be applauded everywhere as evidence of the ability with which the Council transact their money matters, and also of the high point at which their credit stands in the City. It may be regarded as the carping utterance of a morbid detractor of this wonderful public body, but it is only common fairness to point out that the success of the issue is partly accidental, and partly due to an exceptional pliancy on the part of the Council as regards the taking of good advice and the following of an excellent example. Little as some may like to be told of the fact, the inaugurators in London of the system of issuing capital at a fixed price were the South Metropolitan Gas Company, whose Directors and Chairman were roundly abused for adjusting the bearing of their Act of Parliament in order to enable them to bye-pass the Stock Exchange, and get at the small investor in this way. Imitation, we all know, is the sincerest form of flattery. But even the willingness to copy a good model would not have ensured the success of the Council, if they had not at the last moment listened to the prompting of the Bank of England as to the right time for the issue. Just at the time of the brightening of the financial outlook generally —as that smart little journal, the "Londoner," observes— the Bank told the Council, "Now, or never!" There were just three days clear of crises. Pretoria had been taken, and the trouble in China had not then assumed importance. It was an interval of calm and confidence; and the County Council loan was subscribed for many times over. The success carries its own proper warning. It will not do for municipal authorities to hold themselves independent of outside financial advisers of the first consideration. It is recognized by the latter that the cheapness at which municipal loans could be obtained in the period from early in 1894 to the middle of 1896—the era of the birth and rapid growth of the modern idea of "municipalism" in local politics—was not due to the superior credit of the borrowers, but to the plentiful supply of loanable capital. Local authorities got money at 2½ per cent., and turned up their noses at the Public Works Loan Commissioners. They fastened upon the fond belief that 2½ per cent. was the fixed rate for municipal loans; and accordingly they set no bounds to the enterprises they could undertake with such cheap capital. In due course, however, came disillusionment. Certain municipal tentatives to raise money at the low rate failed; and now it is understood that first-class municipalities must be content to pay 3 per cent., if they want to make sure of getting money. It is a shock to feather-headed municipalizers, to discover that the value of money is a consideration in fixing the rate of interest on loans, as well as the nature of the security. When money is dear and the sinking fund has to be added to the rate of interest, the loans of local authorities do not cost them much less than the share and debenture capital of good companies—and there goes to the winds one stock argument for municipalization!

The Latest Dockers' Strike.

That egregious body, the Executive of the Dockers' Union, with Mr. Ben Tillett at their head, have chosen to call a strike of members of the Union employed at the London docks. The result will probably be the final disappearance of the so-called Union, and the cessation of its particularly useless and generally mischievous operations, which have chiefly consisted in the subsidizing of a handful of professional agitators. It is remarkable that even the "popular" newspapers have been chary of extending the usual "moral "support" to the strikers, while of material succour there has been none from any quarter. The ostensible object of the strike was simple enough—pay for dock labour at the rate of 8d. per hour, and "recognition of the Union." The world knows all about that "recognition" by this time. There were other minor claims; but the employers promptly went to the essential, and the misguided dockers had to leave their accustomed places and see other men taken on in their stead. The real reason for the outbreak was probably the conviction of the Union wirepullers that, as they had done nothing for many years to earn their salaries, unless they could show themselves to be of some use at this season of brisk trade, their paymasters would soon leave them in the lurch. Accordingly they staked their all upon the throw, and tried to make the strike effective by the usual course of lying to their own dupes and intimidating the free dock hands. The practical value of that "federation" of the ranks of Labour which one hears talk of occasionally, was early manifested by the decision of all the other "new" Unions not to strike in sympathy with their brethren the dockers, but to give them their good wishes. Of course, the Dockers' Union had no strike funds. The leaders had to pay their supporters with words, which, unfortunately for the latter, will not buy the beef and beer to which they are well accustomed in ordinary circumstances. The violence which was to have been expected as an accompaniment of the strike was unfortunately not prevented by the timely reinforcement of the dock police force, who are otherwise not a very efficient body; and this initial weakness really started the whole difficulty, as the strikers—in more than one sense of the term—fancied they were going to have their own way with their supplanters. Matters are different now; and the inevitable collapse of the strike is only a question of days. There is no force of public sentiment behind the revolt of these misguided labourers against their daily bread, as there was in 1889; and the sooner the men realize their folly, the better it will be for them.

The Cost of Accident Insurance.

We have often urged in these columns that insurance against the liabilities entailed on employers by the Workmen's Compensation Act is the most costly method of meeting these liabilities; the preferable course being the adoption of a mutual scheme, as provided for in the Act. Additional point is given to this contention by the annual report of the Directors of the Guardian Assurance Company. The Company started an Accident Department some two years ago—mainly in view of the business likely to be done in connection with the Workmen's Compensation Act. Last year the accident premiums received amounted, according to the annual report, to £12,159. The accident claims figured at £7671, while the expenses of management and commission swallowed up no less than £3880. This allowed only a small surplus to be added to the amount carried forward to provide for special contingencies. While, therefore, it is obvious that—as such insurance business is conducted—the Guardian Company are not charging excessive premiums (the Directors, in fact, report that they consider them inadequate, but cannot raise them on account of the competition for this class of business), it will be seen that insuring against the liabilities of the Act involves paying annually about 50 per cent. more in premiums than would be sufficient to meet the liabilities if dealt with direct or through a mutual scheme. In other words, of every 30s. paid in premiums, 10s. goes to pay the expenses or provide the profits of the Insurance Company. This is a fact deserving of consideration by the gas industry.

Municipal Electricians and "Hospitalities" of Trading Firms.

By a curious coincidence, the desire which has become a rooted determination on the part of the majority of British gas engineers and managers, to clear the membership and meetings of their technical societies from the merely commercial followers of the gas industry, has found an echo from the best wishers of the closely related profession of municipal electrical engineering. We call the coincidence a curious one, because at different times when the gas professionals have been struggling to raise the desirability of this particular piece of exclusiveness into a matter of settled and united opinion, they have been checked by the reminder that members of similar professions—notably the electrical engineers—had not the slightest objection to the meeting and mingling of men who follow their industry in all capacities, including the industrial and commercial. It now transpires that the municipal electricians, at least, have come under the lash of outside criticism which they would have escaped if they had been a little more reserved in this respect. Last week there was a meeting of the Municipal Electrical Association at Huddersfield; and the then current number of the "Municipal "Journal" had under its "Electrical Notes" a sharply-worded paragraph blaming, as a "lack of dignity on the

"part of municipal officials," "rather too prominent a "feature of electrical gatherings," consisting in "the accep- "tance of hospitality at the hands of contractors." Our contemporary goes on to remark that it has been unkindly whispered abroad "that some of our electrical engineering "firms who spent large amounts in entertaining their "technical friends, reap a rather undue advantage." The grammar of this passage is rather mixed; but that is part of its sting. It is mighty galling to be twitted thus by a scribbler who cannot even write good English. Without knowing what justification there may be for this aspersion on municipal electrical engineers—it could not have referred to the Huddersfield gathering, which it antedated—the lesson may be taken to heart by all ranks in the gas industry. It is not nice that such things should be sayable of any men holding official positions, and entrusted with the responsible management of other people's property. There's the rub! The Municipal Electrical Association is far more nearly akin to a gas managers' society than the latter is to the Institution of Civil Engineers, with which these associations are sometimes mistakenly compared, or than the former is to the Institution of Electrical Engineers. If there were any gas managers' association confined to men in municipal service, the companionships of electricians and gas engineers would be exactly on all-fours. This consideration of the character of the ownership of the property confided to electrical or gas officials is, of course, an unimportant accident. The point is that self-respecting men occupying positions of trust of this general kind should not place themselves in circumstances, or habituate themselves to associations, for which the censorious might and often do malign them.

WATER AND SANITARY AFFAIRS.

Blessed with an environment which affords scope for making a meeting of a technical society—especially an engineering one—a huge success, Mr. C. H. Priestley, the Corporation Water Engineer of Cardiff, was enabled, by the aid of willing co-operators, to cause the meeting of the British Association of Water-Works Engineers in Cardiff last week to be one of those events which live long in a man's memory. From the Mayor and Corporation to the youngest official in the Water Department, all did their part, in great or minor degree, to welcome, entertain, and assist the members of the Association who had honoured the respected chief of the department by electing him to be their President. And outside the municipal pale, the managers of noted docks, iron-works, collieries, and water-works opened their doors to the visitors with such freedom, that the latter found it difficult to give adequate expression to their gratitude and appreciation. The Council of the South Wales Institute of Engineers, too, placed at the disposal of the Association their commodious Lecture Theatre and various rooms for the meetings. The thoroughness also with which the new Secretary (Mr. Percy Griffith) had ploughed through the mass of routine work which is a necessary, and must be a harassing, concomitant of annual meetings of this character, deserves a word of praise; and during the meetings all the *minutiæ* attaching to his office received faithful attention—nothing was neglected, and success resulted.

Small in quantity, but of excellent quality was the technical matter dealt with within the Lecture Theatre of the Institute. The President's address is a practical exposition of a practical man's thoughts on a variety of topics which have claimed, and are claiming, attention in the profession. Unconsciously, we think, the President does scant justice to the inestimable work which the Water Companies have accomplished in bringing to the doors of the inhabitants of this country a plentiful supply of potable water. He acclaims the work of the municipalities and local authorities, and devotes a large part of his address to describing what they have done, and to citing big figures in proof. But all he has to say for the water companies is that "they have done good work in the past in "many places, and are still doing so in many others." Who, we may ask, were the pioneers in bringing about a satisfactory water supply system in this country; who were the people who risked much to replace polluted wells, in which lurked unseen and insidious dangers, by a pure water service—a service (even in the very early days) convenient and almost absolutely certain, as against a laborious, an uncertain, and a questionable means of supply? The answer is the water companies. They it was who, long before the corporations or local authorities moved a hand, brought about a new state of things, which led to the reformation of the sanitary conditions of our country. It is true beyond doubt that the municipalities of half-a-dozen towns can now show works which, for boldness of conception and execution, may outshine any individual water undertaking of a company; but we can, and so could a municipal water engineer if he so chose, point to noble undertakings which have been conceived and administered with equal wisdom by companies, and in some cases in the face of contemptible opposition by local authorities. Therefore we say that the work of the companies, both in the past and in the present, is worthy of the highest respect and recognition, and should not be lost sight of behind the majestic works and figures which Mr. Priestley presents in his address.

The views of the President on the Welsh water scheme of the London County Council—and they are of special interest coming from a Water Engineer in Wales—are wise, assuming that London requires, or is compelled, to resort to Wales for water. If London has to go to Wales, the President is of opinion that it will be to the advantage of the Principality rather than otherwise, providing that "due regard is given to the requirements of the districts "from which the water is drawn, and that they are liberally "and fairly dealt with." It may safely be left to Parliament to see that the localities yielding the water are fully protected, even though, in the President's judgment, "no "adequate provision was made" in the London County Council Bill "for the districts from which it was proposed "to draw the water." That is a matter which when the day comes, if it ever does come, the Welsh authorities will, we fancy, find little difficulty in rectifying. The President does not by any means stand alone on the question of the provision of a duplicate supply of water to towns where it is possible to readily and cheaply secure such a supply; but apparently he has overlooked the paper on the subject which Mr. W. G. Peirce read before the Association about twelve months ago. A good case was made out by the President for standard patterns in connection with the use and manufacture of cast-iron pipes; and a few remarks on Water Boards in general, and the Derwent Board in particular, concluded an address which was much applauded by those who heard it.

There were only two papers read, but they were of excellent quality, and were on subjects upon which the members could freely discourse. One, which touched a sore point of many water engineers, was by Mr. F. J. Bancroft, of Hull. It was upon "The Rating of Water-Works," and was a finished study of this very intricate question. The second paper was by Mr. A. J. Jenkins; and it dealt lucidly with "The Relationship between the Cost of Water "Wasted and the Cost of Detection." A lecture on "The "Strength of Bricks and Brickwork" was a valuable contribution to the knowledge on the subject. Some further comments on the papers may be made as we publish them in future issues. Meanwhile, we will not say more than this, that the meeting was one from which the members went with very happy recollections, and a more intimate knowledge than they possessed before of Cardiff and some of its famous surroundings.

Post Office Delays.—There were throughout the country last week many complaints in regard to the serious delays that had occurred in the delivery of letters, book-packets, &c., in consequence of the moving of the Post Office sorting staff from St. Martin's-le-Grand to Mount Pleasant. The greatest confusion was on Tuesday, and therefore many of our subscribers were without their "Journal" that day and Wednesday morning. It is to be hoped that by this time the trouble is at an end, and that there will be no delay in the delivery of this week's issue.

The Composition and Determination of Cerium Oxalate.—This was the title of a paper read before the last meeting of the London Section of the Society of Chemical Industry. The authors—Dr. F. B. Power and Mr. F. Shedden, B.Sc.—gave details of examinations of several samples of the salt of different origins. In addition to the employment of cerium salts in the manufacture of incandescent gas-mantles, of which they usually form about one per cent., they are also used in pharmacy. The cerium oxalate of the pharmacopœias must, according to the authors, be impure. They proved that the true formula of the salt is CeC_2O_4, $10H_2O$. Lanthanum oxalate and didymium oxalate have similar formulæ; each containing 10 molecules of water.

THE INCORPORATED GAS INSTITUTE.

PROCEEDINGS AT THE THIRTY-SEVENTH ANNUAL GENERAL MEETING,

HELD AT THE

ROYAL UNITED SERVICE INSTITUTION, WHITEHALL,

JUNE 12 AND 13, 1900.

Mr. E. HERBERT STEVENSON, M.Inst.C.E., President.

PAPERS READ.

AUTOMATIC STOKING AND INCLINED RETORTS.*

By WILLIAM R. CHESTER, M.Inst.C.E.

There have been many important advances made during the last twenty years in the direction of lessening the heavy and laborious work involved in hand-stoking; and perhaps in no department of gas-works' administration have the energies and perseverance of inventors met with greater success. Twenty-five years ago mechanical stoking was in the earliest stage of its infancy; the London stokers' strike of 1874 gave it a great stimulus; and shortly afterwards many schemes were devised for accomplishing by mechanical means what had always hitherto been done by the bone and muscle of the individual worker. In the edition of "King's Treatise on Coal Gas," published in 1878, will be found a description of no less than sixteen different types of stoking machinery—many of them admirably conceived, and the outcome of much thought and inventive skill; but out of the whole of them only two succeeded in planting themselves in other works than those in which they first made their experimental trials, and practically only two types are in existence to-day.

The writer was much interested in the subject at this period (1870-80), and personally examined most of the machines when they made their early trials, and himself spent many sleepless nights in the development of one of them, which, unfortunately, had but a short career, and resulted in nothing practical, except the loss of time and a good deal of money in a fruitless attempt to make it "gee when it wouldn't."

Inventors concentrated their attention on perfecting the mechanism for drawing and charging, and paid little heed to the transport of coal and coke to and from the machines. Consequently, there was little financial effect; and many engineers could never be brought to believe that mechanical contrivances could be devised to supersede hand stoking. The machines looked so cumbrous, and had to be made so powerful to accomplish the little a single man was able to do by his own muscular effort, that a comparison of the two always made the machine look ridiculous by contrast.

It was not until the necessity was recognized of bringing the coal to the charger (also by mechanical means), that machine stoking ever made any headway. The earliest success in this direction was achieved by Mr. West at the Maidstone Gas-Works, when he combined with his manual stoker a method of transporting the coal, also by mechanical means, from the store to the scoop used for charging the retort. This he did in 1874; and at the same time Mr. Foulis was at work on his hydraulic stoker at the Glasgow Gas-Works, using a different means of transport for the coal. Mr. Foulis took his scoops to the coal-store on a four-wheeled bogey, where they were loaded by hand, and afterwards brought back to the charging machine by pony traction. This was found to be a cumbrous and expensive process; and ten years later pony traction was abandoned in favour of mechanical transport. About the same time, or a little earlier, power was applied by Mr. West to his manual stoker.

The commercial success of both systems was dependent upon the transport of the coal; and in this respect they out-distanced all their competitors, one after another of which dropped out of existence, until to-day these two systems hold the field in honourable rivalry alone. They are now nearly as perfect as machinery can be made, and do the work of carbonizing in horizontal retorts smoothly, quickly, and cheaply. These machines have now outlived the age of ridicule, and they have undoubtedly come to stay. In every important gas-works throughout the country one or both systems may be seen in daily operation.

The successful development of the inclined retort has, however, opened up a much wider field for the employment of mechanical stoking, since they are applicable to the smaller works, and have an economical limit much lower than the power stoker. Half-a-million cubic feet a day is the utmost economical limit of the latter. At this output, the cost for labour will be quite equal to that of hand stoking; the additional charges for interest, wear and tear, and renewals having to be earned in the winter months.

In the case of inclined retorts, the limit of economical production is the employment of one full bed of retorts—say 100,000 cubic feet of gas per day at the time of the minimum output. This corresponds to a make of 60 to 80 million cubic feet a year, and brings within the range of mechanical stoking an enormous number of moderate-sized works, which, before the introduction of inclined retorts, were excluded from the advantages of mechanical stoking. The writer has both systems in operation—viz., the inclined retort and the power stoker with horizontal retorts, and both deal with the coal from the time it arrives in trucks on the works, through the various processes of carbonizing to the point where the coke is placed in trucks ready to leave again—the whole operation being performed by mechanical means.

Where the installation is of suitable magnitude, there is not much real difference in the cost of mechanical stoking between inclined and horizontal retorts; but the inclined system has the advantage that it can be successfully worked when the power stoker cannot enter the competition on account of the smallness of the works. The main object of this paper, however, is to describe an installation of inclined retorts recently erected, rather than to make a comparison between the working of horizontal and inclined retorts; and to explain the mechanical contrivances for dealing with the coal and coke, which make the installation the most complete of its kind in existence, and renders the process of carbonizing in gas-works as nearly automatic as possible.

The retort-house in which the installation has been erected is one designed and built by the late Mr. Thomas Hawksley, at the Eastcroft Gas-Works, about 45 years ago. It is 196 feet long by 50 feet wide inside, and formerly contained sixteen beds of regenerator settings, with 18 feet through retorts. The house was too narrow for even manual stoking machinery; but it is amply wide enough to permit the comfortable working of inclined retorts, and admirably adapted for such an installation.

The roof of the retort-house was taken down in the early part of 1899, and the walls raised to a total height of 46 feet from the ground line—being an increase of 21 feet in height. The arches of the settings were removed, and the division walls carried up to the required height, and again covered in by an arch built on the incline to suit the rake of the retorts. The producer and the regenerator flues were rearranged; the new setting being heated by one producer. The division walls being only 8 ft. 6 in. wide, it was not possible to get more than seven retorts in a bed; and these were set at an angle of 32° with the horizon. The retorts are 21 ft. 10 in. long measured on the incline, and taper from 20 inches wide at top to 22 inches at bottom, by 16 inches deep. The charge of coal is 8 cwt. for the through retort, or 180 tons for the whole house when on 6-hour charges.

The coal enters the works in trucks by a siding communicating with the Great Northern Railway. It is then dropped into a hopper fixed below the level of the rails, and passes through a breaker made strong enough to negotiate the hardest of the Nottinghamshire hard cannels. From the breaker it is elevated to a point in the middle of the retort-house, 53 feet above the ground line, and delivered into a push-plate conveyor for feeding the coal hoppers, either to the right or left of the elevator head. The breaker and elevator have a capacity equal to 25 tons per hour; so that the whole of the coal required for carbonizing in the retort-house during the depth of winter will be raised in the hours of daylight.

The push-plate conveyors are worked by gearing from the elevator head, and are fixed along the centre of the coal hoppers at the top, having a hinged door fitted to the bottom of the conveyor trough for admitting the coal into the centre of each coal-hopper. The doors can be opened or closed from the charging floor.

* Three separate sheets of illustrations accompany this paper.

In front of each bed of retorts is a coal-hopper, having a capacity equal to about 36 hours' supply. This is ample for the purpose, and will allow a clear day to carry out any repairs to the coal-breaker, elevator, or conveyor that may from time to time be necessary. Duplicates of all wearing parts are kept in stock, and only a very short time is required to replace a defective one. The coal-hoppers are fitted with sliding doors at the bottom, which can be opened and closed from the charging floor.

Underneath the coal-hoppers there is a single line of rails, 3 ft. 8 in. gauge, running from end to end of the retort-house, and upon which the travelling charger moves to and fro. There are two of these chargers, one for each half of the house; and each charger consists of a nest of three hoppers, each one of which is at a different level, to suit the three tiers of retorts. The respective hoppers have a capacity equal to a charge of 8 cwt. of coal, which they receive from the storage hoppers above, and deliver into the retort by the simple process of pulling a chain. This removes the catch by which a hinged door is kept closed; and upon the release of this, the coal at once slides down the retort and takes up its required position.

From the time the coal leaves the trucks until it is safely deposited in the retorts, it is not once touched by hand. This, however, is no new feature in connection with inclined retorts, as it is common to most new installations. There may be slight variations in the mechanism by which this result is accomplished, but the broad principle is the same in all, and the writer claims no particular merit for this portion of the apparatus. The principal novelty in connection with the installation lies in the method of dealing with the coke, and in thus carrying the process of carbonizing by mechanical means to its ultimate limit. Mechanical carbonizing usually stops at the point where the coal has been successfully dealt with, and when the coke is delivered into barrows or trucks to be afterwards stocked loaded or screened by hand. The writer has applied himself to this question of the manipulation of the coke, and has devised machinery for treating it from the point where it leaves the retort until it is stored or loaded into waggons or carts, sorted and sized, and made ready to leave the works in marketable condition.

In front of the retorts at the discharging end there are two push-plate conveyors, each moving towards the centre of the house, with the return chain carried overhead. The push-plates work in a cast-iron trough 27 inches wide; and upon the edges of this trough, which form the rails, a portable hopper and shoot has been devised to traverse the whole length of the retorts on wheels. This portable hopper and shoot is moved in front of the particular retort about to be drawn, and placed so that when the lid is opened the tar will fall on an inclined plate attached to one side and run down it into a bucket provided for its reception. By this arrangement, the tar is all collected, and afterwards disposed of as a commercial product; the lower retort mouthpieces being kept perfectly clean and free from this very troublesome and disagreeable nuisance. The hopper-shoot is then moved up a couple of feet, till the coke shoot is under the mouthpiece. Then the stopper is withdrawn, and the whole charge of coke is received into the hopper. It is partially quenched here, and then lowered on to the conveyor by the opening of a pair of hinged doors fixed to the bottom of the portable hopper. These doors are hinged in the centre, and open from the outer edges—thus protecting the links of the chain from receiving any coke falling into the conveyor. The coke is afterwards completely quenched by means of a hose-pipe as it passes forward to the foot of the elevator.

Another feature of this portable hopper-shoot is that instead of delivering the coke on to the conveyor, it will transmit it, while red hot, to the furnace. The coke intended for the furnace may be received from any particular retort, and afterwards be fed into any particular furnace where it may be most required. It is necessary with inclined retorts and a coke-conveyor to have some hopper arrangement of this kind, as the coke is otherwise discharged so rapidly from the retorts, especially from the upper ones, that it falls into a heap, blocks the conveyor, and cannot then be properly quenched. The conveyors run at a speed of 140 feet per minute, which is quite fast enough for the purpose. From both ends of the house, they deliver into an elevator fixed in the centre. This carries the coke up to the top of some overhead storage hoppers, and delivers it into a push-plate conveyor similar to those fixed in front of the retorts. This conveyor traverses the whole series of hoppers; and by means of sliding doors in the bottom of the trough, the coke can be dropped into any particular hopper in which there is room to receive it.

The coke-storage hoppers have a total capacity of 280 tons, or sufficient for two whole days' production of the two retort-houses. They are erected on columns and girders above the line of railway, at a sufficient height to permit the trucks to pass underneath. The hoppers are divided into fourteen compartments, and may therefore be used for different qualities of coke. To each compartment there are two sliding doors, which open on to a screen over which the coke passes immediately before it enters the truck. The screens are made with bars having spaces between ranging from 2 inches to ¼ inch wide. At first sight it would appear that this must result in considerable loss; but underneath each screen is a hopper for collecting the small coke and breeze which passes through. These hoppers are provided with a sliding door at the bottom; and by opening this, the small coke passes into a funnel and on to a band conveyor fixed under the centre of each breeze hopper. The band conveyor takes it forward to a push-plate conveyor, and this carries it back to the foot of the coke elevator, by which it again ascends to the top of the coke-hoppers and is delivered into a revolving screen. This separates the fine dust, and divides the remainder into smith's breeze, coarse smith's breeze, and domestic and ordinary coke. These various grades are also loaded into trucks over suitable screens; and in this manner the whole of the coke is put into trucks, in the very best marketable condition, without once being touched by hand throughout the whole process.

There is no apparatus specially provided for breaking the coke; a sufficient quantity of the smaller sizes is provided from the loading screens. If at any time more is wanted, the coke is loaded over the wider screens, and if less, it is loaded over the smaller ones. The screens are all interchangeable; and one size can be substituted for another in a few minutes. As the smaller sizes of coke command the highest prices, no drawback arises from the coke being knocked about in transit from point to point rather more than is the case when simply tipped from barrows in the yard.

Provision has been made for converting the second house to inclined retorts at an early date; the coke hoppers and the elevator being put down of sufficient size to deal with the products of the two houses.

The whole of the coal machinery (including breaker, elevator, and conveyors) is driven by a 30-horse power steam-engine; and the whole of the coke machinery (including elevator, conveyors, and revolving screen) is driven by a 12-horse power nominal gas-engine, working up to about 24-brake horse power.

The total cost of the installation is about £25,000. But deducting £5000 as representing the portion spent in making provision for the second retort-house, it leaves a net expenditure of £20,000 for the conversion of sixteen beds of horizontal regenerator settings into a like number of beds of inclined retorts, with all the necessary coal and coke machinery for automatic working. This gives a capital expenditure of £111 per ton of coal carbonized per day, or about 9s. per ton of coal carbonized per annum, assuming an average of 250 full working days. The total saving will be fully 2s. per ton of coal carbonized, or sufficient to recoup the whole outlay in about 4½ years of 250 working days. The aim of the design has been to make the whole process of carbonizing as nearly automatic as possible, and to reduce the laborious work of hand-stoking to a minimum.

The writer is well aware that in several works throughout the country something has been done in the direction of applying machinery to the manipulation and loading of coke; and some six years ago he put down a plant at the Basford Gas-Works for accomplishing this in a partial degree. The present installation is, however, unique in this respect: It is the first installation in existence where the process of carbonizing is mechanically carried through, from the reception of the coal on the works to the departure of the coke from the works in marketable condition—screened, sorted, and sized to suit the requirements of all classes of consumers.

Diagrams have been prepared to illustrate this paper, and these will no doubt make quite plain any point which cannot be followed from the writer's description of the working of the scheme. In some cases, it has been necessary to prepare models of parts of the scheme, where drawings were too complicated to show all the points which had to be con-

sidered in working out the details. These will no doubt be examined with interest by the members.

Samples of the various kinds of coke produced are on the table and may be inspected by the members.

Bottle No. 1.—Contains the fine dust, all of which has passed through a circular hole ¼ inch diameter, and for which there is a limited sale for concreting purposes; the residue being used for steam raising.

Bottle No. 2.—Contains fine smith's breeze, which passes through a circular hole 1 inch in diameter, but will not pass one of ¼ inch diameter, used for small forgings and general smith's use.

Bottle No. 3.—Contains coarse smith's breeze, which will pass through a circular hole 1½ inches diameter, but will not pass one of 1 inch diameter. It is used for heavier forgings and also for slow-combustion stoves.

Bottle No. 4.—Contains domestic coke, which has passed through a circular hole 2 inches in diameter, but will not pass through one of 1½ inches diameter. It commands a ready sale for house purposes.

In addition to these, there is the malting quality of coke, loaded over a screen with bars 2 inches apart, and ordinary coke, loaded over a screen with bars 1½ inches apart.

Discussion.

The President said the paper was extremely interesting, especially to those who had to do with large works. The more one could eliminate hand labour, the better; and Mr. Chester seemed to have carried this out as far as was possible at present. Perhaps at some future time there might be a different method of carbonizing gas. Nearly twenty years ago, his father suggested that there might be some other way of carbonizing adopted. But casting one's memory back for twenty years, he thought that the carbonizing of to-day was very little different, except with regard to the use of mechanical means; and in this direction Mr. Chester seemed to have gone about as far as could be done.

Mr. S. Y. Shoubridge (Sydenham) said they were all obliged to Mr. Chester for his interesting paper; and those who, like himself, had had to do with the development of stoking machinery, would sympathize with him in the troubles he had referred to. With regard to stoking machines, the writer said that to-day two systems stood alone in honourable rivalry. He presumed he meant in England, because in America and on the Continent there were machines which were equal, if not superior, to those in use in this country. He was told recently by an American engineer that, in a large number of gas-works in that country, there was a stoking machine which charged three retorts at once; and they all knew that the Ross rake, which was brought over here from America many years ago, was equal to any other rake in the market. The author said that half-a-million cubic feet a day was the utmost economical limit for stoking machinery. If the author meant by this that power stoking machinery could be used economically on a works having a maximum output of half-a-million a day, he was afraid he must disagree with him; for he did not think it possible to introduce power machinery on a works of so small a size. He probably meant that in a works where stoking machinery was applied in a large retort-house, it did not pay to use the machines when less than six beds were in operation; but if this were so, he must also disagree with him, because his experience led him to say that not less than twelve beds could be economically worked by power machines. They were all glad to find Mr. Chester a convert to the inclined retort system; and he congratulated him on the success he had achieved. He was quite right in emphasizing the great advantages of inclined retorts, and showing that the system was applicable to works of all sizes—the very largest, as well as the smallest—while stoking machinery was not applicable to works of small size. It was gratifying to him personally to see that the writer had adopted the form of charger and the taper retorts which he had introduced at Salford; and he should be glad to hear how he found the taper retorts answered in the matter of discharging. The writer said there was not much difference in the cost of working between inclined and horizontal retorts worked by machinery; and he had both systems at his works operating under similar conditions. But it would add greatly to the value of the paper if he would tell them what the cost of each was. The author said the installation he had described was the most complete of its kind in existence, and was unique in the fact that the whole process of carbonizing was mechanically carried through, from the reception of the coal on the works to the departure of the coke in marketable condition. But this was hardly correct. It was within his own knowledge that at Birmingham some ten years ago, at both the Saltley and the Windsor Street Works, this was done; and it had been done for some time also at the works of which he had charge at Sydenham. There were also a good many places in Germany, Denmark, Austria, and Belgium, and possibly elsewhere, where the same thing was done. The principal novelty in the Nottingham arrangement was the moveable hopper placed so that the tar fell on an inclined plane, and ran down into a bucket. This reminded him of some of the earlier installations of inclined retorts, where the tar was a prominent feature; but in the more modern ones, no tar was produced which could be collected at the mouthpiece. He imagined that something must be amiss with the heating or charging of the retorts, if tar was produced in any quantity. He could quite understand that the ingenious hopper-shoot was a necessity with this form of conveyor, because without it the coke would block the conveyor, and would not be properly quenched. The author, however, went on to say that it was necessary with all inclined retort conveyors to have some hopper arrangement of this kind; but this was hardly so. In the works under his control, they had a conveyor into which the coke was discharged direct from the retorts, with great rapidity, without blocking it in the least; and as the coke passed through water at one end of the conveyor, there was no necessity to catch it and cool it on its way from the retort to the conveyor. The writer said the conveyor ran at a speed of 140 feet per minute, which was fast enough for the purpose; but he thought there must be some clerical error there. He would also ask whether it would not have been simpler and cheaper to have delivered the coke into a revolving screen at the top of the hopper, and screen it all there first, instead of having to elevate a large portion of it a second time. He thought it must tend to the detriment of the coke and increased cost. The samples of coke submitted were interesting; but he should be glad to know what proportion of each kind was produced from each ton of coke delivered to the conveyor.

Mr. T. Duxbury (Middleton) remarked that he had had some little experience in the working of inclined retorts. The author stated that half-a-million cubic feet a day was the utmost economical limit for mechanical stoking. He said that "at this output, the cost for labour will be quite equal to that of hand stoking; the additional charges for interest, wear and tear, and renewals having to be earned in the winter months." Now at Middleton they had an annual make of 120 million cubic feet, six ovens, and eight retorts in each oven, 20 feet long; and they carbonized 7 cwt. per retort, with six-hour charges. He found when they had three ovens of these retorts working, it cost 1s. 2d. per ton of coal carbonized for stokers' wages, taking out the coke, elevating the coal, and all charges appertaining to the stoking generally. With six beds, it cost exactly 1s. 2d. still; so that with nine beds it would cost the same, and with twelve working the same. It seemed to him that inclined retorts would be quite as economical on a large works as on a small, because when one had the whole six ovens in operation they were then working at the minimum cost for wages. If there were twelve ovens working, one had to double the men and have two gangs. They ought to be able to work with six, twelve, or eighteen ovens in operation at the minimum cost for wages. He agreed with Mr. Shoubridge that, when the heats were right, they had practically no tar on the lower mouthpiece. If the charge were improperly laid, or the heats were lower than usual, then there was rather a larger quantity of tar; but with ordinary working, there was very little indeed.

Mr. W. A. Padfield (Exeter) asked whether it was necessary to use a variety of coal, or whether they were confined to one sort, as he understood the inclined retort system was not so satisfactory in working off Durham coals. He agreed with the President that they were still following a rather crude method of manufacture. He was now engaged upon experiments which would, if successful, form the basis of a patent; and therefore he could not go into it. But there had been absolutely very little improvement made during the last thirty years.

Mr. T. O. Paterson (Birkenhead) asked how much Mr. Chester provided for wear and tear, because the working parts of the machinery were very considerable; and as a great deal of it was for carrying hot material, he thought the wear and tear would prove excessive. He also believed they might carry the use of machinery too far, as men must be provided to attend to it, and it might be that these men would cost more in labour than if the machinery were swept away. The application of machinery to deal with a portion of the coke twice over seemed excessive. With regard to the storage of coke, Mr. Chester said he had two days' storage; but this was of little use. What was wanted was something like two months' storage, as when prices were low it was not always wise to sell. If sales were forced, then the price would go down.

Mr. W. Whatmough (Heywood) said he observed that Mr. Chester put the saving at 2s. per ton of coal carbonized. Would he kindly say what was the cost previously for hand labour?

Mr. C. A. Craven (Dewsbury) did not agree with the writer of the paper that half-a-million cubic feet was the utmost economical limit; he had not found that to be so. He had found that there was considerable saving as compared with hand stoking in any quantity at or above the minimum. The saving was not quite so great at the extreme minimum or summer make; but, even then, it was an appreciable saving over hand stoking. As compared with the old labour, including the man who looked after the engine, his experience was that there was a very considerable saving indeed where they had in use a fair number of retorts. They had frequently carbonized at from 1s. 2d. to 1s. 2½d. per ton. But in summer the men could not be so profitably employed; and then the labour cost went up to 1s. 6d. or 1s. 7d. They found, however, that the average thoughout the year was about 1s. 4d.

Mr. Chester asked if Mr. Craven was referring to inclined retorts.

Mr. Craven said that at Dewsbury they had now worked with inclined retorts for nearly three years, with very satisfactory results; and if they were going to increase, as they would have to do sooner or later, they would continue the same system, as their experience had certainly been favourable to working with inclined retorts.

Mr. Chester, in replying, said that, owing to the discussion having been interrupted on the previous day, it had fallen rather short of what it might otherwise have been on a subject of such general importance. Most of the gentlemen who had spoken had somehow or other transposed the paragraphs of his paper, and had applied those which referred to stoking to the inclined retorts; and they had also confounded the minimum with the maximum make. What he said was that the economical limit—which meant the minimum limit—was, in the case of inclined retorts, 100,000 cubic feet per day, or equal to one bed of retorts; and the economical limit of power stoking was 500,000 cubic feet per day, or five times greater. Mr. Shoubridge, who opened the discussion, was a pioneer in connection with inclined retorts, as he believed he was the first to develop them into a real practical success. Up to the time of Mr. Shoubridge's installation at Salford (though he unfortunately got into trouble later on), there was no question that the inclined retorts which he then put up were of the most practical character which had been erected, and produced the very best results. Mr. Shoubridge was also to be credited with the invention of an apparatus for charging retorts which had been adopted in the case of Nottingham, and which Mr. Shoubridge had the modesty not to secure by patent. It was an invention which was well worthy of a patent; and he thought they owed a deep debt of gratitude to Mr. Shoubridge for having brought this piece of machinery to such a high state of perfection, while reaping no benefit from his labours and thought in working it out. Mr. Shoubridge asked why the whole quantity of the coke was not passed through the revolving screen, instead of being passed into the conveyor, and so save the trouble of dealing with the dust afterwards. The reason of this was that the revolving screen extended only to a portion, not to the whole, of the hoppers. The extent it covered was about two-and-a-half hoppers out of the seven; so that it would be impossible to use it for filling the remainder. The conveyor on the top running the whole length of the hoppers enabled the coke to be dropped into any particular one as might be required. Some question had been raised as to doing the work twice over, by passing the dust derived from loading the coke back again up the elevator and through the revolving screen. The object of doing so was this: All those who had had coke-hoppers for loading coke, either directly into trucks or into carts, would have met with the experience that the rough coke ran out while the fine breeze accumulated in heaps inside the hoppers. After a time, there was a rush of this small coke; and it would tumble into the trucks and spoil the whole marketable quality of the load. He had found this in connection with coke-hoppers, and had endeavoured to eliminate the difficulty in the present installation by providing that every particle which entered the truck must pass over a screen to remove the small *débris* and dust which would accumulate in the hopper. There was no loss thereby, further than the loss of the gas which was used in elevating it back to the top of the hoppers. Then all this small material went back and passed through the screen, and was put into the condition of a marketable material. He was not able to give the exact proportions of the different sized cokes that were obtained through the apparatus, because they naturally differed with the size of the screen over which the ordinary coke was loaded. If they used wider bars, they would get a larger proportion of sized coke; and if they loaded over narrower bars, they would get a less quantity. Mr. Duxbury seemed to have been dealing with a fallacy respecting the question of the economic limit. He said he found that by putting on more retorts he did not lower the average cost of making gas; but this, he thought, was contrary to all experience. Mr. Duxbury said that, with three beds of retorts, he had reached a certain economic limit. If he doubled the number, he did not get any decrease of cost; if he put on three more, he did not get any decrease; and if he put on three more still, he did not get any decrease—it was all multiples of three. But everyone knew that, in the unloading of coal, they got a very considerable decrease of cost if they increased the quantity; and the same thing applied to firemen's wages, to the engine man who was in charge of the gas-engine, to the whistle-blower or foreman, and to many other odd men. The wages of these men were the same whether they were working at the minimum or the maximum; and therefore, as they increased their output, they must naturally decrease the cost, and *vice versâ*. Mr. Padfield asked if they had any difficulty with regard to the creeping of the coal, or whether different kinds of coal made any difference in the successful working of the retorts. At Nottingham, they used something like thirty or forty different sorts of coal; and they were prepared to deal with any kind that was likely to come to them. He had heard of difficulties with regard to creeping, and so on, but had never met with them in any personal experience of his own. The amount of wear and tear which Mr. Paterson had referred to had not yet been ascertained, as the apparatus had only recently been put into operation; but he had no doubt in his own mind that it would not be a very excessive figure, because in the power stoking he found that the whole cost of the wear and tear in the coal portion and in the coke portion of the apparatus did not exceed 2d. per ton of coal carbonized. In this plant, he was perfectly sure it would be less than it was in the power stoking. They had in the coke hoppers practically two days' supply; and that was as much as was necessary in connection with this particular works. Of course, it was not all the coke storage room that one wanted. But they happened to have three gas-works at Nottingham; and this gave them the alternative of selling from one particular works, and putting into stock at another. In this way, they could work the matter to the highest economical advantage. If they wanted to store coke, they stored it at another works; and they could go on selling the whole of the production at this particular works, by reason of the economy of working. Mr. Whatmough had spoken of the cost of hand stoking as compared with this apparatus; and he did not seem to see where the 2s. was to come in. At Nottingham, hand stoking was rather an expensive process; and from the point where the coal went into the works to the point where the coke left it, it was quite 3s. per ton of coal carbonized. With this apparatus, they would be able to deal with it for 1s.; the difference being the amount referred to. He was glad to hear from Mr. Craven that he had found his installation of inclined retorts a great success. He did not understand that Mr. Craven dealt with the whole process from point to point; but he was able to do his carbonizing on an average at 1s. 4d. per ton. Mr. Craven, like Mr. Duxbury, had

somewhat mixed up the economical limits of the two processes; but the explanation was that the minimum of 100,000 cubic feet applied to the apparatus before the meeting, and the minimum of 500,000 cubic feet to the other apparatus.

RETORT-HOUSE ROOFS.*

By A. T. Walmisley, of London.

The chief roofs connected with gas-works are constructed over retort-houses and over purifying-houses. The former are generally erected entirely on walls, and slated; the latter are very often open both at sides and ends. Ample ventilation above the eaves is of primary importance in a retort-house roof; but generally speaking no glass is introduced in the covering, and very little sunlight admitted, except in some cases through the ventilator. The house may be adapted for either a single or a double stack of retorts, and may be of the ground-floor or stage-floor type of erection, according to the system of working adopted; the latter needing higher walls or a greater amount of clear headway than the former.

Suitable openings are usually provided in the walls for the admission of light and air, above the level of the retort-benches; and the ridge ventilator is generally made to extend from end to end of the building. Ventilating tubes or towers are sometimes added; and, in short, every effort is made in a well-considered design to provide roof ventilation free from wind currents at the sides of the building. In the author's paper read before the Institute in 1891, dealing with the effect of wind pressure on retort-house roofs and gasholders, he pointed out the fact that retort-houses were, as a rule, placed in sheltered positions, and that the strains produced in a truss fixed upon the side exposed to the wind were greater than the strains produced in a truss that was fixed on the lee-side only.

The site for a ground-floor type of house should present an exceptionally good foundation, in order that the foundation of the retort-stack may be laid at a depth of about 9 ft. 6 in. below the floor-line, and have an underground passage at least 7 feet wide in front of the stack. The clear space in front of a retort-stack should not be less than 18 feet. When mechanical means are adopted for charging and drawing retorts, 22 feet may be allowed.

The "Minutes of Proceedings" of the Institution of Civil Engineers (1898-99, Pt. IV.), Vol.CXXXVIII., contain an interesting article on "Labour-Saving Appliances in Gas-Works," by Mr. C. C. Carpenter, M.Inst.C.E., to which the author need not further here allude, beyond stating that mechanical stoking has created a necessity for wider spans, owing to the position of the charging machine, which prevents the handle of the scoop from getting within about 7 feet from the mouthpiece. Members will be familiar with the system of drawing and charging machines, made by Sir William Arrol and Co., in use at the Vauxhall works of the South Metropolitan Gas Company.

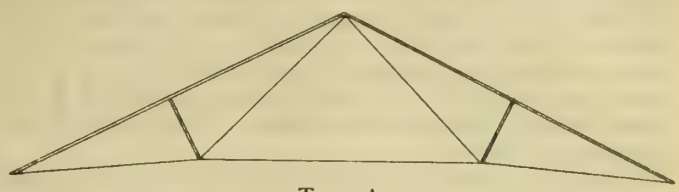
The inclined retorts at Kensal Green have an intermediate hopper fixed high enough to discharge into the charging hopper. This causes the height of the building to be greater than in the case of hand stoking. With sloping retorts, the span, as compared with horizontal retorts, is not reduced, since with the double arrangement usually introduced, a distance is left in the middle, sufficient to allow of the machinery for charging; and instead of a house containing one bench of 20-feet retorts, as with horizontal fixture, there are two benches of 20-feet retorts, the position of which also increases the height of the building. The floor in front of the stack is usually made to slope slightly towards the stack, and is paved with fire-bricks or other hard material. Preference is usually given to the stage-floor type in cases where the site naturally favours this construction.

The chief characteristic in a roof is its "principal," which may be of triangular, quadrilateral, segmental, or a combined outline. As a rule, retort-house roofs usually have a straight inclined surface, suitable for slate covering, and capable of discharging rain and snow in an efficient manner. It may be interesting to note, in passing, that 1 lb. of snow at freezing point requires 150 units of heat to melt it and to raise the temperature of the water obtained to 40° Fahr., and that this effect can be produced in 3½ lbs. of snow (which is the usual weight allowed per square foot) by the consumption of 1 cubic foot of coal gas. The approximate weight of the kinds of slating used are as follows:—

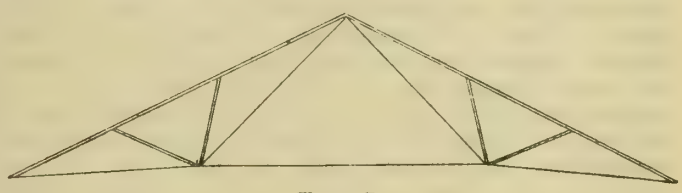
Ladies, 16 in. by 8 in.	5	cwt. per square.
Countesses, 20 in. by 10 in.	5¾	,, ,,
Duchesses, 24 in. by 12 in.	6	,, ,,
Queens, irregular sizes, about 30 in. by 20 in.	8	,, ,,
Imperials, 30 in. by 24 in.	10	,, ,,

They can be fixed directly on angle-iron laths or Z iron bars, without the introduction of woodwork, by means of lead pegs or copper or zinc clips. The angle usually given to the rafters averages 1 in 1½, having a rise of one-third of the span; and this inclination gives an angle of 33° to 34° with the horizontal.

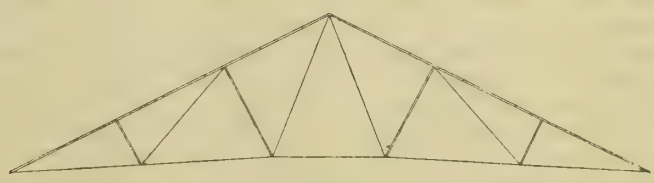
The following Types A to H present the forms usually adopted; and from them it will be seen that the variation and the applicability of each form of principal are mainly



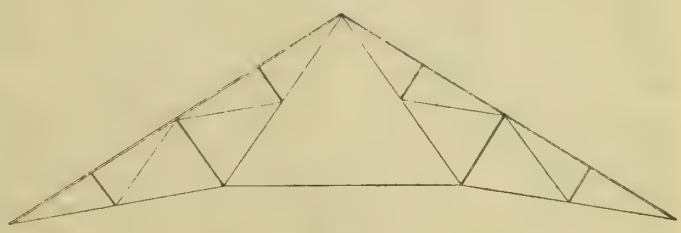
Type A.



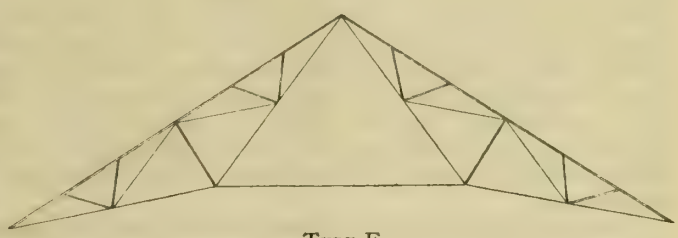
Type B.



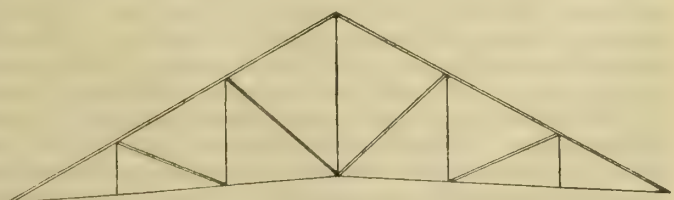
Type C.



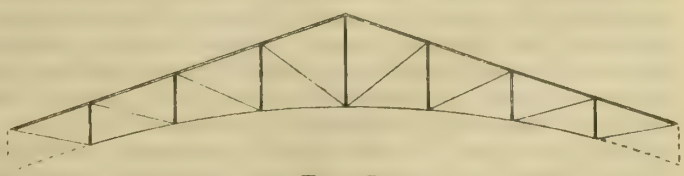
Type D.



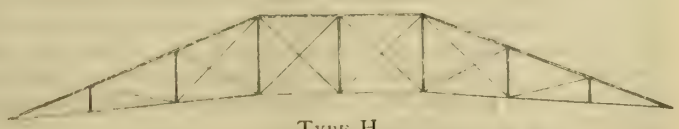
Type E.



Type F.



Type G.



Type H.

* Three separate sheets of illustrations accompany this paper.

ndicated by the number of sub-spans, and divide themselves into two classes—(1) those in which a brace radiates from one or more central points in the truss to each otherwise unsupported point, as in the case of each side rafter to Types A and B; (2) design in which the braces in a truss divide the same into a chain of triangles in a zig-zag fashion, as in Types C and G, but in each type designed to transmit the strains produced at intermediate points to the end supports.

The South Metropolitan Gas Company have a coal-store at East Greenwich of 30 ft. 4½ in. span, formed of a truss with braces radiating from a point in the centre line. The distance apart of the principals is 7 ft. 7½ in.; and the rafters are formed of T-iron 3 in. by 3 in. by ½ in., with T-iron struts 2½ in. by 2½ in. by ⅜ in. Inclined tie flat-bar 2½ in. by ½ in., with central king-rod 2 in. by ½ in. At the connection of struts and ties to the rafters, ½-inch plates are provided. Over some of the bays ventilation is furnished by a raised ridge; but over other bays, the whole covering is raised by means of T-iron standards and cast-iron louvre plates. The roof is 427 feet long, and is slated.

Type A is equally serviceable for large or small spans, and supports the rafter in a central position. Type B is of the same kind, but supports the rafter in two intermediate points. Type C also supports the rafter in two intermediate points, and resembles Types A and B in having the struts perpendicular to the rafter, and in having no vertical members. But otherwise it approaches the type of roof in which verticals are introduced in its general zig-zag arrangement of parts and details of connection. Type D is similar to Type A, but with longer rafters doubly trussed. Type E is the same as Type D, except that the rafter is here divided into six parts, instead of four. The use of either of these types depends upon the distance apart adopted for the purlins and support of the ridge ventilator. The struts are short, and the main part of the bracing is in tension. So far the system is all that can be desired; but in the case of roofs hipped at the ends, or roofs in which vertical longitudinal bracing between the principals is required, the type of roof shown in Type F adapts itself more economically, especially where the span of the roof is made to be a multiple of the distance apart of the principals or of the longitudinal width of the hipped bay. This type is largely employed for covering retort-houses.

Type G may be said to possess the advantage of a curved shape of tie, coupled with a favourable angle at its springing, in regard to the direction of a vertical re-action at the point of support. The lower portions, shown dotted, do not actually form part of the truss, but are added to contribute a vertical braced connection to the walls or columns supporting the roof. Type H, compared with Type F, provides a more perfect stiffening of the rafter at its foot, caused by the shorter intervals between the supported points, and presents a suitable framework when, as in retort-house roofs, the covering must be interrupted to allow ventilation. By the adoption of Type G or H, an angle of considerable magnitude at the springing is combined with the advantage of a moderate depth in the centre of the truss.

The dead-weight of a structure increases with its span. A weight of 8 cwt. per square is regarded as ample to allow for a roof of 60 feet span, or 10 cwt. for a span of 100 feet, if intended to carry slates on boarding. In roofs of 100 feet or less span, there is no economy in making the parts of steel. As stated by the author at the Institution of Civil Engineers in a discussion upon a paper on "Steel for Structures" ("Minutes of Proceedings," Vol. LXIX.), in 1882, "Sections of iron and steel adapted for roof purposes were comparatively so small that an error in the position of the holes became serious; and he thought that, in the adaptation of steel for roofs, it would be decidedly preferable to drill the holes." Steel, however, is now so generally employed that, provided the sections are not cut too fine and an ample margin of safety allowed, its success is established by employing satisfactory tests.

Figs. 52 to 57. The roof over the passenger station at Sittingbourne is an example of Type C, and a good form of a roof with open sides and ends. The principals are 12 ft. 6 in. apart, and 70 feet span, having a rise or depth at centre of 14 ft. 9 in., with rise of tie-rod 3 ft. 6 in. The slope of the rafter is 22°, and the area covered 200 feet in length. The cast-iron purlins are fixed so as to act as ventilators, and are 10½ inches deep.

Figs. 22 to 30. The roof at the Bow Common station, designed by Mr. G. C. Trewby, M.Inst.C.E., Engineer of the Gaslight and Coke Company, consists of seven main principals and six intermediate rafters, covering an area of 129 ft. by 57 ft. 6 in., enclosed by brick walls with openings for doors and windows. The main rafter consists of a T-iron 5 in. by 5 in. by ½ in., with a rise of about one-fourth of the span. The ventilator extends the whole length of the roof; and the distance apart of the main rafters is 18 ft. 8 in. The purlins here employed are of the arched lattice form, span 18 ft. 6 in., depth at centre 18 ft., depth at ends 3 ft., having flanges of L-iron 3 in. by 3 in. by ⅜ in., bracing-bars 2 in. by $\frac{5}{16}$ in. by ⅜ in., connecting the plates. The roof is slated over L-iron intermediate purlins 3 in. by 2 in. by $\frac{5}{16}$ in. placed 10½ inches apart, and has a slope of 25°.

Figs. 69 to 72. Another example of Type C is given in the roof over the Newcastle and Gateshead Gas Company's retort-house, having a clear span of 97 ft. 8 in. The total height of the trussed rafter above the springing line is 28 feet, and the rise of the centre horizontal portion of the tie beam is 6 ft. 3 in. The trussed rafter is composed of lattice work, formed by bracing-bars 5 in. by ½ in. between the top and bottom flanges of two angle irons 5 in. by 5 in. by ½ in., depth 3 feet, with web-plate at the springing of the truss, and at the connection of the purlins. This braced member is curved vertically round at the supports to form a level bearing upon a cast-steel base-plate. The lower tie beam is of two L-irons 5 in. by 4 in. by ½ in. with web-plate 12 in. by ½ in.; and the bracing-bars to the truss are each of two C-irons 6 in. by 2 in. by ½ in., with distance washers and bolts 2 feet apart. Slating laths 2 in. by 1½ in. by ¼ in. L-irons 10½ inches apart support the covering. The roof was erected by Messrs. Ashmore, Benson, Pease, and Co., of Stockton-on-Tees.

Figs. 63 to 66. Type D is illustrated by the roof over the retort-house at Folkestone, designed by Messrs. Thos. Hawksley and Son. The principal consists of T-steel rafter 6 in. by 6 in. by ½ in., with struts of T-steel 3 in. by 3 in. by ½ in., and rolled steel joist 4 in. by 3 in. by ⅜ in. The tie-rods are 2¼ in., 1⅝ in., 1½ in., and ⅞ in. diameter. The span is 60 ft. 9 in., with a rise of 13 feet from the springing line to the central bolt in the rafter; and the rise of the tie-rod in the centre is 2 ft. 6 in. The roof is slated over L-steel purlins 1½ in. by 1½ in. by ¼ in., placed 10½ inches apart. In this design, it will be observed that coupling nuts are used with a cotter joint at the springing.

Figs. 40 to 51. Another example of Type D is furnished by the roof over the retort-house at Grimesthorpe station, designed by Mr. Fletcher W. Stevenson. It consists of 44 principals of 70 feet span, having a slate covering at an angle of 30°. The depth of truss is 18 feet, and the rise of the tie-bar 4 feet; making a total rise above the springing line of 22 feet. The height of the springing line is 32 feet above the stage floor, which is 12 feet above the ground level. The roof is carried by brick walls on either side; and the rafters are composed of 5 in. by 5 in. by ⅝ in. T-steel, with struts of I section 4 in. by 3 in. by 14 lbs. and 5 in. by 5 in. by 24 lbs. The inclined tie-bars are 4 in. by ⅝ in., and the lower tie-bar 6 in. by ⅝ in. The ventilator consists of two cast-iron girders or purlins 2 feet deep of ¾-inch metal, connected to each principal by means of separate cast-iron gussets or brackets of the same thickness. The width of the ventilator in the clear is 7 feet. The main purlins are of 5 in. by 5 in. by ½ in. L-steel. Longitudinal tie-rods 1½ in. and 1¼ in. diameter connect the feet of the longest struts in each rafter; thus giving great rigidity to the whole roof.

The roof over the retort-house at the Luton Gas-Works, designed by Mr. W. R. Phillips, and erected by Messrs. S. Cutler and Sons, consists of seven wrought-iron principals to Type D, of 80 feet span, formed of rafters two L-irons 6 in. by 3 in. by ½ in., main struts two T-irons 5 in. by 2½ in. by ½ in., intermediate struts two T-irons 4 in. by 2 in. by ½ in. Inclined tension flat bars 6 in. by 1 in., 6 in. by ⅝ in., 6 in. by ¾ in., and 4½ in. by ¾ in. with king-rod 1 inch diameter. The purlins are 1¾ in. by 1¾ in. by $\frac{5}{16}$ inch L-iron, 8½ inch centres, and the longitudinal tie-rods between principals are 1 inch diameter. The ventilator, 10 ft. wide by 3 ft. 6 in. high, is carried upon six principals, consisting of one centre and two side cast-iron standards, with rafters 3 in. by 3 in. by ½ in. T-iron.

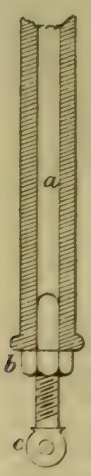
A roof of the form shown in Type E covers the retort-house at the Crystal Palace District Gas Company's works, designed by Mr. Charles Gandon, and erected by Messrs.

Ashmore, Benson, Pease, and Co. The clear span between the walls is 75 ft. 9 in., depth of truss 16 feet, with rise of tie-rod 2 feet, giving a total rise of roof above the springing line of 18 feet. Rafters T-iron 6 in. by 6 in. by $\frac{11}{16}$ in. Inclined tie-bars, 6 in. by $\frac{1}{2}$ in. and 3 in. by $\frac{11}{16}$ in., with lower tie-bars 7 in. by $\frac{11}{16}$ in. and 4 in. by $\frac{11}{16}$ in. Struts L-iron 4 in. by 3 in. by $\frac{1}{2}$ in. and 3 in. by 3 in. by $\frac{1}{2}$ in. The ventilator has cast-iron ridge plates, connected to the rafters by continuous L-irons 6 in. by 4 in. by $\frac{1}{2}$ in., and has a transverse width of 3 feet. The roof is slated.

The favourite type of truss for retort-house roofs appears to be that indicated by Type F. There are two roofs of this type at the Ramsgate Gas-Works, designed by Mr. W. A. Valon, and another at Tottenham (the distinguishing feature of the latter being Z-iron slating bars), erected by Messrs. S. Cutler and Sons. This form is sometimes quoted as a queen-rod roof; the term "queen-rod" being applied to the suspending rods which act as vertical ties to the feet of the inclined struts. In the roof over the retort-house at the Dublin Gas-Works, designed by the late Mr. Jabez Church, the principals are 64 ft. 3 in. span, placed about 6 feet apart, and the foot of each rafter abuts with cast-iron shoes, to which the tie-rod is connected. The depth of the truss is 20 feet, and the rise of the tie-bar 5 feet above the springing. The oblique struts and vertical ties have jaws or forks at their upper ends, where they are hung from the rafters by means of pins and screw ends; and at their lower ends they are connected with pinching nuts. The length of the roof is 296 feet, and includes a ventilating shaft in the centre of its area.

Figs. 31 to 39. An excellent example of this type of roof exists at the Litchurch works of the Derby Gas Company, designed by Messrs. T. Hawksley and Son. The principals are 52 feet span, with a rise of 9 ft. $4\frac{1}{2}$ in. from the springing line, formed of T-iron rafters 6 in. by 5 in. by $\frac{7}{16}$ in., and inclined struts T-iron $2\frac{1}{2}$ in. by 3 in. by $\frac{1}{2}$ in. and 2 in. by 3 in. by $\frac{1}{2}$ in. The vertical suspension rods are $1\frac{3}{8}$ in., 1 in., and $\frac{7}{8}$ in. diameter. The roof is slated upon purlins $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. by $\frac{1}{4}$ in. L-irons placed 10 inches apart, with eaves gutter of lead bedded in the stone coping. The ventilator measures 9 ft. 6 in. by 1 ft. 11 in. deep.

It will be seen, by reference to figs. 31 and 35, that the vertical tie-rods are connected to the rafters by means of cotter-joints, hence avoiding the introduction of coupling nuts. The struts and ties have independent bolt connections, likewise the horizontal tie-rods (see figs. 38 and 39). This method reduces the width of the connection, but necessitates the use of packing-pieces. In the roof over the retort-house at Folkestone, described above, each tie-rod and strut is furnished with independent bolt connections, as shown in the detail at C (fig. 63). At Sittingbourne Station the struts are of flat bars 4 in. by $\frac{3}{8}$ in., $3\frac{1}{2}$ in. by $\frac{5}{16}$ in., and 3 in. by $\frac{3}{4}$ in., with cast-iron distance-pieces to obviate buckling, and $\frac{1}{2}$-inch bolts with washers, which are united by a bolt connection to a U-shaped coupling forming a jaw, into which the inclined tie-rods are screwed.



It is very necessary that the lengths of the various elements of a roof truss be accurate, in order to ensure satisfactory results. Hence some means of adjustment are required. The accompanying figure illustrates the lower extremity of the central part of a strut. *C* is the eye connecting the strut with its adjoining elements; and this eye-piece has a thread cut upon it, and is furnished with a nut *b*, by which the length of the strut can be adjusted, so that the central portion of the strut bears upon the nut. But if a tensile strain comes thereon, it is exhibited by the part *a* leaving its bearing upon the nut *b*, which must then be screwed up until the adjustment is effected. Various other means are adopted in different structures, such as coupling nuts with right and left hand screws and other joint connections, capable of taking tension as well as compression.

Fig. 78 gives an outline of a truss in which cast-iron struts were introduced. The roof is 40 ft. $5\frac{1}{2}$ in. span to Type A, having a rise of 10 ft. 10 in. formed of timber rafters 9 in. by 5 in., with $1\frac{1}{4}$-inch diameter tie-rods, covering one of the London and North-Western Railway workshops at Crewe. Fig. 79 shows the form of strut designed to enable the strut and tie-rods to have independent connections.

The roof over the purifying-house of the Sheffield United Gaslight Company, designed by Mr. F. W. Stevenson, is 226 feet in length by 91 feet wide, in two spans, slated upon laths $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. by $\frac{1}{4}$ in. The roofs are hipped at one end. The merit of the application of Type F is here seen to be advantageous. The ordinary rafters are formed of T-iron 3 in. by 4 in. by $\frac{1}{2}$ in., with T-iron struts 3 in. by 3 in. by $\frac{1}{2}$ in., with inclined tie-rods of $1\frac{3}{4}$ inch and $1\frac{3}{8}$ inch diameter, and horizontal longitudinal tie of $1\frac{1}{4}$ inch diameter at the centre of the lower tie to the principal. The span in the clear of each roof is 45 ft. 2 in., with a rise of 11 ft. 3 in., the tie-rod being raised 18 inches above the springing line. The roof is surmounted by a ventilator of 9 feet span, having timber louvre boards 6 in. by 1 in., fixed as shown in fig. 67; the drainage from the ridge being taken by vertical 2-inch rain-water pipes on to the roof slope.

An example of Type G is seen in the retort-house roof of the East Greenwich works of the South Metropolitan Gas Company; but in this case the tie is not curved, and the truss at the springing is stiffened by the proximity of the first inclined member. The roof is supported by girders; and the principals are placed 6 ft. $7\frac{1}{2}$ in. apart. The span from centre to centre of girders is 72 ft. $5\frac{1}{2}$ in.; and the roof is surmounted with a ventilator 5 ft. 2 in. wide and 4 ft. 8 in. high, open at the top and ends. The rafter consists of two L-irons 6 in. by 3 in. by $\frac{1}{2}$ in., with vertical members $1\frac{1}{2}$ in., 1 in., 1 in., and $\frac{7}{8}$ in. diameter, and inclined members 2 in., $1\frac{3}{4}$ in., and $1\frac{1}{4}$ in. diameter, with a slated slope making 24° with the horizontal. Its length is 427 feet.

Figs. 1 to 21. The roof over the retort-house at Beckton, belonging to the Gaslight and Coke Company, consists of two widths of 120 feet, including a central span of 70 feet and two side spans of 25 feet each. It was designed by Mr. G. C. Trewby to contain 132 settings of inclined retorts each 15 feet long. The ground or coke-hole floor is at the level of Trinity high water, above which the stage for the storage of coal is raised 10 feet. The total height of the retort-house from the ground level to the apex of the roof is 66 ft. 6 in. There are eight lines of railway running through the house—four at the ground-floor level and four on viaducts 30 ft. 5 in. above the ground floor. Three lengths of water-tank 371 ft. 6 in. are placed under the eaves of the roof so as to collect the water from the roof. The side tanks are 7 feet wide, and the central double tank 14 feet wide. The tanks are each 5 ft. $7\frac{1}{4}$ in. deep. At every 28 ft. 6 in. there is a steel roof principal 8 ft. 6 in. deep in the centre, with a curved lower member giving 56 feet clear headway above the coke floor. The straight inclined upper member of the truss, as well as the curved tie, each consists of steel channels $15\frac{3}{4}$ in. by 3 in. by $\frac{9}{16}$ in. There are two secondary rafters of $4\frac{5}{8}$ in. by 3 in. by $\frac{3}{32}$ in. H-steel, spaced 9 ft. 6 in. apart in each bay, supported upon cross girders of lattice work 2 feet deep throughout, having flanges of 6 in. by 4 in. by $\frac{1}{2}$ in. T-steel. The central roof is supported upon steel plate stanchions; and the side inclined rafters form a continuation of the slope at each lower end of the principal. These roofs cover 18 feet out of the 25-feet side spans; the tanks occupying the remainder. The slate purlins are of 3 in. by 3 in. by $\frac{3}{8}$ in. L-iron, spaced $10\frac{1}{2}$ inches apart centre to centre, fastened to the main and intermediate rafter by angle cleats 3 in. by 3 in. by $\frac{3}{8}$ in. The spandril brackets, which rest upon the stanchions, have two $\frac{3}{8}$-inch check-plates riveted with $\frac{3}{4}$-inch rivets, 4 inch pitch, thus forming a closed box support, which is filled with concrete to a depth of 6 feet above the springing level; and the central portions of the main principals, 58 feet span, are attached to the 6-feet spandrils by two angle frames 3 in. by 3 in. by $\frac{1}{2}$ in. An open ventilator 313 ft. 6 in. long, beginning and ending over a principal, runs throughout the roof; and it is 4 feet wide with sides 2 ft. 6 in. high, made of $\frac{3}{16}$-inch plate riveted to vertical T-iron 3 in. by 3 in. by $\frac{1}{2}$ in., 4 ft. 9 in. apart. The details of this roof, as furnished by figs. 1 to 21, show the construction, which was erected by the Horseley Iron-Works, of Tipton, under the superintendence of their representative, Mr. H. L. Batting.

Figs. 58 to 61. Another interesting form of a roof with an arched lower member is given in the design for the new retort-house of the Hartlepool Gas and Water Company, made by Mr. T. Bower. The roof is 100 feet clear span, 230 feet long, and is to be arranged for inclined retorts with overhead coal storage tanks, &c. There are to be ten main

arches, with perforated web plates; the flanges being formed of angle iron and plates. The roof springs at a level of 21 feet above the floor, and has a clear height of 61 feet to the under side of the arch. The stage is only 3 feet above the floor of the coal-store. The straight inclined rafter consists of two L-steel 4 in. by 3 in. by $\frac{3}{8}$ in., carrying duchess slates on 2 in. by 2 in. by $\frac{1}{2}$ in. L-steel purlins $10\frac{1}{2}$ inch centres. Between the sloping rafter and the top of the arch member, struts and ties of $\frac{1}{2}$-inch bars are inserted with packing-pieces and riveted. The curves to the soffit of the arch are 36 ft. 3 in. radius from the springing to a distance of about 34 feet upwards, and thence a curve of 62 feet radius over the centre. The main principals are supported by brick piers 3 ft. 9 in. by 3 ft. $4\frac{1}{2}$ in., built into walls 1 ft. $10\frac{1}{2}$ in. The ventilator is simply an opening of about 5 feet wide carried over the ridge the whole length of the building. The main principals are 21 ft. 6 in. apart, with secondary rafters, consisting of two L-steel 4 in. by 3 in. by $\frac{3}{8}$ in. with trussing of 3 in. by $\frac{3}{8}$ in. bars, dividing the bay into three divisions.

The roof over the Sunderland Railway Station (N.E.R.) is covered somewhat similarly to the above, the principals being 95 feet span with a clear headway in the centre of 45 ft. 6 in. The ridge is here raised about 9 ft. 6 in. above the bottom flange of the arch at the crown, to carry the rafters, which run down upon each side in a straight line to the gutters resting upon the side walls, which are raised at the abutments to receive them. The upper portion of this roof is glazed, and curved glazing is thus avoided. The outside lower portion is slated; while the interior view shows curved boarding carried over the main ribs.

In conclusion, the author has shown upon figs. 74 to 77 a design for a shed 94 ft. 6 in. by 30 ft., covered with corrugated iron, which, though not suitable for covering the roof of a retort-house, can be used to shelter stores. The shed is shown raised 3 feet above the ground level. If used for a coal-store, the raised floor would be omitted. The principals are 13 ft. 6 in. apart, formed of T-iron 3 in. by 3 in. by $\frac{3}{8}$ in., with struts of flat iron $2\frac{1}{2}$ in. by $\frac{5}{16}$ in., and inclined tie-rods $\frac{7}{8}$ in. diameter with lower ties 1 in. by $1\frac{1}{8}$ in. diameter. The principals are 13 ft. 6 in. apart, and have purlins of L-iron $3\frac{1}{2}$ in. by $3\frac{1}{2}$ in. by $\frac{5}{16}$ in., with cleats. The corrugated iron employed is No. 18 B.W.G.; and the building is fitted with sliding doors at the sides.

The author has not attempted to record any particulars of prices, which, at present rates, furnish no guide to actual cost, as it is impossible to prophesy what the prices of the next twelve months may be.

Discussion.

The President observed that the paper was so full of figures and details, that it was more suitable to be read quietly by themselves than before an audience; but it was interesting to observe the various types of roof, showing not only how to do it, but also how not to do it. It struck him that the particular joint which Mr. Walmisley had pointed out was about as bad a type of construction as it was possible to have. It was one that in his own engineering work he would never have used; and it certainly would not be adopted to-day. It was probably one of the old types. He remembered that many years ago, when he first went into his father's office and learned to understand the rules of roof construction, he took it into his head to work out a roof which had just been designed by the draughtsmen, to see if the design were correct. He found it was certainly strong enough, and was not likely to fall in a century; but the strength was entirely misplaced, for what ought to have been the strongest member was the weakest, and though the weakest member was fairly strong enough for the purpose, there was immense waste. The prevention of waste was the real use of understanding how to do these things. As a rule, an Englishman did not make things so weak that they were likely to fall, though now and then they read of an accident of the kind; but they very often put much extra weight, not only into roofs, but into almost every other thing they had to deal with as engineers. To himself, this paper was a very interesting one. He hoped that every gentleman present would criticize it, if he could; and if he could not, praise it.

Mr. C. E. Jones (Leyton) said he felt they were much indebted to Mr. Walmisley for bringing before them different types of roof suitable for all purposes; and they must be very hard indeed to please if they could not find a roof to suit them in the illustrations. He would like to ask if Mr. Walmisley considered it advisable to use cast iron in any roof. For his own part, he thought that cast iron was a source of weakness and danger, which it would be better to eliminate. He endorsed the remarks of Mr. Walmisley with regard to corrugated-iron roofs for gas-works. The life of corrugated-iron roofs was very short; and altogether he thought there was no economy in using them. The same remark, in his opinion, applied to large light roofs that were exposed to much wind. Copper, lead, or zinc nails for fastening would, after a time, wear away and get cut, with the consequence that slates would be stripped off during the next storm. There were various situations in which a very light roof was needed in gas-works; and experience seemed to show that some uniform type of roof principal was required. In roofs, as in many other parts of engineering, it would be as well for them to have a certain type for a certain span; and if it were possible for manufacturers to keep such things in stock, a great deal of trouble would be saved to those who had charge of the erection of works. The paper was one which they could take to their studies and digest with more satisfaction than they could in the course of rapid or hasty discussion in that room. But he would be glad if Mr. Walmisley, in replying, would suggest some types of spans which he thought could not be improved upon with their present knowledge of designing. They were much indebted to Mr. Walmisley for the information he had given them, which was very varied, and certainly most valuable. He thought the Institute should tender to Mr. Walmisley their best thanks for bringing before them such a valuable description of roofs of all kinds.

Mr. F. W. Cross (Lea Bridge) said he was sure the younger generation of gas engineers would appreciate the paper and the various types of roofs illustrated. He would ask Mr. Walmisley to add to the information contained in his paper by giving them some idea of the difference of the strain upon the walls—the outward thrust—of the straight roof and curved roof. What was the difference, if any?

Mr. Fletcher W. Stevenson (London) said it seemed to him rather difficult to discuss this paper, because Mr. Walmisley was a visitor who had been invited by the President and the Council to read his paper. At the same time, members of the Institute must ask him questions; and if they did not quite fall in with what he had said, they were entitled to express their objections. The first point he wished to mention was that the paper did not in any way help them in the matter of the designing of roofs. Mr. Walmisley had givem them examples of what had been done in retort-houses and other places; but Mr. Walmisley was an expert in the matter of roof designing, and personally he would rather have heard from him what faults he could pick in these different designs. He (Mr. Stevenson) had, when applied to, most willingly given the design of the roof over the Grimesthorpe retort-house at Sheffield, because he thought he would hear what were the weak points in it. Was it weak or was it strong, or was the material badly placed? The same with other engineers. They would, he was sure, have been glad to have had from Mr. Walmisley some criticism which would have helped them; and they would have liked to have had instances where designs were faulty on general principles. With respect to the fastenings of slates, Mr. Walmisley had mentioned copper and zinc clips; but his own experience of copper was that it was totally unsuitable for retort-house work, as the fumes carried up by the steam in quenching the coke would destroy any copper fastenings, he should say, in twelve months. On the other hand, good lead would stand for many years in that position; and the plan adopted in Sheffield was to have lead nails about 4 inches long, which were twisted round the slating purlin, and made secure. He thought it well that the slates should be tiered with good hair mortar underneath, in places exposed to high winds, as this prevented them from blowing off. He would like to ask a question with reference to dead-weight. Mr. Walmisley said that "the dead-weight of a structure increases with its span. A weight of 8 cwt. per square is ample to allow for a roof of 60 feet span, or 10 cwt. for a span of 100 feet, if intended to carry slates on boarding." Did this refer to the weight of the framework only, or did it include as well boarding and slating, &c.? As to the use of corrugated-iron roofing for gas-works, it was quite true that it was not

suitable for retort-houses, or for buildings which were much exposed to injurious fumes. But he thought there were many places for which it did very well; and it should not go forth that corrugated iron was not suitable for roofing in gas-works at all. For coal-sheds, for instance, where the trucks were brought in underneath the roof, and coal was likely to strike against the roof, and there would probably be a great deal of vibration, nothing could be better for roofing than corrugated iron. By tarring the roofs, they could be made to last for many years. He knew of examples in Sheffield where roofs had been kept in very good condition indeed by this means; and in respect of its atmosphere, hardly any town could be worse than Sheffield.

Mr. G. R. Hislop (Paisley) said he had found slating a source of very great danger to the lives of his men. At his own works, there had been very many narrow escapes from loss of life and serious injury through the use of slates; and he would certainly say that in any exposed situations galvanized iron was preferable. He had never been, generally speaking, an advocate of galvanized roofing; but of two evils one sometimes chose the least. Notwithstanding the expedient of tying the slates down with bars on the top, and double nailing with zinc nails, there were certain parts where the wind got hold of the slates and lifted them up, like the leaves of a book, to a great height. He had actually seen a "Duchess" slate come down and crack a flag in the pavement below; and when a storm came on, there was nothing for him to do but to dress himself and sit up all night, in the expectation that every minute some accident would occur. Being in this dilemma, in recent roof construction he had had to abandon the idea of slates. Like his friend Mr. Stevenson, he took the precaution of double coating corrugated roofing with good oxide paint, inside and outside, and also occasionally gave it a good finishing coat of slate colour outside, which took away the temporary idea that one generally had in looking at a corrugated-iron roof. So that he thought the advantages of slating did not at all times hold good. But circumstances should be taken into account. This at least was his own experience, where works were seriously exposed to storms. Another idea in connection with roofing was that the roof should have a sufficient margin of strength to enable them to put a batten across two or three of the tie-bars of principals, to elevate retorts and put them into position, or to lift retort-mouthpieces, ascension-pipes, &c., in the retort-house. This he had found to be a great advantage, instead of having to erect temporary apparatus to elevate the retorts. It would necessitate only a very slight additional strength to meet this requirement. It was, in any case, well to be on the safe side as to strength; and a very little additional strength would enable them to utilize the roofing in this way.

Mr. William Carr (Stalybridge) said he would like to express his indebtedness to Mr. Walmisley for his excellent paper, which he thought would be of more value to members of the Institute in time to come for reference than it was for discussion. There was a good deal of matter in it which would be very serviceable to members, and would make a very important addition to their proceedings. Like Mr. Jones, he felt that those of them who wished to get their engineering on the cheap, would have preferred to have had a complete specification of a roof for any particular span, to save them trouble in future; but this would infer that finality had been reached in the matter of roof designing. He did not, however, think that finality had been arrived at. As the President had pointed out, some of the details submitted to-day were already obsolete, and had been superseded by more modern and more excellent appliances. He was obliged to Mr. Stevenson for his contribution to the discussion, because he had himself been thinking of adopting a galvanized-iron roof over a coal-store, and from the remarks of the writer of the paper he had begun to doubt whether it would be wise to do so. But from what he had since heard, he felt reassured; and the galvanized-iron roof would have to go on.

Mr. J. H. Crowther (Wallasey) said, with regard to the general character of Types C and E, he thought it most desirable to put a suspension-rod to keep up the tie-bars in the centre of the roof; a very light bar being all that was necessary. There was nothing said in the paper about wind-ties in connection with the bracing of these roofs. Of course, wind-ties in any building were of service; and he thought it was most desirable to have them in all buildings where there was a long length of roof. Referring to the passage in which the author spoke of the slate purlins being fastened to the main and intermediate rafters by angle cleats, he did not know why cleats were required when they had purlins; but he took it that Mr. Walmisley was not responsible for all the designs of these roofs. With regard to slating, there need be no fear of danger in slating any roof, however exposed. With pure lead nails, it was absolutely necessary that the slate should be tiered on the under side. But it was not much more expensive to put wood purlins and copper nails; and the copper being protected from any fumes they would have a perfectly safe fixing. He did not think this was the best form in which such a paper could have been given. If there had been something more in the nature of working out of details and of the principles of construction, it would have been more beneficial than that they should have before them drawings of a lot of good roofs like these, which might be copied without being understood.

Mr. Hislop remarked that he had omitted to say that, in his opinion, the use of cast iron in roofs was a thing of the past. He did not think that cast iron should be used for roofing of any description. He had had a good deal of experience of the serious consequences and damage arising from the employment of cast-iron struts; and, in his opinion, the use of cast iron ought to be abandoned.

Mr. T. O. Paterson (Birkenhead) said that, upon the question of damage to roofs by storm, he could speak with confidence of the advantage of using 2-inch battens bolted on to the angle irons of the roof; the slates being nailed on with galvanized iron nails. Having adopted this plan for the roof of a large retort-house, and also of a purifying-house, erected for fifteen years, they had never had the slater on the roofs since they had been erected; whereas in the old retort-house, where lead nails were used, there was always expense after the winter gales in getting the roofs done up.

Mr. S. W. Durkin (Southampton) said, with reference to the point of fastening slates on to these iron roofs, some years ago he had a good deal of trouble. He tried copper strips bent round the angle iron; but in process of time they disappeared, and the slates began to disappear as well. He also tried fixing them with slips of Muntz's metal used for sheathing wooden ships, and found them more durable than copper. He had adopted somewhat the same system that Mr. Paterson described, of wooden laths bolted to the principals, and placed in front of the angle iron laths, and using yellow metal counter-sunk nails. They were a little more expensive; but they were far and away better than galvanized iron, and their durability was very great indeed. With regard to galvanized-iron roofing, he had had some experience of covering an open coal-shed with it in a very exposed position alongside of a river; and in their humid atmosphere such a position was a very trying one. The roof had been up now for some years, and had never cost a penny except for a coat of paint on the outside, just to make it look decent and tidy.

Mr. C. S. Ellery (Bath) said one point had been left out of the discussion. He was himself interested in the subject just at present, as he was engaged in taking down a number of roofs erected long since; and he had been struck with the way in which they had kept in position—especially the joints and the parts where one would have expected the strain to be greatest. It was simply a marvel that they should have remained in their place. Two lessons had been taught—namely that, in constructing roofs and working out the weights and strains, they must not draw the matter too fine, as waste was constantly going on, in spite of every care in painting and scraping. He thought that, in designing roofs, the question of accessibility should be kept well in mind. He was disappointed that Mr. Walmisley had not favoured them with any criticisms. It seemed to him that one point to be kept clearly in view, judging from the appearance of the roofs in question, was that the less members there were in a roof the better. It would be advisable to put in a little more weight, and make the members stronger, rather than multiply the members and the joints at which corrosion and rust took place. He hoped to hear something from Mr. Walmisley with regard to securing roofs in position. He was at present putting up a series of roofs and girders; and he had to consider the question as to what extent they should be bolted. He had carefully watched the action of roofs in respect to expansion and contraction, which he

thought was a very important matter ; and he had to consider how far they could really tie up the roofs to the walls and girders, and how far they should give them play. They were deeply indebted to Mr. Walmisley for bringing this matter forward ; and, as a parting suggestion, he would point out that care should be taken to paint the roofs periodically, and that trustworthy men were employed for the purpose.

Mr. Arthur Valon (Ramsgate) remarked that he would like to say, as one of the younger members of the Institute, that he thought the paper a very interesting one, and one that would be very useful to the junior members of the Society. It had been said that the diagrams were a collection of examples which had not been criticized ; but it was just such a collection of examples that the younger members wanted. It was no use for them to work out the stresses. Anybody could do that, as it was really only mechanical work ; but they wanted a collection of examples from which they could, by comparison, get the best form of joints and members, and select those which they considered the most suitable. With regard to Type A, he was rather surprised to find Mr. Walmisley saying that it was serviceable either for large or small spans. He had used it considerably for small spans, but found that its economical limit was very quickly reached. He was not now speaking of the truss when loaded at the joints, but when the loading was, as was usual with the retort-house roof, by means of angle-iron purlins ; the slating being fastened directly to them.

Mr. Walmisley, in reply, thanked the members for the kind way in which they had received his paper. As to the statement that he had said nothing about wind-ties in roofs, of course wind-ties on a roof were of the highest importance, as it was the question of the wind that mainly affected the decision whether the framework should be fixed (1) on both sides, (2) left free on both sides, or (3) fixed only on one side. The reason he had not touched upon the question in his paper, was one that would be evident to the older members of the Institute, who would remember that he had tried to exhaust the subject in the year 1891 ; and therefore he could now only refer them to that paper, which really ought to be read side by side with the present one to make the matter complete. There, also, he pointed out that if roofs were as a rule put in a sheltered position, this also affected the question of the walls. With regard to cast-iron members in a roof, certainly, having regard to the sections that they could now obtain in steel as well as in wrought iron, and to what they knew of strains in structures and wind pressures, cast iron should not be introduced for any member that was likely to be subjected to tensile strain. Cast iron was all very well in certain places ; and it or cast steel was the proper material for gutters, and also for base-plates, but not for struts or for any member that was at all likely, though generally in compression, to come into tensile strain. They knew that, when the wind pressure was on one side, certain parts of the roof were subject to compression, but that at another time, when the wind varied, they might come partly into tension ; and this fact had to be borne in mind. With regard to the question of the connection of the slates to the roof, he had listened with great interest to those who had had experience in the matter. He thought the statements brought forward as to the use of copper were certainly right ; but with regard to lead strips, he believed that the question of their deterioration was mainly one of drainage. If water was allowed to hang about a lead connection, some electrical action might take place between the lead and the iron—as they knew it did—and the metals would wear away. To see this, they had only to look at old iron railings which had been fastened with leaden splits. Where the rain water had worked its way in, these railings had got as thin as a cord or thread. But if the roof was so thoroughly drained that water could not lodge near the lead connection, he thought there was nothing to be feared. As regarded the dead-weight mentioned in the paper, this was simply the framework, and did not include the covering. As to the suggestion that, in dealing with these roofs, he should have pointed out where there might be excess of metal, he must admit that he had not calculated the strains in all the roofs. But if he had criticized them and pointed out in some cases that the trusses were too strong, he would probably have been met, in the course of the discussion, with the remark that had been made by one of the gentlemen, to the effect that roofs should be strong enough to carry arrangements for shifting retorts, and they should therefore be made extra strong. The strength of any roof depended so much upon the data and the requirements, and the situation, that he thought, generally speaking, it did not do to cut down the section too fine. They must allow an ample margin for safety ; and he certainly thought it was a good plan to allow an excess of metal for deterioration, and also for any unforeseen treatment—such as the shifting of machinery below of perhaps greater weight than the designer might have allowed under existing circumstances at the outset, and in this way bringing undue strains upon the roof. Of course, engineers in charge of retort-houses, when arrangements were made for shifting the plant below, would take care that no cross-strain was brought to bear upon the centre of a long tie-rod. All rods and wires for shifting should, of course, be brought to bear at points where the struts were connected to the tie-rods, and not at the centre of a long tie-rod, where they would cause a deflection which the tie-rods were never calculated to sustain. As to the use of galvanized iron, this was, naturally, a matter of opinion. Except in situations close to the sea, engineers did not care for galvanized iron ; and he would far sooner take corrugated iron, and give it two coats of good oxide paint. In some works he was connected with, about ten years ago he put up a sheet of corrugated iron 70 feet by 30 feet ; and he would not have it galvanized under any circumstances, but had it covered with two coats of good oxide paint. It was painted every three years, and was as good now as when it was put up. A good designer always took care that every part of a structure should be accessible to the painter's brush ; and this he thought was a maxim they would all agree with. With regard to the remark made as to the use of cleats, a reference to fig. 13 would explain this. In the hurry of writing out, he had put the angle in the ordinary way, whereas in the revised proof it would appear the other way up ; and in this position a cleat was needed to connect it to the rafter. If the angle was turned round in the ordinary way, he could well understand that the gentleman who spoke would wonder what was the use of a cleat. With regard to his statement that Type A was suitable for large spans, he did not, of course, mean Type A as it was shown in the diagram, but a type in which the bracing members radiated from a point. In that sense, Type A could be used either for large or small spans, if the upper rafter was made sufficiently strong to carry between the unsupported parts. With the upper rafter of proper shape, Type A could be very well adapted for a large span, as they might see at Bristol, where the upper rafter was curved. The remark by one speaker as to reducing the parts and the number of members, so as to avoid a quantity of connecting parts, would also support the argument that Type A might be used for a large span. With a span of 100 feet, Type A would not be suitable, with simply a T-section rafter iron roof. The rafter must be sufficiently deep where it had to be carried on the unsupported parts. Just what was necessary would have to be worked out and tried. There would be more work in that case to be done in the shops. It was, of course, a matter of experiment ; and the thing to do was to work out two or three designs, and see which was best. As to Type F, he would have no hesitation in using it for spans up to 60 or 70 feet. Arched roofs were, of course, suitable for larger spans, where the arch rib was made of a good depth. But it must not be supposed that, even with the adoption of a semicircle, outside thrust could be entirely avoided. They all knew the case of the Crystal Palace, at Sydenham. The roof there was constructed in the days when it was believed that wind pressure acted vertically. They now knew that snow acted vertically, but not wind pressure. It was thought that, by making the rib of the arch of the Crystal Palace roof sufficiently deep to act as a girder, the structure would be made perfectly stable. But when the roof was put up, it was found that there was lateral wind pressure, which produced a side thrust ; and those very awkward diagonal ties under the gallery had to be inserted for the stability of the structure.

SOME DISPUTED POINTS AMONG GAS AND WATER EXPERTS.

By John Wilkinson, of Drighlington.

At the last November meeting of the Manchester District Institution of Gas Engineers an excellent paper was given

by Mr. Thomas Newbigging, of Manchester, entitled "Some Disputed Points in Gas and Water Works Legislation;" and during a recent perusal of Mr. Newbigging's contribution, I formed the opinion that the matter could perhaps be carried a little further. Hence the subject before you to-day. I trust that no words contained in this paper, will be construed into an attack upon the experts in person; for I am confident that any such attack would meet with the contempt it deserved. I venture to think, however, that there is wide room for a discussion upon the policy adopted by experts when giving evidence.

Opinions or evidence given by gas and water experts may be classified into three divisions—viz.: (1) Evidence in connection with the rating of gas and water works. (2) Evidence on Parliamentary Bills promoted for extended powers. (3) Parliamentary, together with arbitration evidence, for the transfer of gas and water undertakings to local authorities. I propose to leave the question of rating to someone competent to deal with such a puzzling problem. I will only say that, although some differences in opinion do exist, there is a fairly general feeling among the leading experts, that gas and water works are more heavily assessed than are other industrial undertakings in their respective townships.

Commencing my paper then with Parliamentary Bills for extended powers, the most frequent case is that of a gas company asking, among other details, for an increase of capital, together with the sliding-scale; and, as the applications to Parliament by a gas company are few and far between, the local authority naturally takes advantage of the opportunity and endeavours to extract some favour from the company.

The company consider their position; and, with the assistance of an expert, decide upon the proposed increase of capital and the standard price. But directly this is done, objections are put forward by the local authority that the increase of capital is excessive, and will prevent the gas undertaking from becoming municipal property for an indefinite period, and therefore the shareholders are to be enriched at the expense of the public. The standard price being too high, will cause serious loss to the tradesmen, who will not be able to compete with the tradesmen of any neighbouring town, where gas may happen to be a few pence per 1000 cubic feet cheaper. The local authority may probably ask for a purchase clause to be inserted; and, ultimately, the Bill comes before Parliament as an opposed measure. It is then most interesting to hear the expert evidence given for both parties; and as these experts are gentlemen who have had long experience in the profession, it would be absurd to suggest that any one of them was tampering with business he did not understand. It is, however, impossible to account for the wide difference in their opinions with any degree of satisfaction.

The company's experts prove, by figures, that their requests are most reasonable, and they cannot carry out their obligations on anything less. The local authority's experts stoutly deny this—producing figures and statistics to bear out their contention that the capital asked for is fully 100 per cent. too much. They declare that the standard price is anywhere about 1s. per 1000 cubic feet too high, and that the present is a most opportune time for the undertaking to be transferred to them—they being fully convinced that such transfer would be to the interests of both shareholders and public. There is, finally, such a juggling of figures and facts that the majority of Parliamentary Committees must really feel bewildered by them. It would appear, however, that some Committee created the happy precedent of splitting the difference, and the matter is thus settled; but not before some £2000 of provincial gold has found its way to Westminster, in order to pay for the luxury of a parliamentary fight. And I venture to suggest that the £2000 has left the district without either the gas consumers or inhabitants deriving any benefit whatever, owing to the fact that, in all probability, the gas company's experts would have advised them to accept similar terms to what the Parliamentary Committee had granted; but, knowing full well the procedure adopted by experts engaged for local authorities, they were bound to protect themselves by asking for a good deal more than they desired or expected.

If we now take parliamentary and arbitration evidence for the transfer of gas and water works, we again find ridiculous and outrageous differences of opinion. Whenever a local authority desires to compulsorily expropriate a gas company, against whom there have been no complaints—and it would be unique to hear of a gas company without—a great deal is made of the question of precedents. The company's experts vow they are not aware of any case of compulsory expropriation; while the local authority's experts quote, with confidence, a dozen cases—even though a few days before they appeared as company experts, when cases of compulsory expropriation were conspicuous by their absence. It is also probable that the gas company's experts have before appeared for the local authority, when, in accordance with tradition, they were quite prepared to quote cases of so-called compulsory expropriation. There is also the question as to whether or not the company are willing sellers. The slightest slip of tongue or pen by any representative of the company is construed into an offer to negotiate; and only by the gross discourtesy of refusing to acknowledge a local authority's communications can any company face Parliament feeling sure they have not, in any way, committed themselves as being willing to sell.

The amount due for compulsory purchase under the Land Clauses Act may be stated at 10 per cent. in one case, but in another case, a few days later, it has suddenly dropped in the same expert's opinion to 5 per cent., or probably it may have vanished altogether, according to the side he represents.

The number of years' purchase of the maintainable profits varies in the same manner; and 23 years' purchase may be fought for, against a claim for 33 years. In a recent case, the local authority's expert complained very bitterly that the gas company were being awarded 41 years' purchase, against his most liberal allowance of 25 years. This same expert was eventually badgered by Counsel into admitting that, in the case of a small neighbouring company, he had stated, in evidence, that 33 years' purchase was but a fair, and not a liberal, allowance. The question of statutory and non-statutory companies is just as hopelessly confusing; and they are appreciated and depreciated in order to show whatever fictitious value is desired. Prospective value for unexpended capital, together with surplus plant, is dealt with in like manner; and the experts seem to possess the power to command it to appear or disappear at will.

There is then the experts' analysis of the accounts and works, &c.; and such differences in opinion as the following are quite common:—

Gas made per ton of coal,	9000 cubic feet,	against	10,000 cubic feet.
Tar made per ton of coal,	9 gallons	,,	12 gallons.
Sulphate of ammonia made per ton of coal,	20 lbs.	,,	30 lbs.
Lost gas (leakage),	5 per cent.	,,	10 per cent.
Value of lost gas,	selling price	,,	cost of production.
Repairs of works, mains, meters, &c.,	5d. per 1000 cubic feet of gas made	,,	9d. per 1000 cubic feet of gas made.
Maintainable profit,	£1,044	,,	£1,626.
Surplus works,	£3,580	,,	minus £300.
Total value of works,	£55,360	,,	£22,911.
Capacity of carbonizing plant,	50 per cent. excess	,,	50 per cent. deficient.
Capacity of condensers,	ample	,,	25 per cent. deficient.
Capacity of scrubbers,	considerably in excess	,,	just sufficient.
Capacity of exhausting machinery,	very ample	,,	50 per cent deficient.
Capacity of purifiers,	considerably in excess	,,	13 per cent. excess.
Capacity of station meter,	100 per cent. in excess	,,	just sufficient.
Capacity of storage,	very ample	,,	12 per cent. deficient.
Capacity of mains,	100 per cent. in excess	,,	just sufficient.

The above are not imaginary or hearsay, but are statements which have actually been given as evidence by experts engaged in recent cases. It would involve too much time to go through the items separately; and I will only point out the absurdity of any expert calculating the value of lost gas at the selling price to the consumer.

I now come to the real point of this paper—that is a desire to elicit the opinions of the experienced members of this Institute as to whether or not they consider as satisfactory the present basis on which experts are compelled to give their evidence. Whenever resource is made to Parliament or arbitration, do experts give their evidence on the basis of justice and equity to all parties concerned? And, if justice and equity are the basis of those inquiries, why is it that gas and water companies show such a fear and dread of appearing before a Parliamentary Committee or a Court of Arbitration—why do they sacrifice some of

their rights and privileges in order to clear away any threatened opposition? I am firmly convinced that the whole system needs quick and drastic reformation. I consider as unhealthy any basis or system which compels an expert to walk round the boundary walls of a gas-works, and then go to Parliament and give evidence that the works are old and antiquated, and not able to meet the consumers' demands for gas. Any principle must be wrong which demands an expert to say that a gas company selling gas at 2s. 6d. per 1000 cubic feet is badly managed, when, but a few days before, he spoke most favourably of a similar company who were charging 4s. per 1000 cubic feet. Quite recently, suggestions were made by experts that the most important gas companies of this country were guilty of doctoring their gas at the testing-stations—one expert vowing that, with a certain form of photometer, he could always get a reliable test of so many candles; while the experts on the other side were prepared to prove that they could not get within a difference of 2 to 6 candles.

My contention is further strengthened by certain remarks which have recently been made by eminent gentlemen connected with the gas and water profession. For instance, only a few weeks ago the attempts made by a leading gas expert to appear consistent were characterized by a well-known Queen's Counsel as damnable heresies. Again, the chairman of a large gas company (himself an expert), speaking of arbitration, said: "We know perfectly well—better than any arbitrator—what the concern is worth to us; and we will trust no arbitrator whatever. He would be misled probably by the *evidence* and by the specious talk of the lawyers." I well remember the following expression of an eminent Baronet, who enjoys a large practice as an expert: "I never see that light burning at the House of Parliament without wondering what person's property was being confiscated, and whose rights and privileges were being violated." If these are the feelings of the leading lights of our profession, do they not suggest that something might be attempted to place negotiations relating to our business on a firmer and more honourable basis.

The chief gas experts are gentlemen who have occupied the chair of this Institute. They are well known to each other; and what is there to prevent them from meeting together and fixing standard facts and precedents, and firmly adhering to them, no matter what side they represent. If this could be done, the experts would gain the confidence of all parties responsible for the management of gas undertakings. Their advice would, therefore, be more frequently sought than at present, for the feeling of mistrust would diminish. They would thus be enabled to command increased fees (for large sums of money would be saved every year which are at present thrown away in useless litigation); and general advantage would result to shareholders, consumers, and the general public. The gas industry is honest and straightforward; sharp practice and trade secrets are almost unknown. Any expert can quickly sum up the value of an undertaking from a balance-sheet and a knowledge of local circumstances. He knows perfectly well what can be got and done with the products from a ton of coal from any of the coalfields.

There is another matter which I have never heard discussed; and, although it may not appear to come within the title of this paper, I propose to mention it in the hope of hearing some expressions of opinion thereon. I refer to the question of costs in parliamentary proceedings. It seems to be the general rule that both parties must pay their own costs; and I understand no deviation is ever made from this rule, unless every member of a Committee is present and unanimous in opinion. In ordinary law, costs usually follow the verdict; and it would be interesting to hear a full explanation of the reason why Parliament makes the distinction. Cases are known where small companies have been put to great expense by being compelled to oppose repeated attempts to interfere with their rights; and, to say the least, the rule of Parliament would appear to offer temptation for wealthy bodies to persecute their humbler friends by repeated applications to Parliament.

In conclusion, I must apologize, for bringing so crude a paper before you; but after committing myself to its preparation, I found it was almost impossible to treat the subject fully without mentioning names of towns and persons, to which I have a strong objection. Moreover, I was reminded of the fact that our worthy President was himself an expert; and I had thus unwittingly strayed into the "Lion's Den."

Discussion.

The PRESIDENT observed that, whether the paper contained any straight-told truth or not, it had certainly been a very interesting one. It had been excessively interesting to himself; but he must say that Mr. Wilkinson did not understand the methods of local authorities and public companies, because experts found that if they tried to save them money, and gave them good advice, they did not increase their fees at all, but did just the other thing. In these circumstances, the experts were not offered any inducement to bring about settlements. At the same time, he always tried to make his people agree if possible, because he could easily get better terms for them by so doing than by fighting. When the blood got heated, people were apt to say at the end: "We won't give anything unless Parliament does it;" and Parliament or the Parliamentary Committees were accused of having invented the process of division. But he himself had always thought that this process was very much older, and that it was invented by one of the most learned and clever men of whom we ever read, when he ordered the poor baby to be cut in half. It was since then that they had heard of splitting the difference. He did not think that the poor experts were so bad as they were painted. Their clients came to them, and asked for their advice as to the best way of putting their case before the Court or tribunal; and would it be honest of the experts to show the other side how to present their case? The experts could not tell everything. They could not tell the other people how to fight their case. But he had often wished that he could fight on both sides, as he felt that he could conduct the matter much better than the others did. If in one case the experts were for the local authority, and in the next case for the gas company, were they any worse, so long as they told the truth, than the barrister who represented his clients, or the solicitor who acted for them? Then, again, as to arbitrations, whereas one company might be worth 33 years' purchase, another company might not be worth more than 23 years. This depended on position, and the circumstances of the case; and just in the same way one house or a parcel of land might be worth 30 years' purchase, while another house or another parcel of land might not be worth nearly as much, because it was not in so good a position and did not appreciate so much, or it might be that it depreciated. All these things had to be taken into consideration. Although Mr. Wilkinson had not mentioned the names of any experts, he had rather dotted the i's and crossed the t's for those who knew in which direction to look; and in some of Mr. Wilkinson's remarks he could recognize several of his own friends, who were near and dear to him. At the same time, he was exceedingly pleased that the paper should have been read. It was an amusing paper, as well as an interesting one; but he did not know that it would have any good effect unless Mr. Wilkinson could induce employers to treat experts in a fair and proper way when, by settling cases, they saved the enormous expenses of which Mr. Wilkinson complained.

Mr. W. A. VALON, having been called upon by the President, said it had not been his intention to enter into the discussion on the paper; and he would say what he had to say in as few words as possible. The President had said that some of Mr. Wilkinson's remarks, he thought, applied to persons whom he knew. Personally, he did not recognize them. The paper was no doubt honestly written from the point of view of the writer; but from his (Mr. Valon's) point of view, the conclusions he arrived at were erroneous from beginning to end. If the suggestions made in the paper were followed, there would be no need either for a Court of Appeal, a Judge, or a Jury. A statement, when made by an expert, should, according to the writer, be able to be accepted on both sides as correct without question, and should not require to be subjected to the usual laws of evidence, to see how far prejudice, feeling, and circumstances ought to modify the statement. An expert giving evidence for purchase would doubtless come to the conclusion, after having given attention to all the circumstances surrounding the case, that in some instances a property might be worth 30 years' purchase, and in another 25 years or less; and both assertions would be absolutely true, though from an outside point of view the difference might appear irreconcilable. In the valuation of gas-works, there were no two concerns in the country where the

valuation could be exactly the same, unless they were entirely on all-fours the one with the other. But this was not possible. Most of the gentlemen he was addressing were conversant with gas-works situated in different parts of the country. Did they know of any two where the conditions were absolutely the same? He could not call to mind any cases perfectly parallel. There were, of course, instances which were almost parallel; and in those cases the rating should be nearly equal. Take the London Companies. Here, at least, it might be thought that the rating of the one Company should govern the rating of the other; but this was far from being the fact. The cases were not parallel. There, as elsewhere, in making a valuation, the capital expended, the working expenses, the price of coal, the receipts for residuals, and the ultimate profits derived from manufacture, all had to come into account, which in no two works were alike. Hence, from an outsider's point of view, the valuations were inequitable. Of course, it must follow that, where hypothetical claims were made on one side which were not taken into consideration on the other, there would be always a wide difference in the result arrived at; but he thought, after the claims had been laid before, and sifted by, the best tribunal the country afforded for the purpose, and a decision arrived at by that tribunal, it was not possible for an outsider to complain that, because the decision in one case appeared to him different from that in another, therefore the decisions were wrong. Nothing was more misleading than an attempt at comparison of cases. Each matter—either valuation or purchase—was a new subject, and must be examined independently of anything that had gone before. He was quite certain, however, leaving himself out of the question, that as a rule expert witnesses deserved the credit of giving the best advice at their disposal, of fighting the cases entrusted to them upon as good a ground as they could select, and generally of doing what was possible to be done in the interests of their clients.

Mr. J. P. Leather (Burnley) said he thought that Mr. Wilkinson's conclusions were certainly wrong, while at the same time there was a good deal of truth underlying the paper. Mr. Valon had indicated some amount of error in comparing the number of years' purchase as between one company and another; but the point which he thought really troubled Mr. Wilkinson was that two experts, both considering the same company, and both having a very good knowledge of the circumstances, did not come to anything like agreement. That was really where the difficulty was in understanding this question of expert evidence. The remedy, if there was one at all, was certainly not in the direction which Mr. Wilkinson had stated; for the simple reason, as the President had pointed out, that it was impossible to say that a certain rule or a certain figure applicable to one case was applicable to another. The only way he saw of remedying the evil—and he did not know whether it was practicable—was in the direction of the tribunal. Instead of cases of this kind being fought by two sides, each having their own expert witnesses, the tribunal should call as witnesses experts not in the pay of either side, but who should be as far as possible impartial. Under these circumstances, there would not be anything like as much difference between the experts. There were several practical difficulties in the way of this suggestion; but nevertheless it was, he thought, the one that was most workable. One of the difficulties was that the engineers, and those who could really speak best, were to some extent connected with the companies they represented, or even if they were not taking fees from a company in a particular case, they might be wishing to have business relations with the undertaking. Things of this kind interfered with the getting of absolutely impartial evidence; but he did not think there was any better way of bringing experts' opinions into more immediate relationship than by making the experts altogether independent of the two sides to the controversy.

Mr. H. Lees (Hexham) wanted to know whether the writer of the paper was serious or not. He supposed they should assume that he was. In the earlier part of the paper, Mr. Wilkinson said he proposed to leave the question of rating to some one competent to deal with such a puzzling problem; and having passed that over thus lightly, he went on to deal very thoroughly, from his point of view, with the still more important question of the purchase of gas undertakings and appearances before Parliamentary Committees. Now he should have thought that one who could deal with so much confidence with the larger question, would not have left the smaller one in that way. The subject of rating was an important one, and it was one that they had to deal with more frequently than they had with the larger question. However, Mr. Wilkinson said he had left that to others; and unless he dealt with it in his reply, he supposed they must leave it, and be thrown back upon the experts. Although he did not hold a brief for the experts, he did not think Mr. Wilkinson was quite fair to them. There were, of course, two sides to the question. In the first place, Mr. Wilkinson said the balance-sheet was so plain that it was not possible for two people to have different opinions as to what were maintainable profits. But he (Mr. Lees) contended that in any balance-sheet that might be presented, experts representing different sides would find points of variation; so that the value of works could not be agreed upon. Then came the contention. Having fixed the maintainable annual profit, it was not always so easy to get at the number of years' purchase as would appear by the references to the subject which had been made in the paper. There, again, there were points of difference—local circumstances, from which different deductions might be made by different people—and, therefore, they were once more thrown back on the work of the experts. He had reason to believe, and no doubt most of them believed, that the experts did the best they could for their employers. But why should gas and water companies dread appearance before a Parliamentary Committee? He knew of no reason, if such companies had a good record; but if there was something in their history which might be brought forward by the experts and the lawyers on the other side, they might have a reason for not wishing to appear before Committees, and might be wise in sacrificing something of what they called their rights and privileges rather than face the ordeal. He thought this might be the explanation in many cases; but where gas and water companies had a good record, they had nothing to fear.

Alderman Miles (Bolton) drew attention to the table in the paper, which Mr. Wilkinson had carefully avoided reading, and said he thought Mr. Wilkinson should explain to the satisfaction of the members how it was that under any circumstances he had arrived at some of the deductions therein contained. He presumed that Mr. Wilkinson had given them the table as being the results of the evidence of two experts, one for and the other against, in the case of a single gas-works; one expert saying that the capacity of the carbonizing plant was 50 per cent. in excess, while another said that it was 50 per cent. deficient. How such statements as these could have been made by two experts who considered themselves honourable men, was more than he could understand. It seemed to him that they were deliberate misstatements, if they were ever made at all; and he wished Mr. Wilkinson to tell them whether they were real records of facts. Again, one expert said the capacity of the exhausting machinery was very ample; while the expert on the other side said it was 50 per cent. deficient. The same applied to the capacity of the mains; one expert saying that it was 100 per cent. in excess, and the other that it was only just sufficient. Having had something to do with experts on Parliamentary Committees, he felt bound to say that within his small experience he had never found gentlemen varying to such an enormous extent; and he would like Mr. Wilkinson to give them some proof of the accuracy of his statements.

Mr. R. G. Shadbolt (Grantham) thought that Mr. Wilkinson was to be congratulated on the courage he had displayed in bringing forward his paper, and also upon his discretion in leaving the assessment question severely alone. He presumed that these differences of opinion would arise so long as time existed; and, indeed, if it were not for them, the calling of the experts would be gone. Circumstances were so various, that it was impossible for two experts to arrive at exactly the same conclusion. The great divergences of opinion which existed in many cases were, he thought, to be accounted for by the point of view taken by the respective experts—no doubt conscientiously. One point he would like to touch upon was as to the costs in which the companies were mulcted from time to time. This was a matter which was well worth bringing out. It did seem a hardship that two concerns, one provided with large means and the other with small, should be mulcted in costs to an equal extent; and if some arrangement could be arrived at by which the loser of the case—assuming it

to be the larger undertaking—should bear part of these costs, it would not be such a hardship. There was no wonder that small undertakings contemplated going for further powers with a great amount of dread, having in view the possibility that, after severe cross-examination and riddling, they might find themselves burdened with overwhelmingly heavy costs; and he considered this was a point which the writer had done well to bring forward.

Mr. W. R. CHESTER (Nottingham) thought that one reason why Mr. Wilkinson had arrived at such extraordinary conclusions was that he had not followed the cases sufficiently closely to discover the explanations which came out in cross-examination. Otherwise he would have seen that it was perfectly understandable how there might be a difference of 50 per cent. excess and 50 per cent. deficiency. In some of the figures which Mr. Wilkinson had quoted, he thought he could identify the individuality of certain gentlemen; and when he perceived how the difference was arrived at, he said, and he thought they would all agree, that there was a reasonable cause for the difference. Take, for instance, the exhauster plant to which Alderman Miles had just referred, and which one expert declared to be ample and the other expert stated to be 50 per cent. deficient. In that particular case, which he could identify, the difference was as between a single exhauster and a duplicate exhauster. A great many of them would like to have a duplicate exhauster, but were forced to carry on their work with one; and the difference (which looked absurd at first sight) was merely one of opinion as to whether a duplicate exhauster was or was not an absolute necessity. In purchasing works, they would give more for those which had a duplicate exhauster than for those which had only one which was being worked to its full capacity. He fancied Mr. Wilkinson must have mixed up a number of different cases, because as a rule, in an arbitration, an accountant was appointed to take out the figures as they actually stood; and there could be no disagreement as regarded facts. If 9000 cubic feet had been produced at a gas-works, he was sure that there was no expert who would come forward and say that an imaginary 10,000 cubic feet had been produced. The same with regard to the number of gallons of tar. No expert would say that the tar produced per ton was 9 gallons, if it was actually 12 gallons, or that the amount of sulphate of ammonia produced per ton was 20 lbs., when the actual figure was 30 lbs. These were facts that could be verified from the accounts of the company, and admitted practically of no variation. It was not perhaps such an easy matter to arrive at the difference in apparatus. For instance, one individual might think the capacity of the purifiers, taking a certain basis and a certain kind of coal, was sufficient for the purpose; while another expert would deal with the purifiers on the basis of another kind of coal. Hence they got such a difference as was represented in the table by "considerably in excess," and "13 per cent. in excess." One expert perhaps knowing more accurately than the other the kind of coals used, it might be that the figure of 13 per cent. was the more accurate of the two. This was a subject which might be made to afford a great deal of amusement at the expense of the experts; but he thought Mr. Wilkinson's attitude arose from not following the facts of the case right through from beginning to end, and from his detaching a portion of the facts from their context. When Mr. Wilkinson had had more experience in the transfer of gas-works and of parliamentary proceedings, he would no doubt not be inclined to write an amusing but inaccurate paper such as this.

Mr. WILKINSON, in reply, said that the gentlemen who had taken part in the discussion might be classified in two divisions—experts and non-experts. He would reply to the experts first of all. The President, Mr. Valon, and Mr. Chester had all taken exception to the figures; but he noticed that, though they went into figures with regard to the plant, they had carefully left alone the £ *s. d.*

Mr. VALON wished to say that he had gone into no figures at all.

The PRESIDENT said neither had he. He had simply dealt with the number of years' purchase.

Mr. WILKINSON observed that none of the speakers had been able to explain why one expert in a case should say that a concern was worth £55,000, while the expert on the other side in the self-same case should say that the undertaking was only worth £22,000. There was a most serious difference there; and it represented somebody's money. Whatever had been said, nothing had been put forward as to how these differences in opinion did arise. No doubt experts gave their evidence honestly, under the circumstances in which they were compelled to give it at present. The expert said to himself: "I must do my best for my client," and that was perfectly right. But, in his opinion, it was possible for experts to formulate a better way of arriving at a reasonable decision. In the case in point, the difference was practically split by the arbitrator; but it was simply ridiculous that in such a valuation experts should differ in opinion to the extent of something like £30,000. In reply to the question whether all these instances related to one and the same case, he would say that the differences were the differences of two or more experts engaged in the same case—that was to say, one gentleman said the value of the works was £55,000, while the other said it was only £22,900. It was the same throughout with all the plant.

Mr. CHESTER remarked that the figures in the table must apply to more than one case, as there was no single instance which would embrace them all.

Mr. WILKINSON said he had not taken one expert's opinion as to the exhausting power, and then gone to another works and taken his opinion there.

Mr. CHESTER said the figures must have been detached, as there was no cohesion between them.

Mr. WILKINSON observed, with reference to the remarks of Mr. Leather, that he did not know whether or not the tribunal could be improved. As to the accuracy of the balance-sheet, he agreed that it was quite possible for some small error to creep in; but it should not admit of a difference of opinion to the extent of 75 per cent.

The PRESIDENT said he would like to make one correction of the paper. He knew where these figures had been obtained from exactly; and he thought others did, too. The comparison of 5d. per 1000 cubic feet of gas made for repairs with 9d. was an error. The two experts agreed upon the figure of 5d.; but one of the Counsel threw over his own witness, and claimed 9d.

Mr. CHESTER: And said that consistency was "a damnable heresy."

Mr. WILKINSON remarked that the President was on the wrong case altogether.

NAPHTHALENE FROM RETORT TO POINT OF DEPOSITION.

By WILLIAM YOUNG, of Peebles.

The reason why naphthalene gives such a large amount of trouble and annoyance during the manufacture and distribution of gas is that, as you are aware, at all ordinary temperatures it passes directly from the state of vapour diffused through the gas to that of a crystalline solid. It does this just in the same way that water vapour diffused through gas or air is deposited as crystalline ice or hoar frost, at all temperatures below the freezing point of water.

The difficulties which arise from the deposition of naphthalene are further accentuated by the naphthalene being deposited in fine thin laminated or feathery crystals. This form of deposit enables a very small weight of naphthalene to occupy a large space; and further, in consequence of their lightness, when these feathery crystals do not become fixed to the walls of the large mains and vessels, they are liable to be drifted or blown forward in the current of moving gas until they become entangled in the narrower passages of the service-pipes.

While these properties of the naphthalene are well known as explaining the nature of naphthalene troubles, it is not so well known and recognized that the same cause—the direct assumption of the crystalline form from the vapour, and *vice versâ*—to a very considerable extent accounts for the naphthalene vapour being present in the gas, so as to produce the trouble referred to.

To get a clear conception of how such results are brought about, it is necessary briefly to consider certain conditions which prevail, and some of the physical and chemical forces brought into play during the processes of condensation, purification, storage, and distribution.

One ton of ordinary gas coal, when carbonized at the high temperatures employed in modern gas-works, will produce approximately from 10,000 to 11,000 cubic feet of permanent gas, accompanied by from 120 to 130 lbs. of condensable hydrocarbon vapours, together with variable quantities of water vapour, ammonia, &c. These products

leave the retort and enter the stand-pipes accompanied by a considerable quantity of flocculent carbon.

The Opposing Forces During Condensation.—The separation and allocation of these products, between the gas and the tars, commence immediately on the products of distillation leaving the retorts. The forces which come into play so as to effect the separation are those of the respective vapour-tensions, the mutual solubilities, chemical affinities, &c.

The hydrocarbon vapours are all more or less soluble in the liquids which result from condensation, just as the ammonia is highly soluble in the condensed water vapour. The great bulk of the hydrocarbons produced have so low a vapour-tension that they cannot remain in the gas in a state of diffusion, but are precipitated as liquids; and these liquids, carrying down with them the flocculent carbon which accompanies the products of distillation, appear as liquid tars. These liquid tars, having a large solvent affinity for the other and smaller portions of such hydrocarbon vapours as have higher vapour-tensions, tend to take them up in solution and to absorb them out of the gas. But these portions have, on the other hand, a strong tendency to remain in diffusion throughout the bulk of the gas. Just in the same way, ammonia gas (which from its high vapour tension tends to remain diffused through the gas) is nevertheless partially absorbed by the condensed ammonia water.

These opposing forces of solution and diffusion depend for their relative values upon the temperature at the time of contact between the condensed liquids and the gases which hold the vapours in diffusion; for, as the temperature falls, the solubility of the vapours in the condensed liquids increases; while the powers of the vapours to remain in diffusion, simultaneously decrease.

These opposing forces also depend for their relative values upon the relative constitutions and proportions of the lower tensioned liquids and the higher tensioned vapours; or, to put this in another way, while the vapours may all be more or less soluble in the condensed liquids, still the vapour of some particular hydrocarbon may be present in such proportion as to be able to saturate the combined liquids. The result of this is that after this saturation has taken place, the force of diffusion is left unaffected by that of solution. Naphthalene, as will be afterwards explained, occupies such a position as this.

The power of condensed water vapour to take up the ammonia and acid gases in solution is subject to the same forces.

Modifications in Condensation.—By modifying the process of condensation, the action of these forces upon the gas and products may, within certain limits, be modified in such a way as to bring about small differences in the allocation of the condensable products between the gas and the liquid tars.

If the 10,000 to 11,000 cubic feet of gas, with the accompanying products obtained from the carbonizing of a ton of coal, be passed through a form of condenser which allows of the whole being cooled to atmospheric temperature while the tars and the gas remain in intimate contact, the liquid tars will exercise their full solvent affinity for the more volatile vapours, and will dissolve the maximum quantities of those vapours that they are capable of absorbing out of the given gas, as against the tendency of these vapours to remain in diffusion. In a similar manner, the condensed water vapour will take up in solution the maximum quantity of ammonia, acid gases, &c., which it is capable of absorbing out of the gas, as against the tendency of these vapours to remain in the gas in question. Under such conditions, the forces of solution would reach their practical maximum, and the forces of diffusion their practical minimum. On the whole, the condensed tars and water would leave the terminal of the condenser holding in solution the maximum weight of vapours they were capable of absorbing out of the given gas; and, on the other hand, the gas would hold in diffusion a proportionally less quantity of diffusible vapours. In fact, the result would be a balance between the forces of solution and diffusion, as regards the whole bulk of the gas and condensable products at the temperature of the terminal of the condensers.

If, on the other hand, the gas and condensable products were passed through a condensing arrangement in which the liquid tars and water were fractionally separated and removed from contact with the gas and vapours as the condensing and cooling process progressed, then the major part of the liquid tars and water would be precipitated and removed from contact with the gas and the remaining diffused vapours, at comparatively high temperatures. At these comparatively high temperatures, the solvent affinities of the liquid tars and water for the higher tensioned vapours are comparatively small, and the vapour tensions of the more volatile vapours are comparatively great. Under these conditions, the tars and water passing from the condenser will contain only such quantities of the more volatile vapours as they have been capable of absorbing from the gas at the temperatures at which they were last in contact with the gas; and in the long run the gas will pass from the terminal of the condensers holding in diffusion a proportionately larger quantity of the higher tensioned hydrocarbon vapours, and of ammonia, &c.

If the condensing process were still further modified by employing such a form of condenser that the fractionally condensed and precipitated liquids were made to flow backwards against the forward current of warm gas and vapours, the solvent power of the tars and water would become still further reduced, and the power of the gases to hold the higher tensioned vapours in diffusion would be correspondingly increased. The portions of the tars and the water deposited in the forward and cooler portions of the condensers, on flowing backwards and meeting the forward flow of the gases, would become hotter; and their solvent power for any vapours they might have absorbed would be correspondingly reduced. The result of this would be that a portion of the vapours dissolved in the condensate would be revolatilized into the warm gas, to be again carried forward to the cooler portions of the condenser, where their less volatile components would be recondensed; but the more volatile vapours would remain diffused through the gas, and be carried forward by it. Through conducting the condensation in this manner, not only would the gases and accompanying vapours from the coal be subjected to a fractional condensation, but the condensed liquids would be subjected to a partial fractional distillation. The more volatile vapours would be continuously driven forward to the cooler end of the condenser; and as the gas would come last into contact with a more volatile portion of the condensate, isolated from the solvent influence of the denser portions of the condensate, the balance of the forces of solution and diffusion would now be that between the more volatile and feebly solvent liquid deposited in the terminal of the condenser, and the gas left comparatively free to take up and retain in diffusion the more volatile vapours that are present.

Such, briefly stated, are the actions of the forces which theory, based upon natural laws, would indicate as those affecting the process of condensation.

Modifications in Products.—If these views be sound, it follows that, by modifying the methods of condensation of the gas and the accompanying condensable products, the relative proportions of the more volatile hydrocarbons may be modified in their distribution or allocation between the condensed solvent liquid tars and water on the one hand and the gas on the other, as these respectively leave the condensers. This distribution would, however, be largely dependent upon the composition of the condensable vapours; and at best it could only be stated as one of degree. In practice it would be almost impossible so to conduct the process of condensation as to get the conditions necessary to secure a perfect fractionation, and to prevent the solvent affinity of the liquid tars from dissolving out of the gas some of the hydrocarbon vapours which the gas could otherwise have held permanently in diffusion, at all ordinary temperatures. Neither would it be any more possible to carry on the process of condensation so as to prevent the gas which passes from the terminal of the condenser from holding in diffusion the vapour of hydrocarbons, which it could not hold permanently in diffusion at the temperatures to which it is afterwards liable to be subjected; and these are, under those circumstances, subsequently deposited.

Distillation of Tars.—When the 10,000 to 11,000 cubic feet of gas, with the 120 lbs. or so of hydrocarbon vapour obtained by the carbonization of a ton of coal, are subjected to condensation in any of the ordinary condensing arrangements, and by existing methods as applied in modern works, there are obtained approximately 120 lbs. of liquid tars. These tars hold in mechanical suspension from 25 to 30 lbs. of flocculent sooty carbon, and when

subjected to careful fractional distillation, from 2 to 3 lbs. of naphtha distil over before crystalline naphthalene makes its appearance. Thereafter the immediately succeeding portions of the distillate are so rich in naphthalene as to be quite solid on cooling, and these portions would choke up the condenser, unless it were kept hot. On the major part of the naphthalene distilling over, the distillate again becomes liquid; and it remains so until anthracene makes its appearance, whereupon the distillate again becomes pasty on cooling.

Constituents of Tars.—It is unnecessary for our purpose to go into the analysis of the tars further than to say that it shows that the 2 to 3 lbs. of distillate coming over before the naphthalene, and therefore having a higher vapour tension than that substance, are mainly composed of benzole and its higher homologues, with small quantities of other hydrocarbons, and that the hydrocarbons present in the tar and liquid at ordinary temperatures, with vapour tensions similar to that of naphthalene, are very small in quantity. This explains why naphthalene passing over, unaccompanied by solvent liquids, would choke up the condenser of the still unless this were kept sufficiently warm.

The quantity of naphthalene present in the tars from a ton of coal amounts approximately to from 12 to 14 lbs.; and in the tars naphthalene is far and away the most abundant individual hydrocarbon present. The quantity in question is more than the liquid hydrocarbons present in the tars could themselves hold in solution; and naphthalene is only prevented from separating out of the tar in a crystalline form by the presence of the sooty carbon and other substances with which it is associated.

Gas Treated with Dead Oils.—If the dead oils—that is, the oils which have tensions only equal to, or lower than, that of naphthalene, and from which the benzole homologues and other hydrocarbons, together with the naphthalene, have been removed by fractional distillation and filtration—are brought into contact with the gas as it leaves the terminal of the condenser, these denser oils at once re-assert their solvent power for the hydrocarbon vapours that have been left in diffusion, and dissolve them out of the gas. In the same manner ammoniacal water, if denuded of the dissolved ammonia by distillation, and then cooled and again brought into contact with the gas, will re-assert its solvent power, and will dissolve out the ammonia diffused through the gas; and just as it is possible, by fractionally applying the denuded ammonia water to the gas, to absorb the last traces of ammonia, so is it possible, by means of the dead oils, to absorb every trace of the volatile hydrocarbon vapours out of the gas. On heating in a still the denser oils that have been thus employed to dissolve the hydrocarbon vapours out of the gas, the solvent power of these denser oils is overcome; and the absorbed hydrocarbons have their vapour tensions raised and distil over. An analysis of the distillate thus obtained shows that the 10,000 to 11,000 cubic feet of gas leaving the condenser hold in diffusion approximately from 20 to 24 lbs. of hydrocarbon vapours, which have a constitution identically the same as that of the more volatile portions of the distillate of the tar. The more volatile benzol is present in quantities approximately from 16 to 18 lbs., with from 2 to 6 lbs. of the higher homologues of benzol, together with small quantities of other hydrocarbons, including from 0·10 to 0·14 lb. of naphthalene. It may be desirable at this point to explain that the 20 lbs. or so of hydrocarbon vapours in the gas is not nearly all that it could take up in diffusion.

Solvent Power and Diffusion.—Through ascertaining, by the distillation of the tar, the quantity of the volatile hydrocarbons it holds, we obtain a measure of the solvent power of the liquid tars—their power to dissolve out of the gas those volatile vapours which would otherwise tend to diffuse through the gas. And through absorption of the diffused vapours out of the gas, by means of the dead oils, we get a measure of the quantity of volatile hydrocarbon vapours that can be held in diffusion through the gases, as against the solvent power of the liquid tars.

Crystallization of Naphthalene.—There is one other force that it is necessary to take into consideration—that is, the force of crystallization, so far as it affects the process of condensation. All the hydrocarbons which are present in tars, and which are liquid at ordinary temperature, are soluble, or at least miscible, in each other in all proportions; and remain equally diffused through each other when mixed. With the hydrocarbon naphthalene, the state of matters is very different. It is only soluble in the liquid hydrocarbons in certain definite proportions at given temperatures. Whenever the conditions are such that the naphthalene is present in quantities greater than can be held in solution in the liquids, the excess, by the force of crystallization, is, or tends to become, separated as pure crystalline naphthalene.

Another characteristic of naphthalene is that, on assuming the crystalline state, it loses its solvent affinity for the hydrocarbon vapours present in the gas. Illuminating coal gas can be passed through a mass of crystalline naphthalene without suffering loss in illuminating power. On the other hand, all liquid hydrocarbons, such as have a vapour tension similar to that of naphthalene—even the liquid oils that have been distilled along with the naphthalene and have been separated from it by cold and filtration—when brought into contact with the gas at once absorb the illuminating hydrocarbons.

Although naphthalene in the crystalline form has no solvent affinity for the other hydrocarbon vapours in the gas, yet if naphthalene vapours are present in the gas to supersaturation, any crystals of naphthalene previously deposited form a nucleus on which the naphthalene vapours are preferably deposited, in the solid state; and, on the other hand, any crystals of naphthalene tend to pass directly from the solid state to the state of vapour into a gas not saturated with naphthalene, when such gas is brought into contact with them. Possessed of these facts, we are now in a position better to understand the conditions which obtain in the different methods of condensation.

Condensation and Distillation Compared.—The process of condensing the gas and products coming from the retorts is, in a sense, practically the reverse of the process of distillation of the tars. In the process of distillation, the tars are placed in a still and gradually heated. The vapour tensions of the different hydrocarbons are thus successively raised, until they become equal to that of the atmosphere. Those with the higher vapour tensions distil over first, and are followed successively by those of lower vapour tensions, as heat is imparted to raise their tensions successively to that of the atmosphere. The vapours are all successively evaporated in the presence, and from the surface, of the liquid tars remaining in the still.

In the process of condensation, the whole of the condensable hydrocarbons leave the retorts in the form of vapour; and by the withdrawal of the heat from the vapours, their tensions are reduced until they fall below that of the atmosphere. Then they pass into the liquid condition; the vapour with the lowest tension condensing first, followed by those of higher and higher tensions, as more and more heat is withdrawn. In this process, the vapours are all successively condensed from, and in presence of, the vapours which still remain uncondensed.

The only essential difference between these reverse processes is that, in the case of condensation, the condensable hydrocarbon vapours leaving the retort are accompanied by the permanent gas; and, as a consequence, the tension of the gas, or the tendency of the gas to hold the vapours in diffusion, is added to that of the hydrocarbon vapours, for which reason the temperature at which the vapours condense in the presence of the permanent gas is so much lowered that the more volatile vapours which, if pure, would be condensed to the liquid state at ordinary temperatures, are, by the added tension of the gas, held in diffusion.

In the process of distilling the tars, on the other hand, as we have already seen, the benzol and its homologues, together with other hydrocarbons of high vapour tensions, distil over first. Thereafter the crystalline naphthalene makes its appearance in such quantities, and accompanied by so small a quantity of other hydrocarbons that are liquid, that it crystallizes, and would choke up the still condenser unless the temperature were kept high; and, after the bulk of the naphthalene has distilled over, the distillate again becomes liquid till the anthracene appears, when it again becomes pasty on cooling.

Theoretical and Practical Results.—Now, seeing that the process of condensation is the reverse of that of distillation, it would naturally follow that in the process of condensation the reverse sequence of conditions should obtain. We might accordingly expect the pasty hydrocarbons to be first precipitated, carrying with them the sooty carbon.

Thereafter the comparatively liquid tars, followed by the deposition of crystalline naphthalene; and finally the precipitation of any excess of the more volatile benzol, its homologues, and other hydrocarbons of high tensions beyond the amounts which the permanent gas could hold in diffusion.

Such undoubtedly would be the sequence of precipitations of the vapours out of the gas, provided that conditions could be realized such as would bring about a sufficiently perfect fractional cooling, and the precipitation and continuous removal of the condensate. In practice, however, it is impossible to realize such ideal conditions, either during the distillation of hydrocarbon liquids, or in their condensation. This is because the solvent fluids in the still retain small quantities of hydrocarbon vapours that would distil over were it not for the solvent power of the liquid; and, again, because the more volatile vapours in the still take up in diffusion dense vapours which would otherwise remain liquid. The same considerations affect the process of condensation; but, of course, in a reverse manner. Hence the impossibility of effecting the separation of liquids which have different vapour tensions by a single distillation or condensation. Besides, there is in the condensation of coal gas and its products the further difficulty that, when hot gas holding vapours in diffusion is more or less suddenly cooled, the vapours on passing into the liquid state are liable to do so in an extremely fine state of division. The more quickly the cooling is effected, the finer is this state of division; and if at the same time that the gas is suddenly cooled it is driven forward at a high velocity, these finely-divided liquid particles are apt to be carried forward in the current of gas through long distances.

Attempts to Solve the Problem.—These facts have been fully recognized, and many different arrangements of condensing plant have been devised in order to overcome the objectionable conditions, such as carrying mains of large area round the walls of the retort-house, so that the warm gas might be slowly cooled in the warm house while it travelled slowly, in order to allow the floating condensed liquids to coalesce and precipitate out of the gas, before final cooling in the condenser to the temperature of the atmosphere.

There have been many other arrangements, with some of which the author was connected more than twenty years ago, by which not only were the products slowly fractionally cooled, but the condensed liquid products precipitated out of the gas were themselves made to travel against the current of warm gas and products; and in some cases the liquid tars were even warmed up, not only by the gas, but by heat from other sources, and were thus subjected to a fractional distilling process, as well as to a fractional condensing process.

Such arrangements of condensing plant undoubtedly presented advantages, more particularly where cannel coal was used, or even where common coal was used at lower temperatures than is now the practice, and when naphthalene was not an abundant product. The advantages, however, are questionable, under modern conditions, in which the coal is carbonized at such high temperatures as greatly to alter the constitution of the tars, and to cause naphthalene to be present in such excessive quantities.

Practical Experiences.—Some time ago, the author was consulted by an eminent gas engineer connected with a large provincial town in England, who had been experiencing grave troubles from naphthalene deposits. He had visited a great many other works, where coal was being used of the same or a similar class to that used in his own works. Some of these works had had troubles like his own; while others were comparatively free from naphthalene difficulties. He observed—and the author was particularly struck with his faculty of observation—that in the works where condensation was carried out on what was universally believed to be the best principle (that of slowly cooling the gas and removing the liquid tars as they were precipitated), it was found that there the troubles from naphthalene were greatest. On the other hand, in those works where the gases and condensable products were suddenly cooled, and no attempt was made to fractionally condense the gas and separate the tars as they were formed, the troubles from naphthalene deposits were least.

Explanation of the Results.—Applying the facts and theories which we have been considering to these conditions, the explanation of those results is simple. In the works provided with condensing arrangements for slow fractional cooling of the gas and vapours, and for removal of the liquid tars from contact with the gas as soon as they are precipitated, the best practicable conditions are provided for restricting the solvent affinity of the tars, and for allowing the more volatile vapours to be carried forward in the gas. Now what are those vapours? We have seen that the most volatile hydrocarbon vapours present in the gas as it leaves the retort are benzol and its homologues, with small quantities of other hydrocarbons; that the quantity of these accompanying the gas is not nearly sufficient to saturate the large volume of gas; that the hydrocarbon presenting the next highest tension is naphthalene; and that this hydrocarbon is present in very large quantities. It is evident that the naphthalene will be the hydrocarbon carried forward in large quantities to the cooler end of the condenser; and as the quantities of vapours having tensions similar to that of naphthalene are extremely small, the naphthalene will pass directly from the state of vapour into that of a solid, and will be deposited on the walls of the condenser in the crystalline form. That such is the result is fully borne out by practical experience; the choking up of the terminal end of the condenser with crystalline naphthalene being a common experience.

In the Condenser.—As the quantity of hydrocarbon vapours which have tensions higher than that of naphthalene is never sufficient to saturate the gas, it is evident that under such conditions the gas coming last into contact with any naphthalene crystals deposited on the walls of the condenser will leave the condenser practically saturated with naphthalene vapours, at the temperature of the terminal of the condenser. This is necessarily so; for in whatever way the temperature may vary, naphthalene crystals will be presented to, and brought into contact with, the gas as it leaves the condenser. Should the temperature be very low, a further quantity of naphthalene will be added to the crystals. Should, on the other hand, the temperature rise, a portion of the previously deposited naphthalene would be sublimed or volatilized with the gas. Had the naphthalene condensed as a liquid, such conditions could not have prevailed, because it would have flowed out of the condenser as it was precipitated, and away to the tar well.

The zone, so to speak, or the portion or region of the condenser in which the naphthalene will be thus deposited and re-volatilized into the gas, will vary with changes of the atmospheric temperature, variations in the makes of gas, &c. As the atmospheric temperature falls, or the make decreases, the zone will retreat towards the inlet end of the condenser; and, *vice versâ*, on a rise of temperature, or an increased make of gas, the zone will be driven forward nearer the terminal cold end of the condenser, and might even, under exceptional circumstances, such as sun's rays falling upon the terminal end of the condenser, be driven forward out of the condenser altogether, into the other portions of the plant.

The same conditions which would lead to variations in the position of the zone of naphthalene deposition in the condensers would have a like effect in altering the zone of deposition of the liquid tars; and it is conceivable, indeed very probable, that an advancing zone of depositing liquid tars may be, under certain conditions, driven forward at such a rate as to overtake the advance of the zone of naphthalene. Under such circumstances, the naphthalene, instead of re-volatilizing into the gas, would be to a large extent dissolved by the tars, and carried away out of the condenser by them; and there is little doubt that such conditions are being constantly brought about in every-day practice, otherwise the condensers would choke up much more quickly than they do.

Mr. Carpenter has devised an ingenious arrangement for condensing, by which the zone of depositing tars can be made to overlap the naphthalene zone at will, by alternately reversing the current of gas and products, and thus making each terminal of the condenser alternately the inlet and the outlet. During the period of the overlapping of the tar and naphthalene zones, a part, and no doubt the major part, of the naphthalene is dissolved by the liquid tars, and passes away in solution along with these; but a small portion of the naphthalene is sublimed or volatilized, and carried forward in the current of gas. A part of this portion might be carried right through the condenser into the scrubber.

In those works which were provided with condensing arrangements, in which the gas was suddenly cooled, the

tar vapours would be reduced to the liquid condition, but in such an extremely fine state of division that they would keep floating forward in the current of gas; and long before the major part of them was removed by coalescence, by friction on the walls of the pipes, or by impact on the bends, they would be so reduced in temperature that the bulk of the naphthalene vapours in the gas would be absorbed and dissolved. Then, further, the presence of the remaining more finely divided tars would so interfere with the forces of crystallization as to prevent the naphthalene being deposited in the crystalline form; and consequently the naphthalene would be removed from the condenser along with the tars, instead of being deposited as crystals on the walls of the pipes of the condenser. No doubt the gas would pass from the condenser still polluted with small quantities of tar particles and still containing naphthalene vapours in diffusion; but the tar particles would be removed in the washer and scrubber. The naphthalene left in diffusion through the gas would be smaller in quantity, and not liable to violent fluctuations. Such fluctuations do result, on the other hand, from the conditions presented in the fractional method of condensation. Under that method, we have crystals of naphthalene continuously presented to the gas during considerable changes of temperature at the terminal of the condenser, or at the point of last contact.

There is also no doubt that, under the method of sudden cooling, the conditions of contact between the liquid tar particles and the gas, which resulted in the solution of the naphthalene, would further enable the tars to dissolve out of the gas some of the benzole and other vapours that would otherwise have remained permanently diffused through it. From a series of experiments made many years ago, the quantity of those higher tensioned vapours so absorbed was, however, found to be extremely small; and this absorption did not reduce the illuminating power, under ordinary temperature conditions, to any very appreciable extent. The reason for so small a loss is that, when coal is carbonized at a high temperature, the quantity of those hydrocarbons which have a higher tension than naphthalene falls so very far short of what would be necessary in order to saturate the gas, that the absorption of a very small quantity of these more volatile hydrocarbons is sufficient to establish a balance between the solvent power of the tars and the power of the large volume of gas to hold the rest of the more volatile hydrocarbon vapours in diffusion.

It is unnecessary, for our present purposes, to discuss those two methods of condensation, as applied to the condensation of the gas and products from ordinary gas coals carbonized at high temperatures, further than to say that both theory, founded upon the action of natural laws, and practical experience, would point to a modification of both as being what is desirable—viz., to get the liquid tars precipitated out of the gas, and yet not to remove the tars and gas from contact with one another, but to keep the tars and gas in intimate contact until both are comparatively cold.

In the Washers and Scrubbers.—We have seen how the crystalline naphthalene is, under certain conditions, driven forward right through the condenser into the succeeding parts of the manufacturing plant. The washers and scrubbers, the next part of the plant, after passing the exhauster, are seldom covered in; and, being exposed, they are subject to considerable variations of temperature. When the temperature in the washers and scrubbers was low, the naphthalene driven forward into them would be partially deposited upon the surface of the moving liquids. The naphthalene crystals deposited under such conditions would be extremely small; and the small quantity of liquid tars present would be also in part entangled in the washing water. In this way, a part of the naphthalene passing forward out of the condensers would be removed along with the washer water; but, besides that, another part of the naphthalene would be deposited in the form of large crystals in the empty spaces, in the pipe connections, and upon solid surfaces. This deposit of crystalline naphthalene would remain there till there was a rise in temperature, say through increased warmth of the atmosphere, or in consequence of the direct action of the sun's rays; and then these deposited crystals of naphthalene would begin to be re-volatilized and carried forward into the purifiers.

In the Purifiers.—The purifiers are generally covered in, and, not being exposed, are not subject to such violent changes of temperature from external causes; but they are subject to great changes of temperature from the chemical action which takes place within them. The temperature of the purifying material in that purifier through which the gas enters the series of purifiers is always warmer than the temperature of the atmosphere; its temperature having been raised by the previous chemical action, the absorption of the acid gases from the coal gas. The naphthalene-charged gas, upon entering the series of purifiers, will not be reduced but rather raised in temperature; and, therefore, there will be no naphthalene deposited at this point.

The purifying material, when charged into the last purifier of the series, is necessarily of the same temperature as the air. In order to ensure that the gas will not pass the purifiers and yet contain traces of impurities, the last purifier is charged sooner than is absolutely necessary; and the gas must pass through it for some time before chemical action begins. The warmer naphthalene-charged gas, on coming into contact with this newly-charged purifying material, is necessarily reduced in temperature. As a consequence of this, a part of its naphthalene vapour is deposited on the surface of the cold material, as also upon the cold purifier walls, covers, &c. This cooling of the gas, and deposition of naphthalene, continues until the current of warm gas, and possibly the advance of the zone of purification and chemical action, sufficiently raise the temperature of the purifying material. Thereupon the deposition of the naphthalene stops, and the reverse action begins. From this stage, the naphthalene which is present in the gas that enters the purifier passes on; and what was previously deposited during the cool period is now being re-volatilized by the heat of the chemical action taking place within the purifier. A small quantity of the naphthalene may be left upon the surface of the purifying material and removed with it; but the great bulk of the naphthalene leaving the scrubber is more or less subjected to this alternating action.

The result of this alternating action in the purifiers is that, during the cold period, when the purifier has been newly charged, the gas traversing the last purifier of the series will have the naphthalene vapours present in the gas reduced in quantity; and what remains will only have a vapour tension equal to that of the cold purifying material. Therefore, should the gas passing from the purifier during that period be subsequently raised in temperature, if brought in contact with naphthalene, it could, and would, take it up in diffusion, in quantities corresponding to the rise in temperature. On the other hand, during the hot stage, the gas would pass from the purifier more and more highly charged with naphthalene as the temperature rose; and if it was subsequently lowered in temperature, it would deposit naphthalene.

In some correspondence which appeared in the "JOURNAL OF GAS LIGHTING" some years ago, Mr. A. F. Browne furnished conclusive evidence that such was the actual condition which obtained in practical working. Mr. Browne explained that, at the Old Kent Road Gas-Works, it had been customary for several years to watch, through glass windows, the outlet-main at the station meter; that thermometers inserted in these mains close to the glass windows showed the average temperatures in that main to be 4° higher than at the inlet to the purifiers; that in these mains naphthalene in the crystalline form was observed to be deposited, and to go on increasing for a time, and that it subsequently diminished, and even disappeared with great rapidity; that this rapid re-volatilization took place immediately on charging the last purifier with fresh material; and that, after a time, naphthalene again began to be deposited, and continued to be so till the purifier was again charged with fresh material. This proved that the gas was alternately under and supersaturated with naphthalene, even at a temperature 4° above that of the gas entering the purifier; and that those alternating conditions of the gas were due to the changes of temperature which took place at the different stages of purification.

It will be noted that, although the naphthalene crystals were alternately deposited and re-volatilized, there was yet no permanent accumulation of naphthalene in the meter outlet-main. This showed that a main having a mean temperature above that to which the gas has been previously exposed will not get choked with naphthalene so long as the alternations of temperature are confined to short periods of time.

At the Holder.—The gas leaving the meter passes on to the gasholder, and on its way it has to pass the inlet to the gasholder, which is deeply buried on the outside of the tank; and the gas has then to pass up through the mass of water inside. While thus situated at a depth, the gas is not liable to violent fluctuations of temperature; but for a great part of the year the mean temperature to which the gas is exposed at this stage is below the mean of the fluctuating temperatures to which it has been previously exposed during its condensation and purification. The result, as is well known, is that the gas during that period of the year deposits more naphthalene than is re-volatilized; and the main becomes gradually choked up with the excess, even although the pipe be of considerable diameter.

In this gasholder, during the period of storage, and in the distributing plant above ground, the gas continues to be exposed to rapid changes of temperature, similar to those in the condensing plant. The underground mains, although not subject to such sudden changes, are yet subject to slower changes of temperature, which play an important part in producing troubles from naphthalene deposits.

We have all observed and admired the beautiful crystals of water deposited upon our room windows after a severe night's frost. These crystals are derived from the moisture diffused through the warm air in the room, on its coming in contact with the cold panes of glass. The tension of the water vapour being thus rapidly reduced, the moisture passes from the state of vapour to that of a crystalline solid, assuming those beautiful feathery forms we so much admire. If there were a supply of moist air entering the room, while the cold air, denuded of its moisture, passed away, the continued supply of moisture-laden air would deposit its vapours upon the surface of the cold existing crystals, thus adding to their beauty and volume. On a rise of temperature, due, let us say, to the fires being lighted, or to the sun's rays striking the windows, the previously deposited moisture will ultimately evaporate into the warm air and pass away in the air currents.

In a gasholder containing gas holding naphthalene and other vapours in diffusion, a very similar set of conditions would prevail. On a frosty night, the plates of the gasholder would play the part of the cold windows, only more perfectly so, on account of their greater surface and their better conducting power; and if we could only see the inside of these plates after such a night, we would find them, like the window panes, coated with a beautiful deposit of crystals. These crystals would, however, not be pure water crystals, but would be associated with crystals of naphthalene; and if the temperature were extremely low, even some of the other vapours of those hydrocarbons which have higher tensions than naphthalene would be condensed to the liquid state. These hydrocarbon liquids would, in that case, condense upon the crystals, and would dissolve a portion of the naphthalene, which would flow down with them and collect on the surface of the water in the tank. If the temperature were low, but not below that of the freezing point of water, then the water vapour would pass out of the gas as a liquid, and flow down into the tank; while the naphthalene would still, owing to its high melting point, be deposited on the cold plates as a crystalline solid. Then, in the event of a current of naphthalene-charged gas passing into the holder, the naphthalene vapour which it contains would go to add to the crystals already deposited.

In the Mains.—The gas leaving the holder during this low temperature period would, to a large extent, be denuded of naphthalene vapours; and as it would not in all probability be exposed on its further course to any temperature lower than that to which it had been subjected in the holder, it would give no trouble during distribution, unless subjected to certain conditions which will be subsequently considered. If, however, after a longer or shorter period of low temperature, the temperature should rise (say) during a bright sunshiny day, the naphthalene and other hydrocarbon vapours previously deposited in the holder would be re-volatilized into the gas; and the gas would pass into the distributing mains more or less highly charged with naphthalene vapour, to an extent dependent upon the temperature at the holder. The gas thus charged with naphthalene would be very liable to give trouble, as whenever its temperature was reduced below that to which it was exposed in the holder, it would deposit naphthalene crystals.

Where these crystals would be deposited, and whether they would give trouble or not, would depend upon a number of conditions; but the main factor would be the mean temperature of the buried mains, and the fluctuating atmospheric temperature dependent upon the season of the year. If, in the first place, the mean temperature of the buried mains was below the mean of the fluctuating surface atmospheric temperature at the holder, then the excess of naphthalene vapours carried forward from the holder by the gas during the short periods of high surface temperature would be mainly deposited in the large trunk mains fairly near the works, and would not be so liable to give trouble. On the other hand, during other periods of the year, when the mean temperature of the buried mains was above the mean surface atmospheric temperatures at the holders, the excess would not be deposited in the mains, but would pass on with the gas. Not only would that be the case, but the naphthalene crystals deposited in the mains when the temperature was below the mean of the surface temperature would now be re-volatilized into the gas. The gas thus left loaded with naphthalene, on reaching the comparatively shallow small mains and exposed services, subject, as these are, to fluctuating surface temperatures, but on the whole colder than the mains, would deposit the excess of naphthalene there in fine feathery crystals, and choke them up, thus giving rise to no end of trouble.

The former set of conditions we find after the mean surface temperatures begin to rise during the late spring and early summer, at which period the mean temperature of the earth at the depth of the mains is below the average mean temperature of the atmosphere. The latter conditions prevail in the autumn and early winter, after the summer heat has warmed the earth to the depth of the mains, and when the average mean surface temperature of the atmosphere falls below that of the buried mains. The troubles from naphthalene deposits during the continuance of the latter conditions are accentuated by the great and rapid fluctuations of temperature which frequently take place in the late autumn and early winter. During such periods, the troubles from naphthalene are often excessive.

General Conclusions.—There are many minor causes leading to troubles with naphthalene, such as the precipitation of the naphthalene as extremely fine crystals, and the drifting forward of these in the current of gas, &c.; but it would take more time than is at our disposal, and, besides, it is not necessary for our present purpose, further to consider these. Sufficient has been said to show the important part which the crystalline condition of the naphthalene plays in producing the troubles experienced from the presence of naphthalene vapours in the gas, and also to explain what has been regarded as the eccentricity of the behaviour of naphthalene, and to show that these apparent eccentricities are in perfect harmony with well-known physical laws. The naphthalene which is the source of trouble may not have been produced at the works immediately before it makes itself manifest in the distant distributing plant, but may have been produced at the works weeks or even months before; and it may, during the interval, have been travelling forward by a series of successive crystalline depositions from and evaporations into the gas, till it reaches the place where it is finally deposited, and occasions trouble by choking up the branch mains or service pipes.

The Remedies.—The question naturally arises, what are the remedies for these troubles? The answer is that they are of two kinds. The first consists in removal of the naphthalene vapour from the gas, or, at least, in removing such a quantity of those vapours as would prevent them from being deposited during the subsequent distribution of the gas. The second consists in adding to the gas something that will prevent the naphthalene vapours present in the gas from being deposited in the crystalline form. The solution of these problems is to be found in a further application of those forces which we have just been considering.

We remove the ammonia left diffused through the gas, beyond what can be absorbed by the water condensed from the gas in the condensers, by a further quantity of the same solvent water. That further quantity of water may be a part of the ammoniacal liquor obtained from the condenser, after the ammonia has been separated from it by distillation.

In the dense oils as obtained by the distillation of the condenser tars, and freed from naphthalene, we have an

excellent solvent for naphthalene, as well as for the other hydrocarbons diffused through the gas. If, however, the benzol and other high tension vapours obtained from the distillation of the tars are returned to the dense oil, the solvent power of the dense oil for the benzol and other high tensioned vapours present in the gas is balanced, and the solvent power of the oil is thus restricted to dissolving out the naphthalene. It is, therefore, evident that if the dense oil thus prepared was applied to the naphthalene-charged gas after the fashion of the prepared ammoniacal liquor or solvent water in the case of the ammonia, the naphthalene vapour could be as perfectly removed from the gas as it was possible to remove the ammonia by water; and that just as the ammonia absorbed from the gas could be separated by the distillation of the water, so also could the naphthalene be similarly separated by the distillation of the dead oil.

The second remedy, or rather preventative, is to evaporate into the naphthalene-charged gas such a quantity of liquid hydrocarbon vapours having vapour tensions approximately the same as that of naphthalene, that when the temperature of the gas falls so low as to cause the vapour of the naphthalene to be precipitated, there will simultaneously be condensed such a quantity of the vapours of these liquid hydrocarbons as will take up the precipitated naphthalene in solution.

The hydrocarbons for both objects may be obtained from any convenient source. A ready means of obtaining a supply of hydrocarbon liquid for either or both purposes, where other sources of supply are not available, is to carbonize a portion of the gas coal at such a low temperature as will produce liquid tars comparatively free from naphthalene but rich in vapours having vapour tensions similar to that of naphthalene. The naphthalene-charged gas, as it leaves the ordinary condenser, when mixed with the hot gas and products from the coal carbonized at the lower temperature, has the major part of the naphthalene vapours dissolved out by the liquid tars as these are precipitated; while, at the same time, the gas takes up in diffusion the vapours of hydrocarbons which have tensions approximating to that of naphthalene. These are present in large quantities in the low temperature products; and, during the distribution of the gas so treated, they prevent any naphthalene which may remain from being deposited in the crystalline form, for these vapours condense along with it, and take it up in solution.

When it is desired not only to remove the naphthalene from the gases produced from coal carbonized at high temperatures, but also to raise the illuminating power, that object can be most conveniently—and, with 90 per cent. benzol at its present price, very economically—effected by adding to the dense oils, used to remove naphthalene, more benzol than is necessary to balance their solvent power for the benzol present in the gas. The excess quantity volatilizing into the gas would raise the illuminating power; and, by regulating the quantity of benzol so added, the desired illuminating power can be maintained with great regularity.

Where cannel coal is available at a reasonable price, the same objects may be obtained, even more economically, by carbonizing the cannel at lower temperatures than that employed for the gas coals. The cannel coal carbonized at the lower temperature yields liquid products which have a very high solvent power for naphthalene; and it also yields a large volume of hydrocarbon vapour, which can be taken up in diffusion through the gas, and which possesses an enriching value of nearly twice that which can be obtained from the same cannel carbonized at higher temperatures along with the ordinary gas coals.

Discussion.

The PRESIDENT, in opening the discussion, said he did not intend to make any remarks upon the paper, as there were so many gentlemen present who had had great experience of this elusive compound.

Mr. J. P. LEATHER (Burnley), on being called on by the President, said he had not much to add to what he said last, and to what was given in the paper. There was nothing in the paper but what he entirely agreed with. His further experience confirmed the opinion of Mr. Young that it was possible to take the naphthalene thoroughly out of the gas, without deterioration of the gas, and without incurring any great cost; and, of course, if the naphthalene was taken out, it could not give trouble afterwards.

Mr. J. W. MORRISON (Sheffield) said it was pretty well known that at Sheffield they had been very seriously troubled with naphthalene. There were three works. At the Grimesthorpe station, they had been practically free since the works were started, and remained free up to the present. There they had settings of ten retorts in each bed; and they ran at pretty high heats to carbonize the coal, which consisted of slack and small nuts. With these conditions, anyone would expect to find a very large quantity of naphthalene in the gas. The foul mains on these works were originally intended for a production of 5 million cubic feet; but at present they were not making more than 2½ million cubic feet. He had recently had occasion to open a Clapham washer which had become temporarily blocked; and after turning steam into it for a few days, the first purifier they opened was found to contain very heavy crystals of naphthalene. This had not been noticed before or since. There had been no complaint in the district; and it puzzled him to find the naphthalene there. At another works, which supplied rather a hilly district, they had been very much troubled formerly; and he was sorry to say the complaints had started again this year. They had generally found that the worst trouble was in the higher districts, in cold clay ground, and where the mains ran to a dead-end. Where they had been able to couple them round, they had in many cases been able to get rid of recurring complaints. He had also had experiments conducted by passing gas containing naphthalene through the lighter tars taken from the foul mains and the condensers; and so far the results had been very satisfactory. He was at present collecting the tars, with the idea that if the naphthalene difficulty should again crop up, they would be able to wash the gas in the lighter tars; and they had found by experiment that, by keeping the tars at a temperature just over 90°, they could remove the naphthalene without robbing the gas of any illuminating power.

The PRESIDENT expressed surprise that there should be such unanimity on this question of naphthalene, upon which he had understood there had hitherto not been much agreement. There seemed to be no difference of opinion that it could be cured; and this was a great blessing for gas producers. It would be a mercy for one or two of his own clients who had been growling about it very considerably, and who had not yet been able to cure it. After hearing the paper, he would doubtless be able to advise that the removal of naphthalene was as easy as getting the ammonia out of the gas. They were indebted to Mr. Glover for having read Mr. Young's paper.

Mr. GLOVER said he did not think it necessary to add anything to what had been contributed in the paper. Mr. Leather's further experience confirmed the experience he related twelve months ago, and Mr. Morrison also confirmed the method of removing naphthalene from coal gas, by washing the gas in the lighter tars, which were, of course, excellent solvents of naphthalene. He was sure that, if Mr. Morrison would carry out this process on the lines put forward by Mr. Young, he would eventually find a complete cure for naphthalene at all his works.

The Behaviour of Acetylene towards Hypochlorites.—On account of the contradictory statements which have been promulgated with regard to the behaviour of acetylene towards hypochlorites, of which some—notably chloride of lime—have been suggested as purifying agents for that gas, experiments have been made by Mr. J. W. Blagden, with a view to elucidate the matter. The account of the researches appears in "Acetylen in Wissenschaft und Industrie." The author is referred to as of Darmstadt; but our readers will recognize him as the son of Mr. Blagden, of the Gaslight and Coke Company. On leaving Cambridge a few years ago, he went to Germany to pursue his chemical studies. In the work of which we now have the report, he used carefully purified acetylene, and both chloride of lime and sodium hypochlorite. When the acetylene was passed through an alkaline solution of the sodium salt, it was found to be contaminated with chlorine; and, on titrating the solution before and after the passage of the gas through it, it was found that the amount of hypochlorite in the solution had been considerably diminished by the action of the passing acetylene. A solution of chloride of lime, however, under similar conditions, scarcely showed any change. Even smaller still was the extent of the action when solid chloride of lime was used. In fact, it was within the limits of error of the estimation of the chloride of lime. This point is of great importance with regard to the purification of acetylene with chloride of lime or mixtures containing it, as it demonstrates that no interaction is to be feared in such cases. Clearly, however, sodium hypochlorite cannot be used to purify acetylene.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1739.)

The condition of the Stock Markets in general continues in the same unsatisfactory state. They seem quite unable to throw off the listless semi-inanimate mood which has persistently oppressed them for some little time past. Certainly, events in China are looking serious. But they scarcely constitute a sufficient reason for so much depression by themselves; and there is no other factor in sight to exercise any downward pressure. The public are doing nothing; and day after day quiet ruled through the past week. There was a slightly better feeling about the middle of it. But it soon fell away; and in view of the Exchange being closed on Saturday, everything settled down to its old quietude. Prices are lower pretty well all through the list, from Consols downwards. The Money Market remained for some days very easy; but towards the close there was a better demand. With the Stock Exchange settlement this week, and the requirements at the end of the half year, rates are likely to keep up for another week. Business in the Gas Market was just as limited as in any other department, and was not marked with any noticeable characteristic. Movements, too, were for the most part slight and irregular. In Gaslights, there was a fall in the ordinary stock in response to the Directors' announcement of a rise of 6d. in the price of gas—a rise which reduces the authorized rate of dividend for the second half year by 12s. per cent. In consequence, the ordinary stock again fell to a discount, and was marked at 99 on Friday. The secured issues were not affected. Very little business was marked in South Metropolitan; and the buying price was lowered. Commercials were in good favour; and the old stock advanced five points. We understand the Company have just made a successful issue of further capital at a premium; the stock offered being over applied for. Hardly a transaction was marked in the Suburban and Provincial group; and quotations did not vary. The Continental Companies were quite as inactive as the rest; and, beyond some changes in Imperial which terminated in lowering the buying price, nothing moved. The undertakings in remoter parts of the earth made no sign. Business in Water resumed its usual quiet appearance. But firmness was well maintained; and two or three quotations advanced.

The daily operations were: On the opening day, there was a marked absence of business in Gas; and the tendency was in the direction of easier figures. Gaslight ordinary and South Metropolitan receded 1 each. In Water, Grand Junction rose 1. On Tuesday, a few dealings in Gaslights saved the department from absolute inanition. The only change was a fall of 1 in Imperial Continental. Wednesday was quite the counterpart of Tuesday, without any change at all. In Water, Southwark ordinary rose 2½. On Thursday there were a few more transactions, and Commercial old moved up 5. But Gaslight ordinary receded 1. Friday was quite the most active day of the week; but all quotations closed unchanged.

ELECTRIC LIGHTING MEMORANDA.

The Lancashire Electric Power Scheme—Electric Power Transmission Generally—Two Much "Wild Cat"—Alderman Higginbottom on the Cost of Electric Motors.

The House of Commons Committee on the Electric Power Bills sat again last week, taking first the part-heard case of the Lancashire Company. The opposition of the municipal boroughs and other local authorities to the scheme of the promoters is very strong. They object to a Company of traders with statutory rights coming into their midst under pretences which they do not believe have any foundation in fact. Many of these authorities have electricity supply undertakings of their own; and besides Lancashire is notoriously a hot-bed of municipalism. On the question of the merit of bulk-generation of electricity in this region, the representatives of the municipalities give a flat contradiction to the declaration of the preamble of the Bill. They allege that there would be no economical advantage in such generation, because the area is too large. Whatever might be the initial advantages of pit-head power generation, these it is argued must disappear in the subsequent transmission of the power. The cost of carrying a trunk cable from the nearest proposed generating station to Clitheroe is estimated at £45,000; and accordingly the local people scout the Company's scheme as wild, ridiculous, and absurd. The Manchester Corporation see no advantage in the Bill. Alderman Higginbottom told the Committee that the Manchester Corporation already supply electricity over an area of 45 square miles, which is quite enough to make their power generation rank as "bulky." Mr. Wordingham, also, the Corporation Electrical Engineer, stated that there is no economy to be got by generating power on a larger scale than 20,000 or 30,000 horse power. The only possible saving by the scheme contemplated by the Bill is in the carriage of coal; and this must be altogether swamped by the high cost of the mains to the area of supply. "He did not believe it was commercially possible to carry electricity long distances in this country."

This observation of Mr. Wordingham is exactly on the lines of our own judgment of this electricity-in-bulk generation craze. We have never been able to see its commercial advantages anywhere, except perhaps in a few particular examples in Switzerland, which our professional electricians are not at all fond of talking about. As for these English schemes now in Parliament, it appears to us to be just within the bounds of possibility that a well-designed power plant might answer in Durham or South Wales. The result, however, must depend entirely upon the circumstances of the transmission and distribution. It is not a question of generation at all; and Mr. Wordingham is conspicuously correct in resting the economic result of any such scheme on the question of carriage. The truth of the matter seems to be that it is the legend of the Niagara power affair which has turned the heads of certain people, and created the popular delusion that there is money, and progress, and all the rest of it in mere power generation on the largest scale for subsequent transmission electrically. It is scarcely necessary to repeat here what has so often been observed as to the expediency of receiving with the greatest caution all the claims that have been advanced for the success of the Niagara business. But even so, it is understood that power can be generated when and where English coal is cheap at a cost which compares favourably with the prime cost of electricity at Niagara. This is not the main point that has to be considered, which is, what can be done with the power after it is generated.

Such commercial success as the Niagara Company can truly claim is due to the unique circumstance that in their case the consumer has come to the source of power. When Mr. Wordingham said that electric power distribution over long distances is not practicable in this country, he might have said that it is not an economical business anywhere, unless coal is not to be had. There is no prospect of a big power scheme on the Niagara pattern—where the user goes to the power—succeeding in this country; because the proportion borne by the cost of power to the total working expenses of any ordinary industry is too small to be worth considering. One or two calcium carbide factories will serve a country; and what other industry is there in which cost of power is a preponderating consideration? It follows from such reflections as these that there must be a good deal of the "wild cat" character about most British electricity-in-bulk projects. Electricity generation in bulk will come fast enough, as regards the practical engineering of it, with the growth of the demand for electric lighting in London and a handful of large towns, and with the tentative extension of electric traction above and below ground. It is putting the cart before the horse to do the generation in bulk first and then look round for trade in it. Parliament will be very chary indeed of granting statutory facilities for occupying a district on this pretence, unless the commercial prospects of the undertakers are pretty clear.

A great deal is said from time to time on the subject of the market for electric power in towns. Continuous current suppliers are always throwing their superior advantages in this regard at the heads of the alternating current men; and the latter dare not retort in the only effective way, by declaring that there is nothing in this branch worth quarrelling over. Everywhere companies and corporations supplying electricity for general purposes make a parade of the low charge at which they sell electricity for power; but it is rarely confessed that so little is used in this way that the business is not worth catering for. Yet it must be tolerably evident to everybody that the use of electric motors on town's mains does not increase very fast. There are several good reasons for this; but one not unimportant one was disclosed to the Electrical Power Bills Committee by Alderman Higginbottom, of Manchester. Answering a question of the Chairman, this witness said that the cost of working a 10-horse engine for 10 hours a day for 5 days a week for 50 weeks in the year, would be about £130 according to the Corporation scale of charging, which is 1½d. per unit. This price is very low for electricity—probably below cost. Yet it may be remarked that a gas-engine of the same power, consuming Manchester gas at the increased price of 2s. 6d. per 1000 cubic feet, and at the rate of 25 cubic feet per horse power per hour, would only run up a gas-bill of £78 2s. 6d. for the same working year. It does not look from this comparison as if the electricians need trouble themselves over much about a general power connection where there is town's gas to be had at any price to be met with in England.

SIR H. H. FOWLER ON MUNICIPAL TRADING.

The resumption of the sittings of the Joint Committee on Municipal Trading revives the interest of Sir Henry H. Fowler's masterly address on the subject, as President of the Royal Statistical Society, which we were only able to notice cursorily on the 29th ult. This address has now been published as a pamphlet, and should be in the possession of everybody who is in any way interested in the subject. It is hardly necessary to more than allude in passing to the desirability of applying the statistical method to the available facts of this matter. The expediency of extending the functions of municipal corporations and local authorities generally to include what are commonly regarded as trading enterprises—it is easier to understand what is meant by this classification than to strictly define it—has been accepted as axiomatic by a large and influential body of persons

interested in the work and the problems of local self-government. It is a view which is held in common by men of every shade of political opinion. As usual, there are extremists in this party of municipal expansion, as well as some whose levity in making the idea a cry for electioneering purposes tends to discredit the whole principle in the minds of serious people who regard the local self-government of communities as a trust, not a game, or a field for journalistic exploitation. Probably the majority of responsible municipal politicians regard the question of municipal trading as one of expediency, determinable with reference to the conditions of every particular case. The persistent endeavours of a few extremists, however, to overrule the question of expediency by erecting the universal desirability of the principle into an axiom, or an article of belief for those who pretend to belong to the Party of Progress and Light in municipal affairs, naturally arouses opposition. The opposition is necessarily directed to the question of principle. People are led to enquire what is the axiom to which they are asked to assent, and what is the justification for the dogma which is proposed as an article of Progressive belief, to be held over and above all considerations of particular instances. If the question is susceptible of a general answer, as the partisans of the principle contend, then the answer may be either yea or nay. Any amount of barren controversy on the abstract principle might be pursued to absolutely no purpose; because every particular example would after all have to be treated on the merits.

The worst of the hasty acceptance of the so-called principle of municipal trading is that, where the facts of any particular example do not support the presumption, there is a strong temptation, for those who have the opportunity, to manipulate the record and the accounts, so as to bring them into accord with their prejudices. It is notorious that the temptation has proved irresistible in many cases. If for this reason alone, Lord Avebury, and those who think with him on this matter, are resisting the attempt to put the municipalization of public works and services—some of which are trading enterprises—upon the ground of an accepted principle; and insist upon the sounder thesis that the prior and superior functions of municipalities are those of government, regulation, and the protection of their communities.

Sir H. Fowler comes forward at this juncture with a statistical presentment of how the local authorities of England and Wales actually stand financially, which is very much to the point of the practical issue of how much farther they should be permitted to pledge the rate funds of the country for all purposes. Following Mr. Goschen's report on local taxation of 1871, Sir H. Fowler shows that at the commencement of the century, and for the first forty years of it, this taxation consisted mainly of the poor, county, church, and highway rates. This list of the sources of local revenues is eloquent of the paucity of the services rendered by the local authorities. From 1841 to 1851, the police and borough rates were added; and during the third quarter of the century, the modern era of rating was initiated. For 1898, the amount of rates levied for all public purposes was £37,605,000; and there was an outstanding debt of £262,017,000. As much of this money represents property which is more or less remunerative, or in respect of which charges other than rates are made, it will be fairer to take the whole of the receipts of the local authorities, amounting to £69,144,000, as revenue corresponding to this capital indebtedness.

Large as this capital expenditure has been, it is classified by Sir H. Fowler as necessary and beneficial. So far from regarding it as excessive, he holds that it must and ought to be largely increased in the interests of the community as a whole. The next thing to be done, in order to test the application of this observation, is to divide the outstanding local debt under the various heads of necessary and obligatory, educational and recreative, and trading capital. Sir H. Fowler gives a mass of figures relating to the reproductive enterprises of municipal corporations. Although the returns are incomplete, he finds that a capital sum of £88,152,595 is represented in these undertakings. After ascertaining all the totals of the revenue accounts, he states as the practical result that "the income produced by the existing municipal enterprises pays the working expenses, the interest and instalments of the borrowed capital, and leaves a profit balance of £370,341, or about ½ per cent. on the outstanding debt."

Well, the natural reflection is, what of it? What meaning do his statistics convey to Sir H. Fowler's mind? Without more ado, having given the figures, he proceeds to observe that "the tendency of the present day is in the direction of combination, by which the public can secure greater advantages at a cheaper rate, and in a more efficient manner, than they could secure them by private enterprise; and there are beyond question certain public needs which ought to be supplied under the control of the local authorities." The difficulty arises as to where the line should be drawn between public enterprises carried on at the public risk, and private ventures supported by individual or joint-stock resources. The first kind of public supply or service undertakings that suggest themselves as an example in point is the railway system of a country; and the inquirer is confronted with the difference between English and Indian and Colonial practice in this regard. Parliament has decided in favour of the private ownership of English railways; and Sir H. Fowler thinks that on the whole no Government Department could beat the Railway Companies in respect to efficiency, safety, and speed. In other matters, as the supply of gas and water, Parliament has been eclectic. But the time has come when the partisans of extreme views on the desirability of municipal trading are trying to force Parliament to take their side. They ask for powers to engage in "banking, pawnbroking, coal supply, saddlery, manufacture of electrical fittings, of the residual products of gas, and other branches of trade and manufacture."

They ask why not? Cannot the local authority raise capital cheaply for general purposes; and should not the community have this and any other advantage of municipal as compared with private service? This contention is fairly met by Sir H. Fowler. The issue does not turn altogether upon the cheapness of municipal loans; and, besides, municipal money is not so cheap after all when the obligation of repayment is reckoned in. And the more a municipality engages in commercial pursuits, the closer will the interest payable on its mortgages approximate to the ordinary traders' rate. Then Sir H. Fowler does not admit that all the individual interest which has been so powerful an incentive to the attainment of the industrial successes of this country can be generally dispensed with, and the same results obtained by an uninterested public board operating through officials. Public bodies are necessarily less inclined to experiment, and more afraid of the scrap heap than are private firms. Their system of audit, moreover, is not satisfactory.

Sir H. Fowler is far from making light of the objection of private traders to municipal competition. He also agrees that the general consumer is not necessarily best served by a municipalized monopoly upon which, in the usual order of things, there is no check. "The essential principle of Free Trade is that the whole body of consumers are not to be taxed for the benefit of the producers; and while we have to carefully eliminate from our commercial system everything which infringes that principle, we must not allow it to be violated for the benefit of public authorities any more than for the benefit of private traders." Manchester gas, to wit!

Lastly, Sir H. Fowler scouts the factitious clamour which pretends that the reference to the Joint Committee is an attack upon our municipal institutions. A municipal corporation is no fetish; but a means to an end. There are other agencies for doing those services to the community which are covered by the classification "municipal trading enterprises." If good and sufficient reasons exist, in places, for allowing the local authority to go into trade, some means must be found for ensuring that the original functions of the authority in regard to the particular trade—those of control and regulation in the public interest—are not neglected. Where the Lord Mayor goes behind the counter, somebody must wield the sword of Justice in his stead. As Sir H. Fowler more formally put it: "When municipal and local bodies are claiming wider powers, embracing new areas of commercial and industrial activity, questions arise not only as to the extent to which those powers should be granted, but also as to the regulations and checks by which they should be accompanied." This is a rebuke that the perfervid partisans of extreme municipalism have brought upon themselves. They must be told, if they do not realize, that there are limits to the field of municipal trading enterprise; and these boundaries are already in sight when the spirit of municipal monopolistic policy is found to be in conflict with the just interests of the ratepayers, the local tradesmen, and consumers. The true friends of municipal life and institutions, as Sir H. Fowler observes, are those who desire to see that life developed, and those institutions strengthened, on the broad basis of public benefit and of public support. They will not weaken the strength and value of municipal administration by extending it beyond its fair limits.

GAS UNDERTAKINGS AND THE SUPPLY OF ACETYLENE.

At the present time, when gas managers everywhere are striving to keep within reasonable bounds all capital expenditure, and when they are perforce obliged to look for an immediate return on all outlays and expenses, some particulars of a scheme recently suggested by the Acetylene Illuminating Company, Limited, may be of interest. As our readers are aware, the Company are manufacturers of carbide of calcium on a large scale; their experience in the matter dating back as far as August, 1894. They were the first in Europe to erect electrical furnaces for the commercial manufacture of carbide, and to introduce lighting by acetylene, which has since made such progress that it is reported that at least 100,000-horse power are now being used throughout the world for making carbide, whereas there were not 100-horse power employed when the Company started operations.

The general feature of the Company's proposal is that, in outlying portions of their districts, where an extension of coal-gas mains is at the present time impracticable, gas managers should recommend the use of acetylene plant, so as to secure a permanent source of profit, though at the same time without incurring the need for any capital expenditure. To carry out this idea, the Company announce that they are prepared to generate acetylene from central stations for the lighting of large villages, hamlets, and groups of private houses (charging by meter for the gas consumed), or to arrange detached installations for single houses, as may be most convenient. In thus extending their operations, they are wishful to act in concert with the gas supplying authority—furnishing everything for a

complete plant, however large, from the generators to the burners, and guaranteeing the apparatus to fulfil all the conditions of perfect illumination.

It will be remembered that when Professor Lewes in January, 1895, first introduced the commercial possibilities of acetylene to a Society of Arts audience, much surprise was expressed by the scientific and industrial world, as at the time it was thought that the manufacture of carbide would be a simple and cheap process, and that it would be advantageous to use acetylene for enriching coal gas. But when it came to actual working on a large scale, it was found that this was far from being the case. From that moment, the Acetylene Illuminating Company recognized that, while acetylene had a place—and a large place—by itself as an illuminant, it could not be claimed for it that it might be used for enriching, or that it would supersede, or even compete as regards cost with, coal gas, because wherever coal-gas works exist incandescent mantles could be used with greater economical advantages. In all their pamphlets and published statements, therefore, the Company have studiously avoided any exaggerated claims as to what their future might be; and their recent action has, we believe, been the first step they have taken to prove that they are now in a position to work in conjunction with gas companies in the actual supply of a portion of their districts. We understand that Professor Lewes, who has been Scientific Adviser to the Company from the outset, is still being retained in that position.

The main question, of course, for gas directors and gas committees to decide is what advantage will accrue to their undertakings from the proposed departure; and time alone can answer this. As already mentioned, however, the Acetylene Illuminating Company have, from the outset of their existence, carefully avoided all exaggerated claims; and consequently any suggestion coming from them is worthy of serious consideration.

PERSONAL.

Mr. H. Hanan has resigned the position of Gas Manager to the Youghal District Council.

Mr. E. Mason has obtained the appointment of Manager of the Walton-on-the-Naze Gas-Works.

Mr. M'Farlane, of Kilmarnock, will succeed Mr. Easson as Manager of the Maybole Gas-Works.

The successor to Mr. H. Fowler as Gas Engineer to the Lancashire and Yorkshire Railway is Mr. G. H. Roberts.

Mr. Thomas Smith, the Borough Surveyor and Gas and Water Works Engineer of Darlington, has resigned the second-named position; and Mr. E. P. Tarratt, the Works Manager, has been appointed by the Committee to full control.

Last Tuesday, the employees at the Perth Gas-Works gave expression to the good feeling which has existed between them and the retiring Gas Manager, Mr. Andrew Wilson, by presenting him with a handsome bedroom clock, accompanied by two silver candlesticks for Mrs. Wilson. The presentation was made by ex-Bailie Wright; and the gifts were suitably acknowledged by Mr. Wilson.

Mr. P. C. Holmes Hunt has been appointed by the Gas Committee of the Birmingham Corporation to the charge of their Adderley Street works, recently vacated (through ill-health) by Mr. E. L. Pryce. The eldest son of Mr. Charles Hunt, Mr. Percy Hunt was educated at Malvern College and Mason University College, Birmingham, and is a Fellow of the Institute of Chemistry. For nearly four years he was assisting his father at the Windsor Street works, and has been in actual charge of the Adderley Street works since October last.

Mr. Frank Howarth, M.Inst.C.E., has been selected by the Plymouth Water Committee for the position of Water-Works Engineer to the Corporation. Mr. Howarth, whose early training was obtained in the service of the Water-Works Engineers to the Bradford Corporation, has been since 1883 assistant to Sir Alexander Binnie, the Chief Engineer to the London County Council. In this position, he has been associated with the various investigations which have been carried on with reference to the water supply of London, including the scheme to obtain a supply from Wales. He has also been engaged in marine surveying and tidal observations in the estuary of the Thames; and altogether he has had a very extensive experience. There were 34 applicants for the post; and the selection of Mr. Howarth was unanimous. The salary is £300 per annum, rising by annual increments of £25 to £500.

Mr. E. Sandeman, who is leaving the service of the Plymouth Corporation to take up the position of Engineer to the Derwent Valley Water Board, was on Friday presented with various tokens of the esteem in which he is held at Plymouth. The presentations, which were made publicly, consisted of a silver tray and candelabra with a gold watch and bracelet for Mrs. Sandeman, subscribed for by members of the Corporation and other residents in the town; and a silver tea and coffee service the gift of the municipal officials. Several members of the Corporation spoke in eulogistic terms of Mr. Sandeman's work, and congratulated him upon his appointment. The Town Clerk, in referring to the progress of the water undertaking, said that when Mr. Sandeman came to Plymouth, ten years ago, the revenue was £13,600, whereas it was now £22,000; while the expense of the department had increased only from £4000 to £4400. Ten years ago the supply was affected by drought and frost, and in dry summers fell to as low as two or three hours a day. It was now constant and abundant even in so dry a summer as that of last year. Mr. Sandeman, in reply, said the work he had been engaged in at Plymouth was a monument of what could be done by municipalities in the direction of carrying out work under their own administration.

OBITUARY.

James Robb.

The death occurred, on the morning of Sunday, the 17th inst., at the house of his daughter (Mrs. Shaw), in Market Street, Haddington, of Mr. James Robb, who was for many years Manager of the Haddington Gas Company. Mr. Robb was the doyen of Gas Managers. He was born at Kippielaw, about a mile from Dalkeith, on Sept. 14, 1808, and was thus 92 years of age. His father had a joiner's business; and some time after the birth of his son he removed to Whitehill, where he got a feu of land from the late Duke of Buccleuch, and built a house. James Robb was educated at the village school there, and afterwards served his apprenticeship with his father as a joiner. A few years later he went to London, where he remained for some years. On his return to Scotland, he was appointed foreman over the joiners and smiths connected with the Duke of Buccleuch's colliery at Thorniebank, and so gained an extensive knowledge of coal working, which served him in good stead when in 1847 he was appointed Manager of the Haddington Gas Company, a post which he held for 41 years, and then retired with a life pension. He took a great interest in geological and antiquarian research, and wrote a considerable number of articles on antiquarian matters for various periodicals. Mr. Robb was the first to discover that valuable ironworks might be developed at Garleton, on the estate of the late Sir Thomas Buchan-Hepburn, Bart. These were leased by the Summerlee Company, and a great deal of ore was extracted. Through some dispute, however, the works were stopped; but those who were interested presented Mr. Robb with a gold watch and a purse of sovereigns, for his services. Many of his inventions were sent to the Royal Scottish Society of Arts; and for one of these—a stop cock for corrosive fluids—he received a silver medal. The model was exhibited as far back as April 24, 1848. Mr. Robb was looked upon locally as the best authority on antiquarian matters relating to the burgh and neighbourhood of Haddington. The deceased was married to Miss Waldie, of Dalkeith, who predeceased him 36 years. He is survived by two sisters and a brother, one son and three daughters. Till about a month ago, Mr. Robb was constantly walking about the town and chatting to his friends. He had an attack of influenza, which was followed by congestion of the lungs, from which he died. There was a large turnout at his funeral on Tuesday to Haddington Churchyard. Mr. Robb was President of the North British Association of Gas Managers in 1880, when that body met in Perth. He had also held the office of President of the Waverley Association of Gas Managers. His reminiscences of the early days of the gas industry were many and were most entertaining.

The recent sudden death is announced of Mr. G. Sumner, formerly Manager, and since about a year Superintendent, of the Ilford Gas-Works. He was in his 61st year.

The many friends of Mr. George R. Hislop, of Paisley, will, we are sure, unite with us in offering our condolences with him on the severe bereavement he has sustained by the death of Mrs. Hislop, which occurred at their residence, Craigielea, Paisley, early last Tuesday morning, in her 59th year. The funeral took place at Biggar on Friday.

We regret to learn of the death, on the 8th inst., of Mr. J. Steel Johnson, Assistant-Manager of the Pará (New) Gas Company. Immediately prior to leaving England, about two years since, for South America, on a three years' engagement with the Company, Mr. Johnson was with Mr. W. J. Carpenter, at the Yarmouth Gas-Works; and he had previously been employed at Beckton and as Assistant at the Gorleston and Southtown Gas-Works. Deceased, who was a young man of considerable promise, succumbed to an attack of yellow fever, at the early age of 26.

One of the most beautiful of the exhibits at the Royal Society *soirée* last Wednesday—the "ladies' night"—consisted of a series of vacuum tubes charged respectively with samples of the various new gases which Professor W. Ramsay and Dr. Travers have succeeded in separating from the atmosphere. These gases are five in number—viz., helium, neon, argon, krypton, and xenon. The apparatus employed in separating the gases from each other and from the air was also on view. The process is one of fractional distillation. A comparatively large vacuum vessel is filled with liquid air. Into this liquid dips a narrower tube sealed at the bottom, and connected at its upper end with a mercury aspirator. In this narrow tube impure argon is liquefied; and on the aspirator being operated, the more volatile impurities distil over first, and can be collected for further examination or purification.

NOTES.

Tests of the Pohle Water Raiser.

At the engineering laboratory of the Berlin Technical High School, some interesting experiments have been carried on with the object of determining the efficiency of what is now called the Pohlé system of raising liquids by air. These appliances are well styled in French *émulseurs*, because they work on the principle of creating within the well pipe a temporary emulsion of water and compressed air, which is forced up by the greater weight of the unaërated fluid outside the pipe. The discovery of this means of lifting fluids appears to date from 1797; but it has recently been perfected as a speciality by several firms, among others that of A. Borsig, of Berlin and Tegel. The pump requires a comparatively deep well; and alongside the rising pipe is fixed the air pipe, which in the Borsig pump ends at the bottom of the former in a ring, so that the air enters radially from all sides. The advantages of the system are that the so-called pump has no valves, and that it will raise sandy or muddy water, hot water, and acids. The immersion depth of the well-pipe should be about equal to the height to which the fluid is to be raised; and the ratio should not exceed 3 to 2. The proportion of air used to water lifted ranges from 1·65 to 2·5, according to the height. The speed of the upward current should not go much beyond 6 feet per second. A rising pipe 70 millimetres diameter appears to be a good working size. The compressed air water lifter has about the same efficiency as the pneumatic motor, according to the determinations of Professor Josse, who, however, expects it to become increasingly popular owing to its cheapness and simplicity.

The Prospects of Cheap Coal from Alabama.

It is stated in "Engineering" that the centre of possible American exports of coal to Europe will be the State of Alabama, and the chief port Mobile. Hitherto, the great handicap which has prevented American coals from competing for the Atlantic trade is the long distance of the important coalfields from this coast. Baltimore, Newport News, and Norfolk are comparatively favourably situated as regards the coalfields of Virginia, West Virginia, and Kentucky; yet last year the price of coals at the pits was from 3s. to 3s. 9d. per ton, while the price f.o.b. at these ports of lading was about 7s. 3d., and is now close on 12s. per ton. Alabama coal is stated to be equal to any American coal for all purposes; and in the near future there is expected to be a heavy surplus production for export. The chief deposit is in what is called the Warrior field, which has from 30 to 35 seams of coal, half being over 2½ feet thick, and six of them 4 feet thick and over. Almost every variety of coal is found here. House and gas coals abound. The Assistant State Geologist, Mr. M'Calley, speaks in the highest terms of their quality. The coalfield is traversed by the Warrior River, from which it takes its name. The cost of extracting the coal throughout the field averaged last year under 2s. 6d. per ton, including interest on capital and placing on rail. No doubt it is higher now. Colliery owners are getting 5s. 10d. per ton at the pit. At present there is only land carriage for it, which keeps it local; but the Government are making progress with rendering the Warrior River navigable to tidewater at Mobile. When this work is done (about the end of next year), it is expected that Alabama coal will be put on board at Mobile at a total working cost of 4s. per ton. Value of the coal and freight added, the total charges will still be low enough to give this product the command of a wide market.

Recent Developments in the Acetylene Industry.

In a contribution to the "Chem-Gesell." of Stockholm, M. Lundstrœm gives, as the result of a large number of analyses, the following figures for the composition of acetylene now made from commercial carbide of calcium:—

	Min.		Max.
Sulphuretted hydrogen	—	..	1·340
Phosphoretted hydrogen	0·03	..	1·700
Siliciuretted hydrogen	—	..	0·800
Arseniuretted hydrogen	—	..	0·004
Ammonia	0·06	..	2·800
Carbonic oxide	—	..	1·480
Hydrogen	0·07	..	0·270
Nitrogen	0·20	..	2·910
Oxygen	0·55	..	1·180

In the event of insufficient cooling during the preparation, the acetylene may also contain benzene vapour. In a general way, commercial carbide of calcium gives a gas containing 99·5 per cent. of acetylene and 0·5 per cent. of other gases. The oxygen and the nitrogen come from the air enveloping the pieces of carbide. The presence of hydrogen is due to the metallic calcium formed by the dissociation of the carbide at a high temperature. The raw acetylene may even contain as much as 20 per cent. of this gas. The siliciuretted hydrogen probably comes from the silica which is always present in the lime used; as for the ammonia, it comes from the nitride of magnesium. Finally, the sulphuretted hydrogen is due to sulphide of alumina, and the phosphoretted hydrogen to phosphide of lime. A large number of methods have been proposed for the purification of acetylene. Lunge and Cedercreutz recommend chloride of lime; Frank proposes acid solutions of metallic salts (ferric chloride or cupric chloride in hydrochloric solution); Ullmann uses an acid chromic solution; and Stern passes the gas through petroleum, alcohol, or benzene. In actual practice, nearly all the impurities are absorbed by the lime water, and a simple washing with water will even suffice, unless the gas contains a large quantity of phosphoretted hydrogen, in which case a more complete purification will be necessary. According to the author, Frank's method should be preferable to any other. Finally, Bunsen burners have been made by means of which acetylene can be used for heating purposes.

A Combination Power Plant.

At the present time, when the distribution of energy in the form of electricity threatens to become a fashion in engineering, it is useful to learn that even in America electric power is not regarded as suitable for all purposes. An interesting account recently appeared in the "Engineering Record" of a combination power plant (the second of the kind) established for the public supply of light, traction, and power to the famous Cripple Creek gold mining district of Colorado. The novelty of the undertaking consists in its being one of the first ventures for providing power to small users at less cost than they could develop it individually, where there are no natural advantages or coal deposits to specially favour power generation in bulk. The power-house is accordingly situated conveniently for the customers, on the side of a mountain in the middle of the mining district, and away from water courses and coal mines. It is consequently the exact converse of the Niagara class of power-in-bulk schemes. The business of the Company is the supply of electric light and power, compressed air, and water. The electricity output is by alternating current, distributed over a radius of six miles, and used chiefly for hoisting, pumping, and ore crushing in the mines. The compressed air is distributed within a radius of two miles, by ten miles of pipes; and is used for air drills, blacksmiths' forges, and ventilation. The water is pumped from a spring to the mines, chiefly for ore washing. All the towns of the district are lighted from the same works, which also operates the Cripple Creek District Railway. Coal is brought to the works by railway; and all the storing and stoking is done mechanically, on the Babcock and Wilcox system. The present output is 1000-horse power. Ingersoll-Sergeant air compressors are in use; and the mains are kept charged at 100 lbs. pressure.

Coke-Breeze Concrete Slabs.

It is reported that a new form of coke-breeze concrete, known by the trade name of "gypsine," has passed a satisfactory test at the station of the British Fire Prevention Committee. The material is a mixture of plastic hydraulic lime with coke and asbestos. For the purpose of fire testing, it was moulded into bricks; and a partition was made of these laid in hydraulic mortar—the joints being ¼ inch thick. On the side exposed to fire, the partition was coated with a thin layer of fire-clay. The area exposed to the flames was 7 ft. 9 in. by 10 ft.; and the heat was maintained for an hour. The temperature inside the test hut reached the maximum of 2050° Fahr. The partition proved impervious to the flames; and at no time during the test did the temperature of the outside surface of the partition become sufficiently high to ignite a match. While on this subject, it may be mentioned that a correspondent of the "Builder" recently urged that contractors (or gas-works) might do worse than stock for sale 2½ inch coke-breeze concrete slabs. The reason is that, owing to the length of time (not less than a month) that such concrete requires to be left to dry before flooring boards can be nailed down to it, architects are often obliged to forego its advantages for hurried work. It is accordingly suggested that the stocking of such slabs, of about the size of paving stones, would be profitable and convenient. Mr. Frank Caws, in a paper published in the "Journal of the Royal Institute of British Architects," indirectly supports the same suggestion by laying it down as essential that concrete used in building construction should remain undisturbed on the centering for six weeks. These slabs would, of course, be reinforced by expanded metal or its equivalent. For courtelages and ground floors, Mr. Caws recommends a surface coating of fine crushed granite, without sand, gauged 3 to 1. If gauged richer, the rendering is apt to show fine cracks on the surface.

Glass-Lined Water-Pipes.—In making repairs recently upon the interior of a dwelling-house in Boston (U.S.A.), the discovery was made that the water-pipes were lined with glass. The house was built some sixty years ago; and when Cochituate water was introduced into Boston, the owner of the house, with hundreds of others, became panic-stricken at the possibility of lead poisoning, and had all the pipes used in bringing city water into his house lined with glass. The experiment is said to have been unsatisfactory.

The Maintenance of Vitrified Clay Water-Mains.—We learn from the report of the City Engineer of Little Falls (N.Y.), that the vitrified clay water-pipe, which was constructed in 1886-7 at a cost of $45,544, has been very expensive to maintain. The pipe has a length of 5·63 miles, and the annual cost of its maintenance has been as follows: 1887, $962; 1888, $2103; 1889, $554; 1890, $81; 1891, $1174; 1892, $135; 1893, $492; 1894, $5790; 1895, $3888; 1896, $926; 1897, $24; and 1898, $8—making a total of about $16,187. During 1899, something like $1800 more was spent in cementing cracked lengths and in replacing 338 feet of the line with cast-iron pipe.

TECHNICAL RECORD.

WESTERN (U.S.A.) GAS ASSOCIATION.

Annual Meeting in Chicago.

The Twenty-third Annual Meeting of this Association was held at the Auditorium Hotel, Chicago, on the 16th, 17th, and 18th ult; and the President, Mr. W. M'Donald, of New Albany (N.Y.), guided the deliberations of a very successful meeting. After the Association had been officially welcomed, he delivered an Inaugural Address. In commencing, he alluded to several matters pertaining to the position of the Association. Attention was next directed to the relation of capital to output, and to the importance of an accurately kept capital account, showing the actual structural value of the plant erected, and also to the need for a system of accounts that would enable gas managers to compare the actual cost of delivering gas at the consumer's meter, under varying circumstances. The general experience was a decreased use of gas for illumination by large consumers, and a decrease in the average consumption per meter; and this would tend to increase the cost of distribution. The gigantic gas war in New York was to be ascribed, he believed, to differences of opinion as to how much capital a given output of gas would stand. During the past few years, there had swept over the country an almost insane desire to secure gas plants and finance them. While this had been profitable to the financiers, it had, in many cases, proved advantageous to all concerned; and the gas business of the country had been largely increased by combinations of capital with good business methods. But no company should have more than a reasonable amount of water in its composition; and when one syndicate after another tried its hand at the watering process, might not the mixture get thin, and had it not done so in certain cases? With a constantly increasing capital, a decreasing output per meter, and determined efforts on the part of the public to control the price of gas, the question of capital as compared with output required careful consideration. He concluded by expressing confidence in the future of gas.

Mr. Howard C. Slater, of Milwaukee (Wis.), read a paper on "Regenerative Benches." The efficiency in the use of the heat transmitted through the walls of the retort was, other things being equal, highest with the greatest difference of temperature between the inside and outside of the retort. As the escaping products of combustion could be cooled to about 500° Fahr. without interfering with the efficiency of the draught, it was easy to see that there was a considerable quantity of heat available for returning into the setting. But whether the economy thus available was counterbalanced by the extra cost of recuperators, was a matter that must be decided by local conditions. According to papers read by Mr. G. Helps and by Mr. C. C. Carpenter, in England, it would seem that little or no benefit was derived from regeneration; and that equal or better results could be obtained if the secondary air supply was heated without utilizing the heat from the waste gases. These results were due to the cheaper construction of the parts for preheating the air as compared with recuperators, and possibly to getting a higher heat, and to more even distribution in the setting. But for this, he failed to see why recuperators should not show an advantage in the fuel account. The preheating of the primary air was somewhat open to question, on account of the use of steam under the grate to keep the clinker from agglomerating. The amount of steam used should be as little as possible, consistent with producing the desired result, as excess of steam tended to lower the temperature of combustion, and prejudiced the even diffusion of heat. The specific heat of steam was higher than that of other products of combustion. Therefore the loss by way of the chimney would be more, to say nothing of the heat rendered latent in the evaporation of water into steam. He preferred a water-pan under the bars, from which steam could be evaporated, to the injection of already formed steam, because by this means the supply was automatically adjusted to requirements. If the under side of the clinker became black, less water would be evaporated; and when it was red-hot, just after pricking out, the evaporation would be more rapid. The quantity of water evaporated would be about 30 lbs. per 100 lbs. of coke used in the furnace. Attention was drawn to the effect of the varying quantities of moisture present in the atmosphere, according to the weather, which might affect the quantity of steam passed into the furnace to the extent of 12 per cent.

Discussion being invited, Mr. Odiorne referred to his experiences with half-depth furnaces, using slag or dump from the coal mines, which formerly could be had for hauling, but was now charged at 1d. per bushel. The cost of firing with coke for 24 hours was 12s. 3d.; the quantity used being 61 bushels. Firing with slag, 46 bushels were required, which cost 3s. 10d., showing 8s. 5d. saving as compared with coke. The furnace and setting had been used over two years, and therefore did not give such good results as when new. The make of gas per bed of six retorts was 42,700 cubic feet, or just over 7100 cubic feet per retort. Mr. Doty alluded to the introduction of mechanical stokers for bench-firing as a great advance, and would like some information about them. Mr. Egner thought the quantity of water evaporated was about twice as much as necessary, and that better results could be secured by reducing it. Mr. Forstall was aware that the English gas engineers had spent 15 or 20 years discussing the question, and were not yet decided whether regeneration paid or not. Theoretically, with a bench of sixes carbonizing 2000 lbs. of coal per retort per 24 hours, the effect of reducing the waste gases to 500° or so, and returning the heat so recovered to the setting, should be a saving of 400 lbs. of coke per day. From this data, it was possible to calculate how much it was worth while to spend upon regenerators. Another point not very much considered was the setting itself. The advantages of generators and recuperators might be lost by a poor setting. He knew of a case where the consumption of coke was reduced from 24 per cent. of the coke made to 19 per cent., merely by improving the setting. The best way to run regenerators was by frequent analyses of the gases; but where this was impracticable, a rough-and-ready test could be taken. Select a point close to the take-off, and commence with a short supply of air, when the blue carbonic oxide flame would be visible. Gradually and carefully increase the secondary air supply until the flame disappears; thus arriving at a point when combustion is complete without any great excess of air. He preferred a slight excess rather than a deficiency of air. Examination of the regenerator for leakages of air should be made every few days; and the average stoker could readily be taught to detect and repair such leaks. The carbonic oxide flame was not visible at a high temperature; but if it could not be observed at the take-off, for this reason there was something very wrong with the setting. Mr. W. E. Steinwedell said there were at least three things to be considered in working regenerator benches. These were the loss of draught in the bench, as shown by comparing the draught at the grate-bar inlet with that at the inlet to the chimney; the analysis of the producer gases and of the waste gases; and the consumption of coke. If these things are regularly determined, leakages into the chimney will soon be detected, and good results would be obtained. The analysis of flue gases for carbonic acid was a simple operation that could be conducted by the average retort-house foreman. Where the flue outlets ran into one large main flue, it was easy, by looking into one end, to observe the condition of things at the outlet from each furnace. Mr. Doherty agreed that the analysis of flue gases for carbonic acid, or testing for leakages, was quite within the capacity of the average workman. He was sorry to perceive an impression that the regenerator was not a source of economy. Fuel must be very cheap indeed where it could be dispensed with, without loss. By its means, the flame temperature and the yield per retort were increased. It had been stated that 500° was necessary to maintain the natural draught; but he questioned whether 300° would not be sufficient. Even at that, it might pay to adopt mechanical draught if the temperature below 300° could be utilized. The initial temperature of the air, and also the proportion of water vapour present, had a marked effect. Very different conditions prevailed in boiler firing to those in the retort-bench; and he thought that with the latter the best results were obtained with a carefully adjusted secondary air supply. The products of combustion escaped from the boiler setting at a lower temperature. He would like to see a Committee appointed to devise some simple means of testing flue gases. Mr. Norris remarked that the full economy of the whole depth regenerator was not realized unless it was kept in active work. Mr. Mitchell said that one simple test was to inject air through a small tube into the bottom flue, when the presence of unconsumed carbonic oxide would be apparent by the appearance of the blue flame at the end of the tube. He was able to adjust the air supply very closely by this method. He used a mechanical stoker, comprising a hopper and a screw at the base; the fuel being coal slack. The screw was run at 2½ revolutions per minute; and he used about a ton of fuel per 24 hours (the cost being 6s. 8d. per ton), and got as good results as were formerly obtained from the best lump coal. Mr. Somerville suggested the desirability of some experiments with artificial draught.

Mr. Slater, in replying, said that his consumption of coke was 23 per cent. of the coke made, using full depth beds with nine retorts in each. He had tried the American under-feed stoker; but it caused difficulty through accumulation of large blocks in the furnace. This was with a fuel composed of one part slag coal to two of breeze; and if a larger proportion of breeze had been used, there would have been less trouble. He did not see how the use of the mechanical stoker could affect the character of the flame; but some change in the arrangement of the primary air supply was desirable when this appliance was introduced.

Mr. Fred. H. Shelton opened a discussion on high-pressure distribution by stating that at the last meeting of the Association he read a paper on this subject, which practically propounded the question—Why not distribute gas at high pressure? Since that time, he had demonstrated that gas could be distributed at 100 or even 200 times the usual pressures, with efficiency and economy as compared with the old plan. The system had been described in a paper read at the last meeting of the New England Association, entitled "Pumping Gas Five Miles at 20 lbs. Pressure." This was done through a 3-inch wrought-iron pipe, tested up to 60 lbs., and well screwed together and coated. At the end of the pipe was a regulator that reduced the pressure to 20-10ths or 30-10ths of water at a single step; and after a little difficulty in adjusting at first, its action was absolutely perfect. He would not hesitate to leave it for a month; but a duplicate was provided in case of breakdown. From the regulator, the gas was passed into the delivery mains without any

holder intervening. No tests had been made to ascertain loss of candle power; but for all practical purposes the gas was not affected either in cold or warm weather. The pumps had given no trouble; and he had not experienced any of the troubles predicted. The system was started in December last, and proved so satisfactory that he was now going ahead largely in high-pressure distribution, and did not hesitate to connect services direct to the high-pressure pipes. Obviously it would never do to run the risk of high-pressure gas getting into an ordinary tin-case meter; but a very simple safety device, costing only 2s., was in the market, that would prevent such an occurrence. If the high pressure by any mischance got into the service, it automatically opened a relief valve connected with the exterior of the premises. Wrought iron was the only pipe available for high pressure, as he did not know of any joint that would make cast-iron pipe available; and as to durability, it was a simple matter to lay wrought-iron pipe in such a manner that it would be as durable as cast iron, as the natural gas people had proved. Cast iron might be made available by surrounding each joint with a gas-tight bandage or sleeve. As it was a new departure, he put tees with plugs at frequent intervals; but as a matter of fact, it was only necessary to attach drip-boxes to the first 3000 feet, as no condensation was found beyond the first 1000 cubic feet. Mr. Highlands said that, having found the consumption increasing beyond the capacity of the mains, and that in October last the pressure frequently fell as low as one inch at the centre of the district, he had tried the plan of increasing the initial outlet pressure at the works with the aid of a high-speed blower. The largest holder only gave 3 inches; but by this means he secured 7 to 8 inches. The system had been in operation for six months, and was a great success. It doubled the capacity of the mains, increased the output 25 per cent. without increasing the leakage, and had relieved him of the necessity for enlarging the mains. Mr. Doherty went with Mr. Shelton to some extent; but could not entirely accept the high-pressure system as a solution of distributing difficulties. He still feared depreciation of illuminating power; and a very important factor in regard to this was the increased velocity of gas in the pipes, which, so far as he knew, had not been considered. He believed in a combined system of high and low pressures, and that at high pressures the delivery was greater than would be indicated by the accepted formula. Mr. Evans had delivered gas to a holder nearly five miles distant through an 8-inch pipe, under an initial pressure of 10 lbs., passing nearly 70,000 cubic feet of gas per hour. This was water gas; and there was some deposition of hydrocarbons—about ¼ barrel of oil being pumped out of the holder-drips daily. Mr. Forstall understood Mr. Shelton to claim that high pressure distribution was economical; but there was no evidence, in the way of photometrical tests, as to the gas at the far end. Mr. Britton had worked a high-pressure pipe line, 8 miles long, for the last ten years. The average pressure was 5 lbs. There was no appreciable loss by leakage, or of illuminating power, as proved by photometrical tests. Mr. D. M'Donald spoke of the durability of wrought-iron pipe laid in clay; but, of course, it would corrode in alkaline soils. He also said it was less liable to be injured by electrolysis, as there was not the break in resistance at each joint that was a feature of cast-iron pipe.

Mr. W. H. Barthold, of Grand Rapids (Mich.), read a paper on "Temperatures in Condensation," illustrated by a chart prepared from the daily records at his own works, on which was also marked the time occupied by the gas in travelling from point to point as calculated on a make of 580,000 cubic feet per day. During the cold months, exhaust steam was admitted at the inlet of the purifiers to supply moisture and heat to the oxide. At a point on the standpipe 10 feet from the retort, the average temperature is 412°, and the time 2 seconds after leaving the retort. At the hydraulic outlet, after 18 seconds' travel, the average is 171°. He found that at this temperature hydraulic main tar exercised no solvent action on 14½-candle gas. But when the temperature was lowered to 110°, the gas lost 1½ candle power. At the inlet of the exhauster the temperature fell to 122°, and there was a steady fall in passing the condensers to 74°. A rise of a few degrees was observed in passing the scrubbers; and when steam was used at the purifier inlet, the temperature rose to 114°, falling steadily to 72° at the outlet of the purifiers. The whole journey to the purifier outlet occupied 10 minutes, of which three-fourths of a minute was spent between the retort and the exhauster, two minutes in the condensers, a similar period in the scrubbers, and the rest in the purifiers. Anti-dip valves were used; and the tar was drawn off from the foul main at frequent intervals, as he believed that prolonged contact of gas with the tar at that point was objectionable. At the inlet of No. 1 condenser, the temperature being 114°, a gallon of naphtha (specific gravity 740) to every 10,000 or 12,000 cubic cubic feet of gas was admitted. All this was vaporized; but if any excess was observed at the next drip, the quantity was diminished. The naphtha was capable of dissolving a little over half its weight of naphthalene, which condensed in the last condenser. He did not object to encourage the precipitation of naphthalene at this point by the use of cold water, because if it went on further, it gave trouble. In the winter, with a make of 630,000 cubic feet per day, he would get a barrel of naphtha saturated with naphthalene in a week; and there was no appreciable loss of candle power. In concluding, he questioned whether sufficient time was allowed for the condensing operations, and enlarged on the necessity for systematic reading of temperatures throughout, as without this there could not be uniform working.

Mr. Eysenbach opened the discussion by emphasizing the importance of a close watch over the temperature records; and advised that every drip should be so arranged as to show the flow of liquid from it. By watching this, it was possible to gauge the working closely. Mr. Highland said that his temperatures were similar to those quoted, except in the stand pipes, where they averaged 700° to 950°. As he believed that trouble from pitch did not arise below 550°, he would like to know how the author got down to 412°. Mr. Norris imagined that water gas was less likely to be injured by low temperatures or sudden changes than coal gas. He would also like to know the proportion of tar deposited at various parts. Out of a make of (say) 12 gallons per ton, what proportion came from the hydraulic, what from the Pelouze and Audouin condenser, and so on. Mr. Thwing referred to some experiments he had made at St. Louis, in conjunction with Mr. Chollar, on the rate of cooling or loss of temperature in the water-tube condenser, by means of thermometers fixed at intervals one foot apart. In the course of 20 feet run, he found the temperature of the gas was reduced from 140° to about 70°. The condenser had a rated capacity of two millions; and he passed on an average 67,500 cubic feet of gas per hour. Thirty gallons of water were sufficient to cool 1000 cubic feet of gas; and he figured roughly that the water took up 15,000 to 16,000 heat units per 1000 cubic feet of gas. His experiments showed that the colder the water, and the more rapid the circulation, the greater the efficiency. Although he had only one condenser, he was never troubled with naphthalene; and he believed it was removed and carried away by the tar in the condenser. The water entered at 68°, and left at 135°; and he noticed that theoretically it did not absorb half the heat carried into the condenser by the gas. The remainder might be accounted for by heat rendered latent in the act of liquefaction, and by radiation from the outside shell of the condenser. The liquids that drained off from the condenser had entered it as vapours. There was a certain excess of naphthalene that must be deposited somewhere; and he believed the best place was the condenser, where it would give no trouble. Mr. Chollar remarked that the experiments showed that the ordinary construction of water-tube condenser had too large an area for the water, and that with a quicker flow better results would follow. At another works, he had found that practically all the work was done in one-third of the condenser just below the middle, so a better form would be a smaller apparatus with fewer water tubes. The apparatus he used was 9 feet diameter, and had 600 2-inch tubes; so the water was several hours travelling through, while the gas went through in a few minutes. At another works, he obtained excellent results by using the same water over and over again, cooling it with an air blast. He could thus regulate the temperature at the water inlet, instead of having it vary with the climate. Mr. Forstall agreed that the construction of condensers was wrong. There was no better way of spoiling the candle power of the gas than by taking it to the top of a condenser 20 to 30 feet high, and letting it descend; cooling it down 50° to 60° in the course of its travel. According to Mr. Chollar, it might drop 60° in 7 feet or 8 feet, which was fairly rapid chilling. The author had shown that tar below 170° would take out nearly 2-candle power; and if the products of condensation descended to the cold end of the condenser with the gas, they would take out illuminants that would otherwise stay in. The tall tower condensers were cheap; but he believed in the horizontal condenser, with the water running up and down alternately through different sets of tubes.

Mr. Barthold, in replying, said that he used no special means to reduce the temperature of the gas in his standpipes. Although 700° to 800° in the mouthpiece, it came down to 412° after travelling through only 10 feet of pipe. He took out 2·6 gallons of tar in the hydraulic; and the remainder (he made 13 gallons per ton of coal carbonized) was dealt with by the Pelouze and Audouin condenser.

(*To be continued.*)

The Committee on Patent Office Reform.—"The Times" understands that the Committee, of which Mr. Hopwood is Chairman, appointed by the Board of Trade to consider the various suggestions for developing the benefits afforded by the Patent Office to inventors, have presented their report, which has been laid on the table of the House of Commons, and will be published in the course of a few days. The Committee recommend that classified illustrated abridgments of all specifications from 1617 to 1883 should be made, and the work completed by the end of 1906; that volumes of collected abridgments for each of a limited number of leading subjects of invention should be placed in the Patent Office as an experiment; that no action should be taken as regards the issue of reminders for payments of patent renewal fees; that authority should be given to the Comptroller-General to reprint specifications of expired patents for which there is a demand; that a system of deposit accounts for Patent Office publications should be experimentally adopted; that the annual allowance for the purchase of books and for binding for the Patent Office library should be increased for the next three years; and that a special sum should be allowed for the purchase of books already selected, but which cannot be supplied for want of funds.

BRITISH ASSOCIATION OF WATER-WORKS ENGINEERS.

The Fifth Annual General Meeting of this Association was held at Cardiff last week—the proceedings commencing on Tuesday morning with a reception in the Town Hall by the Mayor (Mr. S. A. Brain, J.P.). Considering the distance and awkwardness of the railway journey for many of the members, there was a very fair attendance, though some faces one has become accustomed to see at the meetings were missing. However, several local gentlemen, and a few of the members' friends, supplemented the number; and by the time they met in the Council Chamber, at the desire of the Mayor, there was a very respectable assembly.

His Worship's Reception.

The Mayor, who was heartily greeted, said it gave him great pleasure to welcome the Association to the town; and he hoped the reception the members would get would come up to their expectations. Cardiff was always prepared to welcome and entertain members of the great Associations of the country. Meetings of this description, where opportunities were afforded for the interchange of ideas, were bound to result beneficially to the community. Water engineers had contributed much to the health and happiness of the people; and the decided diminution of the death-rate, though assisted by more sanitary dwellings and improved conditions of living among the working classes, was in great measure due to the liberal supply of pure water. So far as Cardiff was concerned, its people owed a deep debt of gratitude to those whose foresight, enterprise, and skill had arranged their great water-works undertaking, which, he was proud to say, gave Cardiff an ample supply of water not bettered in any town in the country. He hoped their visitors would go away with the idea that, although Cardiffians practically existed on coal, and the neighbourhood was rich in the mining industry, they were still a very intelligent and a very civilized people, and that they were only too anxious to extend to such Associations as the Water-Works Engineers the hospitality which was their due.

Mr. William Watts (Sheffield), the retiring President, heartily thanked the Mayor for his official recognition of the Association.

The Business Meetings.

The members then adjourned to the South Wales Institute of Engineers, where the business meetings were held. Mr. Watts presided during the transaction of the formal business.

The minutes of the last meeting having been presented by the Secretary (Mr. Percy Griffith), and confirmed by the members,

Mr. Watts, in a few complimentary terms, introduced his successor in the chair, Mr. C. H. Priestley, Assoc.M.Inst.C.E., the Water Engineer to the Cardiff Corporation.

The President, who was greeted very cordially, paid a tribute to the able manner in which Mr. Watts had discharged his duties, and moved that the best thanks of the members be accorded to him.

Mr. William Matthews (Southampton) seconded the motion, which was carried by acclamation.

The President then proceeded to deliver his

INAUGURAL ADDRESS.

The address commenced in the orthodox manner—with the President's expression of thanks for his election. A hope that the Association would increase in usefulness and numbers lead to the remark that young societies such as this have generally much uphill work during the first years of existence; and therefore it is the duty of all members to do their utmost to aid the Council by every means in their power. However, there is fairly good reason for congratulation, seeing that the roll now numbers 220, although it is not five years since the preliminary meeting was held at Nottingham, at which it was decided to form the Association. A paragraph was devoted to some thoughts on the value to engineers of visits to works in course of construction; and in this regard, by the way, the fortunate situation of the President had enabled him to draw up a splendid programme for the present meeting.

A review of the progress made in the water supply of the country followed; and some historical information was given. Coming down to the construction of the extensive and varied works which have occupied the attention of many of our leading engineers during the last half century, the President gave prominence to the names of Thomas Hawksley and Frederick Bateman, who, he remarked, may be said to have been foremost among the engineers who have carried out the many large schemes of water supply which have been constructed since 1850, and who may, perhaps, be looked upon as the pioneers of water engineering as now understood in this country, more especially with regard to the gravitation supplies. The extensive works which the Glasgow, Liverpool, Manchester, and Birmingham Corporations have constructed or have in progress were mentioned. Besides these, most important and extensive schemes have been carried out during the past fifty years by nearly every large town and many of the smaller municipalities and villages throughout the country; the capital expenditure on municipal water-works alone now standing at the enormous total of £48,434,000 sterling, in addition to upwards of £5,000,000 of borrowed capital paid off. It may be interesting to note that out of 64 county boroughs in England and Wales, the water supply is under public control in all but 19; and of the remaining 141 boroughs, other than county boroughs, 139 have municipal supplies. About half the urban districts, too, are supplied with municipal water. These particulars, the President observed, are not given as in any way reflecting upon the water companies, who have done good work in the past in many places, and are still doing so in many others, but as showing how the municipalities and district councils generally have within recent years been alive to the provision of suitable water for the populations under their care. No doubt much more remains to be done, especially in the smaller towns, villages, and sparsely populated districts; but personally the President has no fear but that the time is not far distant when everyone in this country will have that most excellent of all good things—a supply of pure water sufficient for all ordinary requirements.

The succeeding portion of the address presented a general sketch of the scheme of Sir Alexander Binnie for supplying London with water from Wales, which scheme, if ever carried out, would be the most gigantic water undertaking in the country. Pursuing this subject, the President said: I believe that, when the necessity for the supply does come, as it undoubtedly will some day, if London goes on increasing in population as it has done for many years past, it will be rather to the advantage of Wales than otherwise, always assuming that due regard is given to the requirements of the districts from which the water is drawn, and that they are fairly and liberally dealt with. There is no doubt that at the present time very large quantities of water (sufficient to supply an enormous population) simply run to waste; and I see no reason why this water should not be profitably used either in London or elsewhere so long as it is not needed or likely to be needed in the district where it falls. But here I should like to point out that in the Bills which have been promoted before Parliament by the London County Council, there has been no adequate provision for the districts from which it was proposed to draw the water. Section 21 of the last Bill provided for compensation water to the several rivers amounting in the aggregate to over 60 million gallons per 24 hours. Section 24, which dealt with the supply of water to the county councils and other authorities, was as follows: "It shall be lawful for the Council on the one hand, and any county council, urban or rural district council, highway or other local authority, and any corporation body or persons within the counties mentioned in this Act on the other hand, to enter into and carry into effect contracts for the supply of water in bulk or otherwise." From a careful reading of this section, it will be seen that no provision whatever is made by the Bill for the compulsory supply of any district from which water is taken by the intended works, or through which such works will be constructed. The question of supply is entirely optional with the County Council and any other body. If any district requires a supply of water, the County Council would not be bound as to the price to be charged for it. In all future Acts of Parliament authorizing the abstraction of water from the districts situate at long distances from places where the water is to be used, I would make it compulsory upon the undertakers that proper provision should be made for supplying the district in the watershed, which has a prior right to the water from the works or mains at a reasonable price, to be fixed by arbitration, failing agreement.

The increased use of water for all purposes makes it more difficult to meet the needs of our growing populations; and the President has no doubt it is the experience of water engineers and managers throughout the kingdom that what was considered an ample domestic supply 20 or 25 years ago is now quite insufficient to meet modern requirements. The introduction of a variety of new purposes (public and private) for which water is required has helped to make the total consumption per head of the population very much greater than it was a few years ago; but it is often difficult to convince water committees, directors, and consumers generally that this is the case. The use of water for trade purposes purely is also much greater than formerly; but as this is generally measured by meter, the increase can be more easily accounted for. In stating this, the President assured his auditors that he was not advocating that restrictions should be placed on the legitimate use of water in any of the above ways, believing as he does that the health and happiness of the people, especially those living in large centres of population, is increased thereby.

Speaking next of hydraulic power, the President remarked that during the last few years there has been a demand, especially in the larger towns, for high-pressure water to be supplied for many purposes in connection with business premises, public buildings, churches, hotels, &c. This branch of water supply will, no doubt, in his opinion, be largely developed in the future, especially so where a number of consumers can be found within a reasonable area. Even in domestic life, if water power can be supplied at a cheap rate, considerable saving in time and labour may be brought about; and for small works and industries that require power during perhaps a few hours of the day only, water motors driven from the hydraulic mains should prove very useful and economical.

In connection with the provision of water to the larger towns of the country, it has often occurred to the President whether a duplicate supply might not in many cases be more economical.

Much of the water, as previously mentioned, is used for purposes which do not require it to be absolutely pure, such as should be always supplied for drinking and dietetic use. He believes there are duplicate supplies to some extent in one or two towns in the North of England. Where a number of trades and manufactories are near together, they are supplied from what is called a trade main, the water in which is not filtered; and there must be many towns situate near to rivers from which water could be easily drawn, and also near to gathering-grounds or other sources that do not perhaps give off water suitable for drinking, but which could be advantageously used for trade and municipal purposes. This water could probably often be supplied at a profit to the undertakers for a much less price than water derived from long distances where costly works had to be constructed, or that had been treated by filtration to purify it. The great objection is, of course, the duplication of the water-mains throughout the streets, and the first cost of laying the second set of pipes from which the trade and municipal supply would have to be drawn. But even with this expenditure, he feels convinced that in many towns it might be cheaper than going long distances for a supply, in addition, perhaps, to the cost of increased filter-beds, &c. Another great advantage would be that the gathering-grounds from which the best water could be drawn would be longer preserved, and might be available for districts where it was more urgently required.

The next question to which attention was called was that of standard patterns in connection with the use and manufacture of cast-iron pipes. It is, said the President, no doubt well known to the members that cast-iron pipes manufactured in America have been and are being used in Great Britain, even in Glasgow, one of the chief centres of the pipe industry of the kingdom. It may not be so well known that these American manufacturers will in no case, he believes, conform to the specifications and drawings of the English engineers, but will only supply pipes made to their own patterns—guaranteeing, of course, that they will stand any required pressure and submitting the same to an inspector, who may, if thought desirable, be appointed in England and sent out to the States. They have standard patterns which are in general use for all sizes of ordinary straight pipes from 2 to 60 inches diameter, and also for a large number of special castings, such as bends, branches, tees, &c. On visiting the pipe foundries in England, one is surprised to see the very large number of patterns in the shops for the same size pipes; many of the divergencies being trifling in character and of little practical utility. But still the manufacturer is bound to make his pipes in accordance with the drawings which may be supplied, even if the order be for only a few tons of (say) 4-inch or 6-inch pipes. The President is informed by large manufacturers that one of the difficulties they have to contend with is the great diversity of patterns in use by waterworks engineers and managers throughout the country—thus practically precluding them from keeping a large stock of pipes; whereas if some standard patterns could be adopted by general consent, especially in pipes up to 12 or 18 inches diameter, a great saving in plant would ensue. The manufacturer in slack times, and when materials were low in price, would be able to make pipes to keep in stock; being assured of a market for his goods when a rise took place. The advantages to engineers and consumers would also be very great. Instead of having to wait often for months at a time before any large number of pipes could be delivered, the manufacturer would be able to draw upon his stock, and also to combine with other makers in case of very big orders, knowing that the pipes would all be of the same pattern. Thus the delay in delivery might be obviated to a great extent, more regular work provided for the men, and probably a steadier market generally maintained. Under the above conditions, there need be no fear of the pipes not being up to the required strength, as it would be possible to have them re-tested under the superintendence of an inspector before leaving the foundry. He suggests this matter to the Association as a practical question well worthy of their attention, as he feels assured that, if any considerable body of engineers in this country were able to agree to certain patterns which they would always use, the prices quoted for what might be looked upon as standard patterns would be gradually lowered so that in time they would really become the only patterns used.

The subject of Water Boards was the final topic dealt with. Upon it, the President said: As the members are aware, the question has been before the Association for some time past; a Water Boards Committee having been appointed in 1897. This Committee has met from time to time, and they have given very considerable thought and attention to the matter. It was hoped that a report might have been ready for presentation at this meeting; but the subject is so full of debatable matter, and the Committee were anxious to arrive at such conclusions as they hoped would be acceptable to the majority of the members, that they have been unavoidably obliged to postpone the presentation of the report, but expect to have it ready for the next winter meeting. I think we may congratulate ourselves upon the excellent attendance at our meeting on Feb. 17 last, when Mr. C. E. Jones read his paper on "The Nation's Water Supply, and Its Effective Control"—a paper which caused much discussion both among our own members and the large number of visitors and delegates who represented other Societies and Associations. It is very gratifying to know that since the above meeting one of the members of our Council has been appointed Engineer for the largest scheme to be carried out by a Joint Water Board in the kingdom. I refer, of course, to the Derwent Valley Board. The working of this Board, and the results obtained by an amalgamation of four large municipalities such as those of Leicester, Derby, Sheffield, and Nottingham, will no doubt be watched with the keenest interest; and upon the success or otherwise of this undertaking, I think very much will depend. It is, to a great extent, a new departure in the method of utilizing a watershed in this country, and I see no reason why it should not be a success, although no doubt much depends upon the members of the different Councils working harmoniously together, and helping their Engineer to overcome difficulties which may occur in the construction of the works and the general administration of the undertaking.

On the proposition of Mr. MATTHEWS, seconded by Mr. H. ASHTON HILL (Birmingham), the President was thanked for his address, which was characterized as "a remarkably able contribution to the records of the Association."

NEW MEMBERS AND ASSOCIATES.

The Scrutineers (Messrs. C. Sainty and J. Shaw) reported that the following new members and associates had been elected:

Members—Mr. Joseph Haynes, of Manchester, Mr. C. E. Newton, of Manchester, and Mr. G. B. Rawden, of Morley.

Associates—Mr. E. H. Coller, of Ipswich, Mr. A. H. C. Hines, of Cambridge, and Mr. J. Hopkinson, of Watford.

HOSPITALITY BY THE MAYOR.

At the close of the morning sitting, the Mayor entertained the members of the Association and the chief officials of the Corporation to a luncheon of a very liberal character in the Town Hall Assembly Rooms. His Worship presided; and his geniality and urbanity added considerably to the happiness of his guests. A short toast-list was gone through, in the course of which the Mayor was heartily thanked for his generosity.

Returning to the Engineers' Institute, there was a little time to spare before the members visited the Bute Docks and the Dowlais Iron and Steel Works; and the President usefully employed it by giving them an extempore account of

THE CARDIFF CORPORATION WATER-WORKS.

He said that as the result of the Public Health Act of 1848, an inquiry was held in Cardiff early in 1850 in regard to its sewerage and water supply. To those who were living in Cardiff fifty years after, the condition of things then existing appeared very strange. There were some wells in the town, one of which was at the corner of the High Street and Duke Street; and, in his evidence, a gentleman who lived at that spot stated that he had a cesspit in connection with his house which had not been cleaned out for two years. The well, which was 20 feet deep, was only situated 3 yards from the cesspit. This was the nature of the water supply prevalent in Cardiff at that time; and therefore it was not surprising to learn that there was a serious epidemic of cholera the previous year. In 1850, the Cardiff Water Company was started; and a year or so later, a supply of water was given. The pumping-station was constructed at Ely. In the first place, the water was taken from the river, and was roughly filtered through sand alongside it. The water was then pumped to a service reservoir at Penhill, and was distributed from there by gravitation to the town. For a considerable period after the works were first started, the people did not take to the water; they having been used to fetching it for themselves. But they gradually began to take the services into their houses. The population increasing very rapidly indeed, in a short time after—within ten years—it was found necessary by the Company to go further afield; and they then applied for additional powers in 1860. About that time, they built the Lisvane reservoir, with a capacity of 60 millions (afterwards increased to 80 millions), and a gathering-ground 2200 acres in extent. In 1879, the Corporation bought the works. The Company, finding their then supply quite insufficient, went to Parliament for powers to construct the Lisvane reservoir No. 2, and for a high-level service reservoir. The Corporation did not oppose the Bill; but they came to an arrangement with the Company to purchase the works, without going to arbitration. The sum of £300,000 was paid for the undertaking, or £320,000 including some stock the Company had at the time. It was decided, in the first place, to extend the works at Ely; but only a part of the project was carried out. Up to that time, Mr. Taylor had been Engineer; but, in 1881, the Borough Engineer (Mr. J. A. B. Williams) was instructed to inquire fully into the available water supplies for Cardiff. After some extensive investigation, and a report in favour of the Taff Fawr scheme, the Corporation decided to go for powers to impound the waters of the River Taff Fawr in Breconshire. They obtained authority to construct three reservoirs and other auxiliary works. The watershed consisted of 10,400 acres, divided into two portions—the upper part 4000 acres, and the lower area 6400 acres. The Llanishen reservoir was first constructed; and its capacity was 317 million gallons. It was immediately found of great service; inasmuch as it was filled from the watershed during 1886, and was of immense assistance during the dry year of 1887. In addition to the works in the Taff Fawr Valley, sanction was obtained to make a high-level service

reservoir and filter-beds at Rhubina for the supply of the whole of the high-level district. Concurrently with the construction of No. 2, or Cantreff, reservoir, a pipe-line and balancing reservoirs were built. The pipe-line was 29 inches in diameter for a certain distance and 24 inches for the remainder. The culvert from Breconshire to Cardiff was over 30 miles in length; and it was capable of delivering 12 million gallons of water per day. In the construction of No. 2 reservoir, two contractors failed to carry it through; and then the Corporation took over the work themselves. Great difficulty was found, in constructing this reservoir, in getting a water-tight bed for the concrete shoe of the embankment on either side. The total length of the embankment was 600 feet, and there was at least about one-third more taken into the hillside, in order to get a water-tight foundation. From the completion of the reservoir in 1892 until the present time, water had been brought from Breconshire to Cardiff. Immediately on the completion of the Cantreff reservoir (which has a capacity of 322 million gallons), the extension of the town and the increase of the population being so great, Mr. Williams suggested to the Corporation the advisability of at once commencing No. 1 reservoir—that was, the top reservoir of all. This reservoir was constructed entirely by the Corporation; and it was opened in the autumn of 1897. The reservoir as first designed was not so large as at present; but its capacity is now actually 345 million gallons. The four reservoirs he had mentioned gave them, the President said, a total storage capacity of 1063 million gallons. Referring to the considerable quantity of compensation water the Corporation have to send down the river, the President made the interesting statement that a large iron-works situated at a point just above Merthyr Tydfil were kept going last year owing to the compensation water; while, on the other side of the river, the Dowlais works had to stop for several weeks. In a great many cases, it was an inestimable benefit rather than otherwise to a district to have reservoirs constructed in it. He was now about to report on the advisability of constructing the third reservoir, and this would take the lower drainage area of 6400 acres. It would about equal in capacity the two others together. From the reservoirs the pressure was broken in three places—at Cefn, Blackbrook, and Rhubina; the capacity of each of the balancing reservoirs at these places being a little above ½ million gallons. The top water-levels of these small reservoirs were 765, 490, and 330 feet above Ordnance datum, while the top bank level of No. 1 or top reservoir was 1346 feet. The President proceeded to give further information in regard to minor portions of the works, and the high-level supply.

Papers and Discussions.

Only Wednesday and Thursday mornings were devoted to the consideration and discussion of further technical matters. On the first-named day Mr. F. J. Bancroft (Hull) read a paper on the question of "The Rating of Water-Works;" and a very fruitful discussion ensued. Mr. Alfred J. Jenkins (formerly Assistant Water Engineer at Cardiff) followed with a paper on "The Relationship between the Cost of Water Wasted, and the Cost of Detection and Prevention of Waste." The discussion on the latter was postponed until after the delivery, on Thursday morning, of a lecture by Dr. A. C. Elliott, Professor of Engineering at the University College of South Wales (Cardiff), on "The Strength of Bricks and Brickwork." During the evening, some of the members accepted an invitation by Dr. Elliott to witness his demonstrations with a 100-ton testing-machine. The papers and discussions (which were very protracted) will be dealt with in succeeding issues of the "Journal." Descriptions of the Pontypridd and Rhondda Water-Works, specially prepared respectively by Mr. W. Jones and Mr. Octavius Thomas, were circulated among the members.

Votes of Thanks.

The discussions finished, several votes of thanks were passed, encompassing all who had in any way contributed to the interest or pleasure of the meeting. The authors of the papers and the lecturer were thanked, the handsome way in which the Mayor and Corporation had treated the members was acknowledged, and gratitude was expressed to the President and Council of the South Wales Institute of Engineers for their kindness in allowing the Association the use of their Lecture Theatre and rooms, and for their attention to the comfort of the visitors. The local gentlemen who had entered heartily into the making of arrangements for visits to works were the recipients of the members' best thanks, as were also the representatives of the works visited. Among other votes, cordial acknowledgment was made of the work of the Council and officers of the Association during the year.

The Winter Meeting.

An announcement by the President, that the winter meeting would be held in London in November next, concluded the business proceedings.

The Annual Dinner.

The annual dinner was a very successful and enjoyable feature of the week's doings. It took place on Wednesday evening; the Esplanade Hotel, Penarth—an extremely pretty outlying seaside resort of Cardiffians—being selected for the purpose. The choice was a good one; the dinner being well served, and the musical programme provided good. The President headed the table; and some of the gentlemen who were receiving the members at local works were his guests. A toast-list was gone through; the speeches being commendably short, and certain of them amusing.

Visits to Works, &c.

Cardiff being rich in works of that splendid character, extent, and repute which make them veritable mines of interest to the engineer, the President, with the kindly co-operation of other local gentlemen, constructed a programme of visits which were alone of sufficient technical interest to make the meeting a success. On Wednesday, by the kind permission of the Chief Agent of the Marquis of Bute (Sir W. T. Lewis, Bart.), they inspected the extensive Bute Docks of the Cardiff Railway Company—a special train being provided for the purpose. The heavy constructive work in progress in connection with expansive new docks was examined with very deep interest by those members who have to do with the design of reservoirs. *En route* a visit was paid to the Cardiff Dowlais Iron and Steel Works (including the rolling-mills); and by the considerate action of the General Manager (Mr. E. P. Martin), the members were enabled to watch some of the processes throughout. The metal, for instance, was seen flowing from the cupolas in liquid state, then formed into huge oblong blocks (still at almost white heat), and then converted, by the aid of the rolling-mills, into extensive sheets. On Thursday afternoon, in fair weather, the President gave the members a great treat. By breaks they were taken, through charming woodlands and valleys and over hills, to portions of the Corporation water-works. First they went to the Rhubina high-level supply works filter-beds, where they saw the open and covered service reservoirs in course of construction. It was observed that the work was of a particularly heavy nature on account of the rock deeply embedded in the soil, and all of which has to be removed by hand and trolley work. At this station a Venturi meter and diagrams were examined with much curiosity by several. The Llanishen and Lisvane storage reservoirs (capacity 400 million gallons, and the Heath filter-beds and service reservoir (six beds, calculated to filter a million gallons per day each) were visited. At the latter place, a Greenway sand-washing machine, made by Messrs. James Gibb and Co., of Fenchurch Street, was proving itself a useful apparatus, and its action commended itself to several of the members. A tintometer, by Negretti and Zambra, was also subjected to the tests and criticisms of the visitors. Very welcome, after the long drive, was the tea which the President, in his thoughtfulness, had arranged for at this station; and Mrs. Priestley and other ladies found as much delight in dispensing the refreshments as the visitors were grateful for them. The arrangements for Thursday afternoon included a visit to the Lewis Merthyr Collieries, one of the largest in the kingdom; and there a luncheon was provided. An alternative visit was to the Barry Docks, the Water-Works, &c.; and the greater number of members undertook this—the morning sitting having extended beyond the time appointed for the setting-out on the first-named excursion. A long expedition was mapped out for Friday—extending from 8.30 in the morning to 9 at night. The works arranged to be visited were the Upper Neuadd reservoir of the Merthyr Tydfil District Council, including the large masonry dam being constructed to the designs of Mr. G. F. Deacon. After noon the Taff Fawr works of the Cardiff Corporation were visited. Refreshed by luncheon at the Beacons reservior, an inspection of the structure was made. The Cantreff reservoir and the Cefn balancing reservoir were included in the excursion. Tea was taken at Merthyr Tydfil; and from thence the "trippers" returned direct to Cardiff. This concluded a programme which for completeness equalled, if it did not excel, any one of those prepared for previous meetings.

American Society of Civil Engineers.—The 32nd annual convention of this Society will be held at the Institution of Civil Engineers during the first week in July, under the presidency of Mr. John F. Wallace. One of the subjects to be discussed on the occasion will be the "Filtration of Water for Public Use." It will be introduced by Mr. Rudolph Hering, who will deal with the several processes now used for the removal of objectionable matter, and their comparative sanitary effect, cost, and reliability.

Scraping Water-Mains.—In a letter recently addressed to the Editor of the "Engineering Record," the City Engineer of Halifax, Nova Scotia (Mr. F. W. W. Doane), called attention to some passages in his last annual report furnishing particulars in regard to the scraping of his water-mains. Since 1880 he has been using a mechanical scraper. In 1884 his low-service 24-inch main, 13,400 feet long, was cleaned for $8·22, or 0·06c. per lineal foot; and in the following year the cleaning of the high-service 15-inch main, 29,628 feet in length, was done for $8·30, or 0·03c. per foot. Between 1882 and 1898, 160,800 feet of 24-inch pipe was cleaned for $167·30; 26,848 feet of 20-inch, for $36·67; 348,568 feet of 15-inch, for $204·44; 33,616 feet of 12-inch, for $793·01; 20,514 feet of 6-inch, for $1074·42; and 17,323 feet of 3-inch, for $558·56. The relatively high cost of cleaning much of the smaller pipe was due to the fact that the cleaning was done but once or twice during the period of years covered by the figures, and had to be carried out in many instances in sections only a few hundred feet long.

REGISTER OF PATENTS.

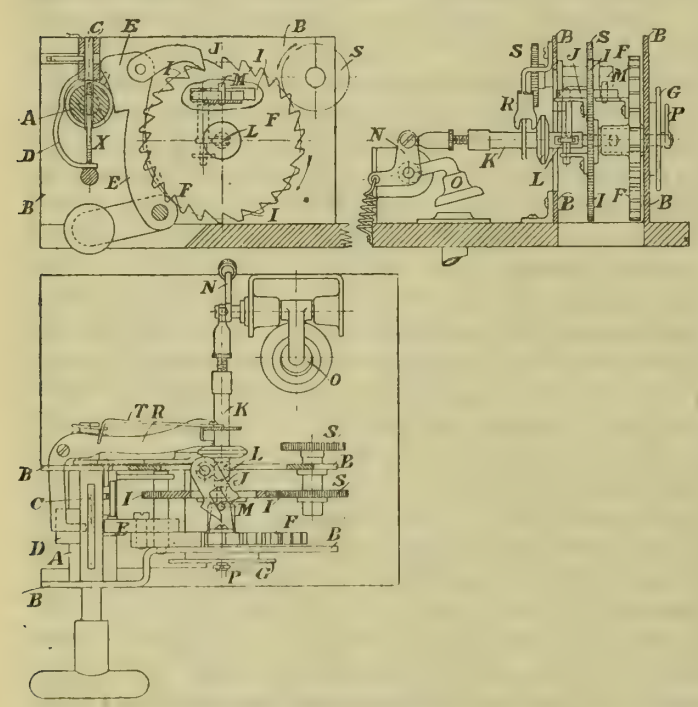
Manufacturing Gas for Motive, Heating, and Lighting Purposes.—Stewart-Wallace, J. S., of Belfast, Cowell, W. B., of Fulham, and Paisley, J. R., and Kemp-Welch, J. S., of Wandsworth. No. 10,983; May 25, 1899.

This invention relates to the manufacture of gas from substances of the hydrocarbon series, for motive, lighting, and heating purposes; and it has chiefly for its object "to so manufacture the gas that it shall be a permanent one, and capable of being used as the motive power for driving engines, without causing the carbonaceous deposit and other objectionable residues which have hitherto taken place in oil and gas engines, and greatly militated against their use."

The patentees propose to admit the hydrocarbon in regulated quantities to one or more retorts or chambers, adapted to be heated to a bright red heat, or to a temperature varying from (say) 1290° to 1470° Fahr.; and at the same time admit to the retorts a suitable quantity of atmospheric air, which commingles with the vapour or gas generated from the hydrocarbon in the retorts. The gaseous mixture is then conducted through suitable devices to eliminate the "aqueous and other objectionable matter" it may contain, and is then passed to a holder for storing, or led direct to the engine.

Coin-Freed Gas-Meters.—Beechey, C. G., and Wright, A. T., of Liverpool. No. 14,753; July 18, 1899.

This invention has reference to the class of gas or similar meters in which, by inserting a coin into the coin-carrier, and rotating it, mechanism will be actuated, which sets the meter (say, by opening a valve) to supply a quantity of gas of the value of the coin introduced; and when the gas so paid for has been consumed, the movement of the meter in passing the gas will work back certain parts, shut off the gas, and stop the meter.



A is the carrier, in the form of a small cylinder, mounted by a spindle at either end in the frame-plates B, and having a slot through it, into and through which the coins introduced into the meter pass. C is a slot or opening through the entrance-piece, into which the coins are placed when introducing them into the mechanism. D is a displacer bar, for moving the coin X when turned in its carrier. E is a lever or arm, the free end of which is disposed near the carrier-barrel A; the other end being mounted on a fulcrum. There is a counter-balance weight on the arm fulcrum, for bringing the arm E to its normal position—up against the carrier as shown; and there is also a pawl on E for actuating the ratchet-wheel F, for setting the meter. This ratchet-wheel revolves in the outer frame-plate B, and has attached to its outer end the dial G.

When a coin is introduced into the carrier, it rests on the lower end of the bar D; and when the carrier is revolved, the coin is pressed by the bar through the carrier-slot, and acts on the arm E, and moves the wheel F. The mechanism affected by the action of these parts, and that operated by the meter in passing gas, comprises: A tooth-wheel I, the spindle of which is mounted in the hub of the wheel F; an arm J, fixed on a spindle carried on the wheel I by brackets; a spindle K, connected with the gas-valve; and an arm L, engaging with the spindle K, by its end, which fits and works in a slot therein. The arm J works through an opening in the wheel I, as shown, and acts in conjunction with a pin M carried from the ratchet-wheel F by a bracket; and the shaft K is carried at one end loosely in the hub of the wheel I—the other end being attached to a lever N which operates the gas-supply valve controlled by the mechanism. This valve O is shown open in the drawing. The spindle of the wheel I is carried through the dial G, and at its outer end is furnished with a pointer P, which works in connection with the dial.

The action of these parts is this: Assuming the indicator on the dial to be at zero, and no gas has been paid for by the introduction of a coin, the arm J will be at one end of its stroke, and pressed up against the metal at the left-hand end of the slot. In this position the arm L will be at the inner end of its stroke, and have moved the shaft K towards the wheel I; closing the gas-valve O. In this position, no gas can pass. Then when a coin is introduced, and the ratchet-wheel F is moved in the manner referred to, the movement of the wheel will take the pin M away from the left-hand arm of the arm J. The result is that the spring, or the pressure of gas, will act upon the valve, pulling the shaft K longitudinally, and moving the arm L (by the metal at the end of its slot), and so, through the spindle, moving the arm J—that is, the arm will follow the pin M as it moves away from it. When the valve has been completely opened, the arm J will not move further. If, however, the spring could not remove the tappet, the pin M itself would come in contact with the right-hand arm of the arm, and move it into the position stated, and open the gas-valve.

By this movement of the wheel F, the dial connected with it will be shifted, and so indicate the amount of gas paid for. If further coins are introduced at this time, the wheel F is revolved, and the pin M will revolve with it, until the latter has made a complete revolution—viz., the wheel F has received movements equivalent to the pitches of its 24 teeth. When the pin has nearly completed this revolution, it acts upon the back of the arm J, and moves it still further; and so, through the arm L, further displaces the shaft K longitudinally. But, in so doing, a flange on the shaft comes up against the jaw of the bell-crank lever R, and moves the lever over. The opposite end of the lever at the same time pushes it across the slot C, and closes it so that no more coins can be introduced. The lever R being normally kept in position by a spring T, it will be seen that when the tappet J leaves the pin M (which it does when the meter supplies gas), the spring will, through the lever R, press the shaft K back into the normal position—that is, the position when the slot is open, as shown.

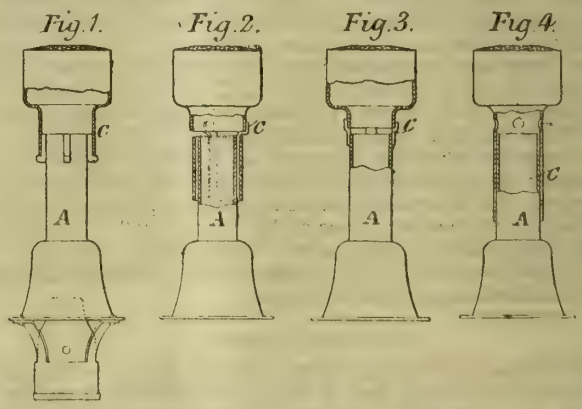
In the action of passing gas for which prepayment has been made, the wheel I is moved by a tooth-wheel S, and suitable gearing, driven by the meter—say, from the counting mechanism—and it is moved in the same direction as the ratchet-wheel F. And, as the arm J and arm L, and their spindle, are carried by this wheel, they move with it bodily, and therefore follow the pin M, which had been moved away from J in the prior action of the coin-operating mechanism. This also revolves the part of the shaft K with which the arm L is engaged; a suitable loose joint being provided to allow of this. As gas is consumed, the instant the wheel I begins to move, the indicator P, which is connected with it, will move over the dial in the opposite direction to that in which the dial is numbered towards zero. Then, when practically all the gas paid for has been consumed, the left-hand arm of the arm J will come in contact with the pin M (which will then be stationary), and so this tappet will be moved about its hinge, and be held; and as the wheel I revolves further, it will cause the shaft K, through the arm L, to be moved inwards and close the gas-valve.

Burners for Incandescence Gas Lighting.—Grautoff, A. H., of Jeffrey's Square, and Fritz, F., of Clifton Street, E.C. No. 15,119; July 22, 1899.

An important feature of the present invention is the provision for admitting an additional supply of air at or near the upper end of the tube or stem, to mingle with the mixture of air and combustible gas passing through, and "so producing a more complete admixture of air and gas."

Figs. 1 to 4 are sectional elevations illustrating different modes of carrying the invention into practice.

The air to be mixed with the gas in the tube A is admitted at the lower end of the tube as heretofore; but at the upper end an additional supply of air is admitted to mingle with the already mixed air and gas before



the latter passes into the burner-head. For this purpose, in fig. 1 the tube C carries the burner-head, and rests upon the upper end of A. It has a larger diameter than A; so that an annular space is provided between the two tubes, through which the additional supply of air enters. Ribs or projections keep the outer tube central on the tube A. In fig. 2, the tube C is made to slide up and down on A; the ribs (in this case secured to C) pressing with sufficient tightness on the inner tube to hold the outer tube in any position to which it may be set. The upper ends of the ribs are bent as shown to receive and grip the burner-head. The construction may be such that, on moving the tube C up or down, the opening for the supply of additional air may be regulated in accordance with the varying conditions of volume and pressure of the gas admitted. Where the pressure and volume of the gas is permanent, the burner-head may be fixed on the supporting stem, as shown in figs. 3 and 4. In fig. 3, the tube C is supported with its lower end some little distance above the end of the tube A; thus providing the required passage for the entrance of the additional supply of air. In fig. 4, the tube C fits closely upon the tube A, and is furnished with holes for admitting the additional supply of air.

Internal Combustion Motors.—Buchet, E. V., of Paris. No. 16,084; Aug. 5, 1899.

In internal combustion motors, as ordinarily constructed (says the patentee), the valve-casings for admission and exhaust are usually so arranged as to leave considerable waste space between the valve and the cylindrical explosion chamber. "This is one of the causes of low capacity of working, inasmuch as the motive fluid contained in this space does not contribute towards the propulsion of the piston, and not only does its

energy remain unutilized, but it exercises a very prejudicial action by the fact that it is transformed into heat passed into the walls of the cylinder, and that on this account these walls require energetic and constant cooling." According to this invention, the waste spaces are obviated by the peculiar arrangement of the admission and exhaust valves. They are disposed in the wall of the explosion chamber, in such a manner as to be flush with the internal surface of the wall.

Automatically Opening a Valve at a Predetermined Time.—Marks, C. C.; a communication from A. Stenhouse and E. Atkinson, of Broken Hill, New South Wales. No 25,443; Dec. 22, 1899.

This invention relates to apparatus of the kind described in patent No. 26,792 of 1898, "whereby a valve or the like is automatically operated to cut off, or turn on, a supply of fluid at any predetermined time or times." The object of the invention is to provide controlling gear and clockwork "alarum" or like apparatus which is constituted of fewer parts than the gear described in the earlier patent; much of the mechanism therein referred to being obviated without interfering with the effective working of the apparatus as a whole. The arrangement consists of gear driven by ordinary clockwork mechanism, whereby "alarum" or like mechanism is set free, or stopped, "to operate a valve or the like at any such time or times according to which an indicator on the gear is set."

Water-Meters.—Duncan, W., of Three Rivers, Quebec, Canada. No. 2288; Feb. 5, 1900.

The object of these "improvements in water-meters" is to provide a meter which is "far more sensitive than those now in use, and is also absolutely noiseless in its operations." It consists essentially of a main cylinder provided with a piston having its rod connected, by a suitable mechanism, to an ordinary meter-clock; a valve-piston cylinder having inlet and outlet ports; and a piston-valve located therein, and provided with ports, and having upward extending projection entering the main cylinder through a slot cut in its inner edge, whereby rotatory movement is conveyed to discs surrounded by, and supporting, a suitable ring with a slotted projection in its circumference. Means are provided for imparting rotatory motion to one or two of the discs, while a rod is connected at its upper end with an indicating clock, and at its lower end to a crank and crank-pin (the latter designed to fit into a hole in one or two of the discs to one side of the centre), so as to register the movements of the meter.

APPLICATIONS FOR LETTERS PATENT.

10,647-8.—Green, W. O., "Coin-freed gas-meters." June 11.
10,698.—Du Bois, E., "Meter dials." June 12.
10,766.—Hamilton, J. H., "Gas-engines." June 13.
10,846.—Pollak, H., and Bartosch, F., "Incandescent gas-burners." June 14.
10,856.—Morgan, C. H., "Gas-engines." June 14.
10,859.—Mette, L., "Automatic gas-igniter." June 14.
10,861.—Bamberg, G., "Mantle for incandescent gas lighting." June 14.
10,881.—Burden, W. H., "Pressure-gauges." June 15.
10,993.—Haddan, R., "Gas-generators." A communication from the Adams and Westlake Company. June 16.
10,994.—Haddan, R., "Acetylene gas generators." A communication from the Adams and Westlake Company. June 16.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Carpenter-Brackenbury-Winstanley Controversy.

Sir,—The author of "Inclined Retorts at Bankside" having introduced into this discussion, by his letter which appeared in the "Journal" for the 29th ult., a personal element, both unwarrantable and erroneous, I have, of course, refrained from taking any further part in it. I should be glad, however—without, I trust, unduly intruding upon your valuable space—to express my acknowledgments to Mr. Frank Winstanley for his support; and, at the same time, I might state that I have not yet had the pleasure of making that gentleman's acquaintance, nor has any communication of any kind ever passed between us.

C. E. Brackenbury.

June 23, 1900.

The Gas Institute Amalgamation Discussion.

Sir,—In your report of the few observations I made on the subject of the proposed amalgamation, I am represented as saying: "It was on the trade question that the split took place." As a matter of fact, I expressed the opinion that "It was *not* on the trade question that the split took place."

James Stelfox.

Belfast, June 20, 1900.

Sir,—In reporting the discussion on the amalgamation of the Gas Institute with the Institution of Gas Engineers at last week's meeting of the Institute, my name appears in your issue of the 19th inst. as the seconder of Mr. Jones's amendment. This is doubtless a mistake on the part of your reporter. It was Mr. James Lees, of Tonbridge, who seconded the amendment.

Herbert Lees.

Hexham, June 21, 1900.

Mr. Edwards's Paper on Artificial Light.

Sir,—My attention has been called to an article in the "Journal" on the paper on "Artificial Light" which I read recently before the Birmingham Association of Mechanical Engineers. As you appear to doubt the accuracy of some part of my paper, I should like, if you will allow me, to lay before your readers more clearly, some of the points you take objection to.

With regard to the illumination in a room painted white, as compared with that in a black room: I thought that the fact which I stated—viz., that, with a given source of light, there would be five times the illumination in the room in the former case, to what there would be in the latter—was common everyday knowledge to every lighting engineer. But such apparently, not being the case, I should like to try to prove it beyond the possibility of doubt. The "Law of Squares," as you call it, does not enter into the calculation at all. The distance between the lamp and the wall makes not the slightest difference, since the amount of light is not diminished, as you seem to think, by travelling across a room. The area of the surface to be lighted increases in proportion to the square of the distance from the light; while, on the other hand, the intensity of the illumination of the surface varies inversely as the square of the distance. In other words, although the intensity of the light on a surface becomes less the greater the distance, the area itself becomes greater in exactly the inverse proportion. To take an instance, the light reflected from a wall of 100 feet area, with the source of light at 10 feet distance, is exactly the same amount as would be reflected from a similar surface of 1 foot area at 1 foot distance from the same lamp.

In the particular case in question—the entire room being white—the whole of the rays of light from the lamp (except 20 per cent., which are absorbed) are reflected. These reflected rays are not in any way diminished by passing across the room to the other walls, which they strike, and 80 per cent. are again reflected. The process is continued, and the result is as previously stated. Whether we take mean spherical candle power, or not, does not make the least difference to the *proportion* of the increase of illumination from the white surfaces. I never suggested such a thing as "multiplying the initial illuminating power of a light." The source of light remains the same; but the illumination in the room is multiplied five times, owing to the illuminating power of the reflecting surfaces.

I cannot agree with you that the bottom 6 feet of a wall should be chocolate colour. You then lose the most valuable reflecting surface. With properly arranged lights, whether electric or gas, there is not the slightest necessity to have a "glare of light" even with white walls.

I cannot make sense of the statement that "the use of frosted glass is a barbarous *superstition*." Frosted glass or ribbed glass is used in the majority of engineers' shops for windows; and thus a serious loss of daylight is occasioned.

You have not read my paper very carefully, or you could hardly have said that I did not seem to appreciate the value of opal globes. I said: "It is better to use a globe if you wish to work immediately beneath the light; because, when no globe is used, the bracket casts the table into shade, whereas, with a globe, we get only 80 per cent. of the light, but it is diffused from the whole surface of the globe, and consequently there are no shadows underneath." Such criticisms are hardly just.

I should like to hear some good sound objections to horizontal burners, which you call "worse than barbarism."

With regard to incandescent gas lighting, you know (notwithstanding your remarks to the contrary), perhaps even better than I do, that there are many situations where incandescent gas lighting would be the most expensive system that could be adopted. The mantles will break; and to call this a "youthful weakness which the system will outgrow," does not affect the present cost of incandescent gas lighting.

I am sorry that the information on Dowson gas in incandescent burners was "vague," but I shall be pleased to supplement it if you will say what further information you require.

The cost of gas lighting as compared with electric lighting should have been 0·2d. per 16-candle power. This mistake was corrected in the first proof of the paper, a copy of which proof you seem to have. The figure (0·2d.) is certainly much nearer the actual cost of lighting by gas than the one you give, which is never touched in practice. The cost of electric energy which I gave, is taken from careful data collected during the actual running of the plant for twelve months. This plant is rather too large for its work, or the expenses would come out under 0.2d. per light.

A. E. A. Edwards.

Birmingham, June 18, 1900.

[We are pleased to hear from Mr. Edwards, and can assure him that it was far from our wish to criticize his paper otherwise than justly. Now that he has explained his views further, we can only remark that we cannot follow the reasoning of the first part of his letter, and must therefore let it pass. Why object to the use of the word "superstition" in the sense of something "standing over" and not needed? People who still use ground-glass partitions, do so because it has been customary, and because they have not troubled to find anything better. We fear it is Mr. Edwards, rather than we, who fails to understand the point of the remark about opal globes. Does he know what a "Christiania" globe is, and its use? Horizontally-disposed flat flames of gas flicker, smoke, and are wasteful, by reason of the excessive cooling effect of the air, and the necessity for a high pressure of gas if they are to be even approximately horizontal. The incandescent system of gas lighting is in its infancy in England. We repeat the charge of vagueness as regards Mr. Edwards's Dowson gas experiment. What is Dowson "water" gas? Does it differ from Dowson gas? What was the illuminating power of the carburetted gas? Were the same burner and the same mantle used throughout? Why was the gas carburetted to the amount stated? These queries do not exhaust the matter. If Mr. Edwards will repeat his experiments with all possible care and amplitude of data, we will gladly publish the results for him. Why is our statement of the cost of lighting by Birmingham gas never realized in practice? It is a simple matter of arithmetic.—Ed. J. G. L.]

Closing of the Kimbolton (Hunts.) Gas-Works.—The Directors of the Kimbolton Gas Company have given notice that they would cease to supply gas after the 24th inst., when the works would be closed. An effort was made to raise money by debentures to carry on the concern, but was not successful. A parish meeting has been held to consider if the Local Authority should be requested to purchase the concern, the price mentioned being £1000; but the proposal was negatived. The Company is an unlimited one.

PARLIAMENTARY INTELLIGENCE.

Gleanings from the Committee Rooms.

Only two or three Gas Bills are likely to come before second Committees of the Houses this session. Agreements and the satisfaction of opponents have almost completely cleared the lists; and the Bills are complacently moving on to the stage at which they will receive the dignity of the Royal Assent. The only measure in the gas line which is to be the subject of serious opposition is the famous Bill of the South Metropolitan Gas Company; and, beyond this, readers need not look for anything of an exciting nature from the Committee rooms during the remainder of the present session. In regard to the South Metropolitan Bill, we do not hesitate to say that some of the witnesses who supported the opposition with their names and position in the lower House would not be at all sorry to see the Bill go through now, if only, in their desire for knowledge, to see what will be the outcome in comparison with other companies working under the old conditions.

The first Bill to undergo a second investigation is the Morecambe District Council Bill; and it has passed through the ordeal unscathed. The inquiry on this occasion lasted two days before a Lords Committee. The purpose of the Bill, it will be recollected, is to obtain the endorsement of Parliament to the agreement which the District Council have entered into with the Morecambe Gas Company for the transfer of the works at a price of £141,000, which a loan of £9000 to be taken over, compensation, &c., will raise to £158,755. The only opponents were the Heysham District Council, who objected to the purchase on the ground that it would place them in an unfavourable position. The justification for the price to be paid will, in some measure, be found in Heysham. There are indications that in this direction, lies to large extent the prospective additional value of the concern. The extensive harbour which is being built there will make this hitherto sleepy district a centre of commercial activity; and the District Council's advisers have taken this into consideration in calculating the price that could be safely paid. When the provisional contract between the Morecambe authority and the Company was made, the Heysham Council suddenly awoke to the fact that some day they would possibly like to be their own suppliers of gas; and therefore they decided to oppose the Bill with the view of securing the insertion of the now almost obsolete "model" clause, which would have conferred on them the right to acquire the distributory plant in their area at its mere pipe value. This would have given them a power which they did not possess under the Company; and the Morecambe Council asked for nothing more than that the existing position of Heysham in regard to purchase should be maintained under the new *régime*. This was only just; and the Commons Committee before whom the Bill first came so recognized it, and rejected the petition of Heysham. To the Lords Committee the opponents preferred a similar request; but very properly with no greater success. Upon this failure, Counsel for Heysham sought to get the Glastonbury provisions of this session applied to the Bill (*ante*, pp. 875, 877); but the Committee refused to entertain them. The Bill will thus proceed; and in due course the works will be handed over to the new proprietors.

The evidence given last week was similar to that adduced in the Lower House. The expert witnesses engaged on the side of the promoters were Mr. Thomas Newbigging, Mr. Corbet Woodall, and Mr. E. H. Stevenson; and on the opposition side Mr. Arthur Silverthorne and Mr. Fletcher W. Stevenson were called. We heartily welcome the last-named gentleman as a professional combatant in the parliamentary arena.

HOUSE OF LORDS.

The following further progress has been made with Private Bills:—

Bills brought from the Commons, read the first time, and referred to the Examiners: British Gaslight Company (Staffordshire Potteries) Bill, Gaslight and Coke, Commercial Gas, and South Metropolitan Gas Companies Bill, Lambeth Water Bill, Mid-Kent Water Bill, Portland Urban District Gas Bill, Rickmansworth and Uxbridge Valley Water Bill, South Metropolitan Gas Bill, Wandsworth and Putney Gas Bill.

Bill read the first time and referred to the Examiners: Local Government Provisional Orders (Gas) Bill.

Bills read a second time and committed: Bradford Corporation Bill, East London Water Bill, Wolverhampton Gas Bill.

Bills reported: Huntingdon Corporation Bill, Walsall Corporation Bill, Water Orders Confirmation Bill.

Bills read the third time and passed: Bury and District Water (Transfer) Bill, Gas Orders Confirmation Bills (Nos. 1 and 2), Maidenhead Gas Bill, Ossett Corporation Gas Bill, Southport Water Bill, Walsall Corporation Bill.

The Examiners reported last Friday that the further Standing Orders applicable to the South Metropolitan Gas Bill had not been complied with. The matter will come before the Standing Orders Committee to-day.

The opposition to the North Warwickshire Water Bill has been withdrawn.

Petitions have been presented against the following Bills: East London Water Bill, South Metropolitan Gas Bill (from the Corporation of London), and Wandsworth and Putney Gas Bill (from the Wandsworth District Board of Works).

HOUSE OF COMMONS.

The following further progress has been made with Private Bills:—

Bills read the first time and referred to the Examiners: Bury and District Water (Transfer) Bill [Lords], Gas Orders Confirmation Bills (Nos. 1 and 2) [Lords], Salford Corporation Bill [Lords].

Bills read a second time and committed: Gas and Water Orders Confirmation Bill [Lords], Perth and Paisley Gas Provisional Orders Bill.

Bills reported, with amendments: Bristol Water Bill [Lords], Falkirk Corporation Bill [Lords], Gas and Water Orders Confirmation Bill [Lords], Gas Provisional Order (No. 3) Bill, Oldham Corporation Bill.

Bills read the third time and passed: British Gaslight Company (Staffordshire Potteries) Bill, Dorking Water Bill [Lords], Fishguard Water and Gas Bill [Lords], Gaslight and Coke, Commercial Gas, and South Metropolitan Gas Companies Bill, Great Berkhampstead Water Bill [Lords], Lambeth Water Bill, Menstone Water (Transfer) Bill [Lords], Mid-Kent Water Bill, Motherwell Water Bill [Lords], Mountain Ash Water Bill [Lords], Newtown and Llanllwchaiarn Urban District Gas Bill [Lords], Portland Urban District Gas Bill, Rickmansworth and Uxbridge Valley Water Bill, South Metropolitan Gas Bill, Wandsworth and Putney Gas Bill.

On Thursday, Mr. Pickersgill gave notice of the following question for last night: "To ask the Secretary of State for the Home Department whether his attention has been called to the fact that the Gaslight and Coke Company have just issued notices to their consumers raising the price of gas to 3s. 5d. per 1000 feet, and that these notices state that the enhanced price will be charged from the date of recording meter indices for the June quarter—the Company thus claiming to charge the enhanced rate for gas consumed during a week or ten days, or even longer, before the notices were served; and whether he will exercise the powers vested in him by section 45 of the Metropolis Gas Act, 1860, which (*inter alia*) provides that if it appears to the Secretary of State that a Metropolitan Gas Company is acting in a manner unauthorized by law, and it would be for the public advantage that the Gas Company should be restrained from so acting, he may set the Attorney-General in motion to take proceedings at law to restrain the wrongful action of the Company."

HOUSE OF LORDS COMMITTEE.

Tuesday, June 19.

(*Before the Earl of* Erne, *Chairman*, *Lord* Bagot, *Lord* Carysfort, *Lord* Erskine, *and Lord* Muncaster.)

MORECAMBE URBAN DISTRICT COUNCIL GAS BILL.

This Bill, which provides for the transfer of the undertaking of the Morecambe Gas and Light Company to the Urban District Council of Morecambe, came to-day before a Committee of the House of Lords constituted as above. The Bill had already been passed by a House of Commons Committee (*ante*, pp. 751, 808).

Mr. Balfour Browne, Q.C., and Mr. Honoratus Lloyd appeared for the promoters. Mr. Blennerhassett and Mr. Royds represented the Heysham Urban District Council; while Mr. Moon appeared on a petition against alterations presented by the Morecambe Gas Company.

Mr. Lloyd, in opening, said the Bill was to authorize the Morecambe Urban District Council to purchase the undertaking of the Morecambe Gas and Light Company, who supplied gas to both Morecambe and Heysham; the gas-works being situate in Morecambe. An agreement had been come to with the Company; and the only opposition arose from the Urban District Council of Heysham. When an urban district took over an undertaking such as this, and the Company supplied not only the district of the authority taking it over, but also an outside area, the invariable practice was to insert a clause enabling the outside authority to purchase their interest in the concern, if they desired to do so. Therefore clause 18 was inserted, to provide that, if the Heysham District Council desired at any time to sever and supply themselves, they could do so upon paying to Morecambe the fair value of that which they would get. Heysham, however, contended that they should be allowed to sever upon the terms of purchasing the pipes and apparatus in their district at "old-iron" price, or on the basis of structural value. Morecambe held that this would be obviously unfair, seeing that they would have had to pay the commercial value of these pipes and apparatus. There were a considerable number of precedents (40 or 50) in favour of clause 18 of the Bill; and some few (mostly inserted by agreement) in favour of the clause which Heysham desired. The Heysham petition pointed out that the Morecambe Council had agreed to purchase the concern for £141,000, which, together with a loan of £9000 (taken over), compensation, &c., would amount to £158,755. The Committee would hear from the Engineers representing the Council and the Company that this was a perfectly fair price; but Heysham held that the sum was enormously excessive, and out of all proportion to the value of the gas undertaking. It would not matter to Heysham if the price were excessive, because if they bought their portion of the concern they would only pay the fair value, and no part of the excessive value. Counsel added, in conclusion, that the Local Government Board had issued a report in which they made certain comments with reference to clause 18, which had been complied with; but they said nothing against the proposal of the promoters to allow Heysham to go out upon the terms of paying their fair share of the undertaking. There was no adverse comment in the report as to that; and no difficulty arose.

Mr. *T. Baxter*, examined by Mr. Balfour Browne, said he was Chairman of the Gas and Water Supply Committee of the Morecambe Urban District Council. He explained the steps leading up to the determination of the Council to buy the gas concern, and to the agreement for purchase which was arrived at on the recommendation of Mr. E. H. Stevenson and Mr. Newbigging. He held that Heysham, if they separated from Morecambe, should pay for their portion of the undertaking on the same basis as Morecambe was proposing to buy—namely, that of a commercial concern.

In cross-examination by Mr. Blennerhassett, witness said the Heysham Authority were not consulted when the agreement was entered into. The question of price had never been before the Morecambe people. Electricity had recently been introduced in Morecambe; and the supply, which was rapidly increasing, encouraged the consumption of gas.

Mr. *Thomas Newbigging*, examined by Mr. Lloyd, gave a number of details regarding the capital, powers of charge, &c., of the Company, showing that the concern was in an exceedingly prosperous condition. If the Company went on working, they would have had to raise the price of gas, just as the Council now would, having regard to the large increase in the cost of coal. Recently the Company had been able to

declare a dividend of 15½ per cent. on the original stock, and of 12½ per cent. on the additional stock. This dividend seemed high; but it did not matter to the consumers, because the higher the dividend the greater the premium which could be obtained on the sale of shares or stock. The district was increasing very rapidly, with the result that the consumption of gas had doubled during the 3½ years to June, 1899—which was almost unprecedented. He knew of no other town in the kingdom where there had been a similar increase. The year 1899 showed an increase over 1898 of 29·18 per cent., notwithstanding that nearly a million cubic feet less gas had been used in the public lamps, owing to the introduction of electricity. Past experience enabled him to say that the increase would be about 20 per cent. per annum in future; but this year it would only be about 12 per cent. The works of the Company had been well managed, and were in excellent order; most of the apparatus and plant, especially the more important sections, being very largely—over 100 per cent.—in excess of present requirements. To meet the increase in consumption, there would have to be some expenditure on mains, meters, and service-pipes; but very little on the works, until the consumption had doubled. The Morecambe Authority were acting wisely in seeking to acquire the works. The dismemberment clause (No. 18) was a fair and proper clause as between all the parties. It was usual, in the purchase of a gas undertaking by a local authority, for the transfer to be effected on the basis of profits—really goodwill; and this was the way in which Morecambe would proceed. The "old-iron" clause sought by the Heysham Council, would be obviously unfair; for the result would be that the Morecambe Council, having bought not only the pipes and apparatus in Heysham, but also the goodwill, would have to sell merely the pipes and apparatus, and bear the loss of the cost of the goodwill. The price agreed on was fair.

The CHAIRMAN: Could you tell us what effect, generally, electric light has had on the consumption of gas?

Witness: Almost universally it has given an impetus to the consumption of gas. I do not know of more than two places where it has had an adverse effect on gas consumption; and one of those places is here in London. The Gaslight and Coke Company have suffered by reason of the public theatres and hotels having resorted to the electric light; but with this exception, almost throughout the kingdom electric lighting has given an impetus to the consumption of gas. In Manchester, it has been very large. There is no place in England where electric lighting has been so successful as in Manchester. This year they are spending £100,000 on the extension of electric lighting, but £250,000 on gas lighting.

Further examined by Mr. LLOYD: In 1898-99, the falling off of gas supplied for public lighting by the Morecambe Company was about a million cubic feet, which was in consequence of electricity being applied for this purpose; but the net gain in the year was 29·18 per cent. It was to be remembered, however, that the price at that time was 3s. 8d. per 1000 cubic feet, whereas now it was 3s. 3d.

Cross-examined by Mr. BLENNERHASSETT: The price of gas would have to be raised; and this would tend to reduce the consumption in ordinary places, but not in a seaside town like Morecambe. Perhaps as a result there would not be the same rapid growth in Morecambe. The doubling of the consumption in 3½ years actually took place when the price was 5d. per 1000 cubic feet more than it was now. If the rise in price reduced the consumption, the value of the concern would not be lessened proportionately. The rise might have some effect; but it would never, he believed, reduce the profits. In 1893, 1894, and 1895, there were reductions in the gas consumption of 29,000, 29,000, and 25,000 cubic feet respectively. He was not aware that this was in consequence of extensive alterations. Then an increase took place; but he should not expect such a result, as following the decrease, because the population had doubled since 1891. He, however, admitted that, if the natural increase was checked for three years, an abnormal increase might be expected in the succeeding years. There had been a boom in Morecambe for the last three or four years; but he was not aware it had ended. After the purchase, the annual liability would be £7451. Witness was then cross-examined in detail regarding the items of the estimate he had made of the way this charge was to be met. He denied that, as a consequence of coal rising 5s. a ton, there would be a large deficiency. It would not be so, because the Corporation would raise the price of gas. For every 10d. per ton increase in the cost of coal, it would be necessary to raise the price of gas 1d. per 1000 cubic feet.

Wednesday, June 20.

Mr. *Newbigging*, further cross-examined by Mr. BLENNERHASSETT, said it was not his experience that wherever there was a considerable increase in the consumption of electricity the consumption of gas was most materially checked. Witness was questioned at considerable length to show that his estimate of the income from the gas concern would not be sufficient in the future to meet the charges upon it, unless the price of gas was raised; but he maintained that the income would be enough. In the House of Commons, witness assumed an increase of 20 per cent. in the sale of gas; but he now reduced this to 12 per cent. This, however, would not interfere materially with his calculations as to the profits being sufficient to meet the charges.

Re-examined by Mr. LLOYD: The price agreed upon was reasonable. If the cost of coal increased, the price of gas could be raised also; and so the profit would be the same, though there might be a tendency to take less gas if the price were raised. The transfer would result (as these purchases usually resulted) in a deficit for the first year or two, and then in substantial gain for the Local Authority, and also for the gas consumers.

Mr. Corbet Woodall, examined by Mr. BALFOUR BROWNE, said electric lighting was much in vogue now; but he had no experience that its advance had been of injury to gas undertakings either at home or abroad, except in the case of London, where, north of the Thames, the rate of increase had been checked. He should not expect the installation of electric lighting in Morecambe to check the consumption of gas; and he saw no circumstance to suggest that the present rate of increase would not be continued, though there might be ups and downs. The bargain made between the Company and the Morecambe Authority was perfectly fair to both sides; being based on the profits earned and the rate of increase. If the parties had gone to arbitration, he thought the Company would almost certainly have been awarded at least the sum agreed on. The gas consumers would derive benefit from the purchase, because the Local Authority would be able to raise the money which would have to be spent on the works at a cheaper rate than the Company. He had no doubt Mr. Newbigging's estimate of the profits would be more than realized. The capacity of the works could be doubled at a cost of £300 per million cubic feet, whereas the usual figure for the construction of works was about £600 per million cubic feet. As regarded the petition of Heysham, he said the purchase was made on a commercial basis; and it would not be fair that Morecambe should be required to part with any portion of the undertaking except on this basis. It would be monstrously unfair that Heysham should be able to buy its portion of the concern at old-iron price.

Cross-examined by Mr. BLENNERHASSETT, who suggested that if the enormous loss arising from the increase in the cost of coal, which would practically sweep away half the profits of the Company, were met by an increase in the price of gas, there would be, under the sliding-scale, a reduction of divisible profits, which formed the basis of the valuation, and thus the agreed price would be affected, witness said if the Company were continuing, the increase in the price of gas would necessitate a reduction in the amount of divisible profit; but the Company were not continuing. The Local Authority, after the transfer, would enter upon a given amount of profit; and if, owing to circumstances, there was a further increase in the price of coal, the Authority would make an equal increase in the price of gas. Thus they would remain exactly where they were when the transfer was effected. If the Company were continuing, he should not advise them to raise the price, because they could go through the present year without doing so. There was a distinct difference between the Company and the Local Authority. The latter would have to raise the price, because they had not the reserves which the Company had accumulated.

Mr. *E. H. Stevenson* gave evidence in support of the Bill; agreeing as to the excellent condition of the works, as to the possibility of doubling their capacity at a very small expenditure, and as to the price agreed on being exceedingly fair.

In cross-examination, witness said that, if Heysham wished to separate from Morecambe, they would have to pay for the goodwill; but no arbitrator would have regard, in such an arbitration, to the price paid by Morecambe to the Company, although that price would be one which had the sanction of Parliament. It would be absolutely wrong to let Heysham leave Morecambe by paying the bare value of the works and pipes in their district. The model clause had no bearing on a case like the present. It had only been once put by a Committee into a Bill in which it had not previously existed; and that was a unique instance, where power was given to a local authority to purchase the gas undertaking at structural valuation. Between 1890 and 1899, there were thirty cases of the model clause, and seven of the undertaking clause. But in the thirty cases, the large majority had no works outside their district. This clause was often put in where there was practically nothing outside to sell. Which clause ought to be inserted, entirely depended on the circumstances of each particular case. Where an undertaking was bought on commercial principles, and where gas was sold outside to the extent of one-third, the commercial principle ought to be acted on with regard to the outside authority.

Re-examined by Mr. LLOYD: At the present moment, Heysham could only undertake their own supply by purchase of the Company's works at commercial value.

This closed the case for the promoters; and evidence was then called for the Heysham Authority.

Mr. *A. Silverthorne*, examined by Mr. BLENNERHASSETT, said if any adverse conditions arose in the manufacture of gas, Morecambe would almost certainly prefer to raise the price rather than make good any deficiency by a rate-in-aid; because in the former case the burden would fall on Heysham, whereas in the latter it would fall on Morecambe only—Morecambe having no power to levy a rate on Heysham. The obvious interest of Heysham was to contract themselves out of the area, under the operation of the model clause. The Bill contained an attempt to make Heysham pay for goodwill; and he therefore advised them to oppose it, because this certainly was not a case in which an outside authority should pay for goodwill. It was an attempt to re-open the model clause as settled by the House of Lords. Between 1890 and 1899, there were thirty Gas Bills and twenty-two Water Bills in which the model clause had been introduced. The undertaking clause appeared in four gas transfers within the same period. The price agreed on he considered excessive. The real test to apply was that of the relation of profit per ton of coal. It was alleged here that the profit made had been 15s. 6d. per ton, which at once showed that the thing was utterly wrong, because the figure for the whole of Lancashire was no more than 10s. 6d. This was an indication that the basis of valuation was inflated. The purchase involved an annual liability of £7255, to meet which all the income they would have would be £3700; and even from this must be deducted the interest on the loan—leaving only £3348, which, at 25 years' purchase, brought out the approximate value at £83,700, against the £141,000 agreed upon. Witness also referred to the phenomenal increase which had taken place in the use of electricity, which must largely affect the increase in the consumption of gas. The price was out of all proportion to the value of the undertaking; and Heysham would have to pay part of the excessive price if they purchased their portion of the concern.

Cross-examined by Mr. LLOYD: The great point between Heysham and Morecambe was as to whether it was fair that Heysham should pay for goodwill if they bought their portion of the undertaking. He admitted that witnesses called in the House of Commons from Heysham had agreed as to the fairness of paying for the goodwill; but they did not understand the question.

Re-examined: If Heysham were driven into this purchase by the action of Morecambe, it would be a gross injustice to make them pay a proportion of the extravagant price agreed on between the Company and Morecambe.

Mr. *Fletcher W. Stevenson*, while agreeing that the works were in good condition and in excess of requirements, except as regarded boilers, coal-stores, and station-meter, said the price was not only excessive, but the highest he knew of. The works could not be made to pay at such a price. In 1901, he thought there would be a deficit of £3471, which would necessitate a rise of 10d. per 1000 cubic feet in the price of gas. Cross-examined, witness said if the model clause would result in considerable

loss to Morecambe, he would not have advised its insertion; but if the loss would only be small, there would be no harm in inserting it. He considered the consumers in Heysham were better off under the Company than they would be under the Morecambe Authority.

Local witnesses having been called,

Mr. BLENNERHASSETT addressed the Committee on behalf of Heysham. He submitted that absolutely no case had been made out for the Bill; that there was no evidence of desire to purchase on fair terms; that it had been conclusively shown that the price was extravagant; and that it would be a great injury to the people in the whole district of the Company. The question of price was never before the people of Morecambe; and therefore it could not be said that they were supporters of the Bill. If the Committee did not reject the Bill, he asked them to give a means of escape by inserting on their behalf the model clause, for which there were many precedents in cases of both gas and water transfers.

Mr. BALFOUR BROWNE briefly replied.

The Committee then deliberated in private. On the re-admission of the public,

The CHAIRMAN said: The Committee have decided to proceed with the Bill, without the modification asked for in clause 18.

Mr. BLENNERHASSETT applied for the insertion of a clause, similar to that put in the Glastonbury Bill, providing that the instalments of the sinking fund should be divided and carried to the credit of the two Authorities in the proportion of the revenue arising from the gas consumed in the respective districts.

The CHAIRMAN said the Committee could not entertain the proposal.

Mr. BLENNERHASSETT pointed out that, as the Morecambe Bill now stood, if at any future time there should be a profit on the gas undertaking the whole would go in reduction of the Morecambe rates. This obviously was not fair, as the profit would be derived in part from Heysham. He therefore asked for provision that the profit, if any, should be applied to reduce the price of gas.

Mr. BALFOUR BROWNE objected; pointing out that, while his learned friend wished to share any profit, he did not propose to share any loss.

The CHAIRMAN declined to accede to the application.

The clauses were then adjusted; and the Bill was ordered to be reported to the House.

THE PARLIAMENTARY COMMITTEE ON MUNICIPAL TRADING.

The Joint Committee of the Houses of Lords and Commons, appointed to consider and report as to the principles which should govern the powers given by Bills and Provisional Orders to Municipal and other Local Authorities for industrial enterprise within or beyond the area of their jurisdiction, resumed their sittings after the Whitsuntide recess on the 15th inst., under the presidency of the Earl of Crewe.

The first witness called was Mr. Chandos Leigh, Q.C., the Speaker's Counsel, who gave evidence as to the practice in regard to Private Bills, their examination, and the means taken to prevent the introduction of clauses which might be objectionable in the public interest. He instanced certain Bills and groups of Bills, promoted by municipal corporations during the present and preceding sessions, which had called for special supervision. They related, in the main, to electric lighting and tramways. In one Bill, promoted by the Rochdale Corporation, there was a clause to enable the Corporation (who were the owners of the market) to create ice stalls, and further to set up refrigerators and to make and sell ice. This was a clear case of municipal trading. A Bill promoted by the Walsall Corporation contained a similar clause. It was at present before the Committee. Such powers were entirely novel, and would not be allowed without careful inquiry. The most important of the novel clauses met with in Municipal Bills was that which related to the raising of money by bills and promissory notes. This was tantamount to issuing new stock; and, where a city or town had sufficient status in population or finance, it might safely be allowed. Asked as to the practice of the Committee on Police and Sanitary Regulations Bills in dealing with novel clauses, witness said that all Bills, and in particular the unopposed ones, were carefully scrutinized. Bury promoted a Bill some years ago which contained a clause making any person who played games on Sunday liable to a penalty of £5. He took upon himself to strike it out. The Chairman asked if *locus standi* was given to any private trader against a Corporation Bill seeking trading powers. Witness said it was not. In the Rochdale ice cream case, it was decided that a private trader could not oppose. The question was, if one trader were allowed *locus standi*, where they were to stop. In an application for municipal slaughter-houses, every butcher in the town might object. The conclusion come to was that this was a question of general policy, and that, as matters stood, *locus standi* could not be given. The Committee would no doubt express its opinion on the point. With regard to Gas and Water Bills, witness said he thought no private company could have carried out a water scheme like that of Manchester, Birmingham, or Liverpool, or the very vast scheme of last session for dealing with the water of the Derwent Valley. At the same time, he rather deprecated the practice of acquiring compulsorily a water or gas undertaking by a municipality against their will and without their consent. This practice had increased to an enormous extent during the last few years. There were in Great Britain 250 local authorities who held gas undertakings, and practically in all these cases the businesses had been originally founded by a company and subsequently purchased by the municipality. One might say, broadly, that the municipalities never invented or initiated anything with reference to tramways, gas, or electricity; and yet when a company had become flourishing, they had been forced into a corner. He did not know of any case in which a municipality had bought a gas undertaking which was not in a flourishing condition. With regard to restrictions upon municipalities in the matter of competition with private traders, witness did not give any opinion of his own, but cited the views of a prominent gas official, who stated that the manufacture of apparatus and fittings would in most cases be carried on equally well, and at less cost, by a manufacturer apart from a company. Therefore the gentleman referred to would be content to see a restriction placed equally on a company and a corporation. Asked what restrictions Parliament had ever put on local authorities with respect to subscribing to various enterprises, witness said they were never allowed to subscribe to an undertaking over which they had not absolute control; but this rule had been infringed on two or three occasions lately. The first case was that of the Hull and Barnsley Railway, in which the Corporation of Hull were allowed to subscribe £100,000 towards the undertaking. The next case was the well-known one of the Manchester Ship Canal. In 1891, the Canal Company asked Parliament to allow the Corporation to subscribe £5,000,000 towards the undertaking. This was an enormous sum for a corporation to contribute, and he remembered perfectly well going to the House of Lords and saying that they had a strong feeling about it in the House of Commons, and that they had always discountenanced such a proposal. In fact, when the Manchester Ship Canal was first started, Salford wished to contribute £250,000; and Parliament disallowed it. But in the end the Corporation of Manchester were allowed to subscribe the money. This was municipal trading of a very municipal kind. Witness put in a statement showing the increase in rates and local debt in proportion to population throughout the United Kingdom from 1878 to 1897. The increase of population was 21 per cent.; that of rates 25 per cent.; and that of local debt, 120 per cent. He had said that he did not know of a case in which a corporation had acquired a gas undertaking which was not in a flourishing condition, and possibly the inference would be that a corporation did not want to take over a concern that was not so. Sir W. Foster asked if it was not explicable on this ground, that where there was a flourishing gas company there was an increasing community and a prosperous town, and therefore a more progressive town council. Witness said this was a question he did not wish to go into.

The next witness was Mr. Sidney Morse, Chairman of the Municipal Trading Committee of the London Chamber of Commerce, who spoke upon the general question of municipal trading. He said he thought that, apart from any abstract objections to such trading, the hands of municipalities were already too full, and they could not spare the time for it. He had frequently had his attention called to the enormous amount of work they had to do; and they suggested that it would be serious if their attention were turned therefrom to matters out of which profit might be made. With regard to tramways, he had found that local authorities did not always appear to consider the question whether or not the proposed lines were desired in the public interest. He had pretty much the same complaint to make with regard to electric lighting. As to the working of tramways, he did not wish to say it was impossible for a municipality to do this fairly well; but, as a rule, those who obtained the management of a tramway by being on a municipal body had to a very small extent experience of the matter, and it was impossible for people without experience to manage a complicated business, and, even with a staff of competent persons, to continue its proper management.

Last Tuesday, Mr. Morse, continuing his evidence, put before the Committee the principle that the action of municipalities in trading should be restricted to matters undertaken in the public interest, and not with a view to making profit—matters in respect of which reasonable rates might be made. The supply of water was to a large extent so much in the interest of everyone, that it should be furnished in proper, wholesome, and pure condition; and it was reasonable that a rate should be made to give that supply pure. One of the difficulties connected with water, however, was that an authority had sometimes to go outside their district for a supply. If they only allowed trading, it was extremely difficult to say, as a matter of principle, that they should draw the line at a particular geographical limit. If they permitted a local authority to carry on a trade and to make no more profit than was sufficient to repay capital and pay expenses, it was very difficult to set a limit to what they might not do. He wished to call attention to the great importance of supervision in such matters as tramways; and as an indication of the vastness of municipal undertakings, he mentioned that the city of Glasgow now employed 20,000 workpeople. If municipal trading were allowed, it must result in abolishing the private trader, and the effect of such abolition upon the wealth of the country would be very serious indeed. Asked by the Chairman what distinction he drew between water and gas, witness said it was essential, from a sanitary point of view, that every house should have a good supply of water, not only for the individual householder, but also for his neighbours. It made no difference to a householder whether his neighbour had any light or used gas, candles, or lamps. If the neighbour preferred lamps, why should he contribute his capital for the benefit of the man who had gas or electric light? The exception he made in the case of water was based on sanitary grounds. The refusal by corporations to consent to companies introducing electric light and tramways had undoubtedly retarded progress in these branches of industry throughout the country.

Mr. S. B. Provis, Permanent Secretary of the Local Government Board, next gave evidence. In the course thereof he stated that the total indebtedness of local authorities in England and Wales had increased about 51 per cent. between 1885 and 1898; the figure in the former year being £173,207,000, and in the latter year £262,017,000. The Board had no jurisdiction over Scottish and Irish matters. He regarded the supply of water by these authorities as a question which stood in a different position from others with which the Committee had been dealing. The restriction that should be placed upon outside trading in water was that the supply should be made to the authority in bulk, and not to the consumers directly. This had been a more common practice of late years.

Discontinuance of Oil Lighting at Stoke-sub-Handon.—The Council of this parish have decided on employing gas in place of oil for the public lighting; and the tender of the Martock Gas Company has been accepted for its supply.

The Leamington Corporation and the Gas-Works.—In the last number of the "JOURNAL" we announced the refusal by the Leamington Priors Gas Company of the offer made by the Corporation to purchase their undertaking for £140,000. The local papers are speculating as to what will be the result. If the matter goes to arbitration, it is thought that the Company will not get as much as they ask, but that they will, at all events, be awarded £20,000 more than the Corporation offer. The question is asked: Do the Leamington ratepayers wish to buy the works at this figure? It is said there is every reason to believe that a mutual arrangement might be come to by which the purchase scheme could be dropped.

LEGAL INTELLIGENCE.

COURT OF APPEAL (IRELAND).

Wednesday, June 20.

(*Before Lord Justice* Fitzgibbon, *Lord Justice* Holmes, *and Lord Justice* Walker.)

Alliance and Dublin Consumers' Gas Company v. County Council of Dublin —Damage to Gas-Pipes by Steam-Rollers.

This was an appeal by the Dublin County Council against a judgment of the Master of the Rolls (*ante*, p. 815) restraining the Council from using, or causing to be used, a steam-roller in such a way as to fracture, damage, or injure the gas mains, pipes, or other works of the Gas Company. It appeared that the respondents sustained injury by reason of damage to some of their pipes laid beneath the roads in certain districts of Dublin; and they alleged that the injury was done by a steam-roller used by the County Council for the purpose of repairing and keeping the roads in order.

Mr. T. L. O'Shaughnessy, Q.C., Mr. T. M. Healy, Q.C., and Mr. J. J. Clancy appeared for the appellants; Mr. S. Ronan, Q.C., Mr. J. Gordon, Q.C., and Mr. J. Pim represented the respondents.

The arguments occupied the day.

Thursday, June 21.

To-day the arguments in the case were concluded, and

Lord Justice Fitzgibbon stated the decision of the Court, which was that the injunction should be amended so as to read in the following form: An injunction against using any steam-roller on any road under which the gas-pipes of the plaintiffs have been laid, so as to break or injure any pipes then properly laid under such road; regard being had to what, at the time of the laying of such pipes, was the then ordinary traffic and the then reasonable means of repairing and maintaining the road.

The appellants were ordered to pay the costs of the appeal.

CHANCERY COURT OF LANCASHIRE.

Manchester, Thursday, June 14.

(*Before Vice-Chancellor* Hall, Q.C.)

Taylor v. Oldham Corporation.

This was an action brought by Moses Horrocks Taylor, of Ogden, against the Oldham Corporation. The plaintiff, as Trustee under the will of James Taylor the elder, deceased, claimed an injunction to restrain the defendants from discharging or permitting to flow into the Ogden reservoir, from the Kitcliffe Mill or elsewhere, any foul matter or liquid, so as to pollute the reservoir, to the injury of the plaintiff as owner of the Ogden Mill and premises, and contrary to the provisions of the Oldham Corporation Water-Works Act of 1870 and other Local Acts of the defendants; and from diverting, interfering with, retaining, or appropriating any of the water of the Piethorn Brook until the defendants had constructed such works as were necessary to collect and restrain separately the water fouled at the Kitcliffe Mill, as provided by the Act of 1870; and also to restrain them from interfering with the supply of water by means of a 15-inch pipe from the Wicken Brook, to which the plaintiff was entitled under an agreement dated the 4th of May, 1870, and from acting in breach of that agreement. Plaintiff further claimed an order upon the defendants to forthwith remove from the 15-inch pipe a grid at the mouth thereof, and a valve connected therewith, and to cut off from such pipe a communication with a pipe of defendants, whereby they had wrongfully diverted water from the 15-inch pipe.

Mr. Mabeely appeared for the plaintiff; Mr. Sutton and Mr. Eastwood represented the Corporation.

Mr. Mabeely, in opening the case, stated that for a great number of years the Corporation had, without the knowledge of the plaintiff or his predecessor in title, connected a pipe to the 15-inch pipe of the plaintiff, and had drawn water therefrom, although the plaintiff was entitled to the sole water supply. Since the action had been commenced, the defendants had severed the connection with the 15-inch pipe of the plaintiff.

Cross-examined by Mr. Sutton, plaintiff said he had been aware for a number of years that the 15-inch pipe had not carried the normal quantity of water, and he found the outlet for the abstracted water before 1886, but made no complaint. He further stated that the Ogden reservoir was about 700 yards long, and he had noticed pollution for a distance of 50 yards, but never at the overflow.

Counsel explained that the reservoir was not for domestic purposes, but for compensation.

Friday, June 15.

The case for the plaintiff was concluded this morning, and evidence was submitted on behalf of the defendants.

Mr. *G. H. Hill*, who designed the works, was called to show that the "secret-service" pipe was not a secret one at all. He admitted that the bars across the mouth of the 15-inch pipe would probably cause obstruction to the flow of water to which the plaintiff was entitled.

Vice-Chancellor Hall, in giving his decision, said he was of opinion that there would be silting up, and he recommended the Corporation—though he did not find that they were to do it—to adopt some different plan which would obviate this. He was of opinion that there had been pollution, and that there should be an inquiry in regard to damages. As to the other point, it was not the case, as the plaintiff had said, that there had been stealing of water by a secret pipe. It was ludicrous to make a statement of this kind in face of the facts. He was of opinion, as he had said, that there had been pollution, and he would grant an inquiry as to the damage. He would also make a declaration, in the language of the Act, that the Corporation must not permit any foul water to flow from the Wicken Brook into the Ogden reservoir, and he would give liberty to apply in the future for an injunction. He again suggested to the Corporation that they should make such arrangements as would prevent silting up, and the free flow of water from the 15-inch pipe which the plaintiff was entitled to. Regarding costs, he thought that, as to the pollution, the plaintiff was right when the action was commenced, and he considered that the costs of the action ought to be paid by the defendants to the plaintiff, except those referring to the part of the case about the interception and diversion.

Monazite Sand for the Manufacture of Incandescent Mantles.

In the Queen's Bench Division of the High Court of Justice on Friday, Mr. Justice Bruce and a Special Jury had before them an action brought by Mr. George Oppenheimer against the Anglo-Continental Gold Mines Company, Limited, to recover damages for breach of contract in not having employed him to sell a large quantity of monazite sand, used in the manufacture of incandescent mantles. The Company denied the alleged contract. Sir Edward Clarke, Q.C., and Mr. Whateley appeared for the plaintiff; Mr. Lawson Walton, Q.C., and Mr. A. M. Bremner represented the Company. The plaintiff's case was that on May 28, 1897, he was engaged by the Company to go to Germany to endeavour to sell some 2000 tons of monazite sand, which the Company said contained about 12 per cent. of thorium and 9 per cent. of cerium. Plaintiff was to get all the information he could about the market, and communicate with the defendants. He was to be paid his travelling expenses and 7½ per cent. commission on sales. On this understanding he went to Germany, and on one occasion he wrote to the Company saying that he could dispose of about 1000 tons; but they requested him to return. As a matter of fact, plaintiff said, the Company never had the material in their possession. He had been paid his travelling expenses, and he now claimed his commission on what he said he could have sold. For the Company it was stated that, on the strength of information they received as to a parcel of 2000 tons being available for purchase in Brazil, they engaged the plaintiff to dispose of it, as they knew he was connected with the incandescent mantle business. The plaintiff went to Germany to report on the state of the market, so that they might know whether or not to accept the offer of the sand, and whether it would be a profitable transaction. The transaction, however, was never completed, and the Company had lost over the business. After evidence had been called, a consultation took place between Counsel, and in the result judgment was entered for the plaintiff for £500.

Liability for Water-Rate.

At the Westminster County Court on Monday last week, a claim by the Grand Junction Water Company against Messrs. Eastman and Son for £4 4s., arrears of water-rate, came before his Honour Judge Lumley Smith, Q.C. Mr. K. B. D. Acland appeared for the plaintiffs; and Mr. W. de Bracy Herbert, for the defendants. Mr. Acland said Messrs. Eastman and Son occupied the lower portion of No. 3, Clifton Road, Maida Vale, under a three years' agreement from Midsummer, 1896. The rate was then paid by Mrs. Boulton, the lessor. She had since died, and Mr. Bentwich became the lessor. He paid one rate and refused to pay any more. The defendants would not pay, claiming that they were not liable because there was a covenant in their lease (they being now lessees of the premises) under which the lessor was to pay all rates and taxes. The Company called upon the occupier, who was statutorily liable when the owner would not pay. A clerk from the office of the Paddington Vestry produced the rate-book, showing that the defendants were the occupiers of the premises in question, which were rated at £50 per annum. The Company's collector deposed that the amount claimed was due. Mr. Herbert said practically all the facts were admitted. He asked his Honour to find that there was, in point of fact, an agreement between the owner and the Company that the rate should be paid by the owner. The Company took the rate from the owner for ten years, and gave receipts in the owner's name. His Honour remarked that the Company got their money and gave a receipt, not an agreement. Mr. Herbert submitted that there was a tacit agreement. His Honour said he did not infer that there was, and thought the plaintiffs were right. He gave judgment for the Company, with ordinary costs, and certified for Counsel.

A Workman's Claim Against the Birmingham Corporation for Injuries Received.

At the Rhayader County Court, on Thursday, an interesting case came before his Honour Judge Evans. The plaintiff was James Edward Baxter, who claimed £50 from his employers, the Birmingham Corporation, for injuries received while working on their quarry in connection with the Birmingham Water-Works at Elan Valley, through the alleged negligence of the defendants. Evidence having been given as to the cause and the nature of the injuries, Mr. Careless, for the defendants, said the plaintiff had elected to make his claim under common law apart from any claim he might possibly have under the Employers' Liability Act or the Workmen's Compensation Act; and therefore the defendants set up the plea of common employment, contending that they were only liable for personal negligence and not for the negligence of any of their servants, even if there had been any negligence, which was not admitted. His Honour said the case was a novel one. The defence was fatal to the common law claim; and though there might have been negligence on the part of the Corporation's servants, he must nonsuit plaintiff.

Robbing a Prepayment Meter at Rotherham.

Herbert W. Brierley was charged at the Rotherham Police Court, on Thursday, with stealing 2s. 7d. from a prepayment meter, the property of the Corporation. The Town Clerk (Mr. H. Hampton Copnall) prosecuted on behalf of the Gas Department. He stated that an inspector, on going to take the state of the meter, found the lock had been forced. There should have been 3s. 4d. in the box; but there was only a penny. Defendant admitted he broke the lock open while he was drunk, and took out 2s. 7d. William Pratt, an inspector, stated that the defendant had admitted to him that he had taken the money, saying he was very sorry, and would not do it again. A police sergeant said, when he served the summons on defendant, the latter remarked that he would not have taken the money if he had not been under the influence of drink. Defendant was fined 5s. and costs.

MISCELLANEOUS NEWS.

THIS YEAR'S EXAMINATIONS IN GAS MANUFACTURE.

The Pass List.

The following are the names of the successful candidates at the last examinations in "Gas Manufacture" conducted by the City and Guilds of London Institute. The question papers set by the Examiner (Dr. Harold G. Colman) were given in the "JOURNAL" for May 8, p. 1238:—

HONOURS GRADE.

First Class.

Cranfield, W.	Halliwell, S. E.	Johns, W. H.	Pearson, D. U. R.
Edwards, A.	Hoggard, A. W.	Nelson, R.	Winslow, D. J.

Second Class.

Astbury, E.	Dougall, A.	Mottram, A. E.	Snowball, W. N.
Brettle, J.	Hislop, L. R.	Oldfield, F.	Studholme, J. H.
Browne, B. F.	Holton, A. L.	Port, H. N.	Townsend, W. W.
Buckley, H.	Judd, G. H.	Robson, O. H.	Williams, H. R. S.
Campbell, J. M.	Knight, H. S.	Scarth, P. F.	
Caton, W. E.	Longbottom, W.	Smith, H.	
Cule, T. G.	Mead, A.	Smith, S. T.	

ORDINARY GRADE.

First Class.

Barnes, F. V.	Dickson, J.	Holland, J.	Thorman, J. S.
Barrett, F.	Garlick, D. E.	Taylor, J.	

Second Class.

Amos, F. H.	Brentnall, J. A.	Hitchens, A. W.	Norman, R.
Anderson, G. W.	Brooke, J. B.	Hutchinson, E.	Ramsden, R. S.
Armstrong, J.	Chandler, D.	Ireland, C. L.	Rice, J.
Barber, L. G.	Cowper-Smith, M.G.	Jowett, T.	Stewart, R.
Bird, F. E.	Gaunt, J.	Legge, H.	Wellens, E. J.
Bowden, R.	Haudley, H. C.	Mead, H. S.	Whyte, J. N.

THE GAS AND WATER ORDERS OF THE PRESENT SESSION.

The Board of Trade have published a memorandum stating the nature of the proposals contained in the Provisional Orders included in the Gas Orders Confirmation (No. 1) Bill. The Orders relate to Abergele, Irthlingborough, Littlehampton, Lymington, Mablethorpe and Sutton, and Romford. The Abergele Order is to empower the Abergele Gas, Coke, and Water Company, Limited, to maintain and continue gas-works, and to manufacture and supply gas within the urban district of Abergele and Pensarn and the rural district of Abergele, in Denbighshire. The Irthlingborough Order is to authorize the Irthlingborough Gas and Coke Company, Limited, to construct, maintain, and continue gas-works, and to manufacture and supply gas in the parishes of Irthlingborough, Little Adlington, Great Adlington, Woodford, and a portion of the parish of Chelverton-cum-Caldecott, all in Northampton. The Littlehampton Order is to enable the Littlehampton Gas Company, Limited, to construct further works for storage purposes, extend their limits of supply, raise additional capital, &c. The Lymington Order is to give the Lymington Gas and Coke Company authority to maintain and continue gas-works, and to manufacture and supply gas within the borough of Lymington, and the parishes or portions of the parishes of Milton and Boldre, all in the county of Southampton. By the Mablethorpe and Sutton Order, the Mablethorpe and Sutton Gas Company, Limited, will be able to maintain and continue gas-works, and manufacture and supply gas in the parishes of Mablethorpe, Trusthorpe, and Sutton-le-Marsh, in Lincolnshire. The Romford Order is to empower the Romford Gas and Coke Company, Limited, to raise additional capital, and for other purposes.

Another memorandum issued by the Board deals with the proposals contained in the Orders included in the Gas and Water Orders Confirmation Bill. They are four in number. The first is to empower the Hoylake and West Kirby Gas and Water Company, Limited, to purchase certain lands by agreement, construct additional gas and water works, and raise further capital for this purpose, and for their gas and water undertakings generally. The next is to authorize the Manningtree and Mistley Gas Company, Limited, to maintain and continue gas-works, and manufacture and supply gas within the parishes of Manningtree, Mistley, and Lawford, in Essex. The South Elmsall, South Kirkby, and North Elmsall Gas Order will give Mr. Charles Scholefield power to construct, maintain, and continue gas-works, and manufacture and supply gas in the townships or parishes of South Elmsall, South Kirkby, and North Elmsall, in the county of York. The last Order in the group is to enable the Steyning and District Water-Works Company, Limited, to raise additional capital for the purposes of their undertaking.

THE INCREASED PRICE OF GAS IN THE METROPOLIS.

The notice given by the Gaslight and Coke Company of their intention to increase their price by 6d. per 1000 cubic feet, as mentioned last week (p. 1663), has given rise to various comments in the Press.

The "Financial News" had a leading article on the subject last Friday in the course of which the following remarks were made: "So far as the three leading Metropolitan undertakings are concerned, the South Metropolitan charge is to be raised 3d. per 1000 cubic feet, from 2s. 1d. to 2s. 4d.; while the Gaslight and Coke and Commercial Companies have decided upon double this rate of augmentation—the former from 2s. 11d. to 3s. 5d., and the latter from 2s. 6d. to 3s. The advance is understood to be due to the increase in the price of coal. But, so far as we are aware, none of the Companies have deemed it necessary or courteous to offer any sort of explanation or justification for the step so generally agreed upon. The Gaslight and Coke Company certainly has not; but that practically goes without saying; for this Company is very seldom to the fore in endeavouring to conciliate its customers or to popularize its service. Yet it will scarcely be denied that a sudden advance of 17 per cent. is a very serious matter for the Company's consumers whose business premises or private residences happen to be situate on the north of the Thames; for, as our readers are aware, its more fortunate customers 'over the water' have the price of their gas regulated by the more moderate scale of the South Metropolitan Company, and will even now have to pay only 2s. 4d. per 1000 cubic feet. Perhaps the absence of any explanation of the rise is discreet; for to have given it with any show of reason would have necessitated some statement of the basis upon which the new coal contracts have been entered into, on the one hand, and, on the other hand, to have enabled consumers to form some idea of the extent to which the enhanced cost of fuel is being counterbalanced by the improved prices of residuals. As matters stand, we are left in the dark with regard to both points—at all events, so far as the current half year is concerned. In the past year, however, the increased cost of the coal used by the Gaslight and Coke Company—which in this respect may be taken as typical of the whole group of gas undertakings—was more than offset by the larger receipts from the sale of residual products." Having critically examined the Company's accounts for the past year, the writer proceeded: "An advance of 6d. per 1000 cubic feet in the Company's charge for gas is a very tall order; and we are not at all surprised to hear that a large number of gas-stoves have been returned to the Company as a protest against the extra charge upon which Colonel Makins and his colleagues have decided. Under the sliding-scale arrangement, the dividend upon the ordinary stock of the Company will have to be reduced rateably with the increase in the price of gas charged to consumers north of the Thames. . . . It is obvious that the increase in the price of gas is a serious business for the shareholders of the Companies, and particularly for those of the Gaslight and Coke Company, as well as for the general consuming public. The Company can ill afford to add to the unpopularity it has done so much to foster; and we cannot but think that the Directors would have been well advised to strain every nerve to make the augmentation in its charge for gas as small as the circumstances would allow. The Directors are fond of posing as the victims of popular prejudice and the unjustly criticized of Mr. Livesey and other gas experts; and they will now be able to add the members of the Select Committee of the House of Commons to those who have persistently misunderstood their capacity and their good intentions. . . . The Gaslight and Coke proprietors would do well to read the evidence furnished regarding their affairs to that Committee, and endeavour to find out from it whether those who are entrusted with the control of their interests are pursuing a sound or businesslike policy in annoying and flouting their customers at every turn."

The "Financial Times" for Thursday had an article on the subject, in the course of which the writer gave the views of Mr. George Livesey thereon, as expressed to a representative on the preceding day. He attributed the rise solely to the higher price of coal: "During the last two years, he explained, gas coal had risen 10s. per ton f.o.b. on the Tyne, and this was equivalent to the addition of 1s. per 1000 feet to the price of gas; so that the extra charge imposed by the Companies did not by any means cover the enhanced expense they had been and would be put to. The war had had little to do with this development of gas coal values, though it had no doubt sent up the cost of steam and kindred coal. The great boom in the iron trade was chiefly answerable for it; gas coal being almost the only mineral fuel used in that industry. Mr. Livesey did not think the high rates ruling would prevail very long; and probably next year consumers would see the price of gas down again. It had to be borne in mind, however, that up till now the public had had the benefit of the comparatively favourable terms on which the coal contracts fixed last year were based, and which only expired at Midsummer; and, therefore, for the next twelve months, consumers must expect to have against them the present contracts, founded on practically top prices. Mr. Livesey added that the South Metropolitan Company would be pretty sure to have to still further advance the price of gas before these troublous times were over; but some consolation may be derived from his admission that not all the Company's coal contracts this year had a twelvemonth's run. There is apparently something to be said for the Companies after all, though many of the methods of their policy are hard to understand. The preferential treatment of the south over the north by the Gaslight Company is an admitted scandal, and led the Select Committee to recommend that the Company should be deprived of that portion of its area. The Committee also recorded as a fact that, as compared with its Metropolitan contemporaries and with some of the small Suburban undertakings, the price charged by the Gaslight Company was very high. The recent practices of the Company fully confirm this. If coal values were going up so much last year, why was any reduction in price made at all, if it was to be followed by an altogether disproportionate rise? It is hardly likely either that the Companies have yet exhausted the supplies of coal received under the old contracts. The Gaslight Company, at the end of 1899, had more in store than it had at the end of June; and though the stock of the South Metropolitan Company was rather low, the Commercial had three months' consumption in hand. These reflections do not offer much satisfaction to the consumer who has to pay so high a price for his light; but they will serve once more to demonstrate the need of some action being taken on the report of the Select Committee—action that has already been too long delayed."

The "Daily News" says the announcement of the increase will come as "an unpleasant shock to consumers north of the Thames. For years there have been just and general complaints of the high price of the gas of this Company, which supplies by far the largest and most densely populated area in the world, and ought to be able to effect economies in production and distribution elsewhere quite impracticable. When, in June, 1898, the Company increased the price from 2s. 10d. to 3s. per 1000 cubic feet, against a charge of 2s. 2d. south of the Thames—an excess of over 38 per cent.—popular indignation reached a climax. The London County Council and the Corporation of the City both gave voice to the general dissatisfaction; and it was proposed to oppose the Company's next Bill in Parliament, with a view to securing a reduction. Last year, in spite of the strenuous resistance of the London County Council, the Company secured the passing of an Act, the chief purpose of which was to convert each £100 of its 12 per cent. stock into £300 of 4 per cent.—thus adding at a stroke some £14,000,000 of 'fictitious capital' to the amount upon which its shareholders draw interest. Having secured this

change, and decreased prices by a penny at the end of last year as a sop to the opposing consumers, the Company now shows its teeth, and by a single stroke of the pen adds 6d. a thousand to a price which was already exorbitant."

The "Builder" for last Saturday contained the following remarks: "The Gaslight and Coke Company, London, is about to raise the price of gas to private consumers from 2s. 11d. to 3s. 5d. per 1000 cubic feet. Several weeks ago we pointed out that the high price of gas coal would probably necessitate a general rise in the price of gas throughout the country; and since then news has been coming to hand every week of the price being largely increased in one town or another. In some localities, agitations are being started to protest against the increased charges; but it is foolish to imagine that gas manufacturers who have had to pay 100 per cent. more for coal than last year can avoid raising the price of gas. We do not doubt that gas-works managers are fully alive to the fact that these increases are extremely inimical to the prosperity of the gas industry, and will in their own interests lower their charges as soon as a fall in the price of coal will permit them to do so. A section of the community appears to be of the opinion that gas manufacture ought to be carried on upon philanthropic principles at the expense of the shareholder, and does not appreciate the fact that a rise in the gas charge injures the shareholder even more than the consumer. During the last few months, the market values of many gas stocks have fallen very considerably."

We learn from the "Daily Chronicle" that the Hampstead Guardians last Thursday, on learning of the Gaslight and Coke Company's increase, were very wroth; and one of the members (Dr. Ryalls) likened the Company unto licensed highwaymen, and said that the sooner their licence was taken away the better. Another Guardian (Major Sheffield) denied that the increase was wholly due to the rise in the price of coal. He said the Company had carried out a "dodge" with their capital, so that it would appear that they were paying less dividend than was really the case. Mr. Rider thought the charge was an imposition, and should be protested against by public bodies, the Press, and business houses alike. The matter was referred to the Finance Committee.

Referring to this subject in their "London Day by Day" last Friday, the "Daily Telegraph" said: "No population in the world is so patient and long-suffering as the people of London. They suffer all sorts of inconveniences, and ungrudgingly tolerate abuses, without a murmur; but it must be said that the action of the Gaslight and Coke Company in coolly raising the price of gas 6d. per 1000 cubic feet has called forth from consumers a general chorus of indignation. The reason given is the enhanced price of coal; but on all sides may be heard expressions of opinion that the increase announced is out of all proportion to the undoubted augmentation in the cost of fuel. It should also be borne in mind that of late many companies have been adulterating the *bonâ-fide* product of coal with a considerable quantity of water gas, the price of which does not depend at all on subterranean deposits. An immense volume of gas is now used for cooking and heating purposes, and the water variety is much less useful in that direction than the other. Considerably more gas is now required to attain the same degree of heat than was the case before the system of adulteration began. The public are therefore called on to pay an enhanced price for an inferior article, on the plea that the price of coals has gone up, while at the same time they are supplied with wishy-washy stuff largely extracted from water. Yesterday an official of the Gaslight and Coke Company stated that a large number of gas-stoves had been returned as a protest against the additional 6d. He added that he would like the Directors to hear some of the unpleasant remarks to which the unoffending officials have been subject during the past day or two." Having given a list of the increases in the Metropolis and the suburbs, the writer said: "The Ramsgate Corporation Gas Committee have set an example which ought to raise a blush to the cheeks of the Directors of the Metropolitan Companies, and will certainly make residents in London long for a gas administration as energetic and as economical as exists in the popular seaside resort mentioned. The authorities there have decided, notwithstanding the increased cost of coal, not to raise the price of gas to consumers, the figure now standing at 2s. 8d. [see p. 1736]. During the financial year just closed, the Gas and Water Departments have realized profits amounting to nearly £6000, of which sum £3200 will be handed over in reduction of district rates; leaving the remainder for contingencies."

EDINBURGH AND LEITH GAS COMMISSIONERS.

The Annual Accounts.

The accounts of the Edinburgh and Leith Gas Commissioners for the year ending the 15th of May have been issued, subject to audit, by Mr. John S. Gibb, the Treasurer. They show the surplus on the year's working to be £69,458. From this surplus there has been paid: For Edinburgh and Leith annuities, £32,772; for Edinburgh-Portobello gas annuities, £1138; amount transferred to the sinking fund in respect of annuities redeemed, £1290; do. in respect of mortgages redeemed, £452; interest on mortgages, &c., £12,530; expenses of mortgages, £231—together, £48,413. After meeting these charges, there remains a balance of £21,045, which, being added to the amount brought forward from the year 1898-9, after taking away contributions to sinking funds and writing off the expense of title to the Granton land, &c., £20,654, makes the total sum at the credit of the profit and loss account £41,699. This is subject to the statutory minimum charges for the sinking funds, as follows: (1) For repayment of money borrowed, £3787; (2) for redemption of annuities, £7172—together, £10,959, which, being deducted from the above sum, leaves a balance of £30,740, which may be dealt with at the discretion of the Commissioners in terms of their Act. The Treasurer adds: "In view of the favourable financial results of the past year's operations, it seems unnecessary that the Commissioners should avail themselves of their statutory power to defer contributing, at this time, to the sinking fund in respect of money borrowed for the new works at Granton. The amount stated above, however, as the contribution to the sinking fund is calculated on the total mortgage debt alone, as on the 15th of May last. It is worthy of the consideration of the Commissioners whether, in the circumstances, the contribution to the annuities sinking fund might not be increased beyond the statutory minimum of 15s. per cent."

The capital account shows that of a total capital of £370,000, upon which there were annuities payable to the amount of £35,200, there have been redeemed annuities to the amount of £1307—extinguishing capital to the amount of £13,853. The capital now stands at £356,146, and the annuities at £33,893. Of loan capital there is authorized £800,000. There has been borrowed on mortgage £378,701; and there have been redeemed out of sinking fund mortgages to the amount of £16,320. There has been expended upon works, manufacturing plant, and gasholders £486,383, of which £44,398 was expended last year. Upon mains and service-pipes and cost of laying, the expenditure has been £269,212; last year, £26,414. There has been expended upon gas-meters, £71,002; last year, £5687. Upon gas cooking and heating stoves, £13,931 was spent; last year, £2942. The total capital expenditure now stands at £847,061, of which £79,442 was expended last year. There is a debit balance on capital expenditure account of £82,039. The total capital expenditure upon the new works at Granton, including cost of site, has been £176,681; and during last year, £44,397. There has been no capital outlay upon any of the other works belonging to the Commissioners. The total revenue for the year was £297,225, of which £256,524 was derived from the sale of 1,736,347,200 cubic feet of gas, £13,195 from the sale of coke, £26,702 from tar and ammoniacal liquor, £31 from the sale of waste lime, and the rest miscellaneous. The total expenditure was £227,767, leaving the balance of £69,458. Coal (161,383 tons) cost £103,231; oil for carburetted water gas (3523 tons), £9970; purifying materials, oil, water, &c., £9297; salaries and wages, £46,786; and repairs and maintenance of works and plant, £12,987—making the total manufacturing charges £182,272. The other charges were: Distribution of gas, £20,286; management, £8841; feu-duties, rates, and taxes, £9911; pensions and allowances, £917; law and parliamentary expenses, £251; accidental damages, £9 12s. 6d.; and discounts, abatements, and bad debts, £5277. The sinking fund for repayment of money borrowed amounts to £3958—there having been already expended out of that fund £16,320; and the sinking fund for the redemption of annuities amounts to £77,850, with £38,841 already expended out of it. The gas-stove account is kept separately from the others. During the year there was expended upon the purchase of stoves £4112; and the cost of repairing and fitting up stoves, less £500 charged to revenue account, amounted to £2165. The receipts amounted to £2085 for hire of stoves; £998 for stoves sold; and £252 for fitting up gas-fires, &c.—a total revenue of £3335. There are stoves on hand, or lent on hire, of the value of £13,931.

The accounts were submitted to the Commissioners at their monthly meeting yesterday. In accordance with the statute, they have to lie on the table for a month before they are approved of.

SOUTHPORT CORPORATION GAS SUPPLY.

The Engineer's Annual Report.

In the "Journal" last week, it was mentioned that the net profit resulting from the working of the Gas Department of the Southport Corporation in the year ending March 31 last was £10,323, and that £9000 of it had been handed over in relief of the rates; leaving £1323 to be carried forward. We are now able to give further particulars in regard to the undertaking, from the annual report of the Gas Engineer and Manager (Mr. John Booth). He begins by expressing satisfaction that there was an increase in the make and sale of gas as compared with the previous year. There was, however, a falling off in the profits, owing to the enhanced prices paid for coal, oil, and other materials, though better prices were realized for residuals. The income and expenditure for gas-cookers are now brought into the revenue account, where in future they will appear. Owing to this change, a comparison with the accounts for the year 1898-9 cannot be conveniently made. The chief increases in the receipts are: Gas, £256; and residuals, £1347. The decreases are: Old iron, £261; and service-pipes and fittings, £272. The laying of service-pipes and the fixing of meters is now done free of charge. The chief items of increased expenditure are: Cannel, coal, and oil, £4143; mains and service-pipes, £689; rates and taxes, £338; general office salaries, £250; interest on loans, £227; and sinking fund, £119. The increased prices to be paid during the current year for gas-making materials will, Mr. Booth says, make a serious difference in the cost of manufacture per 1000 cubic feet; and he is of opinion that for the next twelve months at least no reduction will be seen in the selling prices of such materials. At the same time, he believes the present prices of residuals will be maintained. Under the exceptional state of things at present existing in the coal and oil markets, and the fact of their having to use a large quantity of enriching material in the manufacture of gas, he has for some time had under consideration the question of gas enrichment, and the possibility of bringing about a reduction in its cost. With this object in view, he is at present carrying out experiments on a practical scale to see if this can be effected. The sum of £3130, standing to the credit of the reserve fund, has been placed to the renewals fund. The amount standing to the credit of this fund at the end of the year was £4270, of which £500 is invested with the Corporation, and the balance is in the bank. The expenditure on capital account during the year amounted to £6265. The total outlay on capital account at the close of the year was £244,328; but a sum of £51,635 has been paid off by means of the sinking fund. There was an increase of 465 prepayment meters, and of 4,275,000 cubic feet of gas consumed by these appliances, last year; the value being £728 10s. 5d., or an average of 7s. 4d. per meter. The amount of money collected represented 271,297 pennies, equal to about 2½ tons. The number of cookers in use at the end of the year was 1834 on hire and 21 on the hire-purchase system. The number of new cookers fixed during the year was 363. In the carbonizing department, the following quantities of materials were used: Coal, 27,917 tons; cannel, 3488 tons; coke, 1319 tons; and oil, 1790 tons. The gas made was 405,128,000 cubic feet—an increase of 5,085,000 cubic feet, or 1·27 per cent., on the year 1898-9; the amount sold was 396,580,000 cubic feet, being 7,735,400 cubic feet, or 1·99 per cent., more.

Appended to Mr. Booth's report are the accounts, which are certified

by the Borough Accountant (Mr. G. Lloyd). They show a total revenue of £67,611, and an expenditure amounting to £46,939; leaving a gross profit of £20,672. The expenses of manufacture, distribution, management, &c., last year came to 2s. 3·26d. per 1000 cubic feet of gas sold. Deducting revenue from residuals, rental of cookers, &c., 8·38d., leaves 1s. 6·88d., to which must be added the payment for interest and sinking fund, public lamps, &c., 7·4d.—making 2s. 2·28d., against 1s. 11·75d. for 1898-9.

RAMSGATE CORPORATION GAS AND WATER SUPPLY.

The Past Year's Working.

The accounts of the Gas and Water Departments of the Ramsgate Corporation for the year ending the 31st of March were considered at a meeting of the Gas and Water Committee held last Thursday—the Mayor (Alderman J. B. Hodgson) in the chair.

The minutes of the previous meeting having been read and approved, the recommendations of the Gas and Water Accounts Committee were submitted; the resolution being as follows: "That the sum of £2214 8s. 6d. from the gas revenue account and £1015 7s. 4d. from the water revenue account be paid to the district fund in aid of the rate to be made for the half year commencing Sept. 30, 1900."

Mr. C. J. Gwyn, J.P., the Chairman of the Committee, then proceeded to make his report on the accounts. He said they were of a satisfactory nature, and would probably need very little comment. The prices obtained for residuals had, as was the case last year, produced substantial returns, and had been an important factor in enabling the Committee to record as the gross profit for the year the sum of £10,362. Under the head of "manufacture," an increased amount of £2897 had been paid for coals and labour, &c., which had been fully accounted for on the other side of the balance-sheet. The charges incidental to the distribution of gas were £2190. This was more than in the previous year, due to the fixing of a largely augmented number of gas-stoves, as well as to an increase in the item for the repair, maintenance, and renewal of mains, &c. The make of gas exceeded that of the previous year by 21,941,000 cubic feet, or 11·11 per cent.; and 4,540,000 cubic feet of the increase had been sold within the Minster district, which was taken over by the Corporation on Jan. 1, 1899, though the gas was not supplied from the Ramsgate holders until June. The quantity of gas sold during the year, therefore, though only a short experience, justified the expenditure of the Corporation in the purchase of the Minster works. Last year he stated that the make was fast approaching 200 millions per annum; and, as a matter of fact, for that year it was 197,365,000 cubic feet. The 200 millions had now been passed; the total make for the present year being 219,306,000 cubic feet, including Minster. Without the Minster make, they would have reached 214,766,000 cubic feet; thus showing a substantial increase in the make of gas for Ramsgate alone—a result which had fully justified the foresight of the Committee in making provision to cope with increased manufacture. The net result of the year's working was £4714. In closing his report on the financial affairs of the gas undertaking, he called attention to the efficient condition of the works, many improvements in which had been made during the twelve months. The accounts of the water undertaking were not, he said, without interesting features. The gross amount received for water (less bad debts and empty houses), rent of meters, &c., stood at £10,890. On the other side, the revenue account showed an expenditure of £5131, which deducted from the receipts left a gross profit of £5759. After payment of dividend, stock redemption, and interest on temporary loans, there remained a balance of £1015. They had therefore, from the two undertakings, a sum of £5729. Having referred to the improvements effected in the plant during the year, he emphasized the necessity for proceeding soon with the extension of the headings towards Minster; adding that the recent succession of dry seasons would necessitate the greatest care if the district was not to be inconvenienced during the height of the season, when the requirements were heaviest. In conclusion, he said that what was weighing upon the minds of the Committee, as upon everybody else who had anything to do with gas undertakings, was the very serious increase which had taken place in the price of coal. Their contract fortunately had a little longer to run; but they would require a supplementary quantity of 10,000 tons to take them up to May. At the majority of places they had had to pay 10s. per ton advance, and at this price the profit from the gas undertaking would be shrunk to the amount of £5000. He had a list of 80 places where the price of gas had been advanced from 2d. to as much as 1s. 1d. per 1000 cubic feet. He hoped the Committee would endorse the recommendation of the Accounts Committee, which was that they should hand over a total of £3229 15s. 10d. in aid of the winter's district rate, and keep back £2500 of the gas profits against the £5000 which they were likely to be called upon to pay in the shape of the higher price for coal. They could then adhere to their present price of gas, and not raise it as other towns had been obliged to do. He thought it was very unwise to take such a step as increasing the price, as this would at once stop the consumption, and be a very unpopular thing at the best.

Mr. L. Hart, J.P., in seconding the proposition, said he considered the balance-sheet showed grand working for the year. They would not, he thought, find many works which would produce the amount of profit made at Ramsgate for this particular year. He was quite certain that it would be to the advantage of the town to keep the price of gas down as long as they possibly could.

Mr. R. C. Bean considered the profit earned was a very satisfactory one, but was no more than the ratepayers were entitled to; and, after carefully looking into the matter, he thought they should raise the price of gas, as had been done in other towns. He therefore proposed that the whole of the profits (with the exception of £714 to be added to the reserve fund) be handed over in aid of the district rate.

Mr. J. Barnett seconded this proposition; saying he considered it only reasonable that the present ratepayers should have the whole of the profit earned during the past year.

Other councillors, however, supported the Committee's recommendation.

Mr. Gwyn, in reply, said that to a certain extent he should be disappointed if the recommendation were not accepted, as, in conjunction with the Engineer (Mr. W. A. Valon, J.P.), he had given a great deal of thought to the matter. In most cases where the price of gas had been raised, they had no option in the matter; but here there was a way out of the difficulty.

The amendment was put to the vote; but it only received the support of the seconder. The recommendation of the Committee was thereupon adopted.

A vote of thanks having been accorded to the Chairman of the Committee (Mr. Gwyn), and briefly acknowledged, a similar compliment was paid to the Engineer.

Mr. Valon, in reply, said the Ramsgate works were a labour of love to him, and nothing rejoiced him so much as to find that everything was coming out right at the end of the year. It was to the good working of the whole of the staff, and to the assistance he received both from the Engineer's department (of which Mr. Arthur Valon was the head) and that of the Accountant (Mr. Cockburn) that the success of the concern as a whole was due. With regard to his Chairman, he thought there was not one in the world who could manage any concern better than he did.

OLDHAM CORPORATION GAS SUPPLY.

The Increased Price of Gas—Adoption of Water Gas.

At the last Meeting of the Oldham Town Council, Mr. Letham, in moving the adoption of the proceedings of the Gas Committee, called attention to the proposed increase of 3d. per 1000 cubic feet in the price of gas, and said he had the pleasure of submitting a few figures showing the result of the year's work. They had had a pre-eminently good year, the gross revenue reaching £161,614—an addition of £21,315. Of this sum, £5622 represented an augmented sale of gas. Then from residuals they had received the largely increased amount of £15,638. The gross expenditure had been £125,580; coal and cannel having cost £11,705 more than in the preceding year. Then they had paid £2000 more for wages. The gross profits were £36,023; and there was a net profit of £10,872. If everything had kept at normal prices—those of last year—he would have been in the agreeable position of being able to move a reduction of 2d. per 1000 cubic feet in the price of gas; but, instead of this, they had an advance in coal and cannel of, in round numbers, £34,000. They expected to get an increase from residuals of £5500, which would bring the advance down to £28,500. The Committee considered their position very carefully in view of raising this sum, and they had to remember that the gas-works were the property of the ratepayers and not of the consumers. They had to look at the matter from a business point of view, and they decided to recommend the Council to increase the price of gas 3d. per 1000 from the 24th of June. This meant only for nine months; so it would bring in but £11,600. Then they would have an available surplus of £10,900 on the basis of last year's working; leaving £6000 to be provided out of the profits in hand. He was glad to be able to congratulate the Council on having in its gas undertaking a department that was exceedingly well managed, and in a perfectly sound condition. He hoped the Council would accept the recommendation for an increase of 3d.; and he expressed the belief that they had that in the estimates which would enable them to tide over the difficulty, and, if they came out a little behind on the year's trading, yet have something in hand to enable them to pull through. The motion having been seconded, Alderman Waddington asked the Chairman of the Committee if they were going to have a report of the visit to London with regard to the water-gas plant; and, further, whether the Committee were taking into consideration the fact that this gas was far more detrimental than ordinary coal gas, and whether they intended to give the consumers notice of this. Mr. Letham replied that the report of the visit in question had been presented to the Committee, who had accepted it, and decided to go forward with the water-gas plant. With regard to the alleged detrimental character of this gas, a Home Office Committee had recommended that there must not be more than 25 per cent. of water gas introduced into coal gas. The Committee had no intention of adding more than this, but less. The minutes were then confirmed.

BOLTON CORPORATION GAS SUPPLY.

The Past Year's Working—The Allocation of Profits.

At the last Meeting of the Bolton Town Council, the proceedings of the Gas and Lighting Committee came up for confirmation. In moving their adoption, the Chairman (Alderman Miles) said it devolved upon him to ask the Council to approve of the annual balance-sheet of the department (*ante*, p. 1561); and in doing so he was proud to say that it had again passed through a very successful year. With regard to the all-important account known as the capital account, they had spent £8878 on absolutely productive works, such as new mains, meters, &c. This account, which had been so often criticized, now stood at the comparatively low sum of 13s. 10d. per 1000 feet of gas sold, as compared with £1 3s. 9d. at the time the works were transferred to the Corporation. With regard to revenue account, it was last year intimated in the Council that they were about to reduce the price of gas 3d. per 1000 cubic feet; and this reduction had taken effect for a whole year. If they had not sold any more gas, they would have been £11,000 the poorer; but he was glad to say this had not been the case, inasmuch as they had sold upwards of 52 million cubic feet more this year. Having done this, which represented about 6 per cent. of their turnover, the loss proved to be not £11,000, but £4574. This 52 million cubic feet was distributed among the consumers as follows: Large consumers, an increase of 20,320,000 cubic feet; prepayment consumers, an increase of 14,629,000 cubic feet; monthly consumers, an increase of 5,306,000 cubic feet; and ordinary consumers, an increase of 12,266,000 cubic feet. As against the loss they incurred by the reduction in the price of gas, they had this very gratifying result, that their residuals had produced £12,705 in excess of the year 1898-9. Coal had cost 1s. 5d. per ton more, adding £11,370 to the debit of their revenue account. After providing for all standing charges, they had a net sum of £20,000 to transfer to the relief of rates, or £5000 less than

before. In conjunction with this matter, he wished to draw attention to the following resolution which the Committee had passed: "This Committee desires to place on record its unanimous opinion that it is extremely undesirable to place, as has been done in the past, inordinately large sums out of their profits to the relief of the district rates of the borough; believing that such a course will inevitably interfere with, and cripple the success and prosperity of, the Gas Department." This resolution might, he said, sound a drastic one, and as if its object was to coerce the Council. But there was really no such intention behind it; and he suggested that the Council might, if they deemed it desirable, appoint a Committee or Sub-Committee to take the whole question into consideration, and decide to what extent the gas profits should be allocated in relief of rates. He must remind the Council that they were now losing a large number of consumers who were producing their own electricity, and who, while putting nothing into the coffers of the Corporation, were getting the full relief from these two profit-making departments—the gas and electricity supply undertakings. With regard to the current year, coal would cost them 5s. per ton more, which for 100,000 tons would mean an additional sum of £25,000. In view of this, it would not be possible to make £20,000 of profit unless they did something which they would gladly have left undone—viz., raise the price of gas. This was a matter which they would have to consider at the earliest possible moment. They could supply cheaper gas if they made it poorer in quality. It was of interest to note that there were now in use 10,500 grillers in cottage houses, 9500 prepayment meters, and 2500 gas cookers and fires. In regard to the incandescent system of gas lighting, he was glad to say that the price of mantles had been reduced by one-third, and that of the burners had also been cheapened. These ought to find a place in almost every cottage in the district. All that was required was that ordinary care should be exercised in their use. In conclusion, he paid a tribute to the heads of the department, and also to the staff, for the manner in which they discharged their duties.

In the discussion that ensued, Mr. W. H. Horrocks took exception to the resolution of the Committee with regard to the allocation of profits in relief of rates; and he proposed as an amendment that it should be eliminated. He pointed out that the Corporation enjoyed a monopoly in regard to the manufacture and sale of gas, and said it was their duty not to abuse it, but to supply gas as cheaply as possible to the ratepayers. He thought, however, that it could be readily shown that such monopoly was not abused, and that in places where private companies supplied gas it could not be obtained at the price which was being paid in Bolton. At the same time, it was to be remembered that in their case they were manufacturing on credit, seeing that their capital liabilities amounted to £688,067. Their credit was so good that they were enabled to get the money at £3 6s. 1d. per cent. The result of the last year's working gave them roundly a sum of £63,795. Deducting from this a sum of £13,816 for renewals, which was a very moderate allowance at 2½ per cent. upon the full amount of capital, the profit was brought down to £49,978. Taking from this the interest paid (£22,710), there was left a net sum of £27,267, representing the actual profit from the undertaking, or about 4 per cent. Working as they were upon credit, they should, in his opinion, afford all the advantage they could to the ratepayers, who formed the guarantors to the persons who lent the money. It certainly behoved them to keep down the rates as much as they possibly could, as an inducement to people to bring new undertakings into the town. A sum of £20,000 was not too much to ask the Committee to hand over in relief of the rates, and out of the remaining sum to set aside £2267 for the sinking fund, and £6623 as a reserve fund for the permanent reduction of the capital account. A suggestion having been made that this matter should be referred back to the General Purposes Committee, Mr. Walmsley expressed his agreement therewith. He said it was a matter which struck deep down at the root of rating. It must not be forgotten that since the extension of the borough they had taken in some partners, who were drawing about a quarter of the profit which formerly went into the central district. Instead of a decreased contribution, they should have an augmented one. It was eventually agreed to send this matter to the General Purposes Committee.

COVENTRY CORPORATION GAS SUPPLY.

Annual Report.

The Coventry City Council had before them last Tuesday the annual reports of the various Committees. That of the Gas Committee announced that the revenue for the year from all sources, including sales of gas, coke, tar, &c., amounted to £76,896, and the expenditure to £61,873. The amount at disposal was £15,632. Against this were charges amounting to £10,135; and this deducted from the gross profit left a net surplus of £5497. In view of the great rise in the price of coal and oil, the Committee deemed it desirable that the finances of the undertaking should be in a strong position. They therefore recommended that of the surplus profits £4000 be paid over to the general district fund, and the balance of £1497 be carried forward to the next account. They also recommended that the price of gas be increased by 2d. per 1000 cubic feet from the end of the current quarter; the rebates to large consumers remaining unaltered. This would make the price to the smallest class of customers 2s. 6d. within the city and 3s. without, and to large consumers 2s. 5d. and 2s. 4d. within the city, and 2s. 11d. and 2s. 10d. without.

Mr. Griffiths moved the adoption of the report; first referring to the retirement of Alderman Andrews from the chairmanship of the Committee, of which, however, he is still a member. Continuing, he said that on the whole, the results of the year's trading were fairly satisfactory. There was an increase in the quantity of gas made of 51,368,000 feet, which was equal to 10·18 per cent. The total amount of gas produced was 555,970,000 cubic feet; and this was the largest output the works had ever made. The total revenue from all sources was £76,895—an increase of £9173. The expenditure was £61,873—an increase of £8900. The gross profit was £15,022, to which had to be added interest on reserve fund £132, and amount carried forward from last year £476—making (with the shillings and pence) a total profit of £15,632. From this had to be deducted various charges amounting to £10,135, which left a net profit of £5497, compared with £4476 last year. The profits had been adversely affected by the prices of coal and oil and annexation. The cost of gas to the inhabitants of north-east ward was now the same as to those in the other parts of the city; whereas previously the Committee obtained an increased price from them for illumination. Annexation, therefore, had tended to reduce the profits. In connection with the new and old areas, he submitted figures relating to the last two years, which he thought would be interesting. In 1899 the gas consumed in the city by the large manufacturers paying 2s. 2d. per 1000 cubic feet was 175,607,000 feet; the figures for this year being 206,138,500 feet, or an increase of 30,000,000 feet. The quantity taken by the small manufacturers at 2s. 3d. was 12,761,200 feet in 1899, and 11,382,600 feet this year—a decrease of 1,250,000 feet. The third class of consumers, the ordinary householder, paying 2s. 4d., took 241,552,800 feet in 1899, and 263,826,100 feet this year; an increase of 22,250,000 feet. Outside the boundary, there were two rates—2s. 8d. and 2s. 10d. per 1000 cubic feet. In regard to the 2s. 8d., the quantity of gas consumed last year was 5,860,000 cubic feet, against 3,487,100 feet this year—a decrease of 1,500,000 feet. At 2s. 10d. the consumption last year was 21,817,700 feet against 12,338,600 feet this year—a decrease of 9,500,000 feet. There had been a large increase in the prepayment meters in use. The gas thus consumed had risen from 5,909,800 feet in 1899 to 11,286,500 feet this year—an increase of above 100 per cent. Referring to the increased cost of coal, he said the Committee were of opinion that the rise might last perhaps nine or ten months; and after that there might be a slight fall again. Coventry was an industrial city; and, therefore, they did not want to frighten away the trades and industries by putting the price of gas too high. During the past few weeks, fresh industries had come to Coventry; and therefore he thought it would be a wise policy on the part of the Council to adopt the suggestion the Committee had made of increasing the price of gas by only 2d. per 1000 feet all round. In view of the continued growth of the city and the increased demand that had been experienced for gas, it was absolutely necessary to proceed at once with the erection of new works on the site decided upon at Foleshill. A Sub-Committee had been appointed to deal with the matter; and the Engineer (Mr. G. Winstanley) had been actively engaged for some time on the preparation of plans. Preliminary negotiations for the purchase of land and arrangements for railway sidings were being carried on; and he hoped to bring the question in a tangible shape before the Council for approval at an early date. He desired to acknowledge the ability and attention which had been paid to the interests of the undertaking by the Manager and principal officials in keeping the supply equal to the demand during a very anxious time.

Alderman Andrews seconded the motion, remarking that the financial balance was above what had been expected at the end of the year. The Committee had exercised a wise discretion in recommending that the usual amount of £4000 be handed over to the rates, and that the remainder be carried forward. He would have been glad to have seen the increase in the price of gas postponed for another three months. The price of coal, in his judgment, was not certain to keep up; he thought it would fall again at no distant date. The quantity of gas used by the manufacturers in Coventry was enormous; and therefore the price could not be exactly fixed by any narrow views they might have about making profits. Their main object must be to keep the manufacturers in the city. The price of coal, reckoned on the average at an increase of 5s. per ton, would mean an increase of £10,000 in the cost of coal during the current year. Therefore, the policy recommended by the Committee, of carrying the balance to next year's profits, was a good one.

Alderman Tomson congratulated the Committee on having the courage to look matters fairly in the face, and upon making up their minds to an advance of 2d. per 1000 feet, well knowing they would not be able to produce gas at the rate they had done hitherto.

The report was adopted.

SELBY GAS UNDERTAKING.

A Successful Result for the Past Year—The Manager Complimented.

The past year's working of the Gas Department of the Selby District Council has given every satisfaction to that body; and when the annual statement was formally submitted to the members last Wednesday, the Manager (Mr. T. H. Alderson) and the Gas Committee were congratulated thereon. Commencing the year with an adverse balance of £57, the total receipts were £6033. Against this the working expenses were £3287; while salaries took away £259. After other expenses had been paid, there was a gross profit of £2287. Out of this, £2117 went for the repayment of principal and interest on loans; and after paying off the adverse balance, there remained a net profit of £112, which is carried to the reserve fund. In moving the adoption of the report, Mr. Scott said that, although during the past year they had to pay upon the same quantity of coal carbonized a sum of £160 extra, no advance was made in the price of gas, and the profits were £2287. From a financial point of view, the result was exceedingly satisfactory. He (Mr. Scott) regretted very much that the necessity had now arisen for an increase in the price of gas; but it could not be avoided. Coal would cost them £900 more than last year; and there would be a deficiency which he had no doubt they would realize out of the cost of residuals. In the report there was much that was satisfactory to the Council, and highly creditable to the Manager. The balance-sheet showed a profit at the rate of 8½ per cent.; and in regard to the loan, they had repaid £7320 of the principal.

The Manager afterwards presented the yearly statement, which showed that there was an increase in the quantity of gas made of 3,827,000 cubic feet; while there was an increase of 386 tons 13 cwt. in the quantity of coal carbonized at an increased cost of £229. The gas made per ton of coal carbonized this year was 10,273 cubic feet—a decrease of 90 cubic feet. The illuminating power was 17·96 candles. The quantity of coke sold was 1185 tons, which realized £605, against 910 tons realizing £458—an increase of 275 tons and £147. The amount of coke saleable per ton of coal carbonized was 7 cwt. 19 lbs.—an increase of 3 qrs. 21 lbs. per ton. The total receipts for residuals were £1179, against £820 the previous year—an increase of £359. The balance of loans on the gas-works on April 1 amounted to £27,405, and £360 has been added; this amount being obtained for new mains. From the sum named, £1420 has to be deducted; being repayment of principal due on March 31. This

leaves £26,344 still owing. The total amount of profit was £2287, equal to 8·34 per cent. interest on the capital employed. Mr. Scott remarked that, having heard the statement of the Manager, they would be convinced that the gas-works plant and all connected with it was in a very healthy and satisfactory condition from every point view. He moved—"That this Council, after hearing the financial and working statement of the gas-works read, congratulate their Manager on the highly satisfactory results obtained." Mr. Foster seconded the motion; believing it was the opinion of all the members that they had an excellent Manager. Mr. Alderson briefly acknowledged the compliment, and bore testimony to the excellent work rendered by all his staff. The coal storage was a matter that required attention before the winter came on; and he expressed a hope that the carbonizing plant might be improved.

NEATH CORPORATION GAS SUPPLY.

The Past Year's Working.

The Gas Engineer and Manager of the Neath Corporation (Mr. Robert Browning, Assoc.M.Inst.C.E.) has lately presented to the Gas Committee his report for the past financial year. It appears therefrom that out of the £75,500 borrowed on account of the gas undertaking, £44,411 has been repaid; leaving a balance of £31,089 now due. There was an expenditure of £8486 on capital account last year, including £6737 for new works. The gross profit amounted to £3798; being an increase of about £900 on the preceding year. In making a comparison, Mr. Browning points out that coal cost £328 more, due to the fact that upwards of 1000 tons more were carbonized; and wages (manufacture) £160 more, owing to the stokers' wages being higher and their hours shorter. There was an increase of £129 in wear and tear, due to additional work incurred during the extensions. Public lighting cost £100 more, consequent upon extra wages and expenses in connection with incandescent lighting. Altogether, there was an augmented expenditure of about £802, as compared with the preceding year. On the other side of the account, there was a very satisfactory rise in the gas and meter rentals, amounting to about £1439, most of which was attributable to private consumption. Residual products realized £413 more; and the total receipts were about £1700 more. Subject to the approval of the Committee, the balance of profit and loss has been appropriated as follows: After paying £1152 interest on loans and £73 at the bank, £200 has been placed to the depreciation fund account, which shows a debit balance of £76. A suspense account has been formed to deal with the expenditure on renewals of buildings, boilers, machinery, &c., which is chargeable to revenue—the amount being £1728, which is written off. A sum of £1512 is applied in reduction of the principal; leaving a balance of £4015 to be carried to the next account. In closing his report, Mr. Browning calls the Committee's attention to a few points. There is a debit balance of £1682 on the capital account, due to the ordinary expenditure; and he suggests that at the first opportunity they should apply for fresh borrowing powers, as they have none at present. All the new work, including the renewals, has now been completed; and with the exception of £76, the whole of the renewal of machinery, boilers, buildings, and also the cost of land lately purchased, amounting to £2500, chargeable to revenue, has been paid off out of the balance on the profit and loss and depreciation fund accounts. Mr. Browning expresses his pleasure in stating that all the extensions and renewals are giving every satisfaction. Although he has not had the benefit of a full year's working, the up-to-date plant has been productive of increased profit. Formerly, they used extra screened coal; but out of the 7200 tons carbonized last year, 6000 tons consisted of "through" coal, and the make of gas increased 400 cubic feet per ton, although large coal should show better results than "through." The illuminating power of the gas was kept to more than 1½ candles above the parliamentary standard (14 candles), without the aid of cannel or any other enricher. Mr. Browning reminds the Committee that, in common with others, they have had to pay a greatly increased price for their coal for the next twelve months, amounting to about £2400. He remarks that most gas undertakings are raising the price of gas, from 6d. per 1000 cubic feet upwards; and to meet the large extra expenditure the price at Neath should, he says, be raised at least 8d. But, owing to the foresight of the Committee, there is a disposable balance of more than £4000 to the credit of the profit and loss account, which is intended for use in emergencies of this kind.

GAS v. ELECTRIC LIGHTING AT HASTINGS.

At the last Meeting of the Hastings Town Council, the Public Lighting Committee reported that they had had before them reports from the Sub-Committee on Electric Light, on the subject of the desirability of lighting certain streets by electricity supplied from the works of the Corporation. The streets in question had been viewed by the Committee, and, in accordance with instructions, the Borough Electrical Engineer (Mr. L. Andrews) had submitted a report on the matter. He put the annual expense, charging for current at 1½d. per unit, at £676, as compared with £649, the present cost of gas. In addition, the lamp columns would come to £597; and the total estimated outlay would be £2205. The Committee recommended that application should be made to the Local Government Board for sanction to the borrowing of this sum; and that notice should be given to the Gas Company that the lamps which would be displaced by the scheme would not be required after the 25th of December next. A table was appended, giving the number and type of the existing gas-lamps, their annual cost, the number and size of the electric lamps proposed, the number of units of electricity used per annum, the annual cost of the suggested electric lamps, and the present and proposed illumination in the thoroughfares mentioned. The relative annual cost of the two systems has been already stated. The total light afforded by gas was put at 3484 candles, that which would be furnished by electricity at 20,100 candles. In a letter addressed to the Town Clerk (Mr. B. F. Meadows) by Mr. Chas. E. Botley, the Engineer and Manager of the Gas Company, he submitted the following points for the information of the Council, with the request that his letter might be read at the meeting when the lighting question came up for consideration: "(1) The present candle power of the existing gas-lamps is not correctly stated in the report, it being nearly double the figure given. (2) The existing gas-lamps, if fitted with incandescent burners (which are generally being adopted in preference to electric arc lighting), would give a candle power in excess of that claimed for the proposed electric lamps. (3) With the recent reduction in the price of incandescent burners and mantles, the extra illumination can be given without any increase on current rates, and without disturbing the roads or footways. (4) The large lamps at the Memorial, in Wellington Square, and opposite the Public Hall, as also the 'Whitehall' lamps and columns, were got specially to meet the desires of the Council; and they can be utilized to give any desired illuminating power at a minimum cost."

The adoption of the report was moved by Dr. Allfrey, who expressed the hope that it would be favourably received by the Council, notwithstanding Mr. Botley's letter. He said it seemed to him that the question of illuminating power was very much an academic one. The point really at issue was whether it would be to their advantage to adopt the electric light, now that they had the undertaking in their own hands, as generally as possible for the illumination of the streets. He considered the electric light much more suitable than incandescent gas-light; and as regarded cost, there was only a very slight difference. He thought they would find before long that, by using their own illuminant, they would gain very considerably. Mr. Stace seconded the motion. Mr. Boutwood said he thought it would be interesting to have the correct figures. Reckoned in the aggregate, the difference was between 3484 and 6267 candles. With the incandescent gas-light, the illuminating power would be 22,968 candles; whereas the proposed electric lighting would only furnish 22,100 candles. He considered it was strange that there should be such wide discrepancies in the figures. Mr. Bones moved, as an amendment, that the matter be referred back to the Committee. Dr. Culhane seconded the amendment. Alderman Langham objected to the report being sent back. He said the Corporation had spent money in acquiring works for the purpose of supplying the electric light to the public thoroughfares and for private purposes, and the report simply recommended that certain streets should be lighted, now that they had the cables down, by the electric current. Surely they were going to adopt electric light, or they would never have bought the concern. It was better to use their own property than buy gas from another source; and it must be more economical. If they were going to allow the interest on the money spent on the electric light undertaking to be idle, and not to earn money by illuminating their own streets, they had adopted a suicidal policy. Dr. Gray (the Chairman of the Gas Company), who was received with cries of "Order," asked, if a member of the Council saw incorrect statements put forth, on the authority of which they were to be called upon to act, was he to be prevented, by a so-called rule of "interest," from pointing them out? If he was, and assuming that the Council did not wish to act in ignorance, what was he to do? He told Mr. Botley that it was useless to send him figures, because he would not be allowed to say anything if he did. Mr. Botley put before them statements which they were entitled to prove; and he did so, not with the object of attacking anybody, but in order that the Council might not take a leap in the dark. In reply to Mr. Stace, the Electrical Engineer said his figures were ascertained from scientific facts. Dr. Allfrey having briefly replied, the amendment was lost by 18 votes to 3, and the report adopted.

The following is an extract from a letter on the above subject addressed by Mr. C. F. Botley, the Gas Company's Assistant Engineer and Electrician, in his private capacity as a ratepayer of the town, to a member of the Public Lighting Committee: "Electricity must be supplied at under 1d. per unit to compete, light for light, with incandescent gas; and the recent reduction of prices by the Welsbach Incandescent Gas-light Company renders the possibility of great developments in the latter direction. The candle power of an electric arc lamp can be given at anything in figures, for it varies from a miserable light to great brilliancy; whereas, of course, with a gas-burner it is possible to test it on a photometer, and know within a little the actual candle power. The figures given for the candle power of the gas-lamps are practically about half the actual; and as to this, it is either as I say or not, and can be easily tested. . . . . If incandescent gas were used entirely in the streets proposed to be lighted electrically, more illumination would be obtained than from the electric lamps proposed, at the same, or probably reduced, cost, without the capital expenditure, and without pulling about the roads. The figure of 1¼d. per unit, besides ignoring altogether the wear and tear of the machinery, other than the lamps, is a ridiculous one; and I am particularly struck with the audacity of anyone bringing such a figure before a body of gentlemen supposed to possess some common sense. Such a cost might be obtained in coal-bearing districts under *ideal* conditions; but it is absolutely impossible in Hastings, and would not pay for coal alone. For coal, too, the Electric Light Department are likely to have to pay an advance of 8s. to 10s. per ton; and this too seems to be ignored. In the face of charges up to £52 per lamp per annum for the Front line, the present proposal is truly a fairy tale, and, as I have said, utterly impossible."

CHELSEA WATER-WORKS COMPANY.

The Half-Yearly General Meeting of this Company was held at the Office, Commercial Road, Pimlico, last Thursday—Mr. F. S. Clayton in the chair.

The Secretary (Mr. G. H. Gill) read the notice calling the meeting, and subsequently the certificate of the Government Auditor appended to the accounts, and the report of the Company's Auditors, who stated that they had "great pleasure in again expressing their entire satisfaction with the clear and precise way in which the accounts have been kept, the more so taking into consideration the constant increase of work in the Accountants' Department."

The Governor, in moving the adoption of the report, stated that, in the opinion of the Directors, it was satisfactory, though he would not say very satisfactory. The gross income for the half year ended March 31 last had been £86,805, being £2940 in excess of that of the corresponding period of the previous year; and the working expenses had amounted to £27,496, showing an increase of only £540. Considering that the period under

review was the Company's "lean" half year, this was a very satisfactory state of things; and it justified the Directors in recommending a dividend on the ordinary stock at the same rate as before—namely, at the rate of 11 per cent. The quantity of water pumped during the half year showed a slight increase as compared with the quantity pumped in the corresponding period of last year. The cost of pumping had been a little more, owing to the higher price of coal; and with respect to this subject, the Company, in common with the other Water Companies, would have to face a large advance of price under the new contracts to be entered into as from the present time. The Chelsea Company had just entered into another contract for twelve months, and at a very material increase in the price, which would affect them to a considerable extent—over £2000. The Directors, however, had no control over the matter. The only consolation was that it was an extra expense which he believed the Company were well able to bear without its affecting their dividend in any way. There had been 354 new supplies laid on during the half year, which were estimated to produce an additional water-rental of £1087; and 99 houses had been pulled down for improvements, entailing a temporary loss of income of £172. But there was no doubt that this would be more than compensated for eventually by increased water-rate, as it was found in practice that the old houses that were pulled down were replaced by others of a more important character. Since their last meeting, the Royal Commission on London Water Supply had issued their final report, which was altogether adverse to the claims of the London County Council, while dealing fairly, the Directors thought, with the Water Companies. Having read certain extracts from the report, he observed that it was impossible to state what course the Government might take in regard to it; but he thought it was quite possible that they might bring in a Bill next session to carry out the recommendations of the Royal Commission. The Bill promoted by the County Council for the purchase of the undertakings of the London Water Companies was rejected by a considerable majority on second reading; and the Council's other Bill, for acquiring the Welsh reservoirs and works, was consequently withdrawn. The London County Council had therefore been unfortunate all along the line this year. The proprietors might remember that the Company this session promoted a Bill, the object of which was to declare valid the creation and issue of the capital authorized in March, 1899. The Bill, in other words, was introduced for the purpose of confirming the issue of this stock in consequence of doubts entertained by the Government Auditor as to the legality of the proceeding. No doubt had been entertained on the subject by the Directors, who had felt confident that they had acted within their right; and after a lapse of nine months, the Government Auditor, who took legal advice on the subject, satisfied himself that his doubts had no foundation. He therefore signed the accounts which he had previously refused to sign, and there was thus no object at all in proceeding with the Bill, which was accordingly withdrawn. Another Bill was introduced by the Company jointly with several of the other Companies, the object of this measure being to confer further powers on the Local Government Board. This Bill had also been withdrawn; the Speaker having ruled that it should have been introduced as a public measure, and not as a Private Bill, as it sought to impose new duties on the Government. He was happy to be able to state that the works which the Company had had in hand, and which had been referred to in previous reports—namely, the construction of new service reservoirs at Putney Heath and the raising of the banks of the subsidence reservoirs at Molesey—were practically completed. The subsidence reservoirs were now quite full; and about a week ago the water was turned on in the new service reservoirs at Putney Heath. These two new works would constitute a very important addition to the Company's plant, and tend to the perfection of their system of water supply. They would have at Putney Heath 48 hours of filtered water always ready to hand; and the position of these service reservoirs was exceedingly good, being 175 feet above Ordnance datum. They were therefore able to supply their consumers by gravitation at a most excellent pressure, and they could supply all houses in Victoria Street, Westminster, without any difficulty. In fact, complaints of a short water supply from their mains were practically unknown at the office. He afterwards expressed the great regret of the Directors at the death, since the last general meeting, of their late colleague, Mr. William Peter Bodkin, who had been a Director of the Company for 43 years, and who had always taken an active interest in their affairs. In filling the vacancy thus caused, the Directors had considered it to be important, if possible, to select a candidate with a special knowledge of matters of finance; and they had been fortunate in meeting a gentleman of this character in Mr. Charles Henry Reynolds Wollaston, whom they accordingly elected a member of the Board. They felt satisfied that Mr. Wollaston's special knowledge of banking and finance would be of considerable service to the Company, in the near future, perhaps, as it might be that, sooner or later, their undertaking might be purchased. He also referred to the excellent services rendered to the Company by the Secretary, the Assistant-Secretary, the Engineers, and the entire staff.

The Deputy Governor (Mr. Jackson Hunt) formally seconded the motion.

Mr. Besley, Q.C., having alluded with satisfaction to the very prosperous position of the Company, and to the favourable report which had been issued by the Royal Commission, advised the Directors, in view of that report, to avoid spending further money on promoting Bills in Parliament. He thought that the time had arrived when resistance should be offered to the action of the coal masters in raising the price of coal to railway, gas, and water companies; and he said he thought that it might not be amiss if the Directors of the London Water Companies were to entertain the idea of confederation, for the purpose of buying collieries, which they could afterwards conduct on something of co-operative principles.

The motion was carried unanimously; and resolutions were afterwards passed approving the accounts, declaring the dividends recommended, and re-electing the retiring Directors—Mr. W. H. Yatman, Mr. Jackson Hunt, and Mr. Wollaston—Mr. Yatman being warmly congratulated on entering (as he now does) on his 51st year's service as a Director of the Company.

A vote of thanks to the Chairman and Directors was afterwards passed; and the proceedings then terminated.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1719.

Issue.	Share	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices	Rise or Fall in Wk.	Yield upon Investment	Issue	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.	£			p. c.	GAS COMPANIES.			£ s. d.
190,000	10	Apl. 11	10½	Alliance & Dublin 10 p. c.	20—21	..	5 0 0	60,000	5	Feb. 23	7	Ottoman, Ltd. . . .	5—5⅛	..	6 7 3
100,000	10	,,	7½	Do. 7 p. c.	13½—14½	..	5 3 5	500,000	100	June 1	6	People's Gas 2nd Mtg. of Chicago Bonds.	102—106	..	5 13 2
800,000	100	Jan. 2	5	Australian 5 p. c. Deb. .	102—104	..	4 16 2								
200,000	5	May 16	6	Bombay, Ltd. . . .	6—6½	..	4 12 4	851,070	10	Apl. 27	7	River Plate Ord. . . .	10½—10¾	..	6 10 3
40,000	5	,,	6	Do. New, £4 paid .	4—4½	..	5 6 8	250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb. .	101—103	..	3 17 8
380,000	Stk.	Feb. 23	12	Brentford Consolidated	250—260	..	4 12 4	250,000	10	Apl. 11	8	San Paulo, Ltd. . . .	11½—12½	..	6 8 0
270,000	,,	,,	9	Do. New . . .	185—190	..	4 14 9	135,000	Stk.	Mar. 14	10	Sheffield A.	245—247	..	4 1 6
50,000	,,	,,	5	Do. 5 p. c. Pref. .	140—145	..	3 9 0	209,053	,,	,,	10	Do. B.	244—246	..	4 1 4
159,375	,,	June 14	4	Do. 4 p. c. Deb.. .	116—120*	..	3 6 8	447,427	,,	,,	10	Do. C.	244—246	..	4 1 4
220,000	Stk.	Mar. 14	11½	Brighton & Hove Orig. .	230—240	..	4 15 10	5,600,000	Stk.	Feb. 23	5⅓	South Metrop., 4 p.c. Ord.	127—132	−1	4 0 9
226,320	,,	,,	8½	Do. A. Ord. Stk. .	175—180	..	4 14 5	1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb. . .	98—100	..	3 0 0
999,500	Stk.	Feb. 23	5	Bristol, 5 p. c. max. .	125—130	..	3 16 11	380,940	Stk.	May 16	5	Southampton Ord. . .	115—120	..	4 8 4
420,000	20	Mar. 29	10	British	39—41	..	4 17 7	70,825	,,	Dec. 29	4	Do. 4 p.c. Deb.	120—125	..	3 4 0
50,000	10	Feb. 23	12	Bromley, Ord. 10 p. c. .	24—26	..	4 12 4	120,000	Stk.	Mar. 14	6	Tottenham A. 5 p.c. and B. 3½ p.c.	120—125	..	4 16 0
79,000	15	,,	9	Do. 7 p. c. . . .	19—21	..	4 5 8	250,520	,,	,,	4½		93—98	..	4 11 10
500,000	10	May 16	6	Buenos Ayres (New) Ltd.	9—9¼	..	6 6 4	55,100	,,	June 14	4	Edmonton 4 p. c. Deb.	111—115*	..	3 9 7
220,000	Stk.	June 14	4	Do. 4 p. c. Deb. .	99—101*	..	3 19 3	182,380	10	Jan. 12	5	Tuscan, Ltd.	7—8	..	6 5 0
150,000	20	Mar. 14	8½	Cagliari, Ltd. . . .	24—26	..	6 6 11	149,900	10	Jan. 2	5	Do. 5 p. c. Deb. Red.	101—104	..	4 16 2
100,000	10	June 14	8	Cape Town & Dis., Ltd.	14—15*	..	5 6 8								
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	55—57	..	5 5 9								
350,000	Stk.	Apl. 11	13⅔	Commercial Old Stock .	280—290	+5	4 13 1								
226,425	,,	,,	10⅔	Do. New do. .	210—220	..	4 15 5								
288,237	,,	June 14	4½	Do. 4½ p. c. Deb. .	137—141*	..	3 3 10								
500,000	Stk.	May 31	9	Continental Union, Ltd.	155—165	..	5 9 1					WATER COMPANIES.			
100,000	,,	,,	7	Do. 7 p. c. Pref. .	170—175	..	4 0 0	780,399	Stk.	Dec. 29	11	Chelsea, Ord.	303—308	..	3 11 5
51,600	Stk.	Feb. 23	14	Croydon A 10 p. c. . .	335—340	..	4 2 4	150,000	,,	,,	5	Do. 6 p. c. Pref. .	157—162	..	3 1 9
173,400	,,	,,	11	Do. B 7 p. c. . . .	265—270	..	4 1 5	160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	145—150	..	3 0 0
555,000	Stk.	Feb. 28	5½	Crystal Palace Ord. 5 p.c.	116—120	..	4 7 6	175,785	,,	Mar. 29	4½	Do. 4½ p. c. Deb. .	145—150	..	3 0 0
60,000	,,	,,	5	Do. 5 p. c. Pref. .	130—135	..	3 14 1	1,720,560	Stk.	Apl. 11	7	East London, Ord. . .	192—196	..	3 11 5
486,090	10	Jan. 26	11	European, Ltd. . . .	19½—20½	..	5 7 4	654,740	,,	June 14	4½	Do. 4½ p. c. Deb. .	142—147*	..	3 1 3
354,060	10	,,	11	Do. £7 10s. paid .	14½—15½	..	5 6 5	390,000	,,	,,	3	Do. 3 p. c. Deb. .	97—99*	..	3 0 7
14,993,075	Stk.	Feb. 9	4⅓	Gas-light and Coke 4 p. c. Ord. . .	99—101	−2	4 17 0	700,000	50	June 14	7½	Grand Junction 10 p. c. max. .	104—107*	+1	3 10 1
2,500,000	,,	,,	8½		96—98	..	3 11 5	310,000	Stk.	Mar. 29	4		130—135	..	2 19 3
3,799,735	,,	,,	4	4 p. c. Con. Pref.	116—118	..	3 7 10	708,000	Stk.	Feb. 23	14	Kent	307—312	..	4 9 9
3,993,975	,,	June 14	8	3 p. c. Con. Deb.	95—98*	..	3 1 8	160,000	,,	,,	7	Do. New, 7 p. c. max. .	200—210	..	3 6 8
70,000	10	May 31	8	Hongkong & China, Ltd.	13⅜—14½	..	5 10 4	1,048,800	100	Dec. 29	10½	Lambeth, 10 p. c. max. .	290—295	..	3 11 2
2,800,000	Stk.	May 16	10	Imperial Continental .	203—208	−1	4 16 2	406,200	100	,,	8	Do. 7½ p. c. max. .	207—212	..	3 15 6
473,600	Stk.	Feb. 9	8½	Do. 8½ p. c. Deb. Red.	100—103	..	3 8 0	350,000	Stk.	Mar. 29	4	Do. 4 p. c. Deb. .	130—133	..	3 0 2
75,000	5	June 14	6	Malta & Medn., Ltd. .	4½—5*	..	6 0 0	500,000	100	Feb. 23	13½	New River, New Shares	422—427	..	3 3 2
560,000	100	Apl. 2	5	Met. of 5 p. c. Deb.	107—110	..	4 10 11	1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb. .	132—137	..	2 18 5
350,000	100	,,	4½	Melbourne 4½ p. c. Deb.	106—108	..	4 3 4	902,300	Stk.	June 14	7½	South-wark Ord. . . .	195—200*	+2½	3 15 0
541,320	20	May 31	3½	Monte Video, Ltd. . .	10½—11½	..	6 1 8	126,500	100	,,	7½	and 5 p. c. Pref.	182 187	..	4 0 3
667,946	Stk.	Feb. 23	9½	Newc'tle & Gateshd Con.	215—220	..	4 4 1	489,200	Stk.	,,	5		157—162*	..	3 1 9
299,855	Stk.	Dec. 29	8½	Do. 3½ p. c. Deb. .	104—107	..	3 5 5	1,019,585	,,	Apl. 11	4	Vauxhall 4 p. c. A Deb.	129—134	..	2 19 9
150,000	5	May 16	8	Oriental, Ltd. . . .	7—7½	..	5 6 8	1,155,066	Stk.	June 14	10	West Middlesex . . .	280—285*	..	3 10 2
135,000	5	,,	8	Do. New, £4 10s. pd.	6½—6⅞	..	5 6 8	200,000	,,	,,	4½	Do. 4½ p. c. Deb. .	145—150*	..	3 0 0
15,000	5	,,	8	Do. do. 1879, £1 pd.	1⅛—1⅜	..	4 11 5	200,000	,,	Mar. 14	8	Do. 8 p. c. Deb. .	99—101	..	2 19 5

* Ex. div.

* Ex div.

NEW YORK WATER SUPPLY.

An Important Report.

It may be remembered that an effort was made last year to introduce into New York a supplemental supply of water furnished by the Ramapo Company. We noticed the matter in the "JOURNAL" for the 2nd of January last (p. 39), when we quoted the opinion expressed on the proposal by our contemporary the "Engineer," which was to the effect that the most advantageous course was for the city to provide its own water supply. In the result, the Company's project failed through the energy of Comptroller Bird S. Coler. Reports made by engineers to him showed the desirability of more reliable and comprehensive information than could be obtained from the municipal records, so he engaged Mr. John R. Freeman to make a study of the present sources, the merits and demerits of the Ramapo scheme, the amount of waste and its prevention, and the value of the present supply for fire protection. Mr. Freeman began his work last August, and continued it with all possible despatch till quite recently; calling to his aid a staff of experienced assistants and the resources of the Cornell Hydraulic Laboratory, where experiments of the highest engineering importance were carried out to determine the flow of water over the crest of the old Croton dam. The results of these studies have just been made partially public in a report of great value to engineers and others interested in municipal water supply; and the following summary thereof has been given in the "Engineering Record."

It has been found by careful computation of the records of the daily flow and waste of the Croton River during the past 32 years, and by comparison with the measured run-off from similar watersheds, that although the consumption will very soon be uncomfortably close to the safe limit, with prudent management and moderate and practicable restriction of waste the Croton watershed, supplemented as now by the Bronx and Byram watersheds, can furnish a safe and ample supply for the boroughs of Manhattan and the Bronx for four or five years to come; thus giving a short, but adequate, time in which to build works for an additional supply. The necessary surveys and steps towards the acquisition of an additional supply on a comprehensive scale, capable of ultimately yielding at least 500 million gallons per 24 hours (and preferably 750) should be begun within 90 days, so that construction may be commenced early in the spring of 1901.

While there is ample proof that more than half of the water now delivered by the aqueducts is wasted, the total consumption of water, including waste, in New York and Brooklyn is to-day smaller than in Boston, Philadelphia, Washington, Buffalo, Albany, Pittsburg, Chicago, Cleveland, Detroit, Denver, and certain other large American cities; and it appears plain, from reasons given later, that the hope of restricting waste does not justify delay in making sure of an adequate extra supply. If there has to be delay in securing a moderate additional quantity, from legislative or legal causes, then a thorough system of waste prevention, beginning properly with a meter on every domestic service, must of necessity be begun at once, or danger of a water famine invited.

In estimating the yield of the Croton watershed, various errors were discovered in the records. As the latter are extensively used by engineers, it is interesting to notice how the lack of accuracy occurred. The yield is determined by ascertaining (1) the quantity wasted over the old Croton dam, (2) that drawn through the old aqueduct, (3) that drawn through the new aqueduct, and (4) that drawn from the storage reservoirs to augment the natural flow of the streams, or *vice versâ*. The two parts of the old Croton dam are of a peculiar form, upon which no accurate experiments were ever made to determine the discharge at a given depth by the gauge. In the earlier estimates, an old formula of Eytelwein's was used for computing this quantity, and was assumed to be sufficiently correct. The accurate determination of how much water had wasted over the old dam day by day for all these years is of great importance in the present discussion, because it is only by holding back, in storage reservoirs, water like that hitherto wasted that the yield of the Croton in time of drought can be increased. Full-scale models of the Croton dam-crests were constructed in the Cornell University experimental canal, from careful measurements of the actual dams; and accurate and extended experiments upon the quantity of water discharged over them at various depths were made by Professor Williams. From these measurements, it appears that the earlier estimates of the quantity going to waste over the Croton dam were about 8 per cent. too large.

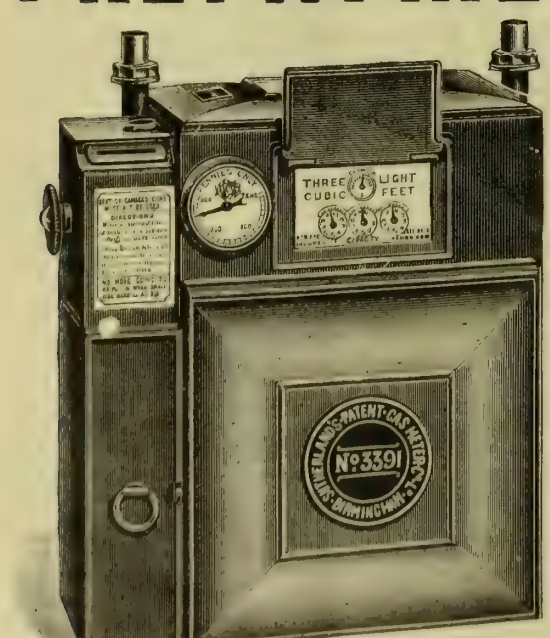
The earlier estimates of the flow through the old Croton aqueduct were based on the assumption that the coefficient of flow in this aqueduct—from thirty to fifty years old, and more or less obstructed—was the same as that in the new smooth and clean Sudbury aqueduct. New gaugings of the old aqueduct were accordingly made with various depths of water by using the current-meter designed by Messrs. Fteley and Stearns, with which the gaugings of the Sudbury aqueduct were originally made. These gaugings, and a study of all the available data, indicate that the earlier estimates of quantity drawn through the old aqueduct, when full, are about 14 million gallons per day too large.

The flow in the new Croton aqueduct had not been gauged since April, 1893; and in all previous estimates of consumption and yield it has been assumed that the delivery in gallons for a given depth of water continued substantially the same as when the aqueduct was new. A new gauging was made by the same engineer who carried out the original gaugings in 1891, 1892, and 1893, using the same instrument, and was repeated on four different days to ensure accuracy. The current-meter was rated again independently; and various comparisons leave no doubt of the accuracy of this measurement. It shows that the original carrying capacity has been impaired 15 per cent. This is equivalent to about 38 million gallons per day with the water at the usual depth. An error in a gauge was also discovered which had led to an over-estimate of 4 to 10 million gallons daily since the gauge was set.

In the former estimates, it was found that in the earlier years no allowance whatever had been made for effect of storage; and in the later years only a part of the storage reservoirs had been allowed for. This affected the estimates of the possible yield of the watershed in ways discussed fully in the complete report.

The rainfall records at all the stations in the Croton watershed were

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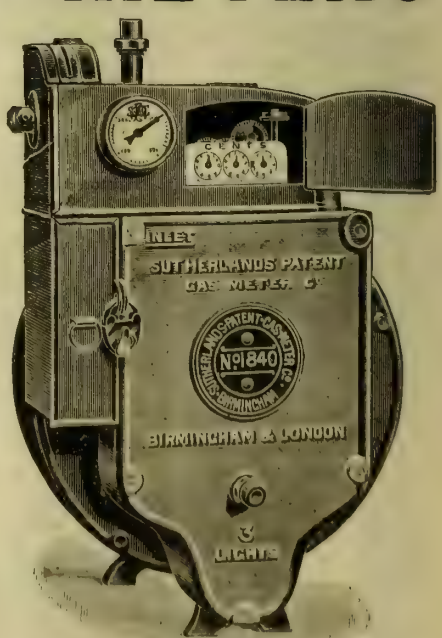
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also investigated and compared, and the estimates of the Croton yield confirmed by what has been found in other watersheds having substantially the same rainfall. The rainfall on the entire Croton watershed, from 1868 to 1899 inclusive, is found to have averaged 47·83 inches per annum. The average equivalent depth of run-off over the entire watershed was 22·93 inches per annum. The run-off has averaged 47·94 per cent. of the rainfall.

Summing up the final results of the new estimate of the Croton yield, the estimates of run-off month by month from 1870 to 1895, published in the Aqueduct Commissioners' report, average about 10 per cent., or 38 million gallons per day, too much. From a careful analysis and comparison with the observed run-off from the Croton, it appears that the safe yield of the Bronx and Byram sources combined is only from 15 to 17 million gallons, instead of 20 millions, as commonly claimed.

In the year 1899, the consumption throughout the boroughs of Manhattan and the Bronx averaged 116 gallons per inhabitant per day. Out of this, the needless waste averaged at least 50, or more probably 70, gallons per inhabitant; while the incurable or necessary waste very likely did not exceed 10 gallons. With a meter on every tap—domestic, public, and commercial—and with mains, service-pipes, and hydrants thoroughly overhauled and put into as good condition as the average pipe in the streets of Fall River, and with meters frequently tested to detect under-registration, and with a careful investigation of leaky plumbing and prompt repairs, probably New York would be better served than it is now, and have greater pressure in its pipes with a supply of 56 gallons per inhabitant per day than it has with 116 gallons; and 20 gallons more would cover all uncertainties.

The hydraulic and engineering features connected with preventing the above 70 or 56 gallons of waste are not doubtful or unduly expensive; but they would require a series of years for their full application. The real difficulties about saving the water wasted rest in human nature, and are questions of getting the voters to understand the truth of the matter—questions of public sentiment, politics, and good government. From studies in the result of efforts at waste prevention in other large cities, and from inquiry made among well-informed men as to the present sentiments of the New York public regarding domestic meters, Mr. Freeman is led to believe that for the immediate future these difficulties are insurmountable, and the hope of a cure for any large part of the waste is very remote. With all of its present waste, the domestic supply of water costs the average citizen (man, woman, and child) of Manhattan and the Bronx only $1 per head per annum. Water is so cheap that the average American citizen unfortunately seems better content to buy more than to save or conserve what he now has. The consumption of water (including waste) per inhabitant is not greater in New York than in the other large American cities. It is, in fact, to-day smaller in New York and Brooklyn than in most other large towns in America. There has been a tendency in many recent discussions to exaggerate New York's rank among other cities in wastefulness of water, and to overestimate the saving that can be made because of an apparent failure to appreciate that the real obstacles to reform are grounded in human nature and not in hydraulic engineering.

Ten days' continuous observations were made under Mr. Freeman's supervision during mild weather in December on the varying height of water in all three of the Central Park distributing reservoirs. Four observers, working in 12-hour shifts, measured the height once in six minutes throughout the 24 hours, by means of a hook gauge set in a still-box shielded from the wind, with such precision that the comparative depth of water at any time was known within a very few thousandths of a foot. The entire delivery of water to Manhattan was coming through the new aqueduct, which was carefully held at a constant depth, without appreciable variation, for two weeks. These reservoirs served as equalizing basins, and the variation in the rate of draught through the city at different hours caused the reservoir level to rise by night and to fall by day. The excess of consumption over the aqueduct delivery, or the reverse, during any hour, was shown by the precise measurements of the increase in depth of water in the reservoirs; and by computation it was found, from these observations of reservoir height and aqueduct flow, easy to determine the rate of consumption during any hour of the day or night. Day after day the observations repeat with remarkable uniformity—reaching their maximum at 10 o'clock in the forenoon, dropping off a little from 11 to 1 p.m., rising again slightly at 2.20 p.m., falling off rapidly after 5 to 6 p.m., decreasing further after 10 p.m. until the minimum was reached about 3 or 4 a.m.; the draught until that time being kept up by the refilling of the house-tanks, &c. Night after night the rate of consumption at 3 to 4 a.m. did not fall below 90 gallons per inhabitant per 24 hours—averaging about 94 gallons; while the highest point reached during working hours averaged at the rate of 137 gallons per inhabitant per day. Thus the excess of consumption in the most active hour of the day was only at the rate of 43 gallons per inhabitant per 24 hours over that in the quietest hour of the night. The average of the whole 24 hours was only 21 gallons per inhabitant greater than the draught at 3 a.m.

Late on Sunday night or early on Monday morning we should naturally expect the consumption to be at its minimum, for at that time domestic use is practically *nil*, house-tanks will have nearly all become refilled through the higher pressure of Sunday, and the factory-tanks will also have become refilled; and almost the only legitimate use that can be imagined after Sunday midnight is that of the water required for the comparatively few newspaper offices, the filling of boilers for steam heat in some few buildings, a small quantity for electric light stations, and a little for hospitals or an infrequent household in which there is sickness, and for a house-tank here and there which has not had time to become entirely replenished. After midnight, from 1 to 4 a.m., the record on Monday, Dec. 11, 1899, almost exactly reproduces that on Monday, Dec. 4, in showing a draught at the rate of 95 gallons per inhabitant per day at this hour, when the legitimate use of water should be at its minimum. Granting that this measurement was correct, the simplest common sense shows that a large part of this large draught from the reservoirs at this quiet hour of the night must have been waste through defective plumbing, leaky street mains, and abandoned service-pipes; and making the greatest reasonable allowance for uncertainty in measurement and for legitimate use at these hours, we are

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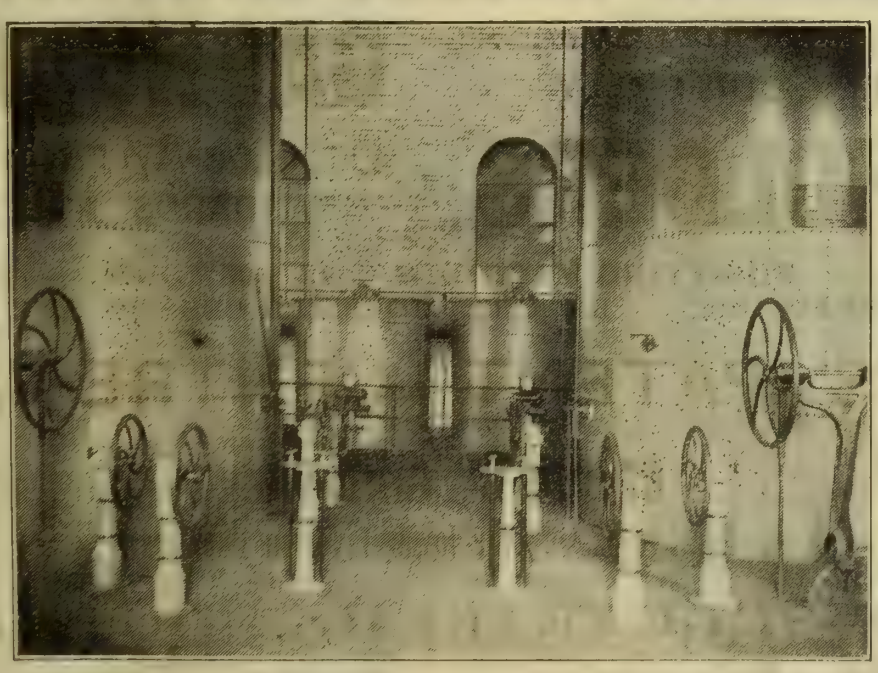
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forced to conclude that water was running to waste at night at the rate of 80 gallons per inhabitant per 24 hours. A part of this waste must be regarded as incurable; for, with the very best of pipe laying, it is found that the small undiscovered leaks in the thousands of joints, aggravated more or less by expansion and contraction under temperature changes and by settlement of the earth around the pipe, cause waste which in the aggregate is considerable.

In the city of Fall River, which has the distinction of water-works the most thriftily managed of any of equal size in the United States, and where there is a meter on substantially every tap, and where close account is also kept of the water used for fires, flushing of streets, and so forth, the discrepancy between the water pumped into the mains and that shown as taken out of the mains by the aggregate readings of all the service meters, and after making allowance for the under-registration of meters, has not been brought below 6 gallons per inhabitant per day. In Woonsocket (R.I.), another thoroughly metered manufacturing city, with a population of about 28,000 supplied, the total water unaccounted for between the pumps and the service meters was 8·5 gallons per inhabitant per day in 1898, and 7·8 gallons in 1899. In two small districts of Boston, very thorough work for about eighteen months with the Deacon system brought a night consumption of 40 gallons down to a rate of 10 gallons per inhabitant per day. Under equal quality of pipe laying and caulking of joints, the waste from joints in cast-iron mains should be proportional to the aggregate length of these leaded joints; and the service-pipe leakage between the mains and the cellar wall should be proportional to the number of pipes. Computation shows that the population along the New York distribution pipes is so much more concentrated than in any other American city that the waste per head from joint leakage in the mains ought therefore to be very much less than is found elsewhere. For example, it appears that the total number of pipe joints in Manhattan is not far from 350,000, and that the length of leaded joints is not far from 1,250,000 to 1,500,000 feet; or, at most, there is only about 0·7 foot of leaded pipe joint per head in Manhattan and the Bronx, while in Fall River a similar computation shows 1·1 feet, and in Providence 2·7 lineal feet, or 4½ times as much as in New York. The number of service-pipes per 1000 inhabitants is only about one-half as great in New York as in certain fully metered cities, like Providence, Fall River, Worcester, and Woonsocket, in which the consumption of water is less than one-half that in New York. Therefore, from what has been accomplished in various cities, and from some experience in testing long pipe-lines subject to no draught except that of leakage, we might fairly expect that this necessary or incurable waste in New York could be reduced to 5 gallons per inhabitant per 24 hours. But, under the badly crowded and frequently disturbed condition of the ground beneath the streets, and with the increasing danger of corrosion by electrolysis and the inconvenience of searching for leaks, a safer figure for the incurable waste in mains and service-pipes in the streets, outside the cellars, appears to be 10 gallons per inhabitant per day.

In the report of Mr. Dalton, the Water Commissioner, for 1898, it is stated that the present meters in Manhattan and the Bronx (35 to 42) "cover every place where water is used to any considerable extent for other than domestic purposes." A careful analysis of the figures furnished by the Water Register, together with those from the Bureau of Arrears, show that for several years past the consumption of metered water in proportion to the total population of Manhattan and the Bronx has averaged 24 gallons per inhabitant per day. There is doubtless some under-registration in the meters with the present system of ownership and repair; but it appears fair to consider this offset by the metered water drawn in hotels, apartment houses, and certain large residences, which should fairly be charged to domestic service. This 24 gallons per inhabitant covers the use of New York's shipping, manufacturing, tall office buildings, electric stations, and a large part of the transient population. The explanation of the small figure may be that, dividing the quantity by the enormous population of 2 millions or more, makes the figure per head unexpectedly small. If from the measured delivery of the aqueduct, averaging 116 gallons per inhabitant per day, we deduct the metered flow for manufacturing and commercial purposes—24 gallons per inhabitant per day—and deduct the probable waste, curable and incurable, assumed to be at least 80 gallons per inhabitant per day, it leaves for the real domestic use, apart from waste, the surprisingly small figure of 12 gallons per inhabitant per day. This figure is not at all absurd in the light of a daily metered consumption of 11·2 gallons at Fall River, 16·3 gallons at Lawrence, 14·1 gallons at Woonsocket, and 14 gallons at Worcester.

(To be continued.)

The Price of Gas at Paignton.—In consequence of the increase in the price of gas, the Paignton District Council decided last Thursday that the public lamps should not be lit on the three nights before and the four nights after full moon, and that they should be lit half-an-hour later than hitherto and extinguished by eleven o'clock at night.

Sales of Shares.—At a recent sale by Messrs. Llewellyn Puttock and Co., of Gosport, £25 shares in the Gosport Gas Company realized £44 apiece, and original stock of the Gosport Water Company £25 10s. and £51 per £10 and £21 lot. Last Thursday at Blyth, Messrs. R. & W. Mack offered by public sale £10 fully-paid "A" shares of the Blyth and Cowpen Gas Company, to produce £9042 5s. for extensions and improvements. The existing original capital of the Company is £17,500; and the additional capital "A" shares £10,957 15s. It was for the purpose of increasing the "A" shares to £20,000 that the sale was held. The prices secured varied between £15 and £15 12s. 6d. per share. At a sale by auction at Alcester on Wednesday, shares in the Alcester Gas Company produced £116 and £117 apiece, and in the local Water Company £5 each. At Luton yesterday week, £7000 of new consolidated ordinary stock in the Luton Water Company, bearing a maximum dividend of 4 per cent. was sold at good prices. Lots of £50 stock were knocked down at £58 each, and lots of £100 stock reached £116 5s. On Tuesday there was exposed for sale by auction in the Town Hall, Coatbridge, 500 new shares of £10 each (bearing interest at 7 per cent. per annum) in the Coatbridge Gas Company. The prices secured ranged between £14 8s. 6d. and £14 11s.

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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Still upward continues to be the progress of the Edinburgh and Leith Gas Commission, the accounts of which for the year ending May 15 have just been issued. The revenue of £297,225 is £30,471 more than in the year 1898-9. The price of gas was the same in both periods—3s. per 1000 cubic feet. But the sale of gas exceeded that of the previous year by no less than 91,028,700 cubic feet; and the revenue from sales of gas (£256,524) was greater by £13,924. The return from coke, &c. (£13,195), is an increase of £7342; and that from tar and ammoniacal liquor (£26,702) is an increase of £9126. The total expenditure was £227,767, which was £19,258 more than in 1898-9. The largest increase was upon coal, the cost of which amounted to £103,231, or £18,716 more than in the preceding year. The quantity of coal used was 161,383 tons, or 7372 tons more. Of oil there was 3253 tons used, an increase of 914 tons; and the cost was £9969, or £1473 more. The total charges for manufacturing gas amounted to £132,271—an increase of £25,605. Distribution cost £20,286, or £4882 less, which was entirely due to a lower expenditure upon the repair and maintenance of pipes and meters. Management cost £8841, or a decrease of £91. Feu-duties, rates, and taxes amounted to £9911, which was a decrease of £2088. Pensions and allowances came to £917, or £119 more. Accidental damages were £9, or a decrease of £6. Were it not for the great rise in the price of coal, the business of the Commission would be in every way in a most satisfactory position. As it is, it is in all respects most healthy, and is only temporarily inconvenienced by the increased cost of coal.

It is not often that anything so wicked is said in the Glasgow Town Council as was said on Wednesday, when the coal contracts were being fixed. The statement of Mr. R. M. Mitchell, the Convener of the Gas Committee, was concise, clear, and interesting. The Corporation are about to extend their oil plant at the Temple Gas-Works, with a view to keeping down the cost of producing gas. Mr. Foulis's system is a pure oil-gas process, and not a carburetting one; neither does it embody the principle of fractional distillation. It has been working for a few years; and its extension now is evidence that it has given satisfaction. Then the Gas Committee are to meet a Committee of their men, to discuss complaints regarding undue dismissal. This is an important step; but it is not necessarily, as was assumed by one speaker, the removal of what threatened to be a deadlock between the Committee and their men. When the conference takes place, it may be found to be the cause of a greater difference than would have arisen had the conference been refused. But I do not really anticipate that. It is to be a conference with the men, and not with the representatives of any Union; and the valour of the men will not be so vigorous in the committee-room as it is on the platform. It is more than likely that the workmen will leave the room convinced that they have been under a misapprehension. In that case, if it were given out by the Committee that they could not entertain any more complaints of a like nature, and that the incident was not to form a precedent, no harm would follow this concession to the men. In any view, the fact that the men are to be admitted to the presence of the Committee is proof that the Committee have no desire to do otherwise than rightly by their workpeople. What I have spoken of as wickedness came out in the remarks upon the coal contracts. It is suggestive of something which is not apparent to everyone—that the malcontents were all of the section favouring Socialism. In fact, I hold it as suggestive of this—that it was only another attempt to discredit the Gas Committee in the interests of Unionism. One member, who is a notorious Union man, remarked openly that it was time some of the old Conveners of Committees should be replaced by younger men. Then it was said that the Corporation were paying more for coal than were the Edinburgh Gas Commission; and the insinuation was thrown out that this was because of Mr. R. M. Mitchell's connection with the coal trade. I daresay none of these things were meant to be taken seriously in the Council; but outside it may be a different matter. A cry of corruption goes a long way with the electors; and some who are at present members of the Gas Committee may, unless they are specially plausible to the Union cause, find their seat endangered. That is the reading I put upon the movement. What is more, I expect that it will be renewed; and the first occasion will probably be when the report is submitted of the conference with the men. Unless it should be to the mind of the Union leaders, a few insinuations of undue influence or the like may be looked for. If it were mere ebullition, there would be little to complain of, beyond waste of time. But I am convinced that there is an ultimate object—the influencing of the electorate—in the doings of these men; and therefore I look upon them as not having a good effect upon municipal life.

Mr. Fleming, the Treasurer of the Glasgow Corporation Gas Department, reports that the gas-rental collected since the financial year began has amounted to £392,699, or an increase of £10,822 upon the collection in the corresponding period of the previous year. The receipts from residual products for the ten months have been £177,405, or an increase of £42,894.

The Dundee Gas Commissioners held their annual meeting on Wednesday last, when Treasurer Ritchie presented the accounts for the year. A summary has been given in these "Notes;" and I take up the Treasurer's statement at the point where he said it was gratifying to find the sale of gas was on the increase, notwitstanding the increased popularity of the electric light. He proposed that the price of gas be advanced from 3s. 4d. to 3s. 10d. per 1000 cubic feet. The main reason for the large increase was the unprecedented advance in the price of coal. Continuing, he said the structural changes and improvements could not be placed at less than £60,000. He pointed out that the chief reason why the price of gas was higher in Dundee than some other cities and towns in much the same circumstances as themselves, was the great disproportion between the sum they required to devote to the repayment of capital and interest and that of other towns. A much greater disproportion existed between their capital and their revenue than existed in other cities and towns. Were their capital in proportion to Glasgow, then their price would be 7d. per 1000 cubic feet less; and it would be 4d. per 1000 cubic feet less were their capital in proportion to that of Edinburgh, Aberdeen,

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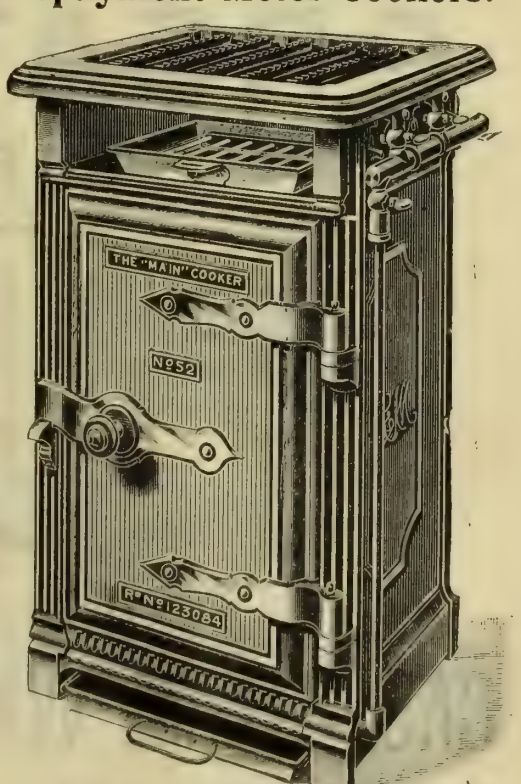


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Greenock, and Paisley. Concluding, Mr. Ritchie said the price of gas could not be properly reduced until the capital account was much lower than at present. It was this which led him to make certain proposals a year ago, and the same consideration compelled him to urge them to continue the policy so that they might bring their capital more in line, as in other towns, with their earning capacity. Ex-Provost Brownlee took exception to the increase in price. He said that since 1870 the sinking fund had repaid £179,178; and if the sinking fund had been £7500 from the beginning, as it should have been, the additional sum paid would have been £74,750, and the capital would have been reduced by £253,878. Consequently, they must see that the operation of the £7500 was amply sufficient and able to keep down the capital account. The items he objected to were interest on sinking fund, contingent fund, and the reconstruction of the gas-works; the total being £8520. They would thus see that if they took £8520 from the accounts, and the sum of £7500 entered into the estimates, they would have a total of £16,020, all beyond the statutory requirements; and from this they had to deduct the deficit of the year of £1479. This brought out a sum of £14,540, which was as near as might be equivalent to 6d. per 1000 cubic feet on the price of gas. If they adopted the policy he had indicated, they would not require to raise the price of gas at all. What he said was that the circumstances were greatly changed, and so unusual that they were warranted in considering whether it was prudent to burden the gas consumers of to-day, in the present state of the coal market, with such a heavy increase in price and such an uncalled-for repayment of capital. The gasholder was estimated to cost over £30,000. This was a provision for futurity; and why should the gas consumer of to-day be called upon to pay for that in a period of ten years? The thing was monstrous and oppressive. He moved disapproval of the items he had mentioned, and that the price of gas remain at 3s. 4d. per 1000 cubic feet. A proposal was made that the price be 3s. 7d. Treasurer Ritchie's motion was adopted, in the final vote, by 14 to 8. In all well-regulated communities this would have been accepted as decisive; but there appear to be public men in Dundee who are not prepared to accept finality unless it is according to their view. It is announced to-day that, being dissatisfied with the figures which were given on Thursday, a number of members visited the gas-works. The gas annuities stand at £225,000; and the object of the visitors was to discover what was represented by the £170,000 of capital beyond that. "Most of them," it is said, seemed to be "of opinion that the plant had been very highly valued, and that there was little chance of anything like £170,000 being obtained for it, if placed on the market." This is scarcely fair. Even assuming the gentlemen to have been expert valuators, they are very poor logicians if they expected that the gas-works plant could realize its value if placed on the market, apart from the use to which it is put as an integral part of the lighting of Dundee. But it is not so much the result they have arrived at, as the bad taste of their action, which is complained of. I should have expected that, when an effort was being made to write down capital, so as to place the gas undertaking on a sounder financial basis, everyone would have been willing to undergo some temporary inconvenience. Should the price of coal come down soon, the Commissioners will be in a good position at once; and to have changed a policy recently adopted, because of one bad year, would not be conducive to the prosperity of the undertaking.

The ceremony of laying the first plate of a new gasholder at Denny was performed on Monday, by Provost Ferguson, the Chairman of the Gas Commissioners. The holder is to be of 60 feet diameter and 40 feet in depth, having a capacity of 115,000 cubic feet. It is to be constructed so as to be capable of being telescoped. The cost is to be about £3500. Mr. J. M'Gilchrist, of Dumbarton, is the Engineer; and the Contractors are the Barrowfield Iron-Works, Limited. Ex-Provost Shanks, of Denny, was presented with an ivory mallet, as a memento of the occasion; and in returning thanks for the gift, he called to mind that it was nigh forty years since he first became interested in the gas supply of the burgh, then in the hands of two Companies. Those present were afterwards entertained to luncheon in the Railway Hotel.

The Edinburgh Association of Science and Art paid a visit last night to the works at Bonnington, Leith, of Messrs. D. Bruce Peebles and Co. They were first shown the gas department, where the processes of manufacture of meters, burners, and governors were seen at work. Then the electrical department was visited. This has been recently developed, under the supervision of one of the sons of the late Mr. D. Bruce Peebles, and is now producing large quantities of electrical appliances. All the machinery in the works is driven by electric motors, of which there are fifteen, varying from 3 to 15 horse power, at work.

The death of Mr. J. Robb, of Haddington, referred to in another column, removes the oldest gas manager in Scotland. He was also the second of the honorary members of the North British Association of Gas Managers who have died since the Association met in July last; the other having been Mr. D. Bruce Peebles, of Edinburgh. It will be remembered that about ten or twelve years ago Mr. Robb presented his file of the "Journal" to a public library—I forget where, but think it was in Edinburgh.

The Dumfries Gas Commissioners have contracted for 6120 tons of coal for the current year, at the price of £5982, or equal to 19s. 6·59d. per ton. The good quality of the purchase will be seen when it is stated that there is included 1120 tons of best cannel, 1000 tons of Hartley, 1000 tons of Cadzow, 1500 tons of Sanquhar splint, 1000 tons of Lugar gas coal, and 500 tons of Pathhead splint. Bailie Currie, who presided, said that they had already purchased 1500 tons of Elmbank cannel; and since they bought it the price had gone up 2s. 6d. per ton. Taking into account the stock they had in hand, their coal this year would cost 22s. 3d. per ton; and the average cost per 1000 cubic feet would be 2s. 2d. The increase in price over the previous year was 4s. 9½d. per ton. Altogether, the Commissioners seem to have made very favourable terms for their coal supply. Last year, the average illuminating power was from 25 to 26 candles, and in the winter time as high as 28 candles; but this year the average would be about 25 candles. There was some discussion upon the proposal to lower the illuminating power, which some of the members rather objected to; but the Committee's recommendations were adopted.

At the last meeting of the Jedburgh Town Council, a report presented

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by the Lighting Committee on the suggested electric lighting of the burgh was under consideration. Messrs. Crompton and Co., Limited, had sent in a proposal for the establishment of an electric light undertaking; and the Committee expressed the opinion that the terms offered were fair and reasonable. With regard to the prices to be charged, the Committee said they had been advised that electricity at 3d. per Board of Trade unit—the price proposed for public lighting—was equivalent to 22-candle gas at 2s. per 1000 cubic feet. The Committee had also considered the question of the Corporation themselves establishing electric light works; and they were of opinion that, in present circumstances, it was not advisable that the burgh should embark upon the scheme. On the whole, the Committee recommended that the Burgh Commissioners should adopt the scheme proposed by Messrs. Crompton and Co., and authorize them to apply for a Provisional Order to carry it out, as they were fully of opinion that a substantial saving would be effected. Bailie Young, the Convener of the Lighting Committee, in moving the adoption of the report, stated that what Messrs. Crompton proposed was that they should establish and maintain a fully-equipped electrical station, and supply light for private consumers at 7d. per unit for the first hour, equivalent to gas at 4s. per 1000 cubic feet, and for all additional current at 4d. per unit, equivalent to gas at 2s. 8d. If they combined the two, they would have an average of 6d., which was equal to 3s. 6d. per 1000 cubic feet of gas; while for heating, cooking, and motive purposes, and public lighting, the charge was to be at 3d. per unit, or equivalent to gas at 2s. per 1000 cubic feet. These charges the Committee considered to be extremely favourable compared with other places. Furthermore, Messrs. Crompton took all the risk of running the installation, whether at a profit or at a loss. If it were worked at a profit, the Corporation would be at liberty to purchase the undertaking on fair terms, as set forth in the proposals. After some discussion, the report was adopted, and the matter remitted to the Lighting Committee.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *June* 23.

Sulphate of Ammonia.—The market remains in a lifeless condition; and there has been a further decline in values—the closing quotations being £10 15s. to £10 18s. 9d. per ton, delivered f.o.b. at the ports. Shipments continue on a moderate scale; but there has been a marked absence of new business—the disposition of buyers being to wait a still more favourable opportunity. Available supplies are becoming more plentiful. But makers seem reluctant to follow the decline in values; and there is no great pressure to sell. In the forward position, there is a fair amount of inquiry; but sellers' and buyers' ideas are too divergent to admit of much business.

Nitrate of Soda is quiet at 7s. 9d. to 8s. 1½d. per cwt., according to quality, on spot.

LONDON, *June* 23.

Tar Products.—The use of 90's benzol for gas enrichment is finding more favour from the wider diffusion of information respecting its use, and in course of time may be expected to influence its value for the better. There is a feeling of weakness in most tar products at the present moment, none of them exhibiting marked strength; but some, such as creosote, oils, and anthracene, showing rather the reverse.

The average quotations during the week are: Tar, 17s. 6d. to 28s. Pitch, east coast, 37s.; west coast, 34s. Benzol, 90's, 6d. to 8d.; special qualities for gas, 9½d.; 50's, 11d. Toluol, 1s. 2d. Solvent naphtha, 1s. 1½d. Crude naphtha, 3¾d. Heavy naphtha, 1s. Creosote, 2¼d. Heavy oils, 3d. Carbolic acid, 50's, 2s.; 60's, 2s. 7d. Naphthalene salts, drained, 33s.; pressed, 75s. Anthracene, "A," 4d.; "B," 2¾d.

Sulphate of Ammonia shows a further falling off, and £10 10s. to £10 12s. 6d. per ton, less 3½ per cent., is about as much as can be obtained for early delivery.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—In the coal trade here there is no material change to note beyond a continued lessening inquiry for house-fire qualities. This restriction of the demand is in places causing the better descriptions of round coal to accumulate. But, as previously pointed out, stocks are so low that collieries are rather anxious than otherwise to replenish them during the summer months; and although from some outside districts house coal is perhaps being offered more freely, with an occasional easing in prices, local collieries are not attempting to push sales, and are very firm at recent rates. With the lessened demand for domestic purposes, there is necessarily more common round coal to dispose of for steam and forge requirements; and consumers have less difficulty in covering their needs. But there is no excess of supplies; and prices are fully maintained. In engine fuel, supplies are also more plentiful on the market, owing to outside districts sending surplus quantities into this market; but local collieries are generally moving away their output, and hold to the rates they have recently been quoting. A moderate business comes forward in the shipping trade, with fair inquiries for coastwise cargoes for next month; and prices for steam coal are steady at the Association basis. Coke continues in brisk request, with no difficulty experienced by makers in getting full late quotations. At the pit, prices may be given as: Best house coal 14s. 6d. to 15s. 6d. per ton, seconds 14s., common round coal 13s. to 13s. 6d., and engine fuel from 10s. 6d. for common to 11s. 6d. for best sorts. For delivery at the Mersey ports, steam coal is quoted at 14s. 6d. per ton for unscreened and 15s. 3d. for screened qualities. Furnace coke is about 24s. to 24s. 6d. per ton, and foundry qualities 31s. to 32s., at the ovens.

Northern Coal Trade.—Though the production of coals has been slightly reduced by local holidays, the output has on the whole been good, and has been readily taken up—the demand having been full, and showing signs of including some quantities to be put into stock. In the steam coal trade, there is a fair demand, and prices have been stiffly maintained without much change in the actual figures. Northumbrian



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"Fetch forth the stocks, ho!"—Lear II., 2.

best steam coals are 17s. 6d. to 18s. per ton f.o.b., second-class steams are about 17s., and steam smalls from 12s. 6d. to 13s. In the gas coal trade, the tendency is steady, though there does not seem to be so much inclination as there was to buy for long periods ahead. For best Durham gas coals, the quotation for occasional cargoes is 17s. per ton f.o.b.; but the bulk of the output is being disposed of on contracts that are probably from 1s. to 1s. 6d. per ton lower than the price just named. Nothing has yet been decided, as far as is known, for the supply of gas coal to Middlesbrough. In the coke trade, the demand is steady, and there is a large export; prices being firm both for blast-furnace and foundry coke. Stocks of gas coke are very low, and prices are firm; while any new contracts are at rather higher prices than those recently quoted.

Scotch Coal Trade.—The market continues strong. It is now generally believed that prices have reached their highest point, and that they will begin to come down. The closing down of works is spoken of as being necessary on account of the high price of fuel making it unprofitable to work. The effect will be that there will soon be more coal than there will be demand for, because it will not be required for productive purposes, and the pits will be crowded with workmen who will be thrown idle in other occupations. The quotations are: Main 14s. 3d. to 14s. 6d. per ton f.o.b. Glasgow, ell 16s. to 17s., and splint 16s. to 16s. 6d. The shipments for the week amounted to 222,322 tons—an increase of 21,206 tons upon the preceding week, and of 28,850 tons upon the corresponding week of last year. For the year to date, the total shipments have been 4,666,261 tons—an increase of 621,111 tons upon the same period of last year.

Brigg and Its Gas Supply.—At the meeting of the Brigg Urban District Council last week, the Finance Committee's report, which included several large items in connection with the legal and other expenses arising out of the purchase by the Council of the Brigg Gas Company's undertaking, was adopted. It was decided to apply to the Local Government Board for sanction to borrow the £1000 required for payment of compensation to officers of the Company.

Increase in the Amount Paid on a Contract.—An extraordinary result of the high price of iron is recorded at Northam, North Devon. For some time past, works of water supply have been in course of construction under a contract which was let to Messrs. Dart and Pollard. Recently the Contractors applied to the District Council for an extension of time for the completion, and also for an allowance of £1000 in excess of the contract, owing to the great increase in the price of iron. The works should be finished by November next; but the Council agreed that the time shall be extended until June, partly on account of difficulties which have been met with in the trenches. As to the additional price, it was decided last Thursday to pay the firm £1 per ton extra, not exceeding in the aggregate £1000, for all iron pipes used in carrying out the works. Mr. Littlejohns thought that in the interest of the ratepayers they ought to help the Contractors. In this opinion all the members except two concurred. Application is to be made to the Local Government Board for an additional loan to cover the cost.

Manchester Water Supply.—At last Thursday's meeting of the Water-Works Committee of the Manchester Corporation, it was decided to get out the necessary specifications and invite tenders in connection with the laying of the second pipe from Thirlmere, which was sanctioned at the last meeting of the City Council. Until the tenders have been let, it is impossible to say when the work will be commenced; but it is reported that three or four years will be occupied in putting down the pipe. Eventually, there are to be five pipes, each with a capacity to pass 10 million gallons in 24 hours. At the same meeting it was reported that the present quantity of water in store was equal to 87 days' supply.

The Position of the Aberavon Gas-Works.—Reporting on the proceedings at the meeting of the Aberavon Town Council last Wednesday, the "South Wales Daily News" says that the new Gas Manager (Mr. W. Lister) presented a report on the general state of the works on his taking over the management, which disclosed a very unsatisfactory condition of things; and he estimated the cost of immediate repairs at £102. The coal in stock when he took up the management was 92 tons short of that reported by the late Manager. The Treasurer's pass-book disclosed that a balance was due to him of over £1000. Alderman Walsh, in pursuance of notice, moved a resolution curtailing the powers of the Gas Committee in reference to the appointment of a Gas Manager in so far that the appointment should rest with the whole Council. He did not think it right that five members of any Committee should have the right to elect such an important official as a Gas Manager without the other eleven members of the Council having a voice in the matter. Mr. Wood seconded. Alderman Williams: It is nothing but a slur on the Gas Committee. Mr. Burgess supported the resolution, and disclaimed any idea of doing so as a slur upon the Committee. He concurred with Alderman Walsh's remarks. After a somewhat heated discussion, a vote was taken; and the proposition was declared carried.

Messrs. W. J. Jenkins and Co., of Retford, have received instructions from the Gaslight and Coke Company for an installation of a De Brouwer conveyor for one of their works.

A Conference between the London County Council and the Vestries and District Boards of the Metropolis will be held on Friday next, with reference to the regulations existing in connection with streets and street traffic. The Council have drawn up various suggestions relating to the regulations for the removal of house refuse, cleansing streets, the naming of streets, street cries, the traffic, and other matters; and numerous suggestions have been received from local bodies. The St. Giles District Board will ask the conference to consider whether the time has not arrived when some greater power should be vested in local bodies to control the operations of the gas, water, and other companies possessing statutory powers of breaking up the public ways. The Holborn District Board will propose that the time has arrived for concerted action on the part of the local authorities of the Metropolis to remedy the inconvenience, annoyance, and loss of time and money caused by the operations of the gas, water, telephone, and electric lighting companies in laying down and repairing their mains, pipes, services, and wires.

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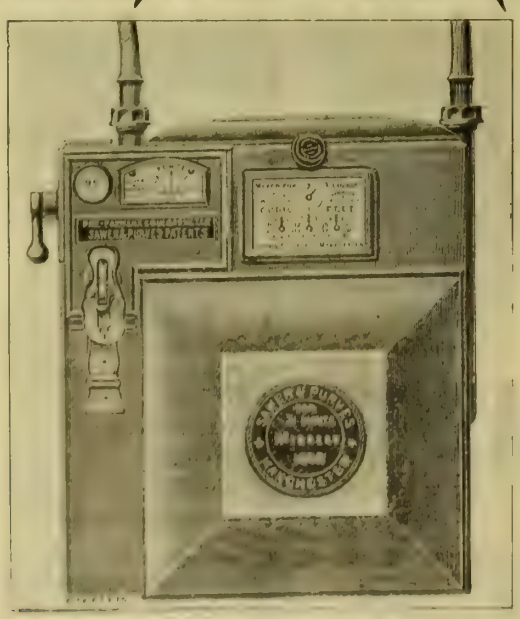
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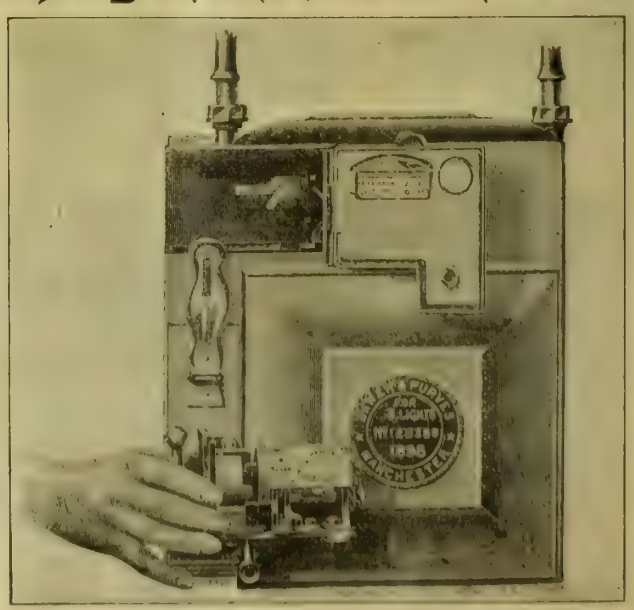
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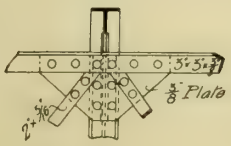


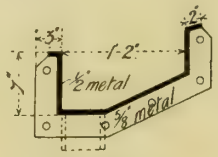
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ROOF C

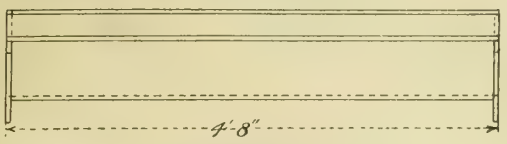
FIG 27

DETAILS OF CUTTER





SECTION



ELEVATION

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DETAIL AT B

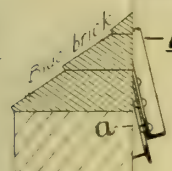


FIG 22

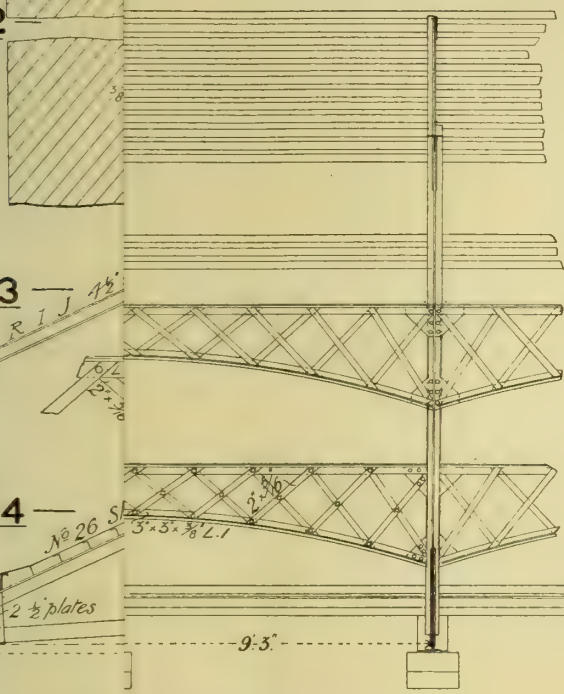


FIG 23

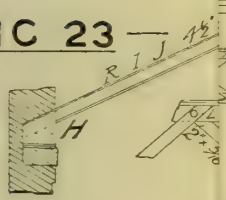
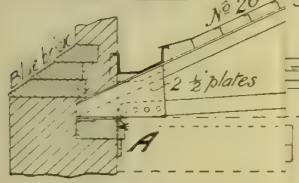


FIG 24

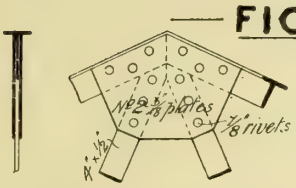


LATTICE PURLINS.

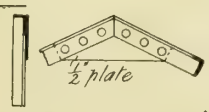
Note - Where chimney slate purlins are to

Scale for Figs 22,25 & 26 TO 29 — 6 0 1 2 3 4 5 6 Feet.

FIG 28



DETAIL AT D

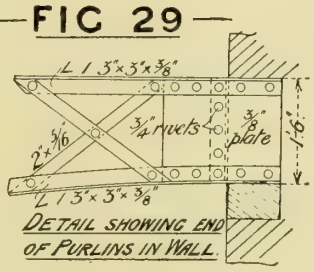


DETAIL AT I

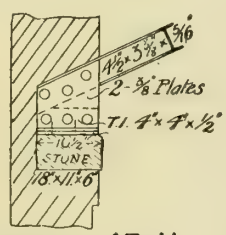


DETAIL AT K

FIG 29



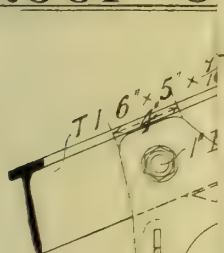
DETAIL SHOWING END OF PURLINS IN WALL.

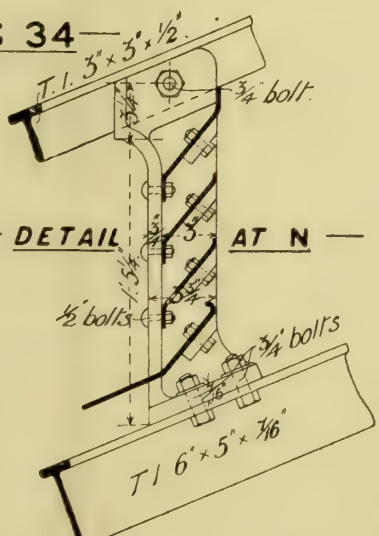


DETAIL AT H

ROOF O

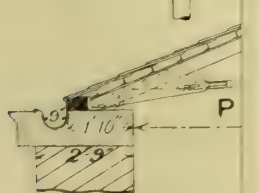
FIG 34





DETAIL AT N

FIG 31



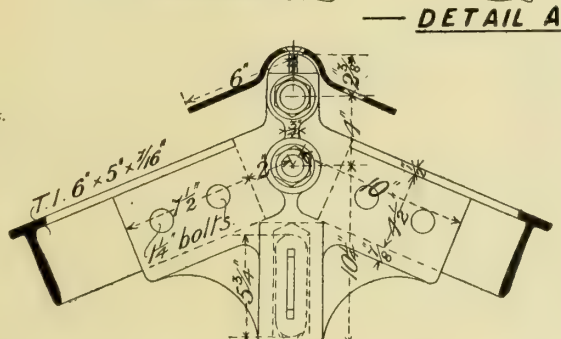


FIG 35

DETAIL AT O

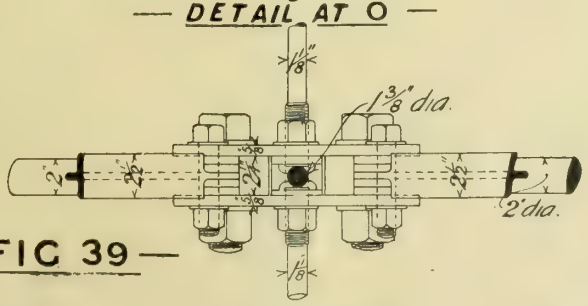
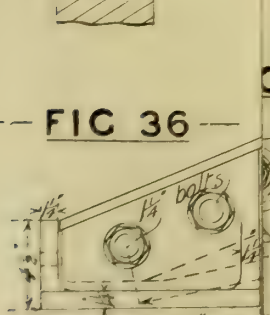


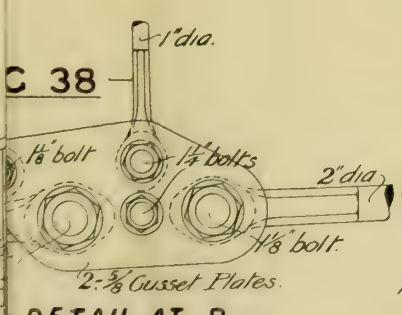
FIG 39

DETAIL AT S

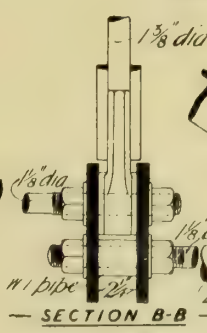
FIG 36



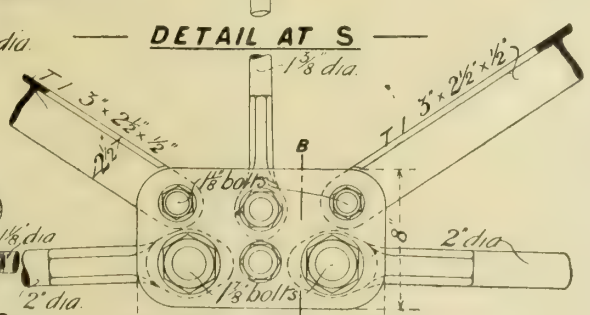
C 38



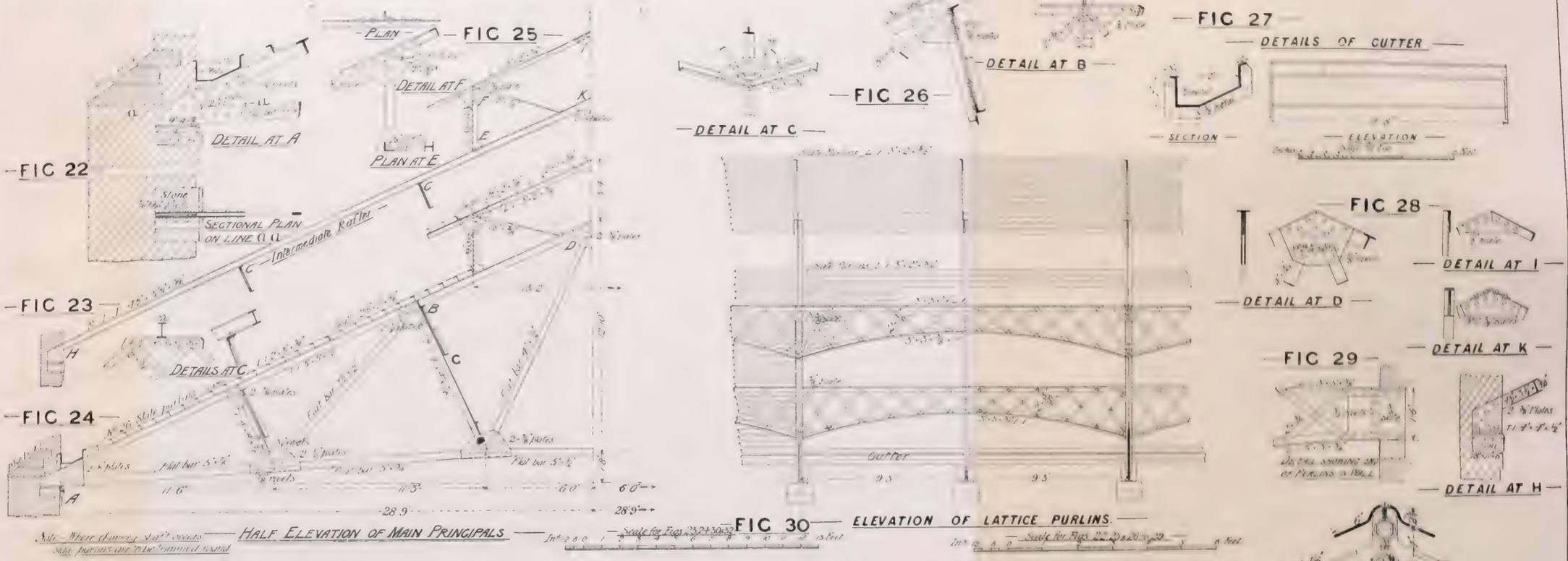
DETAIL AT R



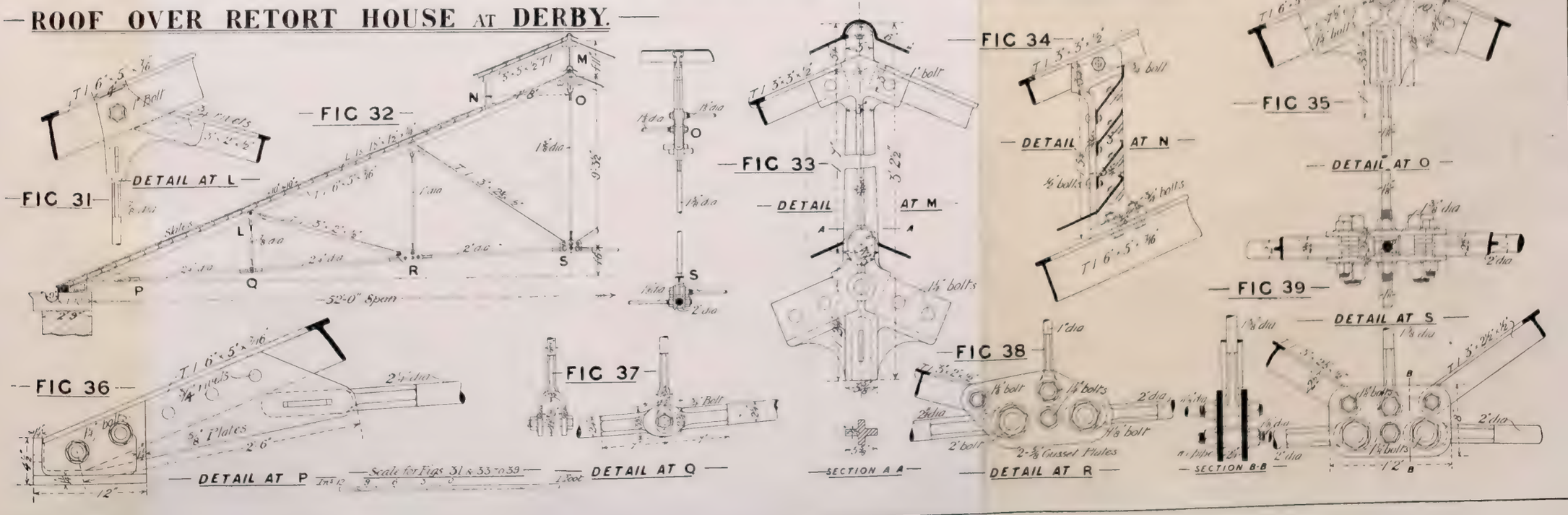
SECTION B-B



ROOF OVER RETORT HOUSE AT BOW COMMON.



ROOF OVER RETORT HOUSE AT DERBY.



ROOF OVER RETORT HOUSE AT BECKTON

FIG 1 — HALF TRANSVERSE SECTION

FIG 2 — DETAIL AT A

FIG 3 — DETAIL AT RIDGE SECONDARY RAFTERS

FIG 4 — SECONDARY RAFTERS

FIG 5 — ELEVATION OF CROSS GIRDERS

FIG 6 — SIDE ELEVATION OF VENTILATOR

FIG 7 — DETAIL AT B

FIG 8 — DETAIL AT K

FIG 9 — DETAIL AT D

FIG 10 — DETAIL AT E

FIG 11 — DETAIL AT C

FIG 12 — DETAIL AT C

FIG 13 — DETAIL AT F

FIG 14 — DETAIL AT H

FIG 15 — DETAIL AT I

FIG 16 — DETAIL AT J

FIG 17 — DETAIL OF COVER PLATES

FIG 18 — SECTION AT C-C

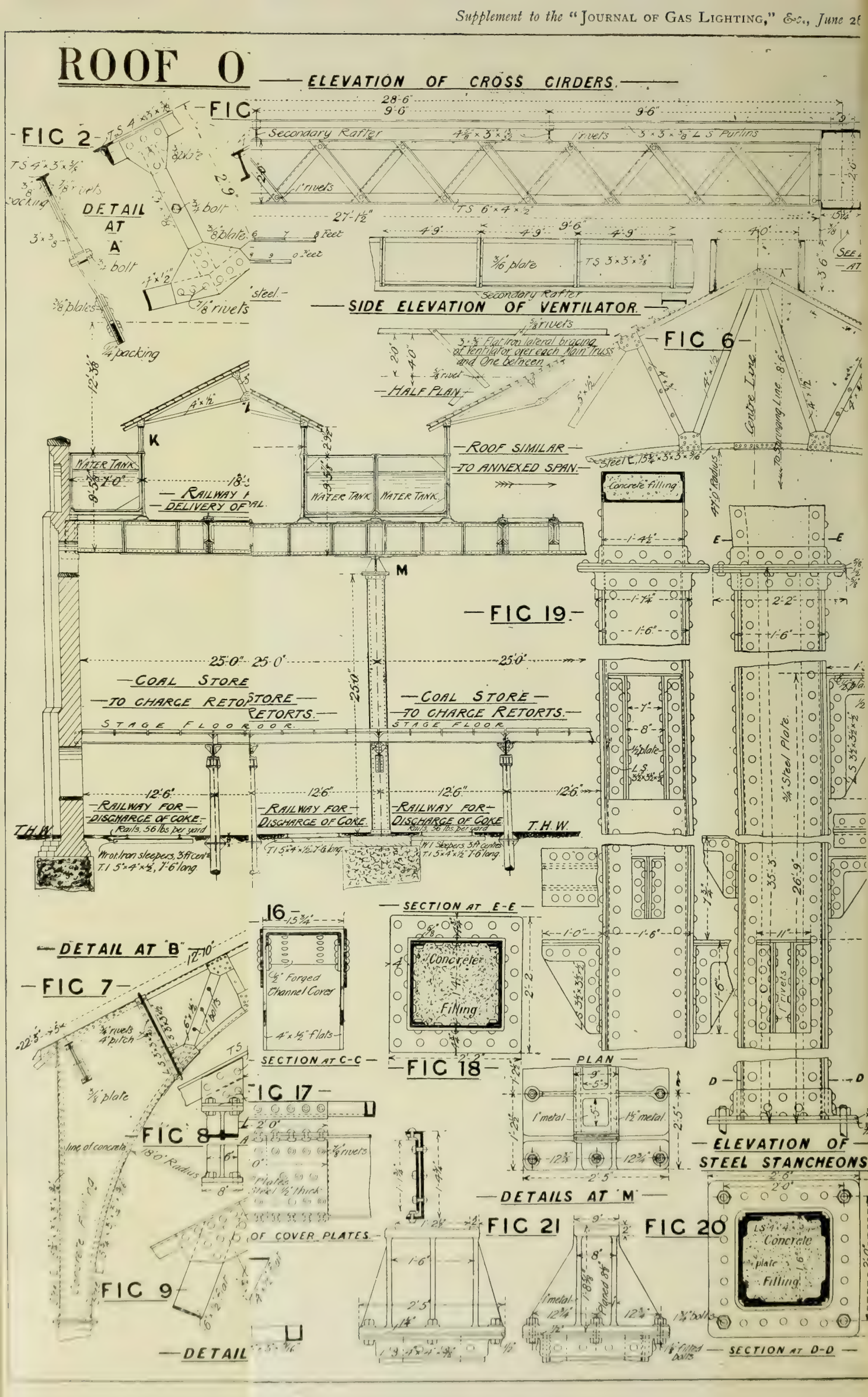
FIG 19 — DETAILS AT M

FIG 20 — SECTION AT D-D

FIG 21 — ELEVATION OF STEEL STANCHEONS L-L

ROOF O

ELEVATION OF CROSS GIRDERS



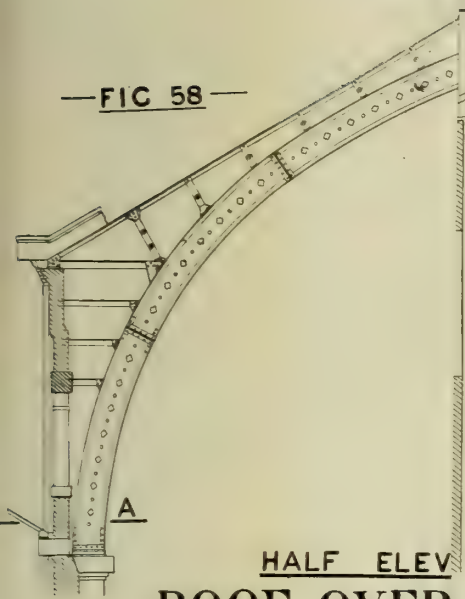
ROOF OVER RETO

SCATE CORPORATION CAS WORKS.—

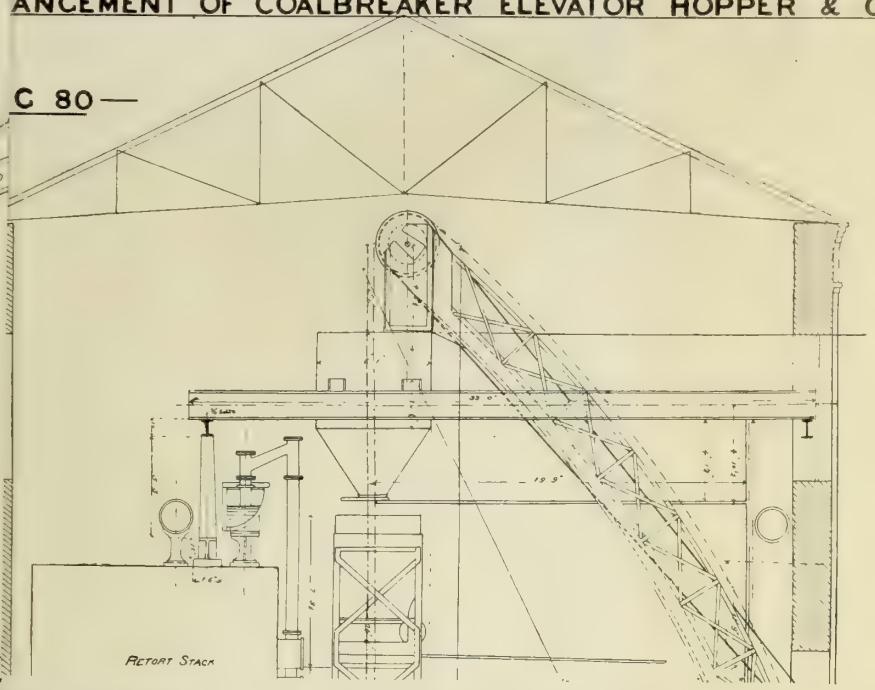
ANCEMENT OF COALBREAKER ELEVATOR HOPPER & CIRDERS.—

C 80

FIG 58



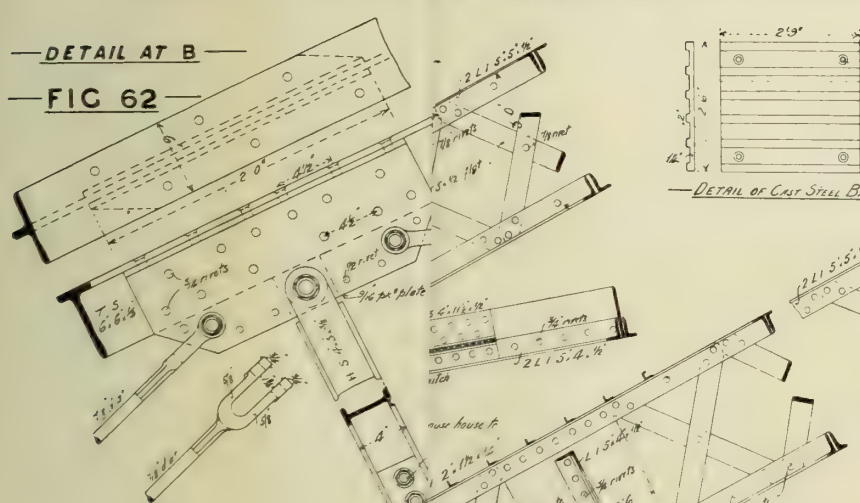
HALF ELEV



ROOF OVER T HOUSE AT NEWCASTLE.—

DETAIL AT B

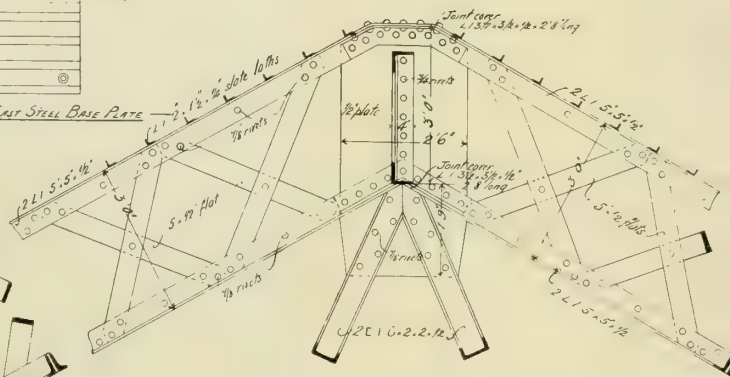
FIG 62





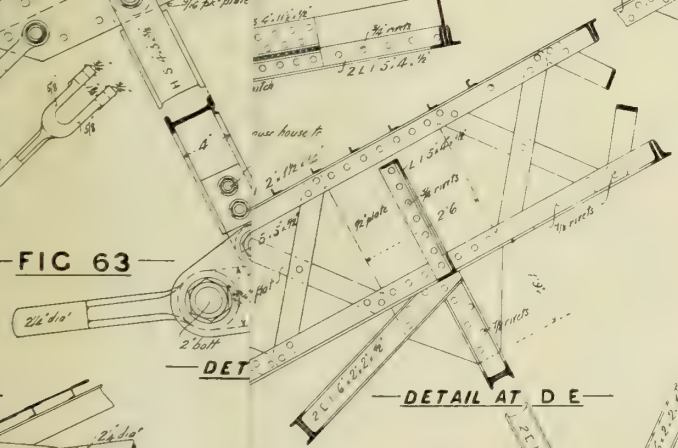
DETAIL OF CAST STEEL BASE PLATE

FIG 70



DETAIL AT F

FIG 63



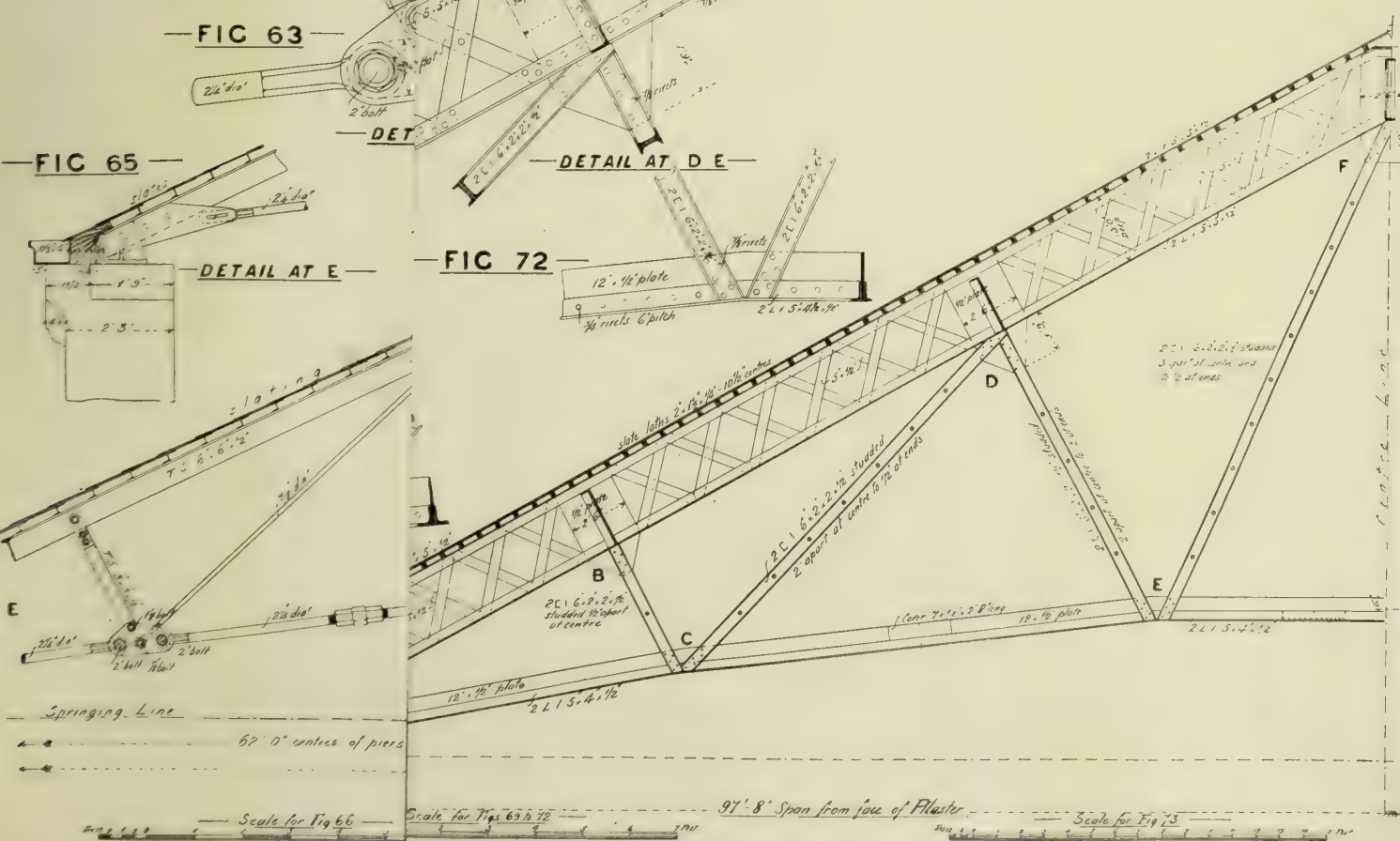
DET

FIG 65

DETAIL AT E

DETAIL AT D E

FIG 72



ROOF OVER RETORT HOUSE AT HARTLEPOOL.

FIG 58

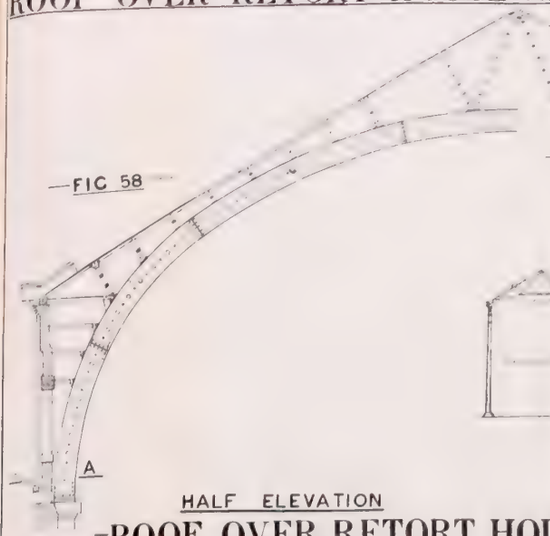
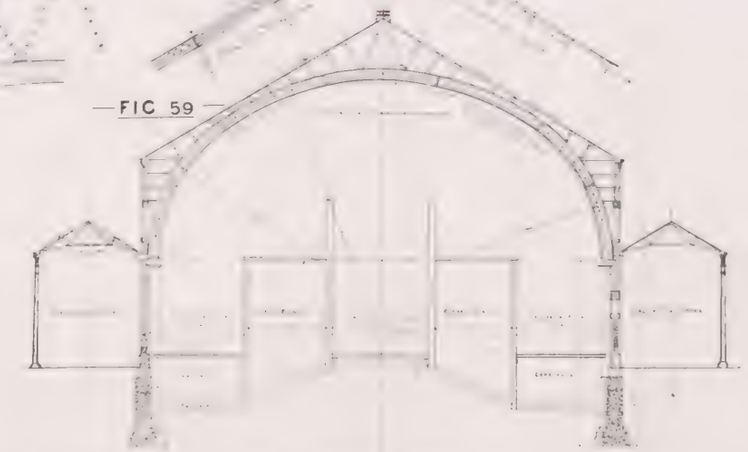


FIG 59



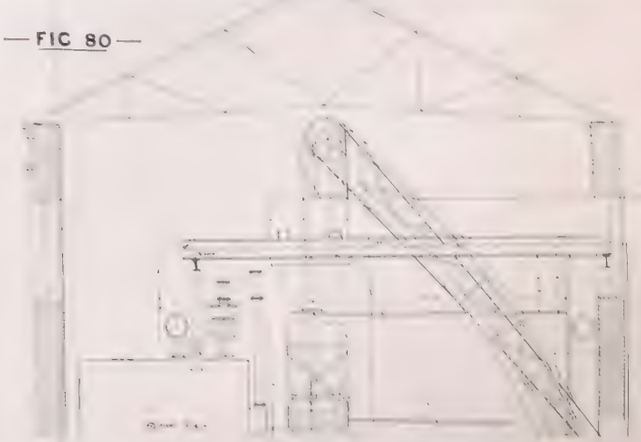
A

HALF ELEVATION

RAMSCATE CORPORATION CAS WORKS.

ARRANGEMENT OF COALBREAKER ELEVATOR HOPPER & CIRDERS.

FIG 80



ROOF OVER RETORT HOUSE AT FOLKESTONE.

DETAIL AT B

FIG 62

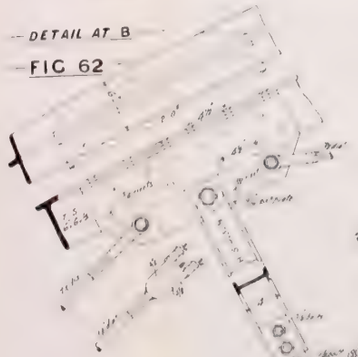
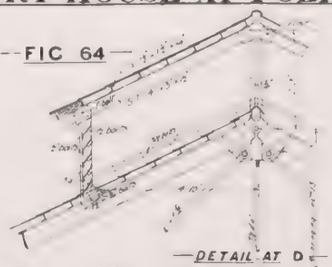


FIG 64



DETAIL AT D

F

FIG 63

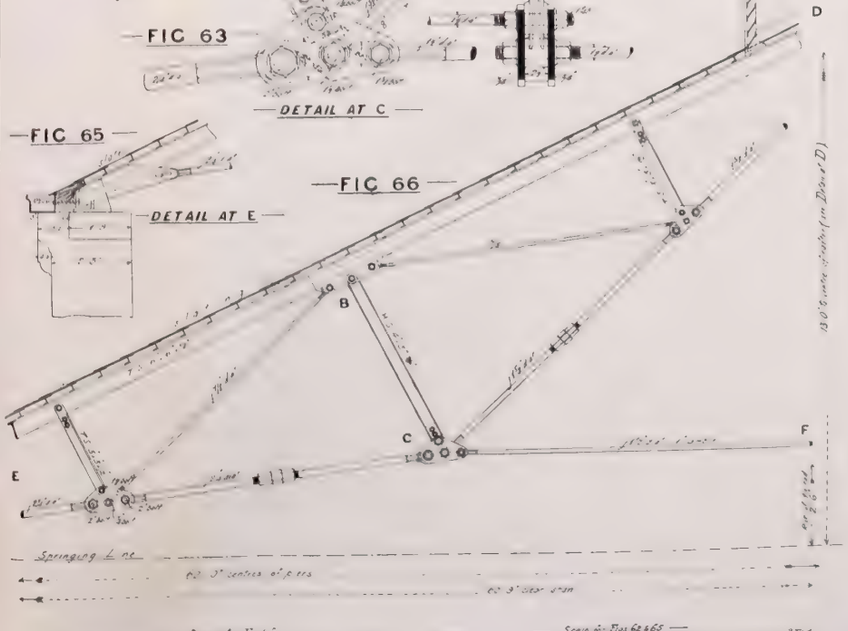


DETAIL AT C

FIG 65

DETAIL AT E

FIG 66



Scale for Fig 66

Scale for Figs 62 & 63

ROOF OVER PURIFYING HOUSE AT CRIMESTHORPE.

FIG 67

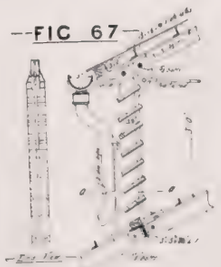


FIG 68



Scale for Figs 67 & 68

ROOF OVER RETORT HOUSE AT NEWCASTLE.

FIG 69

PLAN

DETAIL AT A

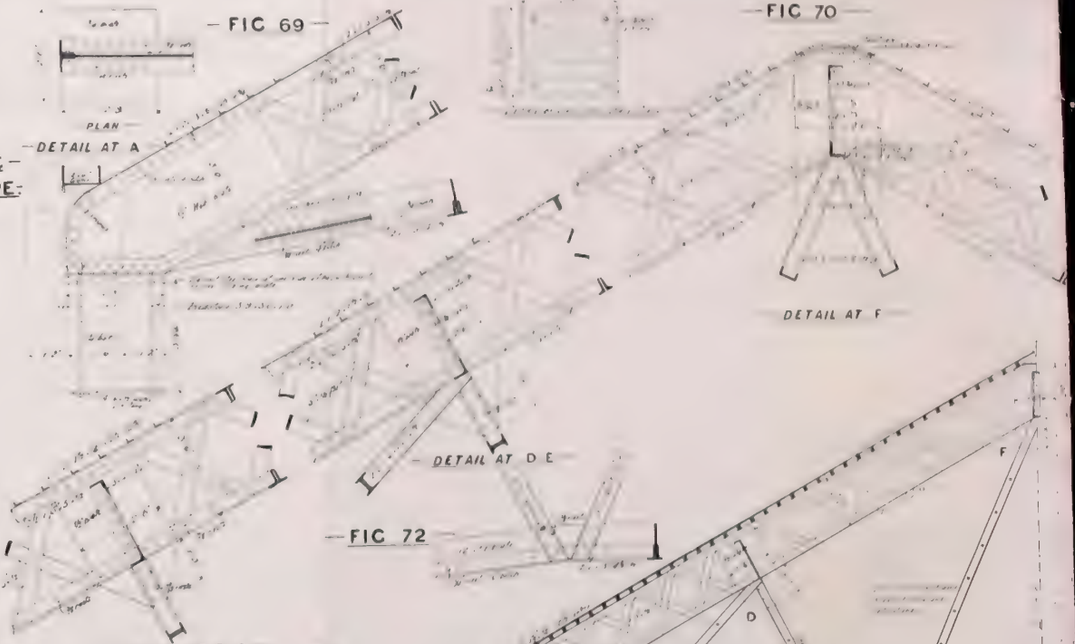
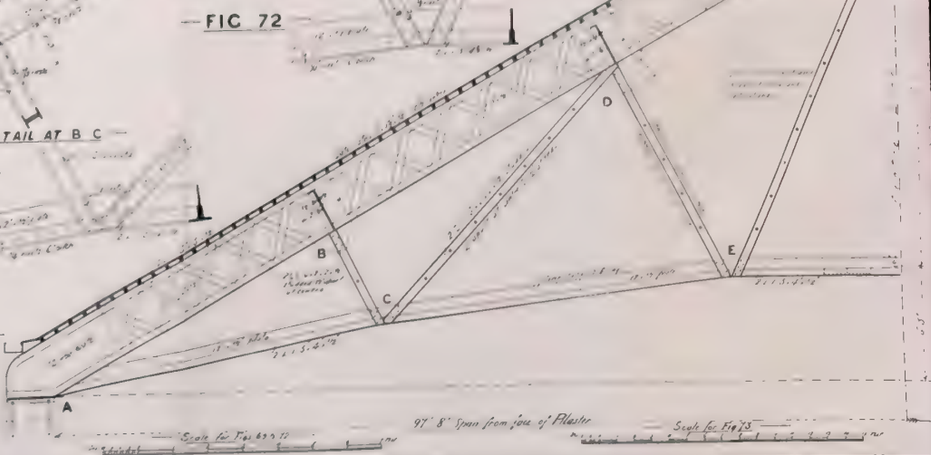


FIG 70

DETAIL AT F

DETAIL AT D E

FIG 72



DETAIL AT B C

FIG 71

FIG 73

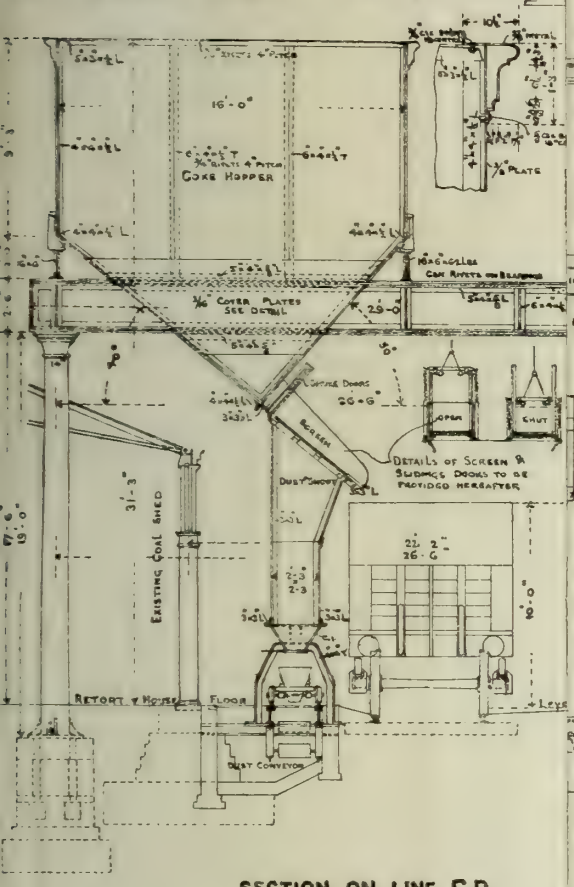
Scale for Figs 69 & 70

97' 8" Span from face of Plaster

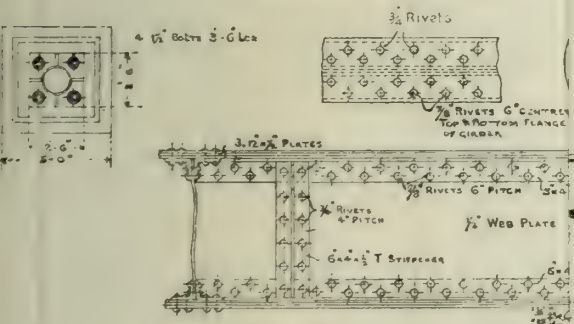
Scale for Fig 73

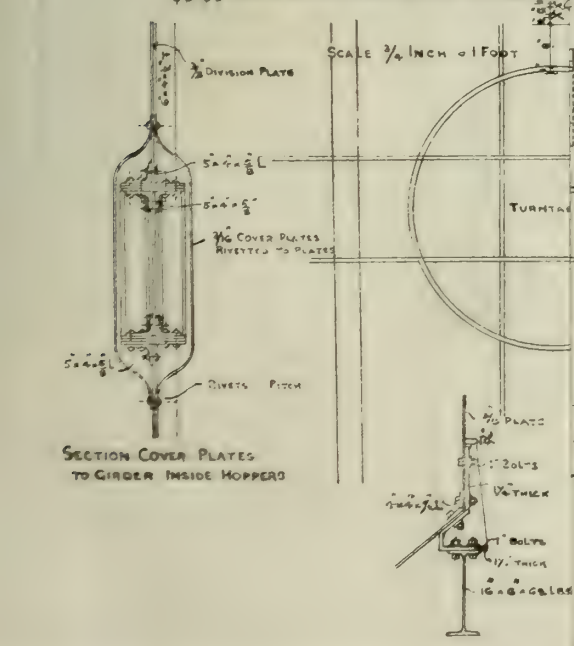
Eastcroft Gas Works
Elevated Coke Hoppers

Capacity 280 Tons Level Full

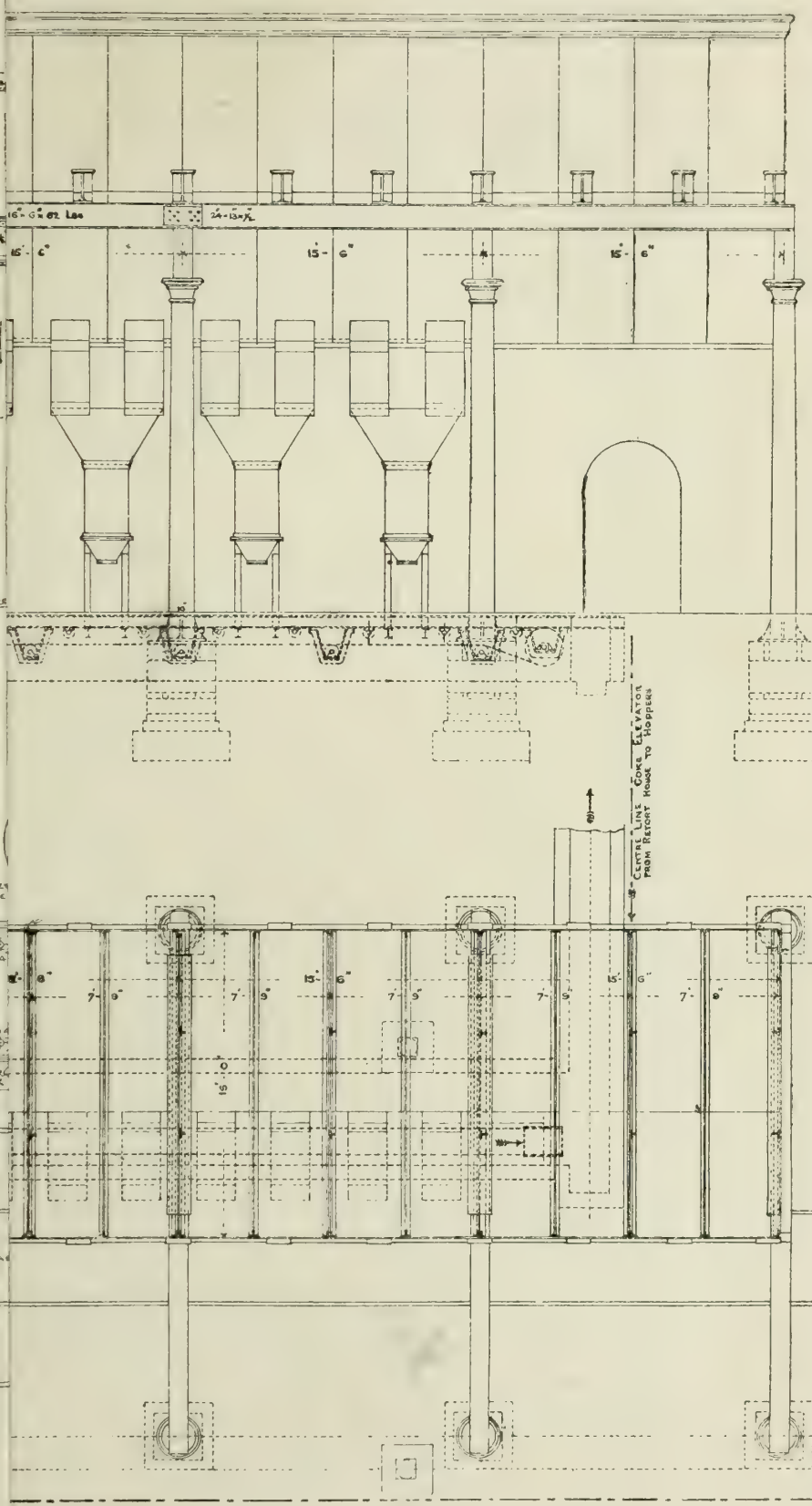


SECTION ON LINE C.D.





Section Cover Plates to Girder Inside Hoppers



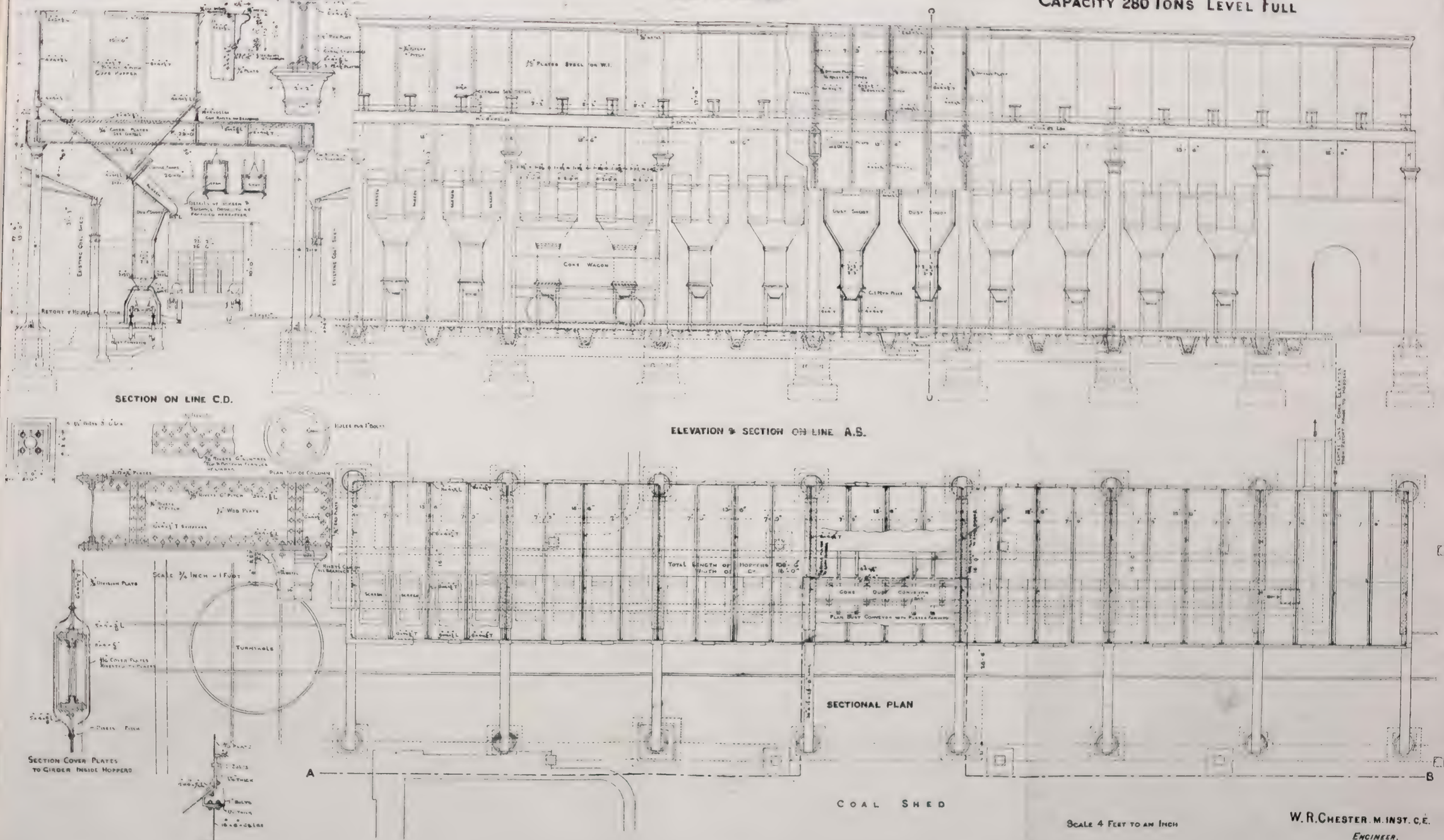
Scale 4 Feet to an Inch

W. R. Chester. M. Inst. C.E.
Engineer.

Eastcroft Gas Works
Elevated Coke Hoppers

Corporation of Nottingham
Gas Department

Capacity 280 Tons Level Full

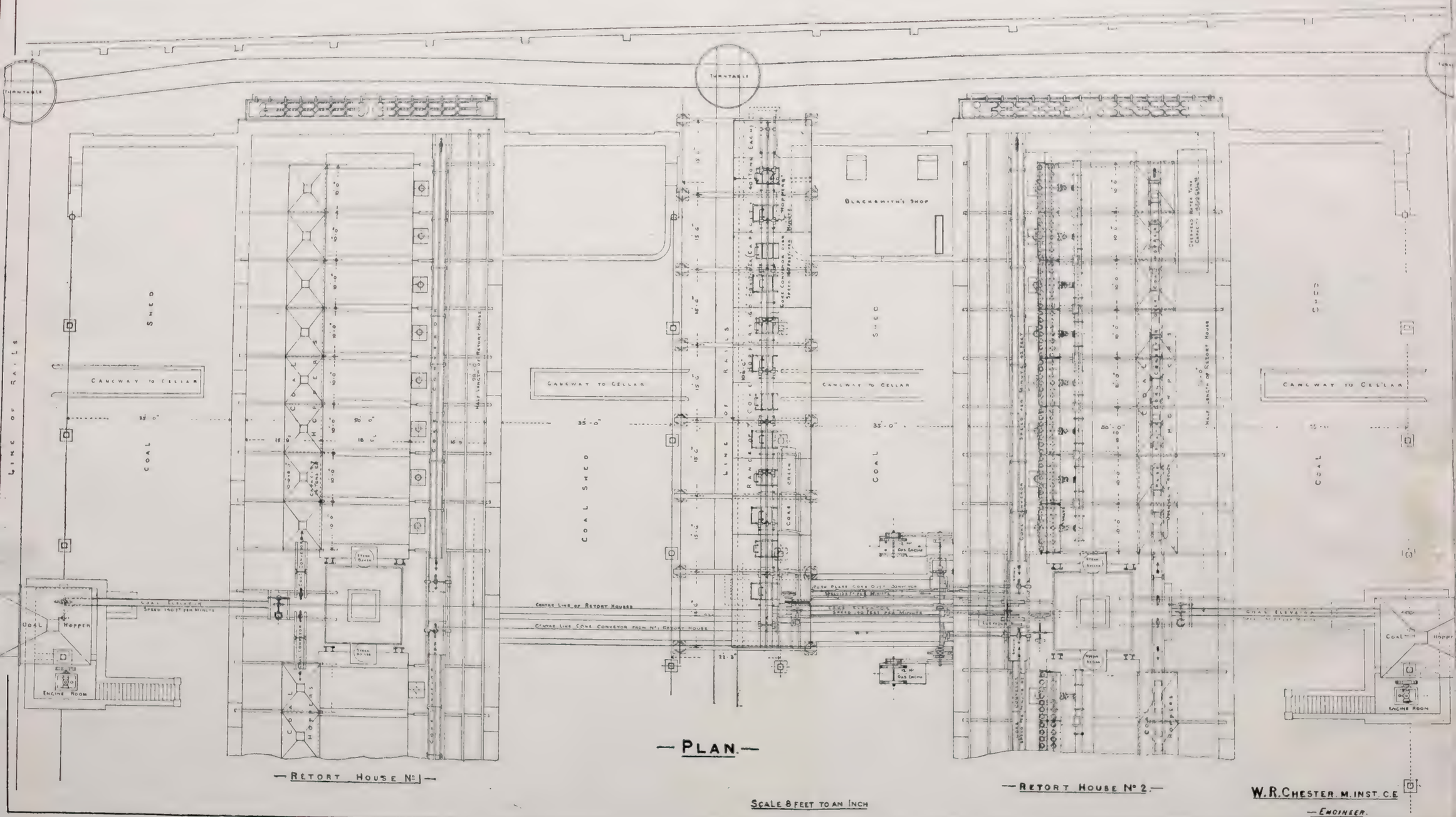


Scale 4 Feet to an Inch

W. R. Chester. M. Inst. C.E.
Engineer.

Automatic Stoking W. R. Chester's.

Installation of Inclined Retorts with Coal and Coke Handling Plant



— Plan. —

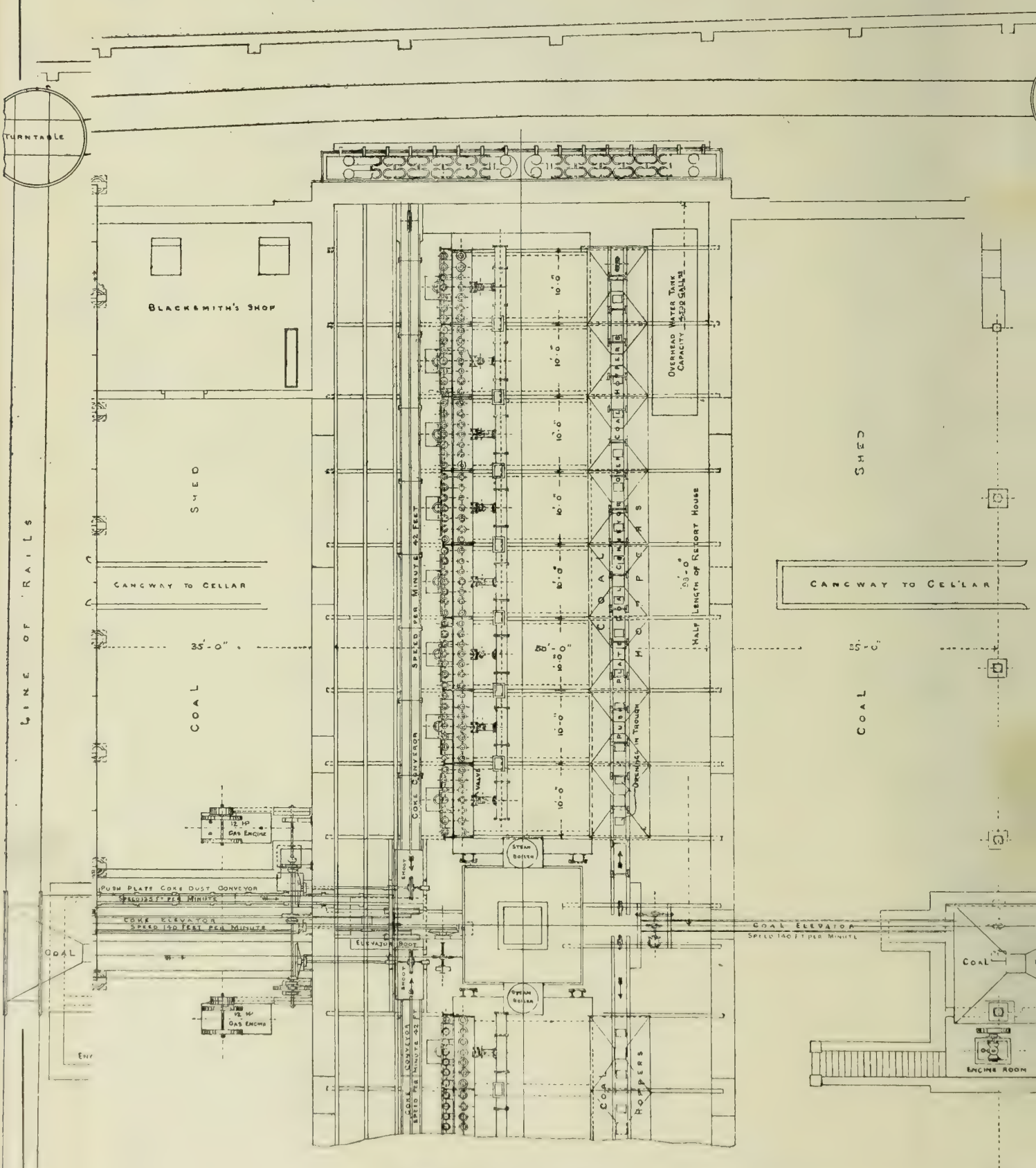
— Retort House No. 1 —

— Retort House No. 2 —

Scale 8 feet to an Inch

W. R. Chester, M. Inst. C.E.
— Engineer.

TALLATION OF INCLINED RETORTS WITH DAL AND COKE HANDLING PLANT

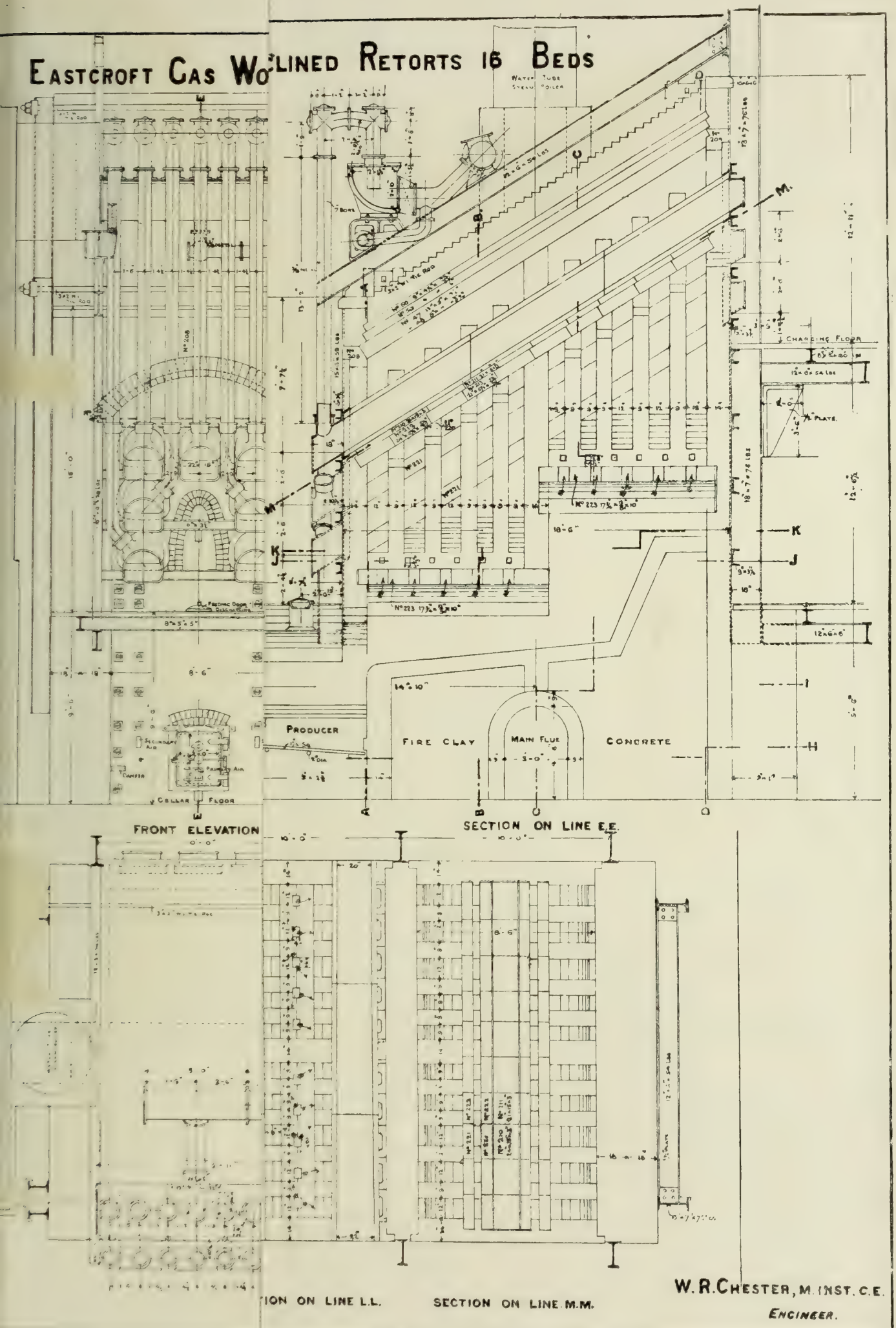


—RETORT HOUSE Nº 2.—

T TO AN INCH

W. R. CHESTER. M. INST. C.E.
—ENGINEER.

Eastcroft Gas Wo[rks] — Lined Retorts 16 Beds



FRONT ELEVATION

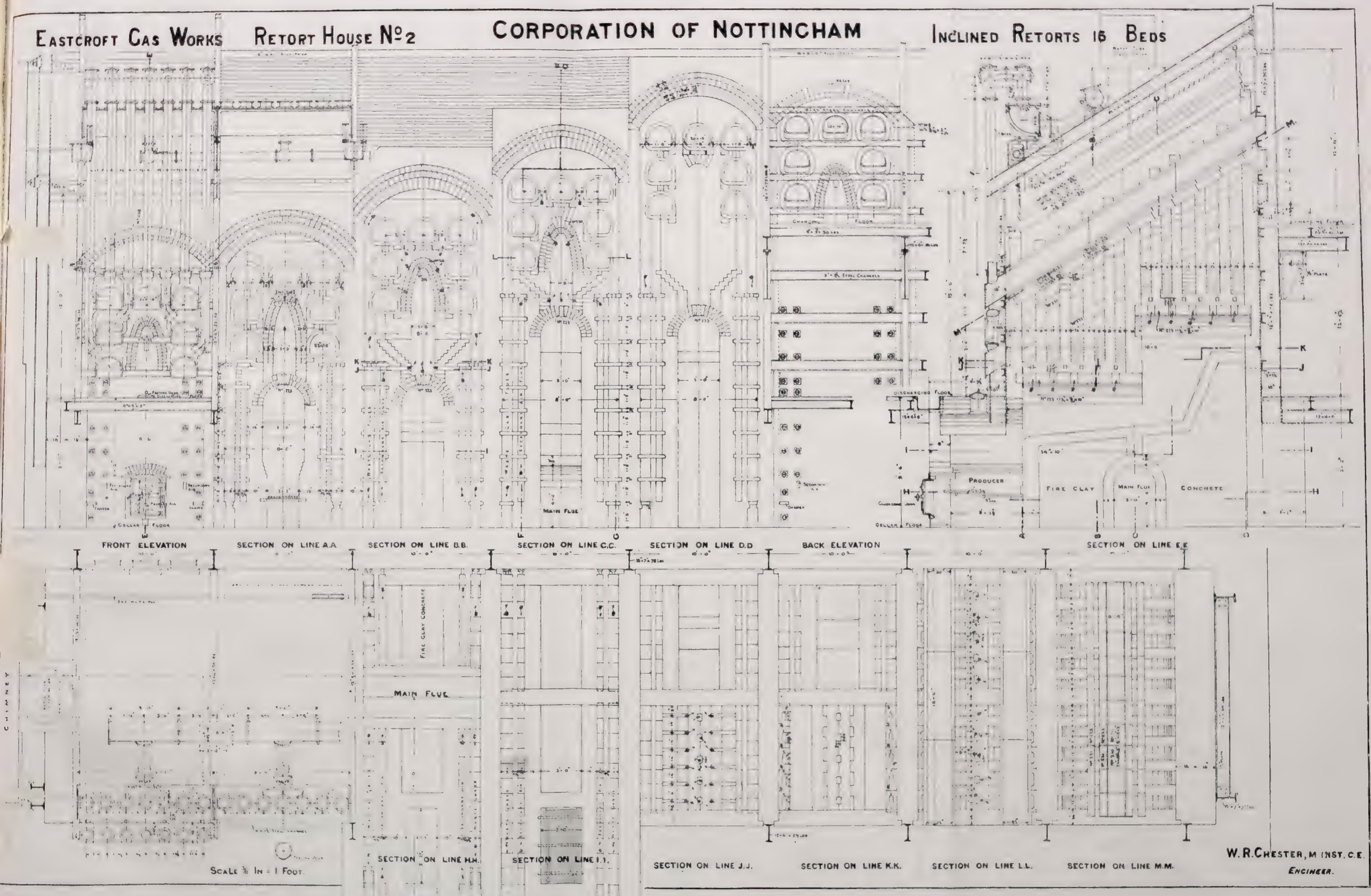
SECTION ON LINE E.E.

[ION] ON LINE L.L.

SECTION ON LINE M.M.

W. R. Chester, M. Inst. C.E.
Engineer.

Eastcroft Gas Works Retort House No 2 — Corporation of Nottingham — Inclined Retorts 16 Beds



W. R. Chester, M Inst. C.E.
Engineer.

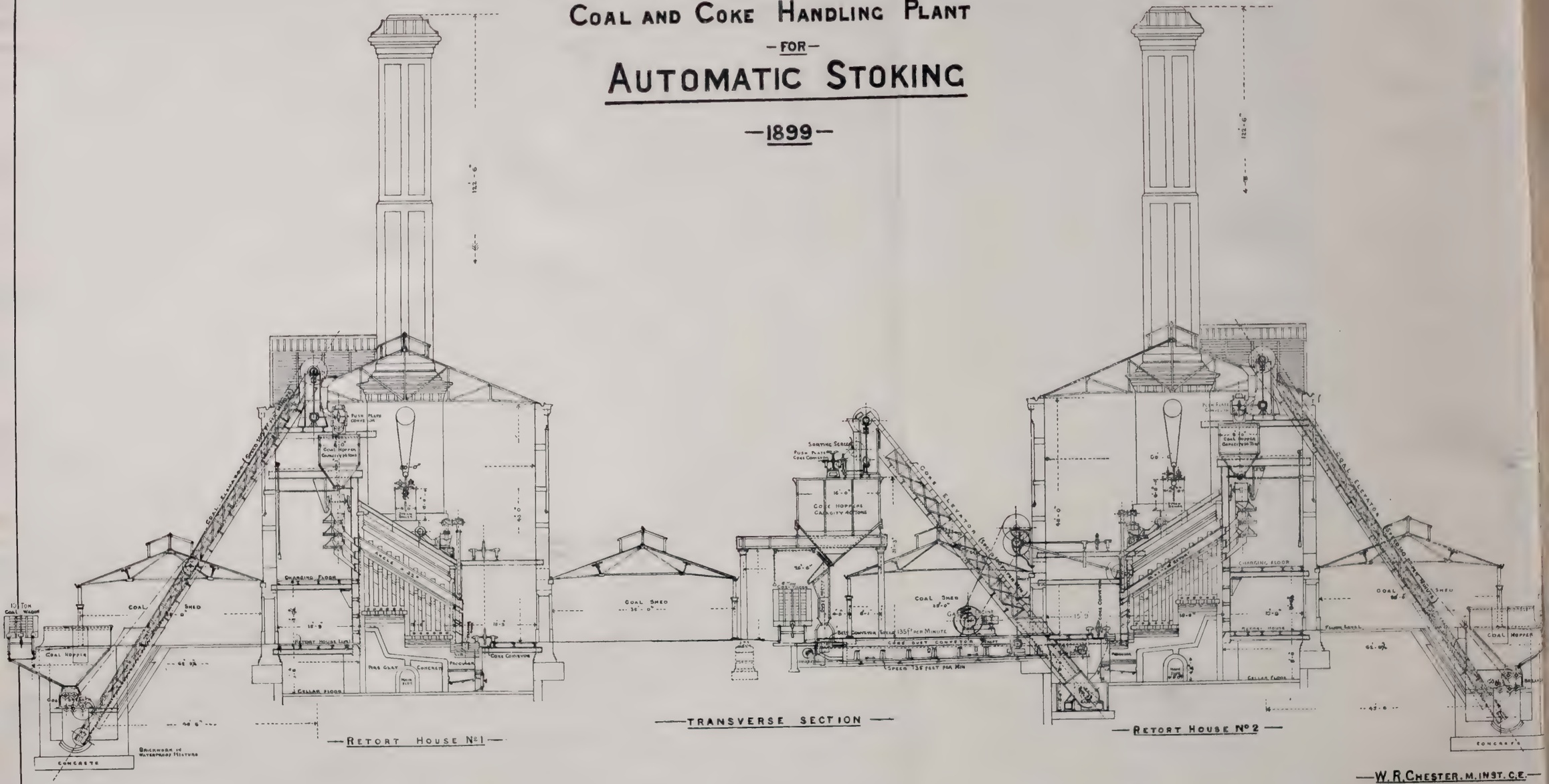
— W. R. CHESTER'S —

INSTALLATION OF INCLINED RETORTS WITH COAL AND COKE HANDLING PLANT

— FOR —

AUTOMATIC STOKING

— 1899 —



— RETORT HOUSE No 1 —

— TRANSVERSE SECTION —

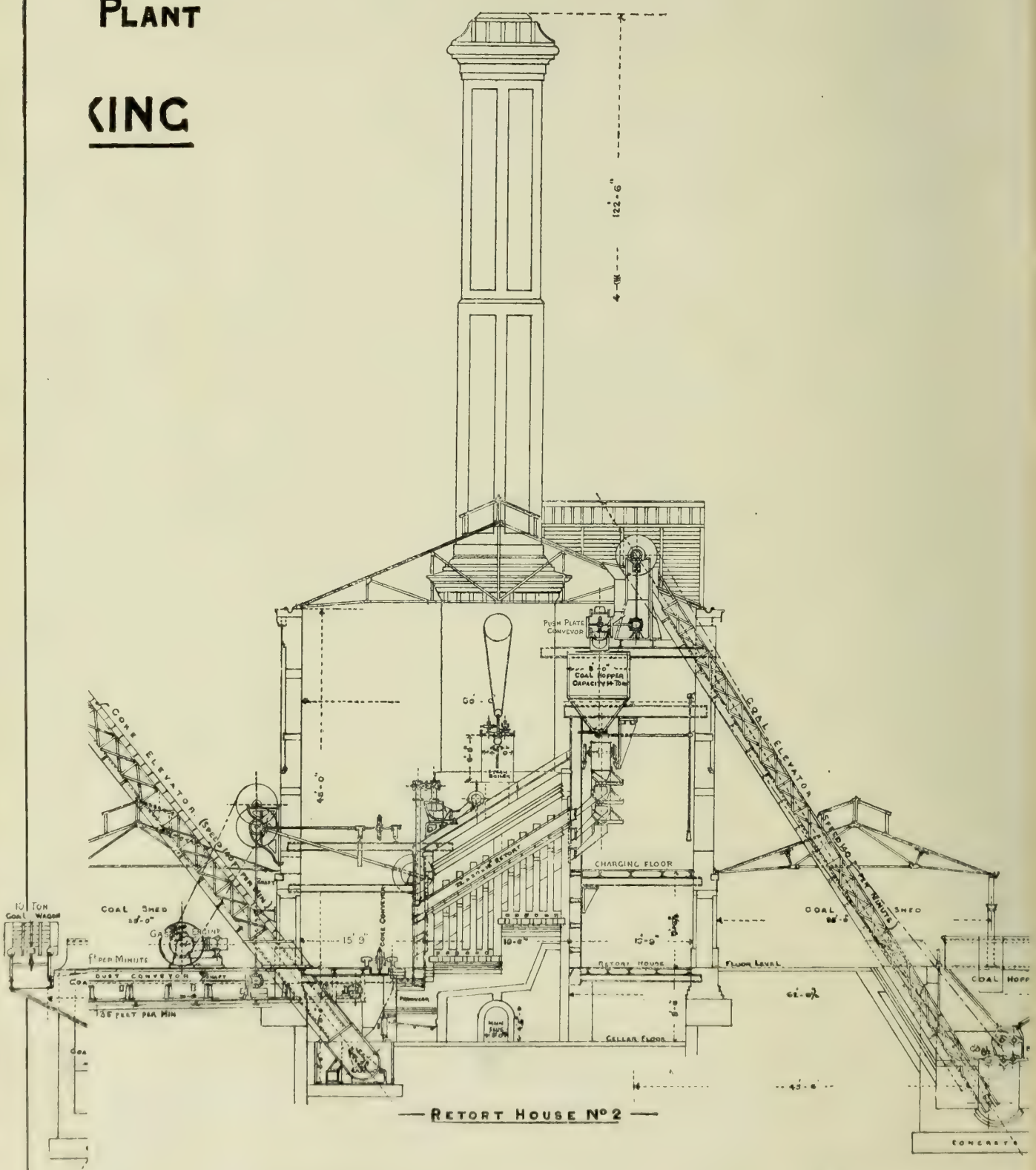
— RETORT HOUSE No 2 —

SCALE 8 FEET TO AN INCH.

— W. R. CHESTER, M. INST. C.E. —
— ENGINEER —

'ORTS WITH
PLANT

KING



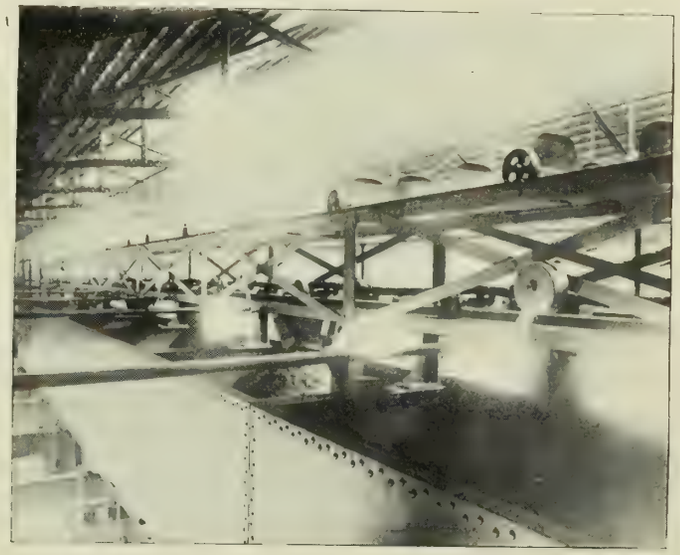
RETORT HOUSE Nº 2

SCALE 8 FEET TO AN INCH.

W. R. CHESTER, M. INST. C.E.
ENGINEER



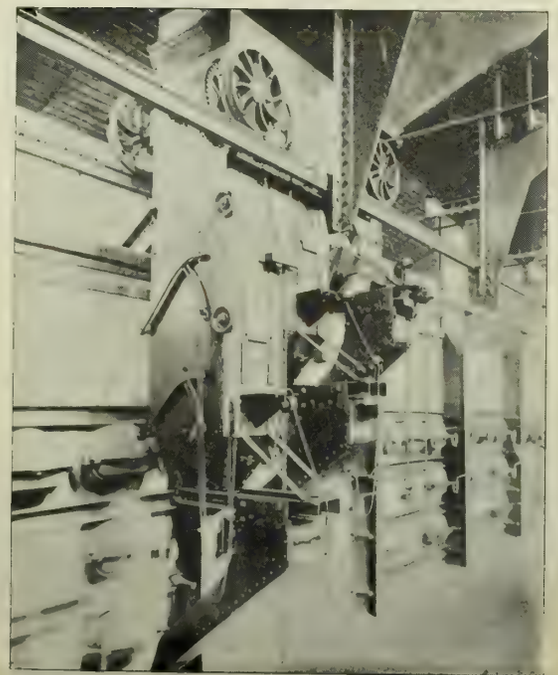
RETORT-HOUSE RAISED FOR RECEPTION OF INCLINED RETORTS.



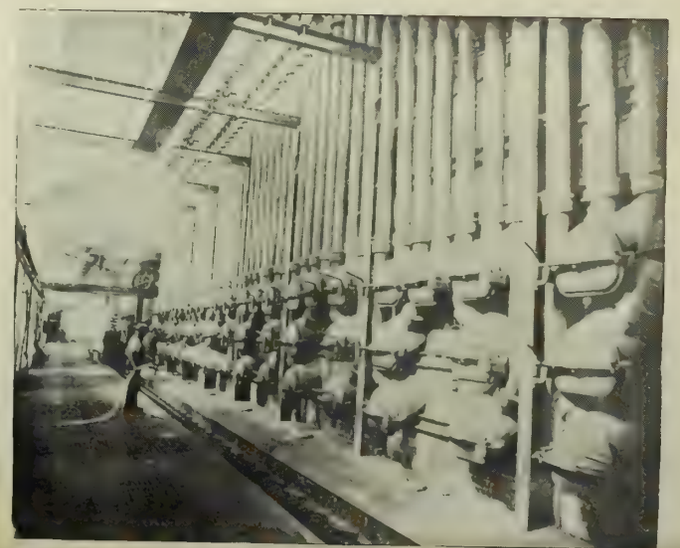
COAL CONVEYOR AND COAL HOPPERS.

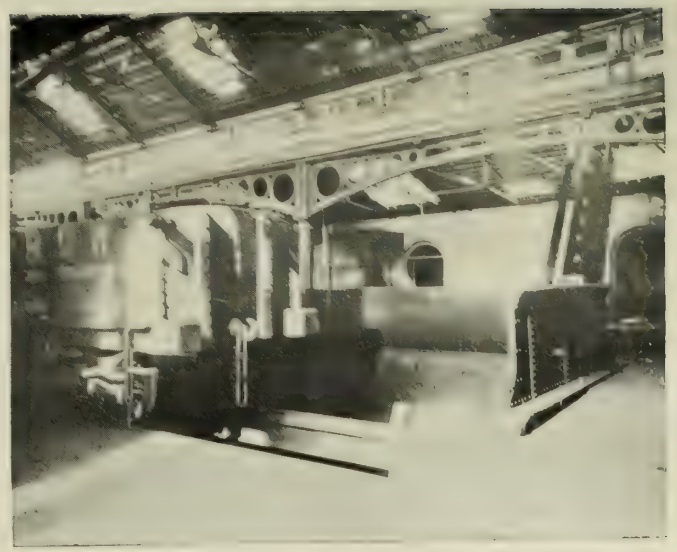


CHARGING FLOOR OF RETORT-HOUS

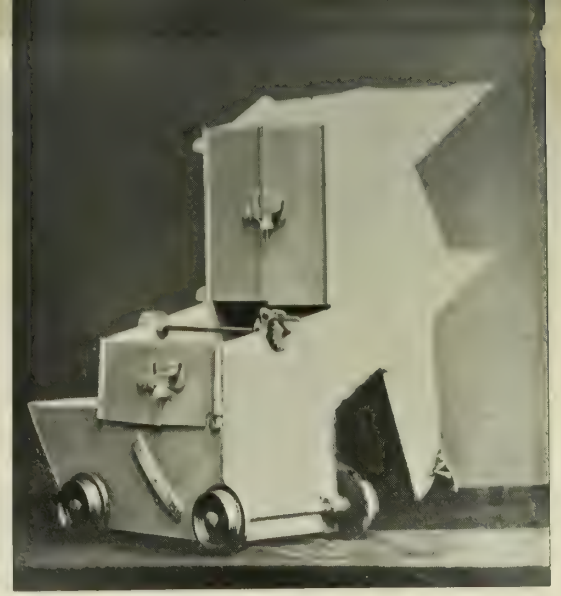


COAL CHARGING MACHINE

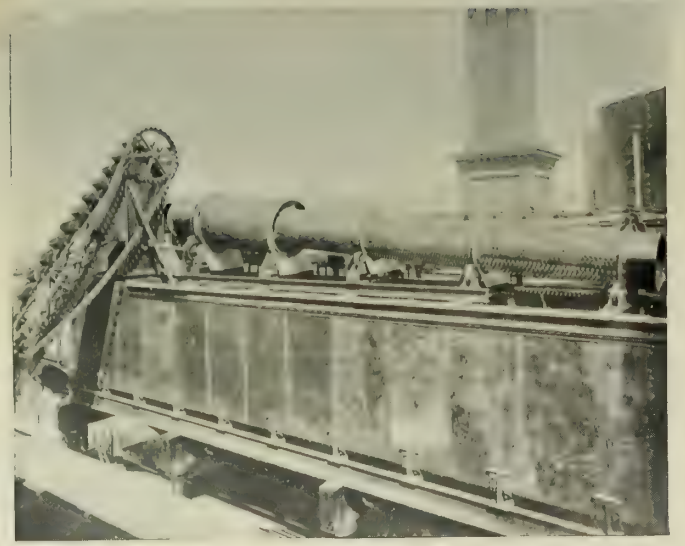




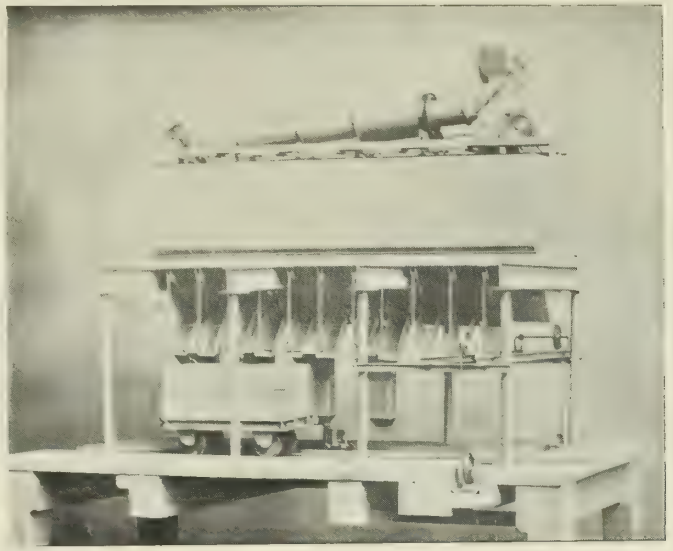
Coal Hopper and Breaker Below.



Portable Coke Discharging Shoot and Hopper.



Coke Hopper, showing Revolving Screen and Elevator Head.



Overhead Coke Loading and Storage Hoppers.



Old Method of Loading Coke into Waggons.

INCLINED RETORT HOUSE AT THE EASTCROFT GAS-WORKS, NOTTINGHAM—W. R. Chester, M.Inst.C.E., Engineer.

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